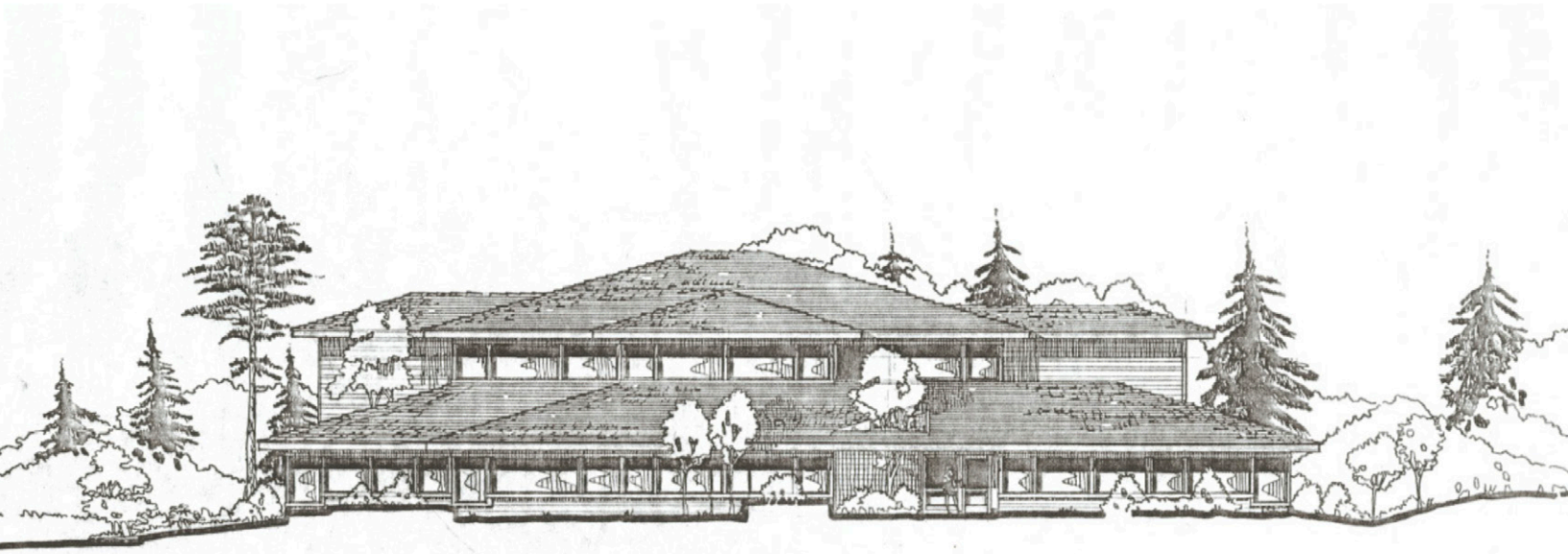
WEINSTEIN A+U

SOUTH KING FIRE
ADMINISTRATIVE BUILDING IMPROVEMENTS
PROJECT MANUAL

BID SET

07/18/2025



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SECTION 00 11 13 – ADVERTISEMENT FOR BIDS

PUBLIC NOTICE
ADVERTISEMENT FOR BIDS

Publication July 18, 2025, Federal Way Mirror and Seattle Daily Journal of Commerce.

South King Fire
Administrative Building Improvements
720 S 333rd Street, Federal Way, WA

Sealed bids will be received by South King Fire up to but not later than 2:00 pm, Tuesday, August 12, 2025 at the address listed below, for South King Fire Administrative Building Improvements, at which time they shall be publicly opened and recorded.

The anticipated construction cost is approximately $4,029,000, not including sales tax.

This project is subject to meet Washington State prevailing wages rates. All work performed on the project will be subject to the approved wage determination rates in the bid documents.

Equal Opportunity/Affirmative Action: Owner is an equal opportunity and affirmative action employer. Minority-owned and women-owned businesses are encouraged to submit bids.

A mandatory pre-bid conference will be held at SKF Administrative Building, 720 S 333rd Street, Federal Way, WA, at 9:00 am, Monday, July 28, 2025. The conference is intended to provide a general review between bidders, owner, and architect prior to bidding the project.

Bid packets and specifications will be available for viewing at www.southkingfire.org and at South King Fire Headquarters, 31617 1st Avenue South, Federal Way. Plans and specifications may be viewed at the following plan centers: Builder's Exchange of Washington, Everett, WA.

A Bid Security must accompany each bid in accordance with the Instructions to Bidders.

Envelopes containing the sealed bids shall be marked "Bid for SKF Administrative Building Improvements" and sent or delivered to:

Physical Address for Hand Delivery, Courier/Overnight Delivery and USPS:
SOUTH KING FIRE
31617 1st AVENUE SOUTH
FEDERAL WAY, WASHINGTON 98003.

The owner reserves the right to reject any or all bids, waive minor irregularities in the bidding process, and to accept the bid deemed best for them.

All questions must be submitted in writing to Weinstein A+U, Inc., attention Lauren Rock; Email: laurenr@weinsteinau.com

Deadline for Questions: 4:00 pm, Monday, August 4, 2025.

Substitution Requests: Architect will consider requests for substitution received no later than ten working days prior to receipt of Bids. Requests received after that time may be considered or rejected at the discretion of the Architect. See Section 012500 for Substitution Procedures.

SECTION 00 21 13 – INSTRUCTION TO BIDDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. INCORPORATE *Instructions to Bidders*, AIA Document A701-2018 BY THIS REFERENCE ONLY; it is not bound in Project Manual.

B. Copies may be obtained from American Institute of Architects, 1735 New York Avenue NW, Washington, D.C 20006, local Chapter offices, or online: https://shop.aiacontracts.com/contract-documents/6128704-instructions-to-bidders

C. Following items supplement, modify, change, and add to referenced instructions to Bidders.

1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

ARTICLE 3 - BIDDING DOCUMENTS

3.2.1 ADD:
"Submittal of Bid constitutes acceptance of products and procedures specified as sufficient, adequate, and satisfactory for completion of the Contract."

3.2.4 ADD new subparagraph:
"3.2.4 Interpretations: Address all questions in writing to the Architect. They will be answered by addendum addressed to all bidders. Questions received less than three working days before bid opening cannot be answered. Neither Owner nor Architect will be responsible for oral interpretations. Addenda issued during the time of bidding will be incorporated into the Contract."

3.3.2 REVISE:
“ten days prior to the date for receipt of Bids“ to read “ten working days prior to the date for receipt of bids”.

3.4.3 REVISE
“four days prior to the date from receipt of Bids” to read “72 hours prior to the time for receipt of bids”.

3.4.4 ADD:
"Bidder shall fill in the space provided on the Bid Form with the Addenda number of each Addenda received. Omission of this information may be cause for rejection of the entire bid."

ARTICLE 4 - BIDDING PROCEDURES

4.2.4 ADD new subparagraph:
"4.2.4 Each bid must be accompanied by a certified check, cashier’s check, or Bid Bond of a duly licensed bonding company, in the amount of five percent of the Base Bid, plus alternates, made payable to South King Fire. Unsuccessful Bidders shall have Bid Bonds returned within thirty (30) days following Bid Award. If Bid Bond is provided in lieu of a certified check or cashier’s check, the required bond form is Bid Bond AIA -310.”

4.3.5 ADD new subparagraph:

“4.3.5 Bid Proposal must be submitted on or before the time specified in the advertisement for the bids. Failure to properly complete Bid Proposal shall render that bid non-responsive.

“4.4.5 In the event a bidder discovers an error in its bid following the bid opening, the bidder may request to withdraw its bid under the following conditions:

1.Written notification is received by the Owner within 24 hours following bid opening.

2.The bidder provides written documentation of the claimed error to the satisfaction of the Owner within 72 hours following the bid opening.

4.4.6 ADD new subparagraph

“4.4.6 The bidder will allow 30 days from bid opening date from acceptance of its bid by the Owner.

ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

7.1.1 MODIFY Subparagraph to read:
"Provide bonds in accordance with the Supplemental Conditions”

7.1.4 ADD new subparagraph:
"7.1.4 Performance and Payment Bonds in the amount of 100 percent of the amount of the Contract including sales tax are required for this work."

7.2.1 and 7.2.2 MODIFY both Subparagraphs to read:
"Provide bonds in accordance with the Supplemental Conditions”

ARTICLE 8 - FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

ADD new subparagraphs:
“8.1 “Within ten (10) days following presentation of agreement, execute and return to Owner referenced AIA A101-2017 Standard Form of Agreement Between Owner and Contractor.

8.2 Retainage: See provisions of referenced Form of Agreement. Retainage: 5% of each payment throughout project.

8.3 Signatures: Each bid must be signed in ink and in longhand by the bidder with his usual signature. Bids by partnerships must be signed with the partnership name by one of the partners followed by the signature and designation of the partner signing. Bids by corporations must be signed with the legal name of the corporation, followed by the name of the State of incorporation and by the signature of the president, secretary, or other person authorized to bind it in the matter. The name of each person signing shall be typed or printed below the signature."

8.4 Responsiveness: The following elements will be considered when determining the Responsiveness of a bid for public works or purchases of materials, supplies of equipment:

- Whether the bid satisfies the needs of the District as specified in the solicitation documents;
- Whether the bid encourages diverse contractor participation;

- Whether the bid provides competitive pricing, economies, and efficiencies;
- Whether the bid considers human health and environmental impacts;
- Whether the bid appropriately weighs cost and noncost considerations;
- Life-cycle cost;
- The ability, capacity, and skill of the bidder to perform the contract or provide the service required;
- The character, integrity, reputation, judgment, experience, and efficiency of the bidder;
- Whether the bidder can perform the contract within the time specified;
- The quality of performance of previous contracts or services;
- The previous and existing compliance by the bidder with laws relating to the contract or services; and
- Such other information may be secured having a bearing on the decision to award the contract.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 00 31 00 – INFORMATION AVAILABLE TO BIDDERS

PART 1 - GENERAL

1.1 KING COUNTY PREVAILING WAGES

A. The following documents are bound into this project manual:

1. Washington State Prevailing Wage Rates - King County Effective 06/01/25.
2. Benefits Code Key.

Copies of these documents are for contractor reference and convenience only. It is the contractor's responsibility to follow the most current edition.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

State of Washington

Department of Labor & Industries

Prevailing Wage Section - Telephone 360-902-5335

PO Box 44540, Olympia, WA 98504-4540

Washington State Prevailing Wage

The PREVAILING WAGES listed here include both the hourly wage rate and the hourly rate of fringe benefits. On public works projects, worker's wage and benefit rates must add to not less than this total. A brief description of overtime calculation requirements are provided on the Benefit Code Key.

Journey Level Prevailing Wage Rates for the Effective Date: 06/01/2025

King County, WA

County	Trade	Job Classification	Wage	Holiday	Over-time	Notes
King	Asbestos Abatement Workers	Journey Level	$63.87	5D	1H	
King	Boilermakers	Journey Level	$78.89	5N	1C	
King	Brick Mason	Journey Level	$71.82	7E	1N	
King	Brick Mason	Pointer-Caulker-Cleaner	$71.82	7E	1N	
King	Building Service Employees	Janitor	$30.33	5S	2F	
King	Building Service Employees	Traveling Waxer/Shampooer	$30.78	5S	2F	
King	Building Service Employees	Window Cleaner (Non-Scaffold)	$32.93	5S	2F	
King	Building Service Employees	Window Cleaner (Scaffold)	$33.93	5S	2F	
King	Cabinet Makers (In Shop)	Journey Level	$22.74		1	
King	Carpenters	Acoustical Worker	$78.96	15J	11U	
King	Carpenters	Bridge Dock and Wharf Carpenter	$80.50	15J	11U	9L
King	Carpenters	Floor Layer & Floor Finisher	$78.96	15J	11U	
King	Carpenters	General Carpenter	$78.96	15J	11U	
King	Carpenters	Scaffold Erector	$78.96	15J	11U	
King	Cement Masons	Application of all Composition Mastic	$77.30	15J	4U	
King	Cement Masons	Application of all Epoxy Material	$76.78	15J	4U	
King	Cement Masons	Application of all Plastic Material	$77.30	15J	4U	
King	Cement Masons	Application of Sealing Compound	$76.78	15J	4U	
King	Cement Masons	Application of Underlayment	$77.30	15J	4U	
King	Cement Masons	Building General	$76.78	15J	4U	
King	Cement Masons	Composition or Kalman Floors	$77.30	15J	4U	
King	Cement Masons	Concrete Paving	$76.78	15J	4U	
King	Cement Masons	Curb & Gutter Machine	$77.30	15J	4U	
King	Cement Masons	Curb & Gutter, Sidewalks	$76.78	15J	4U	
King	Cement Masons	Curing Concrete	$76.78	15J	4U	
King	Cement Masons	Finish Colored Concrete	$77.30	15J	4U	
King	Cement Masons	Floor Grinding	$77.30	15J	4U	
King	Cement Masons	Floor Grinding/Polisher	$76.78	15J	4U	
King	Cement Masons	Green Concrete Saw, self-powered	$77.30	15J	4U	
King	Cement Masons	Grouting of all Plates	$76.78	15J	4U	
King	Cement Masons	Grouting of all Tilt-up Panels	$76.78	15J	4U	
King	Cement Masons	Gunite Nozzleman	$77.30	15J	4U	
King	Cement Masons	Hand Powered Grinder	$77.30	15J	4U	
King	Cement Masons	Journey Level	$76.78	15J	4U	
King	Cement Masons	Patching Concrete	$76.78	15J	4U	
King	Cement Masons	Pneumatic Power Tools	$77.30	15J	4U	
King	Cement Masons	Power Chipping & Brushing	$77.30	15J	4U	
King	Cement Masons	Sand Blasting Architectural Finish	$77.30	15J	4U	

King	Cement Masons	Screed & Rodding Machine	$77.30	15J	4U	
King	Cement Masons	Spackling or Skim Coat Concrete	$76.78	15J	4U	
King	Cement Masons	Troweling Machine Operator	$77.30	15J	4U	
King	Cement Masons	Slabs	$77.30	15J	4U	
King	Cement Masons	Tunnel Workers	$77.30	15J	4U	
King	Divers & Tenders	Bell/Vehicle/Submersible Operator (not under pressure)	$156.25	15J	11T	9I
King	Divers & Tenders	Dive Supervisor	$157.75	15J	11T	9I
King	Divers & Tenders	Diver	$156.25	15J	11T	9I
King	Divers & Tenders	Diver Tender	$86.86	15J	11T	9I
King	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 0-30.00 PSI	$109.76	15J	11U	
King	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 31.01-44.00 PSI	$118.99	15J	11U	
King	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 44.01 - 54.00 PSI	$128.22	15J	11U	
King	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 54.01 - 60.00 PSI	$137.45	15J	11U	
King	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 60.01 - 64.00 PSI	$146.67	15J	11U	
King	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 64.01 - 68.00 PSI	$155.90	15J	11U	
King	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 68.01 - 70.00 PSI	$165.13	15J	11U	
King	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 70.01 - 72.00 PSI	$174.36	15J	11U	
King	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 72.01 - 74.00 PSI	$183.59	15J	11U	
King	Divers & Tenders	Lead Diver (Dive Master)	$101.32	15J	11T	9I
King	Divers & Tenders	Technician)	$86.86	15J	11T	9I
King	Divers & Tenders	Remote Operated Vehicle Operator/Technician	$86.86	15J	11T	9I
King	Divers & Tenders	Remote Operated Vehicle Operator/Technician	$86.86	15J	11T	9I
King	Divers & Tenders	Remote Operated Vehicle Tender	$80.55	15J	11T	9I
King	Divers & Tenders	Stand-by Diver	$96.32	15J	11T	9I
King	Dredge Workers	Assistant Engineer	$85.37	5D	3F	
King	Dredge Workers	Assistant Mate (Deckhand)	$84.71	5D	3F	
King	Dredge Workers	Boatmen	$85.37	5D	3F	
King	Dredge Workers	Engineer Welder	$87.02	5D	3F	
King	Dredge Workers	Leverman, Hydraulic	$88.77	5D	3F	
King	Dredge Workers	Mates	$85.37	5D	3F	
King	Dredge Workers	Oiler	$84.71	5D	3F	
King	Drywall Applicator	Journey Level	$78.76	15O	11S	
King	Drywall Tapers	Journey Level	$78.76	15O	11S	
King	Maintenance Workers	Journey Level	$40.69	5L	1E	
King	Electricians - Inside	Cable Splicer	$115.15	7C	4E	

King	Electricians - Inside	Cable Splicer (tunnel)	$123.64	7C	4E	
King	Electricians - Inside	Certified Welder	$111.30	7C	4E	
King	Electricians - Inside	Certified Welder (tunnel)	$119.41	7C	4E	
King	Electricians - Inside	Construction Stock Person	$54.03	7C	4E	
King	Electricians - Inside	Journey Level	$107.44	7C	4E	
King	Electricians - Inside	Journey Level (tunnel)	$115.15	7C	4E	
King	Electricians - Motor Shop	Journey Level	$48.68	5A	1B	
King	Powerline Construction	Cable Splicer	$102.42	5A	4D	
King	Powerline Construction	Certified Line Welder	$93.99	5A	4D	
King	Powerline Construction	Groundperson	$59.30	5A	4D	
King	Powerline Construction	Heavy Line Equipment Operator	$93.99	5A	4D	
King	Powerline Construction	Journey Level Lineperson	$93.99	5A	4D	
King	Powerline Construction	Line Equipment Operator	$80.96	5A	4D	
King	Powerline Construction	Meter Installer	$59.30	5A	4D	8W
King	Powerline Construction	Pole Sprayer	$93.99	5A	4D	
King	Powerline Construction	Powderperson	$69.84	5A	4D	
King	Technicians	Journey Level	$69.69	7E	1E	
King	Elevator Constructors	Mechanic	$115.14	7D	4A	
King	Elevator Constructors	Mechanic In Charge	$124.53	7D	4A	
King	Fabricated Precast Concrete Products	All Classifications - In-Factory Work Only	$21.34	5B	1R	
King	Fence Erectors	Fence Erector	$54.65	15J	11P	8Y
King	Fence Erectors	Fence Laborer	$54.65	15J	11P	8Y
King	Flaggers	Journey Level	$54.65	15J	11P	8Y
King	Glaziers	Journey Level	$82.16	7L	1Y	
King	Insulators And Asbestos Workers	Journey Level	$91.81	15H	11C	
King	Heating Equipment Mechanics	Journey Level	$99.92	7F	1E	
King	Hod Carriers & Mason Tenders	Journey Level	$67.38	15J	11P	8Y
King	Industrial Power Vacuum Cleaner	Journey Level	$16.66		1	
King	Inland Boatmen	Boat Operator	$71.28	5B	1K	
King	Inland Boatmen	Cook	$69.70	5B	1K	
King	Inland Boatmen	Deckhand	$70.00	5B	1K	
King	Inland Boatmen	Deckhand Engineer	$69.55	5B	1K	
King	Inland Boatmen	Launch Operator	$71.23	5B	1K	

King	Inland Boatmen	Mate	$89.12	5B	1K	
King	Inspection/Cleaning/ Sealing Of Sewer & Water Systems By Remote Control	Cleaner Operator	$51.27	15M	11O	
King	Inspection/Cleaning/ Sealing Of Sewer & Water Systems By Remote Control	Foamer Operator	$51.27	15M	11O	
King	Inspection/Cleaning/ Sealing Of Sewer & Water Systems By Remote Control	Grout Truck Operator	$51.27	15M	11O	
King	Inspection/Cleaning/ Sealing Of Sewer & Water Systems By Remote Control	Head Operator	$49.20	15M	11O	
King	Inspection/Cleaning/ Sealing Of Sewer & Water Systems By Remote Control	Technician	$42.99	15M	11O	
King	Inspection/Cleaning/ Sealing Of Sewer & Water Systems By Remote Control	TV Truck Operator	$46.10	15M	11O	
King	Insulation Applicators	Journey Level	$78.96	15J	11U	
King	Ironworkers	Journeyman	$90.82	15K	11N	
King	Laborers	Air, Gas Or Electric Vibrating Screed	$63.87	15J	11P	8Y
King	Laborers	Airtrac Drill Operator	$65.75	15J	11P	8Y
King	Laborers	Ballast Regular Machine	$63.87	15J	11P	8Y
King	Laborers	Batch Weighman	$54.65	15J	11P	8Y
King	Laborers	Brick Pavers	$63.87	15J	11P	8Y
King	Laborers	Brush Cutter	$63.87	15J	11P	8Y
King	Laborers	Brush Hog Feeder	$63.87	15J	11P	8Y
King	Laborers	Burner	$63.87	15J	11P	8Y
King	Laborers	Caisson Worker	$65.75	15J	11P	8Y
King	Laborers	Carpenter Tender	$63.87	15J	11P	8Y
King	Laborers	Cement Dumper-paving	$64.98	15J	11P	8Y
King	Laborers	Cement Finisher Tender	$63.87	15J	11P	8Y
King	Laborers	Change House Or Dry Shack	$63.87	15J	11P	8Y
King	Laborers	Chipping Gun (30 Lbs. And Over)	$64.98	15J	11P	8Y
King	Laborers	Chipping Gun (Under 30 Lbs.)	$63.87	15J	11P	8Y
King	Laborers	Choker Setter	$63.87	15J	11P	8Y
King	Laborers	Chuck Tender	$63.87	15J	11P	8Y
King	Laborers	Clary Power Spreader	$64.98	15J	11P	8Y
King	Laborers	Clean-up Laborer	$63.87	15J	11P	8Y
King	Laborers	Concrete Dumper/Chute Operator	$64.98	15J	11P	8Y
King	Laborers	Concrete Form Stripper	$63.87	15J	11P	8Y

King	Laborers	Concrete Placement Crew	$64.98	15J	11P	8Y
King	Laborers	Concrete Saw Operator/Core Driller	$64.98	15J	11P	8Y
King	Laborers	Crusher Feeder	$54.65	15J	11P	8Y
King	Laborers	Curing Laborer	$63.87	15J	11P	8Y
King	Laborers	Demolition: Wrecking & Moving (Incl. Charred Material)	$63.87	15J	11P	8Y
King	Laborers	Ditch Digger	$63.87	15J	11P	8Y
King	Laborers	Diver	$65.75	15J	11P	8Y
King	Laborers	Drill Operator (Hydraulic, Diamond)	$64.98	15J	11P	8Y
King	Laborers	Dry Stack Walls	$63.87	15J	11P	8Y
King	Laborers	Dump Person	$63.87	15J	11P	8Y
King	Laborers	Epoxy Technician	$63.87	15J	11P	8Y
King	Laborers	Erosion Control Worker	$63.87	15J	11P	8Y
King	Laborers	Faller & Bucker Chain Saw	$64.98	15J	11P	8Y
King	Laborers	Fine Graders	$63.87	15J	11P	8Y
King	Laborers	Firewatch	$54.65	15J	11P	8Y
King	Laborers	Form Setter	$64.98	15J	11P	8Y
King	Laborers	Gabian Basket Builders	$63.87	15J	11P	8Y
King	Laborers	General Laborer	$63.87	15J	11P	8Y
King	Laborers	Grade Checker & Transit Person	$67.38	15J	11P	8Y
King	Laborers	Grinders	$63.87	15J	11P	8Y
King	Laborers	Grout Machine Tender	$63.87	15J	11P	8Y
King	Laborers	Groutmen (Pressure) Including Post Tension Beams	$64.98	15J	11P	8Y
King	Laborers	Guardrail Erector	$63.87	15J	11P	8Y
King	Laborers	Hazardous Waste Worker (Level A)	$65.75	15J	11P	8Y
King	Laborers	Hazardous Waste Worker (Level B)	$64.98	15J	11P	8Y
King	Laborers	Hazardous Waste Worker (Level C)	$63.87	15J	11P	8Y
King	Laborers	High Scaler	$65.75	15J	11P	8Y
King	Laborers	Jackhammer	$64.98	15J	11P	8Y
King	Laborers	Laserbeam Operator	$64.98	15J	11P	8Y
King	Laborers	Maintenance Person	$63.87	15J	11P	8Y
King	Laborers	Manhole Builder-Mudman	$64.98	15J	11P	8Y
King	Laborers	Material Yard Person	$63.87	15J	11P	8Y
King	Laborers	Mold Abatement Worker	$63.87	15J	11P	8Y
King	Laborers	Motorman-Dinky Locomotive	$67.48	15J	11P	8Y
King	Laborers	nozzleman (concrete pump, green cutter when using combination of high pressure air & water on concrete & rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster)	$67.38	15J	11P	8Y
King	Laborers	Pavement Breaker	$64.98	15J	11P	8Y
King	Laborers	Pilot Car	$54.65	15J	11P	8Y
King	Laborers	Pipe Layer (Lead)	$67.38	15J	11P	8Y
King	Laborers	Pipe Layer/Tailor	$64.98	15J	11P	8Y
King	Laborers	Pipe Pot Tender	$64.98	15J	11P	8Y

King	Laborers	Pipe Reliner	$64.98	15J	11P	8Y
King	Laborers	Pipe Wrapper	$64.98	15J	11P	8Y
King	Laborers	Pot Tender	$63.87	15J	11P	8Y
King	Laborers	Powderman	$65.75	15J	11P	8Y
King	Laborers	Powderman's Helper	$63.87	15J	11P	8Y
King	Laborers	Power Jacks	$64.98	15J	11P	8Y
King	Laborers	Power Washer	$63.87	15J	11P	8Y
King	Laborers	Railroad Spike Puller - Power	$64.98	15J	11P	8Y
King	Laborers	Raker - Asphalt	$67.38	15J	11P	8Y
King	Laborers	Re-timberman	$65.75	15J	11P	8Y
King	Laborers	Remote Equipment Operator	$64.98	15J	11P	8Y
King	Laborers	Rigger/Signal Person	$64.98	15J	11P	8Y
King	Laborers	Rip Rap Person	$63.87	15J	11P	8Y
King	Laborers	Rivet Buster	$64.98	15J	11P	8Y
King	Laborers	Rodder	$64.98	15J	11P	8Y
King	Laborers	Scaffold Erector	$63.87	15J	11P	8Y
King	Laborers	Scale Person	$63.87	15J	11P	8Y
King	Laborers	Sloper (Over 20)"	$64.98	15J	11P	8Y
King	Laborers	Sloper Sprayer	$63.87	15J	11P	8Y
King	Laborers	Spreader (Concrete)	$64.98	15J	11P	8Y
King	Laborers	Stake Hopper	$63.87	15J	11P	8Y
King	Laborers	Stock Piler	$63.87	15J	11P	8Y
King	Laborers	Swinging Stage/Boatswain Chair	$54.65	15J	11P	8Y
King	Laborers	Tamper & Similar Electric, Air & Gas Operated Tools	$64.98	15J	11P	8Y
King	Laborers	Tamper (Multiple & Self-propelled)	$64.98	15J	11P	8Y
King	Laborers	Timber Person - Sewer (Lagger, Shorer & Cribber)	$64.98	15J	11P	8Y
King	Laborers	Toolroom Person (at Jobsite)	$63.87	15J	11P	8Y
King	Laborers	Topper	$63.87	15J	11P	8Y
King	Laborers	Track Laborer	$63.87	15J	11P	8Y
King	Laborers	Track Liner (Power)	$64.98	15J	11P	8Y
King	Laborers	Traffic Control Laborer	$58.20	15J	11P	9C
King	Laborers	Traffic Control Supervisor	$61.47	15J	11P	9C
King	Laborers	Truck Spotter	$63.87	15J	11P	8Y
King	Laborers	Tugger Operator	$64.98	15J	11P	8Y
King	Laborers	psi	$200.40	15J	11P	9B
King	Laborers	Tunnel Work-Compressed Air Worker 30.01-44.00 psi	$205.43	15J	11P	9B
King	Laborers	Tunnel Work-Compressed Air Worker 44.01-54.00 psi	$209.11	15J	11P	9B
King	Laborers	Tunnel Work-Compressed Air Worker 54.01-60.00 psi	$214.81	15J	11P	9B
King	Laborers	Tunnel Work-Compressed Air Worker 60.01-64.00 psi	$216.93	15J	11P	9B

King	Laborers	Tunnel Work-Compressed Air Worker 64.01-68.00 psi	$222.03	15J	11P	9B
King	Laborers	Tunnel Work-Compressed Air Worker 68.01-70.00 psi	$223.93	15J	11P	9B
King	Laborers	Tunnel Work-Compressed Air Worker 70.01-72.00 psi	$225.93	15J	11P	9B
King	Laborers	Tunnel Work-Compressed Air Worker 72.01-74.00 psi	$227.93	15J	11P	9B
King	Laborers	Tunnel Work-Guage and Lock Tender	$67.48	15J	11P	8Y
King	Laborers	Tunnel Work-Miner	$67.48	15J	11P	8Y
King	Laborers	Vibrator	$64.98	15J	11P	8Y
King	Laborers	Vinyl Seamer	$63.87	15J	11P	8Y
King	Laborers	Watchman	$49.97	15J	11P	8Y
King	Laborers	Welder	$64.98	15J	11P	8Y
King	Laborers	Well Point Laborer	$64.98	15J	11P	8Y
King	Laborers	Window Washer/Cleaner	$49.97	15J	11P	8Y
King	Underground Sewer & Water	General Laborer & Topman	$63.87	15J	11P	8Y
King	Underground Sewer & Water	Pipe Layer	$64.98	15J	11P	8Y
King	Landscape Construction	Landscape Construction/Landscaping Or Planting Laborers	$49.97	15J	11P	8Y
King	Landscape Construction	Landscape Operator	$87.54	15J	11G	8X
King	Landscape Maintenance	Groundskeeper	$17.87		1	
King	Lathers	Journey Level	$78.76	15O	11S	
King	Marble Setters	Journey Level	$71.82	7E	1N	
King	Metal Fabrication (In Shop)	Fitter/Certified Welder	$42.17	15I	11E	
King	Metal Fabrication (In Shop)	General Laborer	$30.07	15I	11E	
King	Metal Fabrication (In Shop)	Mechanic	$43.63	15I	11E	
King	Metal Fabrication (In Shop)	Welder/Burner	$39.28	15I	11E	
King	Millwright	Journey Level	$80.28	5A	1B	
King	Modular Buildings	Cabinet Assembly	$16.66		1	
King	Modular Buildings	Electrician	$16.66		1	
King	Modular Buildings	Equipment Maintenance	$16.66		1	
King	Modular Buildings	Plumber	$16.66		1	
King	Modular Buildings	Production Worker	$16.66		1	
King	Modular Buildings	Tool Maintenance	$16.66		1	
King	Modular Buildings	Utility Person	$16.66		1	
King	Modular Buildings	Welder	$16.66		1	
King	Painters	Journey Level	$54.71	6Z	11J	
King	Pile Driver	Crew Tender	$86.81	15J	11U	9L
King	Pile Driver	Journey Level	$80.50	15J	11U	9L

King	Plasterers	Journey Level	$73.54	7Q	1R	
King	Plasterers	Nozzleman	$77.54	7Q	1R	
King	Playground & Park Equipment Installers	Journey Level	$16.66		1	
King	Pipefitters	Journey Level	$107.59	6Z	1G	
King	Power Equipment Operators	Asphalt Plant Operators	$89.02	15J	11G	8X
King	Power Equipment Operators	Assistant Engineer	$83.69	15J	11G	8X
King	Power Equipment Operators	Barrier Machine (zipper)	$88.22	15J	11G	8X
King	Power Equipment Operators	Batch Plant Operator: concrete	$88.22	15J	11G	8X
King	Power Equipment Operators	Boat Operator	$87.82	7A	11H	8X
King	Power Equipment Operators	Bobcat	$83.69	15J	11G	8X
King	Power Equipment Operators	Brokk - Remote Demolition Equipment	$83.69	15J	11G	8X
King	Power Equipment Operators	Brooms	$83.69	15J	11G	8X
King	Power Equipment Operators	Bump Cutter	$88.22	15J	11G	8X
King	Power Equipment Operators	Cableways	$89.02	15J	11G	8X
King	Power Equipment Operators	Chipper	$88.22	15J	11G	8X
King	Power Equipment Operators	Compressor	$83.69	15J	11G	8X
King	Power Equipment Operators	Concrete Finish Machine - Laser Screed	$83.69	15J	11G	8X
King	Power Equipment Operators	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	$87.54	15J	11G	8X
King	Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$89.02	15J	11G	8X
King	Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$88.22	15J	11G	8X
King	Power Equipment Operators	Conveyors	$87.54	15J	11G	8X
King	Power Equipment Operators	Cranes Friction: 200 tons and over	$90.46	7A	11H	8X
King	Power Equipment Operators	Cranes, A-frame: 10 tons and under	$82.59	7A	11H	8X
King	Power Equipment Operators	150' of boom (including jib with attachments)	$88.67	7A	11H	8X
King	Power Equipment Operators	Cranes: 20 tons through 44 tons with attachments	$87.03	7A	11H	8X
King	Power Equipment Operators	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	$89.60	7A	11H	8X

King	Power Equipment Operators	Cranes: 300 tons and over or 300' of boom including jib with attachments	$90.46	7A	11H	8X
King	Power Equipment Operators	150' of boom(including jib with attachments)	$87.82	7A	11H	8X
King	Power Equipment Operators	Cranes: Friction cranes through 199 tons	$89.60	7A	11H	8X
King	Power Equipment Operators	Cranes: through 19 tons with attachments, a-frame over 10 tons	$86.36	7A	11H	8X
King	Power Equipment Operators	Crusher	$88.22	15J	11G	8X
King	Power Equipment Operators	Deck Engineer/Deck Winches (power)	$88.22	15J	11G	8X
King	Power Equipment Operators	Derricks, On Building Work	$87.82	7A	11H	8X
King	Power Equipment Operators	Dozers D-9 & Under	$87.54	15J	11G	8X
King	Power Equipment Operators	Drill Oilers: Auger Type, Truck Or Crane Mount	$87.54	15J	11G	8X
King	Power Equipment Operators	Drilling Machine	$89.91	15J	11G	8X
King	Power Equipment Operators	Elevator and man-lift: permanent and shaft type	$83.69	15J	11G	8X
King	Power Equipment Operators	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$88.22	15J	11G	8X
King	Power Equipment Operators	Forklift: 3000 lbs and over with attachments	$87.54	15J	11G	8X
King	Power Equipment Operators	Forklifts: under 3000 lbs. with attachments	$83.69	15J	11G	8X
King	Power Equipment Operators	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$88.22	15J	11G	8X
King	Power Equipment Operators	Gradechecker/Stakeman	$83.69	15J	11G	8X
King	Power Equipment Operators	Guardrail Punch	$88.22	15J	11G	8X
King	Power Equipment Operators	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$89.02	15J	11G	8X
King	Power Equipment Operators	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	$88.22	15J	11G	8X
King	Power Equipment Operators	Horizontal/Directional Drill Locator	$87.54	15J	11G	8X
King	Power Equipment Operators	Horizontal/Directional Drill Operator	$88.22	15J	11G	8X
King	Power Equipment Operators	Hydralifts/Boom Trucks Over 10 Tons	$86.36	7A	11H	8X
King	Power Equipment Operators	Hydralifts/boom trucks: 10 tons and under	$82.59	7A	11H	8X
King	Power Equipment Operators	Leverman	$90.84	15J	11G	8X
King	Power Equipment Operators	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$89.02	15J	11G	8X

King	Power Equipment Operators	Loaders, Overhead Under 6 Yards	$88.22	15J	11G	8X
King	Power Equipment Operators	Loaders, Plant Feed	$88.22	15J	11G	8X
King	Power Equipment Operators	Loaders: Elevating Type Belt	$87.54	15J	11G	8X
King	Power Equipment Operators	Locomotives, All	$88.22	15J	11G	8X
King	Power Equipment Operators	Material Transfer Device	$88.22	15J	11G	8X
King	Power Equipment Operators	Mechanics: All (Leadmen - $0.50 per hour over mechanic)	$89.91	15J	11G	8X
King	Power Equipment Operators	Motor Patrol Graders	$89.02	15J	11G	8X
King	Power Equipment Operators	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$89.02	15J	11G	8X
King	Power Equipment Operators	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$83.69	15J	11G	8X
King	Power Equipment Operators	Outside Hoists (Elevators and Manlifts), Air Tuggers, Strato	$87.54	15J	11G	8X
King	Power Equipment Operators	Overhead, bridge type Crane: 20 tons through 44 tons	$87.03	7A	11H	8X
King	Power Equipment Operators	Overhead, bridge type: 100 tons and over	$88.67	7A	11H	8X
King	Power Equipment Operators	Overhead, bridge type: 45 tons through 99 tons	$87.82	7A	11H	8X
King	Power Equipment Operators	Pavement Breaker	$83.69	15J	11G	8X
King	Power Equipment Operators	Pile Driver (other Than Crane Mount)	$88.22	15J	11G	8X
King	Power Equipment Operators	Plant Oiler - Asphalt, Crusher	$87.54	15J	11G	8X
King	Power Equipment Operators	Posthole Digger, Mechanical	$83.69	15J	11G	8X
King	Power Equipment Operators	Power Plant	$83.69	15J	11G	8X
King	Power Equipment Operators	Pumps - Water	$83.69	15J	11G	8X
King	Power Equipment Operators	Quad 9, Hd 41, D10 And Over	$89.02	15J	11G	8X
King	Power Equipment Operators	Quick Tower: no cab, under 100 feet in height base to boom	$88.22	15J	11G	8X
King	Power Equipment Operators	Remote Control Operator On Rubber Tired Earth Moving Equipment	$89.02	15J	11G	8X
King	Power Equipment Operators	Rigger and Bellman	$82.59	7A	11H	8X
King	Power Equipment Operators	Rigger/Signal Person, Bellman(Certified)	$86.36	7A	11H	8X
King	Power Equipment Operators	Rollagon	$89.02	15J	11G	8X

King	Power Equipment Operators	Roller, Other Than Plant Mix	$83.69	15J	11G	8X
King	Power Equipment Operators	Roller, Plant Mix Or Multi-lift Materials	$87.54	15J	11G	8X
King	Power Equipment Operators	Roto-mill, Roto-grinder	$88.22	15J	11G	8X
King	Power Equipment Operators	Saws - Concrete	$87.54	15J	11G	8X
King	Power Equipment Operators	Scraper, Self Propelled Under 45 Yards	$88.22	15J	11G	8X
King	Power Equipment Operators	Scrapers - Concrete & Carry All	$87.54	15J	11G	8X
King	Power Equipment Operators	Scrapers, Self-propelled: 45 Yards And Over	$89.02	15J	11G	8X
King	Power Equipment Operators	Service Engineers: Equipment	$87.54	15J	11G	8X
King	Power Equipment Operators	Shotcrete/Gunite Equipment	$83.69	15J	11G	8X
King	Power Equipment Operators	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	$87.54	15J	11G	8X
King	Power Equipment Operators	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$89.02	15J	11G	8X
King	Power Equipment Operators	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	$88.22	15J	11G	8X
King	Power Equipment Operators	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$89.91	15J	11G	8X
King	Power Equipment Operators	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$90.84	15J	11G	8X
King	Power Equipment Operators	Slipform Pavers	$89.02	15J	11G	8X
King	Power Equipment Operators	Spreader, Topsider & Screedman	$89.02	15J	11G	8X
King	Power Equipment Operators	Subgrader Trimmer	$88.22	15J	11G	8X
King	Power Equipment Operators	Tower Bucket Elevators	$87.54	15J	11G	8X
King	Power Equipment Operators	Tower Crane: over 175' through 250' in height, base to boom	$89.60	7A	11H	8X
King	Power Equipment Operators	Tower crane: up to 175' in height base to boom	$88.67	7A	11H	8X
King	Power Equipment Operators	Tower Cranes: over 250' in height from base to boom	$90.46	7A	11H	8X
King	Power Equipment Operators	Transporters, All Track Or Truck Type	$89.02	15J	11G	8X
King	Power Equipment Operators	Trenching Machines	$87.54	15J	11G	8X
King	Power Equipment Operators	Truck Crane Oiler/Driver: 100 tons and over	$87.03	7A	11H	8X
King	Power Equipment Operators	Truck crane oiler/driver: under 100 tons	$86.36	7A	11H	8X

King	Power Equipment Operators	Truck Mount Portable Conveyor	$88.22	15J	11G	8X
King	Power Equipment Operators	Vac Truck (Vactor Guzzler, Hydro Excavator)	$88.22	15J	11G	8X
King	Power Equipment Operators	Welder	$89.02	15J	11G	8X
King	Power Equipment Operators	Wheel Tractors, Farmall Type	$83.69	15J	11G	8X
King	Power Equipment Operators	Yo Yo Pay Dozer	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Asphalt Plant Operators	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Assistant Engineer	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Barrier Machine (zipper)	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Batch Plant Operator, Concrete	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Boat Operator	$87.82	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Bobcat	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Brokk - Remote Demolition Equipment	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Brooms	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Bump Cutter	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Cableways	$89.02	15J	11G	8X

King	Power Equipment Operators- Underground Sewer & Water	Chipper	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Compressor	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Concrete Finish Machine - Laser Screed	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Conveyors	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Cranes Friction: 200 tons and over	$90.46	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Cranes, A-frame: 10 tons and under	$82.59	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Cranes: 100 tons through 199 tons, or 150' of boom (including jib with attachments)	$88.67	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Cranes: 20 tons through 44 tons with attachments	$87.03	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	$89.60	7A	11H	8X

King	Power Equipment Operators- Underground Sewer & Water	Cranes: 300 tons and over or 300' of boom including jib with attachments	$90.46	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Cranes: 45 tons through 99 tons, under 150' of boom(including jib with attachments)	$87.82	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Cranes: Friction cranes through 199 tons	$89.60	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Cranes: through 19 tons with attachments, a-frame over 10 tons	$86.36	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Crusher	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Deck Engineer/Deck Winches (power)	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Derricks, On Building Work	$87.82	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Dozers D-9 & Under	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Drill Oilers: Auger Type, Truck Or Crane Mount	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Drilling Machine	$89.91	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Elevator and man-lift: permanent and shaft type	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$88.22	15J	11G	8X

King	Power Equipment Operators- Underground Sewer & Water	Forklift: 3000 lbs and over with attachments	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Forklifts: under 3000 lbs. with attachments	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Gradechecker/Stakeman	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Guardrail Punch	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Horizontal/Directional Drill Locator	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Horizontal/Directional Drill Operator	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Hydralifts/boom trucks: 10 tons and under	$82.59	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Hydralifts/boom trucks: over 10 tons	$86.36	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Leverman	$90.84	15J	11G	8X

King	Power Equipment Operators- Underground Sewer & Water	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Loaders, Overhead Under 6 Yards	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Loaders, Plant Feed	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Loaders: Elevating Type Belt	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Locomotives, All	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Material Transfer Device	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Mechanics: All (Leadmen - $0.50 per hour over mechanic)	$89.91	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Motor Patrol Graders	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Outside Hoists (Elevators and Manlifts), Air Tuggers, Strato	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Overhead, bridge type Crane: 20 tons through 44 tons	$87.03	7A	11H	8X

King	Power Equipment Operators- Underground Sewer & Water	Overhead, bridge type: 100 tons and over	$88.67	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Overhead, bridge type: 45 tons through 99 tons	$87.82	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Pavement Breaker	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Pile Driver (other Than Crane Mount)	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Plant Oiler - Asphalt, Crusher	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Posthole Digger, Mechanical	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Power Plant	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Pumps - Water	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Quad 9, Hd 41, D10 And Over	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Quick Tower: no cab, under 100 feet in height base to boom	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Remote Control Operator On Rubber Tired Earth Moving Equipment	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Rigger and Bellman	$82.59	7A	11H	8X

King	Power Equipment Operators- Underground Sewer & Water	Rigger/Signal Person, Bellman(Certified)	$86.36	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Rollagon	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Roller, Other Than Plant Mix	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Roller, Plant Mix Or Multi-lift Materials	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Roto-mill, Roto-grinder	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Saws - Concrete	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Scraper, Self Propelled Under 45 Yards	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Scrapers - Concrete & Carry All	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Scrapers, Self-propelled: 45 Yards And Over	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Shotcrete/Gunite Equipment	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$89.02	15J	11G	8X

King	Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$89.91	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$90.84	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Slipform Pavers	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Spreader, Topsider & Screedman	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Subgrader Trimmer	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Tower Bucket Elevators	$87.54	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Tower Crane: over 175' through 250' in height, base to boom	$89.60	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Tower crane: up to 175' in height base to boom	$88.67	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Tower Cranes: over 250' in height from base to boom	$90.46	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Transporters, All Track Or Truck Type	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Trenching Machines	$87.54	15J	11G	8X

King	Power Equipment Operators- Underground Sewer & Water	Truck Crane Oiler/Driver: 100 tons and over	$87.03	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Truck crane oiler/driver: under 100 tons	$86.36	7A	11H	8X
King	Power Equipment Operators- Underground Sewer & Water	Truck Mount Portable Conveyor	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Vac Truck (Vactor Guzzler, Hydro Excavator)	$88.22	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Welder	$89.02	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Wheel Tractors, Farmall Type	$83.69	15J	11G	8X
King	Power Equipment Operators- Underground Sewer & Water	Yo Yo Pay Dozer	$88.22	15J	11G	8X
King	Clearance Tree Trimmers	Journey Level In Charge	$64.20	5A	4A	
King	Clearance Tree Trimmers	Spray Person	$60.74	5A	4A	
King	Clearance Tree Trimmers	Tree Equipment Operator	$64.20	5A	4A	
King	Clearance Tree Trimmers	Tree Trimmer	$57.29	5A	4A	
King	Clearance Tree Trimmers	Tree Trimmer Groundperson	$43.05	5A	4A	
King	Refrigeration & Air Conditioning Mechanics	Journey Level	$100.35	6Z	1G	
King	Mason	Journey Level	$71.82	7E	1N	
King	Carpenters	Journey Level	$36.44		1	
King	Residential Cement Masons	Journey Level	$46.64		1	
King	Residential Drywall Applicators	Journey Level	$78.76	15J	4C	
King	Residential Drywall Tapers	Journey Level	$36.36		1	
King	Electricians	Journey Level	$48.80		1	

King	Residential Glaziers	Journey Level	$28.93		1	
King	Residential Insulation Applicators	Journey Level	$28.18		1	
King	Residential Laborers	Journey Level	$29.73		1	
King	Residential Marble Setters	Journey Level	$27.38		1	
King	Residential Painters	Journey Level	$23.47		1	
King	Residential Plumbers & Pipefitters	Journey Level	$61.87		1	
King	Refrigeration & Air Conditioning Mechanics	Journey Level	$99.92	7F	1E	
King	Residential Sheet Metal Workers	Journey Level	$99.92	7F	1E	
King	Residential Soft Floor Layers	Journey Level	$59.52	7C	3J	
King	Fitters (Fire Protection)	Journey Level	$63.61		1	
King	Residential Stone Masons	Journey Level	$71.82	7E	1N	
King	Residential Terrazzo Workers	Journey Level	$67.51	7E	1N	
King	Terrazzo/Tile Finishers	Journey Level	$24.39		1	
King	Setters	Journey Level	$21.04		1	
King	Roofers	Journey Level	$67.45	5A	3H	
King	Roofers	Using Irritable Bituminous Materials	$70.45	5A	3H	
King	Sheet Metal Workers	Journey Level (Field or Shop)	$99.92	7F	1E	
King	Shipbuilding & Ship Repair	New Construction Boilermaker	$58.93	7X	4J	
King	Shipbuilding & Ship Repair	New Construction Carpenter	$51.85	7X	4J	
King	Shipbuilding & Ship Repair	New Construction Crane Operator	$43.00	7V	1	
King	Shipbuilding & Ship Repair	New Construction Electrician	$58.98	7X	4J	
King	Shipbuilding & Ship Repair	New Construction Heat & Frost Insulator	$91.81	15H	11C	
King	Shipbuilding & Ship Repair	New Construction Laborer	$58.60	7X	4J	
King	Shipbuilding & Ship Repair	New Construction Machinist	$58.79	7X	4J	
King	Shipbuilding & Ship Repair	New Construction Operating Engineer	$43.00	7V	1	
King	Shipbuilding & Ship Repair	New Construction Painter	$58.72	7X	4J	
King	Shipbuilding & Ship Repair	New Construction Pipefitter	$59.07	7X	4J	

King	Shipbuilding & Ship Repair	New Construction Rigger	$58.93	7X	4J	
King	Shipbuilding & Ship Repair	New Construction Sheet Metal	$58.68	7X	4J	
King	Shipbuilding & Ship Repair	New Construction Shipwright	$51.85	7X	4J	
King	Shipbuilding & Ship Repair	New Construction Warehouse/Teamster	$43.00	7V	1	
King	Shipbuilding & Ship Repair	New Construction Welder / Burner	$58.93	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Boilermaker	$58.93	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Carpenter	$51.85	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Crane Operator	$45.06	7Y	4K	
King	Shipbuilding & Ship Repair	Ship Repair Electrician	$58.98	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Heat & Frost Insulator	$91.81	15H	11C	
King	Shipbuilding & Ship Repair	Ship Repair Laborer	$58.60	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Machinist	$58.79	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Operating Engineer	$45.06	7Y	4K	
King	Shipbuilding & Ship Repair	Ship Repair Painter	$58.72	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Pipefitter	$59.07	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Rigger	$58.93	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Sheet Metal	$58.68	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Shipwright	$51.85	7X	4J	
King	Shipbuilding & Ship Repair	Ship Repair Warehouse / Teamster	$45.06	7Y	4K	
King	Sign Makers & Installers (Electrical)	Journey Level	$60.46	0	1	
King	Installers (Non-Electrical)	Journey Level	$38.53	0	1	
King	Soft Floor Layers	Journey Level	$63.29	15J	4C	
King	Solar Controls For Windows	Journey Level	$16.66		1	
King	Sprinkler Fitters (Fire Protection)	Journey Level	$98.99	5C	1X	
King	Stage Rigging Mechanics (Non Structural)	Journey Level	$16.66		1	

King	Stone Masons	Journey Level	$71.82	7E	1N	
King	Street And Parking Lot Sweeper Workers	Journey Level	$19.09		1	
King	Surveyors	Assistant Construction Site Surveyor	$86.36	7A	11H	8X
King	Surveyors	Chainman	$82.59	7A	11H	8X
King	Surveyors	Construction Site Surveyor	$87.82	7A	11H	8X
King	Surveyors	Drone Operator (when used in conjunction with survey work only)	$82.59	7A	11H	8X
King	Surveyors	Ground Penetrating Radar Operator	$82.59	7A	11H	8X
King	Telecommunication Technicians	Journey Level	$69.69	7E	1E	
King	Construction - Outside	Cable Splicer	$41.35	5A	2B	
King	Construction - Outside	Hole Digger/Ground Person	$27.31	5A	2B	
King	Construction - Outside	Telephone Equipment Operator (Light)	$34.53	5A	2B	
King	Construction - Outside	Telephone Lineperson	$39.07	5A	2B	
King	Terrazzo Workers	Journey Level	$67.51	7E	1N	
King	Tile Setters	Journey Level	$65.51	7E	1N	
King	Tile, Marble & Terrazzo Finishers	Finisher	$56.34	7E	1N	
King	Traffic Control Stripers	All cleanup required in connection with traffic control stripers work (Group 1)	$92.44	15L	1K	
King	Traffic Control Stripers	Handling, painting and installing of all car stops, stop signs and any other type sign (Group 2)	$62.69	15L	1K	
King	Traffic Control Stripers	Installation of guard rail and posts and similar protective devices (Group 2)	$62.69	15L	1K	
King	Traffic Control Stripers	Installation of parking gates, ticket spitters and other mechanical and automatic control devices (Group 2)	$62.69	15L	1K	
King	Traffic Control Stripers	Installation of plastic metal or composition button, or lines used instead of paint (Group 1)	$92.44	15L	1K	
King	Traffic Control Stripers	Line removal; chemical sand and hydro-blast, paint and button (Group 1)	$92.44	15L	1K	
King	Traffic Control Stripers	Manufacturing and installation of all car stops and control devices and similar traffic regulators (Group 2)	$62.69	15L	1K	
King	Traffic Control Stripers	servicing, repairing, placing and removal of traffic safety and control devices/barricades (Group 2)	$62.69	15L	1K	
King	Traffic Control Stripers	Painting and installing lines, arrows, bumpers, curbs, etc., on parking lots, air fields, highways, game courts (Group 1)	$92.44	15L	1K	
King	Traffic Control Stripers	Preparation and maintenance of all surfaces (Group 1)	$92.44	15L	1K	

King	Traffic Control Stripers	Seal coating, slurry coating and other surface protection (Group 2)	$62.69	15L	1K	
King	Truck Drivers	Asphalt Mix Over 16 Yards	$79.40	15J	11M	8L
King	Truck Drivers	Asphalt Mix To 16 Yards	$78.56	15J	11M	8L
King	Truck Drivers	Dump Truck	$78.56	15J	11M	8L
King	Truck Drivers	Dump Truck & Trailer	$79.40	15J	11M	8L
King	Truck Drivers	Other Trucks	$79.40	15J	11M	8L
King	Truck Drivers - Ready Mix	Transit Mix	$79.40	15J	11M	8L
King	Irrigation Pump Installers	Irrigation Pump Installer	$17.71		1	
King	Irrigation Pump Installers	Oiler	$16.66		1	
King	Irrigation Pump Installers	Well Driller	$18.00		1	

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Overtime Codes

Overtime calculations are based on the hourly rate actually paid to the worker. On public works projects, the hourly rate must be not less than the prevailing rate of wage minus the hourly rate of the cost of fringe benefits actually provided for the worker.

1. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

B. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

C. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

D. The first two (2) hours before or after a five-eight (8) hour workweek day or a four-ten (10) hour workweek day and the first eight (8) hours worked the next day after either workweek shall be paid at one and one-half times the hourly rate of wage. All additional hours worked and all worked on Sundays and holidays shall be paid at double the hourly rate of wage.

E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

G. The first ten (10) hours worked on Saturdays and the first ten (10) hours worked on a fifth calendar weekday in a four-ten hour schedule, shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

H. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions or equipment breakdown) shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

I. All hours worked on Sundays and holidays shall also be paid at double the hourly rate of wage.

J. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage.

K. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

M. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

1. N. All hours worked on Saturdays (except makeup days) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

O. The first ten (10) hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays, holidays and after twelve (12) hours, Monday through Friday and after ten (10) hours on Saturday shall be paid at double the hourly rate of wage.

P. All hours worked on Saturdays (except makeup days if circumstances warrant) and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

Q. The first two (2) hours after eight (8) regular hours Monday through Friday and up to ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays (except Christmas day) shall be paid at double the hourly rate of wage. All hours worked on Christmas day shall be paid at two and one-half times the hourly rate of wage.

R. All hours worked on Sundays and holidays shall be paid at two times the hourly rate of wage.

U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays (except Labor Day) shall be paid at two times the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

V. All hours worked on Sundays and holidays (except Thanksgiving Day and Christmas day) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Thanksgiving Day and Christmas day shall be paid at double the hourly rate of wage.

W. All hours worked on Saturdays and Sundays (except make-up days due to conditions beyond the control of the employer)) shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

X. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over twelve (12) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage. When holiday falls on Saturday or Sunday, the day before Saturday, Friday, and the day after Sunday, Monday, shall be considered the holiday and all work performed shall be paid at double the hourly rate of wage.

Y. All hours worked outside the hours of 5:00 am and 5:00 pm (or such other hours as may be agreed upon by any employer and the employee) and all hours worked in excess of eight (8) hours per day (10 hours per day for a 4 x 10 workweek) and on Saturdays and holidays (except labor day) shall be paid at one and one-half times the hourly rate of wage. (except for employees who are absent from work without prior approval on a scheduled workday during the workweek shall be paid at the straight-time rate until they have worked 8 hours in a day (10 in a 4 x 10 workweek) or 40 hours during that workweek.) All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and Labor Day shall be paid at double the hourly rate of wage.

Z. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid the straight time rate of pay in addition to holiday pay.

Overtime Codes Continued

2. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

   B. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

   F. The first eight (8) hours worked on holidays shall be paid at the straight hourly rate of wage in addition to the holiday pay. All hours worked in excess of eight (8) hours on holidays shall be paid at double the hourly rate of wage.

   M. This code appears to be missing. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage.

   R. All hours worked on Sundays and holidays and all hours worked over sixty (60) in one week shall be paid at double the hourly rate of wage.

   U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked over 12 hours in a day or on Sundays and holidays shall be paid at double the hourly rate of wage.

3. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

   F. All hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on paid holidays shall be paid at two and one-half times the hourly rate of wage including holiday pay.

   H. All work performed on Sundays between March 16th and October 14th and all Holidays shall be compensated for at two (2) times the regular rate of pay. Work performed on Sundays between October 15th and March 15th shall be compensated at one and one half (1-1/2) times the regular rate of pay.

   J. All hours worked between the hours of 10:00 pm and 5:00 am, Monday through Friday, and all hours worked on Saturdays shall be paid at a one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   K. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

   After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the eight (8) hours rest period.

Overtime Codes Continued

4. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

A. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage

C. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay. On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay. All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

D. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturday, Sundays and holidays shall be paid at double the hourly rate of pay. Rates include all members of the assigned crew.

EXCEPTION:
On all multipole structures and steel transmission lines, switching stations, regulating, capacitor stations, generating plants, industrial plants, associated installations and substations, except those substations whose primary function is to feed a distribution system, will be paid overtime under the following rates:

The first two (2) hours after eight (8) regular hours Monday through Friday of overtime on a regular workday, shall be paid at one and one-half times the hourly rate of wage. All hours in excess of ten (10) hours will be at two (2) times the hourly rate of wage. The first eight (8) hours worked on Saturday will be paid at one and one-half (1-1/2) times the hourly rate of wage. All hours worked in excess of eight (8) hours on Saturday, and all hours worked on Sundays and holidays will be at the double the hourly rate of wage.

All overtime eligible hours performed on the above described work that is energized, shall be paid at the double the hourly rate of wage.

E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one and one half (1½) times the regular shift rate for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

G. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

I. The First eight (8) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) per day on Saturdays shall be paid at double the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

4. J. The first eight (8) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) hours on a Saturday shall be paid at double the hourly rate of wage. All hours worked over twelve (12) in a day, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

K. All hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage, so long as Saturday is the sixth consecutive day worked. All hours worked over twelve (12) in a day Monday through Saturday, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

L. The first twelve (12) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on a Saturday in excess of twelve (12) hours shall be paid at double the hourly rate of pay. All hours worked over twelve (12) in a day Monday through Friday, and all hours worked on Sundays shall be paid at double the hourly rate of wage. All hours worked on a holiday shall be paid at one and one-half times the hourly rate of wage, except that all hours worked on Labor Day shall be paid at double the hourly rate of pay.

S. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, work performed in excess of (10) hours shall be paid at one and one half (1-1/2) times the hourly rate of pay. On Monday through Friday, work performed outside the normal work hours of 6:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations).

All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Multiple Shift Operations: When the first shift of a multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. Special Shifts: The Special Shift Premium is the basic hourly rate of pay plus $2.00 an hour. When due to conditions beyond the control of the employer or when an owner (not acting as the contractor), a government agency or the contract specifications require more than four (4) hours of a special shift can only be performed outside the normal 6am to 6pm shift then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid the special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday).

U. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. (Except on makeup days if work is lost due to inclement weather, then the first eight (8) hours on Saturday may be paid the regular rate.) All hours worked over twelve (12) hours Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

4. X. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage. Work performed outside the normal shift of 6 am to 6pm shall be paid at one and one-half the straight time rate, (except for special shifts or three shift operations). All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. Shifts may be established when considered necessary by the Employer.

   The Employer may establish shifts consisting of eight (8) or ten (10) hours of work (subject to WAC 296-127-022), that shall constitute a normal forty (40) hour work week. The Employer can change from a 5-eight to a 4-ten hour schedule or back to the other. All hours of work on these shifts shall be paid for at the straight time hourly rate. Work performed in excess of eight hours (or ten hours per day (subject to WAC 296-127-022) shall be paid at one and one-half the straight time rate.

   When due to conditions beyond the control of the Employer, or when contract specifications require that work can only be performed outside the regular day shift, then by mutual agreement a special shift may be worked at the straight time rate, eight (8) hours work for eight (8) hours pay. The starting time shall be arranged to fit such conditions of work.

   When an employee returns to work without at a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Overtime Codes Continued

11. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

   B After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

   C The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, and all hours on Sunday shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage. All non-overtime and non-holiday hours worked between 4:00 pm and 5:00 am, Monday through Friday, shall be paid at a premium rate of 15% over the hourly rate of wage.

   D. All hours worked on Saturdays and holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays shall be paid at double the hourly rate of wage.

   After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

   E. The first two (2) hours after eight (8) regular hours Monday through Friday, the first ten (10) hours on Saturday, and the first ten (10) hours worked on Holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, and Sundays shall be paid at double the hourly rate of wage.

   After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

Overtime Codes Continued

11. F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one-half times the hourly rate of wage for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

G. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage.

All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of nine (9) hours or more. When an employee returns to work without at least nine (9) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the nine (9) hours rest period.

H. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage.

All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of ten (10) hours or more. When an employee returns to work without at least ten (10) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the ten (10) hours rest period.

J. All hours worked on holidays shall be paid at double the hourly rate of wage.

K. On Monday through Friday hours worked outside 4:00 am and 5:00 pm, and the first two (2) hours after eight (8) hours worked shall be paid at one and one-half times the hourly rate. All hours worked over 10 hours per day Monday through Friday, and all hours worked on Saturdays, Sundays, and Holidays worked shall be paid at double the hourly rate of wage.

L. An employee working outside 5:00 am and 5:00 pm shall receive an additional two dollar ($2.00) per hour for all hours worked that shift. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

Overtime Codes Continued

11. M. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.

Work performed outside the normal work hours of 5:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations). When the first shift of a multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. When due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift of 5:00 am to 6:00 pm, then a special shift may be worked at the straight time rate, plus the shift pay premium when applicable. The starting time of work will be arranged to fit such conditions of work. Such shift shall consist of eight (8) hours work for eight (8) hours pay or ten (10) hours work for ten (10) hours pay for four ten shifts.

On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay. All work performed after 6:00 pm Saturday to 5:00 am Monday, all work performed over twelve (12) hours, and all work performed on holidays shall be paid at double the straight time rate of pay.

Shift Pay Premium: In an addition to any overtime already required, all hours worked between the hours of 6:00 pm and 5:00 am shall receive an additional two dollars ($2.00) per hour.

N. All work performed over twelve hours in a shift and all work performed on Sundays and Holidays shall be paid at double the straight time rate.

Any time worked over eight (8) hours on Saturday shall be paid double the straight time rate, except employees assigned to work six 10-hour shifts per week shall be paid double the straight time rate for any time worked on Saturday over 10 hours.

O. All work performed on Saturdays, Sundays, and Holidays shall be paid at one and one half (1-1/2) times the straight time rate of pay.

Overtime Codes Continued

11. P. Work performed in excess of ten (10) hours of straight time per day when four ten (10) hour shifts are established and all work on Saturdays, except for make-up days shall be paid at time and one-half (1 ½) the straight time rate.

Work performed outside the normal work hours of 5:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations). When the first shift of multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. When due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift of 5:00 a.m. to 6:00 p.m., then a special shift may be worked at the straight time rate, plus the shift pay premium when applicable. The starting time of work will be arranged to fit such conditions of work. Such shifts shall consist of eight (8) hours work for eight (8) hours pay or ten (10) hours work for ten (10) hours pay for four ten-hour shifts.

In the event the job is down due to weather conditions, then Saturday may, be worked as a voluntary make-up day at the straight time rate. However, Saturday shall not be utilized as a make-up day when a holiday falls on Friday. All work performed on Sundays and holidays and work in excess of twelve (12) hours per day shall be paid at double (2x) the straight time rate of pay.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Q. All hours worked between the hours of 6:00 pm and 6:00 am, Monday through Saturday, shall be paid at a premium rate of 35% over the hourly rate of wage. Work performed on Sundays shall be paid at double time. All hours worked on holidays shall be paid at double the hourly rate of wage.

R On Monday through Saturday hours worked outside 6:00 am and 7:00 pm, and all hours after eight (8) hours worked shall be paid at one and one-half times the hourly rate. All hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

When a holiday falls on a Saturday, the Friday before shall be the observed holiday. When a holiday falls on a Sunday, the following Monday shall be the observed holiday.

S. The first ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. In the event the job is down due to weather conditions, or other conditions beyond the control of the Employer, then Saturday may be worked at the straight time rate, for the first eight (8) hours, or the first ten (10) hours when a four day ten hour workweek has been established.

All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

11. T. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.

On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay.

All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

U. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.

On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay.

All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

If, due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift, then a Special Shift may be worked, Monday through Friday, at the straight-time rate. The starting time of work for the Special Shift will be arranged to fit such conditions of work. Such Special Shift shall consist of eight (8) hours of work for eight (8) hours of pay or ten (10) hours of work for ten(10) hours of pay on a four-ten workday schedule.

Holiday Codes

5. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, and Christmas Day (7).

B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, the day before Christmas, and Christmas Day (8).

C. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

D. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8).

H. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Day after Thanksgiving Day, And Christmas (6).

Holiday Codes Continued

5. I. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

K. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9).

L. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (8).

N. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, The Friday After Thanksgiving Day, And Christmas Day (9).

P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday And Saturday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9). If A Holiday Falls On Sunday, The Following Monday Shall Be Considered As A Holiday.

Q. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

R. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day After Thanksgiving Day, One-Half Day Before Christmas Day, And Christmas Day. (7 1/2).

S. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, And Christmas Day (7).

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

Holiday Codes Continued

6. G. Paid Holidays: New Year's Day, Martin Luther King Jr. Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Christmas Eve Day (11).

H. Paid Holidays: New Year's Day, New Year's Eve Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, Christmas Day, The Day After Christmas, And A Floating Holiday (10).

T. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Last Working Day Before Christmas Day, And Christmas Day (9).

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). If a holiday falls on Saturday, the preceding Friday shall be considered as the holiday. If a holiday falls on Sunday, the following Monday shall be considered as the holiday.

Holiday Codes Continued

7. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any Holiday Which Falls On A Sunday Shall Be Observed As A Holiday On The Following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

C. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

D. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Unpaid Holidays: President's Day. Any paid holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any paid holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

E. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

F. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the last working day before Christmas day and Christmas day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Holiday Codes Continued

7. G. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

J. Holidays: New Year's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Holiday Codes Continued

7. K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

L. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Last Work Day before Christmas Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. When Christmas falls on a Saturday, the preceding Friday shall be observed as a holiday.

P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Q. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

S. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, the Day after Christmas, and A Floating Holiday (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

V. Holidays: New Year's Day, President's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, the day before or after Christmas, and the day before or after New Year's Day. If any of the above listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

W. Holidays: New Year's Day, Day After New Year's, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day, Christmas Day, the day after Christmas, the day before New Year's Day, and a Floating Holiday.

X. Holidays: New Year's Day, Day before or after New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day before or after Christmas day. If a holiday falls on a Saturday or on a Friday that is the normal day off, then the holiday will be taken on the last normal workday. If the holiday falls on a Monday that is the normal day off or on a Sunday, then the holiday will be taken on the next normal workday.

Y. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day. (8) If the holiday falls on a Sunday, then the day observed by the federal government shall be considered a holiday and compensated accordingly.

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, Christmas Eve, and Christmas Day (9). Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday. Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Holiday Codes Continued

15. G. New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, the last scheduled workday before Christmas, and Christmas Day (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

J. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

L. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

M. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

O. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, the day before Christmas day, and Christmas Day (10). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Note Codes

8. D. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $0.75, Level B: $0.50, And Level C: $0.25.

M. Workers on hazmat projects receive additional hourly premiums as follows: Levels A & B: $1.00, Levels C & D: $0.50.

N. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $1.00, Level B: $0.75, Level C: $0.50, And Level D: $0.25.

S. Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

T. Effective August 31, 2012 – A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

U. Workers on hazmat projects receive additional hourly premiums as follows – Class A Suit: $2.00, Class B Suit: $1.50, And Class C Suit: $1.00. Workers performing underground work receive an additional $0.40 per hour for any and all work performed underground, including operating, servicing and repairing of equipment. The premium for underground work shall be paid for the entire shift worked. Workers who work suspended by a rope or cable receive an additional $0.50 per hour. The premium for work suspended shall be paid for the entire shift worked. Workers who do “pioneer” work (break open a cut, build road, etc.) more than one hundred fifty (150) feet above grade elevation receive an additional $0.50 per hour.

8. V. In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.

Depth premiums apply to depths of fifty feet or more. Over 50' to 100' - $2.00 per foot for each foot over 50 feet. Over 101' to 150' - $3.00 per foot for each foot over 101 feet. Over 151' to 220' - $4.00 per foot for each foot over 220 feet. Over 221' - $5.00 per foot for each foot over 221 feet.

Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25’ to 300’ - $1.00 per foot from entrance. 300’ to 600’ - $1.50 per foot beginning at 300’. Over 600’ - $2.00 per foot beginning at 600’.

W. Meter Installers work on single phase 120/240V self-contained residential meters. The Lineman/Groundmen rates would apply to meters not fitting this description.

Note Codes Continued

X. Workers on hazmat projects receive additional hourly premiums as follows - Class A Suit: $2.00, Class B Suit: $1.50, Class C Suit: $1.00, and Class D Suit: $0.50. Special Shift Premium: Basic hourly rate plus $2.00 per hour.

When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications requires that work can only be performed outside the normal 5 am to 6pm shift, then the special shift premium will be applied to the basic hourly rate. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in OT or Double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Y. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay.

Swinging Stage/Boatswains Chair: Employees working on a swinging state or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

Z. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as a contractor), a government agency or the contract specifications require that more than (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they will be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Note Codes Continued

9. A. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications require that more than four (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Certified Crane Operator Premium: Crane operators requiring certifications shall be paid $0.50 per hour above their classification rate.

Boom Pay Premium: All cranes including tower shall be paid as follows based on boom length:

(A) – 130’ to 199’ – $0.50 per hour over their classification rate.
(B) – 200’ to 299’ – $0.80 per hour over their classification rate.
(C) – 300’ and over – $1.00 per hour over their classification rate.

Note Codes Continued

9. B. The highest pressure registered on the gauge for an accumulated time of more than fifteen (15) minutes during the shift shall be used in determining the scale paid.

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

C. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. These classifications are only effective on or after August 31, 2012.

D. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, bridges, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.

E. Heavy Construction includes construction, repair, alteration or additions to the production, fabrication or manufacturing portions of industrial or manufacturing plants, hydroelectric or nuclear power plants and atomic reactor construction. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $1.00, Level B: $0.75, Level C: $0.50, And Level D: $0.25.

F. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.

H. One (1) person crew shall consist of a Party Chief. (Total Station or similar one (1) person survey system). Two (2) person survey party shall consist of a least a Party Chief and a Chain Person. Three (3) person survey party shall consist of at least a Party Chief, an Instrument Person, and a Chain Person.

9. I. In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.

Depth premiums apply to depths of fifty feet or more. Over 50' to 100' - $2.00 per foot for each foot over 50 feet. Over 101' to 150' - $3.00 per foot for each foot over 101 feet. Over 151' to 220' - $4.00 per foot for each foot over 220 feet. Over 221' - $5.00 per foot for each foot over 221 feet.

Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25’ to 300’ - $1.00 per foot from entrance. 300’ to 600’ - $1.50 per foot beginning at 300’. Over 600’ - $2.00 per foot beginning at 600’.

Employees may be required to perform any combination of work within the Diving team/crew, (with the exception of dive Supervisor) provided they are paid at the highest rate at which he/she has worked for the shift.

L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $0.75, Level B: $0.50, And Level C: $0.25.

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay.

Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

SECTION 00 41 13 – BID FORM

TO: **South King Fire**

ADDRESS: 31617 1st Avenue South, Federal Way, WA 98003

I have received Bid Documents titled "**SKF Administrative Building Improvements**", dated July 18, 2025.

I have received Addenda Nos. _____ and have included their provisions in my Bid.

I have examined both Documents and the site/job conditions, and submit the following Bid. In submitting this Bid, I agree:

1. To hold my bid open in accordance with referenced Instruction to Bidders, as modified and supplemented.
2. To enter into and execute referenced Contract, if awarded, on basis of this bid and to furnish bonds and insurance required by Bidding Documents.
3. To accomplish the work in accordance with the Contract Documents.
4. To complete the work by the time stipulated in the Project Manual.

OVERHEAD, PROFIT, AND THE LIKE

All bid prices listed in this form include overhead, profit, bonds, and all other expenses involved.

SALES TAX

All bid prices listed in this Bid Form DO NOT INCLUDE applicable local and Washington State Sales Tax.

BID AMOUNT

I WILL CONSTRUCT THIS PROJECT FOR THE FOLLOWING PRICE:

Base Bid Price (Lump sum):

_____DOLLARS

$ _____

Additive Alternate 1 (Lump sum):

_____DOLLARS

$ _____

Additive Alternate 2 (Lump sum):

_____DOLLARS

$ _____

Additive Alternate 3 (Lump sum):

_____DOLLARS

$ _____

TRENCH EXCAVATION SAFETY PROVISIONS

$

(Included also in Base Bid)

If the bid amount contains any work which requires trenching exceeding a depth of four feet, all costs for trench safety shall be included in the Base Bid and indicated above for adequate trench safety systems in compliance with Chapter 39.04 RCW. 49.17 RCW and WAC 296-155-650. Bidder must include a lump sum dollar amount in blank above (even if the value is $0.00) to be responsive.

PRINCIPAL SUBCONTRACTORS

For any subcontract amount that exceeds 10% of the contractors base bid price, contractor shall list such subcontractor and subcontract amount below (affix additional sheets as necessary):

1) _____ $ _____

2) _____ $ _____

3) _____ $ _____

Provide the name of Subcontractor used for the following:

1) Heating _____

2) Ventilation & Air Conditioning _____

3) Plumbing _____

4) Electrical _____

5) Structural Steel Installation _____

6) Rebar Installation _____

CONTRACT TIME

The Owner anticipates Notice of Award of this contract within 30 days of bid receipt. Owner shall execute contract and issue Notice to Proceed upon satisfactory receipt of Certificate of Insurance, Bonds, and related documents as required by the Instructions to Bidders, the General Conditions of the Contract, and Supplemental Conditions.

If this Bid is accepted, we will Substantially Complete the work within 180 calendar days from Notice to Proceed.

THIS BID PROPOSAL SUBMITTED BY:

NAME OF FIRM _____

SIGNED BY _____ TITLE _____

PRINTED NAME _____

ADDRESS _____

CITY/STATE/ZIP _____

TELEPHONE _____

DATE _____

PRIMARY CONTACT NAME _____

PRIMARY CONTACT EMAIL _____

LICENSING

State of Washington Contractor's License Number: _____

Federal Tax I.D. Number: _____

NOTE:
If Bidder is a corporation write State of Incorporation, and if partnership, give full names and address of all partners below.

_____

_____

CONTRACTOR'S QUALIFICATIONS STATEMENT:

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

_____ _____
Signature Name (printed)

COMBINED AFFIDAVIT & CERTIFICATION FORM:
NON-COLLUSION, MINIMUM WAGE (NON-FEDERAL AID)

NON-COLLUSION AFFIDAVIT

I declare under penalty of perjury of the Laws of the State of Washington that I am the person who submitted the foregoing Bid, and that such Bid is genuine and not sham or collusive or made in the interest or on behalf of any person not therein named, and further, that the declarant has not directly induced or solicited any other individual or entity to put in a sham Bid, or to refrain from submitting a Bid, and that declarant has not in any manner sought by collusion to secure to himself/herself or to any other person any advantage over other bidder or bidders.

AND

MINIMUM WAGE AFFIDAVIT FORM

I, the undersigned, declare under penalty of perjury of the Laws of the State of Washington, that in connection with the performance of the work of this project, I will pay each classification of laborer, workman, or mechanic employed in the performance of such work not less than the prevailing rate of wage or not less than the minimum rate of wage as specified in the principal contract; that I have read the above and foregoing statement and certificate, know the contents thereof and the substance as set forth therein is true to my knowledge and belief.

NAME OF BIDDER'S FIRM

SIGNATURE OF AUTHORIZED REPRESENTATIVE OF BIDDER

CERTIFICATION OF COMPLIANCE WITH WAGE PAYMENT STATUTES

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date, the bidder is not a "willful" violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

I certify under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

_____
Bidder's Business Name

_____
Signature of Authorized Official*

_____
Printed Name

_____
Title

_____ _____ _____
Date City State

Check One:

Sole Proprietorship ☐ Partnership ☐ Joint Venture ☐ Corporation ☐

State of Incorporation, or if not a corporation, State where business entity was formed:

_____

If a co-partnership, give firm name under which business is transacted:

_____

** If a corporation, proposal must be executed in the corporate name by the president or vice-president (or any other corporate officer accompanied by evidence of authority to sign). If a co-partnership, proposal must be executed by a partner.*

CERTIFICATION OF INTENT TO COMPLY WITH APPRENTICESHIP UTILIZATION REQUIREMENTS

(RCW 39.04.320)

Project Title: South King Fire Administrative Building Improvements

Bidder Name: _____

Bidder Address: _____

Contact Person: _____

Phone Number: _____

Pursuant to RCW 39.04.320 and as stated in the bidding documents, this project is estimated to cost $2,000,000 or more, and is therefore subject to the apprenticeship utilization requirements applicable to municipalities. The undersigned certifies the following:

1. Minimum Apprenticeship Requirement

   The bidder shall ensure that no less than fifteen percent (15%) of the total labor hours for the above project will be performed by apprentices enrolled in state-registered apprenticeship training programs approved by the Washington State Apprenticeship and Training Council.

2. Subcontractor Compliance

   The bidder shall require all subcontractors, at any tier, to comply with the same apprenticeship-utilization requirements and will ensure their hours are reported in accordance with state law.

3. Monitoring and Reporting

   The bidder shall track and report all apprentice hours as required by the Washington State Department of Labor and Industries. The bidder understands that failure to meet the 15% requirement or to demonstrate good faith compliance may result in enforcement actions, including penalties or a finding of non-responsibility on future bids, and the bidder shall hold harmless the Owner from any actions based on the bidder's, or the bidder's subcontractor's, failure to comply with RCW 39.04.320.

4. Acknowledgement of Exceptions

   The bidder acknowledges that the Owner may adjust the apprenticeship requirement only for the following reasons:

   - A demonstrated lack of available apprentices in King County;
   - A disproportionately high ratio of material costs to labor hours;
   - A good faith effort by the contractor to comply; or
   - Other criteria deemed appropriate by the Owner and approved by the Owner's legislative authority.

5. Acknowledgement of Limitation

   The bidder understands that no contractor or subcontractor may be required to exceed the 15% apprenticeship requirement.

I certify under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

Executed this ____ day of _____, 2025, at _____ (City), Washington.

Signature: _____

Name (Printed): _____

Title: _____

Company: _____

END OF SECTION

Signature: _____

Name (Printed): _____

Title: _____

Company: _____

END OF SECTION

SECTION 00 52 13 – AGREEMENT FORM

PART 1 - GENERAL

1.1 FORM OF CONTRACT

The Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, AIA Document A101-2017, is included BY THIS REFERENCE ONLY; it is not bound in project manual. The Contractor and all subcontractors shall read and be governed by them.

1.2 AVAILABILITY

Copies may be obtained from American Institute of Architects, 1735 New York Avenue NW, Washington, D.C. 20006, local Chapter offices, or online: https://shop.aiacontracts.com/contract-documents/69981-standard-form-of-agreement-between-owner-and-contractor

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 00 72 13 – GENERAL CONDITIONS OF THE CONTRACT

PART 1 - GENERAL

1.1 STANDARD FORM

The *General Conditions of the Contract for Construction*, AIA Document A201-2017, is included as part of the Contract BY THIS REFERENCE ONLY; it is not bound in project manual. The Contractor and all subcontractors shall read and be governed by them.

1.2 AVAILABILITY

Copies may be obtained from American Institute of Architects, 1735 New York Avenue NW, Washington, D.C. 20006, local Chapter offices, or online: https://shop.aiacontracts.com/contract-documents/25131-general-conditions-of-the-contract-for-construction

1.3 CONFLICTS

In event of conflicts in the Contract Documents, including conflicts between referenced General Conditions and other parts of the Project Manual and Drawings, the Architect reserves the right to determine which governs, and in what order or precedence. See Article 3 of General Conditions and Division 00 Section “Supplemental Conditions”.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 00 73 00 – SUPPLEMENTAL CONDITIONS

The following supplements modify, change, delete from, or add to the referenced "General Conditions of the Contract for Construction." Where any article of the General Conditions is Modified or any Paragraph, Subparagraph, or Clause is modified or deleted by Section 007300, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause remain in effect.

Modification to the General Conditions:

ARTICLE 1
CONTRACT DOCUMENTS

1.1.1 THE CONTRACT DOCUMENTS

Add the following new subparagraphs 1.1.1.1 and 1.1.1.2:

1.1.1.1 In the event of a conflict or discrepancy among or in the Contract Documents, interpretation shall be governed in the following priority:

1. Agreement (A-101)
2. Supplemental Conditions
3. General Conditions (A-201)
4. Addenda
5. Schedules
6. Drawings
7. Specifications
8. Instructions to Bidders and Accepted Bid

1.1.1.2 In the event of any inconsistencies, conflicts or ambiguities between the Contract Documents, or within an individual document not clarified by addendum, the resolution of such inconsistencies, conflict or ambiguity shall be provided in accordance with the Architect's interpretation. All conflicts are to be referred to the Architect for resolution and incorporation into a Contract Modification, if appropriate.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following new subparagraphs 1.2.1.1 and 1.2.1.2:

1.2.1.1 Such execution of the Contract also constitutes a representation by the Contractor that it can fully perform the Contract and deal with all issues arising out of the Contract Documents or conditions of the site of the Work for the Contract Amount. The failure of the Contractor fully to acquaint itself with any applicable condition or matter shall not in any way relieve the Contractor from the responsibility for performing the Work in accordance with the Contract Documents and within the Contract Time and the Contract Sum.

1.2.1.2 Contractor to make the following representation to Owner:

A. Contractor is financially solvent, able to pay its debts as they mature, and possesses sufficient working capital to complete the Work and perform Contractor's obligations required by the Contract Documents; and

B. Contractor is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform the obligations required by the Contract Documents and has sufficient experience and competence to do so.

ARTICLE 2
OWNER

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Delete subparagraph 2.2.5 and substitute the following:

2.2.5 The Contractor will be furnished free of charge 2 copies of Drawings and Project Manuals. Additional sets will be furnished at the cost of reproduction, postage and handling.

Add the following new subparagraphs 2.5 through 2.5.1:

2.5 OWNER'S RIGHT AND RESPONSIBILITES

2.5.1 The Owner will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided in Paragraph 3.3. The Owner will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Owner will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portion of the Work.

ARTICLE 3
CONTRACTOR

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Add the following to subparagraph 3.3.1:

3.3.1 If the Contractor has any concerns, objections or reservations concerning such specific instructions, the Contractor must raise and resolve such issues with the Architect and the Owner prior to performing such specific instructions.

3.4 LABOR AND MATERIALS

Add the following to subparagraph 3.4.3:

3.4.3 At no change to the Contract Sum or Contract Time, the Owner may provide written notice requiring the Contractor to remove from the Work any employee, subcontractor employee, or other person carrying out the Contract whom the Owner reasonably considers objectionable.

Add the following subparagraph 3.4.4 through 3.4.4.6:

3.4.4 PREVAILING WAGES

3.4.4.1 The Washington State Department of Labor and Industries Prevailing Wage Rates are part of the Contract.

3.4.4.2 Copies of the Washington State Department of Labor and Industries Prevailing Wage Rates are bound in the Project Manual for reference and convenience only. It is the Contractor's responsibility to follow the most current edition.

3.4.4.3 No worker may be paid less than the prevailing minimum hourly wage rate established by the State Department of Labor and Industries. Statements of Intent to Pay Prevailing Wages and Affidavits of Wages Paid are required. The Contractor shall fully comply with all current applicable labor laws and regulations, including without limitation RWC Chapters 39.12 (Prevailing Wages); 49.28 (Hours of labor); and 49.70 (Worker Right to Know).

3.4.4.4 Any fabricator or manufacturer that produces nonstandard items and is considered by the Department of Labor and Industries as a contractor must comply with all of the requirements of RCW 39.12, including but not limited to the filing of the "Statement of Intent to Pay Prevailing

Wages" and "Affidavit of Wages Paid" with the Department of Labor and Industries Industrial Statistician.

3.4.4.5 The Owner reserves the right to perform wage rate interviews and/or require Contractor submission of certified payrolls for all Contractor and Subcontractor personnel.

3.4.4.6 Contractor shall provide Owner with copies of the Intent to Pay Prevailing Wage forms as filed with the State of Washington for the contractor's forces and for all subcontractors.

3.6 TAXES

Change subparagraph 3.6 to read:

3.6 The Contractor shall pay all applicable State and Local Sales, Consumer, Use and other similar taxes for Work or portions thereof provided by the Contractor. The Owner shall include these taxes in their payments to the Contractor who shall pay the taxes to the proper authorities in accordance with the applicable laws and regulations governing this project. Sales tax will not be included in bid amount.

3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

Delete subparagraph 3.7.1 and substitute the following:

3.7. The **Owner** shall secure and pay for the **Plan Review Fees, Building Permit, and (where applicable) L&I Electrical Plan Review Fees.** The Contractor shall secure and pay for all other permits and governmental fees, licenses and inspections necessary for proper execution of and completion of the Contract which are legally required when bids are received.

3.9 SUPERINTENDENT

Add the following to subparagraphs 3.9.3:

During the construction period should the initial superintendent fall ill, retire, be laid off or terminated employment, the Owner reserves the right to review and accept the replacement as stated above.

Add the following subparagraph 3.9.4:

3.9.4 The Superintendent shall remain on the Project whenever Subcontractors are present unless the job is closed down due to a legal holiday, a general strike, conditions beyond the control of the Contractor, termination of the Contract in accordance with the Contract Documents, or Final Completion is attained.

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULE

Change this entire paragraph 3.10 to read:

3.10.1 Within (5) calendar days following Notice to Proceed, the Contractor shall submit to the Owner and the Architect for review and comment, three copies of a CPM Schedule in form satisfactory to the Owner for Contractor's construction/erection of the Work. The initial and any revisions of the Project Schedule shall be prepared and submitted in paper form. With each approved monthly payment request, provide an updated Progress Schedule. Not less than 5% (in retention) of Progress Payments to the Contractor may be withheld by the Owner until such initial and updated Progress Schedules have been timely submitted for review by the Owner and the Architect.

3.10.2 The Project Schedule shall consist of a network diagram with activity descriptions and durations and supporting data which will explain the Contractor's planning of the work. Contractor shall provide, if requested by Owner, cost allocation and resource estimates for each activity.

3.10.2.1 The CPM Schedule diagram shall include:

(a) The order and interdependence of the Contractor's activities and the major points of the interface or interrelation with the activities of others, including Specific Dates for completion.
(b) Conformance with and identification of the Specific Dates specified in the Contract Documents.
(c) The descriptions of work by activity.
(d) The time required for preparation, and review of shop drawings, mock-ups, manufacturing, and delivery of Contractor-furnished permanent plant materials, especially long lead items.
(e) Critical Path (or Paths).

(f) Testing of equipment and materials. The CPM Schedule shall provide a complete and detailed sequence of operations of the Work within the time limits specified in the Contract.

3.10.2.2 The identity and duration of all activities to be included in this CPM Schedule shall meet the following criteria:

(a) Activity descriptions shall be clear and concise. The beginning and end of each activity shall be readily verifiable.
(b) Responsibility for each activity shall be identified with a single performing organization.
(c) The identity of any potential problems or constraints related to the implementation of the overall construction plan.

3.10.2.3 A schedule for the purchase of items required for performance of the Work, showing lead items between purchase order placement and delivery dates, shall be integrated with the Progress Schedule upon request of the Owner. The Contractor shall furnish the Architect with copies of all purchase orders and acknowledgements and fabrication, production, and shipping schedules for all major items on the critical path within 10 days of Contractor's receipt of each purchase order, acknowledgment or schedule. Neither the Architect nor the Owner shall be deemed to have approved or accepted any such material, or its schedule, nor deemed to have waived this requirement if some or all of the material is not received.

3.10.3 The CPM Schedule shall indicate an early completion date for the project that is not later than the project's required completion date. All activity durations shall be given in calendar days. The CPM Schedule shall also indicate each of the following:

(a) Interfaces with the work of outside contractors, e.g., utilities, power, and with any separate contractor.
(b) Descriptions of activity including activity numbers.
(c) Estimated duration time for each activity.
(d) Early start date for each activity.
(e) Late start date for each activity.
(f) Early finish date for each activity.
(g) Late finish date for each activity.
(h) Float available for each batch of activities containing float.
(i) Actual start date for each activity begun.
(j) Actual finish date for each activity completed.
(k) Identification of all Critical Path activities in the mathematical analysis.
(l) The Critical Path for the project, with said path of activities being clearly and easily recognizable on the time-scaled CPM Schedule Diagram. The relationship between all non-critical activities and activities on the Critical Path shall be clearly shown on the CPM Schedule Diagram.

3.10.4 It is to be expressly understood and agreed by the Contractor that the schedule is an estimate to be revised from time-to-time as progress proceeds, and that the Owner does not guarantee that Contractor can start work activities on the "early start" or "late start" dates or complete work activities on the "early finish' or "late finish" date shown in the Schedule, or as same may be upgraded or revised; nor does the Owner guarantee that Contractor can proceed at all times in the sequence established by said Schedule. If Contractor's schedule indicates that Owner or separate contractor is to perform an activity by a specific date, or within a certain duration, Owner or any separate contractor under contract with the Owner shall not be bound to said date or duration unless Owner expressly and specifically agrees in writing to same; the Owner's or the Architect's overall review and approval or acceptance of the Schedule does not constitute an agreement to specific dates, durations or sequences for activities of the Owner of any separate contractor.

3.10.5 Should any of the conditions exist such that certain activities shown on the Contractor's CPM Schedule fall behind schedule to the extent that any of the specific dates are in jeopardy, the Contractor shall be required to, at no extra cost to the Owner, prepare and submit to the Owner a supplemental Recovery Schedule, in a form and detail appropriate to the need, to explain and display how they intend to reschedule those activities to regain compliance with the CPM Schedule during the immediately subsequent pay period.

3.10.6 The Contractor shall do the following after determination of the requirement for a Recovery Schedule:

(a) Within three (3) calendar days, the Contractor shall submit a Recovery Schedule to the Owner for review. The Recovery Schedule shall be prepared to a similar level of detail as the CPM Schedule and shall have a maximum duration of one (1) month.
(b) Any revisions necessary as a result of this review shall be resubmitted by the Contractor with any necessary revisions for acceptance within two (2) calendar days of the review. The approved Recovery Schedule shall then be the Schedule which the Contractor shall use in planning, organizing, directing, coordinating, performing and executing the Work (including all activities of subcontractors, equipment vendors, and suppliers) for its one (1) month duration, to regain compliance with the CPM Schedule.

3.10.7 Should the Contractor, after approval of the initial CPM Schedule desire to change their plan of construction, they shall submit their requested revisions to the Owner including a description of the logic for rescheduling the work, methods of maintaining adherence to Intermediate Milestones and Specific Dates. The Contractor shall revise their Schedule to include the effect of changes, acts of God or other conditions or events which have affected the CPM Schedule, If the requested changes are acceptable to the Owner, they will be incorporated by the Contractor into the CPM Schedule in the next reporting period. The resultant cost to the Owner for significant changes or a significant number of changes to the CPM Schedule shall be paid for by the Contractor.

3.10.8 When the Owner orders changes by Change Order which have the potential to impact the Contract Milestones or Specific Dates stipulated, a Network will be prepared by the Contractor and provided to the Project Manager. After the Network has been accepted by the Owner, it will be incorporated into the CPM Schedule by the Contractor.

3.10.9 Failure of the Contractor to substantially comply with any of the scheduling requirements of this Contract at no cost to the Owner shall constitute cause that the Contractor is failing to prosecute the Work with such diligence as will insure its completion within the Contract times and shall be considered cause for termination by the Owner, pursuant to Article 14 of the General Conditions; and may also result in the Owner's withholding of Progress Payment(s) until the Contractor complies.

3.10.10 Float time is defined as the amount of time between earliest start date and the latest start date or between the earliest finish date or the latest finish date of a chain of activities on the CPM Schedule. Float time is not for the exclusive use or benefit of either the Contractor of the Owner. Contractor's work shall proceed according to start dates, and the Owner shall have the right to reserve and apportion float time according to the needs of the project. The Contractor acknowledges and agrees that actual delays, affecting paths of activities containing float time, will not have any effect upon Contract Completion times, providing that the actual delay does not exceed the float time associated with those activities. Extensions of time for performance as described in the Contract Documents will be granted only to the extent that time adjustments for the activity or activities affected by any condition or event which entitles the Contractor to a time extension exceeds the total float or slack time along the actual critical path of activities affected at the time of Notice to Proceed of a Change Order or the commencement of any delay, claim or condition for which an adjustment is claimed or warranted under the Contract Documents.

3.10.11 The Schedule Duration shall be based on the Contract Time of Completion listed on the Bid Form. The Owner shall not be obligated to accept any Early Completion Schedule suggested by the Contractor. The Contract Time for Completion shall establish the Schedule Completion Date. If the Contractor feels that the work can be completed in less than the Specified Contract Time, then the Surplus Time shall be considered Project Float. This Float time shall be shown on the Project Schedule. It shall be available to accommodate changes in the work and unforeseen conditions. Neither the Contractor nor the Owner have exclusive right to this Float Time. It belongs to the project.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add the following new subparagraphs 3.11.1 and 3.11.2:

3.11.1 In addition, the Contractor shall keep the approved permit set of plans at the jobsite during construction, in good condition. Prior to final acceptance, the Contractor shall deliver this permit set to the Architect.

3.11.2 Satisfactory maintenance of up-to-date record drawings will be a requirement for approval of monthly Progress Payments.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

3.12 APPRENTICES

(RCW 39.04.320)
Because the Owner is a "municipality" as defined under RCW 39.04.010 (4) and this project is estimated to cost $2,000,000 or more, the Owner must ensure contractors adhere to the apprenticeship-utilization requirements of RCW 39.04.320.
Pursuant to RCW 39.04.320, no less than 15 percent of the labor hours to be performed to complete this project must be performed by state-registered apprentices.
The contractor may not be required to exceed the apprenticeship-utilization requirements set forth above.
The Owner may adjust the above apprenticeship-utilization requirements for the following reasons:
(a) The demonstrated lack of availability of apprentices in King County;
(b) A disproportionately high ratio of material costs to labor hours, which does not make feasible the required minimum levels of apprentice participation;
(c) Participating contractors have demonstrated a good faith effort to comply with the requirements of this section; or (d) Other criteria the Owner deems appropriate, which are subject to review by the Owner's legislative authority.
Contractors must track and report apprentice hours as required by the Department of Labor and Industries, and failure to comply may result in penalties or other enforcement actions.
Bidders must complete the certification of intent to comply with RCW 39.04.320, attached hereto as Addendum A, to be deemed responsive.

ARTICLE 5

SUBCONTRACTORS

5.3 SUBCONTRACTUAL RELATIONS

Add the following new subparagraph:
5.3.1 The Contractor shall schedule, supervise and coordinate the operations of all Subcontractors. No subcontracting of any of the Work shall relieve the Contractor from its responsibility for the performance of the Work in accordance with the Contract Documents or from its responsibility for the performance of any other of its obligations under the Contract Documents.

ARTICLE 6
CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.2 MUTUAL RESPONSIBILITY

Add the following to paragraph:
6.2.1 If the Contractor receives items from a separate contractor or from the Owner for storage, erection or installation, the Contractor shall acknowledge receipt for items delivered, and thereafter will be held responsible for care, storage and any necessary replacement of item or items received.

At subparagraph 6.2.4, delete the word "wrongfully."

ARTICLE 7
CHANGES IN THE WORK

7.2 CHANGE ORDERS

Add the following paragraphs 7.2.2 through 7.2.5:
7.2.2 Change proposal disagreements shall be submitted by the Contractor to the Architect in a form satisfactory to the Owner for such submittals. The total cost of any change, including a claim shall be limited to the reasonable value thereof, to be determined in the following manner:

7.2.3 ADDITIVE CHANGES:

1a. Direct Labor Costs: This is defined as the estimated labor costs determined by either the estimated number of craft hours and the hourly costs necessary to perform the change in work; or the unit labor costs necessary to perform the change in work; or the unit labor costs applied to the material quantities, provided said unit labor costs are developed from the above craft man hour cost; whichever is applicable, according to industry practice. The hourly cost shall be based on the following:

1. Basic Wages: Current minimum prevailing hourly wage rates, including vacation pay, for all labor, crew foreman, and general foreman performing and/or directly supervising the work on site. These rates, whichever are applicable, are established by the State of Washington, Department of Labor and Industries.
2. Fringe Benefits: Fringe benefits established by the State of Washington, Department of Labor and Industries or contributed to labor trust funds as itemized fringe benefits, whichever is applicable.
3. Worker's Insurance: Direct contributions to the State of Washington as Industrial Insurance; Medical Aid; and Supplemental Pension, by the class and rates established by the State of Washington, Department of Labor and Industries.
4. Federal Insurance's: Direct contributions required by the Federal Insurance Compensation Act (FICA); Federal Unemployment Tax Act (FUTA); and the State Unemployment Compensation Act (SUCA).
5. Costs incurred by the Washington Industrial Safety and Health Act (WISHA); established as 2% of 1, 2, 3, and 4 above.
6. Travel allowances and/or subsistence if applicable not to exceed those established by Regional Labor Union Agreements shall be itemized and identified separately.

1b. Direct Material Costs: This is defined as an itemization of the estimated quantity of materials necessary to perform the change in the work and the cost thereof. These costs shall be by the unit cost applied to the quantity and extended. The unit costs shall be based on the following:

1. The net costs after all offered or available discounts or rebates.
2. Freight costs; express charges; or special delivery costs when applicable.

No lump sum costs will be allowed except when approved in advance by the Architect

1c. Construction Equipment Usage Costs:

1. Rental Equipment: This is defined as an itemization of and the estimated length of time construction equipment will be used on change order work at the site. The rental costs applied thereof will be the rates established by the following whichever is applicable:
   (a) The current hourly rental rates established by agreement between the Associated General Contractors (AGC) and Washington State Department of Highways.
   (b) The current rental rates established by the State of Washington, utilities and Transportation Commission for trucks used on highways.
   (c) The current rental rates established by the National Electrical Contractor's Association (NECA) for equipment used on electrical work.
   (d) The current rental rates established by the mechanical Contractor's Association for equipment used on mechanical work.
   (e) If equipment is required for which a rental rate is not established in any of the above, an agreed rental rate shall be established for that equipment. Such rates and the use of the equipment on the work must be approved by the Architect prior to performing the work.
   (f) The rates in effect at the time of performance of the work are the maximum rates allowable for equipment of modern design and in good working condition and include full compensation for furnishing all fuel, oil, lubrication, repairs, maintenance, and insurance.
2. Small Tools, Expendable and Consumable Supplies:
   (a) These are general in nature and are defined as tools for which the initial purchase price is under $250 and are normally furnished by the performing contractor.
   (b) The allowable rate for small tools will be:

- General Contractors, 3% direct labor costs
- Specialty Contractors, 5% direct labor costs

(c) Expendable and consumable supplies directly associated with the change in work to be itemized.

1d. Subcontractor Proposals: Subcontractors' proposals are to be itemized as in 1a, 1b, and 1c above.

1e. Overhead and Profit by the Contractor Actually Performing the Work: A total amount, not to exceed 10% of items 1a, 1b, and 1c above will be allowed. This is to compensate such contractor for all personnel not defined in 1a above; temporary construction facilities; home office costs; office architecting and estimating costs; profit, and any other cost incidental to the performance of the change in work.

1f. Overhead and Profit by the Contractor and Subcontractor when Subcontractor actually performs the Work:

1. A total amount not to exceed 8% of the total amount of subcontractors proposal as defined in 1d above will be allowed to the Contractor for all overhead and profit to supervise and administer the subcontractors actually performing the change in the work. The Subcontractor doing the work will be allowed no more than 10%. Lower tier sub-subcontractors will be allowed no more than 7%.
2. No direct costs of the Contractor will be allowed to be added to a subcontractor's proposal. Contractor's direct cost, if required, must be submitted as outlined in 1a, 1b, 1c and 1g.

1g. Cost of Any Increase or Decrease in Premium for Insurance and Bond Caused by the Change:

1. Contractor's Liability Insurance: To the above, the costs of the Contractor's Liability Insurance may be increased or decreased.
2. Bond: To the above, the cost of the Contractor's Bond may be increased or decreased.

7.2.4 DEDUCTIVE CHANGES

2a. Items 1a (labor), 1b (material), 1c (equipment), 1d (subcontractor), 1e (overhead and profit, Contractor), 1f (overhead and profit, subcontractor), 1g (insurance and bond) will be itemized for deleted changes in the work.

7.2.5 ADDITIVE CHANGES AND DEDUCTIVE CHANGES TOGETHER

3a. If a change in the work involves both additive and deductive changes, the appropriate overhead and profit amount allowed will be added to the net difference of items 1a, 1b, 1c, and 1d.

3b. If other additive unrelated changed items are included in the same change proposal, the appropriate overhead and profit allowed is to be applied to these individual change items.

ARTICLE 8
TIME

8.2 PROGRESS AND COMPLETION

Add the following new subparagraphs 8.2.4 and 8.2.5:

8.2.4 The Contractor shall furnish such manpower, materials, facilities, and equipment and shall work such hours, including night shifts, overtime operations and Sundays and holidays, as may be necessary to insure the progress and completion of the Work in accordance with the approved and currently updated Progress Schedule. If work actually in place falls behind the currently updated and approved Progress Schedule and it becomes apparent from the current schedule that the Work will not be completed within the Contract Time, the Contractor agrees that they will, as necessary, take some or all of the following actions at no additional cost to the Owner, as required to substantially eliminate tardiness of Work:

1. Increase the manpower in such quantities and crafts as will substantially eliminate, in the opinion of the Owner, the backlog of Work.
2. Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of equipment, or any combination of the foregoing sufficiently to substantially eliminate, in the opinion of the Owner, the backlog of Work; and

3. Reschedule activities to achieve maximum practical concurrency of accomplishment of activities.

8.2.5 The Contractor and Owner acknowledge and contemplate that delay in substantial completion and final completion will cause the Owner substantial damages which are difficult to determine precisely. To the extent the Owner is unable to beneficially occupy each of the facilities which are the subject of this Contract, the Owner is expected to experience damages and costs including but not limited to the following: Loss of use of the facility; the costs of delayed move-in and the disruption of Owner activities and schedule; and rescheduling and shift changes to paid personnel. The parties therefore agree that the following sums of liquidated damages shall be paid to the Owner (or the Owner may withhold payments otherwise due to the Contractor) in liquidation of these difficult to measure damages and/or delay costs reasonably anticipated as a result of delays beyond the dates as established in the Contract, as they may be extended by agreement of the parties by change order during the course of the project:

SUBSTANTIAL COMPLETION: For each calendar day after the date fixed for Substantial Completion and until Substantial Completion of the facilities, the Contractor shall pay the Owner the sum of **Five hundred dollars ($500)**. The Owner shall not be required to accept Substantial Completion of anything less than the entirety of the project but shall have the option to do so. This sum is to be fixed, agreed, liquidated damages and not to be construed as in any sense a penalty.

FINAL COMPLETION: Actual damages will be assessed for failure to achieve Final Completion within (30) days after Substantial Completion. Actual damages will be calculated on the basis of direct architectural, administrative, and other related costs attributed to the Project from the date when Final Completion should have been achieved, to the date Final Completion is actually achieved. Owner may offset these costs against any payment due to the Contractor by reduction in retainage.

8.3 DELAYS AND EXTENSIONS OF TIME

Change subparagraph 8.3.3 to read:

8.3.3 Except as provided in this subparagraph, the Contractor's sole remedy for delays shall be an extension of time. Except for unreasonable delays in performance caused by the acts or omissions of the Owner, the Contractor shall not be entitled to damages, extra compensation or equitable adjustment for direct, indirect or impact damages for delay, including but not limited to cost of acceleration, home office overhead or lost profits. All claims for damages or extensions of time are subject to the requirements of Article 15. In the event the Contractor is entitled to damages from the Owner for delay, it is agreed that the Contractor's sole damages for each day of delay shall be limited to the daily liquidated damage rate provided for the Owner in subparagraph 8.2.5 above.

ARTICLE 9
PAYMENT AND COMPLETION

9.3 APPLICATIONS FOR PAYMENT

Add the following new subparagraph:

9.3.1.3 Until Substantial Completion, the Owner shall pay 95 percent of the amount due the Contractor on account of progress payments.

Add the following new subparagraph:

9.3.4 If authorized by the Owner, the Application for Payment may include request for payment for material delivered to the Project site and suitably stored, or for completed preparatory work. Payment may similarly be requested, subject to Owner's approval, for material stored off the Project site, provided the Contractor complies with or furnishes satisfactory evidence of the following:

1. The material will be placed in a warehouse that is structurally sound, dry, lighted and suitable for the materials to be stored;
2. The warehouse is located within a 25-mile radius of the project. Other locations may be utilized, if approved in writing, by Owner;
3. Only materials for the Project are stored within the warehouse (or a secure portion of a warehouse set aside for the Project);

4. Contractor furnishes Owner a certificate of insurance extending Contractor's insurance coverage for damage, fire, and theft to cover the full value of all materials stored, or in transit;
5. The warehouse (or secure portion thereof) is continuously under lock and key, and only Contractor's authorized personnel shall have access;
6. Owner shall at all times have the right of access in company of the Contractor;
7. Contractor and its surety assume total responsibility for the stored materials; and
8. Contractor furnishes to Owner certified lists of materials stored, bills of lading, invoices, and other information as may be required, and shall also furnish notice to owner when materials are moved from storage to the Project site.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

Add the following to subparagraph 9.5.1:
The Architect may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or part of a Certificate for Payment previously issued, or the Owner may refuse to process an application for payment to such extent as may be necessary in the Owner's or Architect's opinion to protect the Owner from loss because of:

Add the following new subparagraphs 9.5.1.8 through 9.5.1.12:
9.5.1.8 Unsatisfactory prosecution of the Work by the Contractor, including but not limited to failure to carry out the Work in accordance with the Contract Documents.
9.5.1.9 Failure or refusal of the Contractor to fully comply with requirements in the Contract Documents for preparation and submission of scheduling of the Work and updates thereof, or failure to present statements of Intents or Affidavits pertaining to prevailing wages paid as may be required by statue.
9.5.1.10 Liquidated damages.
9.5.1.11 Failure to provide adequate security measures to protect materials stored on site for which the Contractor is seeking payment for.
9.5.1.12 Failure to provide evidence that the performance and payment bonds have been increased to equal the sum of Change Orders.

9.6 PROGRESS PAYMENTS
Add the following new subparagraphs 9.6.8 through 9.6.13:
9.6.8 Upon Commencement of the Work and at the option of the Contractor, an escrow account may be established by the Contractor in a financial institution chosen by the Contractor and approved by the Owner.
9.6.9 The escrow agreement shall provide that the financial institution will act as escrow agent, will pay interest on funds deposited in such account in accordance with the provisions of the escrow agreement and will disburse funds from the account upon the direction of the Owner as set forth below. Compensation to the escrow agent for establishing and maintaining the escrow account shall be paid from interest accrued in the escrow account.
9.6.10 As each progress payment is made, the retainage with respect to that payment shall be deposited by the Owner in the escrow account.
9.6.11 The interest earned on funds in the account shall accrue for the benefit of the Contractor until the substantial completion date named in the Construction Contract or the expiration of any authorized extension of such date. Interest earned after such date shall accrue for the benefit of the Owner. Cost of compensation to the escrow agent paid out of interest earned shall be borne by the Contractor.
9.6.12 When the Contractor has fulfilled all of the requirements of the Contract providing for reduction of retained funds, the escrow agent shall release to the Contractor one-half of the accrued funds but none of the interest thereon. When the Work has been fully completed in a satisfactory manner and the Architect has issued a final Certificate for Payment, the escrow agent shall pay to the Contractor the full amount of funds remaining in the account, including net balance of the interest paid to the account, but less any interest that may have accrued for the benefit of the Owner, which shall be paid to the Owner.
9.6.13 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor, the escrow agent shall make payment to the Contractor as provided in Subparagraph 9.10.3

9.8 SUBSTANTIAL COMPLETION

Change subparagraph 9.8.1 to read:

9.8.1 Substantial Completion is the stage in the progress of the Work (or portion thereof designated and approved by the Architect and Owner) when the construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can fully occupy under necessary permits the Work (or portion thereof designated by the Owner) for the use for which it is intended. All Work other than incidental corrective or punch list work and final cleaning shall have been completed.

Add the following new subparagraph:

9.8.6 The acceptance of Substantial Completion payment shall constitute a waiver of all claims by the Contractor except those previously made in writing and identified by the Contractor as unsettled at the time of the application for payment for the Substantial Completion payment, and except for the Contract Sums due at Final Acceptance.

9.10 FINAL COMPLETION AND FINAL PAYMENT

Add the following to this subparagraph 9.10.1:

The Architect's final Certificate of Payment shall establish the date of Final Completion. If the Contractor notifies the Architect that the punch list items are completed and requests an inspection to determine compliance, and the Architect determines that some or all the punch list items are not completed, the Contractor shall be responsible to the Owner for all costs, including Architect's fees, for any future Architect's inspections after the first inspection to determine subsequent compliance with the punch list.

ARTICLE 10
PROTECTION OF PERSONS AND PROPERTY

Add the following new subparagraph 10.2.8:

10.2.8 At all times until final acceptance of the Work, the Contractor shall protect from damage, weather, deterioration, theft, vandalism, and, malicious mischief all materials, equipment, tools, and other items incorporated or to be incorporated in the Work, or consumed or used in the performance of the Work, and all Work in process and completed Work.

ARTICLE 11
INSURANCE

11.1 CONTRACTOR'S LIABILITY INSURANCE

Add the following new subparagraphs 11.1.1.9 and 11.1.1.10:

11.1.1.9 Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:

1. Premises operations (including X, C and U coverage's as applicable).
2. Independent Contractors' Protective.
3. Products and Completed Operations.
4. Personal Injury Liability with Employment Exclusion deleted.
5. Contractual, including specified provision for Contractor's obligation under Paragraph 3.18.
6. Owned, non-owned and hired motor vehicles.
7. Broad Form Property Damage including Completed Operations.

11.1.1.10 If the General Liability coverage's are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverage's required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2.

Add the following subparagraph 11.1.2.1:

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits, or greater if required by law:

1. Worker's Compensation:

(a) State: Statutory
(b) Applicable Federal: Statutory
(c) Employer's Liability $100,000 per Accident

Comprehensive or Commercial General Liability (including Premises-operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage):

(a) Bodily Injury:
$1,000,000 Each Occurrence
$2,000,000 Aggregate
(b) Property Damage:
$1,000,000 Each Occurrence
$2,000,000 Aggregate
(c) Products and Completed Operations to be maintained for a minimum period of 2 years after final payment.
(d) Property Damage Liability insurance shall provide Explosion, Collapse, and Underground coverage.
(e) Broad Form Property Damage Coverage shall include Completed Operations.

3. Contractual Liability:
(a) Bodily Injury:
$1,000,000 Each Occurrence
$2,000,000 Aggregate
(b) Property Damage:
$1,000,000 Each Occurrence
$2,000,000 Aggregate

4. Personal Injury, with Employment Exclusion deleted:
$2,000,000 Aggregate

5. Business Auto Liability (including owned, non-owned and hired vehicles):
(a) Bodily Injury:
$1,000,000 Each Person
$1,000,000 Each Occurrence
(b) Property Damage:
$1,000,000 Each Occurrence

Add the following subparagraphs 11.1.3.1 through 1.1.3.3:

11.1.3.1 The certificate of insurance shall name the Owner as "Additional Insured." Certificate is required at time contract is signed.

11.1.3.2 The Contractor shall provide an original of the executed insurance policy Endorsement to the Owner prior to commencement of the work.

11.1.3.3 Upon request of the Owner, the Contractor shall provide complete, certified copies of all required insurance policies.

11.4 PERFORMANCE AND PAYMENT BONDS

Delete Subparagraph 11.4.1 and substitute the following:

11.4.1 The Contractor shall provide bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal 100 percent of the Contract Sum including all change orders and sales tax.

Add the following new subparagraphs:

11.4.1.1 The Contractor shall deliver the required bonds to the Owner no later than ten days following the Notice of Award and shall also be submitted with the signed and executed contract.

11.4.1.2 Bonds shall be obtained from companies holding certificates of authority as acceptable sureties pursuant to 31 CFR part 223.

11.4.1.3 Provide bonds executed by surety company or companies authorized to transact business in State in which the project is being constructed. Required form: *Performance Bond* AIA Document A312-2010. Bonding company as approved by Owner.

11.4.1.4 Provide originals of the executed bonds to the Owner, complete with original ink signatures and original stamps/embossing, or digital e-signatures. The parties agree that this agreement may be electronically signed and that such electronic signatures with dates shall have the same force and effect as handwritten signatures and original stamps/embossing.
11.4.1.5 Provide proof of bond rider adjustments in the bond sum for Change Orders in conjunction with requests for progress payments.

Add the following paragraph 11.5:
11.5 HOLD HARMLESS STATEMENT
11.5.1 The Contractor agrees to defend, indemnify and save harmless the Owner, Architect, and their agents, and employees against any and all loss, damage, liability, claims, demands or costs resulting from injury or harm to persons or property (including, with limitation, the Contractor's employees or property) arising out of or in any way connected with Contractor's performance hereof, excepting only such injury or harm as may have been caused solely by the fault or negligence of the Owner, Architect, and their agents, and employees, and shall be deemed to include those of subcontractors.

ARTICLE 13
MISCELLANEOUS PROVISIONS

13.5 TESTS AND INSPECTIONS
Add the following new subparagraph:
13.5.7 No acceptance by the Owner of any Work shall be construed to result from any inspection, tests or failures to inspect by the Owner, the Owner's representative, the Architect or any other person. No inspection, test, failure to inspect or test, or failure to discover any defect or non conformity by the Owner, the Owner's representative, the Architect or any other person shall relieve the Contractor of its responsibility for meeting the requirements of the Contract Documents or impair the Owner's right to reject defective or nonconforming items or right to avail itself of any other remedy to which the Owner may be entitled, notwithstanding the Owner's knowledge of the defect or nonconformity, its substantially or the ease of discovery.

Add the following new paragraphs 13.8 through 13.8.1.2:
13.8 EQUAL OPPORTUNITY
13.8.1 The Contractor shall maintain policies of employment as follows:
13.8.1.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, marital status, physical and mental disabilities, or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth policies of nondiscrimination.
13.8.1.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, marital status, physical and mental disabilities, or national origin.

ARTICLE 14
TERMINATION OR SUSPENSION OF THE CONTRACT

14.2 TERMINATION BY THE OWNER FOR CAUSE
Change subparagraph 14.2.1 to read:

14.2.1 The Owner may, upon seven days' written notice to the Contractor, terminate (without prejudice to any right or remedy of the Owner) the whole or any portion of the Work for cause, including the following circumstances:

1. the Contractor fails to prosecute the Work or any portion thereof with sufficient diligence to ensure the Substantial Completion of the Work within the Contract Time;
2. the Contractor is in material default of any provision of the Contract;
3. the Contractor is adjudged bankrupt, makes a general assignment for the benefit of its creditors, or if a receiver is appointed on account of its insolvency;
4. the Contractor fails to supply a sufficient number of properly skilled workers or proper materials;
5. the Contractor fails to make prompt payment due to Subcontractors or for materials or labor;
6. the Contractor disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction; or
7. the Contractor materially breaches any provision of the Contract Documents.

Add the following new subparagraph:

14.2.5 If the Owner terminates in whole or part the Work pursuant to paragraph 14.2, the Owner may procure, upon such terms and in such manner as it deems appropriate, supplies or services similar to those terminated, and the Contractor shall be liable to the Owner for any excess costs for such similar supplies or services. The Contractor shall continue to perform of this Contract to the extent not terminated hereunder.

ARTICLE 15
ADMINISTRATION OF THE CONTRACT

15.1 CLAIMS AND DISPUTES

Add the following new subparagraphs 15.1.7 and 15.1.8:

15.1.7 All Claims filed against Owner shall be subject to audit at any time following the filing of the Claim. Failure of Contractor, or Subcontractor of any tier, to maintain and retain sufficient records to allow Owner to verify all or a portion of the Claim or to permit Owner access to the books and records of Contractor, or Subcontractors of any tier, shall constitute a waiver of the Claim and shall bar recovery. The audit may be performed by employees of Owner or a representative of Owner. Contractor, and its Subcontractors, shall provide adequate facilities acceptable to Owner, for the audit during normal business hours. Contractor, and all Subcontractors, shall make a good faith effort to cooperate with Owner's auditors.

15.1.8 The Contract Documents and the rights of the parties herein shall be governed by the laws of the State of Washington. Venue for all dispute resolution proceedings (including, but not limited to, mediation, arbitration, and litigation) shall be in the county in which the Owner's principal place of business is located, unless otherwise specified.

END OF SECTION

SECTION 01 00 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project Information
2. Work covered by Contract Documents
3. Work by Owner
4. Work under separate contracts
5. Owner-furnished products
6. Access to site
7. Work restrictions
8. Specification and drawing conventions

B. Related Requirements:

1. Division 01 Section 01 50 00 “Temporary Facilities and Controls” for limitations and procedures governing temporary use of Owner’s facilities.

1.3 PROJECT INFORMATION

A. Project Identification: South King Fire and Rescue Administrative Building Improvements

1. Project Location: 720 S. 333rd Street
   Federal Way, WA 98003

B. Owner Information

1. Owner:
   South King Fire and Rescue
   31617 1st Avenue South
   Federal Way, WA 98003

   Owner’s Representative:

   Mitchell Lee
   Mitchell.lee@southkingfire.org

C. Architect Information

1. Architect:
   Weinstein A+U
   2200 Western Avenue, Suite 301
   Seattle, WA 98121

   Architect’s Representative:
   Lauren Rock
   (206) 443-8606
   laurenr@weinsteinau.com

D. Civil Engineer Information

1. Civil Engineer
   LPD Engineering PLLC
   1932 First Avenue, Suite 500
   Seattle, WA 98101

   Civil Engineer’s Representative:
   Marc Servizi
   (206) 725-1211
   marcs@lpdengineering.com

E. Plumbing Engineer Information

1. Plumbing Engineer
The Greenbusch Group, Inc
1448 Elliott Avenue West
Seattle, WA 98119

Plumbing Engineer's Representative:
Jack Burgess
(206) 644-1369
jackb@greenbusch.com

F. Mechanical Engineer Information

1. Mechanical Engineer
The Greenbusch Group, Inc
1448 Elliott Avenue West
Seattle, WA 98119

Mechanical Engineer's Representative:
Jack Burgess
(206) 644-1369
jackb@greenbusch.com

G. Electrical Engineer Information

1. Electrical Engineer
TFWB Engineers
1200 Westlake Ave. N, Suite 509
Seattle, WA 98109

Electrical Engineer's Representative:
Kevin Wartelle
(206) 285-7228
kevin@tf-wb.com

H. Acoustic Consultant Information

1. Acoustic Consultant
A3 Acoustics
1909 25th Ave. S, Suite A
Seattle, WA 98144

Acoustic Consultant's Representative:
Mohamed Ait Allaoua
(206) 551-5280
mohammed@a3acoustics.com

1.4 WORK COVERED BY CONTRACT DOCUMENTS

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

1. Interior remodeling and plumbing, mechanical and electrical improvements as indicated in Construction Documents. Exterior site improvements at south entry, with new accessible ramp, sidewalk, and accessible parking stalls. New south entry door and relite. New concrete equipment pad.

B. Type of Contract:

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

1.5 WORK BY OWNER

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

B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

1. Move existing furnishings out of the building prior to the start of construction to provide the contractor with a reasonably unhindered access to the construction work areas.

All efforts are to be coordinated with the Contractor for mutually agreeable times and access.

C. Concurrent Work: Owner may replace an existing large 102" x 84" window and perform exterior landscaping operations at Project site. Those operations may be conducted simultaneously with work under this Contract. The Owner or the Owner's separate contractor shall coordinate mutually agreeable time and access with the Contractor.

D. Work Provided by Owner under Separate contract: the following work will be performed by Owner using Owner-provided contractors or forces, concurrently with the Work of this Contract:

1. Furniture, Fixtures and Equipment (FF&E) provided by the Owner; power and schedule to be coordinated between Owner, Owner-provided contractor, and General Contractor:

a. Under-carpet electrical runways and pedestals.

b. Furnishings with integrated power

1.6 OWNER-FURNISHED PRODUCTS

A. Owner will furnish and install products indicated in drawings.

1.7 ACCESS TO SITE

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

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

1.8 WORK RESTRICTIONS

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

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

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Hours for Utility Shutdowns: Coordinate with owner for a mutually agreeable time. Allow time required for Owner to notifiy tenants.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.

2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted on-site

F. Building Access: Access to and from all tenant spaces to the parking garage and to the site shall be maintained for the duration of the project with clear, obstruction free paths of travel.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

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

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

2. Abbreviations: Materials and products are identified by abbreviations published as part of the schedules on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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 the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

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

1.3 PROCEDURES

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

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

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article 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. Additive Alternate No. 1: Level 2 Conference Room and Kitchen

1. Base Bid: All scope of work with exception of Alternate 1, as indicated in the Drawing Set and as specified in the Project Manual.

2. Alternate: All selective demolition and improvements to provide Large Conference Room 201, Kitchen 202, DOAS Closet 204, and all associated finishes and mechanical, plumbing, fire alarm, electrical and lighting improvements, as well as the addition of Door Number 221, as indicated in the Drawing Set and as specified in the Project Manual.

B. Additive Alternate No. 2: Level 2 Bottle Filler

1. Base Bid: No changes; leave existing drinking fountain at Hallway 221.
2. Alternate: Replace existing drinking fountain with bottle filler per Sheet P102 (Elkay LZ8WSSSMC). Provide dedicated power.

C. Additive Alternate No. 3: Mens' Toilet Room 125, Replace Urinal with Toilet.

1. Base Bid: No changes; leave existing urinals in place at Room 125
2. Alternate: Replace one existing urinal with one toilet per Sheet P101 (American Standard Cadet 2467.016). Provide a toilet compartment in lieu of urinal divider.

END OF SECTION 012300

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 60 00 "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. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

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

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.

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

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

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

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.

b. Requested substitution provides sustainable design characteristics that specified product provided for compliance with sustainability requirements.
c. Substitution request is fully documented and properly submitted.
d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Requested substitution provides sustainable design characteristics that specified product provided for compliance with sustainable requirements.
e. Substitution request is fully documented and properly submitted.
f. Requested substitution will not adversely affect Contractor's construction schedule.
g. Requested substitution has received necessary approvals of authorities having jurisdiction.
h. Requested substitution is compatible with other portions of the Work.
i. Requested substitution has been coordinated with other portions of the Work.
j. Requested substitution provides specified warranty.
k. 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.
l. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - EXECUTION (Not Used)

PART 3 - PRODUCTS (Not Used)

END OF SECTION 01 25 00

SUBSTITUTION REQUEST
(During the Bidding/Negotiating Phase)

PROJECT: _____

SUBSTITUTION REQUEST NUMBER: _____

FROM: _____

TO: _____

DATE: _____

A/E PROJECT NUMBER: _____

RE: _____

CONTRACT FOR: _____

SPECIFICATION TITLE: _____

DESCRIPTION: _____

SECTION: _____ **PAGE:** _____

ARTICLE/PARAGRAPH: _____

PROPOSED SUBSTITUTUION: _____

MANUFACTURER: _____ **ADDRESS:** _____ **PHONE:** _____

TRADE NAME: _____ **MODEL NO.:** _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.
Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

SUBMITTED BY: _____

SIGNED BY: _____

FIRM: _____

ADDRESS: _____

TELEPHONE: _____

A/E's REVIEW AND RECOMMENDATION:

- ☐ Approve Substitution—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
- ☐ Approve Substitution as noted—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
- ☐ Reject Substitution—Use specified materials.
- ☐ Substitution Request received too late—Use specified materials.

SIGNED BY: **DATE:**

SUPPORTING DATA ATTACHED: ☐ **Drawings** ☐ **Product Data** ☐ **Samples** ☐ **Tests** ☐ **Reports** ☐ _____

CSI Form 1.5C (August 2020 version)

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SUBSTITUTION REQUEST
(After the Bidding/Negotiating Phase)

PROJECT: _____

SUBSTITUTION REQUEST NUMBER: _____

_____

FROM: _____

TO: _____

DATE: _____

_____

A/E PROJECT NUMBER: _____

RE: _____

CONTRACT FOR: _____

SPECIFICATION TITLE: _____

DESCRIPTION: _____

SECTION: _____ PAGE: _____

ARTICLE/PARAGRAPH: _____

PROPOSED SUBSTITUTUION: _____

MANUFACTURER: _____ ADDRESS: _____ PHONE: _____

TRADE NAME: _____ MODEL NO.: _____

INTALLER: _____ ADDRESS: _____ PHONE: _____

HISTORY: ☐ New Product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED PRODUCT: _____

_____

_____

☐ Point-by-point comparative data attached — REQUIRED BY A/E

REASON FOR NOT PROVIDING SPECIFIED ITEM: _____

_____

SIMILAR INSTALLATION:

PROJECT: _____ ARCHITECT: _____

ADDRESS: _____ OWNER: _____

_____ DATE INSTALLED: _____

PROPOSED SUBSTITUTION AFFECTS OTHER PARTS OF WORK: ☐ No ☐ Yes; explain _____

_____

SAVINGS TO OWNER FOR ACCEPTING SUBSTITUTION:

PROPOSED SUBSTITUTION CHANGES CONTRACT TIME: ☐ No ☐ Yes ○[Add] ○[Deduct] _____ days.

SUPPORTING DATA ATTACHED: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

CONTINUE ON NEXT PAGE

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SUBSTITUTION REQUEST
(After the Bidding/Negotiating Phase—Continued)

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

SUBMITTED BY: _____

SIGNED BY: _____

FIRM: _____

ADDRESS: _____

TELEPHONE: _____

☐ **Attachments**

A/E's REVIEW AND RECOMMENDATION:

☐ Approve Substitution—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.

☐ Approve Substitution as noted—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.

☐ Reject Substitution—Use specified materials.

☐ Substitution Request received too late—Use specified materials.

SIGNED BY: **DATE:**

OWNER'S REVIEW AND ACTION:

☐ Substitution approved—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order

☐ Substitution approved as noted—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.

☐ Substitution rejected—Use specified materials.

SIGNED BY: **DATE:**

ADDITIONAL COMMENTS: ☐ **Contractor** ☐ **Subcontractor** ☐ **Supplier** ☐ **Manufacturer** ☐ **A/E**

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SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Sections:

1. Section 01 60 00 "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

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.

B. On receipt of Supplemental Instruction, update Contractor’s Supplemental Instruct log and immediately distribute the SI to affected parties. Review SI and notify Architect within 7 days if Contractor believes the SI may require an adjustment to the Contract Sum or the Contract Time.

C. Upon execution of an SI, record changes on Record Documents.

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. Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within 10 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

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

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

1. 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 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

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

1.5 CONSTRUCTION CHANGE DIRECTIVE

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

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

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 26 00

SECTION 01 29 00 - 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 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's Construction Schedule.
3. Article 9 “Payments and Completion” AIA Document A201 – General Conditions of the Contract for Construction

1.2 DEFINITIONS

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

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

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.

2. Submit the schedule of values to Architect at earliest possible date but no later than 14 days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of 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. Owner's name.
c. Owner's Project number.
d. Name of Architect.
e. Architect's Project number.

f. Contractor's name and address.
g. Date of submittal.

2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

a. General: In format as approved by Owner, including but not limited to following:

1) Description of the Work.
2) Name of subcontractor.
3) Name of manufacturer or fabricator.
4) Name of supplier.
5) Change Orders (numbers) that affect value.
6) Dollar value.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
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.

a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

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. 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.

8. 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.

1.4 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.

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: The date for each progress payment is the 30th day of each month (or last day of February).

D. Application for Payment Forms: Use AIA Document G702 – Application and Certificate for Payment and AIA Document G703 – Continuation Sheet 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 Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Transmittal – Preliminary Payment Request: Email one PDF draft copy of each Application for Payment to Architect, 5 days prior to end of month, for review and comments by Architect and Owner. Architect will return draft Application for Payment to Contractor, with comments to be incorporated into final draft of Application for Payment.

G. Transmittal – Final Payment Request: Email one PDF signed and notarized copy of each Application for Payment to Architect.

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

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien.

I. 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 - Required at pre-construction conference.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary)-Required at pre-construction conference.
4. Products list.
5. Schedule of unit prices.
6. Submittal Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants - Required at pre-construction conference.
9. Copies of permits - Required at pre-construction conference.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work - Required at pre-construction conference.
11. Report of preconstruction conference.
12. Certificates of insurance and insurance policies.
13. Performance and payment bonds.

J. This initial application shall reflect Certificate of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment including the following:

1. Completion of Project closeout requirements.
2. Completion of Items specified.
3. Ensure that unsettled claims will be settled.
4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
5. Transmittal of required Project construction records to the Owner.
6. Proof that fees and similar obligations were paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish and similar elements.

1.5 SPECIAL PAYMENT REQUIREMENTS

A. Payment for completed work will be made in accordance with the applicable sections of the contract documents.

B. Payment for completed work will include all costs relating to:

1. Furnishing all materials and performing all work under the Contract (including changes in the work, materials or plans) in a complete and acceptable manner.
2. All risks, losses, damages or expense, with the exception of negligence of the contractor, of whatever character arising out of the nature or prosecution of the work.
3. All expenses incurred in consequence of the suspension or discontinuance of the work.

C. No payment will be made for:

1. Work that was deleted from the Contract.
2. Work which was not performed.
3. Anticipated profit or overhead on work not performed or on work deleted from the Contract.
4. Extended overhead costs resulting from any authorized extension of contract time.

D. No separate or special payment will be made for:

1. Samples of materials or equipment submitted for testing by the Architect or by an authorized agent of the Architect.
2. Tests carried out by the Contractor, any Subcontractor, supplier or manufacturer unless specifically identified as an item for payment in the Bid Form or the project documents.
3. The cost of any permits or fees unless specifically identified as an item for payment in the Bid Form or the project documents.
4. Supervision by General Superintendents, Project Managers or General Foreman for force account work if required.

E. Adjustments: Adjustments in the amount to be paid by the Owner under the terms and conditions of the Contract will not be made as a result of any change in laws, ordinances or regulations except as specifically provided by the following:

1. Changes in laws: The Owner will not adjust payment to compensate the Contractor for changes in legal requirements unless those changes are specifically within the scope of RCW 39.04.120, “Change orders due to environmental projection requirements – Costs Dispute resolution” per http://app.leg.wa.cov/rcw/default.aspx?cite=39.04.120. For changes under RCW 39.04.120 the Owner will compensate the Contractor by negotiated Change Order or by force account.
2. Changes in Taxes: The Owner will adjust to compensate for tax changes under the following conditions.

    a. The changes involve Federal or State taxes on materials used in or consumed for the work.
    b. The changes increase Contractor paid taxes by more than $100.00.
    c. For items in the original contract, the tax change must occur after the bid opening date.
    d. The Contractor, if requested by the Architect, certifies in writing that the awarded contract price does not include an extra amount to cover a possible change in taxes.
    e. The Contractor permits the Owner to audit the Contractor’s records to the extent necessary to substantiate and claim for compensation under the provisions of this section. Within the above conditions, the Owner will adjust compensation by the actual dollar amounts of increase caused by the tax changes.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

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

1. General project coordination procedures.
2. Coordination Drawings.
3. Project meetings.
4. Requests for Interpretation (RFIs).

B. Related Requirements:

1. Section 01 73 00 "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 Contractor seeking interpretation or clarification of the Contract Documents.

1.3 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 with other contractors to ensure maximum 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 and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.

3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed.

    a. Include the following information, as applicable:
    b. Indicate relationship of components shown on separate Shop Drawings.
    c. Indicate required installation sequences.
    d. See Division 23 for specific Coordination Drawing requirements for mechanical installations.
    e. See Division 26 for specific Coordination Drawing requirements for electrical installations.

2. Sheet Size: At least 8-1/2 inches by 11 inches but no larger than 36 by 48 inches.
3. Number of Copies: Email one PDF copies of each submittal. Architect will return one copy.
4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

1.5 PROJECT MEETINGS

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

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

    a. Tentative construction schedule.
    b. Phasing.

c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.
e. Procedures for processing field decisions and Change Orders.
f. Procedures for RFIs.
g. Procedures for testing and inspecting.
h. Procedures for processing Applications for Payment.
i. Distribution of the Contract Documents.
j. Submittal procedures.
k. Preparation of Record Documents.
l. Work restrictions.
m. Responsibility for temporary facilities and controls.
n. Construction waste management and recycling.
o. Parking availability.
p. Office, work, and storage areas.
q. Equipment deliveries and priorities.
r. First aid.
s. Security.
t. Progress cleaning.
u. Working hours.

3. Minutes: 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. The Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.

y. Protection of construction and personnel.

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

D. Progress Meetings: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these. Architect shall attend Progress Meetings biweekly. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
   1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:
   1) Interface requirements.
   2) Sequence of operations.
   3) Status of submittals.
   4) Deliveries.
   5) Off-site fabrication.
   6) Access.
   7) Site utilization.
   8) Temporary facilities and controls.
   9) Work hours.
   10) Hazards and risks.
   11) Progress cleaning.
   12) Quality and work standards.
   13) Status of correction of deficient items.
   14) Field observations.
   15) RFIs.
   16) Status of proposal requests.
   17) Pending changes.
   18) Status of Change Orders.
   19) Pending claims and disputes.
   20) Documentation of information for payment requests.

3. Minutes: Record the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

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

1.6 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

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

C. Electronic and Hard-Copy RFIs: Form established by Contractor’s Project Management system.

1. Identify each page of attachments with the RFI number and sequential page number.

D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow 10 working days for Architect's response for each RFI. RFIs received after 1:00 PM 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 RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
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 Division 01 Section "Owner-Contractor Agreement."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten days of receipt of the RFI response.

E. 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 three days if Contractor disagrees with response.

F. 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.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Contractor's Construction Schedule.
2. Submittals Schedule.
3. Daily construction reports.
4. 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 activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. 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.

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

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

G. Daily Construction Reports: Submit at monthly intervals.

1.3 SUBMITTALS

A. Submittals Schedule: Submit one electronic copy of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

B. Contractor's Construction Schedule: Submit one electronic copy of initial schedule, large enough to show entire schedule for entire construction period.

C. Field Condition Reports: Submit one electronic copy at time of discovery of differing conditions.

1.4 COORDINATION

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

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

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

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Final Completion.

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

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

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 “Submittal Procedures” in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than 10 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.

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. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 14 days of date established for commencement of the Work. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.

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

1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report using an Owner-approved form, 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 (see special reports).
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 2-week intervals, update schedule to reflect actual construction progress and activities. Issue schedule 3 days before each regularly scheduled progress meeting, submitted with monthly progress payment request.

1. 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.
2. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect and 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 01 32 00

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 01 31 00 "Project Management and Coordination".
2. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
4. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
5. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
7. Section 01 79 00 "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. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
b. Contractor shall execute an “Agreement for Use of Electronic Data” Provided by the Architect..

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.

1.4 SUBMITTAL SCHEDULE

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

3. Format: Arrange the following information in a tabular format:

a. Scheduled date for first submittal.
b. Specification Section number and title.
c. Submittal Category: Action; informational.
d. Name of subcontractor.
e. Description of the Work covered.
f. Scheduled date for Architect's final release or approval.

1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.

11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

E. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package, and transmit them to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

    a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

2. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.

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

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time

will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 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 10 working days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

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

1.7 SUBMITTAL REQUIREMENTS

A. 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 bookmarked 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 electronic form acceptable to Owner, containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.

j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

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 unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

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

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

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

5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

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 unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.

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

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

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. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

F. 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.

G. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

H. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

I. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

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

    1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

    1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp indication in web-based Project software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.

1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action, as follows:
2. Submittals by Web-Based Project Software: Architect will indicate, on Project software website, the appropriate action.

a. Actions taken by indication on Project software website have the following meanings:

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

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

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

E. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This 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.

C. Related Requirements:

1. Division 02 through 33 Sections for specific test and inspection requirements.

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 used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

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 Tests: 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 industry standards.

F. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

G. Field Quality-Control Tests: 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, assembly, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

J. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five Insert number 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. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. 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 SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

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

C. Reports: Prepare and submit certified written reports that include the following:

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

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

1.5 QUALITY ASSURANCE

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

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

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

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

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

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according

to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

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

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

I. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups of the following rooms:

1. Room number and location to be determined by Owner’s representative.

1.6 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. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, 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.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

D. Retesting/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.

1.7 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 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 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - 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.

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. This information is believed to be accurate as of the date of the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 42 00

SECTION 01 50 00 - 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 01 00 00 "Summary" for work restrictions and limitations on utility interruptions.

1.2 INFORMATIONAL SUBMITTALS

A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.3 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.

1.4 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. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete bases for supporting posts.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Owner will allocate one office space at Level 2 of the project building for use by the General Contractor for the duration of the project.

B. 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 once installed, 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 01 77 00 "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 01 00 00 "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 or private system indicated as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. 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.

1. Toilets: Use of Owner's existing or toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

F. Heating: Provide temporary heating 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.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

H. Electric Power Service: Coordinate with Owner.

1. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
2. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

a. Install electric power service overhead or underground unless otherwise indicated.
b. Connect temporary service to Owner's existing power source, as directed by Owner.

I. 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.
2. Exterior Lighting – Temporary: Lighting shall be shielded and directed away from adjacent buildings,

J. Electronic Communication Service: Provide an accessible Wi-Fi network in the field office, for use by the Owner's Representative, Architect, and other design consultants.

3.3 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E136. 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. Parking: Provide temporary parking areas for construction personnel.

C. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Hang Architect Identification Sign provided by Architect; Coordinate with Architect for location.
2. Identification Signs: Provide Project identification signs as indicated on Drawings.
3. 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.

4. Maintain and touchup signs so they are legible at all times.

D. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

E. 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.

F. Temporary Use of Existing Elevators: Use of existing elevators for construction traffic will be permitted, provided elevators are protected and finishes restored to or equal or better condition at time of Substantial Completion.

G. Temporary Use of Existing Stairs: Use of existing stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to or equal or better condition at time of Substantial Completion.

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.

1. Provide 24 hour security via approved, monitored, mounted CCTV camera(s), or 24 hour on-site security personnel.
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. 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.

D. 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 indicated on Drawings.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

F. 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 weather tight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

G. 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 and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

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.
1. Remove materials that can not 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 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 015713 - TESC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not limited to:
   1. Install and maintain temporary erosion and sedimentation control facilities through project completion and site stabilization.
   2. Managing staging and stockpiling areas.

B. Related sections include but is not limited to:
   1. Section 31 10 00 – Site Preparation
   2. Section 31 22 00 – Earthwork
   3. Section 33 40 00 – Storm Drainage

1.2 REFERENCES

A. City of Federal Way – Development Standards (June 2024); 2021 Addendum to the King County Surface Water Design Manual (KCSWDM).

B. WSDOT – 2024 Standard Specifications for Road, Bridge and Municipal Construction; 2024 Standard Plans.

C. King County – 2021 King County Surface Water Design Manual (KCSWDM).

1.3 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit the following:
   1. Manufacturer’s product cut sheet for proposed materials. .

PART 2 - PRODUCTS

2.1 SILT FENCE

A. Filter fabric material shall meet the following:
   1. AOS (ASTM D4751) = 50-100 sieve size (0.30-0.15 mm)
   2. Water Permittivity (ASTM D4491) = 0.02 sec-1 min.
   3. Grab Strength (ASTM D4632) = 100 lbs min.
   4. UV resistance (ASTM D4355) = 70% min.

B. Sand shall meet the requirements of Base sand per Section 31 22 00.

2.2 INLET PROTECTION

A. Provide catch basin inserts for inlet protection as shown on the drawings. Insert shall be appropriately sized for the structure in which it is installed per manufacturer's recommendation.

2.3 COMPOST BLANKETS

A. Compost shall meet the requirements of WSDOT Std Specifications Sec. 9-14.1(8) medium compost, and shall be applied at a minimum of 3-inches thick.

B. Compost blanket shall meet the landscape mulch requirements.

2.4 PLASTIC SHEETING

A. In accordance with WSDOT Section 9-14.6(3) for 6 mil clear plastic covering.

PART 3 - EXECUTION

3.1 GENERAL

A. The implementation of the Temporary Erosion and Sediment Control (TESC) plans and the construction, maintenance, replacement and upgrading of these facilities is the responsibility of the Contractor until all construction is approved and the site is stabilized. All work shall be in accordance with the DOE and City of Federal Way and the plans. The TESC facilities shown on the plan must be constructed in conjunction with all clearing and grading activities, and in such a manner as to ensure that sediment laden water does not enter the drainage system or violate applicable water standards.

B. The TESC facilities shown are the minimum requirements for anticipated site conditions and permit approval. During the construction period, the Contractor shall anticipate providing additional measures and upgrading the erosion control facilities (e.g. additional sumps, construction of ditches, additional site stabilization measures, construction accesses, laydown areas, and silt fences, etc.) as needed. Contractor shall coordinate and pay for all costs associated with the construction, maintenance, adding, upgrading and removal of the erosion control system throughout project duration as part of the base bid.

C. The Contractor shall provide ground-cover measures, access roads, and staging areas to maintain a workable site. To the maximum extent possible the Contractor shall use the existing pavement or provide temporary gravel working pad for construction staging. The contractor shall be prepared to implement and maintain the required measures to reduce the amount of exposed ground. The Contractor shall be responsible for and shall provide a site maintenance plan in the event storm water turbidity measurements are greater than the Ecology standards.

D. All TESC measures for a given area to be graded or otherwise worked should be installed prior to any activity within that area. The contractor shall sequence construction within a given area to install sediment storage facilities and establish perimeter flow control prior to starting clearing and grading.

E. During the wetter months of the year, or when large storm events are predicted during the summer months, each work area should be stabilized such that if showers occur the work area can receive the rainfall without excessive erosion or sediment transport. During the winter months, areas that are to be left un-worked for more than 2 days shall be mulched or covered with plastic. During the summer months minimum stabilization measures shall be to seal-rolling the subgrade. The Contractor shall create and maintain temporary storm water conveyance channels through work areas to route runoff to the approved treatment facilities.

F. All disturbed areas shall be revegetated as soon as possible or covered with straw mulch treated with a tackifier if outside of the growing season.

G. Soils that are to be reused around the site shall be stored in such a manner as to reduce erosion from the stockpile. Protective measures should include, but are not limited to, covering with plastic sheeting, the use of low stockpiles in flat areas, or the use of straw bales/silt fences around pile perimeters. During the period between October 1st and March 31st, these measures are required.

H. Provide wheel cleaning stations to clean wheels and undercarriage of trucks before leaving site, as necessary to prevent dirt from being carried onto public roads. If roads are fouled, they must be cleaned immediately in conformance with City of Federal Way requirements.

I. Provide inlet protection in all existing catch basins in and adjacent to work area. Provide catch basin insert in all new catch basins and area drains immediately following installation, until site is stabilized.

J. Keep streets and site drains open for drainage at all times. TESC facilities shall be inspected daily during periods of rain, otherwise inspected weekly. Clean streets thoroughly at the end of each day. Remove sediment with a method approved by the Owner's Representative, and transport sediment to an approved sediment disposal area. Street washing will be allowed only as a last resort, and after the above method has been completed.

K. Clean out catch basin sumps prior to placement of catch basin inserts. Conform to manufacturer's recommendations regarding maximum allowable amount of sediment in catch basin insert. Remove sediment buildup or replace the catch basin insert. Clean out catch basins after completion of construction. Do not flush sediment-laden water into the downstream system with cleaning operation.

L. Inspect and repair erosion control measures weekly at a minimum and daily if necessary. Contractor shall be aware of the weather forecasts and shall inspect before, during and after storms and prior to weekend and holidays. Contractor shall inspect the entire system to ensure proper operation.

M. Refer to TESC notes in drawings for additional information.

3.2 DRAINAGE COLLECTION AND CONVEYANCE

A. Surface runoff and discharge shall be controlled at all times during and following development. Additional measures to control runoff may be required, which shall be at no additional expense to the City of Federal Way. Under no circumstances shall the contractor allow concentrated discharges over slopes.

B. The plan locations of temporary interceptor swales are schematic. Field adjust, move, and reconstruct as necessary during construction to maintain drainage to sediment facilities and to allow construction of improvements to proceed. Provide rock check dams per the drawings.

C. Provide additional culverts beyond those indicated on plans as required to maintain unobstructed conveyance of surface flows to sediment traps and sediment storage facilities throughout grading operations.

D. Additional collection structures shall be installed as necessitated by land clearing activities to ensure that sediment laden water does not enter the natural or public drainage system.

E. Storm drains shall be installed in accordance with Section 33 40 00.

F. The project proposes the use of infiltration facilities. The Contractor shall protect the areas proposed for infiltration and shall not allow any sediment storage facilities within the area.

3.6 PHASED CLEARING AND STRIPPING

A. Phased clearing, grubbing and stripping of the site shall be utilized to minimize disturbance to soil and minimize erosion potential.

3.7 REINFORCED SILT FENCE

A. Field adjust silt fence locations to perimeter of clearing and stripping and as necessary to prevent sediment laden water from being transported off site. Locations indicated on drawing are schematic.

3.8 PLASTIC SHEETING

A. Overlap joints minimum of 24”. Overlap joints in the direction of drainage and to prevent water from draining onto material being protected.

B. Secure plastic sheeting as necessary to prevent movement and damage.

C. Provide sandbags at 2.5 foot spacing and tie sandbags together with rope on slopes greater than 3:1

3.9 STOCKPILING

A. Stockpiling shall be per plans and in accordance with Section 31 14 00.

3.10 PROTECTION OF STOCKPILES

A. Protect stockpile areas from stormwater run-on from upstream areas and from release of sediment downstream. Cover stockpiles at all times while not in use to keep stored material dry. Surround materials stockpiled on pavement by two rows compost filter sock or triangular silt dike with joints staggered.

3.11 COMPOST BLANKET

A. Install compost blankets per WSDOT Section 8-01.3(4).

B. Contractor shall maintain the thickness during the entire period of use.

C. If compost blankets are placed at the required thickness per Landscape and tilled into the existing soil they may be used as amended soils for permanent landscape.

D. Compost blankets may be installed on slopes up to 2H:1V.

E. Compost blanket shall be maintained such that no stormwater can run under the blanket.

F. Compost blankets may not be in areas of concentrated flows such as channels, ditches or dikes.

G. Areas that show signs of erosion shall be re-mulched. If erosion is drainage related, the drainage shall be mitigated prior to the area be re-mulched.

3.12 REMOVAL

A. Remove stabilized construction access as quickly as possible following the conclusion of transport of bulk materials and demobilization of heavy equipment, with prior approval of the Owner’s Representative.

B. Remove temporary silt fences at the direction of the Owner’s Representative, but in no case prior to establishment of the Contract as Substantially Complete. The Owner reserves the right to take ownership and control of temporary siltation control facilities following thorough

maintenance by the Contractor and immediately prior to acceptance of the Contract as Physically Complete.

C. Complete site restoration as directed by the Owner's Representative as part of removal operation.

END OF SECTION

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SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This 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 01 77 00 "Closeout Procedures" for submitting warranties.
2. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

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, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3 SUBMITTALS

A. Substitution Requests: Submit one electronic copy 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, or similar document as determined by the Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

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

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 10 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

    a. Form of Acceptance: Change Order.
    b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "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 ensure compliance with the Contract Documents and to ensure 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. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. 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 standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to 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 01 77 00 "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. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. 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 product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product by the other named manufacturers.

9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, and textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 60 00

SECTION 01 73 00 - 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. General installation of products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. Related Requirements:

1. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping, and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. 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 and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

1. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

    a. The Agreement.
    b. Addenda, with those of later date having precedence over those of earlier date.
    c. The Supplementary Conditions.
    d. The General Conditions of the Contract for Construction.
    e. Division 01 Section Specifications.
    f. Drawings and Divisions 02 - 33 of the Specifications.
    g. In the case of conflicts or discrepancies between Drawings and Divisions 02-33 of the Specifications or within either Document not clarified by Addendum, the Architect will determine which takes precedence in accordance with AIA A201 General Conditions of the Contract for Construction, and Section 01 00 00 “Summary.”

2. Where conflicts and/or omissions have not been brought to the attention of the Architect, it is understood that the Contractor has made provisions in the bid for the most costly material or methods.

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.

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 dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. 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.

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. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. 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.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully in compliance with Section 01 74 19 “Construction Waste Management and Disposal.”

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees F.
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.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 01 40 00 "Quality Requirements"

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous construction waste.
2. Recycling nonhazardous construction waste.
3. Disposing of nonhazardous construction waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

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

D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.4 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.6 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch (38-mm) size.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch (38-mm) size.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 1-1/2-inch (38-mm) size.
2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

M. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

N. Conduit: Reduce conduit to straight lengths and store by material and size.

O. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.4 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

D. Paint: Seal containers and store by type.

3.5 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Requirements:

1. Owner-Contractor Agreement for requirements for Applications for Payment for Substantial and Final Completion.
2. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following:

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.

14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. 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.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to the Owner-Contractor Agreement provisions.
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty, per Part 3 of this Section.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for 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.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies 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. Use CSI Form 14.1A, or similar document as determined by the Owner.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 WARRANTIES

A. Submittal Time: 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.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Provide one electronic copy of warranties in bookmarked PDF format.
2. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-inch by-11-inch paper.
3. 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.
4. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Hard copies of each warranty shall be included in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide 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 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; shampoo 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. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Emergency manuals.
   2. Operation manuals for systems, subsystems, and equipment.
   3. Maintenance manuals for the care and maintenance of products, materials, finishes, systems, and equipment.
   4. Systems computer software required for maintenance of electrical and mechanical systems.

B. Related Sections:
   1. Divisions 01 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

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. Electronic PDF 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. Hard Copies: Three paper copies; include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Initial Manual Submittal: Submit draft electronic copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a CSI MasterFormat separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents CSI MasterFormat sectio by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-inch by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

B. Descriptions: Include the following:

1. Product name and model number.
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 start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.

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.

2.3 PRODUCT MAINTENANCE MANUAL

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 inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and 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.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

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.

1. Systems Software: Include mechanical and electrical systems, and equipment software necessary for the maintenance of the systems. Include complete instructions on use of software. Provide software compatible with Windows 10 or later operating system.

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 maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:

D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, that detail essential maintenance procedures.

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. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. 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.

C. 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.

D. 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.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - 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 01 78 23 "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 1 set of marked-up record prints.

a. Final Submittal:

1) Submit 3 paper-copy sets of marked-up record prints.
2) Submit PDF electronic files of scanned record prints.
3) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit 1 paper copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain 1set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.

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. 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. Format: Annotated PDF electronic file with comment function enabled or color-scan of Precord Prints in PDF and JPG formats.
3. 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.
4. 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. Note related Change Orders, record Product Data, and record Drawings where applicable.

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.

3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

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 scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain 1 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 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

B. Related Requirements:

1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Demonstration and Training Video: Submit two copies within seven days of end of each training module.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training.

D. 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 equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Mechanical HVAC equipment and related control systems.
2. Electrical equipment.
3. Fire alarm, security and communications equipment.
4. Others as designated by the Owner's Representative.

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:

1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.
6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish an instructor to describe Owner's operational philosophy.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.2 DEMONSTRATION AND TRAINING VIDEOS

A. General: Engage a qualified commercial photographer to record demonstration and training videos. 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 Format: Provide high-quality color video im MPEG-4 (MP4) format..

C. Narration: Describe scenes on videotape by audio narration by microphone while video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building.

B. Related Requirements:

1. Section 01 00 00 "Summary of Work" to identify barium and chromium in brick mortar.
2. Section 01 74 19 “Construction Waste Management and Disposal” for waste recycling and disposal requirements.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store.

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

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 PRE-INSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

6. Review items to be left in place, removed and salvaged, removed and reinstalled.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Management: Monthly Waste Progress Reports, quantifying waste recycled, waste salvaged and waste to landfill as specified in Section 01 74 19 “Construction Waste Management and Disposal”

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property to remain in use during construction, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's tenants on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of Owner's tenants continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 "Photographic Documentation." Submit before Work begins.

1.6 FIELD CONDITIONS

A. Owner’s tenants will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's tenants operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Furniture.
b. Fixtures and equipment that the Owner wishes to retain.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. No on-site sales of removed items or materials.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations and other agencies having jurisdiction requirements before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations if required by work.

B. Review Project Record Documents of existing construction or other existing conditions and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report including photo documentation to Architect.

D. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

1. If hazardous materials are suspected, promptly submit a written report including photo documentation to Architect and Owner.

3.2 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 01 50 00 "Temporary Facilities and Controls."

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor if necessary.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC/ electrical systems, equipment, and components indicated on Drawings to be removed. Coordinate with mechanical and electrical drawings and specifications.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
c. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches when mechanical means can reasonably achieve required results.
5. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
6. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
7. Maintain adequate ventilation when using cutting torches.
8. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
9. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
10. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
11. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished and then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

F. Roofing: Remove no more existing roofing than is necessary to complete required work. Protect area of work so that building interior remains watertight and weathertight.

1. See Division 07 “Thermal and Moisture Protection” for waterproofing requirements.
2. Remove existing roof membrane, flashings, copings, and roof accessories.
3. Remove existing roofing system down to substrate.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them according to Section 01 74 19 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

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

3.9 SELECTIVE DEMOLITION, GENERAL

A. Remove: Items indicated on Drawings.

B. Remove and Salvage: Items indicated on Drawings.

C. Remove and Reinstall: Items indicated on Drawings.

D. Existing to Remain: Items indicated on Drawings.

3.10 SELECTIVE DEMOLITION SCHEDULE

A. Demolition Scope at Parking Garage:

1. Protect MEP and fire systems serving Level 2 areas outside of the Scope of Work and the Parking Garage
2. Demolition and removal of interior partitions at storage units as indicated on demolition plans.
3. Selective removal of 1-hour rated ACT assembly for installation of plumbing and fire-sprinkler system. Replace all ceiling tiles as required to maintain 1-hour rating

B. Demolition Scope at Level 1:

1. Protect MEP and fire systems serving Level 2 areas outside of the Scope of Work and the Parking Garage
2. Selective demolition of finishes at restrooms
3. Selective demolition of MEP systems and fixtures
4. Demolition and removal of existing interior partition walls, fixtures, casework, equipment, and doors as indicated on demolition plans.

C. Demolition Scope at Level 2:

1. Demolition and removal of existing interior partition walls, fixtures, casework, equipment, and doors as indicated on demolition plans.

D. Exterior Site Demolition Scope:

1. Selective demolition of site paving and walkways for accessible parking stalls, entry ramp and new equipment pad.

END OF SECTION 02 41 19

SECTION 03 54 13 - GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes self-leveling, gypsum cement underlayment for application below interior floor coverings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Provide documentation consistent with 1 hour fire rated floor/ceiling assembly as shown on Drawings.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place gypsum cement underlayments only when ambient temperature and temperature of substrates are between 50 degrees F and 80 degrees F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Comply with ASTM E119; 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.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. IIC-Rated Assemblies: For IIC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E492 and classified according to ASTM E989 by an independent testing agency.

2.2 GYPSUM CEMENT UNDERLAYMENTS

A. Gypsum Cement Underlayment: Self-leveling, gypsum cement product that can be applied in minimum uniform thickness of 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Products: Subject to compliance with requirements, provide the following:

    a. Gyp-Crete 2000/3.2K Floor Underlayment.

2. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C219.
3. Compressive Strength: 2000 psi to 3200 psi at 28 days when tested according to ASTM C109/C109M.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 inch to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 degrees F.

2.3 ACCESSORIES

A. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

B. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

1. Primers: VOCs shall be 100g/L or less.

C. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

1. Sealers: VOCs shall be 100g/L or less.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test, ASTM F1869: Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement, or as recommended by gypsum cement underlayment manufacturer.

C. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.

1. Install underlayment reinforcement recommended in writing by manufacturer.

D. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.2 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.

D. Provide perimeter isolation at demising and corridor wall framing.

E. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

F. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

G. Apply surface sealer at rate recommended by manufacturer.

H. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.3 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 13

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes steel pipe and tube railings.

B. Related Requirements:

1. Section 09 91 13 "Exterior Painting" for site painting.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Handrail brackets.
3. Shop primer.
4. Nonshrink, nonmetallic grout.
5. Anchoring cement.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer.

B. Welding certificates.

C. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

A. Tubing: ASTM A500 (cold formed) or ASTM A513.

B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

D. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.4 FASTENERS

A. General: Provide the following:

1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329 for zinc coating.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast iron center of handrail 2-1/2 inches (63.5 mm) from wall.

B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting”.

F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

H. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

I. Epoxy Intermediate Coat: Complying with MPI #101 and compatible with primer and topcoat.

J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

K. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

L. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.

D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

E. Form changes in direction by bending or by inserting prefabricated elbow fittings.

F. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

G. Close exposed ends of railing members with prefabricated end fittings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

J. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior indicated steel railings, including hardware, after fabrication.
2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

E. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 8 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members.

3.3 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

C. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 52 13

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wood blocking, nailers, and plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Fire-retardant-treated wood.
2. Power-driven fasteners.
3. Post-installed 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, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, 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 beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

1. Concealed blocking.
2. Plywood backing panels.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

B. Concealed Boards: 19 percent maximum moisture content of the following species and grades:

1. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Screws for Fastening to Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES, AC58 ICC-ES, AC193 or ICC-ES AC308 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.6 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches on center.

D. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches on center with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

END OF SECTION 061053

SECTION 06 20 23 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes, interior trim, wall base, and wall panel.

B. Related Requirements:

1. Section 06 41 00 “Architectural Wood Casework” for wood veneered casework.
2. Section 09 91 23 "Interior Painting" for priming and back priming of interior finish carpentry.
3. Section 09 93 00 "Staining and Transparent Finishing” for finishing of interior finish carpentry.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

B. Samples: For each type of item specified.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

B. Softwood Plywood: DOC PS 1.

C. MDF: ANSI A208.2, Grade 130.

D. Architectural Woodwork Standards Grade:

1. Premium for clear finishes.
2. Custom for painted finishes.

2.2 INTERIOR WALL BASE

A. Wall Base for Opaque Finish (Painted Finish):

1. Material:

a. Type B-1: MDF.
b. Type B-2 Solid finger-jointed pine.

2. Sizes: As indicated on Finish Schedules on Drawings.
3. Finish:

a. Paint in accordance with Section 09 91 23 “Interior Painting”.

b. Clear finish in accordance with Section 09 93 00 “Staining and Transparent Finishing”.

2.3 INTERIOR TRIM

A. Wall Base for Opaque Finish (Painted Finish):

1. Medium Density Fiberboard (MDF)
2. Sizes: As indicated on Finish Schedules on Drawings.
3. Finish: As indicated on Finish Schedules on Drawings.

2.4 WALL PANELS

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with ANSI/HPVA HP-1.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. States Industries: Appleply.
b. Columbia Forest Products; Europly Plus.

2. Thickness: 3/4 inch
3. Panel Size: As indicated on Finish Schedules on Drawings.
4. Clear finish in accordance with Section 09 93 00 “Staining and Transparent Finishing”.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Wood glue shall have a VOC content of 30 g/L or less.

C. Multipurpose Construction Adhesive: Formulation complying with ASTM D3498 that is recommended for indicated use by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

B. Standing and Running Trim:

1. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available.
2. Do not use pieces less than 24 inches long, except where necessary.
3. Stagger joints in adjacent and related standing and running trim.
4. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
5. Use scarf joints for end-to-end joints.

END OF SECTION 06 20 23

SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Wood veneered-architectural cabinets.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

B. Related Sections:

1. Section 12 36 61.19 “Quartz Agglomerate Countertops”.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Apply AWI Quality Certification label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Research reports.

C. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.

a. This project has been registered with AWI as AWI Quality Certification Program Number: 25.0511.

B. Architectural Woodwork Standards Grade: Premium.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

1. Reveal Dimension: 1/2 inch.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

1. Manufacturers and Products: As selected by Architect from manufacturer’s standard colors.

F. Plastic Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Wood Veneer Laminates:

1. Hardwood Venner Plywood with Maple Veneer: Manufacturer stock hardwood plywood panels.
2. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. States Industries: Appleply.

b. Columbia Forest Products; Europly Plus.

3. Material: Void free 1/16 inch veneers of Birch plywood.
4. Standard: ANSI/HPVA HP-1.
5. Finish: Manufacturer’s standard transparent, UV-resistant, protective finish.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 percent to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

C. Composite Wood Products: Products shall be made without urea formaldehyde.

D. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Softwood Plywood: DOC PS 1, medium-density overlay.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 00 "Door Hardware."

B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch-thick metal, and as follows:

1. Semi concealed Hinges for Flush Doors: BHMA A156.9, B01361.
2. Semi concealed Hinges for Overlay Doors: BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

D. Pull Bars: Solid metal, angle shape, satin stainless steel.

1. Products: Subject to compliance with requirements, provide products by the following:

a. Top Knobs, Lynwood Collection, Kinney.

2. Lengths: As selected by Architect.
3. Finish: As selected by Architect.

E. Catches: Magnetic catches, BHMA A156.9, B03141.

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

G. Shelf Rests: BHMA A156.9, B04013; two-pin plastic with shelf hold-down clip.

H. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.

a. Type: Full extension.
b. Material: Epoxy-coated steel with polymer rollers.

2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
6. For computer keyboard shelves, provide Grade 1.
7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.

I. Door Locks: BHMA A156.11, E07121.

J. Drawer Locks: BHMA A156.11, E07041.

K. Door and Drawer Silencers: BHMA A156.16, L03011.

L. Grommets for Cable Passage: 1-1/4-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: Black.

M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Flat black Coated, BHMA 631 for steel base, BHMA 613 for Bronze

N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

O. Locker Number Plates: Engraved acrylic brushed metal finish black lettering.

1. Size: 2 inch wide by 1 inch high by 1/8 inch thick rounded corner.
2. Office Sign Company Engraved Mini Door Marker.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Adhesive for Bonding Plastic Laminate: PVA.

1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.5 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide

unencumbered operation. Complete installation of hardware and accessory items as indicated.

3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches on center with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish or toggle bolts through metal backing or metal framing behind wall finish.

3.2 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity shall prepare and submit report of inspection.

END OF SECTION 06 41 00

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass fiber blanket (batt) insulation.
2. Mineral-wool blankets (batts) insulation.
3. Mineral-wool board insulation.
4. Insulation accessories.

B. Location: As required to replace existing thermal insulation, match type.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, Include “insulation schedule” to confirm where each submitted product will be used.

B. Shop Drawings: indicate required flashings, control joints and expansion joints and sealing details at openings, projections, penetrations and sleeves to maintain continuous thermal barrier.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET (BATT) INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type IA; unfaced. Passing ASTM E136 combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Knauf Insulation.
b. CertainTeed, Saint Gobain.
c. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.

3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
5. Minimum thickness 3-1/2 inches.
6. R-Value of 3.1 per inch.

B. Glass-Fiber Blanket Insulation, Faced: ASTM C665, Type IA; faced on one side with foil-scrim-kraft.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Knauf Insulation.
   b. CertainTeed, Saint Gobain.
   c. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
5. R-Value of 21 per ASTM C518 at 5-1/2 inches.

2.2 MINERAL-WOOL BLANKETS (BATTS)

A. Mineral-Wool Blanket, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Rockwool (Roxul Inc).
   b. Johns Manville.
   c. Owens Corning; Thamafiber.

2.3 MINERAL-WOOL BOARD INSULATION

A. Unfaced, Mineral-Wool Board Insulation: ASTM C612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Rockwool (formerly Roxul Inc.) PG.
   b. Johns Manville.
   c. Owens Corning; Thamafiber.

2. R-Value: Minimum R-4.2 per inch.

2.4 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AGM Industries, Inc.
    b. Gemco.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.5 ACCESSORIES

A. 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.

B. Vinyl Facing: White metalized polypropylene film with tri-directional scrim reinforcing layer and metalized polyester film backing layer, ASTM C1136, Type II, IV.

1. Products: Subject to compliance with requirements, provide the following:

    a. Lamtec Corporation; WMP-VR-R Plus.

2. Location: Support of batt insulation in parking garage at underside of concrete slab below occupied space where indicated.
3. Fasteners: Insulation fasteners with caps matching white vinyl facing.

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 indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.2 INSTALLATION OF CAVITY-WALL INSULATION

A. Mineral Board Insulation: Install pads of adhesive spaced approximately 24 inches on center both ways on inside face and as recommended by manufacturer.

B. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions.

C. Press units firmly against inside substrates.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Fill cavities side-to-side, top-to-bottom and front-to-back 100 percent.
2. Select insulation thickness to fit cavity without compressing insulation or resulting in void spaces.
3. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
4. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
5. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
6. For wood-framed construction, install blankets according to ASTM C1320 and as follows:

    a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
    b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

3.4 INSTALLATION OF INSULATION FOR WOOD SUBSTRATES

A. Install board insulation on wood substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

END OF SECTION 07 21 00

SECTION 07 25 00 - WATER-RESISTANT BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water Resistant Barrier (WRB).
2. Self-Adhered Membrane Flashing (SAM).
3. Associated flashings and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For water-resistant barrier and all related products and accessories, include data on air and water-vapor permeance based on testing according to referenced standards, and substantiating compliance.

B. Samples:

1. Weather-Resistant Barriers: 8-1/2-inch by 11-inch samples of sheet, samples of tapes, wall opening specialties.
2. SAM Flashing: 8-1/2-inch by 11-inch samples of each sheet and flashing specified.

C. Installation Instructions: Provide manufacturer’s printed installation instruction for each product specified in this Section.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water resistant barrier and flexible flashing, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials protected against damage from water, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Stack sheathing flat on leveled supports off the ground, under cover, and fully protected from weather.

B. Store rolls of material under cover, on a clean, level surface, either flat or upright.

1.5 WARRANTY

A. Manufacturer's Standard Warranty: Upon installation completion and manufacturer acceptance of the work required by this Section, the manufacturer will provide a warranty, manufacturer’s standard form agreement to the project Owner covering materials during specified warranty period.

1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Water-Resistant Barrier (WRB): ASTM E1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide the following:

a. VaproShield Inc.; WrapShield SA Self Adhered.

B. Weather Barrier Tape (SAM): 3-inch pressure-sensitive plastic tape sealing joints and penetrations in weather barrier.

1. Products: Subject to compliance with requirements, provide the following:

a. VaproShield Inc.; 3” VaproTape.

C. Other Accessories / Auxiliary Materials and Products: Provide underlayment flashing rolls, factory formed corners, small penetration flashing, single-sided taped, double-sided tape, air barrier joint sealant, corrosion resistant fasteners of size and type as recommended by the water-resistant barrier manufacturer for the substrate and structure being specified for this project, and other accessories as recommended by the manufacturer for a complete and proper system.

2.2 SELF-ADHERING MEMBRANE FLASHING

A. Foil-Faced Self-Adhered Membrane Flashing (FF-SAM): Minimum 45 mils thick, consisting of a aluminum foil film top surface laminated to a layer of butyl-adhesive, with release-paper backing;

1. Products: Subject to compliance with requirements, provide the following:

a. ProtectoWrap; PS45 Butyl.

B. Water-Resistant Barrier Flashing (WRB): Self-adhered WRB/air barrier membrane consisting of spun-bonded polypropylene fabric and pressure sensitive adhesive.

1. Products: Subject to compliance with requirements, provide the following:

a. VaproShield Inc.; WrapFlashing SA Self Adhered.

2.3 MISCELLANEOUS MATERIALS

A. Air Barrier Sealant: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide the following:

a. VaproShield; VaproBond.

B. Flat tooled at the interface of existing and new water barriers.

C. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing, fluid applied water-resistant barrier for substrate.

D. Fluid-Applied Flashing: Vapor permeable, waterproof liquid-applied flashing material. Single-component, 99 percent solids, silyl-terminated-poly-ether (STPE).

1. Products: Subject to compliance with requirements, provide the following:

a. VaproShield Inc.; VaproLiqui-Flash.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Surface Preparation: Clean and prepare substrate according to the water-resistant barrier manufacturer’s written recommendations. Provide a clean and dry substrate for product application.

1. Do not install products until unsatisfactory conditions have been corrected.

B. Manufacturer’s Instructions: Install water resistant barrier strictly following the manufacturer’s printed instructions. In case of any conflict between the manufacturer’s printed instructions and the field conditions, drawings or specifications, contact the Architect for clarification prior to commencement of work. Any work undertaken without such clarification will be at the Contractor’s cost and risk.

1. Seal seams, edges, fasteners, and penetrations in accordance with manufacturer’s instructions.
2. Terminate and seal at openings as detailed.
3. Extend into jambs of openings and seal corners in accordance with manufacturer’s instructions.
4. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.

C. Penetrations: Install product as detailed, and as recommended by the manufacturer.

D. Water-Resistive Barrier Installation: Secure the membrane so that the subsurface is protected from weather until exterior finish systems can be installed. Seal against all openings and terminations. Install vertical and horizontal laps per manufacturer's instructions.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Install flexible flashing as indicated herein and as shown on drawings. Follow manufacturer’s printed installation recommendations. Apply primer if required by manufacturer. Comply with temperature restrictions of manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures.

B. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Prime substrates as recommended by manufacturer.

2. Lap seams and junctures with other materials except at flashing flanges of other construction.
3. Lap flashing over weather barrier at bottom and sides of openings.
4. Lap weather barrier over flashing at heads of openings.
5. Install flexible flashing at all locations indicated on the Drawings and where recommended by the manufacturer for a complete and weather tight installation.

3.3 FIELD QUALITY CONTROL

A. Remove and replace applications of where inspections indicate that they do not comply with specified requirements.

3.4 CLEANING AND PROTECTION

A. Do not exceed manufacturer’s maximum allowable UV exposure limits. Provide temporary protection as needed.

B. Remove temporary protective coverings and strippable films, if any, unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction until materials are covered by other construction assemblies.

C. Replace materials that have been damaged or have deteriorated.

END OF SECTION 07 25 00

SECTION 07 46 23 - WOOD SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wood lap siding.

B. Related Requirements:

1. Section 07 25 00 "Weather Barriers" for weather-resistive barriers and flexible flashing.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal flashing and trim installed with siding.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Wood lap siding.

B. Samples for Initial Selection: For each type of siding product with factory-applied finishes.

C. Samples for Verification: For the following products, of sizes indicated, to verify color and finish selected.

1. Wood Lap Siding: Full height by 12 inches (305 mm) long.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For Installer.

B. Sample warranties.

1.5 QUALITY ASSURANCE

A. Grading Agency Qualifications: An independent testing and inspecting agency recognized by authorities having jurisdiction as qualified to label siding for compliance with referenced grading rules.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store siding in a dry, well-ventilated, weathertight location in accordance with manufacturer's written instructions.

B. Store rolls of felt used for weather-resistive barrier on end, and on pallets or other raised surfaces. Do not double stack rolls.

1. Protect unused felt from weather, sunlight, and moisture when left overnight or when work is not in progress.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit siding installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Grading Rules: Provide siding that complies with CSSB's grading rules for products indicated.

1. Identification: Attach a label to each bundle of siding; identify manufacturer, type of product, grade, dimensions, and identification mark of grading agency.

2.2 WOOD SIDING

A. Smooth-Sawn Cedar Lap Siding: Western red cedar shingles.

1. Grade: To match existing siding.
2. Size: 1x4 and 1x8, to match existing siding.
3. Shape: Rabbeted shiplap, to match existing siding.
4. Finish: To match existing siding.

2.3 ACCESSORIES

A. Felt Weather-Resistive Barrier: ASTM D226/D226M Type II or ASTM D4869/D4869M Type III, asphalt-saturated organic felt, nonperforated.

B. 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 40 mil (1.0 mm).

1. Primer: Product recommended in writing by manufacturer of flashing for applicable substrate.

C. Nails: ASTM F1667, stainless steel, Type 304, wire nails, sharp pointed, and of sufficient length to penetrate a minimum of 3/4 inch (19 mm) into sheathing.

1. Cedar: Use box nails.
2. Felt Weather-Resistive Barrier: Use roofing nails.
3. Nails in Contact with Metal Flashing: Use nails made from same metal as flashing or made from metal compatible with metal flashing.

D. Cedar Lath Strip: Western red cedar, clear heartwood, a minimum of 1-1/2 inches (38 mm) wide.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WEATHER-RESISTIVE BARRIER

A. Comply with felt manufacturer's written installation instructions and CSSB written recommendations applicable to products and applications indicated unless more stringent requirements apply.

B. Cover exposed exterior surface of sheathing with felt nailed to framing immediately after sheathing is installed.

1. Apply horizontally with a 2-inch (51-mm) overlap and a 6-inch (152-mm) end lap. Wrap around inside and outside corners 4 inches (102 mm).
2. Cut back felt 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
3. Apply felt to cover vertical flashing with a minimum 4-inch (102-mm) overlap unless otherwise indicated.

3.3 INSTALLATION OF FLEXIBLE FLASHING

A. Apply flexible flashing to comply with manufacturer's written installation instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches (102 mm) except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over felt weather-resistive barrier at bottom and sides of openings.
4. Lap weather-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.4 INSTALLATION OF WOOD LAP SIDING

A. Install products, beginning at base of wall.

B. Wood Lap Siding:

1. Install starter (first) course of siding over starter undercoursing with butts 1/2 inch (13 mm) lower than undercoursing butts.
2. Install siding courses with butt lines staggered 6 inches.
3. Fasten each unit with two concealed nails spaced 3/4 to 1 inch (19 to 25 mm) from edges and 1 inch (25 mm) above butt line of succeeding course.

    a. Drive fasteners flush with top surface of units without crushing wood.
    b. For shingles wider than 10 inches (254 mm), install two additional concealed fasteners, spaced 1 inch (25 mm) apart, at the center of unit.

4. Interior Corner Treatment: Butted against wood stop.
5. Exterior Corner Treatment: Butted against corner boards.

C. Weather Exposure and Spacing:

1. Wood Lap Siding:

    a. Maintain maximum weather exposure of to match existing siding.

END OF SECTION 07 46 24

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet metal fabrications.
2. Miscellaneous materials.

B. Related Requirements:

1. Section 07 25 00 “Weather Barriers”
2. Section 07 92 00 “Joint Sealants” for exterior sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of roof-penetration flashing.
8. Include details of flashings, and counterflashings.
9. Include details of special conditions.
10. Include details of connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.

B. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise noted.

1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested and, shop shall be listed as able to fabricate required details as tested and approved.

1.6 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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 Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. “To prevent buckling, opening of joints, overstressing of components, failure of joint

sealants, failure of connections and other detrimental effects, Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss."

1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: For application in locations as denoted by project documents. ASTM A240/A240M, Type 304, dead soft, fully annealed with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A653/A653M, G90 coating designation; or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 coating designation, Grade 40; pre-painted by coil-coating process to comply with ASTM A755/A755M.

1. Primed Surface: Mill phosphatized for field painting.

a. Locations: Where indicated on siding to be field painted.

2. 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.

1) Color: As selected by Architect from manufacturer's full range of standard colors.

3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

D. Gage: Minimum 24 gauge or as indicate on the Drawings or as required for wind load and thermal performance.

E. Sheet Metal Hidden from View: Galvanized sheet steel HDG G90 minimum 24 gage or as indicated on Drawings.

F. Sheet metal integrated in to single-ply roof membrane: Provide single-ply roofing manufacturer coated sheet metal as required my roof membrane manufacturer for integration into single-ply roof system in accordance with manufacturers requirements. Minimum 24 gage or as indicated on Drawings.

2.3 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as

recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, Same metal as metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
3. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel accordance with ASTM A153/A153M or ASTM F2329.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.4 FABRICATION, GENERAL

A. 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.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.

4. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
6. Exposed or visible metal flashing and trim shall be finished in selected color as indicated. No exposed, cut, unfinished, or otherwise visible metal edges will be considered.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. 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.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Soldered Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

I. Clinched Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Use clinched (Norlok, etc.) seaming techniques for joints whenever possible to avoid drilling, rivets, or fasteners at prefinished metal fabrications.

J. Cleats: Cleats shall be fabricated in a continuous flashing and of same metal type used for the exposed profile to be interlocked with. Cleats shall be two gauges thicker than fabricated element, with a thickness of not less than 20 gauge. Provide hemmed drip edges, minimum 3/8-inch dimension. Miter and seal corners with UV stable sealant, color to closely match exposed sheet metal finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder or sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches on center.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

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 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
2. Do not solder metallic-coated steel sheet.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder, and flow solder into joint.

    a. Fill joint completely.
    b. Completely remove flux and spatter from exposed surfaces.

5. Stainless-Steel Soldering:

    a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
    b. Promptly remove acid flux residue from metal after tinning and soldering.
    c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

3.3 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements and project documents, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:

1. Install copings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing over membranes, termination bars, etc. in accordance with Drawings.
3. Lap counterflashing joints minimum of 4 inches.

F. 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.

3.4 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.6 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.
4. Sound putty pads.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A/D Fire Protection Systems Inc.
b. Hilti, Inc.
c. RectorSeal Corporation.
d. Specified Technologies Inc.
e. Tremco, Inc.; Tremco Fire Protection Systems Group.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

2.3 ACCESSORIES

A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated, including but not limited to:

2.4 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Fire Protection Products; Fire Barrier Moldable Putty + Pads.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

K. Thermal and Endothermic Wraps: Flexible, insulating, and fire-resistant protective wraps tested and listed for up to 2-hour fire ratings in accordance with ASTM E814 or UL 1479; for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines, and for thermal barrier and circuit integrity protection in accordance with ASTM E1725 or UL 1724.

L. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls which accept standard accessories.

M. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and requiring no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.

1. Fire-rated cable pathway devices are the preferred product for data, video, and communications cable penetrations. Install these devices in locations where frequent cable moves, add-ons, and changes will occur. Such devices must be:

    a. Capable of retrofit around existing cables.
    b. Designed so that two or more devices can be ganged together.
    c. Maintenance-free so no action is required to activate the smoke- and fire-sealing mechanism.

2. Where fire-rated cable pathway devices are not practical, openings within walls and floors designed to accommodate data, video, and communications cabling must be provided with re-enterable products specifically designed for retrofit, such as retrofit devices for cable bundles, firestopping putty, plugs, or pillows.

N. Retrofit Device for Cable Bundles: Factory-made, intumescent, collar-like device for firestopping existing over-filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.

O. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.

P. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestopping gasket for use around rectangular steel HVAC ducts without fire dampers.

Q. Firestopping Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.

R. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch (13 mm) in diameter.

S. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings in accordance with manufacturer's written instructions and with the following requirements:

1. Remove foreign materials from substrate surfaces that could interfere with adhesion of penetration firestopping materials.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates in accordance with penetration firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

D. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.

5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated construction.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."

2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Fire Protection Products.
b. A/D Fire Protection Systems Inc.
c. Hilti, Inc.
d. Metal-Lite.
e. Nelson Firestop; a brand of Emerson Industrial Automation.
f. RectorSeal.
g. Roxul Inc.
h. Specified Technologies, Inc.
i. Thermafiber, Inc.; an Owens Corning company.
j. Tremco, Inc.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

D. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.3 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior joint sealants.
2. Interior joint sealants.
3. Acoustical joint sealants.
4. Sealant tapes and accessories.

B. Related requirements:

1. Section 07 25 00 “Water-Resistant Barriers”
2. Section 07 84 43 "Joint Firestopping" for sealing joints in fire-resistance-rated construction.
3. Section 09 29 00 "Gypsum Board" for acoustical sealants for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
4. Section 09 30 13 "Tiling" for sealing tile joints.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated. Include minimum criteria below: Durometer Hardness- press Strength- Tension Adhesion Strength- Joint Movement Capability Staining.

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Primer Schedule: For each sealant type and listed substrate, include manufacturer’s instructions for priming.

E. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer and approved by Sealant and Waterproofing Research Institute (SWRI).

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in this Section.

D. Field-Adhesion-Test Reports: For each sealant application tested.

E. Sample Warranties: For special warranties.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.4 QUALITY ASSURANCE

A. All sealants shall be validated and approved by the Sealant Waterproofing and Restoration Institute (SWRI).

B. Sealant manufacturer shall certify that the specified sealant is “compatible with substrates per sealant schedule.”

C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

D. Perform work in accordance with sealant manufacturer’s requirements for preparation of surfaces and material installation instructions.

E. Perform acoustical sealant application work in accordance with ASTM C919.

F. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

G. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

H. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.

1. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
2. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

I. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, confirm cure time, substrate requirements, priming, etcetera to confirm installed per manufacturer requirements, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.
7. Compare ratio of original length of section tested to maximum pull length prior to failure to movement capabilities per the sealant manufacturer technical data.

1.6 DELIVERY STORAGE AND HANDLING:

A. Shelf-Life Products in Original Containers with Label:

1. Store per manufacturer, storage, temperature and humidity while on site.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 degrees F.
2. When joint substrates are wet, damp, frozen or otherwise unacceptable for sealant adhesion, per manufacturer.
3. Where inclement weather is imminent at installation locations not protected.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 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.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those 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 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by 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 as indicated on SCAQMD Rule 1168 “Adhesive and Sealant Applications”):

1. Architectural sealants shall have a VOC content of 250 g/L or less.
2. Sealants primers for nonporous substrates shall have a VOC content of 250 g/L or less.
3. Sealants primers for porous substrates shall have a VOC content of 775 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

C. Suitable for Immersion in Liquids: To meet ASTM C1247.

2.3 HYBRID JOINT SEALANTS

A. Hybrid, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses NT, T M, A and O.

1. Products: Subject to compliance with requirements, provide the following:

    a. Sika; SikaFlex HY150.

2. Locations: Painted exterior joints: fiber cement, metal siding (Kynar coated).

2.4 SILICONE SEALANT

A. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide the following:

    a. Dow; Dowsil 758 Silicone Weather Barrier Sealant.

2. Locations: Weather resistant barrier terminations and interior perimeter seal for fenestration systems.

B. Silicone, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses NT G, A and O.

1. Products: Subject to compliance with requirements, provide the following:

    a. Dow; Dowsil 795 Silicone Building Sealant.

2. Locations: Unpainted exterior joints, general.

2.5 URETHANE JOINT SEALANTS

A. Urethane, multiple-component, pourable, plus 100 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T, NT, M, G, A, O and I.

1. Products: Subject to compliance with requirements, provide the following:

    a. BASF Sonolastic SL2.

2. Location: Interior horizontal joints.

2.6 INTERIOR 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: Single-component, nonsag, mildew-resistant, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 786 Sealant.
b. Momentive, Sanitary SCS1700.
c. Pecora Corporation; Pecora 860.
d. Tremco Commercial Sealants & Waterproofing; Tremsil 200.
e. Sherwin Williams; 50A Siliconized Acrylic Latex Caulk.
f. Sika: Bondaflex Sil 100 WF

2. Locations: Joints between plumbing fixtures and adjoining walls, floors, and counters. Tile control and expansion joints where indicated.

2.7 INTERIOR BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc.; 5612 Non-Skinning Butyl Mastic Sealant.
b. Pecora; BC-158 One-Part Butyl Rubber Sealant.
c. Tremco; Trempro JS-773+, Non-Skinning, Non-Drying, Flexible, Synthetic Butyl Sealant.

2. Locations: Under aluminum thresholds and sill plates.

2.8 INTERIOR LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pecora Corporation; AC-20 +Silicone
b. Tremco Commercial Sealants & Waterproofing; Tremflex 834.
c. BASF; MasterSeal NP520.

2. Locations: Control joints on exposed interior surfaces of exterior walls. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.

2.9 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.

1. Products: Subject to compliance with requirements, provide one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.; RCS20 Acoustical.
b. Grabber Construction Products; Acoustical Sealant GSC.
c. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant.
d. OSI Sealants; Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
e. Pecora Corporation; AC-20 FTR or AIS-919 or BA-98.
f. Serious Energy Inc.; Quiet Seal Pro.

g. Specified Technologies, Inc.; SpecSeal Smoke 'N' Sound Sealant.
h. Tremco Incorporated; Tremco Acoustical Sealant.
i. USG; Sheetrock Brand Acoustical Sealant.

2. Locations: At penetrations, under metal studs at sound walls, perimeter edge of moldings.

2.10 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 C1330, Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Nomaco; Sof Rod Bi-Cellular Polyethylene Backer Rod.

2. Size backer rod to be 25 percent larger than the opening.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable. As proven by preconstruction adhesion and compatibility testing.

2.11 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, 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. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended 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.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with ASTM C1193 with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. 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. Do not braid backing. Provide heat resistant backing where required.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 C1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
    b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab or Method D, Water Immersion in Appendix X1 in ASTM C1193, as appropriate for type of joint-sealant application indicated.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
4. Inspect tested joints and report on the following:

a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
b. Whether sealants filled joint cavities and are free of voids.
c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.6 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Interior standard steel doors and frames.

B. Related Requirements:

1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to SDI A250.8.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required.

E. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product, by one of the following:

1. Ceco Door Products.
2. Curries Company.
3. Republic Doors and Frames.
4. Steelcraft.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities

having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2. Temperature-Rise Limit: Where indicated on Drawings and at vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F above ambient after 30 minutes of standard fire-test exposure.

2.3 INTERIOR DOORS AND FRAMES

A. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (18 gauge), with minimum A40 coating.
d. Edge Construction: Model 2, Seamless.
e. Core: Manufacturer's standard.
f. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated and temperature-rise-rated doors.

2. Door Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (16 gage), with minimum A40 coating.
b. Construction: As indicated on Door Schedule.

1) Framed Walls: Knock down.
2) Concrete and CMU walls: Full profile welded.

3. Exposed Finish: Prime.
4. Site Finish: In accordance with Section 09 91 23 “Interior Painting”.

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 thick (18 gage), with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick (18 gage).

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

F. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.

G. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M.

H. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing).

I. Glazing: Section 08 80 00 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil 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 Doors:

1. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

C. 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. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
3. 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.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches on center, to match coursing, and as follows:

1) Two anchors per jamb up to 60 inches high.
2) Three anchors per jamb from 60 to 90 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on center and as follows:

1) Three anchors per jamb up to 60 inches high.

2) Four anchors per jamb from 60 to 90 inches high.

5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. 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 doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer compatible with finish coat as specified in Section 09 91 23 “Interior Painting”.

1. Shop Primer: SDI A250.10.

2.8 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 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. At fire-rated openings, install frames according to NFPA 80.
b. 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.
c. Install frames with removable stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.

2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
3. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.

4. 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, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

5. Coordinate with all hardware requirements (gaskets, smoke seals, etc.)

B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

    a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
    c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
    d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

C. Glazing: Comply with installation requirements in Section 08 80 00 "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 on center and not more than 2 inches on center from each corner.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. 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.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

SECTION 08 11 16.13 - INTERIOR ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior aluminum doors and frames.

B. Related Requirements:

1. Section 08 71 00 “Door Hardware” for additional door hardware.
2. Section 08 80 00 “Glazing” for glazing units.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings:

1. Elevations, sections, and installation details for each wall-opening condition.
2. Details of construction of each component, including dimensioned profiles and metal thicknesses.
3. Locations of reinforcements and preparations for hardware.
4. Details of anchorages, joints, splices, connections, and accessories.
5. Details of trim, removable stops, and glazing.

C. Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of interior aluminum-framed doors and frames that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

b. Failure of operating components.

2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INTERIOR ALUMINUM DOORS AND FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products, or equal, by the following:

1. Alpha Aluminum Architectural Products, Inc.

B. Aluminum Framing: ASTM B221 (ASTM B221M), with alloy and temper required to suit structural and finish requirements, and not less than 0.062 inch (1.6 mm) thick.

C. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.

D. Glazing Frames: Extruded aluminum, for glass thickness indicated on Drawings.

E. Trim: Extruded aluminum, not less than 0.062 inch (1.6 mm) thick; removable, snap-in casing trim glazing stops and, without exposed fasteners.

F. Aluminum-Framed Glass Doors: Manufacturer's standard, factory-assembled, 1-3/4-inch- (45-mm-) thick doors.

1. Stile Width: As indicated on Drawings.
2. Top-Rail Height: As indicated on Drawings.
3. Bottom-Rail Height: Provides smooth surface within 10 inches (254 mm) of finished floor measured vertically.

2.2 ACCESSORIES

A. Fasteners: Aluminum, nonmagnetic, stainless steel, zinc-plated steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

B. Corner Reinforcements and Alignment Clips: Manufacturer's standard concealed units to provide accurately fitted hairline joints at butted and mitered connections.

C. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals, in manufacturer's standard color.

D. Glazing Gaskets: Manufacturer's standard extruded or molded rubber or plastic, to accommodate glazing thickness indicated; in manufacturer's standard color.

E. Glazing Stops: Removable to allow glazing replacement without framing disassembly.

F. Glass: As specified in Section 08 80 00 "Glazing."

G. Door Hardware: As specified in Section 08 71 00 "Door Hardware."

2.3 FABRICATION

A. Hardware Preparation: Factory prepare components to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping.

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted hardware.
2. Locate hardware as indicated on Drawings and as specified in Section 08 71 00 “Door Hardware”.

B. Glazing Stops: Locate removable stops on inside of spaces accessed by locking doors.

C. Fabricate components to allow secure installation without exposed fasteners and to provide accurately fitted hairline joints at butted and mitered connections.

D. Fabricate frame components 96 inches (2440 mm) long or shorter as one piece. Where splices are required, no individual piece may be less than 48 inches (1220 mm) long.

2.4 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Black.

PART 3 - EXECUTION

3.1 INSTALLATION OF ALUMINUM DOORS AND FRAMES

A. Glass: Install glass in accordance with Section 08 80 00 "Glazing" and aluminum-frame manufacturer's written instructions.

B. Doors: Install doors aligned with frames and fitted with required hardware.

1. Hardware: Install in accordance with aluminum-frame manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

A. Egress Door Assembly Acceptance Testing: Test and inspect egress doors in accordance with NFPA 101.

B. Prepare test and inspection reports.

3.3 ADJUSTING AND CLEANING

A. Doors: Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly in accordance with manufacturer's written instructions.

B. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and in accordance with AAMA 609 & 610.

C. Touch Up: Immediately after installation, repair damaged areas of aluminum finishes and touchup in accordance with manufacturer's written instructions.

END OF SECTION 08 11 16.13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Five-ply flush veneer-faced wood doors for transparent finish.
2. Five-ply flush wood doors for opaque finish.
3. Shop priming flush wood doors.
4. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Factory-machining criteria.
6. Factory-priming 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. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.
7. Requirements for veneer matching.

C. Samples: For factory-finished doors.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated on Drawings At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F above ambient after 30 minutes of standard fire-test exposure.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI "Architectural Wood Flush Doors."

B. No added urea formaldehyde.

2.3 SOLID-CORE FIVE-PLY FLUSH VENEER-FACED WOOD DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Basis of Design: Subject to compliance with requirements, provide the following:

a. Nonrated: Lynden Door; LD2000 NAUF PC-5.
b. Fire Rated: Lynden Door; LD6000 NAUF.

2. Other Manufacturers: Subject to compliance with requirements, provide products from one of the following:

a. Oregon Door.
b. Vancouver Door.
c. VT Industries.

3. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
4. ANSI/WDMA I.S. 1A Grade: Custom.
5. Thickness: 1-3/4 inches.
6. Faces: Single-ply wood veneer not less than 1/50 inch thick.

a. Species: White Oak.
b. Cut: Rift.
c. Grade: AA.
d. Match between Veneer Leaves: Book match.
e. Assembly of Veneer Leaves on Door Faces: Balance match.

f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

7. Exposed Vertical Edges: Any closed-grain hardwood.

a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
c. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.

1) Finish steel edges and astragals to match door hardware (locksets or exit devices).

d. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

8. Core for Non-Fire-Rated Doors:

a. Sustainable Particleboard: Agrifiber ANSI A208.1 Grade LD1

1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

a) 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
b) 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
c) 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

9. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings needed to eliminate through-bolting hardware:

1) 5-inch top-rail blocking.
2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
3) 5-inch midrail blocking, in doors indicated to have armor plates.
4) 4-1/2-by-10-inch lock blocks, in doors indicated to have exit devices.

10. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD DOORS FOR OPAQUE FINISH

A. Interior Solid-Core Doors:

1. Basis of Design: Subject to compliance with requirements, provide the following:

    a. Lynden Door; LD2000 NAUF PC-5.

2. Other Manufacturers: Subject to compliance with requirements, provide products from one of the following:

    a. Oregon Door.
    b. Vancouver Door.
    c. VT Industries.

3. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
4. ANSI/WDMA I.S. 1A Grade: Custom.
5. Thickness: 1-3/4 inches.
6. Faces: MDO.
7. Exposed Vertical Edges: Any closed-grain hardwood.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
    b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    c. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.

        1) Finish steel edges and astragals to match door hardware (locksets or exit devices).

    d. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

        1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

8. Core for Non-Fire-Rated Doors:

    a. WDMA I.S. 10 structural composite lumber.

        1) Screw Withdrawal, Face: 550 lbf.
        2) Screw Withdrawal, Edge: 550 lbf.

    b. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

9. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

    a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as follows:

        1) 5-inch top-rail blocking.
        2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
        3) 5-inch midrail blocking, in doors indicated to have armor plates.

4) 4-1/2- inch by-10-inch lock blocks, in doors indicated to have exit devices.

10. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Lite Openings: Wood moldings to match veneer species using manufacturer’s standard profiles.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY PRIMING

A. Doors for Opaque Finish: Factory prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 09 91 23" Interior Painting."

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and Factory finish doors where indicated in schedules or on Drawings as factory finished.

B. Transparent Finish:

1. Architectural Woodwork Standards Premium.
2. Architectural Woodwork Standards System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
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 08 71 00 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide1/4 inch from bottom of door to top of threshold unless otherwise indicated.
d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.2 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Provide inspection of installed Work through, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

B. Related Requirements:

1. Section 09 91 23 “Interior Painting” for field painting access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of access door and frame and for each finish specified.

C. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 MANUFACTURERS

A. Basis of Design: J. L. Industries, Inc.

B. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Larsen's Manufacturing Company.

2.3 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:

1. Products Subject to compliance with requirements, provide the following:

a. Karp KDW – Flush Access Door for Drywall Surfaces.

2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Features: Pinned hinges, Removable doors.
4. Locations: Wall and ceiling, typical.
5. Door Size: Required.
6. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory primed.
7. Frame Material: Same material, thickness, and finish as door.
8. Latch and Lock: Cam latch, key operated.

2.4 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Products Subject to compliance with requirements, provide the following:

a. Karp KRP-350FR – Fire Rated Access Door for Drywall Surfaces.

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
3. Features: Piano hinges.
4. Locations: Wall and ceiling in fire rated construction.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Door Size: Required.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-latching door hardware, operated by key.

2.5 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: Same material as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.6 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

2.7 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 33 26 - OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes open-curtain overhead coiling grilles, sound isolation and accessories.

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.

1. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
2. Show locations of controls, locking devices, and other accessories.
3. Include diagrams for power, signal, and control wiring.

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.

B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of grilles that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Overhead coiling grilles shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 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: Subject to compliance with requirements, provide the following:

a. Cornell; Visionaire Model ESG10.

2. Other Manufacturers: Subject to compliance with requirements, provide products from one of the following:

a. Overhead Door Company.
b. Wayne Daton.

B. Operation Cycles: Grille components and operators capable of operating for not less than 50,000 operating seatbelts.

C. Grille Curtain Material: Aluminum.

1. Rod Spacing: Approximately 2 inches on center.
2. Link Spacing: Approximately 6 inches apart in a straight in-line pattern.
3. Spacers: Metal tubes matching curtain material.
4. Pattern: Straight lattice.

D. Bottom Bar: Tubular shape fabricated from aluminum matching curtain slats.

E. Curtain Jamb Guides: Aluminum with exposed finish. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

F. Hood: 24 gauge, galvanized steel, powder coat finish.

1. Mounting: Face of wall, as indicated on Drawings.

G. High Speed Electric Grille Operator:

1. Products: Subject to compliance with requirements, provide the following:

a. SGH 10023 E Logic.

2. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
4. Motor Exposure: Exterior.
5. Motor Electrical Characteristics:

a. Horsepower: 1/2 hp.
b. Voltage: 208-V ac, three phase, 60 Hz.

6. Sound isolators.
7. Emergency Manual Operation: Chain.
8. Obstruction-Detection Device: Automatic photoelectric sensor electric sensor edge on bottom bar.
9. Control Station(s): Interior mounted Where shown on Drawings.
10. Door Size: As indicated on Drawings.

H. Grille Finish:

1. Aluminum Finish: Medium Bronze anodized.

2.3 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 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. Bottom Bar: Manufacturer's standard continuous shape unless otherwise indicated, finished to match grille.

1. Astragal: Equip grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
2. Provide motor-operated grilles with combination bottom astragal and sensor edge.

C. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.5 HOODS AND ACCESSORIES

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

2.6 COUNTERBALANCING MECHANISM

A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a

spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 ELECTRIC GRILLE OPERATORS

A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille 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 grille, 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 grille.

C. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.

1. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

D. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in grille opening without contact between grille and obstruction.

a. Self-Monitoring Type: Designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, grille closes only with sustained or constant pressure on close button.

2. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. 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 grille operator control circuit to detect damage to or disconnection of sensor edge.

E. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.

3. Card reader access.
4. Coordinate with Owner’s long range reader systems (Gentec).

F. Emergency Manual Operation: Equip each electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf.

G. 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.

H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

I. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard. Emergency-Egress Release: Flush, wall-mounted handle mechanism, for accessibility-code-compliant egress feature, not dependent on electric power. The release allows an unlocked grille to partially open without affecting limit switches to permit passage, and it automatically resets motor drive on return of handle to original position.

J. Self-Opening Mechanism: Automatic release mechanism triggered by smoke detector, emergency push-button station, fire alarm or power failure. When activated, the grille self-opens by means of a fail-safe operator to the fully open position without the need for power operation or battery backup systems. When the emergency push-button is reset, and the alarm is cleared and power is restored, the grille will operate normally.

2.8 ACCESSORIES

A. Vibration Isolation Mounts:

1. Include continuous vibration isolators pre-installed on both guides to reduce vibration transferred from the door to the structure.
2. Vibration isolators should be expected to reduce vibration by up to 14 percent.
3. Damping pads are to be manufactured from nitrile oil-resistant rubber, durometer 50A.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports, according to manufacturer's written instructions and as specified.

B. Power-Operated Grilles: Install automatic garage grille openers according to UL 325.

C. 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. Adjust seals to provide tight fit around entire perimeter.

D. Install vibration isolation mounts in accordance with manufacturer’s instructions.

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 08 33 26

SECTION 08 41 13 - ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior storefront framing.
2. Exterior and interior manual-swing entrance doors and door frame units.

B. Related Requirements:

1. Section 08 11 16.13 “Interior Aluminum Doors and Frames” for interior aluminum doors and frames.
2. Section 08 71 00 “Door Hardware” for additional door hardware.
3. Section 08 80 00 “Glazing” for insulated glazing units.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Discuss adjacent assemblies, integration into air barrier, weather barrier, special conditions, and sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include Technical Data Sheets (TDS) and applicable Material Safety Data Sheets (MSDS).

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 Verification: 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: Fenestration Calculation Report / Bid Report according to NFRC CMA procedures. NFRC-certified energy performance values from manufacturer in coordination with insulated glazing units.

B. Product test reports including air infiltration, water penetration, structural performance – AAMA /WDMA/CSA – 101/IS.2/A440.

C. Field quality-control reports.

D. Sample warranties.

E. Manufacturer’s certificate stating products meet or exceed requirements.

F. Laboratory test reports certifying products meet air infiltration, water penetration, and structural performance.

G. Approval letter by manufacturer that proposed and submitted system meets the requirements of the Project to resist wind load forces as calculated by Structural Engineer of Record

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. NFRC Certificates if required by jurisdiction.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Manufacturer qualifications for entity manufacturing aluminum storefronts.

C. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

D. 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 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Noise or vibration created by wind and by thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Failure of operating units.
g. Glass breakage.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Thermal Breaks and Separation: Storefront framing shall incorporate thermal break separating framing components exposed to interior and exterior environments.

D. Structural Loads:

1. Wind Loads: 95 mph, per City of Federal Way “Desing Criteria – Climatic and Geographic”
2. Other Design Loads: per City of Federal Way “Desing Criteria – Climatic and Geographic”

E. 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 1/175 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, whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

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 for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans of less than 11 feet 8-1/4 inches.

F. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and 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.

G. Air Infiltration: Test according to ASTM E283 for infiltration as follows:

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

2. Entrance Doors:

    a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

H. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of not less than 10 lbf/sq. ft. or 15 percent of design pressure, whichever is greater. Water leakage shall be defined as any uncontrolled water passing the plane of air tightness for the system. Water that exists on a surface intended to drain to the exterior is not water leakage.

I. Water Penetration under Dynamic Pressure: Test according to ASTM E1105.

J. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.

K. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor indicated on Drawings as determined according to NFRC 100.

2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC indicated on Drawings as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas as a system shall have an NFRC-certified condensation resistance rating indicated on Drawings as determined according to NFRC 500.

L. Noise Reduction: Test according to ASTM E90, with ratings determined by ASTM E1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 32.

M. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That produces an exterior metal-surface temperature of 180 degrees F.
b. Low Exterior Ambient-Air Temperature: 0 degrees F.
c. Interior Ambient-Air Temperature: 75 degrees F.

2.2 STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Kawneer North America; Trifab Versa Glaze 451T systems.
2. Arcadia Inc.; AD451-T.

B. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Anchors Clips and Accessories: Aluminum, nonmagnetic stainless steel, or zinc coated complying with ASTM B633 for SC 3.

F. Storefront sill condition shall be provided in factory with means for structural attachment at sill condition in back angle method. Installation of storefront with fasteners penetrating sill condition of aluminum extrusion will not be considered.

G. Window System Attachment at Sill Condition:

1. Fasteners for window system shall not penetrate rigid sill pan or membranes.

2. Fastening at sill condition shall be with manufacturer's approved back angle at interior face of extrusion.
3. Sill condition of system shall be provided with means of drainage per Project Documents.

H. Fasteners: Aluminum, nonmagnetic stainless steel or other materials non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.

I. Sealant Within Storefront System: Permanently elastic, non-shrinking, non-migrating type recommended by sealant manufacturer for joint size and movement.

J. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
c. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
d. Structural Profiles: ASTM B308/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 A36/A36M.
b. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
c. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

2.3 SWINGING ENTRANCE DOOR SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Kawneer Company; 500T Wide Stile Insulpour Thermal Entrance.

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2-1/4-inch overall thickness, with minimum 0.188-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design:

a. Wide stile; 5-inch nominal width.
b. Top rail, 5-inch nominal width.
c. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide non-removable glazing stops on outside of door.

C. Entrance Door Hardware: As specified in Section 08 71 00 "Door Hardware."

2.4 ENTRANCE DOOR HARDWARE

A. Door Hardware: Refer to Section 08 71 00 “Door Hardware.”

2.5 GLAZING SYSTEMS

A. Glazing: As specified in Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type and compatible with all sealants and glazing components.

D. Glazing Sealants: As recommended by manufacturer.

1. Sealant shall have a VOC content of 250 g/L or less.

2.6 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 interior for vision glass and exterior for spandrel glazing or metal panels
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.

2.7 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 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 non-movement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" and as indicated on Drawings and building envelope details to produce weathertight installation.

C. Install components plumb and true in alignment with established lines and grades.

D. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

E. Install glazing as specified in Section 08 80 00 "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.

G. Provide trim and flashing components as indicated on Drawings.

H. Do not install units through sill condition. Installation of units shall be via back angle method, into backside of storefront extrusion from interior. Sill condition of window to include rigid metal flashings and flexible membranes shall be free of penetrations as a result of storefront unit installation

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 mockups.

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.
b. Perform test in accordance with ASTM E1105. Test at 2/3 the specified lab performance criteria.

c. Pass/Fail Criteria: Water penetration shall not be as defined in ASTM E1105. Water penetration is defined as the appearance of any water on the interior side of the defined boundary of water control, including interface locations with adjacent envelope systems, that is not contained and drained back to the exterior, or that can cause damage to adjacent materials or finishes. Water fully contained in drained flashings, gutters, and sills is not considered water leakage..

2. Water Penetration Field Testing: ASTM E1105, Procedure A, consistent of 15 minutes induced air pressure difference.
3. Air Infiltration: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

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.

1. Retesting shall be at the expense of the Contractor. At the Architect’s discretion, 1 similar unit shall be tested in addition to the failed specimen.

D. Prepare test and inspection reports.

1. Test and inspection reports shall be prepared by the qualified testing agency and provided to the Contractor for review.
2. Subcontractor and Contractor will facilitate performance of the testing per testing agencies requirements.

END OF SECTION 08 41 13

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Work under this section includes the complete finish hardware requirements for the project. Quantities listed are for the contractor's convenience only and are not guaranteed. Items not specifically mentioned, but necessary to complete the work shall be furnished, matching the items specified in quality and finish.

B. Related Sections:

1. Section 081100 Hollow Metal Doors and Frames
2. Section 081400 Wood Doors
3. Section 084113 Aluminum Entrances and Storefronts

1.2 QUALITY ASSURANCE

A. Product Qualification:

1. To assure a uniform high quality of materials for the project, it is intended that only specified items be furnished. Comparable products may be accepted upon prior approval of architect.
2. Hardware to be new, free of defects, blemishes and excessive play. Obtain each kind of hardware (Mechanical latch and locksets, exit devices, hinges and closers) from one manufacturer except where specified.
3. Fire-Rated opening in compliance with NFPA80. Hardware UL10C/UBC-7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved bearing hinges and smoke seal. Furnish openings complete.

B. Supplier Qualifications:

1. Hardware supplier will be a direct factory contract supplier who employs a certified Architectural Hardware Consultant (AHC) available at all reasonable times during the course of the work for project hardware consultation to owner, architect and contractor.
2. Supplier will be responsible for detailing, scheduling and ordering of finish hardware.
3. Conduct pre-installation conference at jobsite. Initiate and conduct with supplier, installer and related trades. Coordinate materials and techniques and sequence complex hardware items and systems installation.
4. Key Conference shall be initiated and conducted with owner to determine system, keyway(s) and structure.

C. Installer Qualifications:

1. Installer to have not less than 3 years' experience specializing in installation of work in this section. Company must maintain qualified personnel trained and experienced in installing hardware.

1.3 REFERENCES

A. NFPA80 – Fire Doors and Windows

B. NFPA101 – Life Safety Code

C. NFPA105 – Smoke and Draft Control Door Assemblies

D. ANSI A117.1 Accessible and Usable Buildings and Facilities

1.4 SUBMITTALS

A. Hardware schedule: Submit digital copies of schedule. Organize vertically formatted schedule into Hardware Sets with index of doors and headings, indication complete designations of every item required for each door or opening. Include the following:

1. Type, style, function, size, quantity and finish of hardware items.
2. Name, part number and manufacture of each item.
3. Fastenings and other pertinent information.
4. Explanation of abbreviations, symbols and codes contained in schedule.
5. Door and frame sizes, materials and degrees of swing.

B. Product Data: Submit digital copies for each product indicated.

C. Templates: Obtain and distribute templates for doors, frames, and other works specified to be prepared for installing door hardware.

D.
Wiring/Riser diagrams: As required for electric hardware indicated. ELECTRICAL COORDINATION MEETING: After receipt of approved finish hardware schedule, the hardware supplier shall organize and lead a meeting with all related suppliers and installers of electrified hardware and access control systems. Include copies of all door elevation drawings showing location of electrified hardware, point to point wiring diagrams, a separate hardware schedule only listing openings having electrified hardware as part of this section, and manufacturers' catalog cuts of electrified hardware including electrical specifications of the product, will be provided, by the hardware supplier, for each attendee at the meeting. The purpose of this meeting will be to insure that all parties understand their scope of work and the system operation and location of all electrified hardware products. Hardware supplier shall provide a system description for each hardware group that has electrified hardware.

E. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

F. Keying Schedule: Prepared by or under the supervision of supplier, after receipt of the approved finish hardware schedule, detailing Owner's final keying instructions for locks.

G. Samples: Upon request submit material samples.

H. THE SPECIFICATION WRITER MUST APPROVE ALL SUBMITTALS BEFORE ORDERS CAN BE PLACED.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle and protect products to project site under provisions of Division 1 and as specified herein.

B. Tag each item or package separately, with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to Owner by registered mail.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers: Thirty years mechanical, two years electrical
b. Exit Devices: Three years mechanical, one year electrical
c. Locksets: Ten years(ND), three years (everything else), one year electrical

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Provide all door hardware for complete work, in accordance with the drawings and as specified herein.

B. Provide items and quantities not specifically mentioned to ensure a proper and complete operational installation.

2.2 MANUFACTURERS

A. Approval of products from manufacturers indicated as “Acceptable Manufacturer” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

ITEM	SCHEDULED MANUFACTURER	ACCEPTABLE MANUFACTURER
Hinges	Ives (IVE)	Hager, Bommer
Flush Bolts & Coordinators	Ives (IVE)	Tice
Locksets & Deadlocks	Schlage (SCH)	None
Aluminum Door Locks - Narrow Style	Adams Rite (ADA)	None
Exit Devices & Mullions	Von Duprin (VON)	None
Electric Strikes	Von Duprin (VON)	Trine, SDC
Power Supplies	Von Duprin (VON)	Falcon

Cylinders & Keying	Schlage (SCH)	None
Door Closers	LCN (LCN)	None
Automatic Operators	LCN (LCN)	Horton
Door Trim	Ives (IVE)	Tice
Protection Plates	Ives (IVE)	Tice
Overhead Stops	Glynn-Johnson (GLY)	Tice
Thresholds & Weatherstrip	Zero (ZER)	NGP

2.3 HANGING

A. Conventional Hinges: Hinge open width minimum, but of sufficient throw to permit maximum door swing. Steel or stainless steel pins:

1. Three hinges per leaf to 7 feet, 6-inch height. Add one for each additional 30 inches in height or any fraction thereof.
1. Provide 4 ½ x 4 ½ for 1 ¾" thick doors up to 3'5". Provide 5 x 4 ½ on doors 36" and over.
2. Exterior outswing doors to have non removable (NRP) pins.
3. Pin tips, flat button, finish to match leaves
4. Interior doors over 36" – Heavy weight
5. Interior doors up to 36" – Standard weight

2.4 LOCKSETS, LATCHSETS, DEADBOLTS

A. Extra Heavy Duty Cylindrical Locks and Latches: Schlage ND Series ALX SERIES

1. Provide cylindrical locks conforming to ANSI A156.2 Series 4000, Grade 1.
2. UL listed for A label and lesser class single doors up to 4ft x 8ft.
3. Meets A117.1 Accessibility Codes.
4. Provide solid steel rotational stops to control excessive rotation of lever.
5. : Provide completely refunctionable lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
6. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
7. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
8. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
9. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
10. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

    a. Lever Design: Schlage LAT

2.5 EXIT DEVICES

A. Panic and Fire Rated Exit Devices: Von Duprin 98/99 Series

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, AND UL listed for Panic Exit or Fire Exit Hardware.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.

3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.
10. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

    a. Lever Style: Match lever style of locksets.

2.6 ELECTRIC STRIKES

A. Manufacturers and Products: Von Duprin 6000 Series

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide fail-secure type electric strikes, unless specified otherwise.
5. Coordinate voltage and provide transformers and rectifiers for each strike as required.

2.7 KEYS, KEYING, AND KEY CONTROL

A. See Keying Requirements in this section

2.8 CLOSERS

A. Surface Closers: LCN 4040XP Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.

4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

B. Electro-Mechanical Automatic Operator: LCN Senior Swing

1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI A156.19.
2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 seconds, and logic terminal to interface with accessories, mats, and sensors.
3. Provide drop plates, brackets, or adapters for arms as required to suit details.
4. Provide hard-wired motion sensors and/or actuator switches for operation as specified. Provide weather-resistant actuators at exterior applications.
5. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

2.9 OTHER HARDWARE

A. Door stops: Provide stops to protect walls, casework or other hardware.

1. Except as otherwise indicated, provide stops (wall, floor or overhead) at each leaf of every swinging door leaf.
2. Where wall or floor stops are not appropriate, provide overhead holders.

B. Weatherstrip and Gasket

1. Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled.
2. Provide non-corrosive fasteners as recommended by the manufacturer for application indicated.

C. Thresholds

1. Except as otherwise indicated, provide standard metal threshold unit of type, size and profile as detailed or scheduled.

D. Silencers

1. Interior hollow metal frames, 3 for single doors, 2 for pairs of doors.

E. Kickplates

1. Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

2.10 HARDWARE FINISH

A. Provide the following finishes unless noted differently in hardware groups:

Hinges	630 Stainless Steel Exterior, 652 Dull Chrome Interior
Locksets	626 Dull Chrome
Exit Devices	626 Dull Chrome
Closers	689 Aluminum
Kickplates	630 Stainless Steel
Other Hardware	626 Dull Chrome
Thresholds	Aluminum
Weatherstrip/Sweeps	Aluminum

2.11 KEYING REQUIREMENTS

A. All keyed cylinders shall be subject to a new Schlage Masterkey system.

B. Furnish cylinders with construction cores. Following construction supply permanent keyed cores.

C. Cylinders to be furnished with visual key control with key code. Stamped on the face of the keys and marked on the back or side of the cylinders.

D. Key Quantities
   - 6 EA Master Keys
   - 4 EA Control Keys
   - 2 EA Construction Control Keys
   - 10 EA Construction Keys
   - 3 EA Change Keys per keyed alike group

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that walls and frames are square and plumb before hardware installation.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes. Notify Architect of any code conflicts before ordering materials.

3.2 INSTALLATION

A. Do not install surface mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation.

B. Locate floor stops not more than 4 inches from the wall.

C. Drill pilot holes for fasteners in wood doors and/or frames.

3.3 ADJUSTING

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

B. Hardware damaged by improper installation or adjustment methods to be repaired or replaced to Owner’s satisfaction.

3.4 FOLLOW UP INSPECTION

A. Installer to provide letter of agreement to Owner that approximately 6 months after substantial completion, installer will visit project with representative of the manufacturers of the locking devices and door closers to accomplish the following:

1. Re-adjust locks and closers
2. Evaluate maintenance procedures and recommend changes or additions, and instruct Owner’s personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems and likely future problems.

3.5 DEMONSTRATION

A. Demonstrate electrical, electronic and pneumatic hardware system including adjustment and maintenance procedures

3.6 PROTECTION/CLEANING

Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process

. Hardware Group No. 01

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	PIVOT SET	7226 SET VERIFY IF 101A IS ALUM OR WD			BLK	IVE
1	EA	INTERMEDIATE PIVOT	7226 INT			BLK	IVE
1	EA	POWER TRANSFER	EPT10			US19	VON
1	EA	ELEC PANIC HARDWARE	QEL-35A-NL-OP-388 24 VDC			315	VON
1	EA	RIM CYLINDER	20-057			622	SCH
1	PR	DOOR PULL	RM3301 80 12HD BTB MTG verify height b4 ordering			315	ROC
1	EA	SURF. AUTO OPERATOR	9542 MS AS REQ (120/240 VAC)			ANDKB	LCN
2	EA	ACTUATOR, JAMB MOUNT	8310-818T			630	FAL
1	EA	FLOOR STOP	FS444			BLK	IVE
1	SET	SEALS	WEATHERSTRIP BY DOOR/FRAME MFR				
1	EA	DOOR SWEEP	39BK			BK	ZER
1	EA	THRESHOLD	655BK-223			BK	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC			LGR	SCE
			CARD READER - WORK OF DIVISION 28				
			POWER SUPPLY - WORK OF DIVISION 28				

Hardware Group No. 02

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	PIVOT SET	7226 SET		BLK	IVE
1	EA	INTERMEDIATE PIVOT	7226 INT		BLK	IVE
1	EA	POWER TRANSFER	EPT10		US19	VON
1	EA	ELEC PANIC HARDWARE	QEL-35A-NL-OP-388 24 VDC		315	VON
1	EA	RIM CYLINDER	20-057		622	SCH
1	PR	DOOR PULL	RM3301 80 12HD BTB MTG verify height b4 ordering		315	ROC
1	EA	SURF. AUTO OPERATOR	9542 MS AS REQ (120/240 VAC)		ANDKB	LCN
2	EA	ACTUATOR, JAMB MOUNT	8310-818T		630	FAL
1	EA	FLOOR STOP	FS444		BLK	IVE
1	EA	GASKETING	50BK-S		BK	ZER
1	EA	DOOR SWEEP	39BK		BK	ZER
1	EA	THRESHOLD	655BK-223 VERIFY IF NEEDED		BK	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		LGR	SCE
			CARD READER - WORK OF DIVISION 28			
			POWER SUPPLY - WORK OF DIVISION 28			

Hardware Group No. 03

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	BBLK/622	IVE
1	EA	PASSAGE SET	ALX10 LAT	622	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ FC	693	LCN
1	EA	WALL STOP	WS406/407CCV	BLK	IVE
3	EA	SILENCER	SR64 (HM) OR SR65 (WD)	GRY	IVE

Hardware Group No. 04

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	BBLK/622	IVE
1	EA	ENTRANCE/OFFICE LOCK	ALX50R LAT	622	SCH
1	EA	WALL STOP	WS406/407CCV	BLK	IVE
3	EA	SILENCER	SR64 (HM) OR SR65 (WD)	GRY	IVE

Hardware Group No. 05

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		BBLK/ 622	IVE
1	EA	PASSAGE SET	ALX10 LAT		622	SCH
1	EA	WALL STOP	WS406/407CCV ...OR W.S. VERIFY		BLK	IVE
1	EA	SEAL SET	S88D (HEAD & JAMBS)			PEM
1	EA	AUTOMATIC DOOR BOTTOM	412CRL		AL	PEM
3	EA	SILENCER	SR64 (HM) OR SR65 (WD)		GRY	IVE

Hardware Group No. 06

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		BBLK/ 622	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S LAT OS-LOC		622	SCH
1	EA	WALL STOP	WS406/407CCV		BLK	IVE
3	EA	SILENCER	SR64 (HM) OR SR65 (WD)		GRY	IVE

Hardware Group No. 07

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		BBLK/ 622	IVE
1	EA	ELEC FIRE EXIT HARDWARE	QEL-98-NL-OP-F-110MD 24 VDC	✓	315	VON
1	EA	RIM CYLINDER	20-057		622	SCH
1	EA	90 DEG OFFSET PULL	8190HD 12" O		BLK	IVE
1	EA	SURFACE CLOSER	4040XP EDA		693	LCN
1	EA	WALL STOP	WS406/407CCV		BLK	IVE
1	EA	GASKETING	488FSBK PSA		BK	ZER

Hardware Group No. 08

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		BBLK/ 622	IVE
1	EA	POWER TRANSFER	EPT10		US19	VON
2	EA	MANUAL FLUSH BOLT	FB458		BLK	IVE
1	EA	DUST PROOF STRIKE	DP2		BLK	IVE
1	EA	EU STOREROOM LOCK	ND80P6DEU LAT CON 12V/24V DC		622	SCH
1	EA	SURFACE CLOSER	1461 EDA FC ACTIVE LEAF ONLY		693	LCN
2	EA	WALL STOP	WS406/407CCV		BLK	IVE
2	EA	SILENCER	SR64 (HM) OR SR65 (WD)		GRY	IVE
			CARD READER - WORK OF DIVISION 28			
			POWER SUPPLY - WORK OF DIVISION 28			

Hardware Group No. 09

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	BBLK/ 622	IVE
2	EA	MANUAL FLUSH BOLT	FB458	BLK	IVE
1	EA	DUST PROOF STRIKE	DP2	BLK	IVE
1	EA	STOREROOM LOCK	ALX80R LAT	622	SCH
2	EA	OH STOP	100S	BLK	GLY
2	EA	SILENCER	SR64 (HM) OR SR65 (WD)	GRY	IVE

Hardware Group No. 10

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	BBLK/ 622	IVE
1	EA	STOREROOM LOCK	ALX80R LAT	622	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ FC	693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	BLK	IVE
1	EA	WALL STOP	WS406/407CCV	BLK	IVE
3	EA	SILENCER	SR64 (HM) OR SR65 (WD)	GRY	IVE

Hardware Group No. 11

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		BBLK/ 622	IVE
1	EA	STOREROOM LOCK	ALX80R LAT		622	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC		613	VON
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ FC		693	LCN
1	EA	WALL STOP	WS406/407CCV		BLK	IVE
1	EA	GASKETING	488FSBK PSA		BK	ZER
			CARD READER - WORK OF DIVISION 28			
			POWER SUPPLY - WORK OF DIVISION 28			

Hardware Group No. 12

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		BBLK/ 622	IVE
1	EA	STOREROOM LOCK	ALX80R LAT		622	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC		613	VON
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ FC		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		BLK	IVE
3	EA	SILENCER	SR64 (HM) OR SR65 (WD)		GRY	IVE
			CARD READER - WORK OF DIVISION 28			
			POWER SUPPLY - WORK OF DIVISION 28			

Hardware Group No. 13

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ALX80R LAT		626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ FC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64 (HM) OR SR65 (WD)		GRY	IVE

Hardware Group No. 14

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5			BBLK/ 622	IVE
1	EA	ENTRANCE/OFFICE LOCK	ALX50R LAT			622	SCH
1	EA	WALL STOP	WS406/407CCV			BLK	IVE
1	EA	SEAL SET	S88D (HEAD & JAMBS)				PEM
1	EA	AUTOMATIC DOOR BOTTOM	412CRL			AL	PEM
3	EA	SILENCER	SR64 (HM) OR SR65 (WD)			GRY	IVE

Hardware Group No. 15

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8		✓	652	IVE
1	EA	EL STOREROOM LOCK	ND80P6DEL LAT CON 12V/24V DC		✓	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ FC			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CCV			626	IVE
1	EA	GASKETING	488FSBK PSA			BK	ZER
1	EA	DOOR SWEEP	39A			A	ZER
1	EA	THRESHOLD	545A-223			A	ZER
			CARD READER - WORK OF DIVISION 28		✓		
			POWER SUPPLY - WORK OF DIVISION 28				

Hardware Group No. 16

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5			BBLK/ 622	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8		✓	BBLK/ 622	IVE
1	EA	EL STOREROOM LOCK	ND80P6DEL LAT CON 12V/24V DC		✓	622	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ FC			693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			BLK	IVE
1	EA	WALL STOP	WS406/407CCV			BLK	IVE
1	EA	GASKETING	488FSBK PSA			BK	ZER
1	EA	DOOR SWEEP	39BK			BK	ZER
1	EA	THRESHOLD	545BK-223			BK	ZER
			CARD READER - WORK OF DIVISION 28		✓		
			POWER SUPPLY - WORK OF DIVISION 28				

Hardware Group No. 17

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP			BBLK/ 622	IVE
1	EA	STOREROOM LOCK	ALX80R LAT			622	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC		✓	613	VON
1	EA	SURFACE CLOSER	4040XP EDA			693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			BLK	IVE
1	EA	FLOOR STOP	FS444			BLK	IVE
1	EA	GASKETING	50BK-S			BK	ZER
1	EA	DOOR SWEEP	39BK			BK	ZER
			CARD READER - WORK OF DIVISION 28		✓		
			POWER SUPPLY - WORK OF DIVISION 28				

Hardware Group No. 18

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		BBLK/ 622	IVE
1	EA	PUSH PLATE	8200 4" X 16"		BLK	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		BLK	IVE
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ FC		693	LCN
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS		BLK	IVE
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		BLK	IVE
1	EA	GASKETING	488FSBK PSA		BK	ZER

A.

3.7

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glass products, laminated glass, insulated glass, glazing sealants, glazing tapes, miscellaneous glazing materials.

B. Related Requirements:

1. Section 07 92 00 “Joint Sealers” for sealant and back-up materials.
2. Section 08 11 13 “Hollow Metal Doors and Frames” for site glazed doors.
3. Section 08 41 16.13 “Interior Aluminum Doors and Frames” for interior site glazed aluminum doors and windows.
4. Section 08 41 13 “Aluminum Framed Entrances and Storefronts” for exterior site glazed aluminum doors and windows.
5. Section 08 88 13 “Fire-Rated Glazing” for rated glass.

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 achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches 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.

1.5 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

B. Sample warranties.

1.6 SUBMITTALS

A. Submit sealed glass unit manufacturer's certificate under provisions of Section 01 40 00 “Quality Requirements” indicating units meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

A. Conform to Flat Glass Marketing Association (FGMA) Glazing Sealing Systems Manual for glazing installation methods.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site under provisions of Section 01 60 00 “Product Requirements.”

B. Store and protect products under provisions of Section 01 60 00 “Product Requirements.”.

1.9 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.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five years from date of Substantial Completion.

C. 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 PERFORMANCE REQUIREMENTS

A. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.2 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. NGA Publications: "Laminated Glazing Reference Manual" and "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 or manufacturer. 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 the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum.

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.

2.3 GLASS PRODUCTS

A. Float Glass: FS DD-G-451; Type 1, Class 1, quality 3; thickness as required by glass area.

2.4 LAMINATED GLASS SCHEDULE

A. Safety Glass: Clear laminated glass with two plies of annealed float glass.

1. Minimum Thickness of Each Glass Ply: 3 mm. (6 mm overall)
2. Interlayer Thickness: 0.030 inch.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary Perimeter Spacer: Manufacturer's standard spacer material and construction.
2. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

A. Preformed Butyl Rubber Glazing Sealant: FS TT-S-001657; Shore A hardness of 50; black color; non-skinning.

B. Silicone Sealant: Single component, chemical curing; capable of water immersion without loss of properties; non-bleeding; non-staining; cured Shore A hardness of 15-25; color selected by Architect. As specified as Sealant 4 in Section 07 92 00 “Joint Sealants.”

2.8 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 C1281 and AAMA 800 for products indicated below:

2.9 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting and Edge Blocks: Neoprene; 70-90 Shore A durometer hardness; with proven compatibility with sealants used.

C. Spacer Shims: Neoprene; Shore A durometer hardness; 3 inch long x 1/4 inch wide x 1/4 inch thick; self-adhesive one face.

D. Glazing Clips: Manufacturer's standard type.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.

B. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

A. Clean contact surfaces with solvent recommended by sealant or gasket manufacturer and wipe dry.

B. Seal porous glazing channels or recesses.

C. Prime surfaces scheduled to receive sealant as recommended by sealant manufacturer.

3.3 DECORATIVE GLASS INSTALLATION

A. Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

3.4 EXTERIOR COMBINATION METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sightline. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bed of butyl sealant along exterior void ensuring full contact with pane.

C. Place setting blocks at 1/4 points.

D. Rest glass on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane.

E. Install removable stops, spacer strips inserted between glass, and applied stops at 24 inch intervals, 1/4 inch (6 mm) below sightline. Place glazing tape on glass with tape 1/4 inch (6 mm) below sightline.

F. Fill gap between pane and applied stop with polysulfide type sealant to depth equal to bite of frame on pane, but not more than 3/8 inch (9 mm) below sightline.

G. Apply cap bead of sealant along exterior void, to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance.

3.5 INTERIOR COMBINATION METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sightline.

B. Place setting blocks at 1/4 points.

C. Rest glass on setting blocks and push against tape to ensure full contact at perimeter of pane.

D. Install removable stops, spacer shims inserted between glass, and applied stops at 24 inch (600 mm) intervals, 1/4 inch (6 mm) below sightline.

E. Fill gap between pane and applied stop with sealant to depth equal to bite of frame on pane to uniform and level line.

F. Trim protruding tape edge.

3.6 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after work is completed.

3.7 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type:

1. Basis-of-Design Product: Vitro Architectural Glass; Solarban 60.
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Annealed float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Annealed float glass.
7. Low-E Coating: Pyrolytic on second surface.
8. Safety glazing where required.

END OF SECTION 08 80 00

SECTION 08 88 13 - FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire-protection-rated glazing.

B. Related Requirements:

1. Section 08 80 00 “Glazing” for nonrated glazing.

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; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of glass and glazing product, from manufacturer.

B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the NGA's Certified Glass Installer Program.

1.6 WARRANTY

A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.2 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 degrees F temperature-rise limitation; and the fire-resistance rating in minutes.

C. Fire-Protection-Rated Tempered Glass: 6-mm thickness; fire-protection-rated tempered glass; complying with 16 CFR 1201, Category II.

1. Products: Subject to compliance with requirements, provide one of the following:

a. SAFTI FIRST Fire Rated Glazing Solutions; Superlite I.
b. Technical Glass Products: Fireglass 20.

2. Fire Rating: 20 minute.

D. Fire-Protection-Rated Monolithic Glass for Doors Only: 19-mm thickness; clear, fire-protection glass; complying with 16 CFR 1201, Category II. UL listed and tested in accordance with NFPA 252 for fire-rated doors with hose-stream testing.

1. Products: Subject to compliance with requirements, provide one of the following:

a. SAFTI FIRST Fire Rated Glazing Solutions; SuperLite X-45/60/90.

2.3 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.; SilGlaze II SCS2800.
b. The Dow Chemical Company; Dow Corning 795 Silicone Building Sealant.
c. Tremco Incorporated; Spectrem 2.

2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 GLAZING

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. 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.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

H. 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 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.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 88 13

SECTION 09 21 16.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes gypsum board shaft wall assemblies.

B. Related Requirements:

1. Section 09 29 00 "Gypsum Board" finishing of panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For shaft wall assemblies, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Protection: Stored and installed materials shall be protected and kept dry at all times. Any gypsum or related materials that become wet or damaged shall be removed and replaced with new materials.

C. Do not install interior products until installation areas are enclosed and conditioned.

D. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. STC Rating: As indicated.

C. Gypsum Shaftliner Board:

1. Moisture- and Mold-Resistant Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, 1 inch thick, and with double beveled long edges.

a. Products: Subject to compliance with requirements, provide one the following:

1) CertainTeed Corporation; M2Tech Mold and Moisture Resistant Shaftliner Type X.
2) Georgia-Pacific Building Products; DensGlass Shaftliner.
3) National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP.
4) United States Gypsum Company (USG); Sheetrock Brand Mold Tough Gypsum Liner Panels.

D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.

E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: 0.030 inch.

F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: Matching steel studs.

G. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fire Trak Corp.; Fire Trak System.
b. Grace Construction Products; FlameSafe FlowTrak System.
c. Metal-Lite, Inc.; The System.
d. Steel Network Inc.; VertiClip VTD Series.

H. Finish Panels: Gypsum board as specified in Section 09 29 00 "Gypsum Board."

2.3 AUXILIARY MATERIALS

A. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 09 29 00 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

C. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

D. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).

E. Sound Attenuation Blankets: As specified in Section 09 29 00 "Gypsum Board."

F. Acoustical Sealant: Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

D. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

1. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.

E. Penetrations: Install supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.

F. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.

G. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

H. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

I. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

J. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install gypsum board cants covering tops of projections.

K. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

L. Remove and replace panels that are wet, moisture damaged, or mold damaged.

END OF SECTION 09 21 16.23

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Sound Isolation accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation reports for firestop tracks.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members: Comply with ASTM C754 AISI S220 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 AISI S220 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A653/A653M, AISI S220 G60, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C645 AISI S220.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: 0.0329 inch (22 gauge).
b. Depth: As indicated on Drawings.

C. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0329 inch (22 gauge).

E. Hat-Shaped, Rigid Furring Channels:

1. Minimum Base-Metal Thickness: 0.0329 inch (20 gauge).
2. Depth: 7/8 inch.

F. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0538 inch (16 gauge).
3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. 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 E488/E488M conducted by a qualified testing agency.
2. 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 E1190 conducted by a qualified testing agency.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C645.

a. Minimum Base-Metal Thickness: 0.0296 inch.
b. Depth: 1-5/8 inches.

3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.

a. Minimum Base-Metal Thickness: 0.0296 inch.

4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

    a. Configuration: hat shaped.

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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 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 clearance from jamb stud to allow for installation of control joint in finished assembly.

c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches on center

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch 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. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Sections:

1. Section 07 21 00 "Thermal Insulation" for insulation.

1.2 ACTION SUBMITTALS

A. General: All specified finishes are found in the Finish Schedules on the Drawings.

B. Product Data: For each type of product.

C. Samples: For each texture finish indicated on same backing indicated for Work.

1. Provide 12 inch by 12 inch or 24 inch by 24 inch submittal of Level 4 smooth finish for approval. Following approval, provide mockup of finishes at one office for Architect review.

D. Installation Instructions: Manufacturer’s recommended installation instructions for shear resisting gypsum board.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch, unless otherwise indicated.
2. Long Edges: Tapered.

B. Moisture and Mold Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
4. Locations: Behind shower/tub enclosures and wet areas not receiving tile or direct water.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide the following:

a. Georgia Pacific DensShield Tile Backer.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

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.

2.6 JOINT TREATMENT MATERIALS

A. Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Water-Resistant Backing Board: 2 inch fiberglass mesh tape.

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 drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.7 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.

1. Sealant shall have a VOC content of 50 g/L or less.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch 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 07 21 00 "Thermal Insulation."

E. Acoustical Sealant: As specified in Section 07 92 19 “Acoustical Joint Sealants.”

F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-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, rounded or beveled edges, 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 C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile Where indicated on Drawings.
3. Level 3: Where indicated on Drawings.

4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

H. Glass-Mat Water-Resistant Backer Boards: Finish according to manufacturer's written instructions.

I. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

3.3 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 09 29 00

SECTION 09 30 13 – CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes tile, waterproof membrane, metal edge strips and accessories.

B. Related Requirements:

1. Section 09 29 00 "Gypsum Board" for tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. All submittals must be photographed with digital submittal in addition to physical submittal.
2. Each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide samples of each color blend.
3. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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 (T-1, T-2, T-3, AND T-4)

A. Manufacturers, Products, Sizes, Styles and Colors: As indicated on Finish Schedule on Drawings.

2.3 TILE PERFORMANCE

A. Unglazed Porcelain Tile:

1. Dynamic Coefficient of Friction: Not less than 0.81 wet.

2.4 THRESHOLDS

A. Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

2.5 CRACK ISOLATION / WATERPROOF MEMBRANE

A. Manufacturer's standard product that complies with ANSI A118.10 / A118.12 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Laticrete International, Inc.; LATICRETE HYDRO BAN or Laticrete Hydro Barrier.
b. ARDEX Americas; ARDEX 8+9 Rapid Waterproofing and Crack Isolation Compound.

2.6 SETTING MATERIALS

A. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Laticrete International, Inc.; LATICRETE 254 Platinum or LATICRETE 257 TITANIUM.
b. ARDEX Americas; ARDEX X77 Microtec Fiber Reinforced Tile and Stone Mortar.

2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
3. For wall applications, provide nonsagging mortar.

2.7 GROUT MATERIALS

A. Latex-Modified Grout (Unsanded): Latex-modified, factory blended, mildew resistant, non-sanded, grout consisting of portland cement and additives; comply with ANSI A118.7. Latex Additive: Type as recommended by latex mortar manufacturer.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Laticrete International; PermaColor Select NS – Non-Sanded White Base (to be blended with PermaColor Select Color Packs)
b. Ardex Americas; Ardex FG-C Microtec unsanded grout

2. Color: As indicated on Finish Legend on Drawings.

B. Water-Cleanable, Tile Setting; 100% solids three-component - water-cleanable grouting epoxy; comply with ANSI A118.3.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Laticrete International; SpectraLock Pro Premium 100% Solids Epoxy Grout.
    b. Ardex Americas; Ardex WA Solids Epoxy Grout.

2. Color: As indicated on Finish Legend on Drawings.

2.8 MISCELLANEOUS MATERIALS

A. Flexible Sealant for Movement Joint Conditions: Flexible, mold and mildew resistant joint sealant, consisting of either silicone, urethane, or polysulfide; comply with ASTM C920.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Laticrete International; Latasil 100% Silicone Sealant.
    b. Ardex Americas; Ardex SX

2. Color: To match grout color.

B. Trowelable Underlayments and Patching Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

C. Metal Edge Transition Strips to Carpet Tile: As specified in Section 09 68 13 “Tile Carpeting”.

D. Floor Sealer: Manufacturer's standard product for sealing grout joints and cement tile and that does not change color or appearance of grout.

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. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from

other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 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 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: As indicated on Interior Finish Legend.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install at locations indicated where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

K. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors and walls according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

L. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

M. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

N. 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, Wood Subfloor:

1. TCNA F141: Method ANSI A108.1A. Cement mortar bed (thickset) installed over cleavage membrane over waterproof membrane.

a. Ceramic Tile Type: Type as indicated on Finish Legend on Drawings.
b. Bond Coat for Cured-Bed Method: Improved modified dry-set mortar.
c. Grout: Water-cleanable epoxy grout.
d. Waterproof Membrane: Fluid-applied membrane.
e. Joint Width: 1/8 inch (3.2 mm).
f. Movement Joints: Types located on Drawings.

B. Interior Wall Installations: Wood or Metal Studs or Furring:

1. TCNA W245: Thinset mortar on glass-mat, water-resistant gypsum backer board over waterproof membrane

a. Tile Backer Board: As specified in Section 09 29 00.
b. Thinset Mortar: Improved modified dry-set mortar, ANSI A118.15.
c. Ceramic Tile: Type as indicated on Finish Legend on Drawings.
d. Latex-Modified Grout: Standard unsanded cement ANSI A118.7.

END OF SECTION 09 30 13

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Related Requirements:

1. Section 07 21 00 “Thermal Insulation” for insulation above ceiling panels.
2. Mechanical and Electrical sections for coordination of mechanical, electrical and fire sprinkler items installed in or on ceiling grids.

1.2 ACTION SUBMITTALS

A. General: All specification finishes are found in Interior Finish Schedules on Drawings.

1. All submittals must be photographed with digital submittal in addition to physical submittal.

B. Product Data: For each type of product.

C. Shop Drawings:

1. Show layout in relation to field conditions and interior design plans.
2. Show all transition conditions, typical fastenings, seismic bracing, lighting integration and HVAC integration details in shop drawings.
3. Show lay-out in relation to field conditions. show all typical and special junctions, typical fastenings, seismic bracing.

D. Samples: For each exposed product and for each color and texture specified.

E. Delegated-Design Submittal: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Product test reports.

C. Research reports.

D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design seismic restraints for ceiling systems.

B. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E1264 for Class A materials.
2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Mineral-Fiber-Based Panels.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E795.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS (ACT-1)

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Products: Subject to compliance with requirements, provide the following:

1. Armstrong World Industries, Inc.; TECHZONE with High NRC Ultima 2085.

C. Classification: Provide panels as follows:

1. ASTM Classification: Type A, Form A2.2, Pattern E.
2. Material: Mineral fiber.
3. Color: White.
4. Light Reflectance (LR): 85 percent
5. Ceiling Attenuation Class (CAC): 35.
6. Noise Reduction Coefficient (NRC): 0.85
7. Articulation Class (AC): Not less than 170.

8. Edge/Joint Detail: 9/16-inch Beveled tegular.
9. Thickness: 1 inch.
10. Modular Size: 24 inches by 48 inches.
11. Fire Rating: Class A.
12. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C635/C635M.

1. High-Humidity Finish: Comply with ASTM C635/C635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

2.5 METAL SUSPENSION SYSTEM

A. Products: Subject to compliance with requirements, provide the following:

1. Armstrong World Industries, Inc.; Suprafine XL 9/16” Exposed Tee.

B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 9/16-inch-wide metal caps on flanges.

1. Locations for Use: All suspended acoustical panel ceilings with standard square edge panels.
2. Structural Classification: Heavy-duty system.
3. End Condition of Cross Runners: Override (stepped) type.
4. Face Design: Flat, flush.
5. Cap Material: Steel cold-rolled sheet
6. Cap Finish and Color: Painted white.

2.6 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch-diameter wire.

C. Hold-Down Clips: Manufacturer's standard hold-down.

D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

F. Seismic Clips: If required by authorities having jurisdiction, manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

G. Acoustical Insulation: Unfaced fiberglass batt insulation as specified in Section 07 21 00 “Thermal Insulation”.

2.7 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook” and Northwest Wall and Ceiling Bureau (NWCB) Technical Document 401 “Suspension Systems for Acoustical Lay-In Ceilings.”

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
3. Arrange directionally patterned acoustical panels as follows:

    a. As indicated on reflected ceiling plans.

4. Install hold-down and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

C. Loose lay acoustical insulation on top of ceiling panels. Ensure that all gaps are covered.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections.

1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

END OF SECTION 09 51 13

SECTION 09 54 26 - SUSPENDED WOOD CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes panelized linear wood members, panelized wood grilles and suspension systems for ceilings.

B. Related Requirements:

1. Mechanical and Electrical sections for coordination of mechanical, electrical and fire sprinkler items installed in or on ceiling grids.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each exposed finish.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Drawn to scale and coordinating and showing the following:

1. Linear pattern.
2. Joint pattern.
3. Ceiling suspension members.
4. Method of attaching hangers to building structure.
5. Ceiling-mounted items.
6. Ceiling perimeter and penetrations through ceiling; trim and moldings.

B. Product test reports.

C. Evaluation reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC or PEFC-accredited certification body.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F material surfaces.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E1264 for Class B materials.
2. Smoke-Developed Index: 50 or less.

2.2 LINEAR WOOD CEILING GRILLES

A. Panelized Linear Wood Ceiling (WD-1):

1. Basis of Design Products: 9Wood; 2100 Panelized Linear.
2. Other Acceptable Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed, LLC; Wood Panelized Linear.
    b. Gometrik Manufacturing Inc.; Geopanel Linear.

3. Wood Species: As indicated on Finish Schedule on Drawings.
4. Wood Finish: Manufacturers standard interior satin sheen finish.
5. Member Size: 5-1/4 inches wide by 3/4 inch deep by 8 foot board lengths.
6. Edge Profile: Square.
7. Reveal Between Members: 3/4 inch.
8. Assembly Style: Panelized Linear.
9. Removable Panels: Where indicated on Drawings, plus on a grid of 10 foot on center, provide removable panel sections.
10. Fire Rating: Class 1(A) Fire Rating if required by the agency having jurisdiction.
11. Reveal Scrim: Black reveal scrim, where black acoustic panel is not used.
12. Opening Reinforcing: Provide at all opening in panels.

B. Panelized Linear Wood Ceiling (WD-2):

1. Basis of Design Products: 9Wood; 1100 Cross Piece Grille.
2. Other Acceptable Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed, LLC; Wood Backer Grille Ceiling.
    b. Gometrik Manufacturing Inc.; Geopanel Grille.

3. Wood Species: As indicated on Finish Schedule on Drawings.
4. Wood Finish: Manufacturers standard interior satin sheen finish.
5. Member Size: 3/4 inches wide by 1-3/8 inch deep by 8 foot board lengths.
6. Grille Members Per Linear Foot: 8.
7. Edge Profile: Square.
8. Reveal Between Members: 3/4 inch.
9. Assembly Style: Panelized Linear.
10. Removable Panels: Where indicated on Drawings, plus on a grid of 10 foot on center, provide removable panel sections.
11. Fire Rating: Class 1(A) Fire Rating if required by the agency having jurisdiction.
12. Reveal Scrim: Black reveal scrim, where black acoustic panel is not used.
13. Opening Reinforcing: Provide at all opening in panels.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

1. Interior Members: Minimum G90 galvanizing

B. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

C. Attachment Devices: Size for five times the design load indicated in ASTM C635, Table 1, Direct Hung, unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.135-inch-diameter wire.

E. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed from 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

G. Carriers: Factory finished with matte-black baked finish.

1. Main Carriers: Steel, not less than 0.0209-inch nominal thickness, cold-rolled sheet, with factory-applied protective coating, complying with ASTM C635.

a. Electrolytic Zinc-Coated Steel: ASTM A591/A591M, not less than 80Z zinc coating.

H. Carrier Splices: Same metal, profile, and finish as indicated for carriers.

I. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and

other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.

J. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.4 ACCESSORIES

A. Linear-Ceiling-Panel Accessories: Linear-ceiling-panel manufacturer's accessories required to provide a complete installation of ceiling in accordance with manufacturer's written installation instructions.

1. Acoustic Infill Panels:

a. Products: Subject to compliance with requirements, provide one of the following:

1) Rockfon; Cinema Black 1211.

b. Nonwoven black mineral fiber, with flame-spread index of 25 or less and smoke-developed index of 50 or less as determined by testing in accordance with ASTM E84.
c. NRC: 0.95 when tested in accordance with ASTM C423.
d. Thickness: 1 inch.
e. Size: 2’-0” by 4’-0”.

2. Acoustic Felt: Nonwoven cellulose- and glass-fiber fabric, factory applied, black, backer with flame-spread index of 25 or less and smoke-developed index of 450 or less as determined by testing in accordance with ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which linear wood ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of linear wood ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with ASTM C636 and seismic requirement indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook", and as required to meet the requirements of the agency having jurisdiction.

B. Install edge moldings and trim of type indicated at perimeter of suspension system area as recommended by the manufacturer.

1. Do not use exposed fasteners, including pop rivets, on moldings and trim.

C. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

D. Scribe and cut wood ceiling panels for accurate fit at borders and at interruptions and penetrations by other work through ceilings.

E. Install wood ceiling panels in coordination with suspension system, as recommended by the ceiling system manufacturer.

1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
3. Install sound-insulation as recommended by the ceiling system manufacturer.

F. Lay infil materials on top of wood ceilings. Ensure that is completely covers spaces in between wood slats.

3.3 CLEANING

A. Clean exposed surfaces of linear wood ceilings as recommended by the manufacturer, including trim and edge moldings after removing temporary protective covering.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

C. Touch-up minor finish damage as recommended by the manufacturer.

END OF SECTION 09 54 26

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes resilient wall base.

1.2 ACTION SUBMITTALS

A. General: All specified finishes are found in the Finish Schedules on the Drawings.

B. Product Data: For each type of product.

C. Shop Drawings: Indicate color and locations of floor accessories.

D. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE (B-3 AND B-4)

A. Products: Subject to compliance with requirements, provide the following:

1. Roppe; Pinnacle Rubber Wall Base, Coved.

B. Product Standard: ASTM F1861, Type TS (rubber, thermoset).

1. Group: I (solid, homogeneous).

C. Thickness: 0.125 inch.

D. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

E. Outside Corners: Job formed or preformed.

F. Inside Corners: Job formed or preformed.

G. Colors: As indicated on Finish Schedule or selected by Architect from manufacturer’s standard line.

2.2 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Do not install resilient products until they are the same temperature as the space where they are to be installed.

C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

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 practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Form without producing discoloration (whitening) at bends.
    b. Score back base material with grooving tool. Mount base so that score groove is aligned w/ corner. Fit tightly.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Miter or cope corners to minimize open joints.
    b. Scribe to fit door frames, stairs and obstructions as required.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes luxury resilient flooring planks.

B. Related Sections:

1. Section 03 54 13 “Gypsum Cement Underlayment” for self-leveling underlayment.

1.2 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame/fuel/smoke rating requirements in accordance with ASTM E84.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. General: All specified finishes are found in the Finish Schedules on the Drawings.

B. Product Data: For each type of product.

1. Submit product data on specified products, describing physical and performance characteristics, sizes, patterns and colors available.

C. Shop Drawings: For each type of flooring. Include flooring layouts, orientation, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.
2. Show transition accessories.

D. Samples: For each exposed product and for each color and texture specified in manufacturer's standard size.

E. Installation Instructions: Submit manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

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. Floor Tile: Furnish one box for every boxes or fraction thereof, of each type, color, and pattern of floor tile installed. Verify with Owner.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL TILE FLOORING PLANKS (LVP-1)

A. Products: Subject to compliance with requirements, provide the following:

1. Miliken; 5.0 RigidForm.

B. Overall Thickness: 0.2 inches (5.0mm).

C. Wear Layer Thickness: 22 mil.

D. Colors: As indicated on Finish Schedules on Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.

C. Primer as required by manufacturer.

D. Metal Edge Transition Strips to LVP: As specified in Section 09 68 13 “Tile Carpeting”.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

F. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 feet, and are ready to receive Work.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile and accessories.

B. Related Requirements.

1. Section 09 68 16 “Sheet Carpeting” for broadloom carpet.
2. Section 12 48 13 “Entrance Floor Mats” for entrance mats.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. General: All specified finishes are found in the Finish Schedules on the Drawings.

B. Product Data: For each type of product.

C. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

D. Samples: For each exposed product and for each color and texture required.

1. All submittals must be photographed with digital submittal in addition to physical submittal.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 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 CARPET TILE (CPT-1 AND CPT-2)

A. Product Specifications:

1. Manufacturer: Miliken
2. Collection: Journal.
3. Style Numbers: Inscription.
4. Colors: As indicated on Finish Schedule on Drawings.
5. Product Construction: Tufted and textured loop.
6. Yarn System: Solution Dyed Type 6 Nylon.
7. Yarn Manufacturer: Econyl.
8. Dye Method: 100% Solution Dyed.
9. Primary Backing: Synthetic.
10. Secondary Backing: WellBAC Cushion.
11. Soil/Stain Protection: StainSmart.
12. Size: 19.7 inches by 19.7 inches (50 cm by 50 cm).
13. Finished Pile Thickness: 0.094 inch (2.39mm).
14. Average Density: 5,821 oz/yd³.
15. Tufted Weight: 15.5 oz/sq yd.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less.

C. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

1. Carpet Tile to LVP (TRM-1):

a. Products: Subject to compliance with requirements, provide the following:

1) Schluter Systems; Schiene A60MGS.

a) Finish: As indicated on Finish Schedule on Drawings.

2. Carpet Tile to Tile (TRM-2):

a. Products: Subject to compliance with requirements, provide the following:

1) Schluter Systems; Reno-U-EU125.

a) Finish: As indicated on Finish Schedule on Drawings.

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., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. 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 wide or wider, and protrusions more than 1/32 inch 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," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer 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.

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. 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.

J. Ensure carpet is clean and without deterioration or damage at date of substantial completion. Deliver remnant to owner representative.

END OF SECTION 09 68 13

SECTION 09 68 16 – SHEET CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes broadloom carpeting and accessories.

B. Related Requirements.

1. Section 09 68 13 “Tile Carpeting” for modular carpet.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. General: All specified finishes are found in the Finish Schedules on the Drawings.

B. Product Data: For each type of product.

C. Shop Drawings: For carpet installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Seam locations, types, and methods.
5. Type of subfloor.
6. Type of installation.
7. Pattern type, repeat size, location, direction, and starting point.
8. Pile direction.
9. Types, colors, and locations of insets and borders.
10. Types, colors, and locations of edge, transition, and other accessory strips.
11. Transition details to other flooring materials.
12. Type of carpet cushion.

D. Samples: For each exposed product and for each color and texture required.

1. Submit samples 12 inch by 12 inch in size illustrating color and pattern for each carpet and cushion material specified.
2. All submittals must be photographed with digital submittal in addition to physical submittal.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Manufacturer qualifications: Company specializing in tufted carpet with three years minimum experience.

B. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the Commercial II certification level. Company with 3 years minimum documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Store materials for one day prior to installation in area of installation to achieve temperature stability.

1.8 EXTRA MATERIALS

A. Provide 10 square feet of carpeting of each color specified.

1.9 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Special Warranty for Carpet Cushion: Manufacturer agrees to repair or replace components of carpet cushion 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 SHEET CARPETING (CPT-2)

A. Product Specifications:

1. Manufacturer: ShawContract
2. Collection: Noble Materials
3. Style Numbers: 5A220.
4. Color: As indicated on Finish Schedule on Drawings.
5. Product Construction: Multi-level Pattern Cut/ loop.
6. Yarn System: Ecosolution Q Nylon.
7. Dye Method: 100% Solution Dyed.
8. Primary Backing: Synthetic.
9. Secondary Backing: Ultrabac
10. Soil/Stain Protection: SSP Shaw Soil Protection
11. Size: 12 ft. (3.66 m).
12. Gauge: 1/11 inch (43.3 per 10 cm).
13. Finished Pile Thickness: 0.0240 inch (6.1 mm).
14. Average Density: 6,000 oz/yd³ (0.222 g/cm3)
15. Total Thickness: 0.396 in (10.03 mm).
16. Tufted Weight: 40 oz/sq yd (1356.2 g/m3).
17. Repeat: 24 in. x 24 in. (61 cm x 61 cm).

2.2 SHEET CARPETING (CPT-3)

A. Product Specifications:

1. Manufacturer: ShawContract
2. Collection: Noble Materials
3. Style Numbers: 5A221.
4. Color: As indicated on Finish Schedule on Drawings.
5. Product Construction: Multi-level Pattern Cut/ loop.
6. Yarn System: Ecosolution Q Nylon.
7. Dye Method: 100% Solution Dyed.
8. Primary Backing: Synthetic.
9. Secondary Backing: Ultraloc
10. Soil/Stain Protection: SSP Shaw Soil Protection
11. Size: 12 ft. (3.66 m).
12. Gauge: 1/11 inch (43.3 per 10 cm).
13. Finished Pile Thickness: 0.0230 inch (5.84 mm).
14. Average Density: 6,261 oz/yd³
15. Total Thickness: 0.346 in.
16. Tufted Weight: 40 oz/sq yd.
17. Repeat: 72 in. x 72 in.

2.3 CARPET CUSHION

A. Products: Subject to compliance with requirements, provide the following:

1. Tred-MOR Legacy Series; Dubl-Stik 3700.

B. Traffic Classification: Carpet Cushion Council's Class II, heavy traffic.

C. Fiber Cushion: 100% Synthetic Rubber.

1. Weight: 100 oz./sq. yd.
2. Thickness: 0.370 inches plus 5 percent maximum.
3. Density: 22 lb/cu. ft.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet and carpet cushion manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet and carpet cushion manufacturers.

1. Adhesives shall have a VOC content of 50 g/L or less.

C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI's "Carpet Installation Standard."

D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Metal Edge Strips to LVP and to Existing Carpet TRM-3): Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

1. Products: Subject to compliance with requirements, provide the following:

a. Pemko; 157ABSP

1) Finish: As indicated on Finish Schedule on Drawings.

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., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. 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 Standard" and with carpet manufacturer's written installation instructions for preparing substrates.

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 wide or wider, and protrusions more than 1/32 inch, 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, carpet, and carpet cushion manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION - CUSHION

A. Install in accordance with manufacturer's instructions.

B. Install cushion using maximum size pieces. Securely adhere to sub-floor.

C. Lay out cushion so that carpet seams will not fall directly over cushion seams.

D. Butt edges together and tight to edge of carpet gripper. Tape all joints.

E. Remove air pockets and ridges and slightly stretch. Anchor securely around projections and contours.

3.4 INSTALLATION - CARPET

A. Comply with CRI's "CRI Carpet Installation Standard" and carpet and carpet cushion manufacturers' written installation instructions for the following:

1. Stretch-in installation.

B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

1. Stretch-in Carpet Installation: Install carpet cushion seams at 90-degree angle with carpet seams.

C. Install pattern as indicated on Drawings.

D. Install borders with mitered corner seams.

E. Do not bridge building expansion joints with carpet.

F. Cut and fit carpet 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 manufacturer.

G. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

I. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and carpet cushion and adhesive manufacturers.

J. Install in accordance with manufacturer's instructions.

K. Verify carpet match before cutting to ensure minimal variation between dye lots.

L. Double cut carpet, to allow intended seam and pattern match. Make cuts straight, true, and unfrayed.

M. Locate seams in area of least traffic.

N. Join seams by hot adhesive tape method. Form seams straight, not overlapped or peaked, and free of gaps.

O. Lay carpet on floors with run of pile in same direction as anticipated traffic. Lay carpet on stairs with the run of the pile in opposite direction of anticipated traffic to avoid peeking of backing at nosings.

P. Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door centerline.

Q. Cut and fit carpet around interruptions.

R. Lay carpet tight and flat on sub-floor, well fastened at edges, with a uniform appearance. Provide monolithic color, pattern, and texture match within any one area.

S. Install one piece gripper edging strip where carpet terminates at other floor coverings. Where splicing cannot be avoided, seam ends tight and flush.

3.5 CLEANING

A. Remove access adhesive from floor, base, and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

3.6 PROTECTION

A. Prohibit traffic from carpet areas for 24 hours after installation.

B. Protect from stains until substantial completion.

END OF SECTION 09 68 16

SECTION 09 84 33 - SOUND-ABSORBING WALL PANELS AND MOVABLE SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, sound-absorbing acoustical panel units and movable screens tested for acoustical performance.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For unit assembly and installation.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of sound-absorbing systems that fail in performance, materials, or workmanship within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

B. Colorfastness Warranty: Manufacturer and Installer agree to repair or replace components of sound-absorbing systems that fail in visual aesthetics by fading.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 15 or less.
b. Smoke-Developed Index: 200 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

B. Acoustical Performance:

1. Sound absorption NRC of 0.45 to 0.60 according to ASTM C423 for Type A mounting according to ASTM E795.

2.2 SOUND-ABSORBING WALL PANELS (WC-1, WC-2, WC-3, AND WC-5B)

A. Sound-Absorbing Wall Panel: Manufacturer's standard panel construction

1. Products: Subject to compliance with requirements, provide the following:

a. Acoufelt; Fracture Wall Panels, Premier Collection.

2. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
3. Reveals between Panels: Flush reveals.
4. Materials: 100 percent polyester felt.
5. Recycled Content: Minimum 60 percent.
6. Thickness 1/2 inch (12mm)
7. Weight: 0.49 pounds per square foot.
8. Custom Sizes: As indicated on Interior Elevations.
9. Patterns: Unless otherwise indicated on Finish Schedule.

a. Diagonal
b. Intersect

10. Patterns and Colors: As indicated on Finish Schedule on Drawings.

2.3 SOUND-ABSORBING WALL SCREENS (WC-4 AND WC-5)

A. Sound-Absorbing Wall Panel: Manufacturer's standard panel construction

1. Products: Subject to compliance with requirements, provide the following:

a. Acoufelt; Creative Cut Wall Screens, Premier Collection.

2. Mounting: Ceiling mounted with manufacturer's standard tracks secured to substrate.
3. Materials: 100 percent polyester felt.
4. Recycled Content: Minimum 60 percent.
5. Thickness 1/2 inch (12mm)
6. Weight: 0.49 pounds per square foot.
7. Sizes: 48 inches by 96 inches.
8. Patterns: Unless otherwise indicated on Finish Schedule.

a. Rain

9. Patterns and Colors: As indicated on Finish Schedule on Drawings.

2.4 ACCESSORIES

A. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:

1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

B. Ceiling Mounted Sliding Track:

1. Track: HK1224 Sliding track hardware kit for 3 channel.
2. Carrier: HK1228 Sliding track hardware kit.
3. Fasteners: As recommended by manufacturer and for applicable substrate.

2.5 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated.

B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units in locations indicated. Install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align pattern with adjacent units as indicated on Drawings.

3.2 CLEANING AND ADJUSTING

A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

B. Ensure the screens move smoothly on tracks.

END OF SECTION 09 84 33

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on exterior substrates.

B. Related Requirements:

1. Section 05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings.
2. Section 09 91 23 "Interior Painting" for surface preparation and the application of interior paint finishes.
3. Section 09 93 00 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
4. Section 09 96 00 "High-Performance Coatings" for high performance exterior coatings.

1.2 DEFINITIONS

A. Gloss Level 1 (Matte Finish): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2 (Velvet Finish): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3 (Egg Shell Finish): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4 (Satin Finish): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5 (Semi-Gloss Finish): 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6 (Gloss Finish): 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7 (High Gloss Finish): More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Apply coats on Samples in steps to show each coat required for system.

3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. Sherwin Williams Company.

B. Products: Subject to compliance with requirements, provide product listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. 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.

C. Colors: As indicated on the Drawings.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

G. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Fiber Cement Board Substrates:

1. Latex System MPI EXT 3.3A:

a. Prime Coat: Primer, alkali resistant, water based, MPI #3.

1) Sherwin-Williams; Loxon Concrete & Masonry Primer LX02W50

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Sherwin-Williams; A-100 Exterior Acrylic Satin A82-150 series
2) Sherwin-Williams; Latitude Exterior Acrylic Satin K62-650 series
3) Sherwin-Williams; Loxon Self-Cleaning Acrylic Latex Satin LX14-50 series

B. Steel and Iron Substrates:

1. Water-Based Light Industrial Coating System MPI EXT 5.1B:

a. Prime Coat: Benjamin Moore Universal Metal Primer (HP1320)
b. Prime Coat: Primer, zinc rich, inorganic, MPI #19-NA
c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat: Benjamin Moore COMMAND Waterborne Acrylic Urethane Satin (V392)
d. Topcoat: Light industrial coating, exterior, water based, low sheen (Gloss Level 3), MPI #161: Benjamin Moore COMMAND Waterborne Acrylic Urethane Satin (V392)

C. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, galvanized, water based, MPI #134: Benjamin Moore Acrylic Metal Primer (HP1100)
b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat: Benjamin Moore COMMAND Waterborne Acrylic Urethane Satin (V392)
c. Topcoat: Light industrial coating, exterior, water based, low sheen (Gloss Level 3), MPI #161: Benjamin Moore COMMAND Waterborne Acrylic Urethane Satin (V392)

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems (PT) on interior substrates.

B. Related Requirements:

1. Section 09 91 13 “Exterior Painting” for painting on exterior substrates.
2. Section 09 96 00 “High Performance Coatings” for high performance specialty coatings.

1.2 ACTION SUBMITTALS

A. General: All specified finishes are found in the Finish Schedules on the Drawings.

B. Product Data: For each type of product. Include preparation requirements and application instructions.

C. Samples: Paint drawdowns for each type of paint system and in each color and gloss of topcoat.

1. All submittals must be photographed with digital submittal in addition to physical submittal.

D. Product List: For each product indicated. Include 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. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Provide mockup of each unit scheme paints.
2. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

3. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL (PT)

A. MPI Standards: Provide products that comply with MPI standards indicated and are from the following manufacturers:

1. Benjamin Moore & Co.
2. Sherwin Williams Company.

B. 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.

C. Gloss and Colors: As indicated on Finish Schedule on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. 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. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. 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.

C. Visual Standard: each distinct area of finished work shall be free of variations in color, sheen, orange peel, runs, sags, blistering, cracking scratching, dust, dirt, etc.

3.4 CLEANING AND PROTECTION

A. 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.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:

a. Prime Coat: Primer, rust inhibitive, water based MPI #107.

1) Benjamin Moore; Acrylic Metal Primer (HP1100)

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat:
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147:

1) Benjamin Moore; Regal Select Interior Semi-Gloss (N551)

2. Institutional Low-Odor/VOC Latex System MPI INT 5.3N:

a. Prime Coat: Primer, galvanized, water based, MPI #134.

1) Benjamin Moore; Acrylic Metal Primer (HP1100)

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Benjamin Moore; Regal Select Interior Semi-Gloss(N551)

B. Wood Substrates: Wood trim, doors, indicated for opaque finish.

1. Institutional Low-Odor/VOC Latex System MPI INT 6.3V:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.

1) Benjamin Moore; Fresh Start High-Hiding All-Purpose Primer (046)

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Benjamin Moore; Regal Select Interior Semi-Gloss (N551)

C. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.

1) Benjamin Moore; Eco Spec Primer (372)

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat:

1) Typical Ceilings: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

a) Benjamin Moore; Ultra Spec 500 Flat (T535)

2) Typical Walls: Latex, interior, institutional low odor/VOC, eggshell (MPI Gloss Level 3), MPI #145.

a) Benjamin Moore; Ultra Spec 500 Eggshell (T538)

3) Bathroom Walls and Ceilings: Latex, interior, institutional low odor/VOC, satin (MPI Gloss Level 4), MPI #146.

a) Benjamin Moore; Eco Spec (W375/Y375)

END OF SECTION 09 91 23

SECTION 09 93 00 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes primers, wood stains, and transparent finishes.

B. Related Requirements:

1. Section 06 20 23 “Interior Finish Carpentry” for wood substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of finish system and in each color and gloss of finish required.

C. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 MOCKUPS

A. Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals to demonstrate aesthetic effects and to set quality standards for materials and execution.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. PPG Paint.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, unless otherwise indicated in product data, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

B. Remove existing paint by sanding or planing. Do not use chemical strippers.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Exterior Wood Substrates:

1. Scrape and clean knots and apply coat of knot sealer before applying finish.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions.

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish concealed surfaces same as similar exposed surfaces.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 WOOD-FINISH-SYSTEM SCHEDULE

A. Interior Wood Trim and Hardwood Veneer Plywood, Scheduled or noted to be Stained: Including glue-laminated beams (exposed to view in occupied rooms or spaces), and other wood trim (unless scheduled or noted to be painted).

1. Finish:

a. Preparation: Fine sand to provide clean smooth base.
b. Stain: PPG; Olympic 44500 Interior Oil Based Wood Stain.
c. Seal with one coat PPG; Olympic WB Polyurethane 42786 Clear Satin.
d. Finish with two finish coats of PPG; Olympic WB Polyurethane 42786 Clear Satin.

END OF SECTION 09 93 00

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

a. Steel.

B. Related Sections

1. Section 05 52 13 "Pipe and Tube Railings" for shop priming and painting pipe and tube railings with coatings specified in this Section.
2. Section 09 91 13 "Exterior Painting" for general field painting.
3. Section 09 91 23 "Interior Painting" for general field painting.

1.2 DEFINITIONS

A. Gloss Level 5 (Semi-Gloss Finish): 35 to 70 units at 60 degrees, according to ASTM D523.

B. Gloss Level 6 (Gloss Finish): 70 to 85 units at 60 degrees, according to ASTM D523.

C. Gloss Level 7 (High Gloss Finish): More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.

a. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 degrees F and 95 degrees F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. PPG Architectural Finishes, Inc.
2. Sherwin-Williams Company.
3. Tnemec Inc.

B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. Colors: As indicated in color schedule.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Pigmented Polyurethane over Epoxy System MPI EXT 5.1H:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, gloss, MPI #77.
c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

END OF SECTION 09 96 00

SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes tackboards.

B. Related Requirements:

1. Section 06 10 00 “Rough Carpentry” for coordination of backing in walls.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
3. Include sections of typical trim members.

C. Samples for Verification: For each type of visual display unit indicated.

1. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch-long sections of each trim profile.

D. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.

C. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical visual display unit as shown on Drawings. Include accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

2.2 TACKBOARD PANELS

A. Tackboard Panels:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Forbo: Bulletin Board Cork.

2. Facing: 1/4-inch-thick plastic-impregnated cork.
3. Core: Manufacturer's standard.
4. Tackboard Color: Reference Finish Schedule in Construction Drawings.

B. Edges: Metal angle trim.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Schluter System: Scheine

2. Finish: Anodized Aluminum.

2.3 MATERIALS

A. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Forbo; Bulletin Board Cork

B. Medium-Density Fiberboard: ANSI A208.2, Grade 130.

1. Composite Wood Products: Products shall be made without urea formaldehyde.

C. Hardboard: ANSI A135.4, tempered.

D. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.

E. Extruded Aluminum: ASTM B221, Alloy 6063.

F. 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.

1. Adhesives shall have a VOC content of 50 g/L or less.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

3.3 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.

3.4 CLEANING AND PROTECTION

A. Clean visual display units according to manufacturer's written instructions.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 01 - EXTERIOR SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior Building Signage

1.2 Related Documents:

1. Parking Stall Signs per Drawing Set, Sheet C2.4

1.3 SCOPE OF WORK

A. Field verify site conditions and dimensions affecting signage installation and coordinate with signage design and installation.

B. Provide final design for signage based on the schematic level signage design shown in the Contract Documents.

C. Provide signage shop drawings showing the final design for each sign type required for the project.

D. Provide engineering design for exterior pedestal and post signs.

E. Submit signage drawings to local Authority Having Jurisdiction (AHJ) for review and approval; revise final signage drawings as required for approval by AHJ.

F. Install signage in accordance with approved shop drawings.

1.4 PERFORMANCE REQUIREMENTS

A. ADA Accessible Signage shall comply to ICC / ANSI A117.1 Chapter 7 including the Washington State Amendments. Signage shall comply with IBC, Chapters 9, 10 and 11 including color requirements.

B. Fabricator is responsible for providing engineering design for foundations, sign structures and sign electrical components for compliance with applicable local, state and national codes and ordinances.

C. Engage professional engineers licensed in the State of Washington to design and engineer structural and electrical elements.

D. Exterior signs shall be engineered to conform to structural requirements for wind and snow loads in compliance with applicable local, state and national codes and ordinances.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Submit fabricator's technical data for each manufactured component required.

C. Shop Drawings: Provide shop drawings showing locations of signage on site plan, plan view, elevations, sections, details, anchoring method, materials, finishes, signage structures and connections, lighting, artwork.

1. Copy Layout Drawings: Provide scaled drawings showing copy layout for each sign type. Show exact letter, number, symbols, arrows, letter/word/line size, spacing, margins, etc. positioned within the sign face outline. Copy layouts will be adjusted during Architect's review when required to conform to the design intent; resubmit for final approval.
2. Include structural design and include design criteria. Shop drawings shall bear the seal of a Professional Engineer currently licensed in the State of Washington.
3. Include electrical design criteria (voltage, loads, wire size, etc.).

D. Text Information Supplied By Owner: Allow 10 days for Owner verification of signage text noted herein to be verified by Owner during submittal process.

E. Color Samples: Provide three (3) samples (3" x 5" minimum size), of each different color and texture required; samples shall be the actual materials used in signage and not photographic facsimiles.

F. Deferred Submittal To Authorities Having Jurisdiction (AHJ): Submit signage shop drawings to the AHJ for review and approval as a deferred submittal; provide format; information and number of copies required by AHJ. Make any revisions and provide any additional information required to obtain approval by AHJ.

G. Operations And Maintenance Data: Submit fabricator's operation and maintenance instructions for signage and electrical components.

1. Provide cleaning instructions for each different surface / finish exposed to view on signage.
2. Provide a comprehensive Signage Manual in both a paper and PDF format. The Manual shall include shop drawings, signage location plan, signage type and copy schedule, computer graphics files, mounting details and signage reorder information.

    a. Include listing of product and color selections (manufacturer product and color number) for each different finish and color applied on signage.

3. Provide instructions for using the computer software for the LED electronic sign.

1.6 QUALITY ASSURANCE

A. Signage Fabricator Qualifications: Not less than 5 years of successful experience in fabrication and installation of signage similar in type and scope to those required for this project, with record of successful fabrication and installation and sufficient capacity to produce and install the required signage within the project schedule.

1. Obtain signs from one source and a single sign fabricator.
2. The signage fabricator shall have broad in-house knowledge, diverse shop and field experience, flexibility, coordination ability, skilled craftsmen and a physical plant necessary

to produce quality products equivalent to or superior to similar type products produced by other signage fabricators in the same area of expertise.

3. Installers shall be employees of fabricator trained and experienced in signage installation using best workmanship.
4. Upon request, provide list of at least five (5) recently completed projects along with names and contact information for project Owner and Architect

B. Workmanship / Quality: Signage fabrications shall employ the best fabrication practices common to the signage industry and to the highest standards of workmanship. Fabrications shall be free of imperfections in material and workmanship and suitable for its intended use and location.

1.7 Welders: Qualified within the previous 12 months for type of welding required for this project in accordance with AWS D-1.1 and Washington Association of Building Officials (WABO) certified as required by local Building Official having jurisdiction on this project.REGULATORY REQUIREMENTS

A. Permits: Obtain and pay for any signage related permits required by state and local authorities having jurisdiction. Sign permits shall be obtained before beginning fabrication of the signage.

B. Signage Requiring Electrical Connection: Electrical components shall be tested and labeled by Underwriters Laboratories, Inc., as suitable for the installed environment and the intended purpose.

1.8 FIELD CONDITIONS

A. Conduct an on-site inspection of existing and as-built conditions and review of signage locations prior to preparing submittals.

B. For signage that must fit closely within an existing condition or architectural detail, field measure and adjust sign to fit in the space.

C. Field verify/measure dimensions and review site conditions prior to submitting shop drawings.

D. Coordinate signage work with Contract Drawings, change directives and as-built conditions.

1.9 DELIVERY, STORAGE & HANDLING

A. Package signage for protection during shipping, storage and installation.

B. Products should remain in original packaging until installation. Store products in a dry, indoor location.

1.10 PRE-INSTALLATION CONFERENCE

A. Prior to beginning signage installation work, convene a conference to review installation procedures and concerns, work schedule and sequencing/coordination with other work.

1. The following persons shall attend Conference: Contractor, Signage Installer, Architect, and Owner.
2. Stake the locations for pedestal and post signs on site prior to conference for review by attendees.

1.11 WARRANTY

A. Provide two-year warranty covering the following:

1. Signage shall be warranted against defects in materials and workmanship. Promptly correct at no expense to the Owner any defective signage resulting from defective or inferior materials or workmanship.
2. Defective materials and workmanship include, but are not limited to, the following: Delaminating of sign parts or finishes, cupping, warping or dishing of surfaces, bubbling, crazing, chalking, or fading of finishes, rusting or corrosion of parts, installations that are not plumb or securely fastened, use of incorrect finishes or materials, or unapproved deviations from the Contract Documents or approved shop drawings.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Exterior Signage Fabricators: The following fabricators are acceptable for providing signage for this project:

1. Clearway Signs, Puyallup, WA; Contact: John Sevener (john@clearwaysigns.com)

2.2 MATERIALS

A. Concrete: Provide concrete with 4,000 psi (minimum) compressive strength at 28 day from the following materials:

1. Reinforcing Steel: Conform to ASTM A615 and structural design on shop drawings.
2. Cement: Type I or II Portland cement conforming to ASTM C150, gray color.
3. Concrete Aggregate: Sand and gravel aggregates conforming to ASTM C33.
4. Water: Clean, potable, free of any substances or contaminants adversely affecting concrete.
5. Air Entrainment: 5 to 7 percent (by volume) using air entrainment admixture conforming to ASTM C260.
6. Admixtures: Water reducing agents are permitted, calcium is not allowed.
7. Maximum Water / Cement Ratio: 0.45
8. Maximum Slump: 5 inches

B. Steel: Conform to the following:

1. Steel Shapes: ASTM A36
2. Steel Tubing: ASTM A500, Grade B
3. Steel Pipe: ASTM A 53
4. Steel Plate: ASTM A283
5. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 with matching ASTM A563 nuts and ASTM F436 washers.
6. Steel nuts and bolts shall conform to ASTM A307, galvanized in conformance with ASTM A153
7. Welding Materials: AWS D1.1; type required for materials being welded.
8. Cleaning: Clean steel surfaces in accordance with SSPC SP-3, Power Tool Cleaning to remove rust, scale, oil, grease, and foreign matter.

C. Aluminum: Conform to ASTM B209, 5000 series, 6061-T6 and 6063 alloys selected for best performance for each sign application.

1. Materials provided shall be free of surface blemishes such as pitting, roller marks, rolled trade names and surface roughness

D. Paint: Provide paint manufactured specifically for signage painting with excellent color and gloss retention and surface hardness. Use the same manufacturer for each coat specified for a given system.

1. Manufacturers: Matthews Paint is the basis of design and the standard of quality, function and appearance required for this project. The following manufacturers are acceptable provided they can provide products that are equal to or exceed the products provided by Matthews Paint.

a. Matthews Paint (basis of design)
b. Sherwin Williams Genesis
c. AkzoNoble

2. Schedule – Paint Systems: Provide the following paint system for each different material:

a. Steel:

1) Surface Preparation: As recommended by paint manufacturer.
2) Pretreatment Cleaner: Clean surface with Matthews 45 330SP Speed Prep Cleaner.
3) Prime Coat: Matthews 274 808SP/274 909SP Black Epoxy Primer, or 274 908SP/274 909SP White Epoxy Primer applied at 1.5 – 2.0 mils DFT.
4) Top Coats: 2 coats of Matthews MPC 100 Acrylic Polyurethane (MAP) applied at 2 mils DFT.
5) Clear Coats: 2 coats of Matthews MAP Clear applied at 2.0 mils DFT, gloss as selected by Architect.
6) Application: Spray.
7) Gloss: As selected by Architect.

b. Aluminum:

1) Pretreatment Cleaner: Clean surface with Matthews 45 330SP Speed Prep Cleaner.
2) Prime Coat: Matthews 274 808SP/274 909SP Black Epoxy Primer, or 274 908SP/274 909SP White Epoxy Primer applied at 1.5 – 2.0 mils DFT.
3) Top Coats: 2 coats of Matthews MPC 100 Acrylic Polyurethane (MAP) applied at 2 mils DFT.
4) Clear Coats: 2 coats of Matthews MAP Clear applied at 2.0 mils DFT, gloss as selected by Architect.
5) Application: Spray.
6) Gloss: As selected by Architect.

E. Vinyl Film: Premium quality, 2.0 mil, cast vinyl, opaque with high performance, permanent, clear pressure-sensitive acrylic adhesive.

1. Manufacturers / Products:

a. Avery Dennison SC 900 Super Cast Series
b. Oracal *951*

c. 3M Company Scotchcal Series 7125

2.3 FABRICATION – GENERAL

A. General: Fabricate exterior signs from new materials using the best fabrication procedures, practices and workmanship that is common to the signage industry.

B. Design, engineer and fabricate exterior signs to prevent problems caused by weather, expansion and contraction, condensation, corrosion, exposure to UV and other problems resulting from exposure to the elements.

C. Post Signs: Design and engineer to accommodate existing soil conditions, wind load requirements, overhead power lines, setback requirements.

D. Metal Fabrications: Fabrication shall be smooth, free from abrasion, burrs, sharp edges, tool marks, visible welds, exposed fasteners, or similar defects. Corners, reveals, and joints shall be accurately milled to match adjoining pieces and shall be fabricated so that they are straight and/or configured to match the approved shop drawings.

1. Joints and seams shall be minimized by using the largest sheet size reasonably available.
2. Welds: External welds are to be continuous, filled, ground and sanded smooth so the finish seams are not apparent when the unit is completed. Internal welds shall be structurally sound and eliminate racking.
3. Internal concealed framing / bracing shall be galvanized steel or aluminum for corrosion resistance. Internal concealed fasteners shall be hot-dipped galvanized or stainless steel.
4. There shall be no visible seams or fasteners. Joints and connections shall be finished flush, true and smooth without defects. Finish welds on exposed surfaces, and spot welds shall be imperceptible in the finished work. No gaps, light leaks, oil-canning or waviness will be acceptable.
5. Fabricate for smooth and even appearance, free from imperfections and disfigurement including pitting, warping, waviness, bulges, oil-canning or other physical deformities caused by such things as welding, material being too thin, fasteners, welds not being ground smooth, or any other problems not specifically mentioned here
6. Brake-Formed Aluminum: Bends shall not have crazing or cracking.
7. When dissimilar metals are in contact, the contacting surfaces shall be separated by non-conducting tape or coating to prevent oxidation and electrolysis. Aluminum and steel shall not come in contact with each other.

E. Cut Metal Letters: Computer controlled precision machine cut using waterjet cutting equipment for uniform appearance and cut finish.

1. Use the exact typefaces specified; verify prior to production if there is any question about the identity of a specified typeface.
2. Cut edges shall be smooth and free of tool or cutting marks.
3. Edges shall be slightly eased to eliminate sharpness.
4. Install 300 Series stainless steel threaded pins in backside of each letter for secure, theft-proof attachment.

F. Painting: Conform to paint manufacturer’s requirements for surface preparation / cleaning and application.

1. Paints shall be evenly applied without pinholes, scratches, orange peeling, application marks and other imperfections. Workmanship, finishes and formation of letters shall conform to the highest standards of the trade.

2. Color breaks on the sign surface are to be sharp, without serration or color bleed. Remove paint drops, splatters, and over sprays.
3. The cured paint surface shall have a uniform finish that accurately matches the specified color, gloss or approved color samples.

G. Cut Vinyl Letters and Graphics: Conform to manufacturer's requirements for surface cleaning and application.

1. Cut vinyl typography (including letters, arrows, numbers, symbols, logos, etc.) and graphics is to be vector artwork or photographically reproduced and computer processed (digitized or scanned) and precision machine cut.
2. Use the exact typefaces specified; verify prior to production if there is any question about the identity of a specified typeface.
3. Die cutting shall be executed in such a manner that all edges and corners are true and clean.
4. Adhesion to substrate shall be permanent.

H. There shall be no visible labels, manufacturer's or otherwise, code permitting, on the completed signs. If labels are required, a sample label and intended location must be included with submittal for Architect's review.

2.4 EXTERIOR SIGNAGE TYPES

A. Sign Type A1 – Primary Site ID (Pedestal Sign)

1. Signage Type: Free-standing pedestal sign, integrated lighting
2. Overall Size: per Drawing Set Sheet A003.to be verified with jurisdictional signage requirements.)

    a. LED Electronic Message Center : per Drawing Set Sheet A003

3. Sign Construction (Sign Cabinet): Provide a custom fabricated sign cabinet in the size and configuration shown on the Drawings.

    a. Custom fabricate a sheet aluminum cabinet in a manner that will prevent corrosion or deterioration from exposure to the weather and resist damage from vandalism or abuse.
    b. Exterior Faces: 0.25-inch thick (minimum) aluminum sheet; reinforce internally to stiffen face and prevent deflection.
    c. Internal Concealed Frame: Aluminum square tube or angle.
    d. Utilize internal concealed fasteners and welds for connections.
    e. Edges of aluminum faces shall have exposed edges eased.
    f. Seal corners watertight internally, concealed from view.
    g. Finish: Paint on aluminum.

4. Sign Construction (Base): Utilize existing Monument Sign base.
5. Individual Cut Letters / Numbers: Laser or water-jet cut ½ and ¼" -inch thick flat stainless steel, smooth edges and face to remove cutting marks, ease edges.

    a. Provide concealed threaded stainless steel pins for mounting.

6. LED Electronic Message Center:

a. Manufacturer / Product: Vantage LED FLEX Enhanced Resolution is the basis of design and standard of quality, performance and function required for this project.
b. Display Configuration: Two-view (2V).
c. Digital signage pitch: 12mm
d. LED Color: full color
e. Power Requirements: 120 VAC single phase.
f. Regulatory Compliance: UL listed, FCC compliant.
g. Control: Remote message programming via internet cloud-based control software.

1) Provide electronic components required for receiving control data from control computer via:

a) Cellular

2) Control Software: SM Infinity Cloudware

h. Warranty Coverage: 7-year Parts and Labor

7. Owner Training: Provide 1.5 hours of one-on-one online training for Owner's personnel on setup and use of the cloud-based control software.
8. Finish / Colors:

a. Sign Cabinet: Paint on aluminum
b. Base: Natural concrete
c. Individual Cut Letters / Numbers: Brushed stainless steel

9. Typography: Arial Narrow

B. Sign Type A2 – Directory Sign (Post and Panel Sign)

1. Signage Type: Free-standing post and panel sign.
2. Overall Size: per Drawing Set Sheet A003; to be verified with jurisdictional signage requirements.)
3. Sign Construction (Base): Steel post with concrete footing.

a. Bottom of footing shall be 24 inches (minimum) below surrounding finish grade; deeper when required by structural design.
b. Concrete shall conform to the requirements specified in this Section.
c. Foundation and steel post shall be engineered to resist seismic and wind forces on sign.
d. Changeable panels

C. Sign Type A3 – Primary Building ID(Wall-Mtd Panel Sign

1. Signage Type: Individual cut letters/numbers on panel, integrated lighting
2. Overall Size: per Drawing Set Sheet A003
3. Individual Cut Letters / Numbers: Brushed stainless steel letters cut from 1/4-inch thick plate.
4. Text Copy: per Drawing Set Sheet A003
5. Color: Paint on aluminum; as selected by Architect
6. Typography: Arial Narrow

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate signage installation with work of other trades.

B. Coordinate signage installation schedules with General Contractor.

C. Coordinate location of electrical rough-in for signs with electrical installer.

3.2 EXAMINATION

A. Contractor, Sign Contractor, Architect and Owner's Representative shall conduct a walk through to review staked out sign locations.

B. Examine the substrate work by others and conditions under which the signs are to be installed and verify that all such work is complete for proper installation of the signs. Installer shall notify Contractor of unsatisfactory conditions; installer shall not proceed until unsatisfactory conditions are corrected.

C. Verify dimensions, clearance, anchorage methods and final location for each sign before installation.

D. Install wall-mounted signs after wall surfaces are painted and finished.

E. Do not install post signs until concrete foundation has attained design compressive strength.

F. Start of installation indicates acceptance of substrate and conditions as acceptable.

3.3 INSTALLATION - SIGNAGE

A. Sign installation Foreman shall be present on site and directly controlling the signage installation work at all times that signage work is in progress on site.

B. Install signage in locations noted on Drawings in accordance with fabricator's installation instructions and shop drawings.

1. Install signs level, plumb, and true.
2. Mount signage in conformance with location requirements contained in the IBC, ICC / ANSI A117.1 and Washington State Building Code Amendments.
3. Mount signage securely to substrate surface using noncorrosive fasteners in conformance with mounting methods shown on shop drawings and in compliance with fabricator's instructions.
4. Installation shall be performed by sign fabricator's personnel trained and experienced in fabricator's recommended installation methods and procedures.

C. Install signage level, plumb and at the proper height with sign surfaces free from defects. Mounting heights shall conform to ADA requirements. Refer also to drawings / schedules for signage installation requirements.

D. Securely attach free-standing signs to concrete floor / base in conformance with structural design shown on the shop drawings.

E. Upon completion of the work, remove unused or discarded materials, containers and debris from site.

3.4 WORKMANSHIP

A. Signage shall be installed using the best workmanship, including the following:

1. Consistent color, gloss and finish appearance; surfaces free of discoloration, hazing, inconsistent gloss, or defects.
2. Signs installed plumb, level, in square alignment and at required height.
3. Free-standing signs securely attached and free of movement or misalignment.
4. No scratches, stains or damage on signs.
5. Fasteners installed securely into solid backing / substrate.
6. Fasteners installed square with sign face and tightened down snug without misalignment, overtightening or space under head.
7. Landscaping around pedestal and post signs restored and excess soil removed.
8. No damage to surrounding finishes or work.

3.5 CLEANING

A. Clean sign surfaces and touch up any flaws or marring caused during installation. Signage shall be clean and free of glue, tape, and other extraneous materials.

B. Clean the site and signage, removing debris related to the installation of the signs.

3.6 PROTECTION OF WORK

A. Protect signage from soiling and damage during and after installation.

B. Repair any finishes on signs and surrounding architectural surfaces damaged during field installation so there is no evidence of corrective work. Return items which cannot be refinished in the field to the shop, make required alterations, and refinish the entire unit or provide new unit at fabricator’s option.

3.7 FIELD QUALITY CONTROL

A. Contractor Quality Control: Employ / assign quality control personnel to monitor the work of this section for conformance to the requirements of this section and to good construction practices.

1. Contractor is solely responsible for managing and controlling the quality of the work and conformance with the requirements of this Section.

B. Owner may elect to engage an independent testing and inspection agency to perform field inspections and tests and prepare test reports, in accordance with Section 01 77 00.

1. Coordinate inspection of field connections by independent testing company when connections are accessible and prior to cover.
2. Provide testing agency with access to the work to allow required inspections and testing.
3. Correct deficiencies or remove and replace any work that inspections and test reports indicate do not comply with specified requirements.

4. Non-conforming work will be reinspected and tested for compliance at Contractor's expense.

3.8 SIGNAGE SCHEDULE AND LOCATION PLAN

A. Refer to Drawings

END OF SECTION 10 14 01

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cutout 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 at least half size.

C. Samples: For each exposed product and for each color and texture specified.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

E. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article.

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 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 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design sign structure and anchorage of dimensional character sign type(s) to withstand design loads as indicated on Drawings.

B. Thermal Movements: For exterior, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DIMENSIONAL CHARACTERS

A. Cutout Characters: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles; and as follows:

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Impact Signs.

2. Character Material: Water cut sheet or plate aluminum.
3. Character Font: Coordinate with building graphic standard.
4. Character Height: 2 inches and 8 inches, unless otherwise indicated.
5. Thickness: 0.125 inches, unless otherwise indicated.
6. Finishes:

a. Integral Aluminum Finish: Clear anodized.

7. Mounting: Aluminum and threaded studs as indicated

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.
c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

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.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.

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.

3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
4. Back Bar and 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 as signs are installed.

END OF SECTION 10 14 19

SECTION 10 14 2.13 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

1.2 ACTION 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 other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least.

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 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of signs 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. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign with smooth, 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 to acrylic backing sheet to produce composite sheet.

a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
b. Surface Graphics: Photopolymer.
c. Color(s): As selected by Architect from manufacturer's full range.

2. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Square cut.
b. Corner Condition in Elevation: Rounded to radius indicated.

3. Mounting: Manufacturer's standard method for substrates indicated with concealed anchors or two-face tape.
4. Character Font: and Colors: Coordinate with building graphic standard.

2.3 SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Exposed Metal-Fastener Components, General:

a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.

3. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045-inch-thick, with adhesive on both sides.

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. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. 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-Etched Graphics: Reverse etch 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.

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. 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.

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. 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. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

END OF SECTION 10 14 23.16

SECTION 10 21 13 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Solid color reinforced composite (SCRC) toilet partitions and urinal privacy screens.

1.2 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Submit manufacturer's shop drawings for each product specified, including the following:

1. Plans, elevations, details of construction and attachment to adjacent construction.
2. Show anchorage locations and accessory items.
3. Verify dimensions with field measurements prior to final production of toilet compartments.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

C. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

D. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship is approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.4 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard 25 year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1 year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 - PRODUCTS

2.1 SOLID COLOR REINFORCED COMPOSITE (SCRC) SUBSTRATE

A. Products: Subject to compliance with requirements, provide the following:

1. Bobrick Sierra Series.

B. Solid Color Reinforced Composite (SCRC) Toilet Partitions:

1. Design Type:

a. Standard Height.

1) Door/Panel Height: 58 inches (147 cm).
2) Floor Clearance: 12 inches (30 cm).

2. Mounting:

a. Floor-mounted, overhead-braced with extruded anodized aluminum headrails, 0.065 inch (1.65 mm) thick with anti-grip profile.

1) Stile Maximum Height: 83 inches (211 cm).

C. Solid Color Reinforced Composite (SCRC) Urinal Screens: Bobrick SierraSeries.

1. Mounting Configuration: Wall-hung.

a. Screen Height: 48 inches (122 cm) with 12 inches (30 cm) floor clearance.

D. Materials: Solid color reinforced composite (SCRC) material for stiles, panels, doors, and screens with Bobrick GraffitiOff coating, thermoset and integrally fused into homogenous piece; high density polyethylene (HDPE), high density polypropylene not acceptable.

1. Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.
2. Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through a manufacturing steps requiring thermal and mechanical pressure.
3. Edges: Same color as the surface.
4. Color: As selected by Architect.
5. Acceptable SCRC Products: Or manufacturer approved equal.

a. Ultimate Corian System by Shower Shapes.
b. WilsonArt Gibraltar Material.
c. WilsonArt EarthStone Material.

E. Performance Requirements:

1. Graffiti Resistance (ASTM D 6578): Passed cleanability test; 5 staining agents.
2. Scratch Resistance (ASTM D 2197): Maximum load value exceeds 10 kilograms.
3. Impact Resistance (ASTM D 2794): Maximum impact force exceeds 30 inch-pounds.
4. Smoke Developed Index (ASTM E 84): Less than 450.
5. Flame Spread Index (ASTM E 84): Less than 75.
6. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.
7. Uniform Building Code: Class II.

F. Finished Thickness:

1. Stiles and Doors: 3/4 inch (19 mm).
2. Panels and Screens: 1/2 inch (13 mm).

G. Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods.

1. Leveling Devices: 7 gauge, 3/16 inches (5 mm) thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch (10 mm) diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
2. Stile Shoes: One-piece, 22 gauge (0.8 mm), 18-8, Type 304 stainless steel, 4 inch (102 mm) height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch (19 mm) or 1 inch (25 mm) stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

H. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge (1.6 mm) stainless steel with satin finish; 1 inch (25 mm) x 1-1/2 inches (38 mm) x 58 inches high (1473 mm).

I. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00 - Metal Fabrications.

J. Hardware: 18-8, Type 304, heavy gauge stainless steel, satin finish. "Zamak", aluminum and extruded plastic hardware not acceptable.

1. Compliance: Operating force of less than 5 lbs. (2.25 kg).
2. Emergency Access: Hinges, door latch allow door to be lifted over keeper from outside compartment on inswing doors.
3. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
4. Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
5. Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.

    a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lbs. (680 kg) per insert.

6. Clothes Hooks: Projecting no more than 1-1/8 inch (29 mm) from face of door.
7. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16 gauge (1.6 mm) sliding door latch, 14 gauge (2 mm) keeper.
8. Locking: Door locked from inside by sliding door latch into keeper.
9. Hinge Type:

    a. Standard.

        1) Balanced, with field-adjustable cam to permit door to be fully closed or partially open when compartment is unoccupied.

10. Mounting Brackets:

    a. Standard Concealed.

        1) Mounting Brackets: Mounted inside compartment; exposed brackets on exterior of compartment not acceptable with the exception of outswing doors.

PART 3 - PRODUCTS

3.1 PREPARATION

A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.

1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

C. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:

1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
2. Verify location does not interfere with door swings or use of fixtures.
3. Use fasteners and anchors suitable for substrate and project conditions
4. Install units rigid, straight, plumb, and level.
5. Conceal evidence of drilling, cutting, and fitting to room finish.
6. Test for proper operation.

3.3 ADJUSTING, CLEANING AND PROTECTION

A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.

B. Touch-up, repair or replace damaged products.

C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION 10 21 13

SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes public washroom accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

C. Samples: for each type of product indicated.

1. All submittals must be photographed with digital submittal in addition to physical submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. 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.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue Dispenser with Shelf (TPD):

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick; B-540 Surface-Mounted Toilet Tissue Dispenser and Utility Shelf.

2. Type: Double-roll dispenser with shelf.
3. Mounting: Surface mounted with concealed anchorage.
4. Operation: Noncontrol delivery with standard spindle.
5. Capacity: Designed for two 5-1/4-inch-diameter-core tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Seat-Cover Dispenser (SCD):

1. Products: Subject to compliance with requirements, provide the following:

   a. Bobrick; B-4221 ConturaSeries, Surface-Mounted Seat-Cover Dispenser.

2. Mounting: Surface mounted.
3. Minimum Capacity: 250 seat covers.
4. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Sanitary-Napkin Disposal (SND):

1. Products: Subject to compliance with requirements, provide the following:

   a. Bobrick B-270 ConturaSeries Surface-Mounted Sanitary Napkin Disposal.

2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

D. Automatic Foam-Soap Dispenser (SD):

1. Products: Subject to compliance with requirements, provide the following:

   a. Bobrick; B-2013 MBLK Surface-Mounted Automatic Wall-Mounted Foam Soap Dispenser.

2. Description: Designed for dispensing antibacterial soap in liquid or lotion form.
3. Mounting: Surface mounted.
4. Capacity: 27 fluid oz (800 ml).
5. Materials: Matte black finish.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

E. Paper Towel Dispenser and Waste Receptacle (PTD):

1. Products: Subject to compliance with requirements, provide the following:

   a. Bobrick; B-3979 ClassiSeries Surface-Mounted Convertible Automatic Universal Roll Paper Towel Dispenser and Waste Receptacle.

2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
3. Mounting: Surface.
4. Roll Towel Dispenser Capacity: to accept universal standard-core rolls up to 8 inch wide and 8 inch diameter.
5. Minimum Waste-Receptacle Capacity: 12 gallon.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

7. Liner: Reusable, vinyl waste-receptacle liner.
8. Lockset: Tumbler type for towel-dispenser compartment.
9. Finish: Satin stainless steel.
10. 10 Power: four “D” size batteries.

F. Grab Bars (GB):

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick; B-9806 Series, Fino Collection 1-1/2” Diameter Stainless Steel Grab Bars with Concealed Flange.

2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
4. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
5. Configuration and Length: As indicated on Drawings.

G. Coat Hook (CH):

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick; B-542 Coat Hook.

2. Description: Single-prong unit.
3. Mounting: Flanges with concealed fasteners.
4. Material: Stainless steel, 0.05 inch thick.
5. Finish: Satin Stainless steel.

H. Mirror Unit:

1. Products: Subject to compliance with requirements, provide the following:

a. CRL Matte Black 1/4" Deep Nose Aluminum J-Channel

2. Frame: 1/4 inch aluminum J-Channel with 0.625 inch return.
3. Corners: Manufacturer's standard.
4. Size: As indicated on Drawings.
5. Hangers: Manufacturer's standard rigid, tamper and theft resistant.
6. Color: Matte black.

2.2 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of 6 keys to Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

END OF SECTION 10 28 00

SECTION 10 28 19 - SHOWER ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shower base and shower doors.

B. Related Requirements:

1. Section 10 28 00 “Toilet and Bath Accessories” for grab bars and bath accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification:

1. Sample of shower base material.
2. Shower doors.

a. Glass and glazing; 12 inches square.
b. Trim; 12-inch lengths.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower bases, shower doors and hardware include in maintenance manuals.

1.5 FIELD CONDITIONS

A. Verify dimensions by field measurements before fabrication and indicate on Shop Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period without monetary limitation.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHOWER BASE (SH-1)

A. Description: ANSI B compliant transfer type shower base with reinforcing bottom plate, slip-resistant floor, and return flange.

B. Products: Subject to compliance with requirements, provide the following:

1. Everfab; SP3937RFB.

C. Standard: IAPMO Z124.1.2/ANSI Z124.1.2.

D. Material: Gel coated fiberglass.

1. Color: White.

E. Size: 39-1/2 inches wide by 37-1/4 inches deep by 5 inches high.

F. Accessories: Stainless steel 24 inch grab bar and drain.

2.2 SHOWER DOORS (SE-1)

A. Semi frameless glass panels with perimeter frames of extruded aluminum with screw-fastened corners. Minimum 3/8-inch penetration of glass into frame. Framing members of thickness required to support imposed loads.

1. Products: Subject to compliance with requirements, provide the following:

a. Agalite Shower & Bath Enclosures; Accent Collection.

B. Frames, Hardware, and Trim: Manufacturer's standard units as indicated and as required for a complete installation.

1. Materials: Aluminum; ASTM B221.
2. Finish: Matte black.

C. Swinging Doors: Top-and-bottom pivot hinges. Manufacturer's standard pulls and latch. Water diverter at bottom.

D. Glazing: Safety glazing materials complying with 16 CFR 1201, Category II, with permanently etched identification acceptable to authorities having jurisdiction.

1. Glass Nominal Thickness: 1/4 inches (6mm).
2. Clear Glass: ASTM C1048, Type I, Quality-Q3, Class I (clear), Kind FT (fully tempered),

E. Fasteners: Manufacturer's standard stainless steel or other noncorrosive fasteners.

F. Sealant: Mildew-resistant, single-component, nonsag, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, for Use NT.

1. Sealant shall have a VOC content of 250 g/L or less.

G. Options: 6 inch by 24 inch mitered D-pull with integral towel bar on opposing side.

1. Refer to Drawings for configuration.

PART 3 - EXECUTION

3.1 SHOWER BASE INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Ensure that there is adequate blocking for installation of grab bars and accessories.

3.2 SHOWER DOOR INSTALLATION

A. Prepare and install as recommended in manufacturer's written instructions unless more stringent requirements are contained in GANA's "Glazing Manual."

B. Clean substrates, removing projections, filling voids, and sealing joints.

C. Set units level, plumb, and true to line, without warp or rack of frames and panels, and anchor securely in place.

D. Fasten components securely in place, with provisions for thermal movement. Install with concealed fasteners unless otherwise indicated.

E. Install components to drain and return water to shower.

F. Install doors to produce smooth operation and tight fit at contact points.

G. Repair, refinish, or replace components damaged during installation.

3.3 ADJUSTING AND CLEANING

A. Adjust operating parts and hardware for smooth, quiet operation and watertight closure. Lubricate hardware and moving parts.

B. Remove nonpermanent labels, and clean surfaces immediately after installation.

END OF SECTION 10 28 19

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire-protection cabinets for portable fire extinguishers.

B. Related Requirements:

1. Section 10 44 16 “Fire Extinguishers” for portable fire extinguishers.

1.2 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire-protection cabinets.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINETS

A. Products: Subject to compliance with requirements, provide the following:

1. JL Industries, Inc.; Academy 1825

B. Fire-Protection Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Two-hour fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

D. Cabinet Material: Aluminum sheet.

E. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/2-inch backbend depth.

F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

1. Locations: At parking garage and utility spaces with CMU or concrete walls.

G. Cabinet Trim Material: Aluminum sheet.

H. Door Material: Aluminum sheet.

I. Door Style: Vertical duo panel with frame.

J. Door Glazing: Laminated float glass (clear).

K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

L. Accessories:

1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Silk-screened.
3) Lettering Color: Red.
4) Orientation: Vertical.

M. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Color: As selected by Architect from manufacturer's full range.

2. Clear Laminated Glass: ASTM C1036, Type I, Class 1, Quality q3, 6 mm total thickness.

3. Aluminum: ASTM B221 (ASTM B221M) for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.

a. Finish: Clear anodic.

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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare recesses for recessed fire-protection cabinets 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. Identification: Apply vinyl lettering at locations indicated.

E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets.

B. Related Requirements:

1. Section 10 44 13 “Fire Protection Cabinets” for fire extinguisher cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type:

1. In Fire Protection Cabinets: UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

a. Products: Subject to compliance with requirements, provide the following:

1) In Fire Protection Cabinets: JL Industries, Inc.; Activar; Cosmic 10E.

2. Wall Mounted: Low Profile, UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

a. Products: Subject to compliance with requirements, provide the following:

1) Wall Mouthed: JL Industries, Inc.; Activar; Orbit FE10V or FE10VB, Low Profile.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

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 and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 10 75 16 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Ground-set flagpoles made from aluminum.

B. Owner-Furnished Material: Flags.

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. Shop Drawings: For flagpoles.

1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
2. Include section, and details of foundation system.

C. Delegated-Design Submittal: For flagpoles.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

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 01 40 00 "Quality Requirements," to design flagpole assemblies.

B. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Refer to Structural Drawings.

C. 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 100 mph minimum, unless otherwise required by authorities having jurisdiction; 3-second gust speed at 33 feet above ground.
2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

1. Basis of Design: Pole-Tech Company Inc.; Internal Halyard Cable Base Flagpoles – Winch, PT408CIW.
2. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Flagpole.
b. Concord Industries, Inc.

B. Overall Height: 44 feet.

C. Exposed Height: 40 feet.

D. Bottom Diameter: 8 inch

E. Top Diameter: 4 inch.

F. Wall Thickness: 0.188 inches.

G. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

H. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch-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.

1. Flashing Collar: Same material and finish as flagpole.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch thick spun aluminum, with gold anodized finish.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Stainless-steel swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.
2. Equipment System to accept both a USA Flag and a Washington State Flag on the same single pole.

2.5 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

B. Drainage Material: Crushed stone, crushed or uncrushed gravel; coarse aggregate.

C. Sand: ASTM C33/C33M, dry, fine sand.

D. Elastomeric Joint Sealant: Single-component nonsag urethane joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 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. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. 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.

E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

F. Place concrete, as specified in Section 03 30 00 "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.

3.2 FLAGPOLE INSTALLATION

A. 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 layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 10 75 16

SECTION 11 30 13 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes appliances including cooking, refrigeration and cleaning appliances.

B. Work Furnished But Installed Under Other Sections

1. Furnish plumbing requirements for appliances installed under Division 22 -Plumbing.
2. Furnish all wiring, circuit breakers and shut offs installed under Division 26 – Electrical.

C. Related Sections

1. Section 06 41 00 “Architectural Wood Casework” for cabinets.
2. Refer to Finish Schedule for additional information.

1.2 ACTION SUBMITTALS

A. General: All specified finishes are found in the Finish Schedules on the Drawings.

B. Product Data: For each type of product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Field quality-control reports.

C. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Provide residential equipment with UL and Energy Star Standard Labels where noted.

1.6 DELIVERY STORAGE AND HANDLING

A. Deliver appliances in unopened boxes, stating brand name, once installed and model number.

B. Uncrate appliances and dispose of packaging material.

1.7 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 REFRIGERATOR/FREEZERS

A. Refrigerator (RF-1):

1. Basis of Design: Summit FF1089PLIM.
2. Dimensions: 60.25 inches height by 23.25 inches width by 26.5 inches depth.
3. ADA Compliant.
4. Location and Finish: As indicated on Drawings and Finish Schedule.

B. Undercounter Refrigerator (RF-2):

1. Basis of Design: Summit FF6BK17SSHVADA.
2. Dimensions: 32.25 inches height by 23.63 inches width by 23.5 inches depth.
3. ADA Compliant
4. Location and Finish: As indicated on Drawings and Finish Schedule.

2.3 BEVERAGE CENTERS

A. Undercounter Beverage Center (REF-3):

1. Basis of Design: Summit SCR610BLCSS.
2. Dimensions: 34 inches height by 23.63 inches width by 26.5 inches depth.
3. Energy Star.
4. Location and Finish: As indicated on Drawings and Finish Schedule.

B. Undercounter Beverage Center (REF-4):

1. Basis of Design: Summit AL57GCSS.
2. Dimensions: 32 inches height by 23.63 inches width by 26.3 inches depth.
3. ADA Compliant.

4. Location and Finish: As indicated on Drawings and Finish Schedule.

2.4 MICROWAVE OVEN

A. Microwave Oven (MICRO):

1. Basis of Design: Summit SMB127TK27.
2. Dimensions: 18.88 inches height by 26.88 inches width by 27 inches wide.
3. Built-in trim kit.
4. Location: As indicated on Drawings and Finish Schedule.

2.5 DISHWASHERS

A. Dishwasher (DW-1):

1. Basis of Design: Summit DW244SSADA
2. Dimensions: 32.25 inches by 23.5 inches by 22.5 inches.
3. ENERGY STAR
4. Location: As indicated on Drawings and Finish Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Install in accordance with manufacturer's installation instructions.

D. Install plumb, level and secure.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 PROTECTION

A. Protect installed appliances from scratches, dents and theft until substantial completion.

3.4 CLEAN-UP

A. Remove all containers and related waste from job site at end of installation.

B. Clean appliances surfaces by methods approved by manufacturer.

END OF SECTION 11 30 13

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes manually operated roller shades with single rollers.

1.2 ACTION SUBMITTALS

A. General: All specified finishes are found in the Finish Schedules on the Drawings.

B. Product Data: For each type of product.

C. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

D. Samples: For each exposed product and for each color and texture specified.

1. All submittals must be photographed with digital submittal in addition to physical submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS (RS-1 AND RS-2)

A. Basis of Design: MechoShade Systems, Inc.; Mecho /5 System.

B. Other Acceptable Products: Subject to compliance with requirements, provide the following:

1. SWF Contract; SL20.

C. 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: Chain tensioner, sill mounted.

D. 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.

E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

F. 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.

G. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Exposed with endcaps.
b. Color and Finish: As selected by Architect from manufacturer's full range.

H. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
3. Endcap Covers: To cover exposed endcaps.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Weave: Basketweave.
3. Roll Width: 126 inches.
4. Orientation on Shadeband: Up the bolt.
5. Openness Factor and Color: As selected by Architect from manufacturer’s standard.

a. RS-1: Mechoshade 5 Thermoveil 1500 Series, 3 percent openness.
b. RS-2: Mechoshade 5 Thermoveil 1700 Series, 1 percent openness.

6. Color: As selected by Architect.
7. Locations: As indicated on Drawings and Finish Schedule.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 degrees F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Electrical Connections: Connect motor-operated roller shades 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.

E. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 36 23.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plastic-laminate-clad countertops.

B. Related Requirements:

1. Section 12 36 61.19 “Quartz Agglomerate Countertops” for quartz countertops.

1.2 ACTION SUBMITTALS

A. General: All specified finishes are found in the Finish Schedules on the Drawings.

B. Product Data: For each type of product.

C. Shop Drawings: For plastic-laminate-clad countertops.

1. Apply AWI Quality Certification label to Shop Drawings.

D. Samples: Plastic laminates in each type, color, pattern, and surface finish required.

1. All submittals must be photographed with digital submittal in addition to physical submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For the following:

1. Composite wood products.
2. High-pressure decorative laminate.
3. Adhesives.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: AWI's Quality Certification Program accredited participant.

B. Installer Qualifications: AWI's Quality Certification Program accredited participant.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS (PLAM)

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that countertops comply with requirements of grades specified.

B. Manufacturers and Products: As indicated on Finish Schedules on Drawings.

C. Grade: Custom.

D. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Wilsonart LLC.
b. Formica Corporation.
c. Panolam Surface Systems; Pionite.

E. 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 Finish Schedules on Drawings.
2. As selected by Architect from manufacturer's full range in the following categories:

a. Solid colors, matte finish.
b. Patterns, matte finish.

F. Edge Treatment: Exposed hardwood veneer plywood.

G. All composite wood products, including particle board, plywood, OSB, MDF, cabinetry, and any other applicable wood product, must be certified as urea-free.

H. Core Material: Hardwood veneer plywood, Appleply or Europly.

I. Core Thickness: 3/4 inch.

1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

J. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

K. Paper Backing: Provide paper backing on underside of countertop substrate.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

1. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.

2.3 MISCELLANEOUS MATERIALS

A. Adhesives for Bonding Plastic Laminate: As selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
2. Contact Adhesive to meet 80g/L max.

2.4 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

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.

PART 3 - EXECUTION

3.1 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. 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. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inchesvariation from a straight, level plane.
2. Secure backsplashes to tops with concealed metal brackets at 16 inches on center and to walls with adhesive.
3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

F. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches on center Remove protection at Substantial Completion.

END OF SECTION 12 36 23.13

SECTION 12 36 61.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes quartz agglomerate countertops.

1.2 Related Requirements:

1. Section 06 41 00 “Architectural Wood Casework” for cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings:

1. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
2. Indicate fastening methods, relevant dimensions, relationship to other surface and support framing, subtop information and seam location.

C. Samples: For each type of material exposed to view.

1. All submittals must be photographed with digital submittal in addition to physical submittal.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build minimum 24 inch by 24 inch mockup of typical countertop as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS (Q-1, Q-2 AND Q-3)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceasarstone.
2. Daltile.

B. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

C. Colors: As indicated on Finish Schedule on Drawings.

D. Particleboard: ANSI A208.1, Grade M-2.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.
4. Inside Corners: Slightly eased (no radius).
5. Outside Corners: Slightly eased (no radius).

C. Countertops: 2 cm -thick, quartz agglomerate with front edge built up with same material.

D. Backsplashes: 2 cm-thick, quartz agglomerate.

E. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 10 "Interior 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 quartz agglomerate 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. Install aprons to backing and countertops with adhesive.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 07 92 10 "Interior Joint Sealants."

END OF SECTION 12 36 61.19

SECTION 12 48 13 - ENTRANCE FLOOR MATS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes resilient tile entrance mats and accessories.

1.2 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. General: All specification finishes are found in Interior Finish Legends.

1. All submittals must be photographed with digital submittal in addition to physical submittal.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats.

C. Shop Drawings:

1. Note areas with different floor thickness.

D. Samples: For the following products, in manufacturer's standard sizes:

1. Floor Mat: Assembled sections of floor mat.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS, GENERAL

A. Accessibility Standard: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 RESILIENT ENTRANCE MATS (MAT-1)

A. Products: Subject to compliance with requirements, provide the following:

1. C/S Group; Pedimat M1 Entrance Floor Mat.

B. Roll-up, Vinyl-Rail Hinged Mats: Vinyl-acrylic tread rails 2 inches wide by 3/8 inch thick, with slotted or perforated hinges.

1. Tread Inserts: MonoTuft HD Carpet, 33-oz/sy.
2. Tread Rails: PET-G.

3. Surface Rails: Aluminum.
4. Rail Color: As selected by Architect from full range of industry colors.
5. Hinges: Vinyl.
6. Mat Size: As indicated.

2.3 FRAMES

A. Surface-Mounted Frames: Manufacturer's standard extrusion.

1. Frame Type: Tapered Aluminum.
2. Extruded Aluminum: ASTM B221 (ASTM B221M), Alloy 6061-T5.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by walk-off mat manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed walk-off mat and is recommended or provided by walk-off mat manufacturer.

1. Use adhesives with VOC content not more than 50 g/L.

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by walk-off mat manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

2.5 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by walk-off mat manufacturer.
2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving walk-off mat.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

3.2 PREPARATION

A. 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 wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

B. 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 walk-off manufacturer.

C. Installer to broom and vacuum clean substrates to be covered immediately before installing walk-off mat.

3.3 INSTALLATION

A. Install walk-off mats to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

3.4 CLEANING AND PROTECTING

A. Installer shall perform the following operations immediately after installing walk-off:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by walk-off manufacturer.
2. Remove yarns that protrude from walk-off surface.
3. Vacuum walk-off mat using commercial machine with face-beater element.

B. Protect walk-off mat 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 walk-off mat manufacturer and walk-off mat adhesive manufacturer.

END OF SECTION 12 48 13

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work includes the following:
   1. Provide all design, materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, start-up, testing and operation of all fire suppression work for this project as defined by Division 21 and the Contract Documents.
   2. Work shall conform to all relevant NFPA standards and local ordinances.

1.2 DEFINITIONS AND ABBREVIATIONS

A. The word "provide", as used in these specifications, means "furnish and install".

B. The word "accepted", as used in these specifications, means the acceptance of the Engineer and/or Architect.

C. Abbreviations:

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
F	Fahrenheit
FM	Factory Mutual Engineering Corporation
HI	Hydraulic Institute
IBC	International Building Code
IMC	International Mechanical Code
MSS	Manufacturers' Standardization Society of the Valve and Fittings Industry, Inc.
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
psi	Pounds per square inch
psig	Pounds per square inch gauge pressure
SMACNA	Sheet Metal and Air-Conditioning Contractors' National Association
UL	Underwriters' Laboratories, Inc.
V	Volts
UPC	Uniform Plumbing Code
WAC	Washington Administrative Code
WSEC	Washington State Energy Code
WISHA	Washington Industrial Safety & Health Act

D. Refer also to Division 1 for additional acronyms and for additional definitions and explanations of terms.

E. Some of these abbreviations may not be used. All other abbreviations shall have the definition commonly associated with them by the trade or industry. Confirm the meaning of any unclear or unknown definitions with the Architect before proceeding with any work.

1.3 PLANS AND SPECIFICATIONS

A. The drawings and specifications are intended to describe all fire suppression work, unless otherwise shown. Provide all materials which are necessary for the proper completion of the installation and operation of the equipment.

B. The drawings are diagrammatic and do not show exact or complete piping configurations or the necessary number and types of fittings. Provide all labor and materials required to complete the work indicated and per code.

C. Any questions occurring during bidding or construction shall be resolved by direction in writing from the Architect. Any issues not so resolved or any conflicts shall result with the contractor bidding, furnishing and installing the most stringent condition. No exceptions.
D. During bidding, provide a line item breakout additive alternate cost for a fire protection booster pump. The need for a fire sprinkler pump will be determined during the fire suppression system design process by the fire sprinkler designer. If required the line item breakout will represent the additive costs to provide the pump, power for the pump, additional controls, coordination of the fire pump, and the design effort related to the pump.

1.4 LAW AND ORDINANCES

A. General:
1. All fire suppression work specified under this contract shall be in strict accordance with the latest rules and regulations of all applicable codes.
2. Contractor is not relieved from furnishing and installing work shown or specified which may be beyond requirements of ordinances, laws, regulations, and codes. This work shall be included within the construction contract.
3. Contractor is not relieved from furnishing and installing work required by the local Authority Having Jurisdiction (AHJ) which may be beyond requirements of ordinances, laws, regulations, and codes. Review by AHJ of systems should be sequenced to accommodate time in the construction schedule for revisions/correction and second review by AHJ.

B. Approval: File necessary plans, prepare documents and obtain necessary approval of governmental departments having jurisdiction and required certificates of inspection for work and deliver same to Architect before requesting acceptance and final payment for work.
C. Permits, Certificates and Taxes: Procure and pay for all the necessary permits, certificates, and taxes for all work as required in the General and Supplementary Conditions. In addition, perform all ordinance and performance tests in the presence of the Architect, and be responsible for advance notification. Submit copies of signed and accepted permits to the Architect.

1.5 SUBMITTALS

A. General:
1. Deliver material, submittal and shop drawing data to Architect in accordance with the requirements of the General Conditions, Supplemental Conditions, this section and Division 1.
2. Do not place orders for materials, fixtures, or equipment until approval is obtained from Architect in writing. Verbal approval shall not be contractually binding and will not be considered.
3. Make every attempt to respond to the reviewer’s comments in a timely manner.
4. The project construction schedule, beginning with the acceptance of the bid and confirmation of the successful bidder, is not the responsibility of the Consultant Engineer. The Contractor's schedule shall recognize and accommodate the review intervals specified herein. The schedule shall identify and accommodate the specified submittal and re-submittal review and response period. The contractor shall not anticipate or base the construction schedule on expedited reviews or reviews of partial submittals. Submittals shall be organized and delivered as specified. No exceptions.

B. Submit
1. Provide submittals for all equipment and systems indicated and specified by the Contract Documents
2. Provide five copies of the submittals in 3-ring notebook(s), organized by specification section, large enough to accept total volume of material to the Architect. Reference project information shall include
a. Project title,
b. Project number and Location,
c. Architect,
d. Engineer,
e. Contractor,
f. Subcontractor(s),

g. Submission date,
h. Specification sections submitted.

3. Label cover and binder end. Clearly indicate any items not included with submitted assemblies. Consultant Engineer will not take responsibility for collating submitted information into notebooks.
4. Submit only the work of one section per submittal. Submittals within a section shall be organized by subsection so that they are in the order they appear in the specification. Items not in the specification but shown only on the plans shall be included as though they appear at the back of the specification section and be labeled with the appropriate sheet number or be submitted in a separate submittal.
5. Label every submitted product with the associated specification section reference (e.g. 210500-1.05.B.3-“Product A”) and indicate the specific product if multiple products, sizes, models, etc., are shown.
6. The Contractor shall make every attempt to respond to the Consultant Engineer's comments in a timely manner. Submittal material requiring more than three Consultant Engineer reviews will be considered non-responsive. The Consultant Engineer may elect to charge the contractor on an hourly basis for additional consultation as required to secure a responsive submittal.
7. Submittals not bound and organized as specified will be rejected.
8. Digital PDF submittals will be accepted in lieu of physical submittals at the discretion of the Architect and must meet the same organizational requirements.

C. Standards Compliance and Certification:
1. Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI), American Society for Mechanical Engineers (ASME), Underwriters Laboratories Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and accepted.
2. Submit certification for the product submitted and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply the product does not meet all requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material." Simply state that the product conforms to the requirements specified.

D. Substitution of Materials: Substitutions of materials will only be considered where specified materials cannot be obtained or where prior approval has been provided. All work and equipment required incidental to the substitution is the responsibility of the Contractor. Refer to Division 1 for the requirements related to substitutions and prior approvals.

1.6 SHOP DRAWINGS

A. Shop drawings required shall include but are not limited to:
1. Plan location of all Division 21 equipment.
2. All fire protection pipe and sprinkler head layouts.
3. Access Doors for all Division 21 equipment.
4. Fire Sprinkler Room(s) layout.
5. Location and size of all access panels required.

B. All shop drawings shall bear the Contractor's stamp, certifying that the contractor has:
1. Verified all field dimensions and quantities as shown on the shop drawings.
2. Verified all field construction criteria, materials, catalog numbers and similar data.
3. Verify that system is designed to all appropriate NFPA codes.
4. Reviewed and coordinated submittal data with requirements of the work and the Contract Documents with the field conditions.
5. Coordinated all equipment clearances and manufacturers’ written installation requirements.
6. Coordinated with all other trades’ routing, access, space and clearance requirements.

C. Shop drawings shall be drawn on the Architect's final backgrounds; at a minimum, all walls, room numbers, and plan name indicating floor are to be included on the shop drawings. Drawings should be performed by Computer Aided Drafting software (preferred) or drawn neatly by hand in permanent ink. Any field verified dimensions should be shown, as well as each piece of equipment related to the shop drawing. Do not resubmit the fire suppression or architectural sheets marked-up with notes.
D. Submit in mailing tube if drawing cannot be shipped flat. Do not fold.
E. Submit drawings the same size as the bid set, 8-1/2" x 11", 11" x 17" or 24" x 36" unless size of the items depicted makes such sizes impractical. Shop drawings may be submitted as PDFs but must be full size or half-size documents.
F. Acceptance does not extend to products not represented by or included on the shop drawings, nor does it extend to verification of quantity or dimension surveys. Review is limited to checking for conformance with the design concept and to verify that the contractor has taken care in coordination between trades. No changes from the provisions of the Contract Documents are intended and the Contractor remains responsible for compliance with the provisions therein.
G. Shop drawings that do not meet the above requirements will be returned without review.

1.7 CONSULTANT REVIEW

A. Review is general and does not:
   1. Permit departure from Contract Documents.
   2. Relieve Contractor from responsibility for error in detail, quantities, dimensions or related items.
   3. Relieve the contractor from providing a full code compliant system or installation, as determined by the governing code or reviewing official.
   4. Accepted departure from previous instructions or detail.
   5. Relieve Contractor of responsibility to provide all components, wiring, etc., required to make item operational or usable.
   6. Relieve Contractor of the responsibility to coordinate all power and clearance requirements with other trades.
   7. Imply acceptance of items for which no data is submitted.
B. Work which requires submittals shall not be started without Consultant Engineer's review.
C. Allow fifteen (15) working days for Consultant Engineer review.
D. Acceptance will be indicated by a signed stamp affixed to the submittal, or a letter over the Consultant Engineer's signature. No exceptions.
E. Re-submittals
   1. Items of materials, fixtures and equipment not accepted by Consultant Engineer shall be resubmitted within 15 working days after Consultant Engineer review. If Contractor fails to submit items listed below for approval or resubmit in the event of disapproval within specified time, Contractor shall provide materials, fixtures and equipment as scheduled on drawings. Where equipment is not scheduled the Contractor shall provide materials, fixtures and equipment as identified in the specifications.
   2. Decision of Consultant Engineer shall be final and binding and items shall be provided without change in contract price or time of completion.
   3. Where clarification is requested a response in writing may be accepted in lieu of a full resubmittal. Final documentation of the accepted, ordered, installed, item should still be provided.

1.8 PUNCH LIST & WARRANTEE

A. Refer to the requirements of Division 1.
B. Inform project design team of construction progress and schedule a site visit by the Engineer prior to covering pipe, duct, equipment that will, once construction is completed, be otherwise hidden from view. A substantial completion site visit will be completed at a later date.
C. Punch list items shall be provided to the contractor in writing. A written response indicating the corrective action taken or explanation of the situation must be returned to the Engineer.

PART 2 - PRODUCTS

2.1 EXPANSION SHELLS AND BOLTS

A. Expansion Shells for Rod Hangers
   1. Phillips, Gregory, Omark, or Fastite in holes drilled in concrete.
B. Expansion Bolts for Equipment
   1. USM or McCullough in holes drilled in concrete.
   2. No screwed adapters underground.

2.2 FORMED STEEL CHANNELS AT SLAB

A. Provide for all equipment; number and size per manufacturer's recommendations or as indicated.

2.3 ANCHOR BOLTS

A. Provide for all equipment; number and size per manufacturers' recommendations or as indicated.

2.4 SUPPLEMENTARY STEEL FRAMING

A. Standard structural steel shapes or Schedule 40 steel pipe, galvanized with extra-heavy finish.

2.5 SLEEVES

A. Materials, General Schedule: 40 galvanized steel pipe with unthreaded ends, or standard structural steel shapes.
B. Firestopping: Three-hour rated penetration sealing system per UL 1479 and ASTM E-814. 3M Fire Barrier, Dow Chemical RTV, Manville Cerafiber, or accepted.
C. Seal: Seal annulus with bolted compression type seal. Link Seal or accepted equal.

2.6 WELDING TO BUILDING STRUCTURAL MEMBERS

A. Not allowed except as indicated.

2.7 NAMEPLATES

A. Laminated black plastic with lettering cut through to white background. Plastic strips with raised letters made by a marking device are not acceptable.

2.8 VALVE TAGS

A. Shall be 0.030" thick brass, 1" diameter size; state the service and destination of the line controlled. Provide tag inscriptions made with a lettering device with 5/16" high cut lettering. Laminated plastic tags, construction similar to nameplates will also be acceptable.
B. Provide a valve tag list that assigns valve tag numbers to functions.

2.9 PIPING IDENTIFICATION

A. Self adhesive, pre-printed identification labels indicating direction of flow and pipe contents, using common industry abbreviations. Identify pipe at every change of direction.
B. Comply with the latest ANSI Pipe Marking Standards for letter height and label placement.

2.10 PAINTING

A. Paint all exposed fixtures and equipment in conformance with Division 10. Coordinate color with Architect. Refer to Architectural documents for paint and application requirements.

2.11 EQUIPMENT LISTING REQUIREMENTS

A. Whenever UL Standards exist for equipment provide UL-accepted equipment bearing the UL label.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 PREPARATION

A. Field Measurements: Field-verify locations of new and existing work prior to commencing work of this Section.
B. Protect surrounding areas and surfaces to preclude damage from work of this Section.

3.3 INSTALLATION, ERECTION, AND PERFORMANCE

A. Install, apply, erect, and perform the work in accordance with "Quality Assurance" provisions, specifications, and manufacturers' installation instructions and directions. Where these may be in conflict, the more-stringent requirements govern.

3.4 CLEANING

A. Promptly remove waste material and rubbish caused by fire protection construction work. At completion of the project, clean all equipment, piping and fixtures installed or provided under this Contract.

3.5 CUTTING AND PATCHING

A. Cut all openings and holes required for fire protection work. Carefully examine existing conditions prior to commencing work.

3.6 ACCESSIBILITY

A. Locate valves, controls, etc., to be easily accessible.

B. Install all equipment that requires periodic servicing or repairs to be readily accessible. Otherwise, obtain Architect's approval of location. Where valve and equipment is concealed behind access panels or by ceiling tiles, label panel or tile appropriately.

C. Provide access panels as required for piping, valve or equipment access. Refer to Architectural Documents to determine fire-rating requirements. The access panel size shall be in proportion to the equipment, piping, or valve requiring access. Minimum access panel size shall be 12" x 12". Due to the diagrammatic nature of the drawings, not all access panels are shown. Access panels are to be included as part of the base bid work.

3.7 SPECIAL PROTECTION

A. Exercise maximum precaution to provide positive protection for any existing building/structure and equipment from damage of any kind, and in particular prevent any water and dust seepage into the existing building.

B. Storage of materials: Make all necessary provisions to prevent damage or corrosion of materials. Coordinate on-site storage with General Contractor or make provisions to store off site.

3.8 EQUIPMENT INSTALLATION

A. General: Provide supports for all equipment and appurtenances as required, including braces as required for seismic restraint; these include frames or supports for pumps and air handlers and all fire protection equipment. Bracing shall conform with the requirements of IBC and IMC. Include the design, engineering and installation of these members is the responsibility of the contractor.

B. Suspended Equipment: Provide hangers from structure as required; span between structural members with additional structural steel as required to mount equipment in locations shown. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.

C. Floor-Mounted Equipment - General:

1. Provide machine and floor or foundation fastenings; set equipment on concrete pads. Provide equipment base drawings, bolt-setting information, and anchors for all floor-mounted equipment. Provide concrete expansion anchors through concrete equipment pads, installed into existing structural concrete slabs.
2. Install all equipment at the locations, and to the dimensions indicated. Set equipment accurately with principal centerlines and level, using manufacturers' leveling screws, blocks, shims, or wedges. Do not distort equipment or base plates.
3. Install all equipment and piping such as to provide adequate access for service. This includes access to equipment covered in other divisions or sections of this specification.

3.9 PIPE SUPPORTS

A. Attach hangers and support rigidly to the building structure; provide supplementary steel framing and bracing at all changes in pipe direction to resist thrust of flowing water. Provide seismic bracing as required by codes. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.

B. Provide additional steel support for piping runs through tight confinements. Provide trapeze system with vibration isolation and seismic restraint for piping through joists and as applicable, due to accessibility equipment.

3.10 EXPANSION SHELLS AND BOLTS

A. Use only where necessary to support piping or equipment from existing concrete slabs or walls.

3.11 SLEEVES AND SEALING OF SLEEVES

A. Provide all sleeving and sealing of sleeves for pipes.

B. Provide annular clear space of approximately 1/4" to 1/2"; size to accommodate insulation passing through sleeve where applicable.
C. Wherever piping passes through any floor slab above occupied space or equipment, provide pipe sleeves extending 1" above floor.
D. Set sleeves in place prior to pouring of concrete in new construction; core drill and grout sleeves in place for unit masonry construction and existing construction.
E. Sealing of sleeves through floor slabs and firewalls: Provide firestop system by 3M or accepted equal.
F. Sealing of sleeves for below grade floors and walls: Provide Link Seal. Refer to 221000.

3.12 NAMEPLATES
A. Provide for all equipment; fasten mechanically. Label access panel or ceiling appropriately for concealed equipment.

3.13 VALVE TAGS
A. Provide on all new valves; fasten with brass chain to the valve stem.
B. Provide valve tag schedule (key) for identification of all system valves.

3.14 PIPING IDENTIFICATION
A. Provide pipe identification labels on not less than 10 foot centers, on both sides of a wall penetration, and at every change in direction, so that a label is visible from a standing position on the floor, not more than three feet from the wall.

3.15 PAINTING
A. General Paint exposed equipment, piping, and fire protection system appurtenances unless noted otherwise. Coordinate color with Architect. Refer also to Architectural Documents.
B. Application:
1. Thoroughly clean surfaces to be painted to remove dirt, grease and scale. Wash galvanized surfaces with mild solution of acid prior to painting to effectively clean oils from surface and to etch zinc.
2. Paint insulated surfaces and covered piping with one primer coat and two finish coats.
3. Paint exposed equipment, pipes and supports with one primer coat and two finish coats. Paint factory painted equipment to match colors selected by the Architect. Touch up damaged areas with paint to match factory color.
4. Paint the supporting devices for devices or systems specified to be painted.

3.16 MISCELLANEOUS EQUIPMENT AND FIXTURE CONNECTIONS
A. Provide piping and make all final connections in accordance with manufacturers' recommendations for Owner-furnished equipment and fixtures, and equipment and fixtures specified.
B. Perform on-site review and refer to manufacturers' shop drawings for details of connections. Provide rough-in at locations to conveniently serve items.

3.17 WIRING
A. Wiring shall conform to applicable sections of these specifications. Provide wiring from branch circuit over current device to motor controller to motor terminals, including installation of starter and all connections. Provide raceway and conductors as shown for remote control, or interlock connections. Coordinate other control wiring with Divisions 23 and 26 of the Specifications. Provide overload elements in controllers sized to match motor nameplate full load amperes. Space within controllers shall not be used as a junction box.
B. Provide resources for power for any fire suppression specific equipment, including but not limited to air-compressors, fire pumps, etc. Coordinate with Division 26.

END OF SECTION

SECTION 21 11 00 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes fire-suppression water-service piping and related components outside the building and service entrance piping through wall into the building and the following:
   1. Pipes, fittings, and specialties.
   2. Fire-suppression specialty valves.
   3. Concrete vaults.
   4. Protective enclosures.
   5. Alarm devices.

B. Utility-furnished products include water meters that are furnished to the site, ready for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
   2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 registered.

B. NSF Compliance as required by authorities having jurisdiction:
   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."
   3. Comply with NSF 372, "Drinking Water System Components - Lead Content"

C. University of Southern California Foundation for Cross-Connection Control and Hydraulic research (USC FCCCHR).
   1. Manual of Cross-Connection Control.

D. Regulatory Requirements:
   1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
   2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

E. Piping materials shall bear label, stamp, or other markings of specified testing agency.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

H. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
   1. Notify Architect no fewer than 10 days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, annealed temper.

B. Hard Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, drawn temper.

C. 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.

D. Copper, Pressure-Seal Fittings:
   1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
      a. Viega; Plumbing & Heating Systems, or approved equal.
   2. Standard: UL 213.
   3. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
   4. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

F. 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.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.

D. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Manufacturer's: Subject to compliance with requirements provide products by one of the following:
   a. Anvil International, Inc.
   b. Corcoran Piping Systems Inc.
   c. Shurjoint Piping Products.
   d. Star Pipe Products.
   e. Tyco Fire & Building Products LP.
   f. Venus Fire Protection Ltd.
   g. Victaulic Company.
   h. Viking Corporation.
2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.

1. Gaskets: AWWA C111, rubber.

G. Flanges: ASME B16.1, Class 125, cast iron.

2.3 SPECIAL PIPE FITTINGS

A. Ductile-Iron Flexible Expansion Joints:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation; Z190 or comparable product by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. MFG. Co.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products.
2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
3. Pressure Rating: 250 psig minimum.

B. Ductile-Iron Deflection Fittings:

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
   a. EBAA Iron, Inc.
   b. Or approved equal.

2. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
3. Pressure Rating: 250 psig minimum.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.
B. Material: high-density, cross-laminated PE film of 0.004-inch minimum thickness.
C. Form: Sheet or tube.
D. Color: Black .

2.5 JOINING MATERIALS

A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.
B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.
C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

2.6 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. Manufacturers: Subject to compliance with requirements provide products by one of the following:
a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Dresser Piping Specialties.
c. Ford Meter Box Company, Inc. (The); Pipe Products Division.
d. JCM Industries.
e. ROMAC Industries Inc.
f. Smith-Blair, Inc.; a Sensus company.
g. Viking Johnson.
2. 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.
3. Standard: AWWA C219.
4. Center-Sleeve Material: Stainless steel .
5. Gasket Material: Natural or synthetic rubber.
6. Pressure Rating: 200 psig minimum.
7. Metal Component Finish: Corrosion-resistant coating or material.

2.7 CORPORATION VALVES

A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Ford Meter Box Company, Inc. (The); Pipe Products Division.
2. Jones, James Company.
3. Master Meter, Inc.
4. McDonald, A. Y. Mfg. Co.
5. Mueller Co.; Water Products Division.
6. Red Hed Manufacturing & Supply.
B. Corporation Valves: Comply with AWWA C800. Include saddle and valve compatible with tapping machine and manifold.
1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.

2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.8 CURB VALVES

A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Ford Meter Box Company, Inc. (The); Pipe Products Division.
2. Jones, James Company.
3. Master Meter, Inc.
4. McDonald, A. Y. Mfg. Co.
5. Mueller Co.; Water Products Division.
6. Red Hed Manufacturing & Supply.

B. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.

C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

D. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.9 DETECTOR CHECK VALVES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries LLC; Wilkins; Model 310DA or comparable product by one of the following:
1. Watts Water Technologies, Inc.

B. Description: Iron with interior lining complying with AWWA C550 or that is FDA approved, grooved cover for access to internal parts, and flanged ends. Include serviceable corrosion resistant center guided check. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
1. Standards: UL 312 and FMG approved.
2. Pressure Rating: 175 psig.
3. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.
a. Water Meter Type: cu ft/min meter.

2.10 WATER METERS

A. Water meters are furnished by utility company.

B. Manufacturers: Subject to compliance with requirements provide products by one of the following:

1. AMCO Water Metering Systems.
2. Badger Meter, Inc.
3. Carlon Meter.
4. Hays Fluid Controls.
5. McCrometer.
6. Mueller Co.; Hersey Meters Division.
7. Neptune Technology Group Inc.
8. Sensus Metering Systems.

C. Displacement-Type Water Meters:
1. Description: With bronze main case.
2. Standard: AWWA C700.
3. Registration: Flow in cubic feet.

D. Turbine-Type Water Meters:
1. Standard: AWWA C701.
2. Registration: Flow in cubic feet.

E. Remote Registration System:
1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C707.
3. Registration: Flow in cubic feet.
4. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
5. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.11 PRESSURE-REDUCING VALVES

A. Water Regulators:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; Model 600XL (Lead Free) or comparable product by one of the following:
a. Cash Acme; a division of The Reliance Worldwide Corporation.
b. Watts; a division of Water Technologies, Inc.; Watts Regulator Company.
2. Description:
a. Standard: ASSE 1003.
b. Body Material: Bronze
c. Pressure Rating: Initial pressure of 150 psig.
d. End Connections: Threaded.
3. Capacities and Characteristics:
a. Size: NPS 1/2 to NPS 3.

B. Water Control Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; Model ZW209FP (Lead-Free) or comparable product by one of the following:
a. CLA-VAL Automatic Control Valves.
b. OCV Control Valves.
2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
a. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating, or stainless-steel body.
b. Pattern Globe - valve design.
c. Trim: Stainless Steel.
d. Pressure Rating: Initial pressure of 150 psig minimum.

e. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

3. If Project has more than one type or configuration of water control valve, delete subparagraph below and schedule water control valves on Drawings.

2.12 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; Model 375A (Lead-Free) or comparable product by one of the following:
   a. Conbraco Industries, Inc.
   b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Standard: ASSE 1013, CSA B64.4, IAPMO, USC FCCCHR, UL Listed, andAWWA C511.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
5. Size: NPS 1/2 to NPS 10.
6. Body: Stainless-steel for NPS 2 and smaller; stainless-steel for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
   a. Valves NPS 2 and smaller: Ball type with threaded ends on inlet and outlet.
   b. Valves NPS 2-1/2 and larger:
      1) Valve Type: OS&Y gate valves.
      2) End Connection: Flanged end connections.
   c. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
   d. Strainer Option: Cast iron wye strainer.
   e. Valve Monitoring Option: Integral relief monitor switch.
   f. For UL and FM approvals provide indicating-type shut-off valves.

B. Double-Check, Backflow-Prevention Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; Model 350A (Lead-Free) or comparable product by one of the following:
   a. Conbraco Industries, Inc.
   b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
5. Size: NPS 1/2 to NPS 12.
6. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight through low.
9. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
   a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
   b. Valves NPS 2-1/2 and Larger:
      1) Valve Type: OS&Y gate valves.
      2) End Connection: Flanged end connections
   c. Strainer Option: Cast iron wye strainer
   d. For UL and FM approvals, provide indicating-type shut-off valves.

C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; Model 475DA or comparable product by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standards: ASSE 1047 and is FM Global approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
5. Size: NPS 2-1/2 to NPS 10.
6. Body: Stainless steel.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:
   a. Valves: NPS 2-1/2 and Larger.
      1) Valve Type: OS&Y gate valves.
      2) End Connection: Flanged end connections.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
   c. Strainer Option: Cast iron wye strainer.
   d. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
      1) Water Meter Type: cu ft/min meter.

D. Double-Check, Detector-Assembly Backflow Preventers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; Model 450DA or comparable product by one of the following:
   a. Conbraco Industries, Inc.; Apollo Valves.
   b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Standards: ASSE 1048 and is FM Global approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
5. Size: NPS 2-1/2 to NPS 10.
6. Body: Stainless steel.
7. End Connections: Flanged.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
   a. Valves: NPS 2-1/2 or larger.
      1) Valve Type: OS&Y gate valves.
      2) End Connection: Flanged end connections
   b. Strainer Option: Cast iron wye strainer.
   c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
      1) Water Meter Type: cu ft/min meter.

E. Backflow Preventer Test Kits:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; Model TG-5 or comparable product by one of the following:
   a. Conbraco Industries, Inc.; Apollo Valves.
   b. Midwest Instrument Co.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.13 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" on cover; and with slotted, open-bottom base section of length to fit over service piping.
1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" on top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.
C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" on cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches square.

2.14 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857, and made according to ASTM C 858.
B. Ladder: ASTM A 36/A 36M, steel ladder; or PE-encased steel steps.
C. Manhole: ASTM A 48/A 48M, Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
    1. Dimension: 24-inch minimum diameter unless otherwise indicated.
D. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.
    1. Dimension: 24-inch minimum diameter unless otherwise indicated.
E. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.15 ALARM DEVICES

A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.
B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.
C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with excavating, trenching, and backfilling requirements in Section 312200 "Eartwork."

3.2 PIPING INSTALLATION

A. Water-Main Connection: Arrange with water 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 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 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's 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.

F. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
1. Install encasement for tubing according to ASTM A 674 or AWWA C105.

G. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
1. Install encasement for piping according to ASTM A 674 or AWWA C105.

H. Install PE pipe according to ASTM D 2774 and ASTM F 645.

I. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

J. Install fiberglass AWWA pipe according to AWWA M45.

K. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
1. Under Driveways: With at least 36 inches of cover over top.
2. Under Railroad Tracks: With at least 48 inches of cover over top.
3. In Loose Gravelly Soil and Rock: With at least 24 inches of additional cover.

L. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

M. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.
1. Terminate fire-suppression water-service piping within the building at the wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.

N. 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.

O. Comply with requirements in Section 211313 "Wet-Pipe Sprinkler Systems," for fire-suppression-water piping inside the building.

P. Comply with requirements in Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for above-ground applications unless otherwise indicated.

B. Install unions adjacent to each valve in tubing NPS 2 and smaller.

C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
D. Ream ends of tubes and remove burrs.
E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
F. Copper-Tubing, Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
G. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
H. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
I. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.
J. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
K. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
L. 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.
M. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.
N. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
O. Do not use flanges or unions for underground piping.

3.4 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 in fire-suppression water-service piping according to NFPA 24 and the following:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
   3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 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. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
C. UL-Listed or FM Global-Approved 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.
D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.
F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.
H. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.6 DETECTOR CHECK VALVE INSTALLATION

A. Install in vault or aboveground.
B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
C. Support detector check valves and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.7 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.
B. Water Meters: Install water meters in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets, and include valved bypass around meters unless prohibited by authorities having jurisdiction.
C. Support water meters and piping NPS 3 and larger on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.8 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.9 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 and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.10 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.
B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.11 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.12 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.
B. Install protective pipe bollards on three sides of each freestanding fire-department connection. Pipe bollards are specified in Section 055000 "Metal Fabrications."

3.13 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.
B. Supervisory Switches: Supervise valves in open position.
    1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.

2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:
1. Valves: Install chain and padlock on open OS&Y gate valve.
2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Section 283111 "Digital, Addressable Fire-Alarm System."

3.14 CONNECTIONS

A. Connect fire-suppression water-service piping to utility water main. Use tapping sleeve and tapping valve or service clamp and corporation valve.

B. Connect fire-suppression water-service piping to interior fire-suppression piping.

C. Connect waste piping from concrete vault drains to storm-drainage system. Comply with requirements in Section 334000 "Storm Drainage Utilities" for connection to storm sewer.

3.15 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B. 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.

C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.
1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare test and inspection reports.

3.16 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312200 "Earthwork."

B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 220553 "Identification for Plumbing Piping and Equipment."

3.17 CLEANING

A. Clean and disinfect fire-suppression water-service piping as follows:
1. Purge new 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 it 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 it to stand for three 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.

3.18 PIPING SCHEDULE

A. Underground fire-suppression water-service piping NPS 2 and smaller shall be one of the following:
    1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
    2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.

B. Underground fire-suppression water-service piping NPS 3 shall be one of the following:
    1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
    2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.

C. Underground fire-suppression water-service piping NPS 4 shall be one of the following:
    1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
    2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.

D. Underground fire-suppression water-service piping NPS 6 to NPS 12 shall be one of the following:
    1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
    2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.

E. Aboveground fire-suppression water-service piping shall be one of the following:
    1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
    2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.

3.19 VALVE SCHEDULE

A. Underground fire-suppression water-service shutoff valves NPS 2 and smaller shall be corporation valves or curb valves with ends compatible with piping.

B. Meter box fire-suppression water-service shutoff valves NPS 2 and smaller shall be meter valves.

C. Underground fire-suppression water-service shutoff valves NPS 3 and larger shall be one of the following:

1. 250-psig, AWWA, iron, nonrising-stem, resilient-seated gate valves.
2. 250-psig, UL-listed, iron, nonrising-stem gate valves.

D. Indicator-post underground fire-suppression water-service valves NPS 3 and larger shall be 250-psig, UL-listed, iron, nonrising-stem gate valves with indicator-post flange.

E. Standard-pressure, aboveground fire-suppression water-service shutoff valves NPS 3 and larger shall be one of the following:
1. 250-psig, AWWA, iron, nonrising-stem, resilient-seated gate valves.
2. 250-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves.

F. Fire-suppression water-service check valves NPS 3 and larger shall be one of the following:
1. UL-listed check valves.
2. UL-listed or FM Global-approved detector check valves.

END OF SECTION

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe and fittings.
   2. Specialty valves.
   3. Air vent.
   4. Sprinkler piping specialties.
   5. Sprinklers.
   6. Alarm devices.
   7. Pressure gauges.

B. Related Requirements:
   1. Section 331100 "Water Utilities" for application of valves in fire-suppression water-service piping.

1.2 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig .

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For wet-pipe sprinkler systems.
   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.

B. Field Test Reports:
   1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
   2. Fire-hydrant flow test report.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by NICET Level III-certified technician, "Water-Based Systems Layout."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Sprinkler system equipment, specialties, accessories, installation, and testing to comply with .

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

D. High-Pressure Piping System Component: Listed for 300-psig working pressure.

E. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Available fire-hydrant flow test records indicate the following conditions:
   a. No available data.
2. Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping, valves, and backflow preventers.
3. Sprinkler Occupancy Hazard Classifications:
4. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Residential (Dwelling) Occupancy: 0.05 gpm/sq. ft. over 400 sq. ft. area.
   b. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500 sq. ft. area.
   c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq. ft. over 1500 sq. ft. area.
   d. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over 1500 sq. ft. area.
   e. Extra-Hazard, Group 1 Occupancy: 0.30 gpm/sq. ft. over 2500 sq. ft. area.
   f. Extra-Hazard, Group 2 Occupancy: 0.40 gpm/sq. ft. over 2500 sq. ft. area.
   g. Special Occupancy Hazard: As determined by authorities having jurisdiction.
5. Maximum protection area per sprinkler according to UL listing.
6. Maximum Protection Area per Sprinkler:
   a. Residential Areas: 400 sq. ft. .
   b. Office Spaces: 120 sq. ft. .
   c. Storage Areas: 130 sq. ft. .
   d. Mechanical Equipment Rooms: 130 sq. ft. .
   e. Electrical Equipment Rooms: 130 sq. ft. .
   f. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

F. Obtain documented approval of sprinkler system design from authorities having jurisdiction.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight Steel Pipe: Galvanized- and black-steel pipe, ASTM A53/A53M, , Grade B . Pipe ends may be factory or field formed to match joining method.

B. Schedule 30 Steel Pipe: Galvanized- and black-steel pipe, ASTM A135/A135M; ASTM A795/A795M, ; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Thinwall Steel Pipe: Galvanized- and black-steel pipe, ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

E. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M thin-wall with plain ends and wall thickness less than Schedule 10.

F. Hybrid Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.

G. Schedule 5 Steel Pipe: ASTM A135/A135M or ASTM A795/A795M lightwall with plain ends.
H. Steel Pipe Nipples: Galvanized and black steel, ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
I. Steel Couplings: Galvanized and uncoated steel, ASTM A865/A865M, threaded.
J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
    1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
        a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
        b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
    2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
K. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
    1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
L. Grooved-Joint, Steel-Pipe Appurtenances:
    1. Manufacturers: Subject to compliance with requirements, provide products by the following:
        a. CPS Products, Inc.
        b. Tyco Fire Products
        c. Or approved equal.
    2. Pressure Rating: 250-psig minimum.
    3. Grooved-End Fittings for Steel Piping: Galvanized grooved-end fittings, ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
    4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 COVER SYSTEM FOR SPRINKLER PIPING

A. Manufacturers: Subject to compliance with requirements, undefined:
    1. DecoShield Systems, Inc, or approved equal.
B. Description: System of support brackets and covers made to protect sprinkler piping.
C. Brackets: Glass-reinforced nylon.
D. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
B. Pressure Rating:
    1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
    2. High-Pressure Piping Specialty Valves: 300-psig.
C. Body Material: Cast or ductile iron.
D. Size: Same as connected piping.
E. End Connections: Flanged or grooved.
F. Alarm Valves:
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Globe Fire Sprinkler Corporation.
        b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.

c. Viking Group Inc.
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, and fill-line attachment with strainer.
5. Drip cup assembly pipe drain with check valve to main drain piping.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Automatic (Ball Drip) Drain Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America, or approved equal.
2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.5 AIR VENT

A. Automatic Air Vent:
1. Manufacturers: Subject to compliance with requirements, undefined:
a. CLA-VAL.
b. Metraflex Company (The), or approved equal.
2. Description: Automatic air vent that automatically vents trapped air without human intervention.
3. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler systems.
4. Vents oxygen continuously from system.
5. Float valve to prevent water discharge.
6. Minimum Water Working Pressure Rating: 175 psig.

2.6 SPRINKLER PIPING SPECIALTIES

A. Flow Detection and Test Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. AGF Manufacturing, Inc.
b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America, or approved equal.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 300 psig.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

B. Sprinkler Inspector's Test Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AGF Manufacturing, Inc.
b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
c. Viking Group Inc.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

3. Pressure Rating: 300 psig.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

2.7 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Globe Fire Sprinkler Corporation.
   2. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
   3. Viking Group Inc.
B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
C. Pressure Rating for Residential Sprinklers: 175-psig maximum.
D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
E. Pressure Rating for High-Pressure Automatic Sprinklers: 300 psig.
F. Automatic Sprinklers with Heat-Responsive Element:
   1. Early-Suppression, Fast-Response Applications: UL 1767 .
   2. Nonresidential Applications: UL 199 .
   3. Residential Applications: UL 1626 .
   4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
G. Sprinkler Finishes: Chrome plated .
H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
   1. Ceiling Mounting: Chrome-plated steel, one piece, flat .
   2. Sidewall Mounting: Chrome-plated steel Plastic, white finish, one piece, flat.
I. Sprinkler Guards:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
      b. Victaulic Company.
      c. Viking Group Inc.
   2. Standard: UL 199.
   3. Type: Wire cage with fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

A. Alarm-device types to match piping and equipment connections.
B. Water-Motor-Operated Alarm:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Globe Fire Sprinkler Corporation.
      b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
      c. Viking Group Inc.
   2. Standard: UL 753.
   3. Type: Mechanically operated, with Pelton wheel.

4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 8-1/2-inches diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Water-Flow Indicators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ITT McDonnell & Miller.
   b. Viking Group Inc, or approved equal.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Barksdale, Inc.
   b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
   c. Viking Group Inc.
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Fire-Lite Alarms; Honeywell International, Inc, or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.9 PRESSURE GAUGES

A. Manufacturers: Subject to compliance with requirements, undefined:
1. AMETEK, Inc, or approved equal.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gauge Range: 0- to 250-psig minimum .

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 331100 "Water Utilities" for exterior piping.

B. Install shutoff valve, check valve, pressure gauge, and drain at connection to water service.

3.3 INSTALLATION OF PIPING

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.

N. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices .

O. Fill sprinkler system piping with water.

P. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    1. Apply appropriate tape or thread compound to external pipe threads.
    2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
I. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
    1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
M. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
N. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
O. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
P. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

Q. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
R. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.

3.5 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

3.6 INSTALLATION OF VALVES AND SPECIALTIES

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
D. Specialty Valves:
1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
E. Air Vent:
1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
3. Pipe from outlet of air vent to drain.

3.7 INSTALLATION OF SPRINKLERS

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.10 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
C. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2 and Smaller, to be one of the following:
    1. Black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
    2. or standard-weight black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    3. or black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    4. or black-steel pipe with plain ends; welding fittings; and welded joints.
D. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2-1/2 to NPS 4, to be one of the following:
    1. Black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
    2. or Standard-weight black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    3. or black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    4. or black-steel pipe with plain ends; welding fittings; and welded joints.
E. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 5 and Larger, to be one of the following:
    1. Black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
    1. or standard-weight black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    2. or black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    3. or black-steel pipe with plain ends; welding fittings; and welded joints.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
    1. Rooms without Ceilings: Upright sprinklers.
    2. Rooms with Suspended Ceilings: Pendent sprinklers Recessed sprinklers Flush sprinklers Concealed sprinklers Pendent, recessed, flush, and concealed sprinklers as indicated.
    3. Wall Mounting: Sidewall sprinklers.
    4. Spaces Subject to Freezing: Upright sprinklers Pendent, dry sprinklers Sidewall, dry sprinklers Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated .
    5. Special Applications: .
B. Provide sprinkler types in subparagraphs below with finishes indicated.
    1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
    2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
    3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
    4. Residential Sprinklers: Dull chrome.
    5. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

SECTION 22 05 00 - COMMON WORK PLUMBING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Work includes the following: Provide all materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, testing and operation of all mechanical work for this project.

B. Work includes the following:
   1. Motors
   2. Motor Control equipment
   3. Supports and support accessories
   4. Anchoring Hardware
   5. Identification
   6. Balancing work
   7. Painting

1.2 DEFINITIONS AND ABBREVIATIONS

A. The word "provide", as used in these specifications, means "furnish and install".

B. The word "accepted", as used in these specifications, means the acceptance of the Engineer.

C. Definitions and abbreviations of all terms shall be in accordance with applicable definitions of:

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
FM	Factory Mutual Engineering Corporation
HI	Hydraulic Institute
MSS	Manufacturers' Standardization Society of the Valve and Fittings Industry, Inc.
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
SMACNA	Sheet Metal and Air-Conditioning Contractors' National Association
UL	Underwriters' Laboratories, Inc.
IBC	Washington State Building Code
UPC	Uniform Plumbing Code
IMC	Washington State Mechanical Code
WAC	Washington Administrative Code
WSEC	Washington State Energy Code
WISHA	Washington Industrial Safety & Health Act

D. Refer also to Division 1 for additional acronyms and for additional definitions and explanations of terms.

E. Some of these abbreviations may not be used. All other abbreviations shall have the definition commonly associated with them by the trade or industry. Confirm the meaning of any unclear or unknown definitions with the Architect before proceeding with any work.

1.3 PLANS AND SPECIFICATIONS

A. The drawings and specifications are intended to cover all mechanical work, unless otherwise shown. Provide all materials that are necessary for the proper completion of the installation or operation of the equipment.
B. The drawings are diagrammatic and do not show exact or complete piping configurations or the necessary number and types of fittings. Provide all labor and materials required to complete the work indicated.
C. Any questions occurring during bidding or construction shall be resolved by direction in writing from the Architect. Any issues not so resolved or any conflicts shall result with the contractor bidding, furnishing and installing the most stringent condition. No exceptions.

1.4 LAW AND ORDINANCES

A. General:
   1. All mechanical work specified under this contract shall be in strict accordance with the latest rules and regulations of all applicable codes.
   2. Contractor is not relieved from furnishing and installing work shown or specified which may be beyond requirements of ordinances, laws, regulations, and codes. This work shall be included within the construction contract.
B. Approval: File necessary plans, prepare documents and obtain necessary approval of governmental departments having jurisdiction and required certificates of inspection for work and deliver same to Architect before requesting acceptance and final payment for work.
C. Permits, Certificates and Taxes: Procure and pay for all the necessary permits, certificates, and taxes for all work as required in the General and Supplementary Conditions. In addition, perform all ordinance and performance tests in the presence of the Architect, and be responsible for advance notification. Submit copies of signed and accepted permits to the Architect.

1.5 MATERIAL REVIEW, SUBMITTALS AND SHOP DRAWINGS:

A. General:
   1. Provide submittals for all equipment and systems indicated and specified by the Contract Documents.
B. Prepare and distribute submittals:
   1. Identify each transmittal using the 6-digit specification section number and section title.
   2. Pay for all costs associated with materials, reproduction, and distribution.
C. Submittals shall be complete, containing the information describing the equipment and systems of all trades. All submittals and submittal information shall be submitted at the same time, organized as described below.
D. The project construction schedule, beginning with the acceptance of the bid and confirmation of the successful bidder, is not the responsibility of the Architect / Engineer. The contractor's schedule shall recognize and accommodate the review intervals specified herein. The schedule shall identify and accommodate the specified submittal and re-submittal review and response period. The contractor shall not anticipate or base the construction schedule on expedited reviews or reviews of partial submittals. Submittals shall be organized and delivered as specified. No exceptions.
E. Review all items prior to submission. Submittals shall bear the General Contractors stamp, certifying that the contractor has:
   1. Verified all field dimensions and quantities.
   2. Verified all field construction criteria, materials, catalog numbers and similar data.
   3. Reviewed and coordinated submittal data with requirements of the work and the Contract Documents.
F. Indicate any item, component, material or portion of work which deviates from Contract Documents and completely describe and illustrate nature and extent of deviation. Unless such departures are accepted as indicated in paragraph "Engineer Review", such departures shall not be permitted.

G. Make submittals sufficiently in advance of required acceptance date to allow Architect / Engineer 10 working days for each review and resubmission if necessary.
   1. Items submitted without Contractor's review stamp will be returned without action, for re-submission.
   2. Items not submitted in accordance with provisions of this section will be returned, without action, for re-submittal.
   3. Submission of items not accepted as specified by the project manual or addenda will be rejected.

H. Do not place orders for materials, fixtures, or equipment until acceptance is obtained from Architect/Engineer in writing. Oral acceptance will not be considered.

1.6 SUBMITTALS AND SHOP DRAWINGS

A. Submit:
   1. Provide five copies of the submittals in 3-ring notebook(s), organized by specification section, large enough to accept total volume of material. Reference project information shall include:
      a. Project title,
      b. Project number and Location,
      c. Architect,
      d. Engineer,
      e. Contractor,
      f. Subcontractor(s),
      g. Submission date,
      h. Specification sections submitted.
   2. Label cover and binder end. Clearly indicate any items not included with submitted assemblies. Architect / Engineer will not take responsibility for collating submitted information into notebooks. Submittals not bound and organized as specified will be rejected.
   3. The contractor shall make every attempt to respond to the Architect and Engineer comments in a timely manner. Submittal material requiring more than three Engineering reviews will be considered non-responsive. The Architect / Engineer may elect to charge the contractor on an hourly basis for additional consultation as required to secure a responsive submittal.

B. Standards Compliance and Certification:
   1. Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI), American Society for Mechanical Engineers (ASME), Underwriters Laboratories Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA) that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and accepted.
   2. Submit certification for the product submitted and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply the product does not meet all requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material." Simply state that the product conforms to the requirements specified.

C. Substitution of Materials:
   1. Substitutions of materials will only be considered where specified materials can not be obtained. All work and equipment required incidental to the substitution is the responsibility of the Contractor. Substitutions are only permitted if approved in writing by the Owner. Verbal approvals shall not be binding.
   2. Refer also to Division 1.

D. Shop Drawings:

1. Submit in mailing tube if drawing cannot be shipped flat. Do not fold.
2. Submit drawings 8-1/2" x 11", 11" x 17" or 24" x 36" unless size of the items depicted makes such sizes impractical. Scale of drawings shall match that of the construction documents.
3. Prepare shop drawings on a background furnished by the Architect.
4. Prior to any installation or fabrication of the system components, the contractor shall submit five complete sets of shop drawings to the Architect for approval by the Architect, Engineer and the Owner.
5. Contractor shall schedule submittal to Architect and include sufficient resources with bid to accommodate an additional revision and re-submittal.
6. Incomplete shop drawings will be rejected unless prior approval is requested and given from the Architect and Owner for partial submittals.
7. Review of the shop drawings by the Architect, Owner, or AHJ does not relieve the contractor from coordinating the installation of the work with all other trades, nor from compliance with all applicable codes and standards.

E. Engineer Review:
   1. Review is general and does not:
      a. Permit departure from Contract Documents.
      b. Relieve Contractor from responsibility for error in detail, quantities, dimensions or related items.
      c. Accepted departure from previous instructions or detail.
      d. Relieve Contractor of responsibility to provide all components, wiring, etc., required to make item operational or usable.
      e. Imply acceptance of items for which no data is submitted.
      f. Work which requires submittals shall not be started without Architect's / Engineer 's review.
      g. Allow ten working days for engineering review.
      h. Acceptance will be indicated by a signed stamp affixed to the submittal, or a letter over the Architect's / Engineer's signature. No exceptions.

F. Re-submittals:
   1. Items of materials, fixtures and equipment not accepted by Architect shall be resubmitted within 30 days after engineering review. If Contractor fails to submit items listed below for approval or resubmit in the event of disapproval within specified time, Contractor shall provide materials, fixtures and equipment as scheduled on drawings. Where equipment is not scheduled the Contractor shall provide materials, fixtures and equipment as identified in the specifications.

G. Decision of Architect shall be final and binding and items shall be provided without change in contract price or time.

H. Electronic submittals are acceptable in lieu of physical copies noted above. If electronic submittals are disorganized or illegible they shall be rejected and physical copies will be requested.

1.7 SAFETY AND PROTECTION:

A. Drive Guards: Provide OSHA-accepted drive and shaft guards for all exposed, rotating shafts and drive connections between motors and driven equipment. Include steel frames securely fastened for easy removal to the equipment frame. Provide tachometer cut-out at shafts where applicable.

B. Head Protection: Where pipe hangers, equipment support angles, etc., are exposed in walkways, or in access ways for any maintenance, cover all such potentially injurious protrusions less than 7' 2" above the floor with padding; secure and permanently fasten, and finish to match adjacent finishes.

1.8 TESTING, DEMONSTRATION AND COMMISSIONING

A. Demonstrate that all equipment operates as indicated and in accordance with manufacturer's recommendations. Support the inspections and testing of components and systems called for to commission the mechanical system. Commissioning shall be by the Owner, coordinate efforts and support required with the Owner's project manager. Perform tests in the presence of the Architect and Owner's Project Manager; give minimum one-week notice prior to test. Provide all instruments and personnel required to conduct the tests. Refer to Section 230800 for additional Commissioning requirements.

1.9 OPERATIONS AND MAINTENANCE MANUALS

A. Furnish operations and maintenance (O&M) manuals to the Architect before conducting owner instruction session in accordance with Section 017700. Furnish copies of the O & M manuals for review in accordance with Section 017700.

B. O & M manuals shall include full descriptions of all systems and products installed under this contract. Furnish complete narrative descriptions, product and originals of equipment descriptions with exploded diagrams, parts lists including part numbers, disassembly and assembly instructions and control wiring diagrams.

1.10 RECORD DOCUMENTS

A. Maintain record documents as construction commences. Evaluation of pay requests shall be partially based on the level of completion indicated by the record documents.

B. Mechanical Subcontractor shall transfer marks from the jobsite record set to electronic records (AutoCAD) and furnish a reproducible plan set and electronic records (As-Built Drawings) at the conclusion of the contract. This includes but is not limited to detailed and accurate drawings of all site and building piping, equipment, and appurtenances.

1.11 INSTRUCTION PERIODS FOR OWNER'S PERSONNEL

A. Description: Following installation of all mechanical equipment and prior to acceptance of the mechanical work, conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance and operation to Owner's Project Manager. Refer also to the requirements of Section 017700.

1.12 PUNCH LIST & WARRANTY

A. Refer to the requirements of Section 017700 and Section 017800.

B. INDUSTRY STANDARDS, CODES AND SPECIFICATIONS

C. All materials, equipment, and systems shall conform to the following applicable industry standards, codes and specifications:

ANSI	AWS	IBC	NEMA	SMACNA	WISHA
ASHRAE	CISPI	IMC	NFPA	UL	WSEC
ASME	FM	MSS	NSI	UPC	
ASTM	HI	NEC	OSHA	WAC	

D. Where differences occur between state laws, local ordinances, industry standards, utility company regulations and contract documents, the most stringent shall govern.

1.13 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with all applicable City, County, and State codes and ordinances. In case of conflict with drawings or specifications, the more stringent requirements govern.

B. All equipment specified herein, including but not limited to motors, motor control equipment, starters, panels, etc., shall be UL listed. European standard shall not be considered as an equivalent.

C. Basis: Washington State Building Code, Uniform Plumbing Code; Washington State Mechanical Code and local amendments to the same.
D. Installing Contractor Qualifications: Plumbing and piping systems shall be installed by experienced, licensed plumbing contractors and licensed installers. The installation of fixtures, piping and plumbing systems shall be by journeyman plumbers or by journeyman plumbers supervising apprentice plumbers. Installers shall be employed directly by the contractor, and not subcontracted. Journeymen shall have minimum 5 years of experience successfully installing plumbing and piping systems similar to those described by these contract documents.

PART 2 PRODUCTS

2.1 GENERAL

A. Comply with "Quality Assurance" provisions, Specifications, and Manufacturers' Data. Where these may be in conflict, the more stringent requirements govern. Coordinate work with Division 26.

2.2 MOTORS

A. Provide motors conforming to the following unless noted otherwise:
1. Design and Construction: Unless otherwise indicated, provide electric motors and enclosures described by this specification conforming to the applicable definitions and requirements of NEMA MG-1.
2. Standard Commercial Product: Provide motors of manufacturers' standard commercial product. A standard commercial product is a product which has been or will be sold on the commercial market through advertisements or manufacturers' catalogs or brochures, and represents the latest production model(s).
3. Nameplates: Provide all motors with readily visible nameplates containing the information required in NEMA MG-1.

2.3 MOTOR REQUIREMENTS:

A. Manufacturer: General Electric, Lincoln, Allis-Chalmers, Goulds or U.S. Motors or accepted equal.
B. Type: Furnish High Efficiency motors. Motor efficiencies shall meet or exceed the efficiency values required by the Washington State Energy Code.

2.4 MOTOR CONTROL EQUIPMENT

A. General: The mechanical contractor is responsible for providing and installing motor control equipment as required for mechanical equipment and systems, unless otherwise indicated or directed. Refer also to the requirements of Division 26. Motor control equipment shall be comprised of and comply with the following:
1. Magnetic motor starters: Where equipment is under automatic control and is furnished with a disconnecting means, provide magnetic motor starters. Starters shall conform to or contain items called for below and unless noted otherwise, shall be full voltage non-reversing for NEMA size 3 and under. No starters smaller than NEMA size 0 and no half size starters are permitted. Provide starters with protection for phase loss, phase imbalance, overload, and ground fault. Wye-delta type must have motor designed for this use. Coordinate work as required.
a. Overload devices: Melting alloy or bimetallic type. One overload shall be provided for each phase. Provide ambient compensated overload devices only when the motor is at a constant temperature and the controller is subject to a separate, varying temperature. Automatic reset overload devices are not permitted.
b. Accessories: Each magnetic motor controller shall include, "HAND-OFF-AUTO" selector switch, 120 volt coil (unless noted otherwise), red running pilot light, green off pilot light, 100VA (minimum) control transformer (except for 115 volt motors), surge

suppression kit, with fused primary and secondary, two spare auxiliary interlock contacts and all other accessories required or noted.

c. Enclosures: Motor controllers shall be contained in an enclosure suitable for the environment in which the controller is mounted. Enclosures located in damp, moist locations and outdoors shall be NEMA 3R throughout.

B. Combination motor controller Motor starter and disconnect. Where equipment is under automatic control and is not provided with a disconnecting means, provide combination motor starter and disconnect. Provide as specified above, and also include a disconnecting means. Shall be fused switch type (Class RK5), or motor circuit protector type rated for 22,000 RMS A.I.C. minimum unless noted otherwise and containing all accessories as listed above. If externally powered control circuits are used, provide an auxiliary switch on the disconnect switch or protector and fuse in lieu of the control transformer. Switch or protector shall be capable of being padlocked in the off position.

C. Manual Starters: Where equipment is under manual control, provide manual starter. Starter shall be toggle switch type, lockable in the "off" position, with overload relays, pilot light and enclosure per above.

D. Accepted Manufacturers: Allen Bradley or as accepted through prior approval.

2.5 EXPANSION SHELLS AND BOLTS

A. Expansion Shells for Rod Hangers
1. Phillips, Gregory, Omark, or Fastite in holes drilled in concrete.

B. Expansion Bolts for Equipment
1. USM or McCullough in holes drilled in concrete.
2. No screwed adapters underground.

2.6 FORMED STEEL CHANNELS AT SLAB

A. Provide for all equipment; number and size per manufacturer's recommendations or as indicated.

2.7 ANCHOR BOLTS

A. Provide for all equipment; number and size per manufacturers' recommendations or as indicated.

2.8 SUPPLEMENTARY STEEL FRAMING

A. Standard structural steel shapes or Schedule 40 steel pipe, galvanized with extra-heavy finish.

2.9 SLEEVES

A. Refer to Specification Section 221116

2.10 WELDING TO BUILDING STRUCTURAL MEMBERS

A. Not allowed except as indicated.

2.11 NAMEPLATES

A. Laminated black plastic with lettering cut through to white background. Plastic strips with raised letters made by a marking device are not acceptable.

2.12 VALVE TAGS

A. Shall be 0.030" thick brass, 1" diameter size; state the service and destination of the line controlled. Provide tag inscriptions made with a lettering device with 5/16" high cut lettering. Laminated plastic tags, construction similar to nameplates will also be acceptable.

2.13 PIPING IDENTIFICATION

A. Self adhesive, pre-printed identification labels indicating direction of flow and pipe contents, using common industry abbreviations. Identify pipe at every change of direction.

2.14 SPECIAL MAINTENANCE MATERIALS

A. Provide for equipment requiring frequent replacement of maintenance materials. Provide an extra set of filters, and belts; together with application devices and instructions.

2.15 PAINTING

A. Paint all exposed fixtures and equipment in conformance with Division 9. Coordinate color with Architect. Refer to Architectural documents for paint and application requirements.

2.16 EQUIPMENT LISTING REQUIREMENTS

A. Whenever UL Standards exist for equipment provide UL-accepted equipment bearing the UL label.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 PREPARATION

A. Field Measurements: Field-verify locations of new and existing work prior to commencing work of this Section.
B. Protect surrounding areas and surfaces to preclude damage from work of this Section.

3.3 INSTALLATION, ERECTION, AND PERFORMANCE

A. Install, apply, erect, and perform the work in accordance with "Quality Assurance" provisions, Specifications, and manufacturers' installation instructions and directions. Where these may be in conflict, the more-stringent requirements govern.

3.4 CLEANING

A. Promptly remove waste material and rubbish caused by mechanical construction work. At completion of the project, clean all equipment, piping and fixtures installed or provided under this Contract.

3.5 CUTTING AND PATCHING

A. Cut all openings and holes required for mechanical work. Carefully examine existing conditions prior to commencing work.

3.6 ACCESSIBILITY

A. Locate valves, controls, etc., to be easily accessible.
B. Install all equipment that requires periodic servicing or repairs to be readily accessible. Otherwise, obtain Architect's approval of location. Where valve and equipment is concealed behind access panels or by ceiling tiles, label panel or tile appropriately.
C. Provide access panels as indicated or required for piping, valve or equipment access. Refer to Architectural Documents to determine fire-rating requirements. The access panel size shall be in proportion to the equipment, piping, or valve requiring access. Minimum access panel size shall be 12" x 12".

3.7 SPECIAL PROTECTION

A. Exercise maximum precaution to provide positive protection for the existing building and equipment from damage of any kind, and in particular prevent any water and dust seepage into the existing building.

B. Storage of materials: Make all necessary provisions to prevent damage or corrosion of materials.

3.8 EQUIPMENT INSTALLATION

A. General: Provide supports for all equipment and appurtenances as required, including braces as required for seismic restraint; these include frames or supports for pumps and air handlers and all mechanical equipment. Bracing shall conform with the requirements of IBC and IMC. Include the design, engineering and installation of these members is the responsibility of the contractor.

B. Suspended Equipment: Provide hangers from structure as required; span between structural members with additional structural steel as required to mount equipment in locations shown. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.

C. Floor-Mounted Equipment - General:
   1. Provide machine and floor or foundation fastenings; set equipment on concrete pads. Provide equipment base drawings, bolt-setting information, and anchors for all floor-mounted equipment. Provide concrete expansion anchors through concrete equipment pads, installed into existing structural concrete slabs.
   2. Install all equipment at the locations, and to the dimensions indicated. Set equipment accurately with principal centerlines and level, using manufacturers' leveling screws, blocks, shims, or wedges. Do not distort equipment or base plates.
   3. Install all equipment and piping such as to provide adequate access for service. This includes access to equipment covered in other divisions or sections of this specification.

3.9 PIPE SUPPORTS

A. Attach hangers and support rigidly to the building structure; provide supplementary steel framing and bracing at all changes in pipe direction to resist thrust of flowing water. Provide seismic bracing as required by codes. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.

B. Provide additional steel support for piping runs through tight confinements. Provide trapeze system with vibration isolation and seismic restraint for piping through joists and as applicable, due to accessibility of ductwork and mechanical equipment.

C. Where pipe is located below slab on grade, or structure on grade, provide support of pipe from structure such that pipe is protected from damage or displacement should the ground settle away from the structure.

3.10 EXPANSION SHELLS AND BOLTS

A. Use only where necessary to support piping or equipment from existing concrete slabs or walls.

3.11 SLEEVES AND SEALING OF SLEEVES

A. Provide all sleeving and sealing of sleeves for pipes.

B. Provide annular clear space of approximately 1/4" to 1/2"; size to accommodate insulation passing through sleeve where applicable.

C. Wherever piping passes through any floor slab above occupied space or equipment, provide pipe sleeves extending 1" above floor.

D. Set sleeves in place prior to pouring of concrete in new construction; core drill and grout sleeves in place for unit masonry construction and existing construction.

E. Sealing of sleeves through floor slabs and firewalls: Provide firestop system by 3M or accepted equal.

F. Sealing of sleeves for below grade floors and walls: Provide Link Seal. Refer to 221000.

3.12 NAMEPLATES

A. Provide for all equipment; fasten mechanically. Label access panel or ceiling appropriately for concealed equipment.

3.13 VALVE TAGS

A. Provide on all new valves; fasten with brass chain to the valve stem.
B. Provide a framed valve map based on the as-built locations of all new pipe, as well as the field verified arrangement of the existing pipe, and coordinate location of valve map with Owner.

3.14 PIPING IDENTIFICATION

A. Provide pipe identification labels on not less than 10 foot centers, on both sides of a wall penetration, and at every change in direction, so that a label is visible from a standing position on the floor, not more than three feet from the wall.
B. Provide valve location indicators on exposed finish side of adjacent surfaces. Labeling color and style shall be at the discretion of Architect.

3.15 PAINTING

A. General Paint exposed equipment, piping, and mechanical system appurtenances unless noted otherwise. Coordinate color with Architect. Refer also to Division 9.
B. Application:
   1. Thoroughly clean surfaces to be painted to remove dirt, grease and scale. Wash galvanized surfaces with mild solution of acid prior to painting to effectively clean oils from surface and to etch zinc.
   2. Paint insulated surfaces and covered piping with one primer coat and two finish coats.
   3. Paint exposed equipment, pipes and supports with one primer coat and two finish coats. Paint factory painted equipment to match colors selected by the Architect: touch up damaged areas with paint to match factory color.
   4. Paint the supporting devices for mechanical devices or systems specified to be painted.

3.16 MISCELLANEOUS EQUIPMENT AND FIXTURE CONNECTIONS

A. Provide piping and make all final mechanical connections in accordance with manufacturers' recommendations for Owner-furnished equipment and fixtures, and equipment and fixtures specified.
B. Perform on-site review and refer to manufacturers' shop drawings for details of connections. Provide rough-in at locations to conveniently serve items.

3.17 BALANCING WORK

A. General: The Mechanical Subcontractor shall provide all support for balancing and testing work. Coordinate with Section 230593.
B. Work by Mechanical Subcontractor:
   1. Provide the balancing subcontractor with access to all equipment installed under this contract requiring balancing. Provide ladders, scaffolding, lifts as required to permit the Subcontractor to complete their work.
   2. Operate the mechanical systems and be responsible for all equipment until the balancing and testing is complete. Before balancing and testing commences, check all rotating equipment for proper rotation and lubricate per the manufacturers' recommendations.
   3. Do not assume that equipment is shipped from the factory configured to meet specified volumes and quantities. Include belt, sheave, starter heater and other equipment changes, and all work as required as part of this contract in order to permit balancing to required values.
   4. Before balancing and testing commences, operate all pumps and auxiliary equipment for a minimum of one hour. During this period, check out and calibrate all control components under operating service.
C. Work Coordinated With Owner:
   1. Coordinate balancing with other work and building occupancy to ensure no interruptions occur.

3.18 WIRING

A. Wiring shall conform to applicable sections of these specifications. Provide wiring from branch circuit over current device to motor controller to motor terminals, including installation of starter and all connections. Provide raceway and conductors as shown for remote control, or interlock connections. Coordinate other control wiring with Divisions 23 and 26 of the Specifications. Provide overload elements in controllers sized to match motor nameplate full load amperes. Space within controllers shall not be used as a junction box.

END OF SECTION

SECTION 22 05 93 - TESTING, ADJUSTING, AND BALANCING FOR PLUMBING

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. TAB of domestic water system.
   2. TAB of plumbing equipment:
      a. Domestic water booster pumps.
      b. Domestic hot-water in-line circulation pumps.
   3. Pipe-leakage test verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.
B. NEBB: National Environmental Balancing Bureau.
C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
F. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 90 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
B. Certified TAB reports.
C. Sample report forms.
D. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
   2. TAB Technician: Employee of the TAB specialist and certified by AABC.
B. TAB Specialists Qualifications, Certified by NEBB:
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB.
   2. TAB Technician: Employee of the TAB specialist and certified by NEBB.
C. ASHRAE 111 Compliance: Requirements in ASHRAE 111 applicable to analogous domestic water system and plumbing equipment balancing.
D. Code and Authorities Having Jurisdiction Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:
   1. Neudorfer.
   2. Hardin and Sons
   3. United Test and Balance

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, and balancing valves and fittings. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
C. Examine approved submittals for plumbing systems and equipment.
D. Examine design data, including plumbing system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about plumbing system and equipment controls.
E. Examine equipment performance data, including pump curves.
   1. Relate performance data to Project conditions and requirements, including pump system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate pump system-effect factors to reduce performance ratings of plumbing equipment when installed under conditions different from the conditions used to rate equipment performance. 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 plumbing equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
I. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainers are installed and clean.
J. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
K. Examine system pumps to ensure absence of entrained air in the suction piping.
L. Examine operating safety interlocks and controls on plumbing 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.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.
B. Perform system-readiness checks of plumbing systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
   1. Domestic Water System:
      a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed in accordance with applicable code and authority having jurisdiction.
      b. Water heaters are installed and functioning.
      c. Piping is complete and all points of outlet are installed.

d. Water treatment is complete.
e. Systems are flushed, filled, and air purged.
f. Strainers are clean.
g. Control valves are functioning in accordance with the sequence of operation.
h. Shutoff and balance valves are 100 percent open.
i. hot-water circulating pumps are operational and proper rotation is verified.
j. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
k. Variable-frequency controllers' startup is complete and safeties are verified.
l. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
B. Cut insulation, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
   1. Where holes for probes are required in piping or equipment, install pressure and temperature test plugs to seal systems.
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 220716 "Plumbing Equipment Insulation" and Section 220719 "Plumbing Piping Insulation."
C. Mark equipment and balancing devices, including valve position indicators 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.

3.5 GENERAL PROCEDURES FOR PLUMBING EQUIPMENT

A. Test, adjust, and balance plumbing equipment indicated on Drawings, including, but not limited to, the following:
   1. Motors.
   2. Domestic water in-line pumps.
   3. Domestic water heaters.

3.6 PROCEDURES FOR DOMESTIC WATER SYSTEMS

A. Prepare test reports for pumps and other equipment. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required equipment flow rates with system design flow rates.
B. Prepare schematic diagrams of systems' Record drawings piping layouts.
C. In addition to requirements in "Preparation" Article, prepare domestic water systems for testing and balancing as follows:
   1. Check expansion tank for proper setting.
   2. Check water heater for proper discharge temperature setting.
   3. Check remotest point of outlet for adequate pressure.
   4. Check flow-control valves for proper position.
   5. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.
   6. Verify that motor controllers are equipped with properly sized thermal protection.
   7. Check that air has been purged from the system.
D. Measure and record upstream and downstream pressure of each piece of equipment.
E. Measure and record upstream and downstream pressure of pressure-reducing valves.

F. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
G. Check settings and operation of each safety valve. Record settings.

3.7 PROCEDURES FOR DOMESTIC HOT-WATER CIRCULATING INLINE PUMP

A. Balance system with manual or automatic balancing valves by setting at design flow.
   1. Measure flow in main and branch pipes.
   2. Adjust main and branch balance valves for design flow.
   3. Re-measure each main and branch after all have been adjusted.
B. Adjust pump to deliver total design flow.
   1. Measure pump TDH as follows:
      a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      c. Convert pressure to head and correct for differences in gauge heights.
      d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
   2. Monitor motor performance during procedures, and do not operate motor in an over-loaded condition.
   3. Mark final settings and verify that all memory stops have been set.
   4. Verify final system conditions as follows:
      a. Re-measure and confirm that total flow is within design.
      b. Re-measure final pumps' operating data, TDH, volts, amps, speed, and static profile.
      c. Mark final settings.

3.8 PROCEDURES FOR WATER HEATERS

A. Electric Water Heaters:
   1. Measure and record entering- and leaving-water temperatures.
   2. Measure and record water flow.
   3. Measure and record pressure drop.
   4. Measure and Record relief valve(s) pressure setting.
   5. Capacity: Calculate in Btu/h of heating output.
   6. Efficiency: Calculate operating efficiency for comparison to submitted equipment.

3.9 TOLERANCES

A. Set plumbing system's flow rates within the following tolerances:
   1. Domestic Water Flow Rate: Plus 10 percent or minus 5 percent. If design value is less than 10 gpm, within 10 percent.

3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.
   3. Certify validity and accuracy of field data.
B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.

4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents, including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Notes to explain why certain final data in the body of reports vary from indicated values.
14. Test conditions for pump performance forms, including the following:
    a. Variable-frequency controller settings for variable-flow hydronic systems.
    b. Settings for pressure controller(s).
    c. Other system operating conditions that affect performance.

D. Electric Water Heater Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
1. Unit Data:
    a. System identification.
    b. Location.
    c. Model number and unit size.
    d. Manufacturer's serial number.
    e. Output capacity in Btu/h.
    f. Number of stages.
    g. Connected volts, phase, and hertz.
    h. Rated amperage.
2. Test Data (Indicated and Actual Values):
    a. Heat output in Btu/h.
    b. Entering-water temperature in deg F.
    c. Leaving-water temperature in deg F.
    d. High-temperature-limit setting in deg F.
    e. Operating set point in deg F.
    f. Voltage at each connection.
    g. Amperage for each phase.

E. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves, and include the following:
1. Unit Data:
    a. Unit identification.
    b. Location.
    c. Service.
    d. Make and size.

e. Model number and serial number.
f. Water flow rate in gpm.
g. Water-pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump speed.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):
a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

F. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.
B. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
D. If the number of "FAILED" measurements is greater than 20 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.
E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report

and request a second final inspection. All changes shall be tracked to show changes made to previous report.

2. If the second final inspection also fails, Owner may pursue other Contract options to complete TAB work.

F. Prepare test and inspection reports.

END OF SECTION 220593

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic cold-water piping.
   2. Domestic hot-water piping.
   3. Domestic recirculating hot-water piping.
   4. Storm-water piping exposed to freezing conditions.
   5. Roof drains and rainwater leaders.
   6. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:
   1. Section 220716 "Plumbing Equipment Insulation" for equipment insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
   3. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.

1.3 QUALITY ASSURANCE

A. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of the manufacturer, fabricator, type, description, and size.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Johns Manville; a Berkshire Hathaway company.
   b. Knauf Insulation.
   c. Manson Insulation Inc.

1. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ .
2. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Mineral Wool, Preformed Pipe: Mandrel-wound mineral wool fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to 1200 deg F in accordance with ASTM C447. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Johns Manville; a Berkshire Hathaway company, or approved equal.
2. Preformed Pipe Insulation: Type II, Grade A with factory-applied ASJ .
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.

2.3 INSULATING CEMENTS

A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller.
   c. Mon-Eco Industries, Inc.
2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller, or approved equal.
   2. Adhesive: As recommended by phenolic manufacturer and with a VOC content of 50 g/L or less.
   3. Verify adhesives and sealants comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller.
      c. Mon-Eco Industries, Inc.
   2. Verify adhesives have a VOC content of 80 g/L or less.
   3. Verify adhesives and sealants comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.
   1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.
   2. Verify mastics comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller.
      c. Knauf Insulation.
      d. Mon-Eco Industries, Inc.
   2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
   3. Service Temperature Range: 0 to plus 180 deg F .
   4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
   5. Color: White .

2.6 LAGGING ADHESIVES

A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Childers Brand; H. B. Fuller Construction Products.

b. Foster Brand; H. B. Fuller, or approved equal.

2. Verify adhesive is as recommended by insulation manufacturer and has a VOC content of 50 g/L or less.
3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
5. Service Temperature Range: 0 to plus 180 deg F.
6. Color: White.

2.7 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller, or approved equal.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. Verify sealant has a VOC content of 420 g/L or less.
6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. 3M Industrial Adhesives and Tapes Division.
   b. Avery Dennison Corporation, Specialty Tapes Division.
   c. Ideal Tape Co., Inc., an American Biltrite Company.
   d. Knauf Insulation.
2. Width: 3 inches .
3. Thickness: 11.5 mils .
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.9 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Buckaroos, Inc.
   b. McGuire Manufacturing.
   c. MVG Molded Products.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range of between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
   a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and

irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation conforms to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to

flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
   4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
B. Insulation Installation on Pipe Flanges:
   1. Install prefabricated pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
   2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
D. Insulation Installation on Valves and Pipe Specialties:
   1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
   2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.6 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099000 "Painting and Coating."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.
B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless steel jackets.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. NPS 1 and Smaller: Insulation is one of the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.
   2. NPS 1-1/4 and Larger: Insulation is one of the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:
   1. NPS 1-1/4 and Smaller: Insulation is one of the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

C. Stormwater and Overflow:
   1. All Pipe Sizes: Insulation is one of the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

B. Roof Drain and Overflow Drain Bodies:
   2. All Pipe Sizes: Insulation is one of the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
   1. All Pipe Sizes: Insulation is one of the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
   1. 20 mils thick.
   2. Painted Aluminum, Smooth : 0.016 inch thick.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER PIPING

1.1 GENERAL

1.2 SUMMARY

A. Section Includes:
   1. Copper tube and fittings.
   2. PEX tube and fittings.
   3. Piping joining materials.
   4. Transition fittings.
   5. Dielectric fittings.

1.3 ALTERNATES

A. Base Bid: All domestic water piping shall be provided in PEX except for piping between heat pump water heater and storage tank.

B. Additive Alternate: All domestic water piping shall be provided in Copper.
   1.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Pipe and tube.
   2. Fittings.
   3. Joining materials.
   4. Transition fittings.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   3. Environmental Product Declaration: For each product.
   4. Health Product Declaration: For each product.
   5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

1.6 WARRANTY

A. Polypropylene Piping (PP-R) Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.
   1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
   2. Warranty is to be in effect only upon submission by the Contractor to the manufacturer of valid pressure/leak documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 COPPER TUBE AND FITTINGS

A. Hard Drawn-Temper Copper Tube: ASTM B88, Type KandASTM B88, Type L .
B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

2.3 PEX TUBE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   2. IPEX USA LLC.
   3. Uponor.
   4. Zurn Industries, LLC.
B. Tube Material: PEX plastic according to ASTM F876 and ASTM F877.
C. Fittings: ASTM F1807, metal insert and copper crimp rings .
D. Push-Fit Fittings: ASSE 1061, push-fit fittings.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Zurn Industries, LLC.
E. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F876; with plastic or corrosion-resistant-metal valve for each outlet.

2.4 PIPING JOINING MATERIALS

A. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
B. Solder Filler Metals: ASTM B32, lead-free alloys.
C. Flux: ASTM B813, water flushable.
D. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 TRANSITION FITTINGS

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.
B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
C. Plastic-to-Metal Transition Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Charlotte Pipe and Foundry Company.
      b. Uponor.
   2. Description:
      a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
      b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
D. Plastic-to-Metal Transition Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. NIBCO INC.
   2. Description:
      a. CPVC four-part union.
      b. Brass or stainless steel threaded end.
      c. Solvent-cement-joint or threaded plastic end.
      d. Rubber O-ring.
      e. Union nut.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating non-conductive insulating material. Include end connections compatible with pipes to be joined.
B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. WATTS.
      b. Zurn Industries, LLC.
   2. Standard: ASSE 1079.
   3. Pressure Rating: 125 psig minimum at 180 deg F .
   4. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

3.2 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A674 or AWWA C105/A21.5.
E. Install valves according to the following:
   1. Section 220523.12 "Ball Valves for Plumbing Piping."
   2. Section 220523.14 "Check Valves for Plumbing Piping."
   3. Section 220523.15 "Gate Valves for Plumbing Piping."
F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
G. Install domestic water piping level without pitch and plumb.
H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
N. Install piping free of sags and bends.
O. Install fittings for changes in direction and branch connections.
P. Install PEX tubing with loop at each change of direction of more than 90 degrees.
Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
R. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."
S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    1. Apply appropriate tape or thread compound to external pipe threads.
    2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.
G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
I. 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.
J. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
    1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
    2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.

K. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.
L. Joints for PEX Tubing, ASSE: Join according to ASSE 1061 for push-fit fittings.
M. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.
B. Transition Fittings in Underground Domestic Water Piping:
   1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
   2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric unions .

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
B. Install hangers for copper piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
C. Install vinyl-coated hangers for PEX tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
D. Support horizontal piping within 12 inches of each fitting.
E. Support vertical runs of copper piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
F. Support vertical runs of PEX tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. 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 that required by plumbing code.
   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 and larger.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
      a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
      b. Adjust calibrated balancing valves to flows indicated.
   5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
   6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
   8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
         2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      d. Repeat procedures if biological examination shows contamination.
      e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Hose stations.
7. Hose bibbs.
8. Wall hydrants.
9. Roof hydrants.
10. Drain valves.
11. Water-hammer arresters.
12. Trap-seal primer device.
13. Trap-seal primer systems.
14. Flexible connectors.

B. Related Requirements:
1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.

1.2 DEFINITIONS

A. AMI: Advanced Metering Infrastructure.
B. AMR: Automatic Meter Reading.
C. FKM: A family of fluroelastomer materials defined by ASTM D1418.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For domestic water piping specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers :
1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.

3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze .

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers :
   1. Standard: ASSE 1013.
   2. Operation: Continuous-pressure applications.
   3. Pressure Loss: 12 psig maximum, through middle third of flow range.
   4. Pressure Loss at Design Flow Rate: 5psig.
   5. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
   6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   7. Configuration: Designed for horizontal, straight-through flow.
   8. Accessories:
      a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
      b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
      c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check, Backflow-Prevention Assemblies :
   1. Standard: ASSE 1015.
   2. Operation: Continuous-pressure applications unless otherwise indicated.
   3. Pressure Loss at Design Flow Rate: 5psig.
   4. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
   5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   6. Configuration: Designed for horizontal, straight-through flow.
   7. Accessories:
      a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
      b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators :
   1. Standard: ASSE 1003.
   2. Pressure Rating: Initial working pressure of 150 psig.
   3. Body: Bronze for NPS 2 and smaller; bronze for NPS 2-1/2 and NPS 3.
   4. Valves for Booster Heater Water Supply: Include integral bypass.
   5. End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.

2.6 BALANCING VALVES

A. Memory-Stop Balancing Valves :
   1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
   2. Pressure Rating: 400-psig minimum CWP.
   3. Size: NPS 2 or smaller.
   4. Body: Copper alloy.
   5. Port: Standard or full port.
   6. Ball: Chrome-plated brass or stainless steel.
   7. Seats and Seals: Replaceable.
   8. End Connections: Solder joint or threaded.
   9. Handle: Vinyl-covered steel with memory-setting device.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Electronic, Water Mixing Valve Assemblies :

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Type: Exposed, electronically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded or solder joint inlets and outlet.
6. Accessories: Manual temperature override control, check stops on hot- and cold-water supplies, and automatic hot- and cold-water shutoff upon inlet supply failure.
7. Valve Finish: Bronze.
8. Digital temperature control and monitoring module.
   a. Controls temperature within plus or minus 2 deg F.
   b. User programmable at module or through BAS.
   c. ASHRAE 188 compliance.
   d. Local and remote monitoring.
   e. BACNet protocol language(s).
   f. 230 V ac, 60 Hz.
   g. Battery backup.

2.8 HOSE STATIONS

A. Single-Temperature-Water Hose Stations :

1. Standard: ASME A112.18.1.
2. Cabinet: Stainless steel enclosure with exposed valve handle, hose connection, and hose rack. Include thermometer in front.
3. Hose-Rack Material: Stainless steel.
4. Body Material: Bronze with stainless steel wetted parts.
5. Body Finish: Rough bronze.
6. Mounting: Wall, with reinforcement .
7. Supply Fittings: NPS 3/4 gate, globe, or ball valve and check valve and NPS 3/4 copper, water tubing. Omit check valve if check stop is included with fitting.
8. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 50 feet long.
9. Nozzle: With hand-squeeze, on-off control.
10. Vacuum Breaker:
    a. Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.9 HOSE BIBBS

A. Hose Bibbs :

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.

11. Operation for Equipment Rooms: Wheel handle.
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.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants :
   1. Standard: ASME A112.21.3M for concealed -outlet, self-draining wall hydrants.
   2. Pressure Rating: 125 psig.
   3. Operation: Loose key.
   4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
   5. Inlet: NPS 3/4 or NPS 1.
   6. Outlet, Concealed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   7. Box: Deep, flush mounted with cover.
   8. Box and Cover Finish: Polished nickel bronze .
   9. Outlet, Exposed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   10. Nozzle and Wall-Plate Finish: Polished nickel bronze .
   11. Operating Keys(s): Two with each wall hydrant.

2.11 ROOF HYDRANTS

A. Nonfreeze, Draining-Type Roof Hydrants :
   1. Standard: ASME A112.21.3M.
   2. Type: Nonfreeze, exposed-outlet roof hydrant with coated cast-iron head and lift handle with lock option. Provide with deck flange and under deck clamp.
   3. Casing and Operating Rod: Bronze interior parts, galvanized-steel casing, and bronze valve housing designed with hole to drain.
   4. Inlet: NPS 3/4 .
   5. Outlet: Garden-hose thread complying with ASME B1.20.7.
   6. Vacuum Breaker:
      a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
      b. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.12 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves :
   1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
   2. Pressure Rating: 400-psig minimum CWP.
   3. Size: NPS 3/4.
   4. Body: Copper alloy.
   5. Ball: Chrome-plated brass.
   6. Seats and Seals: Replaceable.
   7. Handle: Vinyl-covered steel.
   8. Inlet: Threaded or solder joint.
   9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.13 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters :

1. Manufacturers: Sioux Chief, Watts, Oaty or approved equal.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows Diaphragm.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.14 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device :
   1. Standard: ASSE 1018.
   2. Pressure Rating: 125 psig minimum.
   3. Body: Bronze.
   4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
   5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
   6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.15 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems :
   1. Standard: ASSE 1044.
   2. Inlet Size: NPS 3/4, ASTM B88, Type L; copper, water tubing.
   3. Cabinet: Recessed -mounted steel box with stainless steel cover.
   4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120 V ac power.
      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.
   5. Vacuum Breaker: ASSE 1001.
   6. Number Outlets: Six .
   7. Size Outlets: NPS 1/2 .

2.16 FLEXIBLE CONNECTORS

A. 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 250 psig.
   2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
   3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
   3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.

C. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install cabinet-type units recessed in or surface mounted on wall as specified.
E. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.
   1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
F. Nonfreeze, Sanitary Yard Hydrants: Set with riser pipe in concrete or pavement. Do not encase canister in concrete.
G. Nonfreeze, Draining-Type Roof Hydrants: Install with drain connection piped to nearest floor drain or to the exterior.
H. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
I. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
J. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Vacuum breakers.
   2. Backflow preventers.
   3. Water pressure-reducing valves.
   4. Balancing valves.
   5. Temperature-actuated, water mixing valves.
   6. Hose stations.
   7. Wall hydrants.
   8. Roof hydrants.
   9. Trap-seal primer device.
   10. Trap-seal primer systems.
   11. Water meters.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.
B. Set field-adjustable flow set points of balancing valves.
C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.
D. Adjust each pressure vacuum breaker reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

END OF SECTION

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. ABS pipe and fittings.
B. Additive Bid Alternate:
   1. Cast Iron pipe and fittings. Provide additive alternate for use of no-hub cast iron pipe and fittings throughout.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
C. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.
B. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
C. Field quality-control reports.

1.4 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:
   1. Notify Architectno fewer than seven days in advance of proposed interruption of sanitary waste service.
   2. Do not proceed with interruption of sanitary waste service without Architect's] written permission.

1.5 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:
   1. Soil, Waste, and Vent Piping: 10 ft. head of water.
B. Seismic Performance: Soil, waste, and vent piping and support and installation to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment":

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]."

C. <Insert requirements for Component Amplification Factor and Component Response Modification Factor>.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 ABS PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Charlotte Pipe and Foundry Company.
   2. Mueller Industries, Inc.

B. NSF Marking: Comply with NSF 14 for plastic piping components. Include "NSF-dwv" marking for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

C. Solid-Wall ABS Pipe: ASTM D2661, Schedule 40.

D. Cellular-Core ABS Pipe: ASTM F628, Schedule 40.

E. ABS Socket Fittings: ASTM D2661, made in accordance with ASTM D3311, drain, waste, and vent patterns.

F. Solvent Cement: ASTM D2235.
   1. Verify solvent cement has a VOC content of 325 g/L or less.
   2. Verify solvent cement complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   3. Verify adhesive primer complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

G. Solvent Cement: ASTM D2564.
   1. Verify solvent cement has a VOC content of 510 g/L or less.

PART 3 EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
E. Install piping to permit valve servicing.
F. Install piping at indicated slopes.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.
I. Install piping to allow application of insulation.
J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment".
K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
    1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
    2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back-to-back or side by side with common drainpipe.
        a. Straight tees, elbows, and crosses may be used on vent lines.
    3. Do not change direction of flow more than 90 degrees.
    4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
        a. Reducing size of waste piping in direction of flow is prohibited.
L. Lay buried building waste piping beginning at low point of each system.
    1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
    2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
    3. Maintain swab in piping and pull past each joint as completed.
M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
    1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
    2. Horizontal Sanitary Waste Piping: Two percent downward in direction of flow.
    3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.
N. Install aboveground ABS piping in accordance with ASTM D2661.
O. Install aboveground PVC piping in accordance with ASTM D2665.
P. Install underground ABS and PVC piping in accordance with ASTM D2321.
Q. Install engineered soil and waste and vent piping systems as follows:
    1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
    2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
    3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
R. Install underground, copper, force-main tubing in accordance with CDA's "Copper Tube Handbook."
    1. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.
S. Install force mains at elevations indicated.
T. Plumbing Specialties:
    1. Install backwater valves in sanitary waster gravity-flow piping.
        a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
   a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
   b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary waste gravity-flow piping.
   a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

U. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

V. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join in accordance with ASTM D2235 and ASTM D2661 appendixes.
3. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendixes.

B. Joint Restraints and Sway Bracing:
1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
   a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
   b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
   c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:
   a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
   b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:
1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment".
   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
   3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
   4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
   5. Vertical Piping: MSS Type 8 or Type 42 clamps.
   6. Install individual, straight, horizontal piping runs:
      a. 100 Ft. and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Ft. if Indicated: MSS Type 49, spring cushion rolls.
   7. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
   8. Base of Vertical Piping: MSS Type 52 spring hangers.
C. Install hangers for cast-iron, steel, stainless steel, and copper soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
D. Install hangers for ABS and PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
E. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
F. Support vertical runs of cast-iron, steel, stainless steel and copper soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
G. Support vertical runs of ABS and PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
C. Connect waste and vent piping to the following:
   1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
   4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
   5. Install horizontal backwater valves with cleanout cover flush with floor.
   6. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
   7. Equipment: Connect waste piping as indicated.
      a. Provide shutoff valve if indicated and union for each connection.

b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:
   1. Sanitary Sewer: To exterior force main.
   2. Sewage Pump: To sewage pump discharge.
E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
F. Make connections in accordance with the following unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.
B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
      a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
      a. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
      a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
      b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
      c. Inspect joints for leaks.
   4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
      a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg.
      b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
      c. Air pressure must remain constant without introducing additional air throughout period of inspection.
      d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
a. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.
a. Isolate test source and allow to stand for four hours.
b. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.
B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
C. Place plugs in ends of uncompleted piping at end of day and when work stops.
D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
E. Repair damage to adjacent materials caused by waste and vent piping installation.

END OF SECTION 221316

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:
   1. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
   2. Section 077200 "Roof Accessories" for preformed flashings.
   3. Section 078400 "Firestopping" for through-penetration firestop assemblies.
   4. Section 221323 "Sanitary Waste Interceptors" for metal and concrete interceptors outside the building, grease interceptors, grease-removal devices, oil interceptors, and solids interceptors.
   5. Section 334000 "Storm Drainage Utilities" for storm drainage piping and piping specialties outside the building.

1.3 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Show fabrication and installation details for frost-resistant vent terminals.

PART 2 - **PRODUCTS**

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Jay R. Smith Mfg Co; a division of Morris Group International.
      b. Josam Company.
      c. MIFAB, Inc.
      d. WATTS; A Watts Water Technologies Company.
      e. Zurn Industries, LLC.
   2. Standard: ASME A112.36.2M.
   3. Size: Same as connected drainage piping
   4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   5. Closure: Countersunk or raised-head , cast-iron plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Jay R. Smith Mfg Co; a division of Morris Group International.
      b. Josam Company.
      c. MIFAB, Inc.
      d. WATTS; A Watts Water Technologies Company.
      e. Zurn Industries, LLC.
   2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
   3. Size: Same as connected branch.

4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Polished bronze.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Extra Heavy Duty.
13. Riser: ASTM A74, 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. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. MIFAB, Inc.
d. WATTS; A Watts Water Technologies Company.
e. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure Plug:
a. Brass.
b. Countersunk or raised head.
c. Drilled and threaded for cover attachment screw.
d. Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access, Cover Plate: Round, deep, chrome-plated bronze cover plate with screw.
7. Wall Access, Frame and Cover: Round, wall-installation frame and cover.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:
1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

B. Floor-Drain, Inline Trap Seal:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. MIFAB, Inc.
2. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
3. Material: Polymer.
4. Standard: Tested and certified in accordance with ASSE 1072.
5. Listing: IAPMO listed.
6. Size: Same as floor drain outlet or strainer throat.

C. 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.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Vent Caps:
1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

PART 3 - **EXECUTION**

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. 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.

E. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

F. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

G. Install vent caps on each vent pipe passing through roof.

H. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

I. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

J. Install wood-blocking reinforcement for wall-mounting-type specialties.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 33 00 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Commercial, electric, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:
   1. Product Data for water heater compliance with ASHRAE's "Advanced Energy Design Guides."

1.4 INFORMATIONAL SUBMITTALS

A. Retain "Seismic Qualification Data" Paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.
   1. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including storage tank and supports.
      b. Faulty operation of controls.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Periods: From date of Substantial Completion.
      a. Commercial, Electric, Storage, Domestic-Water Heaters:
         1. Storage Tank: Three years.
         2. Controls and Other Components: Three years.
      b. Expansion Tanks: Five years.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. Seismic Performance: Commercial, electric, domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with 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."

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Electric Heat Pump, Domestic-Water Heaters, DHWH-1:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Nyle.
      b. A. O. Smith Corporation.
   2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
   3. Heat Pump Unit
      a. Heat pump water heater shall be packaged air source equipment, factory assembled, charged, and tested. The heat pump shall be suitable for heating potable water and have the capability of producing no less than 160°F potable water, with published heating capacity and C.O.P. based on project specifications.
      b. Heat Pump unit shall consist of compressor, condenser, evaporator coil, direct drive axial fan or a Centrifugal Blower, hot water circulating pump, piping, and controls, factory assembled, charged, and tested.
      c. All components, including assemblies, sub-assemblies and the materials that go into constructing the heat pump water heater’s potable water system must be certified for coming in direct contact with potable water, including but not limited to: piping, brazing, soldering or welding materials, circulator pump, flow sensor, temperature sensors, thread sealant, flow control valves and flat plate heat exchanger.
      d. Entire heat pump shall be UL1995
      e. Electrical: Unit control panel shall be UL1995.
   4. Cabinet
      a. Shall be either corrosion resistant epoxy coated 12-gauge aluminum, 304L stainless steel or 316L stainless steel. Supports, channels and beams shall also be constructed of the like. Compartments shall have large access doors for servicing. Refrigerant components shall be in a separate compartment from fan for in-operation servicing. Unit shall have stainless steel drip pan for condensate. Cabinet shall be designed for outdoor operation. Cabinet shall be insulated to prevent condensation from forming on exterior surfaces.
   5. Compressor
      a. Compressor: Hermetic scroll type by Copeland Corp., or reciprocating piston type by Carlyle Compressor suitable for high temperature operation with R-134a refrigerant. Compressor shall be furnished with service ports for suction and discharge connections
      b. Compressor Controls: Compressor controls/accessories must include the following:
         1. High Pressure Safety monitoring
         2. Low Pressure Safety monitoring
         3. Multi-function Phase Failure Relay (scroll types)

c. Active compressor mounted protection with advanced algorithms, fault history, and LED indicators. (scroll types)

6. Condenser
   a. 316L Stainless steel copper brazed plate vented double wall type, standard on all units. Single wall condenser construction shall not be allowed. UL Listed, NSF 61 OR 372 compliant, and suitable for up to 450°F (232°C) high temperature operation with potable water. Unit shall be operational pressure rated to no less than 435 PSI (30 Bar), with built in temperature ports for performance monitoring. Refrigerant: Refrigerant shall be R-134a.
7. Fan
   a. Axial Fan: The fan arrangement shall be draw-through design. 24” direct-drive axial fan with high-performance axial impeller with integrated control electronics. Corrosion-resistant galvanized sheet steel, coated with black plastic, aerodynamically optimized guard grill
8. Evaporator Coil
   a. Shall be copper tube with aluminum fins with E-Coating for corrosion protection.
   b. Condensation shall be captured and drained to a single point connection with standard pipe threads
9. Expansion Valve
   a. Thermal expansion valve shall be specifically designed for heat pump use with field adjustable superheat feature.
10. Anti-short Cycle Control
    a. Anti-Short Cycle Control: Units shall be factory wired to allow a maximum of twelve compressor starts per hour to prevent compressor short cycling and allow time for suction and discharge pressures to equalize permitting the compressor to start in an unloaded condition

B. Commercial, Electric, Storage, Domestic-Water Back-up Heaters, DHWH-2:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. A. O. Smith Corporation.
      b. Lochinvar
   2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
   3. Standard: UL 1453.
   4. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.
      a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
         1. NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
         2. NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges, and in accordance with ASME B16.24 for copper and copper-alloy flanges.
      b. Pressure Rating: 160 psig.
      c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
   5. Factory-Installed, Storage-Tank Appurtenances:
      a. Anode Rod: Replaceable magnesium.
      b. Drain Valve: Corrosion-resistant metal with hose-end connection.
      c. Insulation: Comply with ASHRAE/IES 90.1.
      d. Jacket: Steel with enameled finish or high-impact composite material.

e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
f. Temperature Control: Adjustable thermostat.
g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

6. Special Requirements: NSF 5 construction.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. A. O. Smith Corporation.
b. AMTROL, Inc.
2. Source Limitations: Obtain domestic-water expansion tanks from single source from single manufacturer.
3. Description: Steel pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
4. Construction:
a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

B. Domestic-Water Storage Tanks:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. A. O. Smith Corporation.
b. Lochnivar.
2. Source Limitations: Obtain domestic-water storage tanks from single source from single manufacturer.
3. Description: Hot water storage tank, 125 psig working pressure, glass lined, provide with 150 psi temperature and pressure relief valve. Add additional custom 2.5” NPT nozzle if necessary. Provide with Wessfoam R-16 thermal jacket and field installed.

C. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.
D. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1 and ASHRAE 90.2.
E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
F. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

G. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

PART 3 EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."
   1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
   2. Maintain manufacturer's recommended clearances.
   3. Arrange units so controls and devices that require servicing are accessible.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   7. Install anchor bolts to elevations required for proper attachment to supported equipment.
   8. Anchor domestic-water heaters to substrate.
B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
   1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
H. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

J. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 221119 "Domestic Water Piping Specialties."

K. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

L. Fill electric, domestic-water heaters with water.

M. Charge domestic-water expansion tanks with air to required system pressure.

N. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric, domestic-water heaters. Training shall be a minimum of two hour(s).

END OF SECTION 223300

PART 4

SECTION 22 42 16.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vitreous-china, counter-mounted lavatories.
2. Vitreous-china, wall-mounted lavatories.
3. Manually operated lavatory faucets.
4. Supply fittings.
5. Waste fittings.
6. Lavatory supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:
1. Plumbing Fixtures: Provide the following:
a. Manufacturer cut sheet indicating water consumption.
b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
1. In addition to items specified in Section 017800 "Closeout Submittals," include the following:
a. Servicing and adjustments of automatic faucets.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - **PRODUCTS**

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory - Vitreous China, Counter Mounted, Undermount:
1. Fixture:
a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Under-counter mounting.
c. Faucet-Hole Location: Top.
d. Color: White.
e. Mounting Material: Sealant.

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory - Accessible, Rectangular, Vitreous China, Wall Mounted:
1. Fixture:
a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Accessible.
c. Faucet-Hole Location: Top.
d. Color: White.
e. Mounting: For concealed-arm carrier.
2. Support: Type II, concealed-arm lavatory carrier with escutcheons.
3. Lavatory Mounting Height: In accordance with ICC A117.1.

2.3 MANUALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Manual Type: Two-Handle Mixing, Commercial, :
   1. Standard: ASME A112.18.1/CSA B125.1.
   2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
   3. Body Type: .
   4. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
   5. Finish: Polished chrome plate.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:
   1. NPS 3/8 .
   2. ASME A112.18.6/CSA B125.6, braided- or corrugated-stainless steel, flexible hose riser.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:
   1. Size: NPS 1-1/2 by NPS 1-1/4 .
   2. Material:
      a. Chrome-plated, one-piece, cast-brass trap with swivel 0.029-inch- thick tubular brass wall bend; and chrome-plated, brass or steel wall flange.

2.6 LAVATORY SUPPORTS

A. Lavatory Carrier:
   1. Standard: ASME A112.6.1M.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb in accordance with roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
    1. Nameplate to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
    2. Nameplate to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.6 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.
B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed lavatories and fittings.
D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16.16 - COMMERCIAL SINKS

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. Service sinks.
   2. Kitchen/utility sinks.
   3. Handwash sinks.
   4. Supply fittings.
   5. Waste fittings.
   6. Sink supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
   2. Include rated capacities, operating characteristics and furnished specialties and accessories.

B. Sustainable Design Submittals:
   1. Plumbing Fixtures: Provide the following:
      a. Manufacturer cut sheet indicating water consumption.
      b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sinks and faucets to include in operation and maintenance manuals.
   1. In addition to items specified in Section 017800 "Closeout Submittals," include the following:
      a. Servicing and adjustments for automatic faucets.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
   2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE SINKS

A. Service Sinks - Enameled Cast Iron, Floor Mounted:
   1. Source Limitations: Obtain sinks from single source from single manufacturer.
   2. Fixture:
      a. Standard: ASME A112.19.1/CSA B45.2.
      b. Style: With front apron and raised back.
      c. Nominal Size: 28 by 28 inches.
      d. Color: White.
      e. Rim Guard: Coated wire.

2.2 KITCHEN/UTILITY SINKS

A. Kitchen/Utility Sinks - Stainless Steel, Counter Mounted:
   1. Source Limitations: Obtain sinks from single source from single manufacturer.
   2. Fixture:
      a. Standard: ASME A112.19.3/CSA B45.4.
      b. Type: Stainless steel, self-rimming, sound-deadened unit less ledge back .
      c. Number of Compartments: Two .

d. Overall Dimensions: .
e. Material: 18 gauge, Type 304 stainless steel.
f. Compartment:
1) Dimensions: .
2) Drain: Grid with NPS 1-1/2 tailpiece and twist drain.
3) Drain Location: Centered in compartment.
4) Depth: Wheelchair accessible.
g. Each Compartment:
1) Dimensions: .
2) Drains: Grid with NPS 1-1/2 tailpiece and twist drain.
3) Drain Location: Centered in compartment.
4) Depth: Wheelchair accessible.

3. Supply Fittings:
a. Standard: ASME A112.18.1/CSA B125.1.
b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
1) Operation: Wheel handle.
2) Risers: NPS 1/2, ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

4. Waste Fittings:
a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap(s):
1) Size: NPS 1-1/2 .
2) Material:
a) Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.
c. Continuous Waste:
1) Size: NPS 1-1/2 .
2) Material: Chrome-plated, 17-gauge brass tube.

5. Mounting: On counter with sealant.

2.3 HANDWASH SINKS

A. Handwash Sinks - Stainless Steel
1. Source Limitations: Obtain sinks from single source from single manufacturer.
2. Fixture:
a. Standards:
1) ASME A112.19.3/CSA B45.4.
2) NSF 61.
b. Type: Wall-mounted stainless steel basin with radius corners, back for faucet, and support brackets.
c. Material: 18 gauge, Type 304 stainless steel.
3. Faucet: .
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.
6. Support: Type II sink carrier.
7. Mounting Height: Accessible in accordance with ICC A117.1.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
B. Standard: ASME A112.18.1/CSA B125.1.
C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.
D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle .
F. Risers:
1. ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

2.5 WASTE FITTINGS
A. Standard: ASME A112.18.2/CSA B125.2.
B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
C. Trap:
1. Material:
a. Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 17-gauge brass tube to wall ; and chrome-plated brass or steel wall flange.

2.6 SINK SUPPORTS
A. Sink Carrier:
1. Source Limitations: Obtain sink supports from single source from single manufacturer.
2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Install sinks level and plumb in accordance with rough-in drawings.
B. Install supports, affixed to building substrate, for wall-hung sinks.
C. Install wall-mounted sinks at accessible mounting height in accordance with ICC A117.1.
D. Set floor-mounted sinks in leveling bed of cement grout.
E. Install water-supply piping with stop on each supply to each sink faucet.
1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.
F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS
A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS
A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
B. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.6 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.
B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed sinks and fittings.
D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 05 00 - COMMON WORK HVAC

PART 1 GENERAL

1.1 WORK INCLUDED

A. Work includes the following: Provide all materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, testing and operation of all mechanical work for this project.

B. Work includes the following:
   1. Motors
   2. Motor Control equipment
   3. Supports and support accessories
   4. Anchoring Hardware
   5. Identification
   6. Balancing work
   7. Painting

C. DEFINITIONS AND ABBREVIATIONS
   1. The word "provide", as used in these specifications, means "furnish and install".
   2. The word "accepted", as used in these specifications, means the acceptance of the Engineer.
   3. Definitions and abbreviations of all terms shall be in accordance with applicable definitions of:

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
FM	Factory Mutual Engineering Corporation
HI	Hydraulic Institute
MSS	Manufacturers' Standardization Society of the Valve and Fittings Industry, Inc.
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
UL	Underwriters' Laboratories, Inc.
IBC	Washington State Building Code
UPC	Uniform Plumbing Code
IMC	Washington State Mechanical Code
WAC	Washington Administrative Code
WSEC	Washington State Energy Code
WISHA	Washington Industrial Safety & Health Act

D. Refer also to Division 1 for additional acronyms and for additional definitions and explanations of terms.

E. Some of these abbreviations may not be used. All other abbreviations shall have the definition commonly associated with them by the trade or industry. Confirm the meaning of any unclear or unknown definitions with the Architect before proceeding with any work.

1.2 PLANS AND SPECIFICATIONS

A. The drawings and specifications are intended to cover all mechanical work, unless otherwise shown. Provide all materials that are necessary for the proper completion of the installation or operation of the equipment.
B. The drawings are diagrammatic and do not show exact or complete ductwork and piping configurations or the necessary number and types of fittings. Provide all labor and materials required to complete the work indicated.
C. Any questions occurring during bidding or construction shall be resolved by direction in writing from the Architect. Any issues not so resolved or any conflicts shall result with the contractor bidding, furnishing and installing the most stringent condition. No exceptions.

1.3 LAW AND ORDINANCES

A. General:
   1. All mechanical work specified under this contract shall be in strict accordance with the latest rules and regulations of all applicable codes.
   2. Contractor is not relieved from furnishing and installing work shown or specified which may be beyond requirements of ordinances, laws, regulations, and codes. This work shall be included within the construction contract.
B. Approval: File necessary plans, prepare documents and obtain necessary approval of governmental departments having jurisdiction and required certificates of inspection for work and deliver same to Architect before requesting acceptance and final payment for work.
C. Permits, Certificates and Taxes: Procure and pay for all the necessary permits, certificates, and taxes for all work as required in the General and Supplementary Conditions. In addition, perform all ordinance and performance tests in the presence of the Architect, and be responsible for advance notification. Submit copies of signed and accepted permits to the Architect.

1.4 MATERIAL REVIEW, SUBMITTALS AND SHOP DRAWINGS: 01 30 00

A. General:
   1. Provide submittals for all equipment and systems indicated and specified by the Contract Documents.
B. Prepare and distribute submittals:
   1. Identify each transmittal using the 6-digit specification section number and section title.
   2. Pay for all costs associated with materials, reproduction, and distribution.
C. Submittals shall be complete, containing the information describing the equipment and systems of all trades. All submittals and submittal information shall be submitted at the same time, organized as described below.
D. The project construction schedule, beginning with the acceptance of the bid and confirmation of the successful bidder, is not the responsibility of the Architect / Engineer. The contractor's schedule shall recognize and accommodate the review intervals specified herein. The schedule shall identify and accommodate the specified submittal and re-submittal review and response period. The contractor shall not anticipate or base the construction schedule on expedited reviews or reviews of partial submittals. Submittals shall be organized and delivered as specified. No exceptions.
E. Review all items prior to submission. Submittals shall bear the General Contractors stamp, certifying that the contractor has:
   1. Verified all field dimensions and quantities.
   2. Verified all field construction criteria, materials, catalog numbers and similar data.
   3. Reviewed and coordinated submittal data with requirements of the work and the Contract Documents.
F. Indicate any item, component, material or portion of work which deviates from Contract Documents and completely describe and illustrate nature and extent of deviation. Unless such departures are accepted as indicated in paragraph "Engineer Review", such departures shall not be permitted.

G. Make submittals sufficiently in advance of required acceptance date to allow Architect / Engineer 10 working days for each review and resubmission if necessary.
   1. Items submitted without Contractor's review stamp will be returned without action, for resubmission.
   2. Items not submitted in accordance with provisions of this section will be returned, without action, for re-submittal.
   3. Submission of items not accepted as specified by the project manual or addenda will be rejected.

H. Do not place orders for materials, fixtures, or equipment until acceptance is obtained from Architect/Engineer in writing. Oral acceptance will not be considered.

1.5 SUBMITTALS AND SHOP DRAWINGS: 01 30 00

A. Submit:
   1. Provide electronic copy of the submittals. Reference project information shall include:
      a. Project title,
      b. Project number and Location,
      c. Architect,
      d. Engineer,
      e. Contractor,
      f. Subcontractor(s),
      g. Submission date,
      h. Specification sections submitted.
   2. Label cover and binder end. Clearly indicate any items not included with submitted assemblies. Architect / Engineer will not take responsibility for collating submitted information into notebooks. Submittals not bound and organized as specified will be rejected.
   3. The contractor shall make every attempt to respond to the Architect and Engineer comments in a timely manner. Submittal material requiring more than three Engineering reviews will be considered non-responsive. The Architect / Engineer may elect to charge the contractor on an hourly basis for additional consultation as required to secure a responsive submittal.

B. Standards Compliance and Certification:
   1. Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI), American Society for Mechanical Engineers (ASME), Underwriters Laboratories Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA) that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and accepted.
   2. Submit certification for the product submitted and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply the product does not meet all requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material." Simply state that the product conforms to the requirements specified.

1.6 SUBSTITUTION OF MATERIALS:

A. Substitutions of materials will only be considered where specified materials can not be obtained. All work and equipment required incidental to the substitution is the responsibility of the Contractor. Substitutions are only permitted if approved in writing by the Owner. Verbal approvals shall not be binding.

B. Refer also to Division 1.

1.7 SHOP DRAWINGS:

A. Submit in mailing tube if drawing cannot be shipped flat. Do not fold.
B. Submit drawings 8-1/2" x 11", 11" x 17" or 24" x 36" unless size of the items depicted makes such sizes impractical. Scale of drawings shall match that of the construction documents.
C. Prepare shop drawings on a background furnished by the Architect.
D. Prior to any installation or fabrication of the system components, the contractor shall submit five complete sets of shop drawings to the Architect for approval by the Architect, Engineer and the Owner.
E. Contractor shall schedule submittal to Architect and include sufficient resources with bid to accommodate an additional revision and re-submittal.
F. Incomplete shop drawings will be rejected unless prior approval is requested and given from the Architect and Owner for partial submittals.
G. Review of the shop drawings by the Architect, Owner, or AHJ does not relieve the contractor from coordinating the installation of the work with all other trades, nor from compliance with all applicable codes and standards.
H. Electronic submittals are acceptable in lieu of physical copies noted above. If electronic submittals are disorganized or illegible they shall be rejected and physical copies will be requested.

1.8 SUBMITTAL REVIEW:

A. Review is general and does not:
   1. Permit departure from Contract Documents.
   2. Relieve Contractor from responsibility for error in detail, quantities, dimensions or related items.
   3. Approve departure from previous instructions or detail.
   4. Relieve Contractor of responsibility to provide all components, wiring, etc., required to make item operational or usable.
   5. Imply approval of items for which no data is submitted.
B. Work which requires submittals shall not be started without Architect's / Engineer 's review.
   1. Allow ten working days for engineering review.
   2. Approval will be indicated by a signed stamp affixed to the submittal, or a letter over the Architect's / Engineer's signature. No exceptions.

1.9 RE-SUBMITTALS:

A. Items of materials, fixtures and equipment not accepted by Architect shall be resubmitted within 30 days after engineering review. If Contractor fails to submit items listed below for approval or resubmit in the event of disapproval within specified time, Contractor shall provide materials, fixtures and equipment as scheduled on drawings. Where equipment is not scheduled the Contractor shall provide materials, fixtures and equipment as identified in the specifications.
B. Decision of Architect shall be final and binding and items shall be provided without change in contract price or time

1.10 SAFETY AND PROTECTION:

A. Drive Guards: Provide OSHA-accepted drive and shaft guards for all exposed, rotating shafts and drive connections between motors and driven equipment. Include steel frames securely fastened for easy removal to the equipment frame. Provide tachometer cut-out at shafts where applicable.
B. Head Protection: Where pipe hangers, equipment support angles, etc., are exposed in walkways, or in access ways for any maintenance, cover all such potentially injurious protrusions less than 7' 2" above the floor with padding; secure and permanently fasten, and finish to match adjacent finishes.

1.11 TESTING, DEMONSTRATION AND COMMISSIONING

A. Demonstrate that all equipment operates as indicated and in accordance with manufacturer's recommendations. Support the inspections and testing of components and systems called for to commission the mechanical system. Commissioning shall be by the general contractor with construction administration oversight by the Architect / Engineer team. Perform tests in the presence of the Architect and Owner's Project Manager; give minimum one-week notice prior to test. Provide all instruments and personnel required to conduct the tests. Refer to Section 230800 for additional Commissioning requirements.

1.12 OPERATIONS AND MAINTENANCE MANUALS

A. Furnish operations and maintenance (O&M) manuals to the Architect before conducting owner instruction session in accordance with Section 017800. Furnish copies of the O & M manuals for review in accordance with Section 017800.
B. O & M manuals shall include full descriptions of all systems and products installed under this contract. Furnish complete narrative descriptions, product and originals of equipment descriptions with exploded diagrams, parts lists including part numbers, disassembly and assembly instructions and control wiring diagrams.

1.13 RECORD DOCUMENTS

A. Maintain record documents as construction commences. Evaluation of pay requests shall be partially based on the level of completion indicated by the record documents. Refer to Section 017800.
B. Mechanical Subcontractor shall transfer marks from the jobsite record set to electronic records and furnish a reproducible plan set and electronic records (As-Built Drawings) at the conclusion of the contract. This includes but is not limited to detailed and accurate drawings of all site and building piping, equipment, and appurtenances.

1.14 INSTRUCTION PERIODS FOR OWNER'S PERSONNEL

A. Description: Following installation of all mechanical equipment and prior to acceptance of the mechanical work, conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance and operation to Owner's Project Manager. Refer also to the requirements of Section 017700.

1.15 PUNCH LIST & WARRANTY

A. Refer to the requirements of Section 017700 and Section 017800.

1.16 INDUSTRY STANDARDS, CODES AND SPECIFICATIONS

A. All materials, equipment, and systems shall conform to the following applicable industry standards, codes and specifications:

ANSI	AWS	IBC	NEMA	SMACNA	WISHA
ASHRAE	CISPI	IMC	NFPA	UL	WSEC
ASME	FM	MSS	NSI	UPC	
ASTM	HI	NEC	OSHA	WAC	

B. Where differences occur between state laws, local ordinances, industry standards, utility company regulations and contract documents, the most stringent shall govern.

1.17 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with all applicable City, County, and State codes and ordinances. In case of conflict with drawings or specifications, the more stringent requirements govern.
B. All equipment specified herein, including but not limited to motors, motor control equipment, starters, panels, etc., shall be UL listed. European standard shall not be considered as an equivalent.

C. Basis: Washington State Building Code, Uniform Plumbing Code; Washington State Mechanical Code and local amendments to the same.
D. Installing Contractor Qualifications: HVAC, sheetmetal and air moving equipment systems shall be installed by experienced, sheetmetal contractors and experienced installers. The installation of ductwork and air moving systems shall be by journeyman sheetmetal workers or by journeyman sheetmetal works supervising apprentices. Installers shall be employed directly by the contractor, and not subcontracted. Journeymen shall have minimum 5 years of experience successfully installing HVAC, sheetmetal and air moving equipment systems similar to those described by these contract documents.

PART 2 PRODUCTS

2.1 GENERAL

A. Comply with "Quality Assurance" provisions, Specifications, and Manufacturers' Data. Where these may be in conflict, the more stringent requirements govern. Coordinate work with Division 26.

2.2 MOTORS

A. Provide motors conforming to the following unless noted otherwise:
1. Design and Construction: Unless otherwise indicated, provide electric motors and enclosures described by this specification conforming to the applicable definitions and requirements of NEMA MG-1.
2. Standard Commercial Product: Provide motors of manufacturers' standard commercial product. A standard commercial product is a product which has been or will be sold on the commercial market through advertisements or manufacturers' catalogs or brochures, and represents the latest production model(s).
3. Nameplates: Provide all motors with readily visible nameplates containing the information required in NEMA MG-1.

2.3 MOTOR REQUIREMENTS:

A. Manufacturer: General Electric, Lincoln, Allis-Chalmers, Goulds or U.S. Motors or accepted equal.
B. Type: Furnish High Efficiency motors. Motor efficiencies shall meet or exceed the efficiency values required by the Washington State Energy Code.

2.4 MOTOR CONTROL EQUIPMENT

A. General: The mechanical contractor is responsible for providing and installing motor control equipment as required for mechanical equipment and systems, unless otherwise indicated or directed. Refer also to the requirements of Division 26. Motor control equipment shall be comprised of and comply with the following:
B. Magnetic motor starters: Where equipment is under automatic control and is furnished with a disconnecting means, provide magnetic motor starters. Starters shall conform to or contain items called for below and unless noted otherwise, shall be full voltage non-reversing for NEMA size 3 and under. No starters smaller than NEMA size 0 and no half size starters are permitted. Provide starters with protection for phase loss, phase imbalance, overload, and ground fault. Wye-delta type must have motor designed for this use. Coordinate work as required.
1. Overload devices: Melting alloy or bimetallic type. One overload shall be provided for each phase. Provide ambient compensated overload devices only when the motor is at a constant temperature and the controller is subject to a separate, varying temperature. Automatic reset overload devices are not permitted.
2. Accessories: Each magnetic motor controller shall include, "HAND-OFF-AUTO" selector switch, 120 volt coil (unless noted otherwise), red running pilot light, green off pilot light, 100VA (minimum) control transformer (except for 115 volt motors), surge

suppression kit, with fused primary and secondary, two spare auxiliary interlock contacts and all other accessories required or noted.

3. Enclosures: Motor controllers shall be contained in an enclosure suitable for the environment in which the controller is mounted. Enclosures located in damp, moist locations and outdoors shall be NEMA 3R throughout.

C. Combination motor controller, motor starter and disconnect. Where equipment is under automatic control and is not provided with a disconnecting means, provide combination motor starter and disconnect. Provide as specified above, and also include a disconnecting means. Shall be fused switch type (Class RK5), or motor circuit protector type rated for 22,000 RMS A.I.C. minimum unless noted otherwise and containing all accessories as listed above. If externally powered control circuits are used, provide an auxiliary switch on the disconnect switch or protector and fuse in lieu of the control transformer. Switch or protector shall be capable of being padlocked in the off position.

D. Manual Starters: Where equipment is under manual control, provide manual starter. Starter shall be toggle switch type, lockable in the "off" position, with overload relays, pilot light and enclosure per above.

E. Accepted Manufacturers: Allen Bradley or as accepted through prior approval.

2.5 EXPANSION SHELLS AND BOLTS

A. Expansion Shells for Rod Hangers
   1. Phillips, Gregory, Omark, or Fastite in holes drilled in concrete.

B. Expansion Bolts for Equipment
   1. USM or McCullough in holes drilled in concrete.
   2. No screwed adapters underground.

2.6 FORMED STEEL CHANNELS AT SLAB

A. Provide for all equipment; number and size per manufacturer's recommendations or as indicated.

2.7 ANCHOR BOLTS

A. Provide for all equipment; number and size per manufacturers' recommendations or as indicated.

2.8 SUPPLEMENTARY STEEL FRAMING

A. Standard structural steel shapes or Schedule 40 steel pipe, galvanized with extra-heavy finish.

2.9 SLEEVES

A. Materials, General Schedule: 40 galvanized steel pipe with unthreaded ends, or standard structural steel shapes.

B. Firestopping: Three-hour rated penetration sealing system per UL 1479 and ASTM E-814. 3M Fire Barrier, Dow Chemical RTV, Manville Cerafiber, or accepted.

C. Seal: Seal annulus with bolted compression type seal. Link Seal or accepted equal.

2.10 WELDING TO BUILDING STRUCTURAL MEMBERS

A. Not allowed except as indicated.

2.11 NAMEPLATES

A. Laminated black plastic with lettering cut through to white background. Plastic strips with raised letters made by a marking device are not acceptable.

2.12 VALVE TAGS

A. Shall be 0.030" thick brass, 1" diameter size; state the service and destination of the line controlled. Provide tag inscriptions made with a lettering device with 5/16" high cut lettering. Laminated plastic tags, construction similar to nameplates will also be acceptable.

2.13 PIPING IDENTIFICATION

A. Self adhesive, pre-printed identification labels indicating direction of flow and pipe contents, using common industry abbreviations. Identify pipe at every change of direction.

2.14 SPECIAL MAINTENANCE MATERIALS

A. Provide for equipment requiring frequent replacement of maintenance materials. Provide an extra set of filters, and belts; together with application devices and instructions.

2.15 PAINTING

A. Paint all exposed fixtures and equipment in conformance with Section 109900. Coordinate color with Architect. Refer to Architectural documents for paint and application requirements.

2.16 EQUIPMENT LISTING REQUIREMENTS

A. Whenever UL Standards exist for equipment provide UL-accepted equipment bearing the UL label.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 PREPARATION

A. Field Measurements: Field-verify locations of new and existing work prior to commencing work of this Section.
B. Protect surrounding areas and surfaces to preclude damage from work of this Section.

3.3 INSTALLATION, ERECTION, AND PERFORMANCE

A. Install, apply, erect, and perform the work in accordance with "Quality Assurance" provisions, Specifications, and manufacturers' installation instructions and directions. Where these may be in conflict, the more-stringent requirements govern.

3.4 CLEANING

A. Promptly remove waste material and rubbish caused by mechanical construction work. At completion of the project, clean all equipment, piping and fixtures installed or provided under this Contract.

3.5 CUTTING AND PATCHING

A. Cut all openings and holes required for mechanical work. Carefully examine existing conditions prior to commencing work.

3.6 ACCESSIBILITY

A. Locate valves, dampers, controls, etc., to be easily accessible.
B. Install all equipment that requires periodic servicing or repairs to be readily accessible. Otherwise, obtain Architect's approval of location. Where valve and equipment is concealed behind access panels or by ceiling tiles, label panel or tile appropriately.
C. Provide access panels as indicated or required for piping, valve or equipment access. Refer to Architectural Documents to determine fire-rating requirements. The access panel size shall be in proportion to the equipment, piping, or valve requiring access. Minimum access panel size shall be 12" x 12". See Section 083100.

3.7 SPECIAL PROTECTION

A. Exercise maximum precaution to provide positive protection for the existing building and equipment from damage of any kind, and in particular prevent any water and dust seepage into the existing building.
B. Storage of materials: Make all necessary provisions to prevent damage or corrosion of materials.

3.8 EQUIPMENT INSTALLATION

A. General: Provide supports for all equipment and appurtenances as required, including braces as required for seismic restraint; these include frames or supports for pumps and air handlers and all mechanical equipment. Bracing shall conform with the requirements of IBC and IMC. Include the design, engineering and installation of these members is the responsibility of the contractor.
B. Suspended Equipment: Provide hangers from structure as required; span between structural members with additional structural steel as required to mount equipment in locations shown. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.
C. Floor-Mounted Equipment - General:
    1. Provide machine and floor or foundation fastenings; set equipment on concrete pads. Provide equipment base drawings, bolt-setting information, and anchors for all floor-mounted equipment. Provide concrete expansion anchors through concrete equipment pads, installed into existing structural concrete slabs.
    2. Install all equipment at the locations, and to the dimensions indicated. Set equipment accurately with principal centerlines and level, using manufacturers' leveling screws, blocks, shims, or wedges. Do not distort equipment or base plates.
    3. Install all equipment, piping and ducting such as to provide adequate access for service. This includes access to equipment covered in other divisions or sections of this specification.

3.9 PIPE SUPPORTS

A. Attach hangers and support rigidly to the building structure; provide supplementary steel framing and bracing at all changes in pipe direction to resist thrust of flowing water. Provide seismic bracing as required by codes. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.
B. Provide additional steel support for piping runs through tight confinements. Provide trapeze system with vibration isolation and seismic restraint for piping through joists and as applicable, due to accessibility of ductwork and mechanical equipment.

3.10 EXPANSION SHELLS AND BOLTS

A. Use only where necessary to support piping or equipment from existing concrete slabs or walls.

3.11 SLEEVES AND SEALING OF SLEEVES

A. Provide all sleeving and sealing of sleeves for pipes and ducts.
B. Provide annular clear space of approximately 1/4" to 1/2"; size to accommodate insulation passing through sleeve where applicable.
C. Wherever piping passes through any floor slab above occupied space or equipment, provide pipe sleeves extending 1" above floor.
D. Set sleeves in place prior to pouring of concrete in new construction; core drill and grout sleeves in place for unit masonry construction and existing construction.
E. Sealing of sleeves through floor slabs and firewalls: Provide firestop system by 3M or accepted equal.
F. Sealing of sleeves for below grade floors and walls: Provide Link Seal. Refer to 232113.

3.12 NAMEPLATES

A. Provide for all equipment; fasten mechanically. Label access panel or ceiling appropriately for concealed equipment.

3.13 VALVE TAGS

A. Provide on all new valves; fasten with brass chain to the valve stem.

3.14 PIPING IDENTIFICATION

A. Provide pipe identification labels on not less than 10 foot centers, on both sides of a wall penetration, and at every change in direction, so that a label is visible from a standing position on The floor, not more than three feet from the wall. Refer also to this Section for pipe labeling requirements.

3.15 PAINTING

A. General Paint exposed equipment, ducts, piping, sheet metal work and mechanical system appurtenances unless noted otherwise. Coordinate color with Architect. Refer also Division 9.
B. Application:
   1. Thoroughly clean surfaces to be painted to remove dirt, grease and scale. Wash galvanized surfaces with mild solution of acid prior to painting to effectively clean oils from surface and to etch zinc.
   2. Paint insulated surfaces and covered piping with one primer coat and two finish coats.
   3. Paint exposed equipment, pipes and supports with one primer coat and two finish coats. Paint factory painted equipment to match colors selected by the Architect: touch up damaged areas with paint to match factory color.
   4. Paint the supporting devices for mechanical devices or systems specified to be painted.

3.16 MISCELLANEOUS EQUIPMENT AND FIXTURE CONNECTIONS

A. Provide piping, ductwork, and make all final mechanical connections in accordance with manufacturers' recommendations for Owner-furnished equipment and fixtures, and equipment and fixtures specified.
B. Perform on-site review and refer to manufacturers' shop drawings for details of connections. Provide rough-in at locations to conveniently serve items.

3.17 BALANCING WORK

A. General: The Mechanical Subcontractor shall provide all support for balancing and testing work. Coordinate with Section 230593.
B. Work by Mechanical Subcontractor:
   1. Provide the balancing subcontractor with access to all equipment installed under this contract requiring balancing. Provide ladders, scaffolding, lifts as required to permit the Subcontractor to complete their work.
   2. Operate the mechanical systems and be responsible for all equipment until the balancing and testing is complete. Before balancing and testing commences, check all rotating equipment for proper rotation and lubricate per the manufacturers' recommendations.
   3. Do not assume that equipment is shipped from the factory configured to meet specified volumes and quantities. Include and provide belt, sheave, starter heater and other equipment changes, and all work as required as part of this contract in order to permit balancing to required values.
   4. Before balancing and testing commences, operate all pumps and auxiliary equipment for a minimum of one hour. During this period, check out and calibrate all control components under operating service.
C. Work Coordinated With Owner:

1. Coordinate balancing with other work and building occupancy to ensure no interruptions occur.

3.18 WIRING

A. Wiring shall conform to applicable sections of these specifications. Provide wiring from branch circuit over current device to motor controller to motor terminals, including installation of starter and all connections. Provide raceway and conductors as shown for remote control, or interlock connections. Coordinate other control wiring with Division 23 of the Specifications. Provide overload elements in controllers sized to match motor nameplate full load amperes. Space within controllers shall not be used as a junction box.

END OF SECTION 230500

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Elastomeric isolation pads.
   2. Restrained-spring isolators.
   3. Elastomeric hangers.
   4. Snubbers.
   5. Restraints - cable type.

B. Related Requirements:
   1. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
   2. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Detail fabrication and assembly of equipment bases.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.3 QUALITY ASSURANCE

A. Seismic-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: UL product listing FM Approvals an agency acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Design Calculations:
   1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-10 including supplement No. 1
      a. .
      b. Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
      c. Refer to Structural plans for project specific structural parameters.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CADDY; brand of nVent Electrical plc.
      b. Kinetics Noise Control, Inc.
      c. Mason Industries, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
5. Surface Pattern: Smooth, ribbed, or waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.

2.3 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CADDY; brand of nVent Electrical plc.
   b. Kinetics Noise Control, Inc.
   c. Mason Industries, Inc.
2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
   a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
   b. Top plate with threaded mounting holes and elastomeric pad.
   c. Internal leveling bolt that acts as blocking during installation.
3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.4 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CADDY; brand of nVent Electrical plc.
   b. Kinetics Noise Control, Inc.
   c. Mason Industries, Inc.
2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.5 RESTRAINTS - CABLE TYPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CADDY; brand of nVent Electrical plc.
2. Gripple Inc.
3. Vibration Mountings & Controls, Inc.

B. Seismic-Restraint Cables: ASTM A1023/A1023M galvanized or ASTM A603 galvanized-steel] cables. End connections made of steel assemblies with thimbles, brackets, swivel, and

bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.

C. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

PART 3 EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2 INSTALLATION OF VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICES

A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.

B. Provide seismic-restraint devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

D. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

E. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

F. Equipment Restraints:
   1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
   2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
   3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

G. Piping Restraints:
   1. Comply with requirements in MSS SP-127.
   2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
   3. Brace a change of direction longer than 12 feet.

H. Install seismic- restraint cables so they do not bend across edges of adjacent equipment or building structure.

I. Install seismic- restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

J. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

K. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

L. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

M. Mechanical Anchor Bolts:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Provide flexible connections in piping systems where they cross structural seismic joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties" for piping flexible connections.

END OF SECTION 230548

SECTION 23 05 93 - TESTING, ADJUSTING, BALANCING FOR HVAC

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. Testing, Adjusting, and Balancing of Air Systems:
      a. Constant-volume air systems.
   2. Testing, adjusting, and balancing of fuel oil systems for HVAC.
   3. Testing, adjusting, and balancing of steam and condensate piping systems.
   4. Testing, adjusting, and balancing of equipment.
   5. Duct leakage tests verification.
   6. Pipe leakage tests verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.
B. NEBB: National Environmental Balancing Bureau.
C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
F. TDH: Total dynamic head.
G. UFAD: Underfloor air distribution.

1.4 ACTION SUBMITTALS

A. Sustainable Design Submittals:
   1. Air-Balance Report: Documentation indicating that Work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   2. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.5 INFORMATIONAL SUBMITTALS

A. Certified TAB reports.
B. Sample report forms.
C. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
   2. TAB Technician: Employee of the TAB specialist and certified by AABC.
B. TAB Specialists Qualifications, Certified by NEBB :
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB .
   2. TAB Technician: Employee of the TAB specialist and certified by NEBB .
C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

1. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

E. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:
1. Neudorfer .
2. Hardin and Sons
3. United Test and Balance

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.

F. Examine equipment performance data, including fan and pump curves.
1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable refrigerant flow untis, and verify that they are accessible and their controls are connected and functioning.
K. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainer baskets are installed and clean.
L. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
N. Examine system pumps to ensure absence of entrained air in the suction piping.
O. Examine operating safety interlocks and controls on HVAC equipment.
P. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
Q. 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.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.
B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
   1. Airside:
      a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
      b. Duct systems are complete with terminals installed.
      c. Volume, smoke, and fire dampers are open and functional.
      d. Clean filters are installed.
      e. Fans are operating, free of vibration, and rotating in correct direction.
      f. Variable-frequency controllers' startup is complete and safeties are verified.
      g. Automatic temperature-control systems are operational.
      h. Ceilings are installed.
      i. Windows and doors are installed.
      j. Suitable access to balancing devices and equipment is provided.
   2. Hydronics:
      a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
      b. Piping is complete with terminals installed.
      c. Water treatment is complete.
      d. Systems are flushed, filled, and air purged.
      e. Strainers are pulled and cleaned.
      f. Control valves are functioning in accordance with the sequence of operation.
      g. Shutoff and balance valves have been verified to be 100 percent open.
      h. Pumps are started and proper rotation is verified.
      i. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
      j. Variable-frequency controllers' startup is complete and safeties are verified.
      k. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
   3. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
   4. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
   1. Motors.
   2. Pumps.
   3. Fans and ventilators.
   4. Terminal units.
   5. Condensing units.
   6. Energy-recovery units.
   7. Heating and ventilating units.
   8. Variable-refrigerant-flow systems.

3.6 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' Record drawings duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

3.7 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
      b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
      c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   2. Measure fan static pressures as follows:
      a. Measure static pressure directly at the fan outlet or through the flexible connection.
      b. Measure static pressure directly at the fan inlet or through the flexible connection.
      c. Measure static pressure across each component that makes up the air-handling system.
      d. Report artificial loading of filters at the time static pressures are measured.
   3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
   4. Obtain approval from Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
   5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
   1. Measure airflow of submain and branch ducts.
   2. Adjust submain and branch duct volume dampers for specified airflow.
   3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
   1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
   2. Measure inlets and outlets airflow.
   3. Adjust each inlet and outlet for specified airflow.
   4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.
   1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
   2. Re-measure and confirm that total airflow is within design.
   3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
   4. Mark all final settings.
   5. Test system in economizer mode. Verify proper operation and adjust if necessary.
   6. Measure and record all operating data.
   7. Record final fan-performance data.

3.8 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer's name, model number, and serial number.
   2. Motor horsepower rating.

3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.9 PROCEDURES FOR AIR-COOLED CONDENSING UNITS

A. Verify proper rotation of fan(s).
B. Measure and record entering- and leaving-air temperatures.
C. Measure and record entering and leaving refrigerant pressures.
D. Measure and record operating data of compressor(s), fan(s), and motors.

3.10 DUCT LEAKAGE TESTS

A. Witness the duct leakage testing performed by Installer.
B. Verify that proper test methods are used and that leakage rates are within specified limits.
C. Report deficiencies observed.

3.11 PIPE LEAKAGE TESTS

A. Witness the pipe pressure testing performed by Installer.
B. Verify that proper test methods are used and that leakage rates are within specified limits.
C. Report deficiencies observed.

3.12 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 percent or minus 5 percent . If design value is less than 100 cfm, within 10 cfm.
   2. Air Outlets and Inlets: Plus 10 percent or minus 5 percent . If design value is less than 100 cfm, within 10 cfm.
B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.13 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.
   3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.
   2. Fan curves.
   3. Manufacturers' test data.
   4. Field test reports prepared by system and equipment installers.
   5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB specialist.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents, including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fans performance forms, including the following:
      a. Settings for outdoor-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Heating coil, dry-bulb conditions.
      e. Face and bypass damper settings at coils.
      f. Fan drive settings, including settings and percentage of maximum pitch diameter.
      g. Variable-frequency controller settings for variable-air-volume systems.
      h. Settings for pressure controller(s).
      i. Other system operating conditions that affect performance.
   16. Test conditions for pump performance forms, including the following:
      a. Variable-frequency controller settings for variable-flow hydronic systems.
      b. Settings for pressure controller(s).
      c. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outdoor, supply, return, and exhaust airflows.
   2. Water and steam flow rates.
   3. Duct, outlet, and inlet sizes.
   4. Pipe and valve sizes and locations.
   5. Terminal units.
   6. Balancing stations.
   7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units, include the following:
   1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan speed.
d. Inlet and discharge static pressure in inches wg.
e. For each filter bank, filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. List for each internal component with pressure-drop, static-pressure differential in inches wg.
j. Outdoor airflow in cfm.
k. Return airflow in cfm.
l. Outdoor-air damper position.
m. Return-air damper position.

F. Apparatus-Coil Test Reports:
1. Coil Data:
a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Average face velocity in fpm.

c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.
k. Inlet steam pressure in psig.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data:
a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.
2. Test Data (Indicated and Actual Values):
a. Heat output in Btu/h.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan speed.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
   1. Report Data:
      a. System fan and air-handling-unit number.
      b. Location and zone.
      c. Traverse air temperature in deg F.
      d. Duct static pressure in inches wg.
      e. Duct size in inches.
      f. Duct area in sq. ft..
      g. Indicated airflow rate in cfm.
      h. Indicated velocity in fpm.
      i. Actual airflow rate in cfm.
      j. Actual average velocity in fpm.
      k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:
   1. Unit Data:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Apparatus used for test.
      d. Area served.
      e. Make.
      f. Number from system diagram.
      g. Type and model number.
      h. Size.
      i. Effective area in sq. ft..
   2. Test Data (Indicated and Actual Values):
      a. Airflow rate in cfm.
      b. Air velocity in fpm.
      c. Preliminary airflow rate as needed in cfm.
      d. Preliminary velocity as needed in fpm.
      e. Final airflow rate in cfm.
      f. Final velocity in fpm.
      g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
   1. Unit Data:
      a. System and air-handling-unit identification.
      b. Location and zone.
      c. Room or riser served.
      d. Coil make and size.
      e. Flowmeter type.
   2. Test Data (Indicated and Actual Values):
      a. Airflow rate in cfm.

b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves, and include the following:
1. Unit Data:
a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump speed.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.
2. Test Data (Indicated and Actual Values):
a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

M. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.

B. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day .

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 20 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.

E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
   1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
   2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 23 07 13 - DUCT INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Outdoor, exposed supply and return.

B. Related Sections:
   1. Section 230719 "HVAC Piping Insulation."
   2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F in accordance with ASTM C411. Comply with ASTM C553, Type II, and ASTM C1290, Type II with factory-applied vinyl jacket . Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Knauf Insulation.
      c. Owens Corning.

2.3 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
2. Verify fiberglass adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Johns Manville; a Berkshire Hathaway company.
2. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.
1. VOC Content: 300 g/L or less.
2. Low-Emitting Materials: Verify mastic coatings comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Knauf Insulation.
2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements
5. Color: White

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
2. Materials are compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Verify sealant has a VOC content of 420 g/L or less.
7. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Childers Brand; H. B. Fuller Construction Products.

b. Foster Brand; H. B. Fuller Construction Products.

2. Materials are compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. Verify sealant has a VOC content of 420 g/L or less.
7. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. 3M Industrial Adhesives and Tapes Division.
      b. Ideal Tape Co., Inc., an American Biltrite Company.
   2. Width: 2 inches.
   3. Thickness: 6 mils.
   4. Adhesion: 64 ounces force/inch in width.
   5. Elongation: 500 percent.
   6. Tensile Strength: 18 lbf/inch in width.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. Knauf Insulation.
   2. Width: 2 inches.
   3. Thickness: 3.7 mils.
   4. Adhesion: 100 ounces force/inch in width.
   5. Elongation: 5] percent.
   6. Tensile Strength: 34 lbf/inch in width.

2.7 CORNER ANGLES

PART 3 EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents [, unless otherwise approved by the engineer of record].
G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.
I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
L. Cut insulation in a manner to avoid compressing insulation.
M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.
B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
   1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
D. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
B. Comply with manufacturer's written installation instructions.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Impale insulation over pins and attach speed washers.
      f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
      a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
      b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
   5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
   6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
   7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for [100] [50] <Insert number> percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
      a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
      b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
   5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
   6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.6 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. 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 plenums and casings.
   3. Flexible connectors.

3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Refer to schedule in plans.

3.8 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Refer to schedule in plans..

3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Ducts and Plenums, Concealed:
   1. PVC : 20 mils thick.
D. Ducts and Plenums, Exposed:
   1. PVC : 20 mils thick.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
   1. Aluminum, Stucco Embossed : 0.04 inch thick.

END OF SECTION 230713

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes insulation for HVAC piping systems.
B. Related Requirements:
   1. Section 230713 "Duct Insulation" for duct insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
   3. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

1.4 QUALITY ASSURANCE

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
F. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I for tubular materials, Type II, for sheet materials.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armacell LLC.
G. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Knauf Insulation.
      c. Owens Corning.
   2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ .
   3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
   4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
H. Mineral Wool, Preformed Pipe: Mandrel-wound mineral wool fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to 1200 deg F in accordance with ASTM C447. Comply with ASTM C547.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Owens Corning.
   2. Preformed Pipe Insulation: Type II, Grade A .
   3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
I. Polyolefin: Polyethylene thermal plastic insulation. Comply with or ASTM C1427, Type I, Grade 1, for tubular materials and with Type II, Grade 1, for sheet materials , self-seal.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armacell LLC.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armacell LLC.
   2. Adhesive: As recommended by flexible elastomeric and polyolefin manufacturer and with a VOC content of 80 g/L or less.
   3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   4. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
   5. Wet Flash Point: Below 0 deg F.
   6. Service Temperature Range: 40 to 200 deg F.

7. Color: Black .

C. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
   2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
   3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Johns Manville; a Berkshire Hathaway company.
   2. Adhesive: As recommended by Adhesive - PVC Jacket manufacturer and with a VOC content of [50] <Insert value> g/L or less.
   3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.
   1. Mastics: As recommended by insulation manufacturer and with a VOC content of [50] <Insert value> g/L or less.
   2. Verify mastics comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
      c. Knauf Insulation.
   2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
   3. Service Temperature Range: 0 to plus 180 deg F.
   4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
   5. Color: White.

2.5 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. FSK and Metal Jacket Flashing Sealants:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: Aluminum.
   5. Verify sealant has a VOC content of 420 g/L or less.

6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. ASJ Flashing Sealants and PVDC and PVC Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. Verify sealant has a VOC content of 420 g/L or less.
6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Johns Manville; a Berkshire Hathaway company.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color as selected by Architect.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Johns Manville; a Berkshire Hathaway company.
2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   a. Sheet and roll stock ready for shop or field sizing.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
   d. Factory-Fabricated Fitting Covers:
      1. Same material, finish, and thickness as jacket.
      2. Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3. Tee covers.

4. Flange and union covers.
5. End caps.
6. Beveled collars.
7. Valve covers.
8. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. 3M Industrial Adhesives and Tapes Division.
   2. Width: 2 inches.
   3. Thickness: 6 mils.
   4. Adhesion: 64 ounces force/inch in width.
   5. Elongation: 500 percent.
   6. Tensile Strength: 18 lbf/inch in width.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
   3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at [2 inches] [4 inches] o.c.
   4. For below-ambient services, apply vapor-barrier mastic over staples.
   5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
   6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
M. Cut insulation in a manner to avoid compressing insulation.
N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least [4 inches] <Insert value> beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
P. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.

3.3 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Section 078413 "Penetration Firestopping" for 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 below.
B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using prefabricated fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with prefabricated fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
   6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
   7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
   8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes.

Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers. Installation shall conform to the following:
   1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
   2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
   3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
   4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
   5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
   2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When 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 prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof

sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

1. Where PVDC jackets are indicated, install as follows:
2. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
3. Wrap presized jackets around individual pipe insulation sections, with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
4. 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.
5. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
6. 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 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size shall comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Underground piping.
   2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inch thick.

B. Refrigerant Liquid Piping:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inch thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I.

B. Refrigerant Liquid Piping:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Piping, Exposed:
   1. PVC : 20 mils thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Piping, Exposed:
   1. Aluminum, Stucco Embossed with Z-Shaped Locking Seam : 0.016 inch thick.

END OF SECTION 230719

SECTION 23 09 00 - CONTROLS

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. Scope: Furnish all labor, materials, and equipment necessary for a complete and operating Building Management System (BMS) utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All controllers furnished in this section shall communicate on a peer-to-peer bus over a single BACnet open protocol bus.
   1. The intent of this specification is to provide a system that is consistent with the BMS systems installed under BACnet protocols.
   2. The system will control all heating, cooling, and ventilation systems described in the drawings and noted in the specifications below.
   3. System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols including, as a minimum, BACnet, and Modbus.
   4. System architecture shall provide secure web access using current released versions of Firefox, Microsoft Edge, and Chrome browser from any computer on the owner's LAN.
   5. All control devices furnished with this Section shall be compatible with the Niagara N4 Workbench upon completion of this project. The use of configurable or programmable controllers that require additional software tools for post-installation maintenance shall not be acceptable.
   6. Any control vendor that must provide additional BMS server software shall be unacceptable. Only systems that are compatible with the Niagara N4 Framework shall satisfy the requirements of this section.
   7. The BMS server shall host all graphic files for the control system. All graphics and navigation schemes for this project shall be submitted for approval and reviewed with the Owner prior to implementation.
   8. Engineering/Programming software to modify Operating System Server BMS programs and graphics shall be provided and installed on campus-standard laptops.
   9. Controls contractors shall coordinate with network services to configure the system and laptop security settings to meet Owner's network services requirements prior to being connected to the campus IT network.
   10. Remote access to the BMS via the Internet shall only be allowed if it can be properly secured with encryption, logging and authentication.
   11. Initial installation shall be left standalone at the building level throughout warranty period. Integration into the existing network will occur at the end of the warranty period.
   12. All certificates and passwords shall be turned over to the Owner. No portion of the final installation shall be left "locked" after turn over.

1.3 SUBMITTALS

A. Product Data: Provide the number of copies required by the General Conditions of this contract. Should the General Conditions not define the number of copies, include at least 5 copies. Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
   1. Each control device labeled with setting or adjustable range of control.
   2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, and method of field assembly, components, and location and size of each field connection.

3. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
4. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
5. Details of control panel faces, including controls, instruments, and labeling.
6. Written description of sequence of operation.
7. Schedule of dampers including size, leakage, and flow characteristics.
8. Schedule of valves including close-off and flow characteristics.
9. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
10. Listing of connected data points, including connected control unit and input device.
11. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
12. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
13. Samples: For each color required, of each type of thermostat cover.
14. Software and Firmware Operational Documentation: Include the following:

B. Engineering, Installation, Operation and Maintenance manuals.

C. Program Software Backup: On a magnetic media or compact disc, complete with data files.
1. Device address list.
2. Printout of software application and graphic screens.
3. Licenses, guarantee, and warranty documents for all equipment and systems.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: For systems to include in maintenance manuals specified in Division 1. Include the following:
1. Maintenance instructions and lists of spare parts for each type of control device and compressed air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.
6. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
7. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

1.4 QUALITY ASSURANCE

A. All bidders must be Systems Integrators and specialty control contractors in the business of installing direct digital temperature controls.

B. All bidders shall be factory owned branch office or factory authorized, independent installing contractor or Certified Systems Integrator of the manufacturers specified.

C. The system manufacturer shall, as a minimum, manufacture and supply the Custom Application Controller, Application Specific Controller, Equipment Direct Digital Controller, Unitary Equipment Controller, Advanced Application Controller, Graphical User Interface, damper actuators, and valve actuator assemblies.

D. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer's local field office.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
F. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
G. All the work of this contract shall conform to the General and Supplementary Conditions Provisions under Division 1 of the Specifications.
H. This contract shall conform to the Specifications Section 23 05 00 Common Work HVAC.
   1. Smoke Detectors (through alarm relay contacts).
I. Power and Wiring Work Required Under Division 16 Related to This Section:
   1. This contract is responsible to arrange and pay for all power and for all power wiring to and for control components and all line and low voltage interconnections. This contract shall arrange coordinate installation of power for all control components, as it is not known in advance of the bid the power requirements for all various system elements. Include the scope in the bid for this contract of the following:
   2. Power wiring to line side of motor starters, disconnects or variable frequency drives.
   3. Provision and wiring of smoke detectors and other devices relating to fire alarm system.
   4. Campus LAN (Ethernet) connection adjacent to JACE network management controller.

1.5 AGENCY AND CODE APPROVALS

A. All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided on request, with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
   1. Federal Communications Commission (FCC), Rules and Regulations, Volume II -July 1986 Part 15 Class A Radio Frequency Devices
   2. FCC, Part 15, Subpart J, Class A Computing Devices
   3. UL 504 - Industrial Control Equipment
   4. UL 506 - Specialty Transformers
   5. UL 910 - Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air-Handling Spaces
   6. UL 916 - Energy Management Systems All
   7. UL 1449 – Transient Voltage Suppression
   8. Standard Test for Flame Propagation Height of Electrical and Optical - Fiber Cables Installed Vertically in Shafts
   9. EIA/ANSI 232-E - Interface Between Data Technical Equipment and Data Circuit Terminal Equipment Employing Serial Binary Data Interchange
   10. EIA 455 - Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices
   11. IEEE C62.41- Surge Voltages in Low-Voltage AC Power Circuits
   12. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems
   13. 13. NEMA 250 - Enclosures for Electrical Equipment
   14. NEMA ICS 1 - Industrial Controls and Systems
   15. NEMA ST 1 - Specialty Transformers
   16. NCSBC Compliance, Energy: Performance of control system shall meet or surpass the requirements of ASHRAE/IESNA 90.1-1999.

1.6 RELATED WORK SPECIFIED ELSEWHERE

A. Products Supplied and coordinated to be installed by others.:
   1. Wells, sockets and other inline hardware for water sensors (temperature, pressure, flow).
   2. Automatic control dampers, where not supplied with equipment.
   3. Airflow measuring stations.

B. Products Installed But Not Supplied Under This Section:
   1. None.
C. Products Not Furnished or Installed But Integrated with the Work of This Section:
   1. VRF Control System Controls and Monitoring.
   2. DOAS Controls and Monitoring.
   3. DHWH-1 Controls and Monitoring.
   4. In-line Meters (gas, water, power).

1.7 SOFTWARE OWNERSHIP

A. The Owner shall have full ownership and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS.

1.8 DELIVERY, STORAGE AND HANDLING

A. Maintain integrity of shipping cartons for each piece of equipment and control device through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.9 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.10 QUALITY ASSURANCE

A. The manufacturer of the BMS digital controllers shall, if requested, provide documentation supporting compliance with ISO-9001 (Model for Quality Assurance in Design/Development, Production, Installation and Servicing).
B. The Control System Contractor shall have a full service DDC office within 50 miles of the job site. This office shall be staffed with applications engineers, software engineers and field technicians. This office shall maintain parts inventory and shall have all testing and diagnostic equipment necessary to support this Work, as well as staff trained in the use of this equipment.
C. Single Source Responsibility of Supplier: The Control System Contractor shall be responsible for the complete installation and proper operation of the control system. The Control System Contractor shall exclusively be in the regular and customary business of design, installation and service of computerized building management systems similar in size and complexity to the system specified. The Control System Contractor shall be the manufacturer of the primary DDC system components or shall have been the authorized representative for the primary DDC components manufacturer for at least 5 years. All control panels shall be assembled by the Control System Contractor in a UL-Certified 508A panel shop.
D. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in the production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.11 SPECIFICATION NOMENCLATURE - ACRONYMS USED IN THIS SPECIFICATION ARE AS FOLLOWS:

Actuator:	Control device that opens or closes valve or damper in response to control signal.
AI	Analog Input

AO	Analog Output
Analog	Continuously variable state over stated range of values
BMS	Building Management System
DDC	Direct Digital Control
Discrete	Binary or digital state
DI	Discrete Input
DO	Discrete Output
FC	Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
FO	Fail open (position of control device or actuator). Device moves to open position on loss of control signal or energy source.
GUI	Graphical User Interface
HVAC	Heating, Ventilating and Air Conditioning
IDC	Interoperable Digital Controller
ILC	Interoperable Lon Controller
LAN	Local Area Network
Modulating	Movement of a control device through an entire range of values, proportional to an infinitely variable input value.
Motorized	Control device with actuator
NAC	Network Area Controller
NC	Normally closed position of switch after control signal is removed or normally closed position of manually operated valves or dampers.
NO	Normally open position of switch after control signal is removed; or the open position of a controlled valve or damper after the control signal is removed; or the usual position of a manually operated valve.
OSS	Operating System Server, host for system graphics, alarms, trends, etc.
Operator	Same as actuator
PC	Personal Computer
Peer-to-Peer	Mode of communication between controllers in which each device connected to network has equal status and each shares its database values with all other devices connected to network
P	Proportional control; control mode with continuous linear relationship between observed input signal and final controlled output element.
PI	Proportional-Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controller variable (reset control).
PICS	BACnet Product Interoperability Compliance Statement
PID	Proportional-Integral-Derivative control, control mode with continuous correction of final controller output element versus input signal based on proportional error, its time history (reset) and rate at which it's changing (derivative).
Point	Analog or discrete instrument with addressable database value
WAN	Wide Area Network

PART 2 MATERIALS

2.1 GENERAL

A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a network area controller, graphics and programming, and other control devices for a complete system as specified herein.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall BMS.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURE

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system utilizing the BACnet communication protocol in one open, interoperable system.
B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. Physical connection of any BACnet control equipment, such as chillers, shall be via Ethernet.
C. All components and controllers supplied under this contract shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable.
D. All components and controllers supplied under this contract shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable.
E. The supplied system must incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on the existing Operating System Server currently located in the Facilities Office on the LAN. Systems requiring proprietary database and user interface programs shall not be acceptable.
F. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network. Systems employing a “flat” single tiered architecture shall not be acceptable.
    1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
    2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 SYSTEM NETWORK CONTROLLER (SNC)

A. These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC), and advanced unitary controllers (AUC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.
B. The controllers must be fully programmable to meet the unique requirements of the facility it must control.
C. The controllers must be capable of peer-to-peer communications with other SNC’s and with any OWS connected to the BAS, whether the OWS is directly connected, connected via the Internet.
D. The communication protocols utilized for peer-to-peer communications between SNC’s will be BACnet TCP/IP and SNMP. Use of a proprietary communication protocol for peer-to-peer communications between SNC’s is not allowed.
E. The SNC shall be capable of executing application control programs to provide:
    1. Calendar functions
    2. Scheduling
    3. Trending
    4. Alarm monitoring and routing
    5. Time synchronization
    6. Integration of BACnet, and ModBus controller data
    7. Network management functions for all SNC, PEC and ASC based devices
F. The SNC must provide the following hardware features as a minimum:
    1. One Ethernet Port-10/100 Mdps

2. One RS-232/485 port
3. One BACnet Interface Port
4. Battery Backup
5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)

G. The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.

H. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.

I. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
   1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
      a. Alarm,
      b. Return to normal,
      c. To default.
   2. Alarms shall be annunciated in any of the following manners as defined by the user:
      a. Screen message text,
      b. Email of complete alarm message to multiple recipients.
      c. Pagers via paging services that initiate a page on receipt of email message.
      d. Graphics with flashing alarm object(s).
   3. The following shall be recorded by the SNC for each alarm (at a minimum):
      a. Time and date
      b. Equipment (air handler #, accessway, etc.)
      c. Acknowledge time, date, and user who issued acknowledgement.

J. Programming software and all controller “Setup Wizards” shall be embedded into the SNC.

2.4 PROGRAMMABLE EQUIPMENT CONTROLLER (PEC)

A. HVAC control shall be accomplished using BACnet™ based devices where the application has a BACnet profile defined.

B. For each Bacnet device that does not have Bacnet certification, the device supplier must provide an XIF file for the device. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara N4 Framework™, that allow standard and customizable control solutions required in executing the “Sequence of Operation”.

C. All PECs shall be application programmable and shall at all times maintain their Bacnet certification. All control sequences within or programmed into the ILC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.

D. The PECs shall communicate with the SNC at a baud rate of not less than 78.8K baud. The PEC shall provide LED indication of communication and controller performance to the technician, without cover removal.

E. The following integral and remote Inputs/Outputs shall be supported per each PEC:
   1. Eight integral dry contact digital inputs.
   2. Any two digital inputs may be configured as pulse counters with a maximum pulse read rate of 15 Hz.
   3. Eight integral analog inputs (configurable as 0-10V, 0-10,000 ohm or, 20K NTC).
   4. Six integral 4-20 ma analog outputs.
   5. Eight integral 24 Vac Triac digital outputs, configurable as maintained or floating motor control outputs.
   6. One integral 20 Vdc, 65-mA power supply for auxiliary devices.

7. If a 20 Vdc 65-mA power supply terminal is not integral to the ILC, provide at each PEC a separate, fully isolated, enclosed, current limited and regulated UL listed auxiliary power supply for power to auxiliary devices

F. Each PEC shall have expansion ability to support additional I/O requirements through the use of remote input/output modules

G. PEC Controllers shall support the following control techniques:
1. Ten configurable general-purpose control loops that can incorporate Demand Limit Control strategies, Setpoint reset, adaptive intelligent recovery, and time of day bypass.
2. Ten general-purpose, non-linear control loops.
3. Eight start/stop Loops.
4. Thirty-two If/Then/Else logic loops.
5. Thirty six Math Function loops (MIN, MAX, AVG, SUM, SUB,SQRT, MUL, DIV, ENTHALPY).

2.5 ADVANCED UNITARY CONTROLLER

A. The advanced unitary controller (AUC) platform shall be designed specifically to control HVAC – ventilation, filtration, heating, cooling, humidification, and distribution. Equipment includes: constant volume air handlers, VAV air handlers, packaged RTU, heat pumps, unit vents, fan coils, natural convection units, and radiant panels. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara N4 Framework™, that allow standard and customizable control solutions required in executing the “Sequence of Operation”.

B. Minimum Requirements:
1. The controller shall be fully programmable with full functionality on any Niagara N4 brand platform.
   a. Support downloads to the controller from any brand of Niagara N4 platform.
   b. Support uploads from the controller to any brand of Niagara N4 platform.
   c. Support simulation/debug mode of the controller.
   d. Maintain native GUI.
   e. Native function-block programming within the Niagara N4 environment.
2. The controller shall be capable of either integrating with other devices or stand-alone operation.
3. The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications. Controller memory minimum requirements include:
   a. FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
   b. FLASH Memory settings retained for ten years.
   c. RAM: 2 Kilobytes
4. The controller shall have an FTT transformer-coupled communications port interface for common mode-noise rejection and DC isolation.
5. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
   a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
   b. Accuracy: ±1 minute per month at 77° F (25° C).
   c. Power Failure Backup: 24 hours at 32° to 122° F (0° to 50° C).
6. The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
7. The controller shall have an internal DC power supply to power external sensors.

a. Power Output: 20 VDC ±10% at 75 mA.

8. The controller shall have a visual indication (LED) of the status of the devise:
   a. Controller operating normally.
   b. Controller in process of download.
   c. Controller in manual mode under control of software tool.
   d. Controller lost its configuration.
   e. No power to controller, low voltage, or controller damage.
   f. Processor and/or controller are not operating.
9. The minimum controller Environmental ratings
   a. Operating Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
   b. Storage Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
   c. Relative Humidity: 5% to 95% non-condensing.
10. The controller shall have the additional approval requirements, listings, and approvals:
   a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
   b. CSA (LR95329-3) Listed
   c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
   d. Meets Canadian standard C108.8 (radiated emissions).
   e. Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity)
   f. Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission)
11. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
12. The controller shall have a mix of digital inputs (DI), digital Triac outputs (DO), analog outputs (AO), and universal inputs (UI).
   a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO)
   b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
   c. Input and Output wiring terminals shall be designated with color coded labels.
   d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA)
13. The controller shall provide for “user defined” Network Variables (NV) for customized configurations and naming using Niagara N4 Framework™.
   a. The controller shall support 62 Network Variables with a byte count of 31 per variable.
   b. The controller shall support 1,922 separate data values.
14. The controller shall provide “continuous” automated loop tuning with an Adaptive Integral Algorithm Control Loop.
15. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized “sequence of operations” as outlined in Section 4.
   a. Discharge air control and low limit
   b. Pressure-dependent dual duct without flow mixing.
   c. Variable air volume with return flow tracking.
   d. Economizer with differential enthalpy.
   e. Minimum airflow coordinated with CO2.
   f. Unit ventilator cycle (1,2,3) 2-pipe.
   g. Unit ventilator cycle (1,2,3) 2-pipe with face/bypass.
   h. Unit ventilator cycle (1,2,3) 4-pipe.

i. Unit ventilator cycle (1,2,3) 4-pipe with EOC valve.

2.6 OTHER CONTROL SYSTEM HARDWARE

A. Motorized control dampers that will not be integral to the equipment shall be furnished by the Control System Contractor. Control damper frames shall be constructed of galvanized steel, formed into changes and welded or riveted. Dampers shall be galvanized, with nylon bearings. Blade edge seals shall be vinyl. Blade edge and tip seals shall be included for all dampers. Blades shall be 16-gauge minimum and 6 inches wide maximum and frame shall be of welded channel iron. Damper leakage shall not exceed 10 CFM per square foot, at 1.5-inches water gauge static pressure.

B. Control damper actuators shall be furnished by the Control System Contractor. Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators.

C. Wall Mount Room Temperature sensors: Each room temperature sensor shall provide temperature indication to the digital controller, provide the capability for a software-limited occupant set point adjustment (warmer-cooler slider bar or switch) and limited operation override capability. Room Temperature Sensors shall be 20,000-ohm thermistor type with a temperature range of -40 to 140 degrees F. The sensor shall be complete with a decorative cover and suitable for mounting over a standard electrical utility box. These devices shall have an accuracy of 0.5 degrees, F., over the entire range.

D. Duct-mounted and Outside Air Temperature Sensors: 20,000-ohm thermistor temperature sensors with an accuracy of ± 0.2ºC. Outside air sensors shall include an integral sun shield. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of -40 to 160 degrees F. The sensor shall include a utility box and a gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 8 - foot long sensor element. These devices shall have accuracy of 0.5 degrees, F., over the entire range.

2.7 INTEGRATION WITH OWNER'S SOFTWARE SYSTEMS

A. The Owner operates facility management software is a Niagara based system. The objective is to build the new system standalone and to integrate with existing system including many management and maintenance tracking functions on this platform in the future.

B. Data will be passed between the BMS system and the Niagara N4 software by a .csv file. The file shall be of "flat" format and not the output from Excel or some other application that may be subject to a revised format.

C. The format of the .csv file will be established between the BMS vendor and the Owner.

D. The BMS Contractor shall coordinate with Niagara N4 and coordinate data transfer requirements, and all aspects of the BMS system necessary to integrate successful data transfer from the BMS to Niagara N4.

E. The BMS Contractor shall coordinate with the owner to insure the that the data is competent and correctly represented in the manner expected by the Owner for their use.

2.8 BAS GUI SYSTEM OVERVIEW

A. The BAS Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BAS server shall communicate using Ethernet and TCP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet. Update web browser specifications to match with basic requirements for Niagara N4.

B. The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary opearator interface and configuration programs of browser plug-ins. Current released versions of Microsoft Edge, Firefox, and Chrome browsers shall be used, and Windows as well as non-Window operating systems.
C. The BAS server software must support at least the following server platforms (Windows 7 or later, Server 12). The BAS server software shall be developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.
D. The web browser GUI shall provide a completely interactive user interface and must offer and shall provide a HTML5 experience that supports the following features as a minimum:
    1. Trending
    2. Scheduling
    3. Electrical demand limiting
    4. Duty Cycling
    5. Downloading Memory to field devices
    6. Real time 'live' Graphic Programs
    7. Tree Navigation
    8. Parameter change of properties
    9. Setpoint Adjustments
    10. Alarm / Event information
    11. Configuration of operators
    12. Execution of global commands
    13. Add, delete, and modify graphics and displayed data
E. Software Components: All software shall be the most current version. All software components of the BAS system software shall be provided and installed as part of this project .BAS software components shall include:
    1. Server Software, Database and Web Browser Graphical User Interface
    2. <1, 3, or 5> Year Software Maintenance License. Labor to implement not included.
    3. Embedded System configuration Utilities for future modifications to the system and controllers.
    4. Embedded Direct Digital Control software
    5. Embedded Application Software
    6. Embedded Graphical Programming Tools.
    7. Any required third party software
    8. If licensing credits are required provide a minimum of 10% additional to as built control system requires.
F. BAS Server Database: The BAS server software shall utilize a database compatible with the existing systems, and suitable for future expansion, such as: Current released version of Microsoft SQL Server. BAS systems written to Non -Standard and/or Proprietary databases are NOT acceptable.
G. Database Open Connectivity: The BAS server database shall allow real time access of data via the following standard mechanisms:
    1. Open protocol standard like SOAP
    2. OLE/OPC (for Microsoft Client's/Server platform only)
    3. Import/Export of the database from or to XML (eXtensible Mark-up Language)
H. Communication Protocol(s): The native protocol for the BAS server software shall be TCP/IP over Ethernet. Proprietary protocols over TCP/IP are NOT acceptable.
I. Thin Client – Web Browser Based: The GUI shall be thin client or browser based and shall meet the following criteria:
    1. Web Browser's for PC's: Current released versions of Microsoft Edge, Firefox, and Chrome browsers will be required as the GUI, and a valid connection to the server

network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet.

2. Secure Socket Layers: Communication between the Web Browser GUI and BAS server shall offer encryption using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper-Text Transfer Protocol (HTTP)

2.9 WEB BROWSER GRAPHICAL USER INTERFACE

A. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic setpoint controls, configuration menus for operator access, reports, and reporting actions for events.

B. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and password. Navigation in the system shall be dependent on the operator's role privileges, and geographic area of responsibility.

C. Navigation: Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft's Explorer program), and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane shall be displayed simultaneously, enabling the operator to select a specific system or equipment, and view the corresponding graphic. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.

1. Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and objects.
2. Groups View shall display Scheduled Groups and custom reports.
3. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

D. Action Pane: The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. A functional view shall be accessed by clicking on the corresponding button:

1. Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh.
2. Properties: Shall include graphic controls and text for the following: Locking or overriding objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an 'accept/cancel' button.
3. Schedules: Shall be used to create, modify/edit and view schedules based on the systems geographical hierarchy (using the navigation tree).
4. Alarms: Shall be used to view alarm information geographically (using the navigation tree), acknowledge alarms, sort alarms by category, actions and verify reporting actions.
5. Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling
6. Logic - Live Graphic Programs: Shall be used to display' live' graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.
7. Other actions such as Print, Help, Command, and Logout shall be available via a drop-down window.

E. Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated .gifs or .jpg, vector scalable, active setpoint graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:
   1. Display Size: The GUI workstation software shall graphically display in 1024 by 768 pixels 24 bit True Color.
   2. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
   3. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. Provide a visual display of temperature relative to their respective setpoints. The colors shall be updated dynamically as a zone's actual comfort condition changes.
   4. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
   5. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
      a. Each piece of equipment monitored or controlled including each terminal unit
      b. Each building
      c. Each floor and zone controlled

F. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day ‘Holiday’ for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the ‘Independence Day’ Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
   1. Schedules: Schedules shall comply with the BacNet standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
      a. Types of schedule shall be Normal, Holiday or Override
      b. A specific date,
      c. A range of dates,
      d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)
      e. Wildcard (example, allow combinations like second Tuesday of every month).
   2. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of “things” to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
   3. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an ‘individual tenant’ group – who may occupy different areas within a building or buildings. Schedules applied to the ‘tenant group’ shall automatically be downloaded to control modules affecting spaces occupied by the ‘tenant group’
   4. Intelligent Scheduling: The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied

space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler, and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.

5. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
6. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.

G. Alarms. Take the following actions with alarms: 1) Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an 'Alarms' view. 2) Report alarms and system notifications to .csv file for upload to the Owner's existing system. Alarms, and reporting actions shall have the following capabilities:

1. Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report, and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
2. Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.
3. Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
4. Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.
5. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
6. Alarm Configuration: Operators shall be able to define the type of Alarm generated per object. A 'network' view of the Navigation Tree shall expose all objects and their respective Alarm Configuration. Configuration shall include assignment of Alarm, type of Acknowledgement and notification for return to normal or fault status.
7. Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement, and total number of Alarms in the BAS Server database.
8. Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
9. Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BAS server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
   a. Print: Alarm information shall be printed to the BAS server's PC or a networked printer.

b. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
c. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
d. Similar to above, see also paragraph 2.8 for Owner software integration, and write alarm file to .csv file and transfer to the existing Building Management software system.
e. Write Property: The write property reporting action updates a property value in a hardware module.
f. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.
g. Run External Program: The Run External Program reporting action launches specified program in response to an event.

H. Trends: Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane. Refer to Point Schedule for Trended Data.
1. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
2. Similar to above, see also paragraph 2.8 for Owner software integration, and write trended data to file to .csv file and transfer to the existing Building Management software system.
3. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.
4. Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis.
5. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
6. Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and 'pan through' historical data by simply scrolling the mouse.
7. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.
8. Copy/Paste. The operator must have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard keystrokes (i.e. CTRL+C, CTRL+V).

I. Security Access: Systems that Security access from the web browser GUI to BAS server shall require a Login Name and Password. Access to different areas of the BAS system shall be defined in terms of Roles, Privileges and geographic area of responsibility as specified:

1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of ‘easily understood English language’ privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
   a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
   b. Edit Privileges shall comprise: Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
   c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.
2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

2.10 GRAPHICAL PROGRAMMING

A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL is a method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors, etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents. Finished GUI graphic images should be consistent with existing system images as much as possible.

B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

C. Graphic Sequence: The clarity of the graphic sequence must be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming must be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.

D. GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:
   1. Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
   2. Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
   3. Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
   4. Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.
   5. Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead

of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.

6. Parameter: A parameter shall be a value that may be tied to the input of a microblock.
7. Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields, and shall contain 'push buttons' for the purpose of selecting default parameter settings.
8. Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
9. Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
10. Live Graphical Programs: The Graphic Programming software must support a 'live' mode, where all input/output data, calculated data, and setpoints shall be displayed in a 'live' real-time mode.

2.11 NETWORK MANAGEMENT

A. Systems requiring the use of third party network management tools shall not be accepted.
B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
C. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
D. These tools shall provide the ability to "learn" an existing network, regardless of what network management tool(s) were used to install the existing network, so that existing BACnet or Niagara 4 devices and newly added devices are part of a single network management database.
E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system shall not be accepted.

2.12 PORTABLE OPERATOR'S TOOL (LAPTOP COMPUTER)

A. Contractor is responsible for providing suitable device with all necessary drives, connectors and cables for communication with the provided control system.

PART 3 INSTALLATION

3.1 GENERAL

A. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
B. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.
C. Equipment furnished by the Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.
D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.2 WIRING

A. All electrical control wiring to the control panels shall be the responsibility of the Control System Contractor.

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. All control wiring shall be installed in raceways.

3.3 ACCEPTANCE TESTING

A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.
B. The Control System Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
C. System Acceptance: Satisfactory completion is when the Control System Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.4 OPERATOR TRAINING

A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control System Contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
B. The Control System Contractor shall provide 40 hours of comprehensive training in two separate sessions (80 hours total) for system orientation, product maintenance and troubleshooting, programming and engineering, if not provided under a previous contract at the site using the same brand and type of controllers within the previous 3 years.
C. The Control System Contractor shall provide 16 hours (total) of instruction to the owner's designated personnel on the operation of the BMS and describe its intended use with respect to the programmed functions specified. Operator orientation of the BMS shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation

3.5 WARRANTY PERIOD SERVICES

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.
B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner
C. Maintenance of Computer Software Programs: The Control System Contractor shall maintain all software during the warranty period. In addition, all factory or sub-vendor upgrades to software shall be added to the systems, when they become available, at no additional cost. New products are not considered upgrades in this context.
D. Maintenance of Control Hardware: The Control System Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The Control System Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work, and description of the corrective actions taken. The report shall clearly certify that all software is functioning correctly.

E. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.
F. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

3.6 WARRANTY ACCESS

A. The Owner shall grant to the Control System Contractor reasonable access to the BMS during the warranty period. Remote access to the BMS (for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period) will be allowed.

3.7 OPERATION & MAINTENANCE MANUALS

A. See Division 1 for requirements. O&M manuals shall include the following elements, as a minimum:
   1. As-built control drawings for all equipment.
   2. As-built Network Communications Diagram.
   3. General description and specifications for all components.
   4. Completed Performance Verification sheets.

PART 4 SEQUENCE OF OPERATIONS

4.1 SEQUENCE OF OPERATIONS

A. GENERAL
   1. All control points, setpoints, limits, etc. shall be accessible through the central CPU or the laptop computer connected to the system through the GUI.
   2. Control points as may be available for the VRF system shall be able to be observed from the central CPU or laptop through the GUI and adjustable.
   3. Control points for the equipment controlled by the DDC BMS system shall be able to be observed and adjusted through the central CPU or laptop.
B. DEDICATED OUTSIDE AIR SYSTEM
   1. GENERAL:
      a. THE UNIT SHALL OPERATE BASED ON LIBRARY HOUR SCHEDULE TO PROVIDE TEMPERED VENTILATION AIR.
      b. THE UNIT IS SUPPLIED WITH SIMPLE TERMINAL STRIP CONTROL, PACKAGED VFDS AND AIRFLOW MONITORING. THE DDC SHALL INTERFACE WITH THE TERMINAL STRIP CONTROL FOR ON/OFF AND BYPASS CONTROL AS WELL AS MONITORING OF POINTS. THE DDC SHAL ALSO CONNECT DIRECTLY TO THE FACTORY VFDS FOR CONTROL AND MONITORING.
   2. UNOCCUPIED/OFF MODE/MAINTENANCE MODE (NOT SCHEDULED BUT AVAILABLE FOR OPERATOR COMMAND):
      a. NORMAL OPERATION
         1) UNIT IS DISABLED
         2) FANS ARE OFF
         3) DAMPERS ARE CLOSED
   3. OCCUPIED MODE:
      a. NORMAL OPERATION: DISCHARGE AIR TEMPERATURE IS WITHIN HEAT DEADBAND.
         1) UNIT IS ENABLED
         2) DAMPERS OPEN
         3) SUPPLY FANS START AND RUNS CONTINUOUSLY ONCE DAMPER PROVES OPEN
         4) EXHAUST FANS START AND RUNS CONTINUOUSLY ONCE DAMPER PROVES OPEN

5) HEAT RECOVERY BYPASS DAMPER POSITIONED AS DESCRIBED IN HEAT RECOVER BYPASS SEQUENCE.

b. HEAT RECOVERY BYPASS
   1) THE HEAT RECOVERY BYPASS DAMPER SHALL OPEN/CLOSE TO DIVERT AIR FLOW PAST THE HEAT EXCHANGER DURING THE FOLLOWING CONDITIONS.
      (a) 68 DEGREES F < OSAT < 72 DEGREES F AND;
      (b) EAT > 72 DEGREES F OR;
      (c) EAT < 68 DEGREES F
   2) 55 DEGREES F < OSAT < EAT AND;
      (a) CALL FOR COOLING IS PRESENT IN MORE THAN 70% (ADJUSTABLE) OF ASSOCIATED ZONES. UNDER THIS CONDITION ELECTRIC HEATER IS LOCKED OUT. THIS SEQUENCE IS TO BE ACCOMPLISHED BY POLLING THE COOLING DEMAND AT THE VRF UNITS.

c. AIRFLOW MONITORING
   1) THE DDC SHALL CONNECT TO THE FACTORY PROVIDED AIR FLOW MONITORING STATION AND DISPLAY MEASURED VALUE AT GUI.

d. FAN SPEED CONTROL
   1) THE DDC SHALL HAVE CAPABILITY TO MONITOR AND CONTROL FAN SPEED. SPEED TO BE SET AS DETERMINED DURING BALANCING (ADJUSTABLE)

e. SAFETIES/ALARMS: SAFETIES DEVICE SHUTDOWN SHALL BE HARDWIRED AND INDEPENDENT OF DDC SYSTEM CONTROLS (EXCEPT FOR MONITORING). ALL SAFETIES SHALL BE AUTOMATIC RESETTING UNLESS SPECIFICALLY NOTED OTHERWISE.
   1) FAN FAIL: IF UNIT IS ENABLED AND SUPPLY OR EXHAUST FAN STATUS IS NOT PROVEN, ALARM IS GENERATED.
   2) HIGH FILTER PRESSURE: IF FILTER DIFFERENTIAL PRESSURE EXCEEDS 0.5” WC AN ALARM IS GENERATED.
   3) FIRE ALARM INTERFACE: UNIT SHUTS DOWN UPON ACTIVATION OF FIRE ALARM SYSTEM.
   4) DAMPER FAIL: IF DAMPER IS COMMANDED OPEN AND NO PROOF IS REGISTERED AND ALARM IS GENERATED.

C. ELECTRIC HEATER
   1. GENERAL:
      a. OPERATION OF ELECTRIC HEATER IS BY PACKAGED CONTROL NATIVE TO THE HEATER.
   2. UNOCCUPIED/OFF MODE/MAINTENANCE MODE:
      a. NORMAL OPERATION
         1) UNIT IS DISABLED
   3. OCCUPIED MODE:
      a. HEATING
         1) OPERATES TO MEET SET POINT.

D. VRF HEAT PUMPS
   1. GENERAL:
      a. OPERATION OF THE VARIABLE REFRIGERANT FLOW (VRF) SYSTEM SHALL BE REGULATED BY PACKAGED CONTROLS NATIVE TO THE SYSTEM.

b. DDC SHALL COMMUNICATE WITH THE VRF CENTRAL CONTROLLER VIA BACNET PROTOCOL FOR VARIOUS MONITORING POINTS AS WELL AS CONTROL OF ENABLING/DISABLING THE UNITS AND SETPOINT ADJUSTMENT.

2. MAINTENANCE MODE (NOT SCHEDULED BUT AVAILABLE FOR OPERATOR COMMAND):
   a. ALL UNITS ARE DISABLED.
3. UNOCCUPIED MODE (NOT SCHEDULED BUT AVAILABLE FOR OPERATOR COMMAND):
   a. SYSTEM FOLLOWS SAME SEQUENCE OF OPERATIONS FOR OCCUPIED MODE WITH THE FOLLOWING SETPOINTS.
      1) HEATING: 60 DEGREES F
      2) COOLING: 85 DEGREES F
4. OCCUPIED MODE:
   a. GENERAL:
      1) VRF SYSTEM SHALL BE ENABLED AND COMMANDED TO OPERATE. COMMAND SIGNAL FROM DDC TO VRF CONTROLLER SHALL BE CYCLED EVERY 12 HOURS (ADJUSTABLE).
   b. HEATING
      1) WHEN SPACE TEMPERATURE IS BELOW OCCUPIED HEATING SETPOINT, 70 DEGREES F (ADJUSTABLE); UNIT IS ENABLED AND CONTROLLED BY PACKAGED CONTROLLER TO MAINTAIN SETPOINT.
      2) WHEN SPACE TEMPERATURE IS ABOVE OCCUPIED HEATING SETPOINT (ADJUSTABLE); UNIT SHUTS OFF.
   c. COOLING
      1) WHEN SPACE TEMPERATURE IS ABOVE OCCUPIED COOLING SETPOINT, 75 DEGREES F (ADJUSTABLE); UNIT IS ENABLED AND CONTROLLED BY PACKAGED CONTROLLER TO MAINTAIN SETPOINT.
      2) WHEN SPACE TEMPERATURE IS BELOW OCCUPIED COOLING SETPOINT (ADJUSTABLE); UNIT SHUTS OFF.
5. SAFETIES/ALARMS
   a. FAULT: IF UNIT IS IN FAULT AT THE VRF CENTRAL CONTROLLER, ALARM IS GENERATED.
   b. COMMUNICATION FAILURE: IF COMMUNICATION WITH THE CENTRAL CONTROLLER OR INDIVIDUAL UNIT IS LOST, ALARM IS GENERATED.
   c. HIGH SPACE TEMPERATURE: IF SPACE TEMPERATURE EXCEEDS SETPOINT BY 5 DEGREES F (ADJUSTABLE) FOR 5 MINUTES, ALARM IS GENERATED.
   d. LOW SPACE TEMPERATURE: IF SPACE TEMPERATURE IS BELOW SETPOINT BY 5 DEGREES F (ADJUSTABLE) FOR 5 MINUTES, ALARM IS GENERATED.
6. SERVER ROOM EXHAUST FAN
   a. GENERAL:
   b. THE UNIT SHALL OPERATE BASED UPON ROOM TEMPERATURE SET POINT.
   c. UNOCCUPIED/OFF/MAINTENANCE MODE (NOT SCHEDULED BUT AVAILABLE FOR OPERATOR COMMAND):
      1) UNIT IS DISABLED
         (a) FAN IS OFF
         (b) EXHAUST MOTOR DAMPER IS CLOSED
   d. OCCUPIED MODE (24/7/365):
      1) UNIT IS ENABLED

2) UNIT RUNS TO MAINTAIN ROOM SET POINT (ADJUSTABLE).

7. DOMESTIC HOT WATER CIRCULATION PUMP
   a. MAINTENANCE (NOT SCHEDULED BUT AVAILABLE FOR OPERATOR COMMAND):
      1) tHE HOT WATER CIRCULATION PUMP SHALL BE DISABLED.
   b. OCCUPIED:
      1) THE HOT WATER CIRCULATION PUMP IS ENABLED AND OPERATES TO MAINTAIN RECIRCULATING WATER TEMPERATURE SETPOINT, 100 DEGREES F (ADJUSTABLE). TEMPERATURE SENSOR SHALL BE LOCATED IN HOT WATER RECIRCULATION, RETURN LINE.
8. HEAT PUMP DOMESTIC HOT WATER HEATER
   a. MAINTENANCE MODE (NOT SCHEDULED BUT AVAILABLE FOR OPERATOR COMMAND):
      1) THE HOT WATER HEATER SHALL BE DISABLED.
   b. OCCUPIED MODE:
      1) THE HOT WATER HEATER IS ENABLED AND OPERATES TO MAINTAIN WATER TEMPERATURE SETPOINT, 140 DEGREES F (ADJUSTABLE).

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PART 5 POINTS SCHEDULE

5.1 POINTS

A. GENERAL
   1. All setpoints, limits, etc. shall be accessible through the central CPU or the laptop computer connected to the system.

B. POINTS LIST

BUILDING CONTROL SYSTEM POINT SUMMARY							
DESCRIPTION	ANALOG INPUTS	ANALOG OUTPUTS	DIGITAL INPUTS	DIGITAL OUTPUTS	ALARMS	DEVICE TYPE	REMARKS
DEDICATED OUTSIDE AIR SYSTEM	ANALOG INPUTS	ANALOG OUTPUTS	DIGITAL INPUTS	DIGITAL OUTPUTS	ALARMS	DEVICE TYPE	REMARKS
START/STOP				X		DI	
OSAT TEMPERATURE	X					TS	MOUNT IN UNIT, FIELD INSTALLED
HR EXHAUST TEMPERATURE	X					TS	MOUNT IN UNIT, FIELD INSTALLED
HR SUPPLY TEMPERATURE	X					TS	MOUNT IN UNIT, FIELD INSTALLED
HR RETURN TEMPERATURE	X					TS	MOUNT IN UNIT, FIELD INSTALLED
AIR FLOW RATE	X					AI	PROVIDED BY UNIT VENDOR
SUPPLY AIR DAMPER			X	X	X	CR/AUX	PROVIDE ENDSWITCH FOR PROOF
EXHAUST AIR DAMPER			X	X	X	CR/AUX	PROVIDE ENDSWITCH FOR PROOF

FAN STATUS (2)			X		X	CT	ONE FOR EACH FAN
FAN SPEED (2)		X				AO	ONE FOR EACH FAN
FROST STATUS			X			DI	
BYPASS DAMPER				X		CR	HRV UNIT ENABLES BYPASS OPERATION
FILTER PRESSURE DROP			X		X	DPH	
CO2 LEVEL	X					CO2	DUCT MOUNTED, FIELD INSTALLED
ELECTRIC HEATER	ANALOG INPUTS	ANALOG OUTPUTS	DIGITAL INPUTS	DIGITAL OUTPUTS	ALARMS	DEVICE TYPE	REMARKS
ENABLE/DISABLE				X		DO	
STATUS			X			DI	
VRF SYSTEMS AND SINGLE ZONE HEAT PUMP SYSTEMS	ANALOG INPUTS	ANALOG OUTPUTS	DIGITAL INPUTS	DIGITAL OUTPUTS	ALARMS	DEVICE TYPE	REMARKS
ENABLE/DISABLE				X		CR	
STATUS			X			DI	
ROOM/ZONE TEMPERATURE	X	X			X	T	MONITOR ZONE TEMPERATURE AND CONTROL ZONE SETPOINT
FAN SPEED		X				AO	
OPERATING MODE	X					DO	ALL MONITORING OF VRF SYSTEM BY DDC
							VIA BACNET PROTOCOL
EXHAUST FANS	ANALOG INPUTS	ANALOG OUTPUTS	DIGITAL INPUTS	DIGITAL OUTPUTS	ALARMS	DEVICE TYPE	REMARKS
ENABLE/DISABLE			X	X		OS	START/ STOP BASED ON MOTION/OCCUPANCY SENSOR
EXHAUST DAMPERS/ RELIEF DAMPERS				X	X	DO	OPEN/CLOSE WITH ENABLE/DISABLE SIGNALS. MONITOR DAMPER STATUS WITH END SWITCHES
FAN STATUS			X			CT	
HEAT PUMP WATER HEATER	ANALOG INPUTS	ANALOG OUTPUTS	DIGITAL INPUTS	DIGITAL OUTPUTS	ALARMS	DEVICE TYPE	REMARKS
ENABLE/DISABLE				X		CR	
STATUS			X			DI	
ENTERING WATER TEMPERATURE	X					TS	
LEAVING WATER TEMPERATURE	X					TS	
STORAGE TANK TEMPERATURE	X				X	TS	

FAULT			X		X	DI	
DOMESTIC WATER CIRCULATION PUMP	ANALOG INPUTS	ANALOG OUTPUTS	DIGITAL INPUTS	DIGITAL OUTPUTS	ALARMS	DEVICE TYPE	REMARKS
ON/OFF				X		CR	
HOT WATER RETURN TEMPERATURE	X				X	TS	
STATUS			X				

END OF SECTION

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Copper tube and fittings.
2. Steel pipe and fittings.
3. Valves and specialties.
4. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.

1.3 INFORMATIONAL SUBMITTALS

1.4 CLOSEOUT SUBMITTALS

1.5 QUALITY ASSURANCE

A. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:
1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L .
B. Wrought-Copper Fittings, Brazed or Solder-Joint: ASME B16.22.
C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

2.3 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Arkema Inc.
b. DuPont Fluorochemicals Div.
c. Genetron Refrigerants; Honeywell International Inc.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Hot-Gas and Liquid Lines , and Suction Lines for Heat-Pump Applications:
1. Copper, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install valves in suction and discharge lines of compressor.
B. Except as otherwise indicated, install valves on inlet and outlet side of filter dryers.
C. Install a full-size, three-valve bypass around filter dryers.

D. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:
   1. Compressor.
E. Install flexible connectors at compressors.
F. Provide refrigerant locking caps on refrigerant charging ports that are located outdoors unless otherwise protected from unauthorized access by a means acceptable to the authority having jurisdiction.

3.3 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
B. Install refrigerant piping according to ASHRAE 15.
C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
F. Install piping adjacent to machines to allow service and maintenance.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.
I. Select system components with pressure rating equal to or greater than system operating pressure.
J. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.
K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
M. Install refrigerant piping in protective conduit where installed belowground.
N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
O. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps and double risers to entrain oil in vertical runs.
   4. Liquid lines may be installed level.
P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
R. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.
B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
    1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
    2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic restraints in Section 230548 "Vibration and Seismic Controls for HVAC."
B. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
C. Install the following pipe attachments:
    1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
    2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
    3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
    4. Spring hangers to support vertical runs.
    5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
D. Install hangers for copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
E. Support horizontal piping within [12 inches] <Insert dimension> of each fitting.
F. Support vertical runs of copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
    1. Comply with ASME B31.5, Chapter VI.
    2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
    3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
        a. Fill system with nitrogen to the required test pressure.
        b. System shall maintain test pressure at the manifold gage throughout duration of test.
        c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

B. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

C. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

D. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 23 31 13 - METAL DUCTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Single-wall rectangular ducts and fittings.
   2. Single-wall round ducts and fittings.
   3. Sheet metal materials.
   4. Duct liner.
   5. Sealants and gaskets.
   6. Hangers and supports.
   7. Seismic-restraint devices.

B. Related Sections:
   1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
   2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.
   3. Seismic-restraint devices.

B. Sustainable Design Submittals:
   1. Ventilation: Product Data for ventilation equipment, indicating compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment."
   2. Product Data: For adhesives, indicating VOC content.
   3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   4. Product Data: For sealants, indicating VOC content.
   5. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
   6. Laboratory Test Reports: For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory- and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
   4. Elevation of top and bottom of ducts.
   5. Dimensions of all duct runs from building grid lines.
   6. Fittings.
   7. Reinforcement and spacing.
   8. Seam and joint construction.
   9. Penetrations through fire-rated and other partitions.
   10. Equipment installation based on equipment being used on Project.
   11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers, supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7
   1. Refer to Structural plans for project specific seismic data.
B. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
E. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
   1. Construct ducts of galvanized sheet steel unless otherwise indicated.
   2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   1. Construct ducts of galvanized sheet steel unless otherwise indicated.

2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G60.
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. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

E. 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.

F. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

2.5 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, provide products by one of the following:
   a. Johns Manville; a Berkshire Hathaway company.
   b. Knauf Insulation.
   c. Owens Corning.
2. Maximum Thermal Conductivity:
   a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg Fat 75 deg F mean temperature.
   b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg Fat 75 deg F mean temperature.
3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. Verify adhesive has a VOC content of 80 g/L or less.
b. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized or stainless steel (to match associated duct material)]; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
10. Verify sealant has a VOC content of 420 g/L or less.
11. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
12. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
13. Service: Indoor or outdoor.
14. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. 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. Verify sealant has a VOC content of 420 g/L or less.
7. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
H. Trapeze and Riser Supports:
    1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
    2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
    3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.8 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Kinetics Noise Control, Inc.
    2. Mason Industries, Inc.
    3. Unistrut; Atkore International.
B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
    1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
D. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E 488/E 488M.

PART 3 EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
C. Install ducts in maximum practical lengths with fewest possible joints.
D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
J. Install fire dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
M. Elbows: Use long-radius elbows wherever they fit.
    1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
    2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCTWORK EXPOSED TO WEATHER

A. All external joints are to have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.
B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
C. Single Wall:
    1. Ductwork shall be Type 304stainless steel.
    2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 230713 "Duct Insulation."

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Outdoor, Supply-Air Ducts: Seal Class A.
   3. Outdoor, Exhaust Ducts: Seal Class C.
   4. Outdoor, Return-Air Ducts: Seal Class C.
   5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
   6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
   7. Unconditioned Space, Exhaust Ducts: Seal Class C.
   8. Unconditioned Space, Return-Air Ducts: Seal Class B.
   9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
   10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
   11. Conditioned Space, Exhaust Ducts: Seal Class B.
   12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.
C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
D. Hangers Exposed to View: Threaded rod and angle or channel supports.
E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes.
B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.
E. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
F. Drilling for and Setting Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Set anchors to manufacturer's recommended torque, using a torque wrench.
   5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Leakage Tests:
   1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test the following systems:
      a. Outdoor-Air Ducts with a Pressure Class of 2 Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
   3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
   5. Test for leaks before applying external insulation.
   6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
   7. Give seven days' advance notice for testing.
C. Duct system will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.10 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 233113

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Turning vanes.
6. Duct Silencers.
7. Duct-mounted access doors.
8. Flexible connectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

B. Sustainable Design Submittals:
1. Product data showing compliance with ASHRAE 62.1.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 90A and NFPA 90B.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Greenheck Fan Corporation.
3. Ruskin Company.

B. Description: Gravity balanced.

C. Performance:
1. Maximum Air Velocity: 2000 fpm.
2. Maximum System Pressure: 2 inches wg.
3. AMCA Certification: Test and rate in accordance with AMCA 511.
4. Leakage:
a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
b. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.

d. Class III: Leakage shall not exceed 40 cfm/sq. ft. against 1-inch wg differential static pressure.

D. Construction:
1. Frame:
a. Hat shaped.
b. 16-gauge- thick, galvanized sheet, with welded or mechanically attached corners and mounting flange.
2. Blades:
a. Multiple single-piece blades.
b. Center] pivoted, maximum 6-inch width, 16-gauge- thick, galvanized sheet steel with sealed edges.
3. Blade Action: Parallel.

E. Blade Seals: Neoprene or vinyl, mechanically locked].

F. Return Spring: Adjustable tension.

G. Damper Actuator – Gravity/Counterweight:

H. Accessories:
1. Adjustment device to permit setting for varying differential static pressure.
2. Screen Mounting:
a. mounted in sleeve.
1. Sleeve Thickness: 20 gauge minimum.
2. Sleeve Length: 6 inches minimum.
3. Screen Material: [Galvanized steel] [Aluminum].
4. Screen Type: Bird Insect.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Warming and Ventilating; a Mestek Architectural Group company.
b. Greenheck Fan Corporation.
c. Ruskin Company.
2. Performance:
a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Construction:
a. Linkage out of airstream.
b. Suitable for horizontal or vertical airflow applications.
4. Frames:
a. Hat-shaped, 16-gauge- thick, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized steel; 16 gauge thick.
e. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
6. Tie Bars and Brackets: Galvanized steel.

7. Locking device to hold damper blades in a fixed position without vibration.

B. Jackshaft:
1. Size: 0.5 inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Greenheck Fan Corporation.
3. Ruskin Company.

B. General Requirements:
1. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.

C. Performance:
1. AMCA Certification: Test and rate in accordance with AMCA 511.
2. Leakage:
a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
b. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.
d. Class III: Leakage shall not exceed 40 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm.
5. Temperature: Minus 25 to plus 180 deg F.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:
1. Linkage out of airstream.
2. Suitable for horizontal or vertical airflow applications.
3. Frames:
a. Hat, U, or angle shaped.
b. 16 gauge- thick, galvanized sheet steel.
c. Mitered and welded corners.
d. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:

a. Multiple blade with maximum blade width of 6 inches.
b. Parallel or Opposed blade design per 2.4.B.1.
c. Galvanized steel.
d. 16-gauge- thick single skin.

5. Blade Edging Seals:
   a. Replaceable Closed-cell neoprene .
6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch diameter; galvanized steel.
8. Blade-Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of air stream.

E. Damper Actuator - Electric:
   1. Electric - 24 V ac.
   2. UL 873, plenum rated.
   3. Two position or fully modulating, with spring return as applicable. Refer to sequence of operations on plans for applicability of actuator type.
      a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
      b. Minimum 90-degree drive rotation.
   4. Clockwise or counterclockwise drive rotation as required for application.
   5. Environmental Operating Range:
      a. Temperature: Minus 40 to plus 130 deg F.
      b. Humidity: 5 to 95 percent relative humidity noncondensing.
   6. Environmental enclosure: NEMA 2.
   7. Actuator to be factory mounted and provided with a single-point wiring connection.
F. Controllers, Electrical Devices, and Wiring:
   1. Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
   2. Electrical Connection: 24 V, 60 Hz.

2.5 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Greenheck Fan Corporation.
   2. Ruskin Company.
B. Type: Dynamic; rated and labeled in accordance with UL 555 by an NRTL.
C. Fire Rating: 1-1/2 hours.
D. Frame: Curtain type with blades inside airstream; fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.
E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.
F. Mounting Orientation: Vertical or horizontal as indicated.
G. Blades: Roll-formed galvanized sheet steel. Material gauge is to be in accordance with UL listing.
H. Horizontal Dampers: Include blade lock and stainless steel closure spring.
I. Heat-Responsive Device:
   1. Electric, resettable link and switch package, factory installed, 212 deg F rated.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Duro Dyne Inc.

B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
   1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
D. Vane Construction:
   1. Single wall.
   2. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.7 DUCT SILENCER, DA-1

A. General: refer to schedule on the drawing for product performance and basis of design info.
B. Manufacturers:
   1. Vibro-acoustics.
   2. Non-basis of design manufacturers shall provide, for approval, professional engineer stamped pressure drop calculations for all systems with silencers to demonstrate that the resultant install pressure drop with system effects does not exceed scheduled values.
   3. For non-basis of design product supplied, contractor is financially responsible to ensure noise control solution is delivered to achieve specified NC level in spaces.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Duro Dyne Inc.
   2. Ruskin Company.
B. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."
   1. Door:
      a. Double wall, rectangular.
      b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
      c. Vision panel.
      d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
      e. Fabricate doors airtight and suitable for duct pressure class.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
      a. 24-gauge- thick galvanized steel or 0.032-inch- thick aluminum frame.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Duro Dyne Inc.
B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
D. Materials: Flame-retardant or noncombustible fabrics.
E. Coatings and Adhesives: Comply with UL 181, Class 1.

F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
   1. Minimum Weight: 26 oz./sq. yd.
   2. Tensile Strength: 480 lbf/inch in the warp and [360 lbf/inch] <Insert value> in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F.

G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
   1. Minimum Weight: 24 oz./sq. yd.
   2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
   3. Service Temperature: Minus 50 to plus 250 deg F.

H. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
   1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
   2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

2.10 DUCT ACCESSORY HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Duro Dyne Inc.

B. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.11 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No.2 finish for concealed ducts and No.4 finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
    1. Install steel volume dampers in steel ducts.
    2. Install aluminum volume dampers in aluminum ducts.
F. Set dampers to fully open position before testing, adjusting, and balancing.
G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
H. Install fire dampers in accordance with UL listing.
I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
    1. On both sides of duct coils.
    2. Upstream and downstream from duct filters.
    3. At outdoor-air intakes and mixed-air plenums.
    4. At drain pans and seals.
    5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
    6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
    7. For grease ducts, install at locations and spacing as required by NFPA 96.
    8. Control devices requiring inspection.
    9. Elsewhere as indicated.
J. Install access doors with swing against duct static pressure.
K. Access Door Sizes:
    1. Two-Hand Access: 12 by 6 inches.
L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
M. Install flexible connectors to connect ducts to equipment.
N. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
O. Install duct test holes where required for testing and balancing purposes.
P. 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 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 size and location of access doors are adequate to perform required operation.
    3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.

4. Inspect turning vanes for proper and secure installation and verify that vanes do not move or rattle.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 23 37 13.13 - AIR DIFFUSERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rectangular and square ceiling diffusers.
   2. Louver face diffusers.
   3. Linear slot diffusers.
B. Related Requirements:
   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
   2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Price Industries.
   2. Titus
   3. Tuttle & Baily.
B. Devices shall be specifically designed for variable-air-volume flows.
C. Material: Steel.
D. Finish: Baked enamel, color selected by Architect.
E. Face Size: as scheduled on the plan set.
F. Mounting: Surface.
G. Pattern: Adjustable.
H. Dampers: Radial opposed blade.

2.2 LOUVER FACE DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Price Industries.
   2. Titus
   3. Tuttle & Baily.
B. Devices shall be specifically designed for variable-air-volume flows.
C. Material: Steel.
D. Finish: Baked enamel, color selected by Architect.
E. Face Size: As scheduled.
F. Mounting: Surface.
G. Pattern: Adjustable core style.
H. Dampers: Radial opposed blade.
I. Accessories:
   1. Square to round neck adaptor.

2.3 LINEAR SLOT DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Price Industries.
2. Titus
3. Tuttle & Baily.

B. Devices shall be specifically designed for variable-air-volume flows.
C. Material - Shell: Steel, insulated.
D. Material - Pattern Controller and Tees: Aluminum.
E. Finish - Face and Shell: Baked enamel.
F. Finish - Pattern Controller: Baked enamel.
G. Finish - TeesBaked enamel, color selected by Architect
H. Slot Width: As scheduled.
I. Number of Slots: As scheduled.
J. Length: As scheduled.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install diffusers level and plumb.
B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 23 37 13.23 - REGISTERS AND GRILLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Adjustable blade face registers and grilles.
   2. Fixed face registers and grilles.

B. Related Requirements:
   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
   2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 REGISTERS

A. Adjustable Blade Face Register
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Price Industries.
      b. Titus
      c. Tuttle & Baily.
   2. Material: Steel.
   3. Finish: Baked enamel, color selected by Architect.
   4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
   5. Core Construction: Removable.
   6. Rear-Blade Arrangement: Horizontal spaced 1/2 inch apart.
   7. Frame: 1 inch wide.
   8. Mounting: As required by specific application.
   9. Damper Type: Adjustable opposed blade.
   10. Accessories:
      a. -blade gang operator.

B. Fixed Face Register
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Price Industries.
      b. Titus
      c. Tuttle & Baily.
   2. Material: Steel.
   3. Finish: Baked enamel, color selected by Architect.
   4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
   5. Core Construction: Removable.
   6. Frame: 1 inch wide.
   7. Mounting: As required by specific application.
   8. Damper Type: Adjustable opposed blade.

2.2 GRILLES

A. Fixed Face Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Price Industries.
   b. Titus
   c. Tuttle & Baily.
2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal; spaced 1/2 inch apart.
5. Core Construction: Removable.
6. Frame: 1 inch wide.
7. Mounting: As required by specific application.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 23 72 23.19 - PACKAGED INDOOR ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed-plate, total heat exchangers in packaged, indoor, energy-recovery units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include packaged, indoor, fixed-plate, energy-recovery unit rated capacities, operating characteristics, furnished specialties, and accessories.
   2. Fans:
      a. Certified fan-performance curves with system operating conditions indicated.
      b. Certified fan-sound power ratings.
      c. Fan construction and accessories.
      d. Motor ratings, electrical characteristics, and motor accessories.

B. Sustainable Design Submittals.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, elevations, and other details, drawn to scale. and coordinated with each other, using input from installers of the items involved.

B. Seismic Qualification Data: Certificates, for packaged, indoor, fixed-plate, energy-recovery units, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, indoor, fixed-plate, energy-recovery units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Packaged Energy-Recovery Units: Two years.
   2. Warranty Period for Fixed-Plate Total Heat Exchangers: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

B. ASHRAE Compliance:
   1. Applicable requirements in ASHRAE 62.1.
   2. Capacity ratings for fixed-plate energy-recovery units shall comply with ASHRAE 84.

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.

D. UL Compliance:
   1. Packaged heat-recovery ventilators shall comply with requirements in UL 1812 or UL 1815.
   2. Electric coils shall comply with requirements in UL 1995.

E. Seismic Performance: Packaged, indoor, fixed-plate, energy-recovery units shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Component Importance Factor: 1.5.

2.2 PACKAGED, INDOOR, FIXED-PLATE TOTAL ENERGY RECOVERY UNITS

A. Source Limitations: Obtain from single source from single manufacturer, or as the basis of design.
B. Manufacturers:
   1. Lossnay
   2. Valent
   3. Oxygen 8
C. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
D. Performance: refer to equipment schedule on construction drawings.
E. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, hinged access doors with neoprene gaskets for inspection and access to internal parts, minimum 1- inch- thick thermal insulation, knockouts for electrical connections, exterior drain connection, and lifting lugs.
F. Fixed-Plate Total Heat Exchanger:
   1. Casing: Galvanized steel.
   2. Drain Pan: Same material as casing, with drain connections on exhaust and supply side.
   3. Comply with requirements in ASHRAE 62.1
   4. Plates: Evenly spaced and sealed and arranged for cross-flow.
      a. Plate Material: Polymer Membrane Energy Recovery Core.
   5. Bypass Damper: Not required.
G. Supply and Exhaust Fans: Forward-curved centrifugal fan with restrained spring isolators of 1-inch static deflection.
   1. Motor and Drive: Belt driven with adjustable sheaves.
   2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
H. Filters:
   1. MERV 13 on outside airstream, minimum MERV 8 on return airstream, unless indicated otherwise in the schedule of equipment.
I. Wiring: Fabricate units with space within housing for electrical conduits. Wire motors and controls, so only external connections are required during installation.
   1. Indoor Enclosure: NEMA 250, Type 12 enclosure contains relays, starters, and terminal strip.
   2. Include nonfused disconnect switches.

2.3 CONTROLS

A. Control Panel: Provide terminal strips for each the supply and exhaust fans that accept 0-10V fan speed control signal from the BAS or provide circuit board with required terminals, pins, dip switches and the like that facilitate the BAS to wire physical inputs and outputs for the control points and sequences shown in the details on the Div 25 Mechanical Instrumentation (MI) drawings.

2.4 SOURCE QUALITY CONTROL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
B. AHRI Compliance: Capacity ratings for air-to-air energy-recovery equipment certified as complying with AHRI 1060.
C. Fan Performance Rating: Comply with AMCA 211 and label fans with AMCA-certified rating seal. Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency according to AMCA 210/ASHRAE 51.
D. Fan Sound Ratings: Comply with AMCA 301 or AHRI 260 (IP). Air-handling unit fan sound ratings shall comply with AMCA 301 or AHRI 260 (IP).
E. UL Compliance:

1. Packaged fixed plate energy recovery units shall comply with requirements in UL 1812; or UL 1815.
2. Electric Coils: Comply with UL 1995.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine casing insulation materials and filter media before packaged, indoor, fixed-plate, energy-recovery unit installation. Replace with new insulation materials and filter media that are wet, moisture damaged, or mold damaged.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install packaged, indoor, fixed-plate, energy-recovery units, so supply and exhaust airstreams flow in opposite directions.
   1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to interior components.
   2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
   3. Access doors and panels are specified in Section 233300 "Air Duct Accessories."
B. Suspended Units: Suspend and brace units from structural-steel support frame, using threaded steel rods and spring hangers. Comply with requirements for vibration-isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
C. Install units with clearances for service and maintenance.
D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

3.3 DUCTWORK CONNECTIONS

A. Comply with requirements for ductwork according to Section 233113 "Metal Ducts."
B. Connect duct to units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

3.4 PIPING CONNECTIONS

A. Condensate Drain Piping: See Section 232113 "Hydronic Piping" for pipe type. Pipe drains from drain pans to nearest floor drain, same size as condensate drain connection.
   1. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

3.5 ELECTRICAL CONNECTIONS

A. Install electrical devices furnished with units but not factory mounted.
B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
D. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
E. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.
B. Connect control wiring according to division 25 and BAS (MI series) control drawings.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.
B. Tests and Inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Packaged, indoor, fixed-plate, energy-recovery units will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.9 ADJUSTING

A. Adjust moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity setpoints.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy-recovery units.

END OF SECTION

SECTION 23 81 29 - VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes complete VRF HVAC system(s) including, but not limited to the following components to make a complete operating system(s) according to requirements indicated:
   1. Indoor, concealed, ceiling-mounted units for ducting.
   2. Indoor, exposed, wall-mounted units.
   3. Outdoor, air-source heat recovery units.
   4. Heat recovery control units.
   5. System controls.
   6. System refrigerant and oil.
   7. System condensate drain piping.
   8. System refrigerant piping.
   9. Metal hangers and supports.
   10. Fastener systems.
   11. Equipment stands.
   12. Miscellaneous support materials.
   13. Piping and tubing insulation.
   14. System control cable and raceways.

1.2 DEFINITIONS

A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.

B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.

C. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.

D. HRCU: Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones. "Heat Recovery Control Unit" is the term used by ASHRAE for what different manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

F. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

G. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units.

H. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.

I. VRF: Variable refrigerant flow.

1.3 ACTION SUBMITTALS

A. Product data.

B. Sustainable Design Submittals:
   1. Product Data: For energy performance.
   2. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   3. Air-Balance Report: Documentation indicating that Work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   4. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
   5. Refrigerant: Product Data for refrigerants, indicating compliance with refrigerant management practices.
   6. Product Data for EA Credit "Optimize Energy Performance": Indicating that system meets efficiency requirements.
   7. Refrigerant: Product Data for refrigerants, indicating compliance with refrigerant management practices.
   8. Product Data for EA Credit "Advanced Energy Metering": For continuous metering equipment.
   9. Product Data for EQ Credit "Acoustic Performance": Documentation indicating that systems and equipment comply.

C. Shop Drawings: For VRF HVAC systems.
   1. Include plans, elevations, sections, and mounting/attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
   5. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.
   1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
   2. Installer certification shall be valid and current for duration of Project.
   3. Retain copies of Installer certificates on-site and make available on request.
   4. Each person assigned to Project shall have demonstrated past experience.
      a. Demonstrated past experience with products being installed for period within five consecutive years before time of bid.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.
   1. Warranty Period:
      a. For Compressor: ten year(s) from date of Substantial Completion.
      b. For Parts, Including Controls: ten year(s) from date of Substantial Completion.
      c. For Labor: five year(s) 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. Mitsubishi Electric & Electronics USA, Inc.

2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.
   1. Two-pipesystem design. Three-pipe is acceptable alternate at no additional cost.
   2. System(s) operation, heat recovery as indicated on Drawings.
   3. Each system with one refrigerant circuit shared by all indoor units connected to system.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
C. AHRI Compliance: System and equipment performance certified according to AHRI 1230
D. ASHRAE Compliance:
   1. ASHRAE 15: For safety code for mechanical refrigeration.
   2. ASHRAE 62.1: For indoor air quality.
   3. ASHRAE 135: For control network protocol with remote communication.
   4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.
E. UL Compliance: Comply with UL 1995.

2.3 PERFORMANCE REQUIREMENTS

A. Service Access:
   1. Provide and document service access requirements.
   2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
   3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
   4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
   5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
   6. Comply with OSHA regulations.
B. System Design and Installation Requirements:
   1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
   2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

C. System Adaptability to Future Changes: Arrange and size system refrigerant piping to accommodate future changes to system without having to resize and replace existing refrigerant piping.
   1. Future changes to system(s) indicated on Drawings.
   2. Each branch circuit shall accommodate addition of two indoor unit(s) with unit capacity equal to largest indoor unit connected to the branch circuit.
D. Isolation of Equipment: Provide isolation valves to isolate each HRCU, indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.
E. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:
   1. Not less than 60 percent.
   2. Not more than 120 percent.
   3. Range acceptable to manufacturer.
F. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.
G. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.
H. Outdoor Conditions:
   1. Suitable for outdoor ambient conditions encountered.
      a. Design equipment and supports to withstand wind loads of governing code and ASCE/SEI 7 .
      b. Design equipment and supports to withstand snow and ice loads of governing code and ASCE/SEI 7 .
      c. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.
   2. Maximum System Operating Outdoor Temperature: See Drawings.
   3. Minimum System Operating Outdoor Temperature: See Drawings.
I. Seismic Performance: VRF HVAC system(s) shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified [and the system will be fully operational after the seismic event]."
   2. Component Importance Factor: 1.0 .
J. Capacities and Characteristics: As indicated on Drawings.

2.4 INDOOR, CONCEALED, CEILING-MOUNTED UNITS FOR DUCTING

A. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.
B. Cabinet:
   1. Material: Galvanized or painted steel.
   2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
   3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
   4. Mounting: Manufacturer-designed provisions for field installation.
   5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
C. DX Coil Assembly:
   1. Coil Casing: Aluminum, galvanized, or stainless steel.
   2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
   3. Coil Tubes: Copper, of diameter and thickness required by performance.

4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:
1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:
1. Fan(s):
   a. Direct-drive arrangement.
   b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
   c. Fabricated from non-ferrous components or ferrous components with corrosion-resistant finish.
   d. Wheels statically and dynamically balanced.
2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:
1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. Efficiency: ASHRAE 52.2, MERV 13
3. Media:
   a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.

G. Unit Accessories:
1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

H. Unit Controls:
1. Enclosure: Metal, suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:
4. Features and Functions:
   a. Self-diagnostics.
   b. Time delay.
   c. Auto-restart.
   d. External static pressure control.
   e. Auto operation mode.
   f. Manual operation mode.
   g. Filter service notification.
   h. Power consumption display.
   i. Drain assembly high water level safety shutdown and notification.
   j. Run test switch.

5. Communication: Network communication with other indoor and outdoor units.
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

I. Unit Electrical:
1. Enclosure: Metal, suitable for indoor locations.
2. Field Connection: Single point connection to power unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways.

2.5 INDOOR, EXPOSED, WALL-MOUNTED UNITS

A. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

B. Cabinet:
1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:
1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:
1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Pumped unless specifically noted on plans otherwise.
   a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.
3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:
1. Fan(s):
   a. Direct-drive arrangement.
   b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
   c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
   d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:
1. Access: Front, to accommodate filter replacement without the need for tools.
2. Washable Media: Manufacturer's standard filter with antimicrobial treatment.

G. Grille Assembly: Manufacturer's standard discharge grille with field-adjustable air pattern.

H. Unit Accessories:
1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.

I. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Communication: Network communication with other indoor units and outdoor unit(s).
4. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

2.6 OUTDOOR, AIR-SOURCE HEAT RECOVERY UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.

B. Cabinet:
1. Galvanized steel and coated with a corrosion-resistant finish.
2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:
1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
2. Protection: Integral protection against the following:
a. High refrigerant pressure.

b. Low oil level.
c. High oil temperature.
d. Thermal and overload.
e. Voltage fluctuations.
f. Phase failure and phase reversal.
g. Short cycling.

3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
4. Vibration Control: Integral isolation to dampen vibration transmission.
5. Oil management system to ensure safe and proper lubrication over entire operating range.
6. Crankcase heaters with integral control to maintain safe operating temperature.
7. Fusible plug.

D. Condenser Coil Assembly:
1. Plate Fin Coils:
a. Casing: Aluminum, galvanized, or stainless steel.
b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
c. Tubes: Copper, of diameter and thickness required by performance.
2. Aluminum Microchannel Coils:
a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
b. Single- or multiple-pass arrangement.
c. Construct fins, tubes, and header manifolds of aluminum alloy.
3. Coating: Corrosion resistant.
4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

E. Condenser Fan and Motor Assembly:
1. Fan(s): Propeller type.
a. Direct-drive arrangement.
b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
c. Statically and dynamically balanced.
2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

G. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:
a. Refrigerant suction temperature.
b. Refrigerant discharge temperature.
c. Outdoor air temperature.

d. Refrigerant high pressure.
e. Refrigerant low pressure.
f. Oil level.

4. Communication: Network communication with indoor units and other outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

I. Unit Hardware: Zinc-plated steel, or stainless steel.

J. Unit Piping:
1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.7 HEAT RECOVERY CONTROL UNITS (HRCUS)

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.

B. Cabinet:
1. Galvanized-steel construction.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

D. Refrigeration Assemblies and Specialties:
1. Specially designed by manufacturer for type of VRF HVAC system being installed, either two or three pipe.
2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.
3. Spares: Each heat recovery control unit shall include at least two branch circuit port(s) for future use.

4. Each system piping connection upstream of heat recovery unit shall be fitted with an isolation valve to allow for service to any heat recovery control unit in the system without interrupting operation of the system.
5. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.
   a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.

E. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Features and Functions: Self-diagnostics, fuse protection
4. Communication: Network communication with indoor units and outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

F. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

G. Unit Piping:
1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.8 SYSTEM CONTROLS

A. General Requirements:
1. Network: Indoor units , HRCUs and outdoor units shall include integral controls and connect through manufacturer-selected control network.
2. Network Communication Protocol: Open control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:
   a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.
   b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 5 minutes > of battery backup operation after a power loss.
   c. Integration shall include control, monitoring, scheduling, change of value notifications. Refer to points list/sequence of operations on plans for additional requirements.
   d. Operator Interface:
   e. Operators shall interface with system and unit controls through the following:
      1. Operator interfaces integral to controllers.

2. Web interface through web browser software.
3. Integration with Building Automation System.

f. Users shall be capable of interface with controllers for control of indoor units to extent privileges are enabled. Control features available to users shall include the following:
1. On/off control.
2. Temperature set-point adjustment.

B. Central Controllers:
1. Centralized control for all indoor and outdoor units from a single central controller location. Mitsubishi AE-200 or equal.
2. Include multiple interconnected controllers as required.
3. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
4. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
a. Sets schedule for daily, weekly, and annual events.
b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.
5. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
6. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
7. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
8. Service diagnostics tool.
9. Able to disable and enable operation of individual controllers for indoor units.
10. Information displayed on individual controllers shall also be available for display through central controller.
11. Information displayed for outdoor units, including refrigerant high and low pressures
12. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
13. Operator interface through a backlit, high-resolution color display touch panel

C. Wired Controllers for Indoor Units:
1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. On/Off: Turns indoor unit on or off.
4. Hold: Hold operation settings until hold is released.
5. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
6. Temperature Display: 1-degree increments.
7. Relative Humidity Display: 1 percent increments.
8. Relative Humidity Set-Point: Adjustable in 1 percent increments between
9. Fan Speed Setting: Select between available options furnished with the unit.
10. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
11. Seven-day programmable operating schedule with up to five events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
12. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
13. Occupancy detection.
14. Service Notification Display: "Filter".
15. Service Run Tests: Limit use by service personnel to troubleshoot operation.
16. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.

17. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
18. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
19. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

2.9 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:
   1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
   2. ASHRAE 34.
   3. R-410a .
B. Oil:
   1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.10 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.
B. PVC plastic pipe according to ASTM D1785, Schedule 40, with socket-type pipe fittings according to ASTM D2466 and solvent cement according to ASTM D2564, primer according to ASTM F656.

2.11 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.
B. Refrigerant Piping:
   1. Copper Tube: ASTM B280, Type ACR Wrought-Copper Fittings: ASME B16.22.
   2. Brazing Filler Metals: AWS A5.8/A5.8M.
C. Refrigerant Tubing Kits:
   1. Furnished by VRF HVAC system manufacturer.
   2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
   3. Standard one-piece length for connecting to indoor units.
   4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
   5. Factory Charge: nitrogen.
D. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.
E. Refrigerant Isolation Ball Valves:
   1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
   2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
   3. Valve Connections: Flare or sweat depending on size.

2.12 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or copper-coated steel .

2.13 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated or stainless steel.
   2. Outdoor Applications: Stainless steel.

2.14 OUTDOOR EQUIPMENT STANDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eberl Iron Works, Inc.
   2. MIRO Industries.
   3. RectorSeal HVAC; a CSW Industrials Company.
B. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof-supported outdoor equipment components, without roof membrane penetration, in a prefabricated system that can be modularly assembled on-site.
C. Foot Material: Rubber or polypropylene.
D. Rails Material: Hot-dip galvanized carbon steel.

2.15 MISCELLANEOUS SUPPORT MATERIALS

A. Grout: ASTM C1107, 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.
B. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.16 PIPING AND TUBING INSULATION

A. Comply with requirements in Section 230719 "HVAC Piping Insulation" for system piping insulation requirements.
B. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:
   1. Flexible Elastomeric Insulation:
      a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
   2. Field-Applied Jacket:
      a. Concealed: None required.
      b. Indoors, Exposed to View: PVC, color selected by Architect, 20 mils thick.
      c. Outdoors, Exposed to View: Aluminum, smooth, 0.020 inch thick.
C. Refrigerant Tubing Insulation and Jacket Requirements:
   1. Flexible Elastomeric Insulation:
      a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
   2. Field-Applied Jacket:
      a. Concealed: None required.
      b. Indoors, Exposed to View: PVC, color selected by Architect, 20 mils thick

c. Outdoors, Exposed to View: Aluminum, smooth, 0.020 inch thick

D. Flexible Elastomeric Insulation Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.17 SYSTEM CONTROL CABLE AND RACEWAYS

A. Low-Voltage Control Cabling:
1. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

B. TIA-485A Network Cabling:
1. Standard Cable: NFPA 70, Type CMG.
2. Plenum-Rated Cable: NFPA 70, Type CMP.

C. Ethernet Network Cabling: TIA-568-C.2 Category 6RJ-45connectors.

D. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for control wiring and cable raceways.

2.18 MATERIALS

A. Steel:
1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:
1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

E. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.

F. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 3000hour salt-spray test according to ASTM B117.
1. Standards:
a. ASTM B117 for salt spray.
b. ASTM D2794 for minimum impact resistance of 100 in-lb.
c. ASTM B3359 for cross-hatch adhesion of 5B.
2. Gloss: Minimum gloss of 60 on a 60-degree meter.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Clearance:
1. Maintain manufacturer's recommended clearances for service and maintenance.

2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.
   1. Loose components shall be installed by [manufacturer's service representative] [or] [system Installer under supervision of manufacturer's service representative].

C. Equipment Restraint Installation: Install equipment with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

D. Indoor Unit Installations:
   1. Install units to be level and plumb while providing a neat and finished appearance.
   2. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.
   3. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.
   4. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.
   5. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.
   6. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.
   7. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.
   8. Install floor-mounted units on support structure indicated on Drawings.
   9. Attachment: Install hardware for proper attachment to supported equipment.

E. Outdoor Unit Installations:
   1. Install units to be level and plumb while providing a neat and finished appearance.
   2. Install outdoor units on support structures indicated on Drawings.
   3. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
      a. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
      b. Grouting: Place grout under equipment supports and make bearing surface smooth.
   4. Roof-Mounted Installations: Install outdoor units on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, stainless-steel fasteners.

3.2 GENERAL REQUIREMENTS FOR PIPING AND TUBING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.
K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors.
L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors.

3.3 CONDENSATE DRAIN PIPE AND TUBING INSTALLATION

A. General Requirements for Drain Piping and Tubing:
   1. Install a union in piping at each threaded unit connection.
   2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
   3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:
      a. Details indicated on Drawings.
      b. Manufacturer's requirements.
      c. Governing codes.
      d. In the absence of requirements, comply with requirements of ASHRAE handbooks.
   4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
   5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.
B. Gravity Drains:
   1. Slope piping from unit connection toward drain termination at a constant slope of not less than two percent.
C. Pumped Drains:
   1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.4 REFRIGERANT PIPING AND TUBING INSTALLATION

A. Refrigerant Tubing Kits:
   1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
   2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet Minimum rod size, 1/4 inch.
   3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.
B. Install refrigerant piping according to ASHRAE 15 and governing codes.
C. Select system components with pressure rating equal to or greater than system operating pressure.
D. Install piping as short and direct as possible, with a minimum number of joints and fittings.
E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
F. Install refrigerant piping and tubing in protective conduit where installed belowground.
G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.
H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.

J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

K. Joint Construction:
1. Ream ends of tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
   a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
   b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.5 PIPE AND TUBING 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. Installation to maintain a continuous vapor barrier.

B. 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.

C. 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 unavailable, 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. 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.

D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. 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.

E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 DUCT, ACCESSORIES, AND AIR OUTLETS INSTALLATION

A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.

B. Comply with requirements for metal ducts specified in Section 233113 "Metal Ducts."

C. Comply with requirements for air duct accessories specified in Section 233300 "Air Duct Accessories."

D. Comply with requirements for air diffusers specified in Section 233713.13 "Air Diffusers."

E. Comply with requirements for registers and grilles specified in Section 233713.23 "Registers and Grilles."

3.7 SOFTWARE

A. Cybersecurity:
   1. Software:
      a. Coordinate security requirements with IT department
      b. Ensure that latest stable software release is installed and properly operating.
      c. Disable or change default passwords to password using a combination of uppercase and lower letters, numbers, and symbols at least eight characters in length. Record passwords and turn over to party responsible for system operation and administration.
   2. Hardware:
      a. Coordinate location and access requirements with IT department
      b. Enable highest level of wireless encryption that is compatible with Owner's ICT network.
      c. Disable dual network connections.

3.8 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."
B. Comply with TIA-569-D, Annex A, "Firestopping."
C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.9 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.
   1. Service representative shall be a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
   2. Complete startup service of each separate system.
   3. Complete system startup service according to manufacturer's written instructions.
B. Startup checks shall include, but not be limited to, the following:
   1. Check control communications of equipment and each operating component in system(s).
   2. Check each indoor unit's response to demand for cooling and heating.
   3. Check each indoor unit's response to changes in airflow settings.
   4. Check each indoor unit , HRCU and outdoor unit for proper condensate removal.
   5. Check sound levels of each indoor and outdoor unit.
C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.
   1. Installer shall correct deficiencies found during startup service for reverification.
D. System Operation Report:
   1. After completion of startup service, manufacturer shall issue a report for each separate system.
   2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
   3. Manufacturer shall electronically record not less than twohours of continuous operation of each system and submit with report for historical reference.
      a. All available system operating parameters shall be included in the information submitted.
E. Witness:

1. Invite Architect. Owner, Commissioning Agent and Engineer to witness startup service procedures.
2. Provide written notice not less than 10 business days before start of startup service.

3.10 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.
B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.
C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.
D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.11 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: Provide notification at least 30 days in advance to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.12 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's or factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system as specified below:
   1. Train Owner’s maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventative maintenance.
   2. Schedule training with Owner with at least 7 days notice.
   3. Provide operator training on data display, alarm and status descriptors, requesting data, execution of commands, and request of logs. Include a minimum of 8 hours dedicated instructor time on-site.
   4. All owner training shall be completed prior to building occupancy such that the building maintenance staff is completely versed in the operation and control system for this project when building occupancy occurs.

END OF SECTION 238129

SECTION 26 05 00 – COMMON WORK RESULTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes general electrical requirements for all Division 26 work and is supplemental and in addition to the requirements of Division 01.

B. Section Includes:
1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

C. General Requirements: Conform to Contract Documents. This section is supplemental and in addition to requirements of Division 01.

D. Provide a complete working installation with all equipment called for in proper operating condition. Documents do not undertake to show or list every item to be provided. When an item not shown or specified is clearly necessary for proper operation of equipment shown or specified, provide an item which will allow the system to function at no increase in Contract Sum.

E. Workmanship shall be of the best quality and competent and experienced electricians shall be employed and shall be under the supervision of a competent and experienced foreman.

F. The drawings and specifications are complimentary and what is called for (or shown) in either is required to be provided as if called for in both.

1.2 DEFINITIONS

A. Definitions of all terms shall be in accordance with applicable definitions of:
1. IEEE - Institute of Electrical and Electronic Engineers
2. IES - Illuminating Engineering Society
3. NEMA - National Electrical Manufacturers Association
4. NEC - National Electrical Code
5. IBC - International Building Code
6. IFC - International Fire Code
7. ADA - Americans with Disabilities Act
8. NFPA - National Fire Protection Association

1.3 CODES

A. Codes for installation of electrical work shall be National Electrical Code, Electrical Safety Code, applicable rules and regulations and OSHA and Washington Industrial Safety and Health Act. Any violation of the above Safety Codes shall be cause for immediate termination of Contractor’s authority to proceed with work, and recourse to surety for completion of the project.

1.4 PERMITS AND INSPECTIONS

A. Obtain permits and pay fees required by governmental agencies having jurisdiction over this work.

B. Arrange for inspections required during construction. On completion of work, furnish satisfactory evidence to show all work installed in accordance with codes.

1.5 CLEARANCES

A. Adequate working space shall be provided around electrical equipment for maintenance and operation. Minimum clearances shall conform to Art. 110-26 of National Electric Code.

1.6 TESTS

A. Test all wiring and connections for continuity and grounds before any fixtures or equipment are connected, and run a Megger test. Where such tests indicate faulty insulation or other defects, all such defects and faults shall be located, repaired and tested again.

B. Make check of proper load balance on 3-wire system and on phases of 3-phase system. Check direction of rotation and lubrication on all motors after final service connections have been made.

1.7 INDUSTRY STANDARDS, CODES AND SPECIFICATIONS

A. All materials, equipment, and systems shall conform to the following applicable Industry Standards, Codes and Specifications:
   1. ANS I - American National Standards Institute
   2. IEEE - Institute of Electrical and Electronic Engineers
   3. IES - Illuminating Engineering Society
   4. IPCEA - Insulated Power Cable Engineers Association
   5. NFPA - National Fire Protection Association
   6. NEMA - National Electrical Manufacturers Association
   7. UL - Underwriters Laboratory
   8. IBC - International Building Code
   9. IFC - International Fire Code
   10. IMC - International Mechanical Code
   11. ADA - Americans with Disabilities Act (WAC)
   12. WAC - Washington Administrative Code
   13. NEC - National Electrical Code

B. Where differences occur between state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Nothing in the Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules or regulations.
   2. When Drawings or Specifications exceed requirements of applicable laws, ordinances, rules, or regulations, comply with documents establishing the more stringent requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Ship equipment in its original package to prevent damage or entrance of foreign matter. Perform all handling and shipping in accordance with manufacturer’s recommendations. Provide protective coverings during construction.

B. Identify materials and equipment delivered to the Site to permit check against approved materials list, and reviewed submittals.

1.10 PROJECT CONDITIONS

A. Equipment Rough-In:
   1. Rough-in locations for equipment furnished under other Divisions and for equipment furnished by Owner are approximate only. Obtain exact rough-in locations from the following sources:
      a. From Shop Drawings for Contractor provided equipment.
      b. From Architect for Owner furnished, Contractor installed equipment.

1.11 MATERIAL AND EQUIPMENT ENVIRONMENT

A. All equipment and material shall be suitable for the environment of the installation, and the installation including equipment shall satisfy the governmental agencies having jurisdiction.

1.12 DRAWINGS AND SPECIFICATIONS

A. Specifications, with drawings, are intended to cover installation of all electrical equipment. Materials shown and called for on drawings, but not mentioned in specifications, or vice versa, necessary for proper completion and operation of equipment, shall be furnished the same as if called for in both.

B. Electrical drawings do not attempt to show complete details of project construction which affect electrical installations. Refer to architectural, structural and mechanical drawings for additional details which affect installation of this work.

1.13 COORDINATION

A. Also Refer to Section 01 30 00.

B. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Section "Penetration Firestopping 078400."

F. Before installation Contractor shall make proper provisions for electrical work and to avoid interferences with installation of other work. Any changes caused by neglect to do so shall be made at no cost to owner.

G. Electrical drawings and specifications shall be compared with drawings and specifications of other trades and any discrepancies between them reported to the Architect prior to installation of work.

H. Coordinate and arrange work so there is no interference between wiring outlets, lighting fixtures, and raceways with sheet metal work, insert hangers, mechanical piping, and structural members.

1.14 CUTTING AND PATCHING

A. Do all cutting and patching for installation of the work.

1.15 RUBBISH AND CLEAN-UP

A. Contractor shall promptly remove waste material and rubbish caused by workers.

B. At completion of work, clean all fixtures, electrical panel interiors, switchboards, distribution centers, and all other equipment installed.

1.16 SCOPE OF WORK

A. Mention herein or indication on drawings of articles, materials, operations or methods, requires that Contractor provide each item mentioned or indicated, of quality, or subject to qualifications noted; perform according to conditions stated, each operation prescribed.

B. Work included under this contract provides for all labor, equipment, and materials to complete all electrical work as outlined in drawings and specifications for project.

C. The scope of this work is listed generally but is not limited to as follows:
   1. Lighting System and fixtures
   2. Fire Alarm System
   3. Branch wiring, power, lighting, and equipment
   4. Equipment connections
   5. Data and Voice Cabling System
   6. Site electrical work
   7. Low Voltage Lighting Control
   8. CCTV System
   9. Access Control System
   10. Intrusion Detection System

1.17 SUBMITTALS

A. General:
   1. Submittals shall be in accordance with requirements of section 01 30 00.
   2. Forward all submittals to the Architect, together, at one time. Individual or incomplete submittals are not acceptable.
   3. Organize submittals in same sequence as they appear in Specification Sections.
   4. Identify each submittal item by reference to Specification Section paragraph in which item is specified, or drawing and detail number.
   5. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and review materials and equipment. Words ″as specified″ are not sufficient identification.
   6. Submit color samples for devices and faceplates when requested by Architect.

B. Shop Drawings:
   1. Show physical arrangement, construction details, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and weights.
   2. Catalog cuts and published material may be included to supplement Shop Drawings.

C. Contract Closeout Submittals:
   1. Operation and Maintenance:
      a. Subsequent to final completion, and testing operations, instruct Owner’s authorized representatives in operation, adjustment, and maintenance of electrical plant.
      b. Before Owner’s personnel assume operation of systems, submit operating and maintenance instructions, manuals, parts lists on electrical plant, its component parts, including all equipment which requires, or for which the manufacturer recommends, maintenance in a specified manner. Data sheets shall show complete internal electrical wiring, ratings, and characteristics, catalog data on components parts whether furnished by equipment manufacturer or others, names, addresses, and telephone numbers of source of supply for parts subject to wear or electrical failure, and description of operating, test, adjustment, and maintenance procedures.

D. Submit the equipment list to the Architect for final review. This list shall consist of, but not be limited to, the basic items applicable to the project as follows:
   1. Lighting System and fixtures
   2. Lighting controls
   3. Fire Alarm System
   4. Branch wiring, power, lighting, and equipment
   5. Data/Voice Cabling System
   6. Access Control System
   7. Intrusion Detection System
   8. CCTV System

1.18 ELECTRICAL EQUIPMENT MAINTENANCE MANUALS

A. Also Refer to section 017700

B. The Electrical Contractor shall prepare maintenance manuals for the servicing of all equipment installed as a part of the construction contract.

C. The information contained in the manuals shall be grouped in an orderly arrangement under basic categories, i.e., Secondary Systems Equipment, Special Raceways, Motors & Controls, Lighting Equipment, etc.

1.19 JOB RECORD INFORMATION

A. Refer to section 017700.

B. Drawings shall include dimensions on all underground conduits.

1.20 NAMEPLATES AND TAGS

A. The following items shall be equipped with tags or nameplates with etched letters:
   1. All motors, motor starters, pushbutton stations, control panels and time switches. Disconnect switches, fused or unfused; switchboards and panelboards; circuit breakers, contactors or relays in separate enclosures.
   2. Wall switches controlling outlets, or equipment where the outlets are not located within sight of the controlling switch. All low voltage lighting switches.
   3. Special electrical systems shall be properly identified at junction and pull boxes, terminal cabinets and equipment racks.
   4. Label all junction boxes with pen indicating type of system (i.e. Power, Data, etc.), circuit voltage, panel and circuit number and switch leg.

1.21 Low Voltage
   1. Tags shall adequately describe the function of, or use of, the particular equipment involved. Tags for panelboards and switchboards shall include the panel designation, voltage and phase of the supply. For example, “Panel A, 208V/120V.” The name of the machine shall be the same as the one used on all motor starter and disconnect tags for that machine.
   2. Tags for 120/208 volts shall be laminated phenolic plastic with white engraved letters on black background. Tags for emergency systems identification shall be red with white lettering. Lettering shall be 3/16” high at pushbutton stations, thermal overload switches, receptacles, wall switches and similar devices, where the tag is attached to the device plate. All other locations, lettering shall be 1/4” high, unless otherwise detailed on the drawings. Tags shall be securely fastened to the equipment with screws or brass bolts. Contact cement is approved in dry locations. All tags and their installation are a part of this work.

1.22 FINAL SUBMITTALS

A. Refer to section 017700

B. After completion of all electrical work and prior to final inspection, submit the following:
   1. One copy of the electrical equipment maintenance manual to be sent direct to Engineer for review, containing the following:
      a. Letter of transmittal, addressed to Engineer, containing a list of suppliers of replacement parts for all electrical equipment used on job.
      b. Panel, switchboard, and control drawings corrected to agree with Engineer’s notations.
      c. Catalog cuts of all lighting fixtures, lamps, starters, special devices, door control system, and all other equipment used on job.
      d. All available maintenance data published.
      e. Wiring diagrams and operating instructions for all systems installed.
      f. Marked-up set of prints showing exact location of all conduits and outlets deviating from original plans. Purchase prints new for this purpose. Prints not required to be bound in maintenance manual.
      g. Signed receipts for all loose items i.e. keys, instructions and guarantee, etc.
   2. Refer to Division 01 for Operations and Maintenance Manuals.

1.23 WARRANTY & GUARANTY

A. Refer to General Terms and Conditions

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Equipment General Requirements:
   1. All items of materials in each category of equipment shall be of one manufacturer.
   2. Groups of items having same or similar function shall be by single manufacturer to facilitate maintenance and service.
   3. Compatible with space allocated. Modifications necessary to adjust items to space limitations shall be at no cost to owner.
   4. Conform with conditions shown and specified. Coordinate with other trades for best possible assembly of completed Work.
   5. Install fully operating without objectionable noise or vibration.

B. Firestopping and Smokestopping: Provide in accordance with section 078413 Through Penetration Firestopping.
   1. Provide firestopping where wiring, conduit, or cable tray penetrates fire wall or floor.
   2. Provide smokestopping where wiring, conduit, or cable tray penetrates smoke barrier.

2.2 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Plastic, Carbon steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's directions in all cases where manufacturers of articles used furnish directions covering points not shown or specified.

B. Accurately set and level equipment with supports neatly placed and properly fastened. No allowance of any kind will be made for negligence on the part of the Contractor to foresee means of bringing in and installing equipment in position inside the building.

C. Conduit System:
   1. Work into complete integrated arrangement with like elements. Make work neat and finished appearing.
   2. Run concealed, except where shown otherwise. Where exposed run parallel with walls or structural elements with vertical runs plumb, horizontal runs level; groups racked together neatly with bends parallel and uniformly spaced.
   3. Flash and counterflash all penetrations through roof in accordance with requirements of Division 07 and as shown.

D. Provide hangers, supports, anchors and chases as required for installation of Electrical Work.

E. Excavating and Backfilling: In accordance with requirements of Division 31 and 32. Provide all necessary shoring, sheeting, and pumping as part of Work of this Division.

F. Concrete: In accordance with requirements of Division 03.

G. Interface with other products:
   1. For purposes of clarity and legibility, Drawings are essentially diagrammatic to the extent that many offsets, bends, special fittings, and exact locations of items are not indicated, unless specifically dimensioned. Exact routing of wiring, and locations of outlets, panels, and other items shall be governed by structural conditions or obstructions. Contractor shall make use of data in Contract Documents. In addition, Architect reserves right, at no increase in Contract Sum, to make any reasonable change in location of electrical items exposed at ceilings or on partitions to group them in orderly relationships or to increase their utility. Verify requirements in this regard prior to roughing-in.
   2. Take dimensions, location of doors, partitions, and similar features from Architectural Drawings. Verify at the Site under this Division. Consult Architectural Drawings for exact location of outlets, and other items to center with architectural features. Coordinate location of all ceiling mounted items with Division 09.

3.2 FIELD QUALITY CONTROL

A. Test panels and circuits for grounds and shorts with mains disconnected from feeders, branch circuits connected, and circuit breakers closed, all fixtures in place, permanently connected, grounding jumper to neutral lifted, and with all wall switches closed.

3.3 CLEANING

A. Properly prepare Work under this Division to be finish painted under Division 01.

3.4 EQUIPMENT IDENTIFICATION

A. Properly identify panelboards, circuit breakers in panelboards, disconnect switches, starters, and other apparatus used for operation or control of circuits, appliances or equipment.

3.5 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.

3.6 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. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants.".

J. 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 Section 078413 "Through Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.7 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.

3.8 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 Section 078400 "Penetration Firestopping."

END OF SECTION 26 05 00

SECTION 26 05 19 – LOW VOLTAGE CABLE AND TERMINATIONS

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. Qualification Data: For testing agency.

C. Field quality-control test reports.

D. Refer to Section 013000 for additional requirements.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alcan Products Corporation; Alcan Cable Division.
   2. American Insulated Wire Corp.; a Leviton Company.
   3. General Cable Corporation.
   4. Senator Wire & Cable Company.
   5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70. Minimum size - No. 12 AWG. Stranded for sizes No. 8 and larger, stranded for No. 10 and No. 12.

C. Aluminum Conductor: Allowed for conductor sizes #1 AWG AL and larger.

D. Conductor Insulation: Comply with NEMA WC 70. Drawings are based on using THHN-THWN cables. Contractor shall increase conduit size for any other insulation.

E. Ground Wire: Proved THWN ground wire in all circuits, sized per code. Raceway shall not be used as ground.

F. Control and Low Voltage Cable: Cable shall be as recommended by manufacturer. Contractor shall coordinate location of plenums in building with all other trades. Provide plenum rated cable whenever cable passes through a plenum for the entire length.

2.2 CONNECTORS AND SPLICES

A. Splices and Terminations
   1. 600 Volt
      a. Splices: Solderless type only. Preinsulated "twist-on" type permitted on solid conductor size number 10 and smaller. Hydraulic compression long barrel type with application preformed insulated cover, heat shrinkable tubing or plastic insulated tape for all stranded conductors. For stranded conductors provide terminations designed for use with stranded conductors.
      b. Terminations: 250 kcmil and above - two hole long barrel compression lugs. Below 250 kcmil - single hole compression lug. Conductors No. 12 and smaller: provide eye or forked tongue compression lugs at bolted or screw connections - no lugs required for compression style terminal blocks.
      c. Cable Ties: Nylon or accepted, locking type. Use a torque limiting tool for installation of ties.
   2. Control Cable Splices and Terminations
      a. Splices: Preinsulated crimp pigtail or butt splice connectors.
      b. Terminations: Locking spade, insulated, compression lugs.

B. 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.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Type THHN-THWN, single conductors in raceway.

B. Branch Circuits: Type THHN-THWN, single conductors in raceway.

C. Class 1 Control Circuits: Type THHN-THWN, in raceway.

D. Class 2 Control and Low Voltage Circuits: Type THHN-THWN, in raceway, or as required by manufacturer. Plenum rated where required. Cable shall not be installed in slab or under ground. All circuits shall be installed in raceway when installed in walls and non-accessible spaces.

3.2 BRANCH WIRING

A. General: Complete system of conduit required to all light outlets, receptacles, switches, etc. as shown. Conduit size as shown on drawings, except where no size is shown, conduit shall be sized per National Electrical Code. No conduit shall carry more than 8 conductors. All exposed switches, receptacles or outlet boxes for other purposes, install die cast boxes, except where specifically noted otherwise. Feeder cables shall have each phase identified according to the established code.

B. Coding: Branch circuit color code shall be: For 120 V.-Black, 208 V - Red, White – Neutral, Green – Ground, Purple “Travellers” on 3 and 4 way switching. Where colors are not available (No. 4 and larger) all terminals shall be coded, both on the wire and on the terminal. Phase and neutral wires shall appear in the same position and rotation at all appearances.

3.3 EQUIPMENT WIRING

A. General: Wiring connections for power and control for all equipment shall be complete including disconnect switches and controls unless otherwise specified or noted on drawings.

B. Control wiring for mechanical systems installed under this section of specifications shall be in accordance with mechanical drawings and specifications.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in raceway in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Exposed cables not permitted.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and branch conductors for compliance with requirements.
      a. Megger Test
   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. 4 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 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding.

B. Provide all grounding and bonding required per NEC and authority having jurisdiction.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
   1. Test wells.
   2. Ground rods.
   3. Ground rings.
   4. Grounding arrangements and connections for separately derived systems.
   5. Grounding for sensitive electronic equipment.

C. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
   1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems, based on NFPA 70B.
      a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
      b. Include recommended testing intervals.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch 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 wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

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. Insulated Ground Conductors: Per 260519.

D. 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 feet in diameter or as required by code authority.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 3/0 AWG minimum.
1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Equipment Ground Conductors: Green colored insulation. Provide in all raceways.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors or exothermic weld where required by code authority.
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 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk

insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.3 GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Flexible raceway runs.
   6. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
   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.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
   1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
   2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

2. For grounding electrode system, install at least four (4) rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
1. Install tinned-copper conductor not less than No. 3/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building foundation.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 3/0 AWG.
1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

J. Consult with code authority and comply with all code authority requirements.

3.5 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, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

D. IBC: International Building Code

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

E. All supports shall comply with IBC, Washington Seismic Zone, Building Use Group III.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze hangers. Include Product Data for components.
   2. Steel slotted channel systems. Include Product Data for components.
   3. Nonmetallic slotted channel systems. Include Product Data for components.
   4. Equipment supports.

C. Welding certificates.

D. See Section 013100 and 013300 for additional requirements.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. ERICO International Corporation.
      d. GS Metals Corp.
      e. Thomas & Betts Corporation.
      f. Unistrut; Tyco International, Ltd.
      g. Wesanco, Inc.
   2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   5. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Not permitted.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Hilti Inc.
         2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         3) MKT Fastening, LLC.
         4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Cooper B-Line, Inc.; a division of Cooper Industries.
         2) Empire Tool and Manufacturing Co., Inc.

3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.

7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 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 26 05 29

SECTION 26 05 33 – RACEWAYS 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 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

J. RGS: Rigid galvanized steel

K. PVC: Polyvinyl Chloride

1.3 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.
   2. For handholes and boxes for underground wiring, including the following:
      a. Duct entry provisions, including locations and duct sizes.
      b. Frame and cover design.
      c. Grounding details.
      d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
      e. Joint details.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For professional engineer and testing agency.

E. Source quality-control test reports.

F. See Section 013000 for additional requirements.

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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: Not permitted.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

F. EMT: ANSI C80.3. Hot dipped galvanized inside and outside.

G. FMC: Aluminum.

H. LFMC: Flexible steel conduit with PVC jacket.

I. 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, compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

K. MC Cable, NMSC, NMC:

2.2 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.

5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13. Not permitted except for fiber optic cable innerduct in raceway.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated as PVC 80.

D. LFNC: Not permitted.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: Not permitted.

2.3 METAL WIREWAYS

A. 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.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R when outside, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Minimum size: 4-inch by 4-inch by 1 ½-inch. Voice/data boxes minimum 2 1/8-inch deep.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Not permitted.

E. Nonmetallic Floor Boxes: Not permitted.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

H. 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.

I. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
   2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: Rigid steel conduit.
   2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC, EMT.
   3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried with plastic coated RGS bends and sweeps.
   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 4.

B. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit.
   3. Concealed in Ceilings and Interior Walls and Partitions: EMT for homeruns. MC cable for branch circuits.
   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. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

D. Communications and Electronic Safety and Security: Shall be EMT overhead. Underground is not permitted except for connections between MDF and IDF’s.

E. Do not install aluminum conduits in contact with concrete.

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 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, Supports and Fasteners."

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. Exposed raceways not allowed except in Mechanical and Electrical Rooms. In particular, note locations of masonry walls on architectural plans. Raceways shall be concealed in masonry walls as well. Coordinate as required with mason.

H. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch 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 RNC Type EPC-40-PVC to plastic coated rigid steel conduit or EMT before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
   1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
      c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
      d. Attics: 135 deg F temperature change.
   2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
   3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and

semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

O. 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.

P. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT – SEE SECTION 260543

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 34 – RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for raceways, fittings, and boxes specific to communications circuits (cabling) for television, voice, and data which are additional to, or different from, that of Division 26.

1.2 REFERENCES

A. The applicable portions of the following specifications, standards, codes and regulations (latest editions and/or amendments) shall be incorporated by reference into these specifications.
   1. General:
      a. National Electrical Code (NEC)
      b. National Electrical Safety Code (NESC)
      c. Washington Industrial Safety and Health Act (WISHA)
      d. Occupational Safety and Health Act (OSHA)
   2. Communications:
      a. TIA/EIA - 568A: Commercial Building Telecommunications Cabling Standard
      b. TIA/EIA - 568A2: Corrections and Additions to TIA/EIA 568A
      c. TIA/EIA - 569A: Commercial Building Standard for Telecommunication Pathways and Spaces
      d. TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
      e. TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
      f. TIA/EIA -TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems
      g. ISO/IEC IS 11801: Generic Cabling for Customer Premises
      h. BICSI: BICSI Cabling Installation Manual

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of conduit, multi-outlet assemblies (SMR), device boxes, fittings, enclosures, pull boxes, hangers/supports, backboards, and other raceway incidentals and accessories as required and as detailed in Division 26 except where specifically noted below.

2.2 MATERIALS

A. Conduit: Minimum conduit size shall be 3/4 inch. Provide EMT, IMC or RGS conduit except as noted below:
   1. Underslab, and in floor: Provide PVC Schedule 40 with RGS bends or rigid galvanized steel with external PVC coating. Protect male threads of conduit with PVC coating using an application of an electrically conductive two-part urethane coating.
   2. Rigid Aluminum, ENT, and Flex conduit are not acceptable.

B. Device boxes: Provide device boxes as follows:
   1. For flush outlets to be used for wall mounted telephones:
      a. Device boxes shall be single gang 2.125” depth with single gang extension rings covers ((i.e. device covers, mud rings).
   2. Surface mounted outlets – Not allowed:
   3. For flush outlets to be used for wall mounted data:
      a. Device boxes shall be double gang deep depth with single gang extension rings (i.e. device covers, mud rings) unless otherwise noted on the Drawings. Combined depth of device box and extension ring shall be 2-3/4”.
   4. For all other outlets:

a. Device boxes shall be double gang deep depth with single gang extension rings (i.e. device covers, mud rings) unless otherwise noted on the Drawings. Combined depth of device box and extension ring shall be 2-3/4".

C. Backboards: Provide backboards which are 1" thick A-C fire treated plywood, void free, 8-ft high unless otherwise noted, capable of supporting attached equipment, and painted with a minimum of two coats of fire retardant paint. Refer to Division 9.

D. Pull Boxes: Provide pull boxes (junction boxes) as shown on the Drawings and as required. 90 degree condulets (LB's) are not acceptable.
1. Pull boxes shall be sized as follows:

Trade Size Conduit	Box Size Width	Length	Maximum For Each Additional Conduit Depth Increase	Width
1"	4"	16"	3"	2"
1-¼"	6"	20"	3"	3"
1-½"	8"	27"	4"	4"
2"	8"	36"	4"	5"

E. Firestopping: Provide firestopping material to maintain the fire rating of all penetrated walls, floors, and ceiling structures. Material shall be acceptable to the local fire and building authorities as well as applicable codes and shall be removable. Firestopping material shall be per section 078400.

F. Grounding Conductor: Provide #6 AWG insulated solid copper conductor (green) to bond all metallic raceway to the nearest grounding bus bar (as provided under Division 26 Section — "Grounding for Communications Circuits and Raceway").
1. Labels: Provide labels as recommended in TIA/EIA 606. Labels shall be permanent/legible typed and created by a Brady LS-2000 label maker or equivalent system. Handwritten labels are not acceptable. Labels are required for all raceway and pull boxes.

PART 3 - EXECUTION

3.1 GENERAL

A. All work shall comply with Division 26.

B. The Contractor shall follow all applicable safety rules and regulations including OSHA and WISHA. The National Electrical Safety Code (NESC) and the NEC shall be strictly followed except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in Article 1.03, — References above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. The Contractor shall install all components strictly to manufacturers recommendations.

E. Install the raceway system in a manner ensuring that communications circuits, when installed, are able to fully comply with the TIA/EIA, ISO/IEC and BICSI references listed in Article 1.03 — References, above.

F. If raceway (conduits, sleeves, etc.) is installed after walls are installed and/or after finish to walls has been applied, wall penetrations shall be sealed, patched and painted to match condition and finish of undisturbed wall.

G. Upon project completion, all surplus material and debris shall be cleared from the job site and legally disposed of.

3.2 INSTALLATION

A. Conduit:
   1. Run conduit in the most direct route possible, parallel to building lines. Do not route conduit through areas in which flammable material may be stored, or over or adjacent to boilers, incinerators, hot water lines, or steam lines.
   2. Conduit bends:
      a. A conduit bend shall not exceed 90 degrees.
         1) For conduit up to 2”, the bend must be at least 8 times the internal diameter of the conduit.
         2) For conduit greater than 2”, the bend must be at least 10 times the internal diameter of the conduit.
      b. The sum total of conduit bends for a section of conduit shall not exceed 180 degrees, except as noted below:
         1) One additional bend of up to 90 degrees is acceptable if the bend is located within 12” of the cable feed end.
      c. 90 degree condulets (LB’s) are not acceptable.
   3. Ream conduits to eliminate sharp edges and terminate with metallic insulated grounded throat bushings. Cap each conduit with a mechanical-type seal for protection. Equip all conduits with a plastic or nylon pull string with a minimum test rating of 200 lb.
   4. Terminate conduits that protrude through a floor 1” to 3” above the surface of the floor.
   5. Label each conduit end in a clear manner by designating the location of the other conduit end (i.e. room name, communications closet name, junction box number, etc.). Indicate conduit length on the label.

B. Device Boxes: Set device boxes plumb, level, square and flush with wall. Do not exceed more than 1/16” tolerance for each condition.

C. Pull Boxes: Install pull boxes in an exposed location, readily accessible both at time of construction and after building occupation. Pull boxes shall not be installed in interstitial building space.
   1. Do not exceed one pull box per total conduit run between device box and termination point in a communications closet.
   2. If mounting pull box on ceiling structure above ceiling grid, do not mount higher than 4’ above grid (mount on wall instead).
   3. A pull box may not be substituted for a 90 degree bend.
   4. Install pull boxes such that conduit enters and exits at opposite ends of the box as follows:

D. Grounding/Bonding: All grounding and bonding work shall comply with the International Building Code, International Fire Code, WAC, National Electrical Code, Washington State Electric Code, UL 467, and ANSI/TIA/EIA standards listed in Part 1 — References above, as well as local codes which may specify additional grounding and/or bonding requirements.
   1. Bond all metallic raceway at both ends to the nearest grounding bus bar (as provided under Division 26. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic raceway.

END OF SECTION 26 05 34

SECTION 26 05 43 – UNDERGROUND RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section provides additional requirements to Section 260533

B. Provide all materials and labor for the installation of a pathway system underground circuits. Work in this section includes excavation and trenching, duct (raceway) construction, cutting and patching, concrete, underground cable vault (UCV) construction, and landscaping.
   1. This Section includes requirements for the above work which specifically pertain to outside plant communications and which are more stringent, additional to, or different from that of the Division 03, Division 31, Division 26, Division 27 and Division 28 sections.

1.2 REFERENCES

A. The applicable portions of the following specifications, standards, codes and regulations (latest editions and/or amendments) shall be incorporated by reference into these specifications.
   1. General:
      a. National Electrical Code (NEC)
      b. National Electrical Safety Code (NESC)
      c. Washington Industrial Safety and Health Act (WISHA)
      d. Occupational Safety and Health Act (OSHA)
      e. WSDOT/APWA 1998 Standards Specifications for Road, Bridge and Municipal Construction (APWA Standard Specifications)
   2. Communications:
      a. TIA/EIA - 758: Customer-owned Outside Plant Telecommunications Cabling Standard
      b. TIA/EIA - 568A: Commercial Building Telecommunications Cabling Standard
      c. TIA/EIA - 569: Commercial Building Standard for Telecommunication Pathways and Spaces
      d. TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
      e. TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
      f. ISO/IEC IS 11801: Generic Cabling for Customer Premises
   3. Trenching and Backfill:
      a. ASTM D1557: Test Method for Laboratory Compaction Characteristics Using Modified Effort

1.3 DEFINITIONS

A. Aggregate: The mineral materials such as sand or stone used in making concrete

B. Backfill: Earth material used specifically for filling and grading excavations back to a finished state. Backfill is placed on top of the bedding surrounding encased ductbanks and direct-buried conduits.

C. Base: Earth material used specifically to level and grade an excavation’s subgrade for the subsequent placement of encased ductbanks, direct-buried conduit, and UCVs. Base material is placed on top of the subgrade and beneath the bedding surrounding encased ductbanks, conduits, or UCVs.

D. Bedding: Earth material used specifically for filling excavations. Bedding is placed around encased ductbank, conduits, or UCVs. Bedding is placed on top of the base and beneath the backfill.

E. Fill: The collective term for base, bedding, and backfill.

F. Handhole/Pullhole: A small UCV in which it is expected that a person cannot enter to perform work. Handholes/pullholes are used for the placement of cable only, they are not used for splicing or for equipment.

G. Manhole: A large UCV in which it is expected that a person can enter to perform work. Manholes may be used for splicing and outside-rated telecommunications equipment.

H. RNC: Rigid Non-Metallic Conduit (PVC)

I. RGC: Rigid Galvanized Steel Conduit.

J. PSC: PVC Coated Rigid Steel Conduit.

K. Underground Cable Vault (UCV): Underground vaults (manholes, or handholes/pullholes) which are used for the routing of communications cable.

1.4 SUBMITTAL INFORMATION

A. The Contractor shall provide shop drawing submittal information for review before materials are delivered to the job site.
   1. Provide material and equipment submittals for each item of equipment as follows:
      a. For items which are being provided exactly as specified, do not provide submittal information. Instead, provide written documentation stating that the items are to be provided as specified.
   2. For those items noted as allowing “or equal,” and which are not being provided as specified, provide standard manufacturer's cut sheets or other descriptive information and a written description detailing the reason for the substitution.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of fill, topsoil, concrete formwork, concrete, raceway, UCVs, and other incidentals and accessories as required.

2.2 BASE, BEDDING AND BACKFILL

A. Use of on-site soils for base, bedding, and backfill is not acceptable.

B. Base: Base material shall have size and shape characteristics that will allow it to compact readily and shall conform with the following gradation requirements.
   1. For UCVs (provide gravel):
      a. Sieve Size — Percent Passing
      b. 1” Square — 100
      c. ¼ “ Square — 25 - 80
      d. U.S. No. 200 — 15.0 max
      e. Sand Equivalent — 30 min
   2. For Trenches (provide sand):
      a. Sieve Size — Percent Passing
      b. U.S. No. 10 — 35 - 100
      c. U.S. No. 20 — 20 - 80
      d. U.S. No. 40 — 10 - 55
      e. U.S. No. 100 — 0 - 10
      f. U.S. No. 200 — 0 - 3
   3. Bedding: Same as Base - For Trenches, above.

C. Backfill:
   1. For UCVs - Same as Base - For UCVs, above.
   2. For Trenches
      a. Sieve Size — Percent Passing
      b. ½ “ Square — 100
      c. ¼ “ Square — 65 - 100
      d. U.S. No. 10 — 40 - 100
      e. U.S. No. 50 — 3 - 50
      f. U.S. No. 100 — 0 - 4
      g. U.S. No. 200 — 0 - 3

2.3 DUCTS AND DUCTBANKS

A. Ducts: Provide in locations as shown on the drawings. Refer to Part - 3, Execution for details on when to use each type. All conduit, fittings, and adhesives shall be provided by the same manufacturer.
   1. Types:
      a. Rigid Non-Metallic Conduit (RNC):
         1) RNC shall be NEMA TC 2 schedule 40 or 80 (see Part - 3, Execution for details on when to use each type) rigid polyvinyl chloride (PVC) approved for direct burial without concrete encasement. RNC shall be UL listed.
         2) Fittings shall be NEMA TC3, matched to conduit and material.
         3) Bends shall be PSC
      b. Rigid Galvanized Steel Conduit (RGC):
         1) RSC shall be rigid steel conduit hot-dipped galvanized inside and out with threaded ends meeting ANSI C80.1.
         2) Couplings: Unsplit, NPT threaded with galvanizing equal to and compatible with conduit. Running thread or set screw threaded fittings (except for three piece and watertight split couplings) are not acceptable.
         3) Nipples: Factory made through eight inches with no running threads.
      c. PVC Coated Rigid Steel Conduit (PSC):
         1) PSC shall be NEMA RN 1 rigid steel conduit coated with rigid polyvinyl chloride (PVC) inside and out.
         2) Fittings shall be NEMA RN 1.
   2. Fittings:
      a. Bends/Sweeps:
         1) Unless otherwise noted on the Drawings, bends/sweeps shall be factory manufactured.
         2) Unless otherwise shown on the Drawings, bends shall consist of a single arc of not less than a 15 foot radius. Where this is not possible, a bend radius shall not be less than 10 times the internal diameter of the conduit for communications circuits.
         3) Unless otherwise shown on the Drawings, the use of 90 degree elbows, LB's, condulets, or the use of a UCV in place of a bend/sweep is not acceptable for communications circuits.
      b. End Caps (Plugs): Provide pre-manufactured water-tight end caps for all ducts during construction. Tape is not an acceptable end cap or cover.
      c. End Bells: Provide end bells for terminating conduit in UCVs. Do not provide for conduit ends terminating in UCVs which are equipped with TERM-A-DUCT.
   3. Pull Cords: Provide nylon pull cord indicating length measurement for each duct. Pull cord strength shall be a minimum of 130 pounds.

B. Ductbanks:
   1. Duct Spacers/Supports: Provide high-density plastic interlocking spacers/supports to maintain uniformity of multiple ducts within a ductbank. Spacers shall be:
      a. Underground Devices Inc.: WUNPEECE
   2. Warning Tape: Provide metallic warning tape above each ductbank. Tape shall be 6" wide and orange in color.
   3. Grounding/Bonding: Provide #2 bare ground along length of ductbank.

PART 3 - EXECUTION

3.1 EXCAVATING, TRENCHING AND FILL

A. Excavation:
   1. Excavations shall not be performed where the outside temperature is less than 35 F or when there is standing water or snow on the subgrade.
   2. Excavations requiring crossing of concrete or asphalt shall be performed only after the surface material has been saw cut and removed. Concrete shall be removed in complete sections from control joint to control joint regardless of the width of the excavation. Concrete and asphalt shall be replaced to match existing depth, strength, color, and type of material. Coordinate with and obtain approval from AHJ.

3. Adjacent structures which may be compromised or damaged by excavation work shall be underpinned as evaluated and recommended by a registered structural engineer employed by the contractor prior to proceeding with the work.
4. The Contractor shall maintain adequate separation between the excavation and adjacent underground utilities. The excavation shall be located such that ductbank and UCVs, when installed, shall have a minimum separation of 12 inches between the ductbank and UCV and the nearest underground utility. For gas lines a minimum separation of 18 inches is required. For water/sewer a minimum separation of 36 inches is required.
5. Excavations shall not be left unprotected at the end of the work shift. Excavations shall be covered with steel sheets and barricaded prior to leaving the job site, in accordance with all applicable rules, regulations, building codes, and ordinances.
6. The Contractor shall not allow water to accumulate in excavations. The Contractor shall install, operate and maintain all pump or dewatering equipment necessary to meet this requirement.
7. Depth of excavation
    a. For UCVs: Depth shall allow for the overall assembled height of the vault plus the added height of risers, covers and bedding material consisting of a minimum six (6) to twelve (12) inches of base. Width of excavation for UCVs shall provide for a minimum of six (6) inches clearance around each side of the UCV.
    b. For trenches: Depth shall be sufficient to cover a minimum of twenty-four (24) inches over the conduit or ductbank formation. Width of excavation for trenches shall be a minimum of six (6) inches to each side of the ductbank formation. Depth of excavation for trenches shall allow for the proper alignment of ducts into UCVs.
8. Soft spots in the subgrade shall be over-excavated, filled, and compacted under supervision of soils engineer.
9. Excavation for trenching shall run true and as straight as practicable. Trenches shall be clear of stones and soft spots. Coordinate slope with actual conditions in field.
10. Trench grade shall be sloped to fall 3 inches per 100 feet in general and ¼” per foot where possible. Slope shall fall toward lower UCVs or from high points toward both UCVs.

B. Fill:
1. Prior to the placement of fill, all groundwater and surface water shall be drained and/or pumped from the recipient area.
2. Frozen fill shall not be placed.
3. Base:
    a. The subgrade bed to receive fill shall be scarified and moisture conditioned prior to placing materials.
    b. Base material shall be moisture conditioned to within 3 percent of optimum moisture content and shall be placed in loose, horizontal layers.
    c. The subgrade bed shall be leveled using sand for trenches and gravel for UCVs as necessary to form an even base.
4. Bedding:
    a. For concrete encased ductbank Bedding lifts/layers shall not exceed 4 inches before compaction.
    b. For Direct-buried Ductbank Lifts/layers shall not exceed 1 to 2 inches before compaction until the top of the ductbank is reached and shall not exceed 4 inches thereafter. Bedding shall be placed simultaneously on both sides of ductbank for the full width of the trench. The materials shall be carefully worked above, to each side, and below the ducts with a tool capable of preventing the formation of void spaces and without damaging the structure or waterproofing of the ducts.
    c. Backfill Backfill lifts/layers shall not exceed 6 inches before compaction.
5. Compaction: Compaction shall be performed using a vibratory plate or roller or other mechanical device. Compaction through jetting and/or ponding is not acceptable. Compact per APWA Standard Specification Paragraph 7-10.3 (11).
    a. Bedding: Material shall be compacted to a dense state equaling at least 95% of the maximum dry density per ASTM D1557.
    b. Backfill: Material shall be compacted to within 2 feet of the finished surface with a minimum relative compaction of 90% of the maximum dry density per ASTM D1557. Material within 2 feet of the finished surface shall be compacted with a minimum relative compaction of 95% of the maximum dry density per ASTM D1557.

C. Waste Disposal: Remove excavation materials and other construction debris from the site in a timely manner. Materials shall be disposed of legally.

3.2 DUCTS AND DUCTBANKS

A. Ducts:
   1. The type of duct to use shall be dictated by the application:
      a. Outdoor underground – direct buried: Provide RNC Schedule 80 (Type II) or PSC.
         1) Transition to PSC at stub up locations and at entrances to buildings or other locations where the raceway changes from direct buried to encased in concrete or exposed conditions.
         2) Transition to PSC or RGC for short radius bends (i.e. bends with less than 15-foot radii sweeps).
      b. Outdoor underground – concrete encased: Provide RNC Schedule 40 (Type 1).
         1) Transition to PSC at stub up locations and at entrances to buildings or other locations where the raceway changes from encased in concrete to direct buried or exposed conditions.
      c. Exposed or within five feet of steam lines or Utilidor trenches : Provide RGC.
   2. Fittings:
      a. Duct ends shall be cut square and reamed to remove burrs and sharp ends. Duct shall extend the maximum distance into all fittings, couplings, and/or connectors. All fittings shall be tightened securely and sealed watertight (see below).
      b. Bends/Sweeps:
         1) Unless otherwise shown on the Drawings, bends shall consist of a single arc of net less than a 15 foot radius. Where this is not possible, a bend radius shall not be less than 10 times the internal diameter of the conduit for communications circuits.
         2) Unless otherwise shown on the Drawings, an individual bend shall not exceed 90-degrees.
         3) Unless otherwise shown on the Drawings, a duct section may have no more than the equivalent of two 90-degree bends (a total of 180 degrees) between pull points. The 180-degree maximum shall include kicks and offsets. Where it is not possible to construct a section of duct within the 180-degree bend maximum, intermediary UCVs must be installed.
         4) Two 90-degree bends separated by less than 10’ is not permissible.
         5) Bends for ducts within a common ductbank shall be parallel, measured from the same center-point.
         6) Where factory manufactured bends cannot be obtained due to a unique bend radius, bends shall be formed only with factory recommended equipment and shall be manufactured in such a way as to ensure that the internal diameter of the duct is not changed.
      c. End Caps (Plugs): End caps shall be placed on all duct ends throughout construction in order to prevent the intrusion of water or debris. End caps shall be installed on all duct that is not directly being worked on during the work day and on all ducts at night. End caps shall be left in place upon final completion of the work.
      d. End Bells: For UCVs which are not equipped with TERM-A-DUCT, install protective end bells on ducts flush with UCV wall.
   3. Sealing: Duct connections shall be made waterproof and rustproof by application of a watertight, conductive thread compound (for RGC and PSC) or by solvent-type cement (for RNC). Duct terminations in UCVs shall be sealed and grouted (to ensure that all voids in the joints are filled).
   4. Test Mandrels: Each duct, once installed, shall be cleaned of debris with a wire brush or swab and shall be proven out with a minimum 16 inch long test mandrel which is ¼ inch smaller than the inside diameter of the duct. Test mandrel shall be pulled after backfilling but prior to the replacement of landscaping. The Contractor shall repair any duct that does not prove out at no cost to the Owner.
   5. Duct Entrances: Duct entrances at opposite ends of a UCV shall be at the same level and in the same position with respect to the side walls. The Contractor shall ensure that each duct leaving a UCV in any position shall enter the next UCV in the same relative position.
   6. Length: Unless otherwise shown on the Drawings, the maximum length of a duct run shall not exceed 600 feet between UCVs or pulling points. Install additional UCVs as required to maintain spacing.

7. Pull Cords: Install in each duct immediately after the duct has been mandreled. Leave a minimum of 10 feet looped and tied off at each end of the duct.
8. Protection: Insure that after installation all duct coatings and finishes are without damage. Repair as follows:
    a. PVC Coated Rigid Steel Conduit: Patch all nicks and scrapes in PVC coating after installing conduits.
    b. Rigid Galvanized Steel Conduit: Repair damage to galvanized finishes with zinc-rich paint as recommended by the manufacturer.
    c. Rigid Non-metallic Conduit: Repair damage with matching touchup coating recommended by the manufacturer.

B. Ductbanks:
1. Duct Spacers/Supports: Supports shall be spaced on 8 foot centers if encased in concrete and 5 foot centers otherwise. Spacers shall be interlocked horizontally only. Spacers encased in concrete shall be staggered at least 6 inches vertically.
2. Warning Tape: Install metallic warning tape 6 inches below grade and 18 inches above the ductbank.
3. Grounding/Bonding: Install ground wire along length of ductbank.

END OF SECTION 26 05 43

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Identification for raceway.
   2. Identification for conductors and communication and control cable.
   3. Underground-line warning tape.
   4. Warning labels and signs.
   5. Instruction signs.
   6. Equipment identification labels.
   7. Miscellaneous identification products.
   8. Panel Directories

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 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 and cable size.

B. Color for Printed Legend:
   1. Power Circuits: White letters on a black field.
   2. Fire Alarm: White on red.
   3. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 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.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength: 50 lb, minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black, except where used for color-coding.

B. Junction Boxes: All junction boxes shall be painted per the following color code:
   1. 120/208 Volt Normal: Black
   2. 120 Volt Emergency: orange
   3. Fire Alarm: Red
   4. Data: Blue
   5. Television: White
   6. Sound: Purple

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

D. Panel directories shall indicate each circuit by load and field room number (Drawing room numbers are not acceptable. Spares and spaces shall be indicated in erasable ink or pencil.)

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label or snap-around label or self-adhesive vinyl tape applied in bands.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands or snap-around, color-coding bands:
   1. Fire Alarm System: Red.
   2. Security System: Blue and yellow.
   3. Mechanical and Electrical Supervisory System: Green and blue.
   4. Telecommunication System: Green and yellow.
   5. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 4 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use aluminum wraparound marker labels. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data 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 Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.
2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

I. Instruction Signs:
1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
   a. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label. Stenciled legend 4 inches high.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
2. Equipment to Be Labeled:
   a. Panelboards, electrical cabinets, and enclosures.
   b. Access doors and panels for concealed electrical items.
   c. Electrical switchgear and switchboards.
   d. Emergency system boxes and enclosures.
   e. Disconnect switches.
   f. Enclosed circuit breakers.
   g. Motor starters.
   h. Push-button stations.
   i. Power transfer equipment.
   j. Contactors.
   k. Remote-controlled switches, dimmer modules, and control devices.
   l. Power-generating units.
   m. Intercommunication and call system master and staff stations.
   n. Fire-alarm control panel and annunciators.
   o. Junction boxes: System, voltage and circuit with black pen.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color 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 maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

I. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 26 05 53

SECTION 26 05 73 – POWER SYSTEMS PROTECTIVE DEVICE STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. System coordination study
   2. Short circuit study
   3. Protective device calibration and setting
   4. Arc fault study per NEC 70E. Provide an Arc Flash Hazard Study for the electrical distribution system shown on the one-line drawings. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the one-line drawings. This includes switchgear, switchboards, panelboards, motor control centers, automatic transfer switches, VFD's, and transformers. The study will include creation of Arc Flash Hazard warning labels. These labels serve as a guide to assist technicians and others in the selection of proper personal protective equipment when working around exposed and energized conductors. Electrical contractor shall install the labels.

1.2 SCOPE

A. It is the intent of these tests to assure that protective devices are operational, correctly applied, within industry and manufacturer's tolerances, and installed in accordance with the specifications. This effort should minimize the damage caused by any electrical failure. The testing agency shall verify that the electrical system and electrical equipment configuration matches the contract documents, vendor shop drawings, and the electric system coordination study recommended settings.

B. Prepare a coordination study for the specific electrical overcurrent devices and feeder lengths, to be installed under this project, from the primary overcurrent protective device to the branch circuit breaker panels to assure proper equipment and personnel protection.

C. The study shall present an organized time-current analysis of each protective device in series from the individual device back to the source at Tacoma Power. The study shall reflect the operation of each device during normal and abnormal current conditions, and confirm that devices are coordinated.

D. Provide arc fault/flash study per NFPA 70E.

1.3 APPLICABLE CODES, STANDARDS AND REFERENCES

A. Inspection and tests shall be in accordance with the following codes and standards except as provided otherwise herein:
   1. American National Standards Institute ANSI C2: National Electrical Safety Code
   2. American Society for Testing and Materials – ASTM
   3. Association of Edison Illuminating Companies – AEIC
   4. Institute of Electrical and Electronic Engineers – IEEE
   5. Insulated Cable Engineers Association – ICEA
   6. International Electrical Testing Association NETA Maintenance Testing Specifications MTS- 1989
   7. National Electrical Manufacturer's Association – NEMA
   8. National Fire Protection Association – NFPA
      a. ANSI/NFPA 70: National Electrical Code
      b. ANSI/NFPA 70B: Electrical Equipment Maintenance
      c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
      d. ANSI/NFPA 78: Lightning Protection Code
      e. ANSI/NFPA 101: Life Safety Code
      f. NFPA 70E
   9. Occupational Safety and Health Administration – OSHA
   10. State and local codes and ordinances

1.4 SUBMITTALS

A. Submit the following in accordance with Division 01:

1. Protective equipment shop drawings with the protective device study. The one-line diagram showing available fault currents and timing of devices shall be submitted both as hard copies and as two electronic copies of Autocad drawings on Compact Disc. Two electronic copies of both the Dapper and Captor software files shall be provided on Compact Disc. An index shall be provided which cross references the file names on these disks to the specific pieces of equipment or system.
2. Certifications: Two weeks prior to final inspection, the Contractor shall deliver four copies of the following certifications to the Owner's representative:
   a. That the protective devices have been adjusted and set in accordance with the approved protective device study.
   b. That tests and settings have been witnessed by the Owner.
   c. Report of results.
3. Short circuit study in conjunction with, and at the same time as, the submittal for Panelboards. The study shall show fault currents available at key points in the system down to a fault current of 7000A. The purpose of this submittal is to verify the fault current ratings of the panelboards.

1.5 QUALIFICATIONS

A. The coordination study shall be prepared by qualified engineers of the switchgear manufacturer or an approved consultant. Provide pertinent information required by the preparers to complete the study.

B. The short circuit study and coordination study shall be performed on the Dapper and Captor computer software packages. No substitutions.

PART 2 - EXECUTION

2.1 REQUIREMENTS

A. The complete study shall include a system one line diagram, short circuit and ground fault analysis, and protective coordination plots.

B. One-Line Diagram:
   1. Show, on the one line diagram, electrical equipment wiring to be protected by the overcurrent devices installed under this project. Clearly show, on the one line, the schematic wiring of the electrical distribution system.
   2. Show reference nodes on the one line diagram referring to a formal report, to include the following specific information:
      a. X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the bus of the main switchboard, and all downstream equipment containing overcurrent devices.
      b. Breaker and fuse ratings.
      c. Transformer KVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
      d. Voltage at each bus.
      e. Identifications of each bus.
      f. Conduit material, feeder sizes, and length.
      g. Calculated short circuit current.

C. Short Circuit Study:
   1. Determine the available 3 phase short circuit and ground fault currents at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.
   2. The study shall be calculated by means of the Dapper computer software package. Pertinent data and the rationale employed in developing the calculations shall be incorporated in the introductory remarks of the study.
   3. Present the data determined by the short circuit study in a table or report format. Include:
      a. Device identification.
      b. Operating voltage.
      c. Protective device.
      d. Device rating.

e. Calculated 3 phase short circuit current (asymmetrical and symmetrical), and ground fault current.

D. Coordination Curves:
1. Prepare the coordinations curves to determine the required settings of protective devices to assure selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between existing and supplied series devices. Plot the specific time-current characteristics of each protective device in such a manner that all upstream devices will be clearly depicted on one sheet.
2. The following specific information shall also be shown on the coordination curves:
   a. Device identifications.
   b. Time and current ratio for curves.
   c. ANSI damage points for each transformer.
   d. Complete fuse curves.
   e. Cable damage curves.
   f. Transformer inrush points.
   g. Maximum short circuit cutoff point.
3. Develop a table to summarize the settings selected for the protective devices. Include in the table the following:
   a. Device identification.
   b. Tap, time delay, and instantaneous pickup.
   c. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
   d. Fuse rating and type.
   e. Ground fault pickup and time delay.
4. Provide electronic copies of the Captor Data files on two Compact Discs. Provide a cross reference between the data file names and the hard copy tables and reports.

2.2 ANALYSIS

A. Analyze the short circuit calculations, and highlight any equipment that is determined to be underrated as specified or not coordinated. Propose approaches to effectively protect the underrated equipment. Proposed major corrective modifications will be taken under advisement by the Owner and further instructions will be given.

B. After developing the coordination curves, highlight areas lacking coordination. Present a technical evaluation with a discussion of the logical compromises for best coordination.

2.3 ADJUSTMENTS, SETTINGS AND MODIFICATIONS

A. Accomplish necessary field settings, adjustments and minor modifications to conform with the study without additional cost to the Owner. (Examples of minor modifications are trip sizes within the same frame, the time curve characteristics of induction relays, ranges etc.)

2.4 FIELD INFORMATION

A. Gather field information needed for the protective device study.

END OF SECTION 26 05 73

SECTION 260923 – LIGHTING CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. System Software Interfaces.
   2. System Backbone and Integration Equipment.
   3. Wired Networked Devices

1.2 DEFINITIONS

A. Data Bus: A wired interface used to communicate with connected devices.

B. Device: A collective term for bus or wireless connected devices, including fluorescent ballasts, LED drivers, incandescent luminaires, manual switches, switching relays, sensors, and similar.

C. Global: Communication between devices in otherwise separate spaces using a bridging device or system controller.

D. Group: A set of devices that communicate together.

E. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

F. Scene: Digital light level associated with a preset.

G. System Backbone: Devices used to connect and manage otherwise separate spaces, including bridging devices and gateways or system controllers. Used to expose devices to software configuration via TCP/IP.

1.3 SUBMITTALS

A. Product Data:
   1. Bill of Materials necessary to install the networked lighting control system.
   2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
   3. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
   4. Other Diagrams and Operational Descriptions - as needed to indicate system operation or interaction with other system(s).

B. Shop Drawings:
   1. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.

C. Contractor Startup/Commissioning Worksheet.

D. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.

E. Field quality-control reports.

F. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Contracts:
   1. Hardware and Software Operation Manuals
   2. Maintenance service agreement.
   3. Software service agreement.

B. Warranty documentation.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Phone Support: Toll-free technical support available from manufacturer through an online tool to schedule a technical support appointment and provide 24/7 emergency support.
   2. Remote Support: Manufacturer capable of providing remote support and ability to virtually connect with customers to address issues with visual guidance overlaid on images of real-world objects.
   3. Cellular Connectivity: Manufacturer capable of cellular connectivity to a networked lighting control systems available to provide remote support within the continental United States.
   4. On-Site Support: Manufacturer capable of providing a 72-hour, on-site response time within the continental United States.
   5. Service Contracts: Manufacturer capable of providing service contracts for continued on-site and remote support of the lighting control system post-installation for terms up to 10 years from substantial completion, including:
      a. Remote and on-site emergency response.
      b. Remote system performance checks.
      c. Remote diagnostics.
      d. Replacement parts.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.
   1. Failures include, but are not limited to, the following:
      a. Faulty operation of lighting control hardware.
      b. Faulty operation of lighting control firmware.
   2. Minimum Warranty Period: Five years from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Specification is based on Nlight by Acuity. No substitutions allowed.

2.2 SYSTEM COMPLIANCE

A. System components manufactured in accordance with UL 916 and UL 924 standards where applicable.

B. System components manufactured in accordance with CFR Title 47, Part 15 standards where applicable.

C. System components manufactured in accordance with ISED Canada RSS-247 standards where applicable.

D. System components manufactured in accordance with IFT-008-2015 and NOM-208-SCFI-2016 standards where applicable.

E. Performance Criteria:
   1. Regulatory Requirements:
      a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

A. System Architecture:
   1. System architecture based upon the following concepts:
      a. Networkable intelligent lighting control devices.
   2. Intelligent lighting control devices with individually addressable network communication capability and having one or more basic lighting control components including: occupancy sensor, photosensor, relay, dimming output, contact closure input, analog 0-10 V(dc) input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure permissible to minimize overall system device count.
   3. System capable of interfacing directly with networked luminaires such that either low-voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches, and system backbone.
   4. Networked luminaires and intelligent lighting control devices support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
   5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices capable of providing automatic control from sensors (occupancy and/or photosensor) and manual control from local wall stations without requiring connection to a higher-level system backbone.
      a. Lighting control zones (wired and wireless) support at least 128 devices per zone.
      b. Capable of being networked with a higher-level system backbone to provide time-based control, control from inputs or systems external to control zone, and remote configuration and monitoring through a software interface.
   6. Networked luminaires and intelligent lighting control devices with distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones operate according to their defined default settings and sequence of operations.
   7. System to include one or more system controllers that provide time-based control.
   8. System controller provides means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
   9. System controller supports both low-voltage wired and wireless RF communication within a single controller device.
   10. System devices support firmware update, either remotely or from within the application space, for purposes of upgrading functionality at a later date.
   11. System capable of reporting lighting system events and performance data to management software for display and analysis.

B. Wired Networked Control Zone Characteristics:
   1. Connections to devices within a wired networked lighting control zone and to backbone components accomplished with a single type of low-voltage network cable
   2. Devices connected in "daisy-chain" topology. "Hub-and-spoke" topology, requiring all individual networked devices to be connected to a central component, is unacceptable, to reduce the total amount of network cable required for each control zone.
   3. Following proper installation and provision of power, all networked devices connected with low-voltage network cable must automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton).
      a. The "out of box" default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.

4. System software capable of automatic discovery of all connected devices without requiring any provisioning of system or zone addresses.
5. Networked devices capable of detecting improper communication wiring and LED notification to alert installation/startup personnel.
6. Networked control devices suitable for control of egress or emergency light sources without additional, externally mounted UL 924 shunting or 0-10 V(dc) disconnect devices, to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. Capable of supporting the following sequence of operation:
    a. Low-Voltage Power Sensing: Devices automatically provide 100 percent light level upon detection of loss of power sensed via low-voltage network cable connection where applicable.
    b. Line-Voltage Power Sensing: Devices listed as UL 924 emergency relays which automatically close load-control relay and provide 100 percent light output upon detection of loss of power sensed via line voltage connection to normal power.
7. Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.
8. Wired Networked Wall Station Scene-Control Capabilities:
    a. Preset Scenes that activate a specific combination of light levels across multiple local and global channels.
    b. Local Profile Support: Profile Scenes that modify the sequence of operation for devices in the area (group) in response to a button press to dynamically optimize occupant experience and lighting energy usage.
        1) Wall stations able to manually start and stop local profiles, or local profile capable of ending after a specific duration of time between five minutes and 12 hours.
        2) Configurable Parameters:
            a) Fixture light level.
            b) Occupancy time delay.
            c) Response to occupancy sensors (including enabling/disabling response).
            d) Response to daylight sensors (including enabling/disabling response).
            e) Enabling/disabling wall stations.
    c. Three-Way or Multi-Way Control: Multiple wall stations capable of controlling the same local and global control zones, to support "multi-way" preset scene and profile scene control.

C. System Integration Capabilities:
1. Capable of interface with third-party building management systems (BMS) to support two-way communication using BACnet/IP protocol, BACnet MS/TP protocol, and RESTful API including the following system integration capabilities:
    a. "Write" messages for control of individual devices, including control of relay and dimming output.
    b. "Write" messages for control of groups of devices through a single command, including control of relay and dimming output of all devices.
    c. "Read" messages for individual device status information.
        1) Available status will vary based on device type and capabilities, which may include relay state, dimming output, power measurement, occupancy sensor status, and photosensor light measurement.
    d. "Read" messages for group status information for occupancy, relay state, and dimming output.
    e. Activation of pre-defined system Global Profiles.

D. Supported Sequence of Operations:
1. Control Zones:
    a. Local Control Zones: Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) capable of transmitting and tracking occupancy sensor, photosensor, and manual switch information within at least 48 unique

control zones to support different and reconfigurable sequences of operation within area. These will also be referred to as local control zones.

b. Adjacent Control Zones: Networked luminaires and intelligent lighting control devices capable of tracking occupancy broadcasts from adjacent zones. When this feature is enabled, luminaire output for a vacant zone will reduce to a configurable dimmed state if one or more adjacent zones are occupied. Luminaires will turn off when both primary and adjacent zones are vacant.

c. Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.

2. Wall Station Capabilities:
   a. Wall stations support the following capabilities:
      1) On/Off of a local or global control zone.
      2) Continuous dimming control of light level of a local or global control zone.
   b. Multi-Way Control: Multiple wall stations capable of controlling the same local or global control zones, to support "multi-way" switching and dimming control.
3. Occupancy Sensing Capabilities:
   a. Occupancy sensors configurable to control a local or global zone.
   b. Multiple occupancy sensors capable of controlling the same local or global zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
   c. Occupancy sensing sequence of operation modes:
      1) On/Off Occupancy Sensing.
      2) Partial-On Occupancy Sensing.
      3) Partial-Off Occupancy Sensing.
      4) Vacancy Sensing (Manual-On / Automatic-Off).
   d. On/Off, Partial-On, and Partial-Off Occupancy Sensing Modes Sequence of Operation:
      1) Occupancy automatically turn lights on to a designated level when occupancy is detected. Designated occupied light level support at least 100 dimming levels.
      2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
      3) System capable of combining Partial-Off and Full-Off operation by dimming lights to a designated level when vacant and turning the lights off completely after an additional time delay.
      4) Photosensor readings, if enabled in occupancy sensing control zone, automatically adjust light levels during occupied or unoccupied conditions as necessary.
      5) Wall station activation changes the dimming level or turn lights off as selected by the occupant. Lights optionally remain in this manually specified light level until the zone becomes vacant. Upon vacancy, normal sequence of operation resumes.
   e. Vacancy Sensing or Manual-On/Automatic-Off Mode Sequence of Operation:
      1) Activation of a wall station is required turn lights on. System capable of programming the zone to turn on to either a designated light level or previous user-set light level. Initially occupying the space without using a wall station must not result in lights turning on.
      2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
      3) System capable of dimming the lights when vacant and then turning the lights off completely after an additional time delay.
      4) System capable of an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy results in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.

5) Photosensor readings, if enabled in the Occupancy Sensing control zone, capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary.
6) Wall station interaction changes the dimming level or turn lights off as selected by occupant. Lights remain at manually specified light level until zone becomes vacant; normal sequence of operation resumes upon vacancy.

f. Occupancy time delays before dimming or shutting off lights separately programmable for all control zones from 15 seconds to 2 hours.

4. Photosensor Sensing Capabilities (Automatic Daylight Sensing):
   a. Photosensor devices configurable to control a local zone.
   b. Photosensor-Based Control:
      1) Continuous Dimming: Control zone automatically adjusts dimming output in response to photosenor readings, to maintain a minimum light level consisting of both electric light and daylight sources. Photosensor response configurable to adjust set point and dimming rates.
5. Schedule Capabilities:
   a. System capable of time schedules for time-of-day to override devices including offsets from dusk and dawn.
   b. System capable of providing a visible "blink warning" five minutes prior to the end of the schedule.
   c. Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional time period.
      1) Timed override/extension duration programmable for each individual device, zone of devices, or customized group of devices, from five minutes to 12 hours.
6. Global Profile Capabilities:
   a. System capable of automatically modifying the sequence of operation for selected devices in response to any of the following:
      1) Time-of-day schedule.
      2) Contact closure input state.
      3) Manually triggered wired wall station input.
      4) RS-232/RS-485 command to wired input device.
      5) BACnet input command.
   b. Global Profile Capabilities:
      1) Global Profiles stored within and executed from the system controller (via internal timeclock). Dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
      2) Global Profile time-of-day schedules capable of recurrence settings including daily, specific days of week, every "n" number of days, weekly, monthly, and yearly. Lighting control global profile schedules support definition of start date, end date, end after "n" recurrences, or never ending.
      3) Daylight savings time adjustments capable of being performed automatically, if desired.
      4) Global Profile holiday schedules follow recurrent settings for specific U.S. holiday dates regardless if they always occur on a specific date or are determined by day/week of the month.
      5) Global Profiles capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times automatically derived from location information using an astronomical clock.
      6) Software management interface capable of displaying a graphic calendar view of profile schedules for each control zone.
      7) Global Profiles capable of manual activation directly from system controller, specially programmed wired input devices, scene-capable wired wall stations, and software management interface.
      8) Global Profiles selectable to apply to a single device, zone of devices, or customized group of devices.
      9) Global Profile Configurable Parameters:
         a) Fixture light level.

b) Occupancy time delay.
c) Response to occupancy sensors (including enabling/disabling response).
d) Response to daylight sensors (including enabling/disabling response).
e) Enabling/disabling of wall stations.

c. Local and Global Profiles backed up and stored on software's host server such that Profile backup can be applied to a replacement system controller or wired wall station.

7. System supports automated demand response capabilities with automatic reduction of light level to at least three levels of demand response, configurable for each output device.

2.4 SYSTEMS SOFTWARE INTERFACES

A. Management Interface:
1. Web-based management interface for remote system control, live status monitoring, and configuration of lighting control settings and schedules.
2. Compatible with industry-standard web browser clients.
3. Minimum of 100 unique password-protected user accounts.
4. Minimum of three user permission levels: read-only, read and change settings, and full administrative system access.
5. Capable of restricting access for user accounts to specific devices within the system.
6. All system devices capable of being given user-defined names.
7. Device identification information displayed in the Management interface including:
a. Model number.
b. Model description.
c. Serial number or network ID.
d. Manufacturing date code.
e. Custom label.
f. Parent network device.
8. Management interface capable of displaying live status of a networked luminaire or intelligent control device including:
a. Luminaire on/off status.
b. Dim level.
c. Power consumption.
d. Device temperature.
e. PIR occupancy sensor status.
f. Microphonic occupancy sensor status.
g. Remaining occupancy time delay.
h. Photosensor reading.
i. Active Profiles.
9. Management interface capable of displaying and modifying the current active settings of a networked luminaire or intelligent control device including:
a. Dimming trim levels.
b. Occupancy sensor and photosensor enable/disable.
c. Occupancy sensor time delay and light level settings.
d. Occupancy sensor response (normal or vacancy).
e. Photosensor setpoints and transition time delays.
10. Management interface capable of applying settings changes for a zone of devices or a group of selected devices using a single action that does not require the user to apply settings changes for each individual device.
11. Management interface capable of compiling a printable network inventory report.
12. Management interface capable of compiling a printable report detailing all system profiles.
13. All sensitive information stored encrypted.
14. System software updates available for automatic download and installation via the Internet.

B. System Energy Analysis and Reporting:
1. Intuitive graphical screens to facilitate simple viewing of system energy performance.
2. Energy Scorecard: Summarized display that indicates calculated energy savings in dollars or KWh.

3. Software calculates allocation of energy savings by control measures including occupancy sensors, photosensors, and manual switching.
4. Energy savings data calculated for the system as a whole.
5. Time-scaled graph showing all relay transitions.
6. Time-scaled graph showing zone occupancy time delays.
7. Time-scaled graph showing the total light level.
8. Software capable of storing information remotely onto an open-source, object-relational database, such as PostgreSQL.
9. Data stored in the database will be accessed utilizing an open standard, application programming interface, such as Open Database Connectivity (ODBC).

C. Visualization and Programming Interfaces:
1. System provides an optional web-based visualization interface that displays a graphical floorplan.
2. Graphical floorplan will offer the following types of system visualization:
a. Full Device Option: Master graphic of entire building, by floor, showing each control device installed with zones outlined including:
1) Controls embedded light fixtures.
2) Controls devices not embedded in light fixtures.
3) Daylight sensors.
4) Occupancy sensors.
5) Wall switches and dimmers.
6) Scene controllers.
7) Networked relays.
8) Wired bridges.
9) System Controllers.
10) Wired relay panels.
11) Group outlines.
b. Group-Only Option: Master graphic of the entire building, by floor, showing only control groups outlined.
c. Pan and zoom commands supported to allow smaller areas to be displayed on a larger scale simply by panning and zooming each floor's master graphic.
d. Selecting any control device displays the following as applicable:
1) Device catalog number.
2) Device name and custom label.
3) Device diagnostic information.
4) Link to further information on device including status or current configuration.
3. Programming capabilities through the application will include the following:
a. Switch, occupancy sensor, and photosensor zone configuration.
b. Manual-on or automatic-on modes.
c. Turn-on and dim to dimming levels.
d. Occupancy sensor time delays and PIR sensitivity.
e. Dual technology occupancy sensors sensitivity.
f. Photosensor calibration adjustment and auto-setpoint.
g. Multiple photosensor zone offset.
h. Trim level settings.
i. Preset scene creation and copy for scene-capable devices.
j. Application of custom device labels to the Bluetooth Low-Energy Programming Devices and individual connected lighting control devices.
k. Fade rate settings.

D. Smartphone Programming Interface for Wired and Wireless Devices:
1. Interface provided for both Apple iOS and Android operating systems that allows configuration of lighting control settings.
2. Application supports configuration of wireless networked control devices.
a. Application access granted with valid user name and password.

b. Access to program information governed by permission system that allows users to share access with other users and restrict access to those who should not be able to reconfigure the equipment.
c. Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.

3. Application supports configuration or wired networked control devices.
   a. Connected device access granted through user-defined passcode at initial install.
   b. Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.
4. Programming Capabilities:
   a. Switch, occupancy sensor, and photosensor group configuration.
   b. Manual-on or automatic-on modes.
   c. Turn-on and dim to dimming levels.
   d. Occupancy sensor time delays and PIR sensitivity.
   e. Dual technology occupancy sensors sensitivity.
   f. Photosensor calibration adjustment and auto-setpoint.
   g. Multiple photosensor zone offset.
   h. Trim level settings.
   i. Preset scene creation.
   j. Application of custom device labels for individual connected lighting control devices.
   k. Fade rate settings.

2.5 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

A. System Controller: Multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
   1. System Controller Processor: 32-bit microprocessor operating at a minimum of 1 GHz.
   2. System Controller Memory: Minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support operating system and databases.
   3. System Controller Functions:
      a. Time-based control of downstream wired and wireless network devices.
      b. Linking into an Ethernet network.
      c. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
      d. Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.
   4. Integral web server to support system controller configuration and diagnostics
      a. Web Server Control Interface:
         1) Display associated devices within the context of a graphical floorplan.
         2) Provide control of output-capable devices through virtual sliders, toggle buttons, preset level widgets, and transparent layers on floorplan.
         3) Control Capabilities:
            a) Control of individual output devices, including control of relay state and analog dimming level where applicable.
            b) Control of local lighting control zones, including control of relay state and analog dimming level where applicable.
            c) Control of global lighting control zones, including control of relay state and analog dimming level where applicable.
            d) Control of Global Profiles.
   5. Minimum of three RJ-45 networked lighting control ports for connection to any of the following:
   6. Device will automatically detect all network-connected devices.
   7. Capable of managing and operating a minimum of 750 networked devices (wired or wireless) per system controller.
   8. Multiple System Controllers capable of connection via LAN for scalability to a minimum of 20,000 networked devices.
   9. Supports BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without additional protocol translation gateways.
      a. BACnet MS/TP Connection Speed: 9600 to 115200 baud rate.

b. BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
10. Integral FIPS 140-2, Level 1 cryptographic module.
11. Supports RESTful API for control of BACnet objects, user management, date and time, and file management.
12. NEMA 1 enclosure with Class 1 and Class 2 separation.
    a. Power Supply Voltage: 120 to 277V(ac).
13. Automatic algorithm to eliminate redundant, wireless networked paths to streamline communication between the system controller and end devices.
14. System Controller Security Provisions:
    a. Disallow the use of default passwords and require passwords to be updated prior to use.
    b. Support user role-based access, such as administrator, user, and viewer.
    c. Signed firmware to ensure that unmodified, authentic software is always installed.
    d. IP-based communication protected with strong encryption algorithms such as AES or TLS1.2+.
    e. Prevent rollback of firmware to firmware versions with known, critical vulnerabilities.
    f. Valid cybersecurity listing through a third party.

2.6 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches
1. Mounting: Suitable for installation in single-gang switch box.
2. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
3. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
4. Devices with mechanical push buttons provide tactile and LED user feedback.
5. Devices with mechanical push buttons manufactured with custom button labeling.
6. Wall switch and dimmer options:
    a. Control Types Supported:
        1) On/Off.
        2) On/Off/Dimming.
        3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types.
    b. Color: Per 262726

B. Wall Switch Occupancy Sensor: WSXA or equal

C. Exterior photocell input to relay panel

D. Wired Networked Relay Panel:
1. Outputs: 16 Individual relays per pane
2. Field Configurable Relays (FCR):
    a. Field configurable to operate in single-, double-, or triple-pole relay groupings.
    b. Field configurable to operate as normally closed or normally open.
    c. Provides visual status of current state and manual override control of each relay.
    d. Minimum Relay Contact Ratings:
        1) 40 A at 120-480 V(ac) Ballast.
        2) 16 A at 120-277 V(ac) Electronic.
        3) 20 A at 120-277 V(ac) Tungsten.
        4) 20 A at 48V (dc) Resistive.
        5) 2 HP at 120 V(ac).
        6) 3 HP at 240-277 V(ac).
        7) 65kA SCCR at 480 V(ac).
3. Dimming Output Rating: Minimum of 100 mA sink current per dimming output.
4. Relay and dimming outputs individually programmable.
5. Listing: UL 924 for control of emergency lighting circuits.
6. Low-Voltage Sensor Input:
    a. Configurable to support any of the following input types:

1) Indoor Photosensor.
2) Outdoor Photosensor.
3) Occupancy Sensor.
4) Contact Closure.

b. Low-voltage sensor input provides 24 V(dc) power for sensor so additional auxiliary power supplies are not required.
c. Sensor input supports all standard sequence of operations.

7. Integrated Digital Time Clock for local schedule control.
8. Panel supplies current limited low-voltage power to other networked devices connected via low-voltage network cable.
9. Enclosure:
   a. Enclosure Rating: NEMA 1. Divide emergency circuits
   b. Surface mount with switch adjacent

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260523 "Control-Voltage Electrical Power Cables." Minimum conduit size is 1/2 inch (13 mm).
   1. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."
   2. Comply with requirements for raceways and boxes specified in Section 260533.13 "Conduits for Electrical Systems," and Section 260533.16 "Boxes and Covers for Electrical Systems,"

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in Section 260553 "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with Section 260553 "Identification for Electrical Systems."

C. Identify all controls with device address.

D. Label each device cable within 6 inch (152 mm) of connection to bus power supply or termination block.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:
   1. Test continuity of each circuit.

B. Tests and Inspections: Engage a factory-authorized service representative to perform test inspections.
   1. Test each zone using local and remote control hardware.
   2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.

C. Nonconforming Work:
   1. Lighting controls will be considered defective if they do not pass tests and inspections.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Field Test Reports: Prepare field test reports.

1. Prepare functionality and inspection reports, including a certified report that identifies controls included and describes test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.
2. Include list of all points created from actual tests of all addressed control points for lamps, ballasts, manual controls, and sensors.

3.4 REMOTE ACCESS

A. Digital network lighting control system capable of remote access by manufacturer with the following features:
   1. System diagnostics including detection of fault condition in hardware or connected devices.
   2. Access to all connected devices for complete programming including scheduling of time-of-day events and device parameters necessary to meet required sequence of operations.
   3. Browser-based interface to verify system functionality.
   4. On-demand access to manufacturer technical support for remote troubleshooting, diagnostics, configuration, and programming.
   5. Owner training on the digital network lighting control system available remotely.

B. Remote access system fully functional over commercial cellular connection or Internet-connected ethernet network.

C. All hardware associated with remote access including cellular modem and cellular antenna are to remain on-site regardless of warranty or cellular contract status.

3.5 SYSTEM STARTUP

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks in accordance with manufacturer's published instructions.
   2. Activate luminaires and verify that all maximum output levels match output levels detailed in an Owner-approved sequence of operations.
   3. Confirm correct communications wiring, initiate communications between control devices and controller/gateways, and program the lighting control system in accordance with approved configuration schedules, time-of-day schedules, and input override assignments.
   4. Program network devices to meet required sequence of operations.
   5. Program and verify all sequence of operations.
   6. Create backup of system programming.
   7. Assist in installation of system software on customer-provided workstation or server.
   8. Verify bidirectional communication of manufacturer-provided cellular router with manufacturer-managed remote access portal.

B. Commissioning Walkthrough: Collaborate with third-party commissioning agent to demonstrate lighting control system functionality and verify the system meets the specified Project requirements.

3.6 CLOSEOUT ACTIVITIES

A. Enhanced Documentation: Engage lighting system manufacturer to provide comprehensive system documentation including detailed programming, sequence of operation data per Project specifications, and related code requirements.

B. Training: Engage lighting system manufacturer to provide comprehensive system overview, software overview, and documentation relating to system operation and maintenance.

3.7 PROTECTION

A. After installation, protect digital network lighting controls from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.8 MAINTENANCE

A. Engage a factory-authorized service representative to perform on-site system adjustments.
   1. On-Site Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site settings adjustments to suit actual occupied conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose.
   2. Prepare and submit report after each visit that details activities performed.
   3. Prepare and submit report after each session that details activities performed.

END OF SECTION 26 09 23

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Panelboard - Furnish and install lighting and appliance panelboard(s) as specified herein and where shown on the associated drawings.

B. Distribution Panelboards/ Main Panel - Furnish and install distribution/main panelboard(s) as specified herein and where shown on the associated drawings.

C. Arc Flash Study

1.2 REFERENCES

The panelboard(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following specifications.

A. NEMA PB 1 – Panelboards

B. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

C. NEMA AB 1 - Molded Case Circuit Breakers

D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

E. UL 50 - Enclosures for Electrical Equipment

F. UL 67 – Panelboards

G. UL 98 - Enclosed and Dead-front Switches

H. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures

I. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards

J. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers

K. Federal Specification W-P-115C - Type I Class 1

L. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.

M. NFPA 70 - National Electrical Code (NEC)

N. ASTM - American Society of Testing Materials

1.3 SUBMITTAL AND RECORD DOCUMENTATION

A. Approval documents shall include drawings. Drawings shall contain overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one line diagrams with applicable voltage systems.

1.4 QUALIFICATIONS

A. Company specializing in manufacturing of panelboard products with a minimum of 50 years documented experience.

B. Panelboards shall be manufactured in accordance with standards listed Article 1.2 - REFERENCES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspect and report concealed damage to carrier within their required time period.

B. Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

1.6 OPERATIONS AND MAINTENANCE MATERIALS

A. Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Shall be Square D Company, General Electric, Eaton, or Siemens. Square D products are listed to establish a basis of performance. Similar and equal by the other manufacturers listed here are acceptable. Products provided shall be by one manufacturer.

B. Substitutions see Section 016000.

2.2 208/120 VOLT PANELBOARD

A. Arc Flash Study – Provide Arc flash study and label all panel boards with available arc flash level per National Electric Code.

B. NQOD
   1. Interior
      a. Shall be type NQOD panelboard rated for 208 Vac/48 Vdc maximum. Continuous main current ratings, as indicated on associated drawings, not to exceed 600 amperes maximum.
      b. Minimum short circuit current rating: as shown on drawings but minimum 10,000 in rms symmetrical amperes at 208 Vac.
      c. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be plated copper or aluminum. Bussing rated for 600 amperes shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
      d. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
      e. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided mounted on insulators.
      f. Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length. Where indicated UL Listed panelboards with 200% rated solid neutral shall be plated copper for non-linear load applications. Panelboards shall be marked for non-linear load applications.
      g. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twistouts covering unused mounting space.
      h. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
      i. Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 100A interiors shall be vertically mounted. Main circuit breakers over 100A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
   2. Main Circuit Breaker where indicated.
      a. Shall be Square D type circuit breakers.

b. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.
c. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
d. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
e. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Lug body shall be bolted in place; snap-in designs are not acceptable.
g. The circuit breakers shall be UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

3. Branch Circuit Breakers
   a. Shall be Square D type circuit breakers. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the associated drawings. Provide AFCI style breakers for all circuits serving receptacles in Bunk Rooms.
   b. Molded case branch circuit breakers shall have bolt-on type bus connectors.
   c. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
   d. There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red VISI-TRIP® indicator appearing in the clear window of the circuit breaker housing.
   e. The exposed faceplates of all branch circuit breakers shall be flush with one another.
   f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16.
   g. Breakers shall be UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.
   h. Provide manufacturer's handle ties for all branch breakers sharing the same neutral in compliance with NEC 210.4.

4. Enclosures
   a. Type 1 Boxes
      1) Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Galvannealed steel will not be acceptable.
      2) Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
      3) Box width shall be 20" wide maximum unless approved.
   b. Type 1 Fronts
      1) Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
      2) Fronts shall be hinged 1-piece with door (door in door). Mounting shall be as indicated on associated drawings.
      3) Panelboards shall have MONO-FLAT fronts with concealed door hinges and mounted with trim screws. Front shall not be removable with the door locked. Doors on front shall have rounded corners and edges shall be free of burrs.
      4) Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
   c. Type 3R, 5, and 12 where indicated.

1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
2) All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59” or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
3) Maximum enclosure dimensions shall not exceed 21” wide and 6.5” deep.

5. Provide Innovative Technology PTE-080 surge protector, 30/3 breaker with maximum 8” lead length at all 120/208V panels.

2.3 DISTRIBUTION PANELBOARDS/MAIN PANEL

A. Arc Flash Study – Provide Arc flash study and label all distribution/main panel boards with available arc flash level per National Electric Code

B. Main Distribution Panel shall be UL listed as service entrance.

C. I-LINE Circuit Breaker Distribution Panelboard
1. Interior
a. Shall be Square D I-LINE type rated 600 Vac or 250 Vdc maximum. Continuous main current ratings as indicated on associated drawings not to exceed 1200 amperes maximum. Where distribution board noted abovge 1200 amperes provide switchboard. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67.
b. Provide UL Listed short circuit current ratings (SCCR) as indicated on the associated drawings not to exceed the lowest interrupting capacity rating of any circuit breaker installed with a maximum of 200,000 RMS symmetrical amperes. Main lug and main breaker panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230.VI and VII.
c. The panelboard interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.
d. The bussing shall be fully rated with sequentially phased branch distribution. Panelboard bussing rated 100 through 600 amperes shall be plated copper or aluminum. Bussing rated 800 amperes and above shall be plated copper. Bus bar plating shall run the entire length of the bus bar. The entire interleaved assembly shall be contained between two (2) U-shaped steel channels, permanently secured to a galvanized steel-mounting pan by fasteners.
e. Interior trim shall be of dead-front construction to shield user from all energized parts. Main circuit breakers through 800 amperes shall be vertically mounted. Main circuit breaker and main lug interiors shall be field convertible for top or bottom incoming feed.
f. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided.
g. Solid neutral shall be equipped with a full capacity bonding strap for service entrance applications. Where indicated UL Listed panelboards with 200% rated solid neutrals shall have plated copper neutral bus for non-linear load applications. Gutter-mounted neutral will not be acceptable.
h. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label, and Short Circuit Current Rating shall be displayed on the interior or in a booklet format. Leveling provisions shall be provided for flush mounted applications.
2. Group mounted circuit breakers through 1200A
a. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.
b. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.
c. Circuit breakers equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breakers shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breakers of different frame sizes shall be capable of being mounted across from each other.

d. Line-side circuit breaker connections are to be jaw type.
e. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

3. Thermal magnetic molded case circuit breakers
   a. Molded case circuit breakers shall have integral thermal and instantaneous magnetic trip in each pole.
   b. Circuit protective devices shall be Square D molded case circuit breakers. Circuit breakers shall be rated as shown on schedules. Ampere ratings shall be as shown on the drawings.
4. Enclosures
   a. Type 1 Boxes
      1) Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Zinc-coated galvannealed steel will not be acceptable.
      2) Boxes shall have removable blank end walls and interior mounting studs. Interior support bracket shall be provided for ease of interior installation.
      3) Maximum enclosure dimensions shall be 44” wide and 9.5” deep.
   b. Type 1 Trim Fronts
      1) Trim front steel shall meet strength and rigidity requirements per UL 50 standards. Shall have an ANSI 49 medium gray enamel electrodeposited over cleaned phosphatized steel.
      2) Trim front shall be hinged 1-piece with door available in flush or surface mount as indicated. Trim front door shall have rounded corners and edges free of burrs. A clear plastic directory cardholder shall be mounted on the inside of the door.
      3) Locks shall be cylindrical tumbler type with larger enclosures requiring sliding vault locks with 3-point latching. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.
   c. Type 3R, 5, and 12 where indicated.
      1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
      2) All doors shall be gasketed and be equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners. A clear plastic directory cardholder shall be mounted on the inside of door. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.
      3) Maximum enclosure dimensions shall not exceed 44” wide and 14.5” deep.

D. Housekeeping Pad: When floor mounted provide 4” housekeeping pad minimum 3” beyond footprint.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and NEC standards.

3.2 FIELD QUALITY CONTROL

A. Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20% of each other. Maintain proper phasing for multi-wire branch circuits.

C. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

END OF SECTION 26 24 16

SECTION 26 27 26 – 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. Twist-locking receptacles.
   3. Switches and wall-box dimmers.
   4. Floorboxes and multioutlet assemblies.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions. See Section 017700 for additional requirements.

F. See Section 013000 for additional requirements.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
   1. Cord and Plug Sets: Match equipment requirements.

1.6 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide ten duplex receptacles, 4 switches, and 4 GFCI receptacles each with fifty feet 3/4-inch EMT-5#12 and four elbows each. All installed at location directed by owner. If not used during construction turn over to owner at end of project. Provide accounting of use of extra materials.

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. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).
   4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

B. All wiring devices shall be white color. If more than one white option is offered by a manufacturer in a given product, architect shall be presented with options in order to choose the preferred option.

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. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 5351 (single), 5352 (duplex).
      b. Hubbell; HBL5351 (single), CR5352 (duplex).
      c. Leviton; 5891 (single), 5352 (duplex).
      d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 CONTROLLED RECEPTACLES

A. Controlled receptacle, 20A, 125V dual controlled duplex receptacle with controlled marking printed on both face of duplex outlet. Pass and Seymour/Legrand or approved equal.

2.4 GFCI RECEPTACLES

A. All exterior receptacles, receptacles within 10 feet of sinks and mop sinks shall be GFCI type whether indicated on drawings or not.

B. For exterior receptacles, provide die cast aluminum weatherproof while in use cover. Bell #5881-0 or equal.

C. General Description: Straight blade. 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.

D. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; GF20.
      b. Pass & Seymour; 2084.

E. Range Receptacles: NEMA 14-50R

F. Dryer Receptacles: NEMA 14-30R

2.5 SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
      b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.6 WALL PLATES

A. Single and combination types to match corresponding wiring devices, stainless steel.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum while in use with lockable cover.
   1. Hubbell #WP26

2.7 SHORE POWER RECEPTACLES

A. Shore Power Pedstal: Metal pedestal bolted to concrete base. 20 amp receptacle at the end of cord. NEMA 5-20R with 3#12 AWG 20 amp rated retractable SO cord. Circuit shall have 20 amp, GFI breaker.

2.8 ELECTRIC VEHICLE CHARGING STATION

A. Dual port Level 2 charging station. Chargepoint #CT4000 Series.

B. 208V, single phase. 30A input current.

C. 6’ cable. SAEJ1772 connector. Bollard mount.

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 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.
10. Install double duplex, four-plex, and multiple switch locations under common plate.

E. 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.

F. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

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. Coordinate with architectural plans as shown for location prior to rough-in.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

3.3 MOUNTING HEIGHTS

A. Refer to architectural elevations for mounting heights of all devices.

B. Where mounting height not indicated on architectural elevations, the default mounting heights for devices shall be as follows:
1. Light Switches – 48” on center AFF
2. Receptacles – 18” on center AFF
3. Above counter receptacles – in backsplash above counter
4. Comm outlets – 18” on center AFF

END OF SECTION 26 27 26

SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Selective Coordination: see section 260573 for selective coordination study on both emergency and normal systems. Contractor shall provide correct breakers including electronic trip breakers as required to obtain selective coordination. None of the following equipment specifications alleviates the contractor from this requirement.

1.2 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Molded-case circuit breakers (MCCBs).
   4. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 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."

1.5 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current ratings (interrupting and withstand, as appropriate).
   4. Include evidence of NRTL listing for series rating of installed devices.
   5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
   6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. 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.

F. Manufacturer's field service report.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. 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 specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open where required.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. 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.

B. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double 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.

D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open where required.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products to match panelboard breakers.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Provide electronic trip where required for coordination.

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.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
   4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
   5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 26 28 16

SECTION 26 29 13 – MOTOR CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:
   1. Across-the-line, manual and magnetic controllers.

1.2 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each enclosed controller.
   1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Each installed unit's type and details.
      b. Nameplate legends.
      c. Short-circuit current rating of integrated unit.
      d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.
      e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
   2. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed controllers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Routine maintenance requirements for enclosed controllers and all installed components.
   2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.

D. 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.

E. Comply with NFPA 70.

F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, minimum clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

1.5 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

C. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

D. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
2. Danfoss Inc.; Danfoss Electronic Drives Div.
3. Eaton Corporation; Cutler-Hammer Products.
4. General Electrical Company; GE Industrial Systems.
5. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
6. Siemens/Furnas Controls.
7. Square D.

2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

A. Manual Controller (Starter): NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."
1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.

B. Magnetic Controller (Starter): NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.

1. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 10 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
3. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
4. Hand off auto switch.
5. Red running and green stop pilot lights.
6. Control transformer.

C. Combination Magnetic Controller (Starter): Factory-assembled combination controller and disconnect switch.
1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
2. Magnetic controller per above.

2.3 ENCLOSURES

A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.4 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Elapsed Time Meters: Heavy duty with digital readout in hours.

F. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.

G. Current-Sensing, Phase-Failure Relays for Bypass Controllers: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

3.3 INSTALLATION

A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers, Supports and Fasteners."

B. Enclosed Controller Fuses: Install fuses in each fusible switch.

3.4 IDENTIFICATION

A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.5 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers.

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
   1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
   2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 CONNECTIONS

A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment according to Division 26 Section "Grounding."

3.7 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS, "Motor Control - Motor Starters." 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.

3.8 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers. Refer Section 017700 Closeout Procedures.

END OF SECTION 26 29 13

SECTION 26 51 00 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior lighting fixtures, lamps, and drivers.
   2. Exterior lighting fixtures, lamps, and drivers.
   3. Emergency lighting units.
   4. Exit signs.
   5. Lighting fixture supports.

1.2 DEFINITIONS

A. CRI: Color-rendering index.

B. CU: Coefficient of utilization.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. RCR: Room cavity ratio.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
   2. Emergency lighting units including battery and charger.
   3. Energy-efficiency data.
   4. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, and Grilles."
   5. Life, output, and energy-efficiency data for lamps.
   6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
      a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
   1. Wiring Diagrams: Power and control wiring.

C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Lighting fixtures.
   2. Suspended ceiling components.
   3. Structural members to which suspension systems for lighting fixtures will be attached.
   4. Other items in finished ceiling including the following:
      a. Air outlets and inlets.
      b. Speakers.
      c. Sprinklers.
      d. Smoke and fire detectors.
      e. Occupancy sensors.
      f. Access panels.
   5. Perimeter moldings.

6. See Section 013000 for additional requirements.

D. Qualification Data: For agencies providing photometric data for lighting fixtures.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
1. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 2 lamps modules for each LED fixture type
2. Power Supplies & Drivers: 2 combinations for each LED fixture type

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Refer to Lighting Fixture Schedule on drawings.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. LED Fixtures: Fixtures with LM79 and LM80 testing only. Publish L70 rating for all submitted fixtures. Provide with matching drivers and power supplies. Exterior fixtures shall be rated for minimum 100,000 hours of life at L70 25C. Interior fixtures shall be rated minimum 50,000 hours

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating

conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.
   4. Laminated Silver Metallized Film: 90 percent.

G. Plastic Diffusers, Covers, and Globes:
   1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
      a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
      b. UV stabilized.
   2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 EXIT SIGNS

A. Description: 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, 70,000 hours minimum rated lamp life.
   2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
      a. Battery: Sealed, maintenance-free, nickel-cadmium type.
      b. Charger: Fully automatic, solid-state type with sealed transfer relay.
      c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
      d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
      f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
      g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
      h. See drawings.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
   1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
   2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
   3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
   4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
   3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Wire, Cable, Terminations."

F. All outlets, unless specifically noted otherwise, shall be completely equipped with fixtures and lamps.

G. After construction has been completed, wash all fixtures and clean lamps.

H. Contractor responsible for roughing-in details and mounting provisions in general construction for all lights.

I. Coordinate lighting fixture layout with general contractor as directed. Provide additional support if necessary to keep fixtures level where secured to ceiling supports.

J. Where no fixture is scheduled, use same fixture as scheduled in similar areas.

K. Contractor shall examine ceiling plans and provide complete rough in and mounting for all fixtures. This includes safety chains, seismic support, sloped ceiling adaptors, cast extension boxes, unistrut for intermediate support, etc.

L. All lamps shall be burned in for a 24 hour period after they are first turned on. After lamps are first turned on they shall be left on at full output for 24 consecutive hours.

3.2 CEILING, PENDANT, & WALL MOUNTED FIXTURES

A. Mount to withstand minimum downward pull, after installing fixtures, of 150# per 48" fixture length, or fraction thereof. Where fixture is not rated for installation against type of ceiling used, equip with 1-1/2" factory made spacers. Provide all unistrut required to support pendant fixtures and the like.

B. Provide box, custom as required, for all fixtures. Where exposed conduit or Wiremold provide cast box to match fixture.

C. Provide safety chains on all pendant fixtures that weigh over 50 pounds.

D. Provide knuckle stems on all pendant fixtures.

3.3 RECESSED FIXTURES

A. General: Equip with plaster rings, frames, latches and other supports and fasteners required for installation in various types of ceiling styles and slopes as specified in Architectural drawings and specifications.

B. Provide and install additional ceiling or fixture supports as necessary to withstand minimum downward pull at any point on fixture longitudinal centerline of 150# per 12" x 48" fixture size, or fraction thereof.

C. In addition, install two #10 safety chains per fixture, permanently attached to building structure above ceiling and hook fastened at ends of fixture. Use galvanized steel link type chain of length and strength to permit fixture to drop 18" from ceiling without parting or breaking loose from fastenings. Also permitted to support with 2 ceiling support wires.

D. Make flexible conduit feeding fixtures of sufficient length to permit above chain suspension without disconnecting.

E. Install recessed fixtures and outlets in suspended ceilings to not interfere with installation and removal of acoustical ceiling panels.

F. Installation: During building construction, prior to ceiling application install solid wood or metal backing for attaching fixtures. Do not use toggles, "Molly" bolts and other similar inserts for attaching fixtures or fixture canopies direct to plasterboard or plaster ceilings.

G. Mount fixtures to withstand minimum downward pull, after installation, of 150# per 48" fixture length and 12" width, or fraction thereof, supported.

H. Verify ceiling construction at recessed fixture location and provide mounting hardware, "plaster" rings, heat resistant wire, flex conduit, etc. as necessary and required by Code. Support independent of finish ceiling construction and conduit system.

I. Locate outlets and install fixtures on ceiling tile centerline and/or joints as determined by Architect.

J. Operate fluorescent fixtures ample period of time for ballast's and lamps to stabilize. Check fluorescent installations for quietness with room shut off and empty except for person checking. Under these conditions no fluorescent installation shall exhibit objectionable sound characteristics as judged by Architect.

3.4 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 26 51 00

SECTION 27 15 00 – DATA AND TELEPHONE CABLING SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Provide complete and comprehensive Cabling and Termination System.

1.2 INSTALLER

A. All work shall be performed by a Leviton/General Cable Business Partner who shall provide the 20 year extended product warranty for a certified installation.

B. If approved equal products to Leviton/General Cable are used, the work shall be performed by a certified installer for the manufacturer used and a 20 year extended product warranty for that manufacturer shall be provided.

1.3 WORK INCLUDED

A. The work includes all necessary labor, installation, preparation, materials, equipment, services, and other items required, whether specified or not, to provide a complete and fully operational local area network cabling and jack system conforming to EIA/TIA 568B.1, B.2, & B.3 for Category 6 cabling systems.

B. The work requires installation of cabling, station jacks, patch cables, patch panels and racks.

C. The work includes performance of diagnostic tests on all cables, connectors and components. A signed written report of all diagnostic findings shall be provided to the Owner. Using the results of the diagnostic report, the contractor is responsible for repairing all cable, connector and component problems.

1.4 OWNER FURNISHED EQUIPMENT

A. All wiring hubs, modules, computer equipment, file servers, workstations, network interface cards, and related hardware and software will be provided by the Owner.

B. No other equipment furnished by Owner.

1.5 DRAWINGS AND PLANS

A. All indicated data drop locations are to be cabled, including RJ45 jack at workstation end and termination at appropriate punch-down blocks in head-end rack.

1.6 PHYSICAL LAYER COMPONENTS

A. All components shall be new and shall comply with IEEE 802.3i standards for EIA/TIA Standard 568B.1, B.2, & B.3. All components shall be housed in appropriate equipment racks so as to assure a solid, permanent installation. Bidder shall identify each proposed data, phone system component by manufacturer and part number including data cabling, fiber optic cabling, data jacks, UTP and fiber optic and headend patch cables, patch panels, mounting devices for termination blocks, and equipment racks.

1.7 RECORD DRAWINGS

A. Upon completion of project, provide as built record drawings showing all data outlets and associated labels.

PART 2 - PRODUCTS

2.1 All material, components, and equipment shall be new and of high quality. The components and equipment furnished must have a proven track record, and if required, the contractor must furnish satisfactory evidence as to the kind and quality of materials and equipment. Leviton, General Cable,

and Chatsworth components are specified to establish a basis of performance and quality. Approved equal components by other manufacturers are allowed. Approved alternate manufacturers are as follows: Ortronics/Superior Essex. Any other manufacturers seeking approval shall submit for consideration during bidding process.

2.2 DATA/VOICE OUTLETS

A. Category 6, modular with number of RJ45 jacks indicated by Symbol on front. 568B termination pattern. Provide manufacturer's standard wall plate with label. White color outlets and plate. Provide icons for all jacks. Label jacks individually. Leviton #61110-RW6-LEV jack. Leviton #41080-4WP-LEV four port faceplate.

2.3 DATA/VOICE CABLE

A. Category 6, 4 pair, 24 gage, plenum rated, blue color. General Cable #7131800VP

2.4 RACKS

A. 84” high by 24” wide by 33.6” deep with 19” rack rails. Black color. Cabinet type enclosure with hinged lockable door. Rack rails shall be hinged to allow access to all components and cabling termination from the front of the rack. Rack shall be bolted on the floor. Chatsworth C-Series or approved equal.

B. Ground strap kit. Chatsworth #40164-001

C. Grounding bus bar kit. 10” long, wall mounted, black. Chatsworth #10622-010.

2.5 PATCH PANEL

A. Data Station Patch Panel: EIA/TIA 568B, 110 IDC terminations on back, RJ45 jacks on front. 48-port. Cat 6. Leviton #69586-U48-LEV. Provide patch panels for termination of all data cables plus 25% spare capacity.

B. Horizontal Wire Manager. Leviton #49253-BCM-LEV. Provide one per patch panel.

2.6 PATCH CABLE

A. Data: Category 6, 4 pair, 24 gage, yellow color. General Cable. Provide (10) 3 foot cables, (10) 10 foot cables, and (10) 14 foot cables.

2.7 MISCELLANEOUS

A. J-Hooks. Ceiling mounted cable support. Mono System H-433-S or H-233-S

PART 3 - EXECUTION

3.1 EQUIPMENT MOUNTING

A. All equipment shall be suitable mounted on fire rated terminal backboards, in equipment racks, or otherwise suitably solidly supported. Equipment suspended by its cable or connector is unacceptable. Placing of equipment shall be done to insure that it is readily accessible.

3.2 CABLE INSTALLATION

A. Cable run layouts indicated on the drawings are generally diagrammatic. Exact routing of conduit and wiring shall be governed by the location of obstructions and building structural conditions. Cable runs shall be in cable trays, raceways, and above ceiling spaces as shown on drawings.

B. All cable runs shall have a minimum 8 times the outside diameter bending radius.

3.3 CABLE SUPPORTS

A. Cable shall be in raceway, or supported at 4' O.C. by J-hooks where open above ceilings. See section 260533. Tye wrap cable to perform a neat and professional installation. Cable tye wraps shall be loose to provide no strain on cables.

3.4 CABLE LABELS

A. All cables shall be permanently labeled at workstation jack, termination block and host module port to identify terminal location and on both ends of cable. Label shall be per labeling scheme identified by Owner.

3.5 DATA CABLE ROUTING

A. All shall be routed to prevent interference with any existing systems such as access boxes, ventilation mixing boxes, access hatches to air filters, switch panels, fire alarm equipment, clock systems, lighting fixtures, etc. The routing must not interfere with any other service or system, operation or maintenance. Raceway shall not be placed in close contact with other devices, electrical or otherwise, that will interfere with its proper operation as a transmitter of data signal. The contractor will be responsible for rerouting any raceway that is not acceptable to the Architect at no cost.

B. All data and voice station cables shall be terminated on rack mounted patch panels.

3.6 DATA STATION DROPS

A. All drop cables shall be installed at locations as indicated on drawings. Exact outlet location within each room will be as indicated on the drawings and will deviate from the drawing only by minimal shifting the outlet laterally along the indicated wall. The drop cabling shall be installed without splices from the outlets to the appropriate terminal block.

3.7 TESTING

A. The contractor shall test all installed unshielded twisted-pair cables, termination to termination, for pair continuity, shorts, grounds, crosses, near end cross talk, resistance, noise, and measure dB loss per GigaSpeed standards.

B. Print out and deliver test report in electronic format.

3.8 COMPANY QUALIFICATIONS

A. The bidder shall be regularly engaged in the type of work specified herein. Award will be made only to a bidder who furnished satisfactory evidence that he has the technical ability, experience, equipment, personnel, and financial resources to enable him to successfully and promptly fulfill the requirements and conditions of these specifications.

B. Bidder must have an installation base of at least 500 workstation drops using proposed products.

END OF SECTION 27 15 00

SECTION 28 13 00 - ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide a complete and fully operation Access Control system fully integrated to the building security system. The installer must be the same as for Section 281600 Intrusion Detection System.

B. System is fully Internet Protocol (IP)

C. System will have three security zones.
   1. Garage communication and electrical rooms plus Level 2 electrical room
   2. Level 1
   3. Level 2 classroom

1.2 INSTALLER QUALIFICATIONS

A. Systems Integrator must be a current Genetec VAR

1.3 DEFINITIONS

A. API: Application Programming Interface.

B. LDAP: Lightweight Directory Access Protocol.

C. NTSC: National Television Standards Committee.

D. PAL: Phase Alternating Line. PAL is the color video standard used in Europe and many other countries.

E. SMS: Security Management System.

1.4 REFERENCE STANDARDS

A. Where more than one (1) reference standard, code, or regulation applies, the more stringent one shall govern.

B. Electronic Industries Alliance (EIA):
   1. EIA RS-170 - Standard for Composite Video Signals.

C. Federal Communications Commission (FCC).
   1. FCC Part 15 - Unlicensed RF Devices.
   2. FCC Part 68 - Requirements for Connecting to the U.S. Phone Network. F. Institute of Electrical and Electronics Engineers, Inc. (IEEE).

D. International Organization for Standardization (ISO). H. International Radio Consultive Committee (CCIR).

E. Microsoft® Open Database Connectivity (ODBC) Interface.

F. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code.

G. National Institute of Standards and Technology (NIST):
   1. Federal Information Processing Standards Publication (FIP PUBS 197) - Specification for the Advanced Encryption Standard (AES).

H. National Television Standards Committee (NTSC):
   1. Color Camera Broadcast Standard.

I. Underwriters Laboratories Inc. (UL):
   1. UL 294 - Standard for Access Control System Units.
   2. UL 1076 - Standard for Proprietary Burglar Alarm Units and Systems.

1.5 SECURITY MANAGEMENT SYSTEM (SMS) DESCRIPTION

A. Provide a complete Genetec software package and network to the fire district system.

B. The Security Management System (SMS) outlined in this section and detailed in Part 2 of this section is the key central component for managing physical security and the bridge between physical and logical security for a project. The system shall provide a variety of integral functions including: regulation of access and egress; provision of identification credentials; monitor, track and interface alarms and; view, record and store digital surveillance video linked to SMS events.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings.
   1. Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the SMS.
   2. A system description including analysis and calculations used in sizing equipment required by the SMS. The description shall show how the equipment will operate as a system to meet the performance requirements of the SMS. The following information shall be supplied as a minimum:
      a. Server(s) processor(s), disk space and memory size.
      b. Description of site equipment and its configuration.
      c. Network bandwidth, latency and reliability requirements.
      d. Backup or archive system size and configuration.
      e. Start up operations.
      f. System expansion capability and method of implementation.
      g. System power requirements and UPS sizing.
      h. Device or component environmental requirements (cooling and or heating parameters).
      i. A description of the operating system and application software.

B. Shop Drawings: Submit plans, elevations, sections, details, and attachments to other work.
   1. Indicate all system device locations on architectural floor plans. No other system(s) shall be included on these plans.
   2. Include full schematic wiring information on these drawings for all devices. Wiring information shall include cable type, conductor routings, quantities, and connection details at device.
   3. Include a complete SMS one-line, block diagram.
   4. Include a statement of the system sequence of operation.

C. Operation and Maintenance Data: For electronic security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23, include the following:
   1. Provide 5 sets electronic format manuals including operating instructions, maintenance recommendations and parts list including wiring and connection diagrams modified to reflect as-built conditions.
   2. Manuals: Deliver final copies of the manuals after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the Contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:
      a. Functional Design Manual: Identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific

functions.Include a description of hardware and software functions, interfaces, and requirements.

b. Hardware Manual: Describe equipment furnished including:
   1) General description and specifications.
   2) Installation and check out procedures.
   3) Equipment layout and electrical schematics to the component level.
   4) System layout drawings and schematics.
   5) Alignment and calibration procedures.
   6) Manufacturer’s repair parts list indicating sources of supply.

c. Software Manuals: Describe the functions of software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
   1) Definition of terms and functions.
   2) System use and application software.
   3) Initialization, startup, and exit.
   4) Reports generation.
   5) Details on forms customization and field parameters.

3. As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the SMS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the SMS. Copies of the final as-built drawings shall be provided to the end user in DXF format.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. SMS manufacturer shall be an established organization with referenced and documented experience delivering and maintaining SMS of equal or higher sophistication and complexity as compared to the system detailed in this specification.
   2. SMS manufacturer shall employ at a minimum the following methods for quality assurance of component and assembly devices.
      a. Perform visual inspection of devices to verify assembly according to defined procedures. Perform end of line operational tests to ensure product functionality has been correctly configured.
   3. Perform individual functionality and system level regression testing to ensure compliance with product specifications. Perform single and multiple unit system tests to mimic end-user installation configurations. Utilize automated hardware and software testing to evaluate system performance under published operational loads and compare to published system capabilities.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.

B. Store components and equipment in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 degrees Fahrenheit (10 and 29.4 degrees Celsius), and not more than 80 percent relative humidity, non-condensing.

C. Open each package; verify contents against packing list; and file copy of packing list, complete with package identification, for inclusion in operation and maintenance data.

D. Mark packing list with the same designations assigned to materials, components, and equipment for recording in the system labeling schedules that are generated by software.

E. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.9 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
   1. Equipment and Components: Rated for continuous operation in ambient conditions of 60 to 85 degrees Fahrenheit (15.5 and 29.4 degrees Celsius) and a relative humidity of 20 to 80 percent, non-condensing.
   2. Indoor Environment: NEMA 250, Type 1 enclosure.
   3. Outdoor Environment: NEMA 250, NEMA 250, Type 4 enclosures.

1.10 WARRANTY

A. SMS, Third-party, and Access Control Warranty:
   1. SMS manufacturer warrants that the product disc and hardware key shall be free from defects in material and workmanship and that SMS software product will function in substantial accordance to SMS manufacturer's specifications. Any defective dongle will be replaced at no charge provided that the system is currently on a supported version of SMS software. Dongles for non-supported versions will be replaced for a cost.
   2. All SMS manufacturer branded access control hardware is provided with a three (3) year warranty from the date of project substantial completion. SMS manufacturer warrants that such products will be free from defects in material and workmanship and that they will operate in general accordance with their product specifications. The parts will be repaired or replaced at the manufacturer’s option. Reseller shall follow SMS manufacturer’s procedures for RMA with these products. SMS manufacturer provides repair or replacement of SMS manufacturer branded components for up to five years from the product discontinuance date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Genetec

B. Substitutions will not be considered.

2.2 SMS SOFTWARE

A. Security Management System (SMS) Software: Genetec with add on text notification and mapping. System shall be expanded completely to accommodate this project. Include all components necessary for a complete and fully operational access control system.

2.3 Equipment

A. Security Management System (SMS) Hardware: The SMS shall be equipped with the access control field hardware required to receive alarms and administer all access granted or denied decisions. All field hardware must be designed to meet UL 294

B. The SMS must be able to retrieve device serial numbers from all field hardware, excluding card readers, biometric readers, and keypads. Depending upon the configuration, the SMS field hardware must be able to include any or all of the following components:
   1. System and Door Controller
      a. Genetec .
         1) The interface is for use in low voltage, Class 2 Circuits only.
         2) The installation of this device must comply with all local fire and electrical codes.
         3) Primary Power: 12 to 24 Vdc ± 10 %, 500 mA maximum (reader and USB ports not included)
         4) Reader Ports 600 mA maximum (add 600 mA to primary power current)
         5) Micro USB Port 5 Vdc, 500 mA maximum (add 270 mA to primary power current)
         6) Memory and Clock Backup Battery: 3 Volt Lithium, type BR2330 or CR2330

7) microSD Card: Format: microSD or microSDHC; 2GB to 8GB
8) Host Communication: Ethernet: 10-BaseT/100Base-TX and Micro USB port (2.0) with optional adapter: pluggable model USB2-OTGE100, Wiegand
9) Serial I/O Device One each: 2-wire RS-485, 2,400 to 115,200 bps, asynchronous, half-duplex, 1 start bit, 8 data bits, and 1 stop bit
10) Inputs: Eight unsupervised/supervised, standard EOL: 1k/1k ohm, 1%, ¼ watt Two unsupervised dedicated for cabinet tamper and UPS fault monitoring
11) Outputs: Four relays, Form-C with dry contacts Normally open contact (NO) contact: 5 A @ 30 Vdc resistive Normally closed contact (NC) contact: 3 A @ 30 Vdc resistive
12) Reader Interface
    a) Power: 12 Vdc ± 10 % regulated, 300 mA maximum each reader (jumper selectable) (input voltage (VIN) must be greater than 20 Vdc) or 12 to 24 Vdc ± 10 % (input voltage (VIN) passed through), 300 mA maximum each reader
    b) Data Inputs: TTL compatible, F/2F or 2-wire RS-485
    c) RS-485 Mode: 9,600 to 115,200 bps, asynchronous, half-duplex, 1 start bit, 8 data bits, and 1 stop bit. Maximum cable length: 2000 ft. (609.6 m)
    d) LED Output: TTL levels, high>3 V, low<0.5 V, 5 mA source/sink maximum
    e) Buzzer Output: Open collector, 12 Vdc open circuit maximum, 40 mA sink maximum
13) Cable requirements
    a) Power and Relays: 1 twisted pair, 18 to 16 AWG
    b) Ethernet: CAT-5, minimum
    c) RS-485
    d) (I/O Device Port): 1 twisted pair, shielded, 120 ohm impedance, 24 AWG, 4,000 ft. (1,219 m) max.
    e) (Reader Port): 1 twisted pair, shielded, 120 ohm impedance, 24 AWG, 2,000 ft. (610 m) max.
    f) Alarm Input: 1 twisted pair, 30 ohms maximum
14) Product Compliance
    a) UL294 Recognized
    b) FCC Part 15 Class A
    c) CE Compliant
    d) RoHS (2011/65/EU & 2015/863)
    e) EU REACH (1907/2006)
    f) California Proposition 65
    g) NIST Certified Encryption
15) Warranty: Mercury Security warrants the product is free from defects in material and workmanship under normal use and service with proper maintenance for one year from the date of factory shipment.
16) Technical Features
    a) Connectivity: 10/100 Ethernet.
    b) Security:
    c) Host/Controller connection protected by TLS 1.2/1.1 or AES-256/128
    d) Controller/IO Expansion connection protected by AES
    e) Generate and load custom peer certificates for TLS
    f) Port based network access control using 802.1X
    g) Crypto memory chip
    h) FIPS 140-2 user of OpenSSL
    i) HTTPS protection for installer web pages
    j) Secure cookies
    k) SNMPv3/v2c

l) DIP switch toggle sets 5 minute time to disable webpage access
m) Disable default login credentials
n) Authorized IP address filtering
o) IP Client Proxy
p) Bulk erase controller and periphery devices during replacement
q) Strong password enforcement

17) Door Control:
a) Two-reader ports: Clock and Data, Wiegand, or RS-485
b) Eight programmable inputs, four relays, diagnostic LEDs

18) Access Control:
a) 240,000 Cardholder capacity
b) 50,000 Transaction buffer
c) If/Then Macro capability
d) Adjustable cardholder capacity
e) Supports up to 520 inputs and 516 outputs

19) Card Formats:
a) 16 card formats per active reader, 8 per offline reader
b) Entire card number reported on invalid read
c) 19 digit (64-bit) User ID and 15 digit PIN numbers maximum
d) PIV, CAC, TWIC card compatible
e) 255 Access Levels per cardolder
f) Activation/Deactivation Date or Date & Times

20) Card Reader Functions
a) Multiple card format support by reader
b) Paired reader support
c) Alternate reader support
d) Elevator support
e) Turnstile support
f) Biometric device support
g) Open Supervised Device Protocol (OSDP) and OSDP SC compliant
h) Occupancy count
i) Support of multi-occupancy rules
j) Anti-passback support
k) Area-based, reader-based, or time based
l) Nested area, hard, soft, or timed forgiveness

21) Supports host-based approval rules
22) Keypad support with programmable user commands, card input
23) Shunt relay support
24) Strike follower relay support
25) Threat level and Operating Modes
26) Host controlled OSDP reader passthrough
27) Elevator floor override
28) Database Functions
a) Encrypted database
b) Configurable card database
c) Supports up to nineteen (19) digit card numbers
d) Supports pin codes up to fifteen (15) digits
e) Card issue code of up to 32 bits, ADA and VIP flags; PIV (75 bits); Smart Card (200 bits)
f) Ability to track people and objects

29) Intrusion Alarm Functions
a) Supports entry delays and exit delays
b) Area monitoring
c) Standard alarm masking
d) Provides control and alarm processing from the keypad

30) Supported Integrations

a) Regional I/O shares I/O status
b) Wireless locks
c) Map Power Supply Alarms and Events using PSIA
d) Reader firmware and configuration download
e) Supports 1 total RS-485 I/O protocols

31) System Functions
a) Relay count activations
b) Interoperability with older host software using Legacy Mode feature
c) Synchronize time using NTP

2. Door Control Modules
a. Mercury Intelligent Controller with Mercury MR52 2-Reader interface module
1) For use in low voltage, Class 2 circuits only.
2) Power Input PoE (12.95 W), compliant to IEEE 802.3af orPoE+ (25 W), compliant to IEEE 802.3at or 12 Vdc +/-10 %, 1.7 A maximum
3) Power Output PoE: Readers and Lock, combined: 12 Vdc @ .66 A maximum, PoE+ or 12 Vdc: Lock 12 Vdc @ 1 A maximum, RVO, Readers 12 Vdc @ .5 A maximum
4) Output: Four relays, Form-C contacts rated at 2 A @ 30 Vdc
5) Inputs: Six unsupervised/supervised, End of Line resistors, 1k/1k ohm, 1%, ¼ watt standard
6) Reader Interface Power: 12 Vdc @ .5 A maximum
7) Communication: 2-Wire RS-485, OSDP protocol, four devices maximum
8) Cable Requirements: Communication: Ethernet, CAT-6, minimum
9) External Input Power: 1 twisted pair, 18 AWG (if required)
10) Alarm Inputs: 1 twisted pair per input, 30 ohm maximum
11) Relay Outputs: As required for the load
12) Reader Data RS-485/power: 2 twisted pair with shield, 24 AWG, 120 ohm impedance 4000 foot (1220 m) maximum. or RS-485: 1 twisted pair with shield, 24 AWG, 120 ohm impedance, 4000 foot (1220 m) maximum and Power: 1 pair 18 AWG* * Type of cable(s) and gauge determined by length and voltage/current requirements. Local power source may be required
13) Environmental
14) Temperature
15) -55 to +85 C, storage
16) 0 to +70 C, operating
17) Humidity: 5 to 95 % RHNC
18) Mechanical
19) Dimension
20) 5.5 in. (140 mm) W x 2.75 in. (70 mm) L x 0.96 in. (24 mm) H without bracket
21) 5.5 in. (140 mm) W x 3.63 in. (92 mm) L x 1.33 in. (34 mm) H with bracket
22) Weight: 4 oz. (112 g) without bracket 5 oz. (142 g) with bracket
23) Product Compliance
24) UL294 Recognized. For UL, the Power Sourcing Equipment (PSE) such as a PoE/PoE+ enabled network switch and/or PoE/PoE+ power injectors must be UL Listed under UL294B.
25) FCC Part 15 Class A
26) CE Compliant
27) ROHS
28) NIST Certified Encryption

3. I/O Modules: AC-MER-CON-MR16IN and OUT
4. SDC kit for lock – Furnished by Hardware, installed by Access Control Contractor. Similar to Sargent LR100SGK
5. Dual Contact Door Contacts – SPDT – Interlogix GE 1076C-XXX Series with 1840-N rare earth magnet - Reports to access control and security systems.
6. Interface to l Security Panel

7. Proximity Readers
   a. HID RPK40 Multiclass SE Proximity Reader/Keypad
   b. HID iClass SE U90 Long Range Reader
8. Request to Exit – On electronic Latch Retraction with built in device – connect device to system. Other locations: Securitron XMS motion detector or Kantech T-REX-XL.
9. FOBS/Cards: Provide 500 School District standard proximity fobs/cards with this project. Order with code provided from school district
10. Electric Locks: Coordinate with hardware specification. Provide all power supplies for latch retraction devices and magnetic locks. Electric strikes are powered from POE controller.
11. ADA Relay Adaptor: Spaceage SSU-PAM-4. ADA Doors: Provide relays required to interface to ADA automatic door systems.
12. Panic Button: In Main office for lockdown: STI#SS2239LD-EN
13. Door Release Button: Desk mounted, green with plate. STI#UB/LTUL – Green push to exit button
14. Power Supplies: Lifesafety Power FP0150 or Altronix AL4000. Coordinate with the hardware contractor and provide power for all locks connected to the system. Locate power supplies at access control junction boxes and run power cabling to all doors. All shall be POE unless not possible. Battery backup for all power supplies. Minimum 25% spare battery capacity.

C. Cabling:
   1. Network and Power cable are provided under 271500.
   2. Power cable provided in 271500 is to be 4 conductor#18. Access control contractor shall confirm this cable, provide voltage drop calculations for all doors.
   3. All other cabling (Card Reader, REX, Key Switch, etc.) is provided under this section and is generally #18 or as required by the manufacturer. Provide plenum rated open cable whenever in a plenum.

D. Data Switches
   1. POE switches will be provided by the owner. Contractor shall plug into ports directed by the owner.
   2. Contractor shall provide any additional patch cords require. See 271500 for patch cords provided by the data contractor
   3. System shall be fully connected and operational

E. SMS Third-party Devices: The SMS shall interface with select devices from the following manufacturers:
   1. Bosch Intrusion Detection System

F. Cabling:
   1. Network and Power supply cabling included in 271500
   2. Banana peel cabling from controller to door switch, card reader, lock, REX provide in this specification as directed by the manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of electronic security system.

B. Examine rough-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before electronic security system installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEM INTEGRATION

A. Integrate electronic security system with the following systems and equipment:
   1. Electronic door hardware.

2. Security system.

3.3 PROGRAMMING

A. Programming system configuration parameters shall be as directed by the owner. The contractor shall attend a meeting and review the entire system with the owner and program as directed. The programming parameters shall be written by the contractor and approved by the owner or the system is not considered programmed to the owner's needs. After 3 months return to the site and adjust all programming as directed by the owner.

3.4 INSTALLATION

A. Install electronic security system in accordance with manufacturer' written instructions.

B. Wiring Method: Install wiring in metal raceways in exposed areas and above non-accessible ceilings. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4-inch. Control and data transmission wiring shall not share conduit with other building wiring systems. Cable, concealed in accessible ceilings, walls, and floors when possible.

C. Installer shall fully program the existing district system at the district office to accommodate all new devices and cards on this project. Program all cards as directed by the district.

D. Integrate system to the Honeywell Vista security panel. The interior access control card readers shall deactivate the security system and rearm the system.

3.5 TRAINING

A. Provide complete training systems to building users and as well as district maintenance staff. Contractor shall provide 1 training session of 2 hours to building user and 1 sessions of 4 hours each to maintenance personnel. Record all sessions and deliver 3 copies of training sessions to the owner.

END OF SECTION 28 13 00

SECTION 28 16 00 – INTRUSION DETECTION

PART 1 - GENERAL

1.1 PURPOSE

A. The Burglary Detection, Alarm and Communication (Security System) specified herein is intended to assure protection of valuable property. This specification references manufacturers' guidelines and general requirements that shall be complied with to ensure the proper and reliable functioning of the system.

1.2 SCOPE OF WORK

A. Provide Security Panel and devices as indicated on plans. System shall be of Bosch Manufacturer.

B. System shall be fully integrated with Genetec access control system as specified in 281300 Access Control System.

1.3 GENERAL CONDITIONS

A. Submittals/System Documentation:
   1. Specification sheets (cutsheets) of all proposed equipment.
   2. Equipment list identifying:
      a. Model number of each unit.
      b. Quantities of each type of device.
      c. Unit costs (including labor).
   3. Specifications compliance: A letter submitted with the bid responding to specification sub-sections individually, indicating exceptions, substitutions and alternates. The Contractor shall submit requests for substitutions (as well as all relevant technical data pertaining to the substituted equipment) to the specifier 10 days prior to the close of bid for evaluation and approval. For substitution requests refer to section 012500.

B. Submittals/System Documentation:
   1. Drawings: The Contractor shall submit shop drawings to provide ″reasonable″ details of proposed system components, layout, and wiring. The following is a list of required drawings:
      a. Equipment location drawings indicating locations of all system components such as the control panel, the console keypads, detectors, audible and visible alarm annunciators, power supply boxes and accessories.
      b. Riser diagrams indicating the system in a block diagram form. This diagram shall indicate the block interconnection of system components, the distribution of detectors and alarm annunciators by floor or area, the types of detectors and annunciators, zoning information, and number and type information.
      c. Conduit and wiring drawings indicating conduit routing, junction boxes, splice locations, and types and counts of wiring in each conduit.
      d. Typical color-coded wiring diagram for each type of device.
      e. System point-to-point drawings indicating system component interconnection.

C. Documentation: (At the time of system acceptance)
   1. ″As-builts″: Indicating actual installation details, including modifications to items listed in Section 1.3 paragraph B.
   2. Operation and Maintenance Manuals: Per manufacturer's guidelines.

D. System Approvals:
   1. Standard product of one manufacturer. Manufacturer in business manufacturing similar projects for at least five (5) years.
   2. Approvals and listings U.L.

E. Quality Assurance
   1. MTBF - Mean Time Between Failure
   2. FMECA - Failure Mode Effect and Criticality Analysis
   3. MTTR - Mean Time to Repair

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. New system complete with all devices, wiring, programming, power supplies and so forth to form a complete and fully functional system.

2.2 MATERIALS

A. System Hardware Description:
   1. Security Control Panel: Bosch 9412
   2. System Accessories:
      a. Motion Sensor – As required for installation location.
      b. Door Switch

B. Wiring: The Contractor shall provide cables consistent with the Manufacturer's recommendations. The following general guidelines shall be followed for wiring installation.
   1. Wiring shall be appropriate color-coded with permanent wire markers. Copper conductors shall be used.
   2. All junction boxes that are visible/accessible shall be painted blue unless in finished areas.
   3. ALL cables, where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway. (Check your local codes/authorities for variations or additional local requirements).
   4. Wire size for Initiating Device Circuits (IDC) shall not be smaller than 16 AWG stranded/14 solid, 14 AWG for signaling line circuits (SLC). Stranded wire must be bonded or shall have seven (7) strands max.
   5. IDC or SLC wires shall not be enclosed in conduit or raceways containing ″AC″ wires. Inside FDAC control panel, ″AC″ wires must be appropriately separated.
   6. Where EMI may interfere with the proper operation of the initiating circuits, twisted/shielded cable shall be used.
   7. All cable shall be PLENUM rated or installed in conduit

PART 3 - EXECUTION

3.1 INSTALLATION (Based on)

A. Applicable Requirements of Referenced Standards.

B. System Installation Criteria per Manufacturer's Recommendations.

C. Approved Submittals.

D. Many door switches are installed in aluminum storefront. Fish flexible conduit in doorfront as it is installed to door head location. Install wires in flex. Coordinate all provisions with general contractor.

3.2 SUPERVISION

A. Supervision of Sub-Trades.

B. Coordination with Other Contractors for System-Related Work. (Electrical contractor, finish hardware contractor, Consultant and general contactor).

C. Keeping Updated Construction Drawings.

3.3 PROGRAMMING

A. Programming System Configuration Parameters (hardware and software-zone/circuit numbers, and communication parameters).

B. Programming Operational Parameters (textual displays, telephone numbers, input/output event responses).

C. Other System Programming Tasks Required by the Engineer. These additional programming requirements shall be submitted by the Engineer to the Contractor prior to system programming.

3.4 TESTING/VERIFICATION OF SYSTEM PERFORMANCE

A. The Contractor shall perform a complete operational test of the system and verify that all system components comply with the performance criteria defined by the manufacture's specifications prior to the ″Acceptance Testing″.

B. The Burglary Alarm System Certification Document, the Certificate of completion for a Central Station Signaling, the ″as-builts″ and the Manufacturer's instruction manual(s) shall be available at the time of acceptance testing. The Contractor shall notify the authorities having jurisdiction and pertinent personnel, prior to testing, that the system is under test.

C. All system components shall be 100% tested. Additional testing procedures specified by the Manufacturer shall be implemented. Testing shall include:
   1. Installation Testing: Test the security system for:
      a. Stray voltages.
      b. Ground faults.
      c. Short circuit faults (conductor-to-conductor isolation & conductor to ground).
   2. System Testing: Test the panel monthly for:
      a. Supervisory condition for all initiating devices.
      b. Alarm condition for all initiating devices.
      c. Primary and secondary power supply integrity.
      d. Transmission and reception of all signals transmitted over telephone lines to the Central Station.
   3. Periodic Testing: Bi-monthly testing shall be performed and documented to test the proper functioning of the system.

END OF SECTION 28 16 00

SECTION 28 23 00 – VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Provide complete and comprehensive IP MEGAPIXEL CCTV System for surveillance of selected areas inside and outside of the building as shown on drawings.

B. This contract shall include amplification, expansion to Omnicast Software and all camera licenses and firmware updates, controllers, and power supplies required to connect all devices

C. Specification includes Mega-Pixel cameras.

1.2 WORK INCLUDED

A. The work includes all necessary labor, installation, preparation, materials, equipment, services, and other items required, whether specified or not, to provide a complete and fully operational CCTV System.

B. The work requires installation of cabling, video cameras, heaters, splitters, servers, housings, supports and monitors, power patch panels, and data switches.

1.3 COMPANY QUALIFICATIONS

A. The bidder shall be regularly engaged in the type of work specified herein. Award will be made only to a bidder who furnished satisfactory evidence that he has the technical ability, experience, equipment, personnel, and financial resources to enable him to successfully and promptly fulfill the requirements and conditions of these specifications. Bidder must have 5 years experience in installing similar systems.

PART 2 - PRODUCTS

2.1 CAMERAS

A. General Cameras – Indoor and Outdoor
   1. Sony XM632 Outdoor 1080p Mini-Dome Camera D/N, IP66
   2. RGB CMOS 1/3.2”
   3. Lens Varifocal remote zoom and focus, IR corrected, megapixel resolution
   4. 3-9 mm, 84-30 view, F1.2
   5. Day and night Automatically removable infrared-cut filter
   6. Minimumillumination
   7. Color: 0.2 lux, F1.2, B/W: 0.04 lux, F1.2
   8. Shutter time: 1/28000 s to 2 s
   9. Pan/Tilt/Zoom Digital PTZ, preset positions, guard tour
   10. Camera angle adjustment: Pan 360°, tilt 160°, rotation 340°
   11. Videocompression
      a. H.264 (MPEG-4 Part 10/AVC)
      b. Motion JPEG
   12. Resolutions
      a. 2592 x 1944 – 5 Megapixel
   13. Frame rate
      a. 5 MP Capture mode, 12 fps in all resolutions.
   14. Video streaming Multiple, individually configurable streams, H.264 and Motion JPEG. Controllable frame rate and bandwidth
   15. VBR/CBR H.264
   16. Multi-view streaming:
   17. Audio streaming Two-way
   18. Audio compression
      a. AAC LC 8/16 kHz, G.711 PCM 8 kHz, G.726 ADPCM 8 kHz . Configurable bit rate
   19. Audio input/output: External microphone input or line input, line output

20. Security Password protection, IP address filtering, digest authentication,user access log, IEEE 802.1X** network access control, HTTPS** encryption
21. Supported protocols
    a. IPv4/v6, HTTP, HTTPS**, QoS Layer 3 DiffServ, FTP, SMTP, Bonjour,
    b. UPnP, SNMPv1/v2c/v3(MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP,
    c. UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS
22. System integration
    a. Application Programming Interface: Open API for software integration, including the ONVIF specification available at www.onvif.org, as well as VAPIX® and AXIS Camera Application Platform from Axis Communications, specifications available at www.axis.com Support for AXIS Video Hosting System (AVHS) with One-Click
23. Camera connection
    a. Intelligent video Video motion detection, active tampering alarm, audio detection
    b. Support for Sony Camera Application Platform enabling
    c. installation of additional applications
    d. Events Intelligent video, external input
    e. Alarm actions File upload via FTP, HTTP and email
    f. Notification via email, HTTP and TCP
    g. External output activation
    h. Video and audio recording to edge storage
    i. Pre- and post-alarm video buffering
    j. Installation aids in software

B. Mounts
    1. Wall Mount
    2. Ceiling Mount
    3. Corner Mount
    4. Pendant Mount

2.2 CENTRAL VIDEO SERVER – By Owner. Install software on central video server.

2.3 SOFTWARE

A. Provide a complete and fully functional Omnicast Server software package for this site and all camera licenses.

2.4 BACKUP POWER

A. Provide UPS to maintain system on for a minimum of 15 minutes on power outage. Liebert UPStation GXT2

2.5 WIRING AND CABLING

A. Provide CAT 6 cable to each camera location.

B. See Section 271500.

2.6 SWITCHES

A. Owner will provide POE switches for the system. Contractor shall assist the Owner in setup, programming, subnets, POE, and queueing of the switches.

PART 3 - EXECUTION

3.1 CABLE SUPPORTS

A. Cable shall be in raceway when underground, exposed, above non-accessible ceilings or supported at 4'O.C. by bridle rings or J-hooks where above accessible ceilings. Velcro wrap cable to perform a neat and professional installation. Cable tye wraps shall be loose to provide no strain on cables. CCTV cables are not to be routed in same J-hooks, bridle rings or conduit with any other system.

3.2 CABLE ROUTING

A. All shall be routed to prevent interference with any systems such as access boxes, ventilation mixing boxes, access hatches to air filters, switch panels, fire alarm equipment, clock systems, lighting fixtures, etc. The routing must not interfere with any other service or system, operation or maintenance. Raceway shall not be placed in close contact with other devices, electrical or otherwise, that will interfere with it's proper operation as a transmitter of video signal. CCTV cables are not to be routed in same J-hooks, bridle rings or conduit with any other system. The contractor will be responsible for rerouting any raceway that is not acceptable to the Engineer at no cost.

3.3 CAMERA AIMING AND PROGRAMMING

A. Aim and zoom each fixed cameras as directed by owner/Engineer in field. Allow for One initial aim of each camera and one re-aim of each camera as directed 1 week after school starts at direction of owner. Schedule aiming one week prior to allow for scheduling of personnel.

B. Program frames per second and quality of Server recording per Owner/Engineer as directed in field. Submit recommended settings for approval.

C. Program DVR to interface with access control system (program a virtual button for each door with a door intercom for user to pick button will unlock door.)

3.4 CAMERA MOUNTING

A. Mount cameras and power supplies per manufactures recommendations.

B. Seal all building mountings and penetrations with a single part non sag urethane elastameric selant. Bases of design Sikaflex 15LM.

C. Provide backing for all building mounting locations to support work. Coordinate locations and mounting details with architectural drawings.

3.5 TESTING

A. At completion of installation, perform complete operational test and make adjustments as required.

3.6 LABELING

A. The SYSTEM shall be permanently labeled with scheme directed by the owner. Submittals shall include the proposed label scheme for owner review. Owner will make changes to the label scheme during the submittal process.

3.7 TRAINING

A. The manufacturer shall provide complete training on the system as follows:
   1. Provide 3 – 4 hour training sessions to owner designated personnel
   2. Videotape all training with a professional grade camcorder. Deliver 3 copies of training to owner in either DVD or on a zip drive

B. All training sessions must be scheduled with the owner’s on site representative and signed off as complete by the owner’s representative. If this session is not signed off it shall be repeated.

C. Provide site specific operation instructions laminated and attached to CCTV head end rack for system use instructions shall include but not be limited to:
   1. Program tour on Server and on camera
   2. Record CD rom for evidence purposes
   3. Review of recorded information
   4. Zoom and pan
   5. Set program.

3.8 MAINTENANCE AND EXTENDED SERVICE

A. Manufacturer shall provide on site equipment testing for 6 hours within building. The person shall arrive 2 hours prior to the testing, meet with the owner and confirm all systems are up and operational.

B. The manufacturer shall return to the site within the 1 year warranty period and review the system setup with the owner. At that time the owner will direct any changes to the system and the manufacturer shall re-aim, refocus, and reprogram the system.

END OF SECTION 28 23 00

SECTION 28 31 11 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Fully addressable fire alarm system. Provide all equipment, programming, devices, cabling, raceways and so forth for a complete and fully functional system. Existing fire alarm control panel (FACP) shall remain. Add devices as indicated on plans.

B. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

C. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Remote Station Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
   1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 60 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.

D. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

E. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

F. Underwriters Laboratories Inc. (UL) - USA:
   1. No. 38 Manually Actuated Signaling Boxes
   2. No. 50 Cabinets and Boxes
   3. No. 864 Control Units for Fire Protective Signaling Systems
   4. No. 268 Smoke Detectors for Fire Protective Signaling Systems
   5. No. 268A Smoke Detectors for Duct Applications
   6. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
   7. No. 464 Audible Signaling Appliances
   8. No. 521 Heat Detectors for Fire Protective Signaling Systems
   9. No. 1971 Visual Notification Appliances

G. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

1.2 SCOPE:

A. An intelligent, microprocessor-controlled, fire alarm detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance:
   1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
   2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
   3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
   4. All circuits shall be power-limited, per 1995 UL864 requirements.
   5. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
   6. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.

C. Basic System Functional Operation:
   1. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
   2. The system alarm LED on the FACP shall flash.
   3. A local piezo electric signal in the control panel shall sound.
   4. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
   5. Printing from the control panel and history recording shall log the information associated each new fire alarm, along with time and date of occurrence.
   6. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm

1.3 SUBMITTALS

A. General:
   1. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
   2. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
   3. Show annunciator layout, configurations, and terminations.

C. Manuals:
   1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
   2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
   3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications
   1. Provide the services of a qualified technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
   2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
   3. Provide electronic copy of all programming to the owner to allow for reprogramming of system.

1.4 GUARANTY:

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.5 MAINTENANCE:

A. Maintenance and testing shall be on a semi-annual schedule or as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
   1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
   2. Each circuit in the fire alarm system shall be tested semiannually.
   3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 7.

1.6 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification.

B. The system shall fully comply with the latest issue of these standards, if applicable.

C. National Fire Protection Association (NFPA) - USA:
   1. No. 13 Sprinkler Systems
   2. No. 70 National Electric Code (NEC)
   3. No. 72 National Fire Alarm Code
   4. No. 101 Life Safety Code

D. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

E. Local and State Building Codes.

F. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
   1. UL Underwriters Laboratories Inc
   2. FM Factory Mutual

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL:

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a fire protective signaling system, meeting the National Fire Alarm Code.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

D. All equipment must be available "over the counter" through the Security Equipment Distributor (SED) market and can be installed by dealerships independent of the manufacturer.

2.2 CONDUIT AND WIRE:

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements. All fire alarm wire will be installed in EMT conduit where in walls, exposed or above non-accessible ceilings. Open cabling allowed above accessible ceilings.
2. All wiring shall be installed in conduit or metallic raceway unless routed open above an accessible ceiling. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. Wiring for 24-volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.
7. All fire alarm system wiring shall be new. Except where connecting to existing fire alarm loops.
8. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
9. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
10. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).
11. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. For new systems, shielded wire shall not be required.
12. All field wiring shall be electrically supervised for open circuit and ground fault.
13. The fire alarm control panel shall be capable of T-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the amount of T-taps, length of T-taps etc., are not acceptable.

B. Terminal Boxes, Junction Boxes and Cabinets:

C. All boxes and cabinets shall be UL listed for their use and purpose.

D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to building ground through the equipment ground conductor. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

2.3 MAIN FIRE ALARM CONTROL PANEL:

A. Existing FACP: Hochiki FireNet Plus. Provide modules and programming as required to support added fire alarm system devices indicated on plans.

2.4 SYSTEM COMPONENTS:

A. Programmable Electronic Sounders:
1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
3. Shall be flush or surface mounted as show on plans.

B. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

C. Audible/Visual Combination Devices:
1. Shall meet the applicable requirements of Section A listed above for audibility.
2. Shall meet the requirements of Section B listed above for visibility.

D. Manual Fire Alarm Stations
1. Manual fire alarm stations shall be non-code, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
4. Manual stations shall be constructed of sturdy metal construction, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

E. Waterflow Indicator:
1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.
4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

F. Sprinkler and Standpipe Valve Supervisory Switches:
1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4-inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

G. The control panel will have the capability of Reverse Polarity Transmission or connection to a Municipal Box for compliance with applicable NFPA standards.

H. Digital Alarm Communicator Transmitter (DACT). The DACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed Central Station.
1. The DACT shall be compact in size, and shall plug into the fire alarm control printed circuit board within the control cabinet. Systems that utilize relay contact closures are not acceptable.
2. The DACT shall include connections for dual telephone lines (with voltage detect), per
3. UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
4. The DACT shall be completely field programmable via the fire alarm control panel keypad or via downloaded programming information via a PC.
5. The DACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
6. Communication shall include vital system status such as:

a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
b. Independent Addressable Device Status
c. AC (Mains) Power Loss
d. Low Battery and Earth Fault
e. System Off Normal
f. 12 and 24-Hour Test Signal
g. Abnormal Test Signal (per UL requirements)
h. EIA-485 Communications Failure
i. Phone Line Failure

7. The DACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 640 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

I. Field Wiring Terminal Blocks
1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks which are permanently fixed are not acceptable.

J. Addressable Devices - General
1. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
2. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm
3. control panel signaling line circuits.
4. Addressable smoke and thermal (heat) detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
6. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a base with a built-in (local) sounder rated for a minimum of 85 DBA, a relay base and an isolator base designed for Style 7 applications.
7. Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.
8. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
9. Detectors shall provide address-setting means using decimal switches.

K. Addressable Pull Box (manual station)
1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual pull stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

L. Intelligent Multi-Sensing Detector (Smoke detector)
1. The intelligent detector shall be an addressable device which is capable of detecting multiple threats by employing photoelectric and thermal technologies in a single unit. This detector shall utilize advanced electronics which react to slow smoldering fires (photoelectric) and heat (thermal) all within a single sensing device.
2. The multi-detector shall include two bicolor LEDs for 360-degree viewing.
3. Automatically adjusts sensitivity levels without the need for operator intervention or programming. Sensitivity increases with heat.

M. Intelligent Thermal Detectors (Heat detector)
   1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

N. Intelligent Duct Smoke Detector
   1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
   2. When sufficient smoke is sensed, an alarm signal shall be initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

O. Addressable Monitor Module for Dry Contact Devices
   1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.
   2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
   3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
   4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

P. Two-Wire Detector Monitoring
   1. Means shall be provided for the monitoring of conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally open contact alarm initiating devices (pull stations, heat detectors, etc).
   2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable module. The module will supervise the IDC for alarms and circuit integrity (opens).
   3. The monitoring module will be compatible, and listed as such, with all devices on the supervised circuit.
   4. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
   5. The monitoring module shall be capable of mounting in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or in a surface mount backbox.

Q. Addressable Control Relay Module
   1. Addressable control relay modules shall be provided to control the operation of fan shutdown and other auxiliary control functions.
   2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
   3. The control relay module will provide a dry contact, Form-C relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.
   4. The control relay module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

R. 6 Output Addressable Control Relay Module
   1. Up to 6 Addressable intelligent control relay modules combined on one circuit board shall be provided to control the operation of fan shutdown and other auxiliary control functions.
   2. Using rotary address switches, the first module shall be addressed from 01 to 154 while the remaining modules shall be automatically assigned to the next five higher addresses. Note: binary dipswitches for setting address are not acceptable.
   3. Provision shall be included for disabling a maximum of three unused modules

4. A single isolated set of dry relay form C contacts shall be provided for each of the 6 module addresses, which shall be capable of being wired for either a normally open or normally closed operation.
5. The module shall allow an addressable control panel to switch these contacts on command.
6. The module shall contain removable plug in terminal blocks capable of supporting 12 AWG to 18 AWG wire.
7. The control relays mounted on the module shall be suitable for pilot duty applications and rated for a maximum of 3.0 amps at 30 VDC, resistive, non-coded and 2.0 amps at 30 VDC maximum, resistive, coded.

S. Six-Zone Interface Module
1. A six-zone interface module shall be provided as an interface between the addressable panel and two-wire conventional detection zones.
2. A common SLC input shall be used for all modules, and the initiating device circuits shall share a common external supervisory supply and ground.
3. The first address on the interface module shall be addressed from 01 to 154 while the remaining modules are automatically assigned to the next five higher addresses.
4. Address shall be set using decimal encoded rotary address switches. Binary address switches are not acceptable.
5. Provision shall be included for disabling a maximum of two unused addresses of the six available.
6. All two-wire detectors being monitored shall be two-wire compatibility listed with the six zone input module.
7. The six zone input module shall transmit the status of a zone of two-wire detectors to the fire alarm control panel. Status shall be reported as normal, open or alarm.
8. Removable plug-in terminals shall be provided capable of accepting from 18 AWG up to 12 AWG wire.

T. Multiple Two-Wire Detector Monitoring
1. A single multi input module shall be provided for the monitoring of up to 10 conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc).
2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable point. The module will supervise the IDC for alarms and circuit integrity (opens).
3. The first address on the 10 input boards shall be set from 01 to 150 and the remaining module addresses shall be automatically assigned to the next nine higher addresses.
4. Provision shall be included for disabling a maximum of two unused addresses.
5. The supervised state (normal, open, or short) of the monitored device shall be sent back to the panel. A common SLC input shall be used for all modules, and the initiating device loops shall share a common supervisory supply and ground.
6. The IDC zone may be wired for Class A or B (Style D or Style B) operation. A green LED for each circuit shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. LEDs shall latch on when a circuit is in alarm.

U. Isolator Module
1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Style 6 (Class A) or Style 4 (Class B branch). The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.5 BATTERIES:

A. Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time 60 hours followed by 5 minutes of alarm.

B. batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

C. If necessary to meet standby requirements, external battery/charger systems may be used.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual pull stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 TEST:

A. The service of a competent, NICET level II technician shall be provided to technically supervise and participate during all the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.

B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

D. Verify activation of all waterflow switches.

E. Open initiating device circuits and verify that the trouble signal actuates.

F. Open and short signaling line circuits and verify that the trouble signal actuates.

G. Open and short notification appliance circuits and verify that trouble signal actuates.

H. Ground all circuits and verify response of trouble signals.

I. Check presence and audibility of tone at all alarm notification devices.

J. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

K. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

L. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 FINAL INSPECTION:

A. At the final inspection, at a minimum a NICET level II technician shall demonstrate that the system functions properly in every respect.

3.4 INSTRUCTION:

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor or installing dealer shall provide a user manual indicating "Sequence of Operation."

END OF SECTION 28 31 11

SECTION 311000 – SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes but is not limited to the following:

1. Provide pre-mobilization video of existing site conditions.
2. Locate and document existing utilities and controls.
3. Save and protect from harm any trees, structures, features, and facilities to remain.
4. Provide staging and stockpiling locations.
5. Remove and dispose of curbs, pavement, fencing, signs, lights, pavement markings, topsoil, trees, bollards, and other items shown on plans and as required to install new improvements.
6. Remove and dispose of utility materials from below the ground surface as required.
7. Clear and grub areas of the site as required and designated for new construction. Remove trees and plantings in such a manner to protect those that are to remain.
8. Salvage existing materials as specified.
9. Dispose of material from the site.

1.2 RELATED SECTIONS

A. Coordinate related work specified in other parts of the Project Manual, including but not limited to following:

1. Section 01 57 13 – TESC
2. Section 31 22 00 – Earthwork

1.3 REFERENCES

A. City of Federal Way – Development Standards (June 2024); 2021 Addendum to the King County Surface Water Design Manual (KCSWDM).

B. WSDOT – 2024 Standard Specifications for Road, Bridge and Municipal Construction; 2024 Standard Plans.

C. King County – 2021 King County Surface Water Design Manual (KCSWDM).

1.4 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit surveyor’s Certificate of Insurance

C. Submit demolition procedures and operational sequence for review and acceptance by the Owner’s Representative. Include permits for transport and disposal of debris as required.

D. Prior to mobilization to the site, submit to Owner’s Representative a copy of a video recording of existing conditions of fences, surfaces (including existing pavement, building and structures to remain), equipment, and adjacent improvements that might be misconstrued as damage related to construction.

E. Prior to mobilization, submit for review a complete site access, staging, and stockpiling plan using a copy of the basic site layout plan. Identify all areas to be used for access, staging, and stockpiling throughout various phases of the construction sequence. Provide a legend or key as appropriate where phasing affects location.

F. Submit shop drawing of portable temporary fencing panels and connection hardware.

G. Submit Record Drawings according to Section 01 33 00 identifying and accurately locating capped utilities and other subsurface structural, electrical and mechanical conditions.

1.5 MATERIAL OWNERSHIP

A. All site demolition materials shall become the Contractor's property unless otherwise noted in the project documents.

1.6 EXISTING CONDITIONS

A. Protection of existing improvements

1. Provide, erect, and maintain barricades, coverings, or other types of protection necessary to prevent damage to existing improvements.
2. Restore any existing on or off-site improvements damaged by this work to their original condition, as acceptable to Owner's Representative. Restoration includes but is not limited to landscaping, pavement, walks, structures and fences.
3. Restore to original grades and conditions, areas adjacent to site disturbed or damaged as a result of site preparation and demolition work.

B. Contact all necessary utility purveyors including City of Federal Way and Puget Sound Energy to coordinate utility cutoffs and removals. Verify that all appropriate services have been disconnected.

C. Do not shut off or cap utilities without prior notice and Coordination. Site utilities shall remain in service unless otherwise directed. Coordinate work with Division 01 requirements.

D. Objectionable Noises: Limit use of air hammers and other noisy equipment. Conform to local governing requirements regarding Noise Control.

E. Maintain vehicular and pedestrian traffic routes:

1. Contractor shall maintain the pedestrian pathway in the ROW unless otherwise coordinated.
2. Ensure minimum interference with roads, streets, alleys, sidewalks, and adjacent facilities for all areas of the park not under construction.
3. Do not close or obstruct streets, fire lanes, sidewalks, alleys, or passageways without permission from authorities having jurisdiction.
4. If required by governing authorities, provide alternate routes around closed or obstructed traffic ways.

F. Verify location and elevation of existing utilities at points of connection prior to commencing work on new utility that is to be connected to the existing utility. Coordinate with Owner's Representative if actual conditions are at variance with plans.

G. Verify location and elevation of existing utilities sufficiently in advance of construction to allow for coordination and mitigation of conflicts without down time or project delays.

1.7 DIMENSIONS AND LAYOUTS

A. The Contractor is responsible for furnishing, setting, and marking all line and location stakes including offsets and general construction staking. When work requiring control is required, all necessary related equipment and instruments shall be on site. A qualified layout engineer, surveyor, or technical specialist shall be assigned to the Contractor Crew for this work. The equipment and personnel must be available, at no additional cost to the owner for the purposes of verifying layout, conformance of grading, and certifying the accuracy of the work per the contract documents.

B. The Contractor is responsible for preserving all benchmarks and stakes and is required to replace any stakes or benchmarks that are displaced or missing.

C. The Contractor is responsible for review of all utility purveyor and City records relating to the existing underground utilities. The Contractor is responsible for avoiding damage to these facilities and shall restore all utilities at Contractor's own expense. The Contractor is to notify the Owner's Representative immediately if underground utilities not shown on record documents are encountered.

D. If any discrepancies are found by the surveyor between the drawings and actual field conditions, the contractor shall immediately notify the Owner’s Representative.

1.8 REGULATORY REQUIREMENTS

A. Schedule the required pre-construction meeting with City of Federal Way and Owner/Architect.

B. Comply with all applicable Federal, State, and Local codes and safety regulations. If there are any conflicts among referenced standards, the more stringent requirements shall govern.

C. Coordinate demolition work with utility companies.

D. Obtain all necessary permits.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin work prior to receiving Notice to Proceed from Owner.

B. Verify that site improvement removal may safely and appropriately begin.

C. Obtain required permits and permission from local governing authorities and Owner prior to commencing work.

D. Prior to beginning site removals and clearing, meet with the Owner’s Representative and review demolition plan. Indicate all existing trees that will be affected by construction and coordinate with Landscape Architect. Coordinate removals of landscape materials with the Owner’s Representative and Landscape Architect.

3.2 DOCUMENTATION OF UTILITIES AND CONTROLS

A. Maintain a separate drawing to be stored on-site for identifying key utilities and controls. Identify and apply color-coded markings identifying shut-offs for domestic water, irrigation

water, power, and gas. Identify sanitary sewerage, stormwater discharge, gas, fiber optics, and telephone (all as appropriate) lines, which are to be maintained in service during the work. Color-code emergency contact information for each utility directly on the drawing.

B. In accordance with Section 31 22 00, identify and accurately locate all capped utilities, utilities to be abandoned in place and other subsurface piping, structural, electrical and mechanical existing improvement to remain.

3.3 GENERAL

A. Install perimeter Temporary Erosion and Sedimentation Control (TESC) measures and flag or fence, as shown on plans, all clearing limits prior to clearing or grubbing of the site.

B. Project Sequencing requirements /Project Stages are described per Architect phasing plan sheets.

C. The CONTRACTOR SHALL NOTE THAT THE FILL SOILS AND RESIDUAL SOILS HAVE HIGH FINES CONTENT (soil fraction passing the #200 sieve, such as silt and clay). The majority of the near-surface soils appear to contain more than 5 percent fines and, therefore, WILL BE MOISTURE-SENSITIVE DURING PERIODS OF WET WEATHER AND COULD BE DIFFICULT TO COMPACT IN WET WEATHER CONDITIONS. The moisture content of the near-surface soils is moist, indicating that moisture conditioning (i.e., drying) may be necessary to achieve adequate compaction. Because of the variable nature of the on-site soils, and the variables involved with weather conditions, on-site soils shall not be used as structural fill. Nonetheless, the native on-site soils can be used for non-structural purposes such as preload fill or in landscaped areas. See Section 31 22 00. The Contractor shall implement and employ means and methods necessary to execute site demolition work in accordance with the Contract requirements and project schedule.

D. The contractor shall schedule site demolition work to minimize existing soil disturbances. The Contractors ability to perform site demolition work with the existing moisture sensitive soils may be impossible during different periods of the work and may require the contractor to cease operations until some soil healing occurs. Inactive workdays or wet weather days shall be expected and planned for in the Contractor's schedule and bid without extra cost to the Owner, except in abnormal wet weather cases. Abnormal wet weather cases shall be in accordance with the General Conditions. Time delays caused by the inability to perform work in existing saturated soils shall not be a basis for additional money or time claims.

E. Prior to commencing site demolition and clearing, locate and flag all limits. Save and protect all areas to outside limits or existing improvements to remain. Contractor shall repair to equal or better condition areas outside limits impacted by Contractors work. Prior to site clearing and demolition, contact utility location service and have all underground utilities on the site and adjacent right of ways clearly marked. Locate, flag, and protect existing underground utilities to remain.

F. Approximate locations of existing utilities have been obtained from available records and are shown for convenience. The contractor shall be responsible for verification of the locations shown and for discovery of possible additional utilities not shown so as to avoid damage or disturbance. The underground utility location service shall be contacted for field location prior to any construction. The Owner shall be contacted if a utility conflict exists.

G. Protect from weather existing soils exposed by site clearing and demolition activities. Protect exposed soils from erosion by covering with straw mulch or plastic. Prevent disturbance from vehicular traffic. Coordinate with TESC requirements.

H. Protect and maintain benchmarks and survey control points from disturbance during construction.

I. The Contractor shall provide temporary barricades, barriers, guard railing, shoring etc as necessary to protect personnel, structures, and utilities to remain intact during the operation of this contract. Conduct work in such a way to prevent damage to adjacent buildings, structures, other facilities and injury to persons. The Contractor shall clean adjacent structures and improvements of dust, dirt or debris caused by demolition and clearing operations. Any damage to existing facilities to remain or to improvements on adjacent properties shall be repaired, replaced and/or reconstructed by the Contractor at their expense to its original condition or better as directed by the Owner's Representative.

J. Conduct site demolition and clearing in such a way to ensure minimum interference with roads and other adjacent properties. Do not close or obstruct streets or other occupied or used facilities without permission from authorities having jurisdiction.

3.4 CLEARING

A. Specifically locate and establish clearing limits by physical means as required by the documents. The chain-link security fence shall also be allowed to establish the clearing limits.

B. Clear areas of the site as required and designated for new construction. Remove trees and plantings in such a manner to protect those that are to remain. Cut and remove entire stumps of trees designated to be removed. Completely remove all roots, stumps, vegetation and all other organic debris within the clearing limits as required for new construction and as indicated on the documents.

C. Save and protect trees indicated on plans to remain. Protect all off-site trees along adjacent roadways and on surrounding properties. Refer to Section 01 56 39 for tree and plan protection and extents of stump removal.

D. Remove growth and underbrush within the clearing limits as required for new construction and as indicated. Perform removal operations in a manner to protect existing property and trees and plants to remain.

E. Do not drive heavy equipment outside of clearing limits to perform any clearing or tree removal. Replace all fencing and TESC features damaged by logging at no additional cost to the Owner.

F. Dispose of clearing debris off site in a legal manner. Remove all debris and litter found on-site.

3.5 GRUBBING

A. Grub or otherwise prepare areas where clearing has occurred to receive construction or other improvements.

B. Excavate and remove all stumps to depth as necessary (assume 3 feet for bidding purposes) to remove all organic material and roots associated with the stumps.

C. Excavate and remove roots larger than 1 inch in diameter, rocks, boulders and other unsuitable materials.

D. Strip site to an average depth of 6 inches, with greater depth as required for stump and root removal listed above.

E. Use only hand methods for grubbing inside a 10-foot radius or the drip line (whichever is greater) of trees indicates to remain.

F. Fill depressions caused by clearing and grubbing operations as indicated for the respective areas of work in these specifications. Compact to the appropriate level indicated per Section 31 22 00.

3.6 DRAINAGE AND GROUNDWATER

A. Review and follow the Geotechnical recommendations concerning sub-grade protection.

B. Control all surface and sub-surface water in order to prevent damage to the project site and adjacent properties. Provide all means necessary to immediately resolve surface water drainage problems generated on the construction site. Protect disturbed areas from inclement weather and surface runoff during construction process to provide a suitable working platform for all phases of the construction. Provide proper grading to prevent standing water.

C. Intercept and route upstream stormwater around the project site.

D. Keep natural drainage ways open for drainage at all times. Provide erosion control and stormwater turbidity control facilities as required according to the Plan, Section 01 57 13, and per the City inspector to prevent sediment transport and turbid stormwater discharge either downstream or offsite. TESC facilities shall be installed prior to clearing and demolition. At no time shall more than one foot of sediment be allowed to accumulate within a catch basin, ditch, or swale. All catch basins and conveyance ditches shall be cleaned prior to paving. Mud/sediment build-up shall be removed, and the cleaning operation shall not flush sediment-laden water into the downstream system.

E. Keep open pits and holes caused as a result of demolition work free of standing water. All water shall be discharged in a stabilized manner to the site TESC system.

F. Keep all trenches, holes and pits free of water during clearing, grubbing, excavation, construction of structures and installation of drains. Control surface run-off in order to prevent collection of water in areas not indicated to hold run-off.

3.7 SITE REMOVALS GENERAL

A. Remove and dispose of site walls and foundations, fences, site furnishings, stairs and foundations, landscaping, topsoil, piping, and other obstructions in areas to be cleared. Materials not designated for salvage shall be broken up, loaded, and legally disposed of by the Contractor. Care shall be taken removing items to ensure that damage does not occur to the existing trees and improvements which are to remain in place.

B. Sprinkle excavated material and access roads as necessary to limit dust to the lowest practicable level. Do not use water to such an extent as to cause flooding, contaminated runoff, or icing.

C. Explosive blasting is forbidden.

3.8 PAVEMENT DEMOLITION

A. Raze, remove, and dispose of curb, concrete and asphalt pavements and appurtenances, concrete walls, concrete plaza and patios, concrete site stairs, and other Pavement removals adjacent to existing pavement to remain shall be accomplished by making a neat vertical sawcut at the limits of removal for asphalt and to the nearest joint on concrete. All concrete walk removals shall be sawcut at the next adjacent joint. Adjacent pavement materials designated to remain that are damaged by the Contractor during the work shall be replaced at no additional cost to the Owner.

B. Contractor may elect to crush (rubblize, grind, pulverize etc.) and stockpile existing concrete and/or asphalt on-site for use per Section 31 22 00. Special care shall be taken to not mix recycled material with onsite soils.

C. Crushing (rubblizion, grinding, pulverizing etc.) of asphalt or concrete material may be conducted such that they are within the allowable work hours and meet all noise ordinance requirements.

D. Asphalt pavement can be ground and recycled in-place as base course in areas to be repaved in accordance with WSDOT requirements. Recycled asphalt pavement shall not be used in any area except below those areas proposed to be repaved with standard paving including but not limited to under pervious pavement, building, planting areas or underneath bioretention areas. Care shall be taken to not mix ground asphalt pavement into other onsite soils that are to be exported or removed from the site. Onsite soils designated to be exported from the site that have been contaminated with ground asphalt shall be removed at no additional cost to the Owner.

E. Recycled Portland cement concrete rubble may be considered for construction aggregate with approval from the geotechnical engineer that it meets the material specification and if it has not been painted or exposed to dangerous or hazardous materials. It may also be considered for structural fill if it meets the requirements for structural fill per section 31 22 00. Recycled Portland cement concrete may not be used in the following areas or under the following conditions:

1. Pervious Pavement
2. Planting/Landscape areas
3. Underneath bioretention areas
4. Where exposed to the elements
5. Where free drainage is required
6. Where wet conditions exist or are anticipated to exist

3.9 FILLING DEPRESSIONS

A. Fill depressions caused by clearing, grubbing, demolition and utility removal operations shall be accordance with Section 31 22 00 and shall meet all criteria specified for moisture and compaction with respect to the future conditions designated for that area. The Contractor is cautioned to the anticipated use of common backfill materials due to their moisture sensitivity. The contractor is responsible and shall install satisfactory soil materials to accomplish the work. The demolition excavation and backfill shall be incidental to the Site Demolition work.

3.10 STRIPING REMOVALS

A. Removal of existing thermoplastic or paint striping on existing pavement to remain shall be completed by hydroblasting or approved equal.

3.11 DISPOSAL OF MATERIALS

A. All site demolition materials shall become the Contractor’s property unless otherwise noted in the project documents.

B. The refuse resulting from site preparation shall be disposed of by the Contractor in a manner consistent with all government regulations. In no case shall refuse material be left on the project site, shoved onto abutting private properties, or be buried in embankments or trenches on the project site. Debris shall not be deposited in any stream or body of water, or in any public right-of-way or upon any private property except by written consent of the private property owner. On-site burning is not allowed. Maintain hauling routes clean and free of any debris resulting from work of this Section.

C. The Owner encourages the salvage and recycling of materials from demolished structures. The Contractor shall salvage or recycle, in an acceptable manner to environmental agencies and the Owner, at his/her option any of the materials designated for disposal.

D. Non-salvageable or non-recyclable demolition, contaminated soils, and creosote debris shall be transported to an approved lined landfill with a leachate collection system.

E. The Contractor has the option to secure its own demolition debris, asphalt, concrete, and creosote materials disposal or recycle site(s) provided it has acquired all permits and approvals necessary from governing agencies and the Owner.

F. The Contractor shall submit to the Owner’s Representative copies of trip tickets and receiver tickets for all material transported to approved landfills and/or recyclers to ensure disposal at proper facilities. Trip tickets will not be used to quantify material.

G. Leave the project area in a neat and orderly condition to meet the approval of the Owner/Owner's Representative.

3.12 PROTECTION OF STOCKPILES

A. Protect stockpile areas from release of sediment. Cover stockpiles at all times while not in use to keep stored material dry. Surround materials stockpiled on pavement by two rows of straw bales or compost filter sock with joints staggered.

END OF SECTION

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SECTION 312200 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes but is not limited to the following:
   1. Accomplishing indicated and required excavation, filling, compaction, and rough grading as required for parking lot, sidewalks, retaining walls, walkways, and parking, site grading, utility construction, and the construction of other miscellaneous improvements.
   2. Protection and conditioning of on-site materials.
   3. Removing and disposing of materials that are unsuitable for reuse from the site.
   4. Importing any additional required materials.
   5. Coordinating earthwork operations with the other work of the Project.

B. Work shall be in accordance with the Standard Specifications for Road, Bridge and Municipal Construction, latest edition, Washington State Department of Transportation/APWA.

C. Related sections include but are not limited to:
   1. Section 31 10 00 – Site Preparation
   2. Section 32 12 10 – Flexible Paving
   3. Section 32 13 13 – Concrete Paving
   4. Section 33 40 00 – Storm Drainage

1.2 REFERENCES

A. AASHTO T176 Plastic Fines in Graded Aggregates and Soils by use of the Sand Equivalent Test.

B. ASTM D1556Test Method for Density of Soil in Place by the Sand-Cone Method.

C. ASTM C136 Standard Method for Sieve Analysis of Fine and Coarse Aggregate.

D. ASTM D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/cu ft).

E. ASTM D2922 Standard Test methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

A. City of Federal Way – Development Standards (June 2024); 2021 Addendum to the King County Surface Water Design Manual (KCSWDM).

B. WSDOT – 2024 Standard Specifications for Road, Bridge and Municipal Construction; 2024 Standard Plans.

C. King County – 2021 King County Surface Water Design Manual (KCSWDM).

1.3 SUBMITTALS

A. Comply with Section 01 33 00.

B. Samples:

1. Submit sieve analysis of each type of material from an independent testing agency. Review and acceptance of a sieve analysis does not constitute approval of the actual product, which may be subject to additional testing at any time.
2. Submit to onsite Geotechnical Engineer a 50-pound sample of proposed fill material at least seven (7) days prior to importing material to the site.

C. WSDOT pit certifications for each pit.

D. Health and Safety Plan - Prepare and submit a Worker Health and Safety Plan. Although certain requirements are identified here and elsewhere in these specifications, it is the sole responsibility of the Contractor to provide a safe work environment and adequate protection to individuals under their employ. Maintain a copy of the Health and Safety Plan in a conspicuous location on the Job Site and reinforce the requirements of the document at weekly Job Site Safety Meetings.

E. Safety Products - Submit for the Engineer's approval manufacturer's product data for each worker safety product specified.

F. Provide current calibration certificates for each piece of mechanical monitoring equipment to be used in the work. Perform field testing of equipment for the Engineer's approval prior to commencing excavation.

1.4 EXISTING CONDITIONS

A. Documentation regarding existing conditions is the current survey supplied in the Contract Drawings.

B. Protection of existing improvements:
1. Provide protection necessary to prevent damage to existing vegetation and improvements not indicated for removal. Restore site improvements, including but not limited to landscaping, pavement, walks, structures, fences and planters, damaged by this work to their original condition, as acceptable to Owner's Representative. Restore to original grades and conditions, areas adjacent to site disturbed or damaged as a result of site preparation and demolition work.
2. Minimize the impact to the surrounding area during construction and installation of utilities and other improvements by using the minimum size of equipment required to perform the work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Stockpile materials on site within clearing limits and at approved locations. The Contractor shall be responsible for delivery coordination, placement, and protection of stockpiled material.

B. Direct surface water away from stockpile site to prevent erosion and/or deterioration of materials. Place stockpile or grade site surface around stockpile to prevent ponding of surface water.

C. Remove stockpile and construction debris, restore area as indicated on plans or to pre-existing state, leave area in a clean and neat condition.

D. Trench spoils and stockpiles shall be located at least 6 feet from edges of trenches and excavations and shall be graded such that surface water is prevented from discharging into excavations or trenches. Large stock piles from site grading should not be located within 20 feet of utility trench excavations.

1.6 DIMENSIONS AND LAYOUTS

A. Furnish, set, and mark all line location stakes. Assign a qualified layout engineer, surveyor, or technical specialist for this work; this person shall be on site at all times when work requiring control is being performed, together with necessary equipment, supplies and instruments related thereto. This equipment and personnel must be available, at any time and at no additional cost to the Owner, for the purpose of verifying layout, grades, and certifying the accuracy of work on the site.

B. Preserve benchmarks and stakes and replace stakes or benchmarks that are displaced or missing.

C. Provide Interim and Final surveyed information on bioretention to Owner's Representative for review.

1.7 MANUFACTURER'S QUALIFICATIONS:

A. The Contractor shall select materials that are products of firms that are regularly engaged in the manufacture of the specified materials.

1.8 BASE BID REQUIREMENTS

A. Contractor shall include in the base bid all costs of achieving final grades as shown on the Contract Documents including all excavation to suitable bearing soil, export, legal disposal, import, placement, compaction, and protection. The Contractor accepts the provided information as existing condition upon commencing land disturbing clearing or earthwork activities.

B. The Contractor has the option to perform, at their own expense, a topographic survey of existing conditions and submit their survey for Owner's Review and approval for use for earthwork calculations prior to Contractor's land disturbing clearing or earthwork activities.

C. The cost of excavation and off-site disposal of material and imported fill and its placement and compaction required to meet sub-grade elevations as defined in the Contract Documents shall be included in the base bid amount. In the base bid it should not be assumed that the on-site soils may be used structural fill.

D. Subgrade: For the purpose of the Contractor Bid, the following shall define the required base bid subgrade elevations after stripping:

1. Footings: As indicated on plan
2. Building Slab: As indicated on plan
3. Paving: The elevation of bottom of paving section.
4. Utilities Trenches: The elevation of the bottom of pipe bedding.
5. Landscape: The elevation below the stripping depth or the soil planting.
6. Detention Vault: The elevation of bottom of subgrade

E. If the Contractor's sequencing of the Work includes stock piling and double handling of materials, it shall be included within the base bid amount and shall be at no additional cost to the Owner.

F. THE ONSITE SOILS ARE MOISTURE SENSITIVE AND COULD BE DIFFICULT TO COMPACT IN WET WEATHER CONDITIONS. The soil integrity will be influenced by weather conditions and by the Contractor's sequencing, handling and protection of the material. It is the sole responsibility of the Contractor to protect the soils from wet weather conditions, and/or disturbance from construction activities.

G. The Contractor shall be solely responsible for all unauthorized excavation and import and shall be at no additional cost to the Owner. Unauthorized excavations shall be backfilled with structural fill and compacted as required.

H. Removal, disposal, and placement of soils deemed unsuitable as a result of the Contractor's sequencing, handling and protection of the materials will not be compensated.

1.9 QUALITY ASSURANCE

A. Crew Foreman shall have a minimum of six years working experience and four years experience as foreman performing similar work.

B. All work shall comply with WSDOT Standard Specifications and City of Federal Way Standards. Where in conflict the City of Federal Way Standards will prevail.

C. Testing:

1. The Owner will engage a qualified independent Geotechnical Engineer and/or testing agency to perform field quality-control testing including but not limited to, soil bearing verification, fill compaction testing, and laboratory gradation and other index testing of on-site and imported materials for compliance with these specifications.
2. If the material is found to be non-compliant with the Contract, the Contractor shall bear the cost of testing, removal of all non-compliant materials from the project site, and replacement of the materials with materials meeting the requirements of the Contract.

D. It is the responsibility of the Contractor to verify the accuracy of all survey information provided by the Owner prior to commencing excavations or filling operations. Commencement of these operations constitutes acceptance of the survey information as appropriate to meet the intent of the Contract.

E. Grading Tolerance: Finished grade will match contours and elevation shown will be within 1/10 foot.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Approval of Fill Material: All material which is proposed to be used as fill, bedding or backfill shall be graded and tested for moisture content and compactability. Gradation and test results shall be submitted for review and acceptance by the Owner's Engineer prior to placement of fill. Materials shall be checked during the course of importation to ensure they continue to meet the Specifications.

B. Material used in filling shall be appropriate to the site and the intended for use in that portion of the site.

C. Onsite soil shall not be assumed for use as structural fill in wet weather conditions, where not protected and without moisture conditioning.

D. Topsoil shall not be used as a fill material.

E. No frozen or thawing material shall be used as fill.

F. Utility Trench Backfill:

1. Shall be Gravel Borrow for onsite areas unless native material is suitable. Native material will be deemed suitable if it is:
   a. Capable of attaining the degree of compaction specified;

b. Within a range of two percent of the optimum moisture content for compaction;
c. Free of organic material, clay, frozen lumps, rocks or pavement chunks larger than 6 inches, or other deleterious matter.
d. Less than 35% silt and clay.
e. Imported gravel borrow containing recycled material is allowed to be used as trench backfill on-site as long as it meets the Gravel Borrow Specifications, hazardous materials testing in conformance with WSDOT 9-03.21(1) is provided, and the material conforms to City of Federal Way Standards.
f. Recycled material generated on-site is not allowed for use as utility trench backfill.

2. Remove native material that is unsuitable for use as trench backfill from the site if it does not meet the requirements for use elsewhere on site

G. Pipe Bedding:

1. Perforated drain pipe bedding shall be Gravel Backfill for Drains in conformance with WSDOT 9-03.12(4).
2. Utility pipe bedding shall be in accordance with City of Federal Way Standards.

H. Washed Rock: Washed rock shall be Gravel Backfill for drains in accordance with WSDOT 9-03.12(4).

I. Crushed Surfacing Top and Base Course shall be in accordance with WSDOT Section 9-03.9(3), except that the percent by weight passing the U.S. No, 200 sieve shall not exceed 5 percent and shall have a minimum of two mechanically fractured surfaces.

J. Gravel Borrow: per WSDOT Section 9-03.14(1) except that the percent by weight passing the U.S. No, 200 sieve shall not exceed 5 percent.

K. Structural Fill:

1. All fill placed under paved surfaces including footings, slab on grade floor, roadways, sidewalks, walkways, behind walls, and all other paved areas, including utility trench back fill beneath these areas shall be “structural fill” unless otherwise authorized by Owner’s Representative.
2. Imported structural fill shall be used under the building slab, building footings and within ten (10) feet of the building footprint unless moisture conditioned native material is deemed suitable for use as structural fill per this section.
3. Structural fill:
   a. During the dry season structural fill shall be shall be imported well-graded sand and gravel material free of organic material, debris and other deleterious material, meeting the requirements of WSDOT Standard Specifications section 9-03.14(1), Gravel Borrow modified such that 100 percent passes the 1-1/2 inch sieve or moisture conditioned native material deemed suitable for use as structural fill per this section.
   b. During the rainy season, structural fill shall be washed crushed rock or select granular fill consisting of well-graded sand and gravel or crushed rock free of organic material, debris and other deleterious material meeting the requirements of WSDOT Standard Specifications section 9-03.9 Aggregate for ballast or crushed surfacing or 9-03.14 Gravel Borrow, both with a maximum particle size of 6-inches and less than 5 percent passing the U.S. Standard No.200 sieve.
   c. Native material will be deemed suitable for Structural fill if it is:
      1. Capable of attaining the degree of compaction specified;
      2. Within a range of two percent of the optimum moisture content for compaction;
      3. Free of organic material, clay, frozen lumps, rocks or pavement chunks larger than 6 inches, or other deleterious matter.

4. Less than 35% silt and clay.
5. Is approved for use by Geotechnical Engineer

4. On site material, meeting the specification of Common Borrow, may not be used as structural fill except as approved by Geotechnical Engineer but may be considered for use in landscaped areas.
5. Structural fill placed in maximum 8-inch loose lifts, with each lift being compacted to at least 95% of the modified Proctor maximum density using ASTM D1557. Structural fill shall be placed and compacted within 2 percent of the optimum moisture content.
6. The Contractor shall use best management practices to protect soils during construction and shall be familiar with wet weather and winter soil work.

2.2 RECYCLED CRUSHED MATERIALS GENERATED ON-SITE

A. With prior approval from the Owner's Representative and the Geotechnical Engineer, the Contractor may use the following recycled material as is or blended uniformly with naturally occurring minerals or aggregates. The final blended product shall me the requirements for the specified type of aggregate. Recycled material shall originate on-site and shall conform to WSDOT Section 9-03.21. The recycled material component included in a blended product shall meet the specific requirement of the following sections:
   1. Recycled Hot Mix Asphalt – Section 9-03.21(1)B.
   2. Recycled Portland Cement Concrete Rubble – Section 9-03.21(1)C.

B. Recycled asphalt material generated on site may only be used under proposed asphalt areas as approved by geotechnical Engineer.

C. Recycled concrete material generated onsite shall not be used as utility trench backfill, within bioretention areas, landscape areas, or where not approved for use by the Geotechnical Engineer. In addition, Recycled Portland Cement material shall not be used in the following situations:
   1. Pervious Pavement
   2. Where exposed to the elements
   3. Where free drainage is required
   4. As structural fill, including pavement base or subbase, where wet conditions exist or are anticipated to exist.

D. Onsite crushing (rubblization, grinding, pulverizing etc.) of concrete or asphalt material must be in compliance with all applicable noise requirements.

E. Special care shall be taken to not mix recycled material with onsite soils. Any contamination of onsite soils is the sole responsibility of the Contractor.

2.3 IMPORTED RECYCLED CRUSHED MATERIALS

A. Recycled material generated off-site should not be used onsite without approval from the geotechnical engineer and acceptance by City of Federal Way. The use of recycled material will be subject to performance criteria, gradation requirements, and hazardous materials testing in conformance with WSDOT 9-03.21(1). Recycled glass and steel furnace slag is not allowed. Imported recycled material is not allowed for use as utility trench backfill within the ROW.

2.4 SAFETY, MONITORING, AND RESPONSE EQUIPMENT

A. The Contractor shall provide barricades, safety guards, temporary fencing, signage and/or other methods to secure trenches, open excavations, and other unsafe conditions resulting from this construction. Undertake work in full compliance with all applicable regulatory requirements.

2.5 CONDUCTIVE WARNING TAPE

A. Conductive warning tape is required over all pipes and shall be located 12-inches below the proposed finished subgrade. Tape shall be manufacturer's standard permanent, bright-colored, continuous printed plastic tape, aluminum backed, intended for direct-burial service. Tape shall be not less than 6" wide x 4 mils thick. Tape Schedule:

Piping	**Color**	**Wording**
Domestic Water	Blue	Caution Domestic Water
Fire Service	Blue	Caution Fire Service
Storm Sewer	Green	Caution Storm Sewer
Sanitary Sewer	Green	Caution Sanitary Sewer

PART 3 - EXECUTION

3.1 GENERAL

A. All earthwork shall conform to the Washington Administrative Code (WAC) 296-155 requirements for Excavation, Trenching and Shoring.

B. Supplemental to these requirements the Contractor shall note that THE EXISTING SITE SOILS ARE MOISTURE SENSITIVE. See Geotechnical Engineering Report. The Contractor shall expect to perform site earthwork during the spring, summer, fall, and winter months. The Contractor shall not assume that the on-site soils are suitable for re-use during wet weather conditions. The Contractor shall implement and employ means and methods necessary to execute earthwork in accordance with the Contract requirements and project schedule. The Contractor shall execute earthwork to minimize existing soil disturbances. Inactive workdays or wet weather days shall be expected and planned for in the Contractor’s schedule and bid without extra cost to the Owner, except in abnormal wet weather cases. Abnormal wet weather cases shall be in accordance with the General Conditions. Time delays caused by the inability to perform work in existing saturated soils shall not be a basis for additional money or time claims.

C. Permits:

1. The Contractor is responsible for obtaining permits required for work within the right of way.

3.2 SAFETY MONITORING AND RESPONSE

A. Maintain conformance to the Contractor’s Health and Safety Plan.

3.3 PROTECTION OF EXISTING FACILITIES

A. Utilities:

1. The Contractor shall protect from damage private and public utilities in accordance with WSDOT Section 1-07.17. Contractor shall, before excavation begins, call the Utilities Underground Location Center 1-800-424-5555. Contractor shall pay for location of existing utilities.
2. The Contractor shall, at their own expense, make excavations and borings ahead of the work, as necessary, to determine the exact location of utilities and underground structures.
3. It is understood that there will be interfering utilities, service laterals and other underground pipes, drains, or structures encountered that are not shown or areas shown incorrectly on the plans or have not been previously discovered in the field. Contractor agrees this is a normal and usual occurrence in the construction of underground improvements. Furthermore, Contractor understands and agrees that work in some cases must be done in close proximity to said utilities and underground pipes, drains, and structures not shown or shown incorrectly on the plans which may require a change in operations and may cause sloughing of the trench, additional traffic control, additional pavement and backfill costs and time. The Contractor agrees that these occurrences are usual and ordinary, and are reflected in the Bid and plan of operation.

B. Pavement: The Contractor shall protect from damage all pavement or paved areas including curbs intended to remain. Contractor shall be responsible for replacement if damage occurs to pavement or curbs to remain.

1. Access Streets and Roadways: Provide wheel cleaning stations per Section 31 10 00.
2. Repair and/or replacement of damaged facilities will be accomplished at the Contractor's expense.
3. Dust Control: Per Section 31 10 00.

3.4 PROTECTION OF WORK IN PROGRESS

A. It is the responsibility of the Contractor to protect all work in progress from damage due to extremes of cold, moisture, or drying, or mechanical damage from equipment traffic or foot traffic. Alert the Owner's Representative to the presence or likelihood of conditions that may adversely affect the quality of the work, the physical structure of soils, or transport of site soils off-site.

B. Do not work frozen soils.

C. Protect soils from excessive moisture. See Geotechnical Report recommendations. During periods of prolonged precipitation, take aggressive steps to avoid over-saturation, erosion, or homogenization of soils by covering with protective plastic sheeting, collection and controlled dewatering, detention for sediment removal, and not disturbing wet soils. It shall be the Contractor's sole responsibility to manage soils that are too wet or too dry for use.

D. Protect foundation subgrades as necessary from foot and equipment traffic and ponding of water during wet weather conditions. Typical measures of protection include compacted crushed rock or a lean-mix concrete mat placed over a properly prepared subgrade. Contractor should place foundation concrete and backfill excavations as soon as possible to protect the bearing surface.

E. Apply supplemental moisture to overly dry soils, but not to the extent that would cause runoff, puddling, or erosion.

F. Do not operate heavy equipment near excavations where trench wall or slope failure may result.

3.5 SITE GRADING

A. Required contours and elevations are shown on the Drawings with the exception of bedrock area noted on plans; if indicated information conflicts with actual conditions, notify Owner's Representative and obtain direction before proceeding with grading of area in conflict.

B. In areas to be graded, remove trees as indicated in plans, brush, and other deleterious material.

C. Remove organic topsoil and stock pile in accordance and grub any remaining roots in accordance with Section 31 10 00.

D. Provide subgrades required for various backfill soils and soil amendments as shown on Plans and Details.

E. Following clearing, grubbing, stripping, excavations to reach subgrade and prior to placement of any fill, the exposed subgrade in areas to be occupied by paving, or structures shall be proof rolled and compacted to a dense, unyielding condition with a loaded dump truck, large vibrating roller or equivalent. Site clearing, proof rolling and compacting shall be observed by the Geotechnical Engineer to identify soft spots or unsuitable material. Overexcavate per the Geotechnical Engineer's recommendations areas that cannot be reworked and/or compacted. Replace overexcavated material with imported structural fill unless otherwise directed.

F. Unless otherwise approved or not recommended during winter construction by the Geotechnical Engineer, scarify soils surfaces to receive compacted fill to a depth of at least eight (8) inches. Moisture condition scarified soil to obtain moisture to near optimum moisture content. Compact scarified soils to a minimum relative compaction as listed in this section.

G. Place fill in controlled layers in thicknesses that are compatible with the type of equipment being used. Do not exceed a loose thickness of eight (8) inches for each fill layer. Compact each layer to a minimum relative compaction as listed in this Section. Determine the field density of the compacted soils by the ASTM D2922 and D3017 test method.

H. All areas to receive compacted fill shall be field reviewed and tested by Geotechnical Engineer prior to the placement of new fill.

I. Fill soils shall be granular and shall meet the specifications graduation requirements. The testing agency shall evaluate and/or test material for its conformance with specification prior to delivery to site. The Contractor shall notify the Geotechnical Engineer 72 hours (three working days) prior to importing fill to the site.

J. The Geotechnical Engineer shall observe the placement of compacted fills and conduct in place field density tests on the compacted material to check for adequate moisture content and required relative compaction. Where less than required relative compaction or inadequate moisture is indicated, remove and replace the substandard fill or apply additional compactive effort and moisture conditioning as necessary until relative compaction, as specified in this section, is achieved. Additional testing (re-testing) is at the Contractor's own expense.

K. Provide a level testing pad for Geotechnical Engineer's field density tests.

L. The Contractor shall grade the site and control drainage at all times to prevent water from ponding in construction areas and/or flowing into excavations. Exposed grades shall be crowned, sloped, and smooth drum-rolled at the end of each day to facilitate drainage. Accumulated water must be removed from subgrades and work areas immediately prior to performing further work in the area. Soil deemed unfit due to Contractor's inattention to drainage or lack of soil protection shall be replaced with imported structural fill at the Contractor's own expense.

M. Perched ground water could be encountered in excavations completed during construction. See Geotechnical Engineering Report. The Contractor shall be prepared to intercept any ground water seepage entering the excavations and route it to a suitable discharge location.

N. Slope prepared surfaces to have positive drainage and direct flows to TESC facilities.

O. Refer to Tree Protection in the Drawings and specifications for grading in the vicinity of trees to be protected.

P. In area of bedrock to remain, design intent is to selectively expose bedrock formations in order to create a geologic site feature. In this area, remove existing soils to expose bedrock for inspection by Owner's Representative, Geotechnical Engineer, and Landscape Architect. Leveling, grading, and selective excavation of bedrock will be directed by Owner's Representative, Geotechnical Engineer, and Landscape Architect. Some parts of this area may differ in grade and surface treatment from Contract Drawings. Revisions to Planting and Irrigation to be coordinated with Landscape Architect.

3.6 RETAINING WALLS

A. Installation of concrete retaining walls shall be per Plan Details .

B. Install perforated drain per plans and 33 40 00.

3.7 SLOPES

A. The Contractor is responsible for the stability and safety of all temporary slopes. Refer to Geotechnical Engineering Report for guidance regarding maximum recommended temporary and permanent slopes on site.

3.8 PREPARATION

A. Subgrade preparation and protection shall be per Section 2-06 of WSDOT, except Contractor shall perform all staking.

3.9 EXCAVATION, EMBANKMENT, AND BACKFILLING

A. General:

1. Exercise sound engineering and construction practices for excavations and trenches. Maintain trenches such that no damage will occur to any foundation, structure, pole, utility

or other facility due to sloughs or any other cause. If as a result of trenching operation, there is disturbance of the ground which may endanger or damage other property and require repair, the Contractor shall take remedial action at no additional expense to the Owner.

2. Provide dewatering, shoring and other types of stabilization, in addition to shoring required for Safety by State codes to maintain the integrity of the trench or excavation and protect adjacent utilities or structures. All earthwork shall conform to the Washington Administrative Code (WAC) 296-155 requirements for excavation, trenching and Shoring.

B. Excavation Material

1. Common Excavation: The naturally occurring sand, gravel, clays, or mixtures of the above, required to be moved for the construction of roadways and for the establishment of proposed site grades. Common excavation material shall be moved with the use of mechanical equipment, such as shovels, loaders, bulldozers, graders, rippers, etc., but shall not require drilling and blasting or drilling and line breaking. Excavation by sluicing method will not be permitted.

2. Unsuitable Excavation: Shall consist of unstable materials, such as topsoil, peat, muck, water-impregnated clays, yielding or wet soils, swampy or other undesirable materials, including buried logs, stumps, abandoned utility and product delivery lines, or trash. Excavated material shall be replaced with Structural Fill.
   a. Unsuitable materials beneath structures, roadways, or embankments shall be removed to the depth designated by the Owner's Representative, and backfilled with Structural Fill.

C. Structural Fill:

1. Embankments shall be constructed in accordance with WSDOT Section 2-03..

2. Placement of structural fill shall be in accordance with WSDOT 2-03.3(14)C, Method C.

D. Moisture Conditioning and Temporary Stockpiling:

1. Where the Contractor excavates material which may be considered for reuse based upon the requirements of common fill or structural fill but is over the allowable range of moisture content for placement as fill, the Contractor shall condition the material before it can be considered for reuse. Excavated material considered for reuse must be evaluated and approved for use by the Geotechnical Engineer.

2. The Contractor shall stockpile excavated material when no fill material is required at the time of excavation. The Contractor shall be responsible for preventing the stockpiled material from becoming saturated beyond the critical moisture limits for fill placement.

3. Stockpiled selected material, which becomes saturated beyond allowable limits for placement as fill, shall be removed and disposed of and replaced with Gravel Borrow or Structural fill, as appropriate for the intended use and weather conditions during installation at the expense of the Contractor.

3.10 DISPOSAL OF EARTH MATERIALS

A. Contractor shall remove all excavated material that is not acceptable for use as fill on site. Legally dispose of excess material off site, at Contractor's expense.

3.12 FIELD QUALITY CONTROL

A. General: Control soil compaction during construction providing minimum percentage of density specified for area classification. In landscape areas, do not allow equipment traffic to overly compact areas beyond specified percentages. Remediate over-compaction as directed by the

Engineer including ripping, re-grading and re-compaction or over-excavation and in-kind replacement per plan.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the percentages below for maximum density for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D1557; and not less than the following percentages of relative density.

C. Compaction:

1. Compact all fill and backfill to prevent subsequent settlement.
2. Water settling or jetting will not be permitted as a means of compaction.
3. Furnish heavy rollers or compactors except as follows:
   a. Use pneumatic hand tampers for trenches and areas not accessible to heavy equipment.
   b. Compact areas within 3-feet of footings, foundations and walls with hand equipment.
4. Required compaction: Compact fill and backfill to the following minimum relative compaction (percentage of maximum dry density determined in accordance with ASTM D1557).

Locations	Required Minimum Relative Compaction
Utility Trenches: (under non roadway and greater than 2 feet below surface below walks and roadways)	90%*
Utility Trenches: (under foundation slabs, roadways, or within 2 feet of the surface below walks and roadways)	95%
Under Slabs on Grade and Foundations	95%
Under Walks and Pedestrian Paving	95%
Retaining Wall Subgrade	95%
Within 3-feet of Back of Retaining Walls	90%
Subgrade in Planting and Landscape areas	85%-90%*
Subgrade in lawn areas	90%
Planting soils (not tested)	85%
Structural fill	95%
Fills on slopes steeper than 3:1	95%
Parking, fire lanes, and vehicular drive lanes	95%

* Firm and unyielding suitable for support of construction equipment per Geotechnical Engineer is acceptable.

D. Moisture Control:

1. Before compaction, moisten or aerate each layer as necessary to provide optimum content. Compact each layer to required percentages of maximum dry density or relative dry density for each area classification.
2. Do not perform compaction operations on excessively wetted soils.

3.12 DISPOSAL OF EXCESS AND/OR WASTE MATERIALS:

A. Remove from the Owner's property, all waste materials, trash and debris, and dispose of it off site in a legal and timely manner. Provide dump receipts from an approved dump site if directed

B. Remove unacceptable excavated material as determined by the Owner’s Representative.

END OF SECTION

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SECTION 321200 -FLEXIBLE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes but is not limited to the following:
   1. Provide and install asphalt concrete pavement, including crushed surfacing top course and crushed surfacing base course.
   2. Grind and overlay.
   3. Provide and install paved Accessible stalls.

B. All work shall be in accordance with:
   1. City of Federal Way, Development Standards (June 2024)
   2. 2021 King County Surface Water Design Manual (KCSWDM).
   3. Washington State Department of Transportation (WSDOT/APWA) “Standard Specifications for Road, Bridge and Municipal Construction” and “Standard Plans for Road, Bridge and Municipal Construction”, current editions.
   4. Where there are conflicts or differences between these standards notify Engineer. City Standards shall govern unless otherwise directed by the Engineer.

C. Related Sections: Coordinate related requirements specified in other parts of the Project Manual, including but not limited to the following:
   1. Section 31 10 00 – Site Preparation
   2. Section 31 22 00 – Earthwork
   3. Section 32 13 13 – Concrete Paving
   4. Section 32 17 23 – Pavement Markings

1.2 REFERENCES

A. Washington State Department of Transportation (WSDOT/APWA) “Standard Specifications for Road, Bridge and Municipal Construction” and “Standard Plans for Road, Bridge and Municipal Construction”, current editions.

B. American Public Works Association of Washington (APWA-WA) – Local Agency General Special Provisions (GSPs)

C. ANSI/ASTM C136 – Method for Sieve Analysis of Fine and Coarse Aggregates

D. ANSI/ASTM D1557 – Test Methods for Moisture – Density Relations of soils and soil/aggregate mixtures using 10 lb. rammer and 18-inch drop.

E. ASTM D2950 – Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.

F. Manual on Uniform Traffic Control Devices (MUTCD) Current Edition.

G. City of Federal Way – Development Standards (June 2024); 2021 Addendum to the King County Surface Water Design Manual (KCSWDM).

H. WSDOT – 2024 Standard Specifications for Road, Bridge and Municipal Construction; 2024 Standard Plans.

I. King County – 2021 King County Surface Water Design Manual (KCSWDM).

1.3 DESCRIPTION

A. This work consists of the installation of crushed surfacing base course, top course and asphalt paving placed on a prepared subgrade in accordance with these Specifications and in close conformity with the lines, grades, thickness, and typical cross-sections shown in the plans.

1.4 DIMENSIONS AND LAYOUTS

A. Furnish, set and mark all line location stakes. Assign a qualified layout engineer, surveyor, or technical specialist to do this work; this person shall be on site at all times when work requiring control is being performed. Furnish and maintain on site necessary equipment, supplies and instruments related thereto. Make this equipment and personnel available, at no additional cost to the Owner, for the purpose of verifying layout and certifying the accuracy of work on the site.

1.5 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit Certificates: Furnish certification that all materials comply with Specification requirements. Include laboratory test reports verifying compliance. Material supplier to be approved by Owner's Representative.

1.6 PROJECT SITE CONDITIONS

A. Environmental requirements, in accordance with referenced Standard Specifications and the following:

1. Do not proceed with placement when subgrade or base is saturated, pumping, or frozen.
2. Apply asphalt concrete surface only when atmospheric temperature is more than 45-deg F., when underlying base is dry and when weather is not rainy or damp. Aggregate base course material may be applied when air temperature is greater than 30 degrees F. and rising if approved by Owner's Representative.
3. Do not apply tack coats when temperature is below 50 degrees F. or when base is wet.

1.7 QUALITY ASSURANCE

A. Producer/Installer: Provide materials produced by bulk asphalt concrete producer regularly engaged in the production of hot-mix, hot-laid asphalt concrete. Installer must be experienced in the installation of Asphaltic concrete paving with adequate plant, equipment, and personnel for the completion of the work.

B. Provide materials meeting or exceeding requirements specified herein.

C. Allowable Tolerances: Surface Smoothness shall be in accordance with WSDOT Std. Spec Section 5-04.3(13).

D. Testing:

1. Contractor will furnish material testing and inspection for quality control during paving operations. Paving thickness is subject to core tests upon completion. Should average thickness be less than specified, apply more paving to furnish specified thickness as a minimum. Patch all core drill holes.
2. Pavement shall be tested for proper thickness and proper drainage as specified in Division 1.
3. Any applicable portion of the crushed surfacing work under this specification shall be tested for the specified compaction by ASTM D1557 procedures as applicable. Failure of the material to achieve the specified density will be just cause for rejecting any portion of,

or all the material represented by the test. Provide one density test for each 5,000 square feet of all crushed surfacing courses placed.

4. When stabilizing base course or portion thereof has been placed and compacted in accordance with requirements, notify the testing laboratory to perform density tests. Do not place asphalt pavement until results have been verified and base course installation approved.
5. Test asphalt concrete pavement in-place compaction by the nuclear method, ASTM D2950. If compaction tests indicate that stabilizing base course or asphalt paving do not meet specified requirements, remove defective work, replace and retest at Contractor's expense.

1.8 WARRANTY

A. Note that work correction is to include soft spots, pumping, aggregate separation, settlement, puddling, and/or uneven finish not level with adjacent existing surfaces. Correction may involve removal and replacement of the material if condition is determined to be irreparable, at the discretion of the Owner's Representative, and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with Quality Assurance Section provisions, Specifications, and Manufacturer's data. Where these may be in conflict, the more stringent requirements govern.
   1. Conform to WSDOT Specifications of above referenced manuals. Provide bases, type and thickness of asphalt concrete as required by these Specifications and plans for site paving.

B. Compact subgrade and provide thickness of crushed surfacing as required by these Specifications and the plans.

C. All materials shall conform to WSDOT Std. Spec Sections 9-02 and 9-03.8 and City of Federal Way Standards.

D. Recycled concrete rubble and recycled hot mix asphalt may be allowed in accordance with WSDOT Std. Spec. Section 9-03.21(1) and if approved by the Owner's Representative.

E. Recycled asphalt may be allowed as aggregate in the production of HMA if it meets the requirements of WSDOT Std. Spec Section 9-03.8(3)B and is approved for use by Geotechnical Engineer.

2.2 CRUSHED SURFACING

A. Crushed Surfacing shall be in accordance with Section 31 22 00 and with WSDOT Std. Spec Section 9-03.9(3).

2.3 ASPHALT CONCRETE

A. Asphalt concrete shall be composed of asphalt and aggregate which, with or without the addition of mineral filler and blending sand as may be required, shall be mixed in the proportions specified to provide a homogenous, stable and workable mixture.

B. Asphalt concrete shall be HMA (hot mix asphalt) Class ½" conforming to WSDOT Std. Spec Section 9-03.8(6).

2.4 TACK COAT

A. Tack coat of asphalt shall have 0.05 to 0.08 gallons of retained asphalt per square yard of application and be in accordance with WSDOT Std. Spec 5-04.3(5)A.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes Contractor's acceptance of conditions as satisfactory.

1. Construct in conformance with the plans, details, dimensions and grades specified. Maximum variations in finished grade of paving are +/- 1/8" in 10 feet.
2. Confirm that final grades allow for the finished surface to drain freely to an acceptable location prior to installation.
3. Special care shall be taken when installing ADA parking areas such that they meet the requirements of Chapter 4 and Chapter 5 of the ADA Standards for Accessible Design.

B. Protect surrounding areas and surfaces to prevent damage from work of this Section.

1. Protect work of other trades. Take special care in work adjacent to buildings.
2. Should any damage occur, repair or replace as directed by Owner's Representative.

C. Provide barricades and warning devices in accordance with the MUTCD.

3.2 SUBGRADE PREPARATION

A. Subgrade

1. Preparation of subgrade shall conform to Section 31 10 00 and WSDOT Std. Spec Section 2-06.
2. Verify compaction of subgrade per Section 31 10 00, for on-grade work.

3.3 CRUSHED SURFACING

A. Prepare subgrades and place crushed rock courses in conformance with WSDOT Std. Spec Section 4-04.3(4), and as shown in the drawings.

3.4 ASPHALT CONCRETE

A. Prepare surfaces to receive final paving in accordance with WSDOT Std. Spec Section 5-04.3(5).

B. Preparation of aggregates, mixing, hauling, spreading, finishing and compaction shall be as specified for HMA in WSDOT Section 5-04.3.

C. Joints and Connections with Existing Facilities shall be in accordance with WSDOT Std. Spec Section 5-04.3(12).

D. Sampling and testing of asphalt concrete shall be in accordance with WSDOT Std. Spec Section 5-04.3(8)A, non-statistical.

E. All edges to be straight or a continuous smooth line tapered at a 45-degree angle where free-standing or adjacent to soil area. No reverse slopes or birdbaths will be allowed. The complete surface of the asphalt shall be of uniform texture, smooth uniform as to grade, and free from defects of all kinds. Verify elevation requirements prior to commencing paving.

3.5 ACCESSIBLE STALLS

A. Install flush curb prior to paving. The flush curb delineates the limits of the accessible stalls and shall be utilized to help control grades.

B. Prior to paving, Contractor shall confirm the flush curb is constructed as intended such that asphalt pavement slopes will meet pavement slope requirements.

C. Slope requirement for Accessible Stalls are not to exceed: 2% in both directions and as measured with a 2-foot level.

D. Deviation from grade across any two-foot section, in any direction, shall not exceed ADA requirements. These conditions will warrant removal and replacement to meet requirements at the Contractors expense.

3.6 TACK COAT

A. Tack coat shall be applied per WSDOT Std. Spec Section 5-04.3(4).

3.7 DEFECTIVE WORK

A. Remove and replace defective work not conforming to the plans and specifications to specified tolerances at no additional cost to the Owner.

B. Remove and replace, as directed, any crushed surfacing that shows soft spots, pumping, settlement, puddling, and/or uneven finish not level with adjacent existing surfaces, at no additional cost to the Owner.

C. Remove and replace any pavement that shows cracks, ponds or puddles, bulges, which does not freely drain or exhibits other defects, at the Contractor’s own expense.

3.8 CLEANING

A. After placement of crushed surfacing, clean adjacent surfaces outside the limits of the existing crushed surfacing of excess or spilled materials, to allow for landscape restoration.

B. After completion of paving operations, clean surfaces of excess or spilled asphaltic materials.

C. Do not permit vehicular traffic on asphaltic paving until it has cooled and hardened, and in no case sooner than six (6) hours after placing.

D. Provide barricades and warning devices to prevent traffic on asphalt paving and to alert pedestrians to the surface condition

END OF SECTION

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SECTION 321313 – CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Work includes but is not limited to the following:
   1. Provide vertical concrete curb, flush curb, and concrete curb and gutter as shown on the project documents.
   2. Provide concrete walkways, curb ramps, ADA ramps, equipment pad and other site paving as shown on the project documents and as required to provide complete and uniform pedestrian access to the site.
   3. Finish Concrete in accordance with the project documents.
   4. Provide jointing and score concrete per Architectural plans.

B. Work shall be in accordance with the WSDOT/APWA Standard Specifications for Road, Bridge and Municipal Construction, and Standard Plans for Road, Bridge and Municipal Construction, current editions, and City of Federal Way requirements.

C. Coordinate related work specified in other parts of the Project Manual, including but not limited to following:
   1. Section 31 10 00 – Site Preparation
   2. Section 31 22 00 – Earthwork
   3. Section 32 13 16 – Flexible Paving
   4. Section 32 17 23 – Pavement Markings

1.3 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Structural Concrete for Buildings
   2. ACI 305R - Hot Weather Concreting
   3. ACI 306R - Cold Weather Concreting
   4. ACI 316R - Recommendations for Construction of Concrete Pavements and Bases

B. American Society for Testing and Materials:
   1. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete

C. City of Federal Way – Development Standards (June 2024); 2021 Addendum to the King County Surface Water Design Manual (KCSWDM);

D. WSDOT – 2024 Standard Specifications for Road, Bridge and Municipal Construction; 2024 Standard Plans.

E. King County – 2021 King County Surface Water Design Manual (KCSWDM).

1.4 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit product data and manufacturer's instructions for:

1. Concrete mix design for all surfaces, noting where mix designs to be used throughout site.
2. Admixtures
3. Joint Sealants
4. Curing compounds/retarders.

C. Concrete mix design: Thirty days minimum prior to concrete placement, submit mix design for each strength and type of concrete. Include laboratory test reports for concrete materials and mix design tests, as well as material certificates stating that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specified requirements.

D. Provide a concrete joint layout drawing including dimensions, locations and joint type per the joint layout and spacing provided on the Landscape Plans.

1.5 DIMENSIONS AND LAYOUTS

A. Furnish, set and mark all line location stakes. Assign a qualified layout engineer, surveyor, or technical specialist to do this work; this person shall be on site at all times when work requiring control is being performed. Furnish and maintain on site the necessary equipment, supplies and instruments related thereto. Make this equipment and personnel available, at no additional cost to the Owner, for the purpose of verifying layout and certifying the accuracy of work on the site.

1.6 WARRANTY

A. Unsatisfactory conditions and work correction is to include soft spots, settlement, puddling, separation of aggregate, excessive cracking, and/or uneven finish not level with adjacent existing surfaces. Correction may involve removal and replacement of the pavement if condition is determined to be irreparable, at the discretion of the Engineer, and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Provide wood or steel edge forms. Wood forms shall be Douglas fir or larch, number two grade minimum, seasoned SAS, straight and true.

B. Special Edge forms for radii shall be approved in advance by Owner’s Representative. Rigid C. steel forms shall not be used on curved edges.

C. Do not use forms if they vary from a straight line more than 1/8 inch (3 mm) in any ten foot (3000 mm) long section, in either a horizontal or vertical direction.

D. Provide wood edge forms, Douglas fir or larch, number two grade minimum, seasoned SAS, straight and true. Wood forms shall also be free from warp, twist, loose knots, splits, or other defects.

2.2 JOINTS

A. Expansion joint shall be in accordance with WSDOT Section 9-04.1(1), 3/8" or approved equivalent.
   1. Expansion joints shall be placed to align with scoring pattern.

B. Saw cut score joints to match pedestrian pavement.

2.3 CEMENT CONCRETE PAVEMENT AND SIDEWALKS

A. Cement concrete pavement shall conform to WSDOT Section 5-05, Cement Concrete Pavement (min 4000 psi).

B. Cement concrete sidewalks, cement concrete monolithic curb, cement concrete curb, curb and gutter and cement concrete curb ramps shall conform shall conform to City of Federal Way standards and WSDOT Sections 8-04 and 8-14.

C. Portland cement, aggregates, joint filler, and curing materials shall conform to WSDOT Sections 9-01, 9-03, 9-04, and 9-23, respectively. The use of admixtures is subject to written approval. Calcium Chloride is not allowed as admixture.

2.4 CEMENT CONCRETE CURBS

A. Materials for cement concrete curb shall conform to WSDOT Section 8-04.

2.5 RETAINING WALLS.

A. Cast-in-place reinforced concrete for concrete retaining walls shall be formed, reinforced, cast, cured, and finished in accordance with Section 6-02, and the details shown in the Plans and Standard Plans.

B. All cast-in-place concrete shall be Class 4000

2.6 BASE COURSE

A. Base course shall be in accordance with Section 31 22 00.

2.7 REINFORCING STEEL

A. WSDOT Std. Specs Section 9-07.

2.8 RELATED MATERIALS

A. Expansion Joint Filler Strips: ASTM D 3575, 3/8-inch closed-cell polyurethane foam backing with removable joint cap.

B. Joint Sealant: Self-leveling. Submit color samples for selection and approval prior to installation. Basis of design: BASF MasterSeal NP 1 Sealant.
   1. Color: Gray. Final color selection shall be determined after installed concrete color is confirmed in the field.

C. Builder's Sand: Clean washed sand applied to top of expansion joint sealant prior to drying.
   1. Color: Dark gray.

2.9 SURFACES FINISHES

A. Concrete Pavement Type 1: Light broom finish: in areas as indicated on plans.

B. Concrete Pavement Type 2: Medium sandblast finish: in areas as indicated on plans.

2.10 ACCESSIBLE ROUTES

A. Slope requirement for Accessible Stalls: Not to exceed 2% slope as measured with a 2-foot level in both directions.

B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes Contractor's acceptance of conditions as satisfactory.

3.2 PREPARATION

A. Field Measurements: Verify existing dimensions and shapes. Allow for transitions to existing grades where shown on Plans.

B. Subgrade:

1. Preparation of subgrade shall conform to Section 31 10 00 and WSDOT Section 2-06.
2. Verify compaction of subgrade for on-grade work per section 31 22 00.

3.3 SETTING FORMS

A. Base Support:

1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.

B. Form Setting:

1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
3. Forms shall conform to line and grade with an allowable tolerance of 1/8 inch (3 mm) when checked with a straightedge and shall not deviate from true line by more than 1/4 inch (6 mm) at any point.
4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
5. Clean and oil forms each time they are used.
6. Make necessary corrections to forms immediately before placing concrete.

7. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.

3.4 PLACING REINFORCEMENT

A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement. All reinforcement shall be supported for proper placement within the concrete section.

B. Before the concrete is placed, the Engineer shall approve the reinforcement placement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown on the Drawings.

3.5 INSTALLATION

A. Curbs and curb cut openings:

1. Cement concrete curb shall be installed in accordance with contract documents and WSDOT Section 8-04. Expansion joints shall be provided at 10 foot maximum spacing. The work shall be performed in a manner which results in a curb constructed to specified line and grade, uniform in appearance and structurally sound. Curbs found with unsightly bulges, ridges or other defects shall be removed and replaced at the Contractor's expense if Owner’s Representative considers them to be irreparable. When checked with a 10-foot straightedge, grade shall not deviate more than 1/8 inch, and alignment shall not vary more than 1/4 inch.

B. Walkways, Pavement and ADA ramps and landings:

1. Cement concrete walkways, pavement, and ADA shall be installed as shown on Plans and in accordance with WSDOT Section 8-14.
2. Expansion joints shall not exceed a 10 foot maximum spacing and shall be coordinated with the scoring lines. When checked with a 10-foot straightedge, grade shall not deviate more than 1/8 inch, and alignment shall not vary more than 1/4 inch.
3. Special care shall be taken when installing ADA ramps such that they meet the requirements of Chapter 4 and Chapter 5 of the ADA Standards for Accessible Design. Grades within the ADA ramps are held to a higher standard of care. Deviation from grade across any two-foot section, in any direction, shall not exceed ADA requirements nor direct stormwater toward the building in any way when adjacent. Either of these conditions will warrant removal and replacement of the landing and ramps to meet requirements at the Contractors expense.
4. Minimum Slope requirements are not to exceed:
    a. 2% in both directions on landings, parking stalls or other areas where turning is required, and as measured with a 2-foot level
    b. 5% in the longitudinal direction and 2% in the lateral direction on walkways without handrails, and as measured with a 2-foot level.
    c. 8.3% in the longitudinal direction and 2% in the lateral direction on walkways with handrails, and as measured with a 2-foot level,
5. Where paving is adjacent to building, a minimum of 1.0% slope away from the building is required. Contractor shall coordinate with Engineer prior to construction if that is not achievable.
6. Score pavement per Landscape plans.
7. Broom finish and cure rigid pavement in accordance with WSDOT Section 5-05.

C. Curing and Protection

1. Protect concrete adequately from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks and oil stains, and do not allow it to dry out from the time it is placed until the expiration of the minimum curing periods specified herein. Use impervious-sheeting curing. Membrane-forming compound is not allowed. Maintain temperature of air next to concrete above 40 degrees F for the full curing periods.
2. Impervious-Sheeting Curing: Wet entire exposed surface thoroughly with a fine spray of water and then cover with impervious sheeting. Lay sheets directly on concrete surface and overlap 12 inches. Make sheeting not less than 18 inches wider than concrete surface to be cured, and weight down on the edges and over the transverse laps to form closed joints. Repair or replace sheets when torn or otherwise damaged during curing. Leave sheeting on concrete surface to be cured for at least 7days.

3.6 FINISHING

A. Concrete Pavement Type 1: Light broom finish. Saw-cut score joints
   1. Draw a soft-bristle broom across float-finished concrete, perpendicular to line of traffic, to provide a uniform, fine-line texture
   2. Perform finish work in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns as indicated.

B. Apply Joint Sealant on expansion joints in accordance with details and manufacturer's recommendations.

C. Apply Builder's Sand immediately after installation of Joint Sealant. Sweep sand over joints to fully cover the joints. Use caution to not disturb the even finish of the sealant.

D. In areas on the plans that do not indicate a specific finish, Float and Trowel: Match existing finish or provide "broom finish" by lightly combing straight lines with a medium stiff broom as directed by Owner's representative. Broom pattern to be perpendicular to main traffic route.

3.7 FIELD QUALITY CONTROL

A. Cement concrete curing and protection shall meet the requirement of WSDOT Section 5-05.

B. The contractor shall protect the concrete against all damage prior to final acceptance. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints at no additional cost to the Owner.

3.8 DEFECTIVE WORK

A. Remove and replace defective work not conforming to plan and specifications specified tolerances at the Contractor own expense.

B. Remove and replace any pavement that shows cracks, ponds or puddles, bulges, which does not freely drain or exhibits other defects at the Contractor own expense.

C. Remove and replace any ADA walkways and landings exceed tolerances.

3.9 CLEANING

A. After completion of the curing period:
   1. Remove the curing material.
   2. Sweep the concrete clean.
   3. After removal of all foreign matter from the joints, seal joints as specified.

4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

B. Leave premises clean and free of residue for work of this Section.

END OF SECTION

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SECTION 32 17 13 - PARKING BUMPERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes vehicle wheel stops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PARKING BUMPERS

A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.

1. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch diameter, minimum length.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.

B. Install wheel stops in bed of adhesive before anchoring.

C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION 32 17 13

SECTION 321723 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes but is not limited to the following:
   1. Furnish materials and apply painted parking stall striping, access parking space (ADA) symbols, and striping on pavement surfaces.
   2. Furnish and install signs as indicated.
   3. Furnish and install detectable warning surfaces.
   4. Furnish and install wheel stops as indicated.

1.2 RELATED SECTIONS

A. Coordinate related requirements specified in other parts of the Project Manual, including but not limited to the following:
   1. Section 31 22 00 – Earthwork
   2. Section 32 12 16 – Asphalt Paving
   3. Section 32 13 13 – Concrete Paving

1.3 REFERENCES

A. APAW - Designs and Specifications for Asphalt Concrete Pavements and Bases, 1990 Edition.

B. Manual on Uniform Traffic Control Devices (MUTCD) Current Edition.

C. City of Federal Way – Development Standards (June 2024); 2021 Addendum to the King County Surface Water Design Manual (KCSWDM).

D. WSDOT – 2024 Standard Specifications for Road, Bridge and Municipal Construction; 2024 Standard Plans.

E. King County – 2021 King County Surface Water Design Manual (KCSWDM).

1.4 DIMENSIONS AND LAYOUTS

A. Furnish, set and mark all line location stakes. Assign a qualified layout engineer, surveyor, or technical specialist to do this work; this person shall be on site at all times when work requiring control is being performed. Furnish and maintain on site necessary equipment, supplies and instruments related thereto. Make this equipment and personnel available, at no additional cost to the Owner, for the purpose of verifying layout and certifying the accuracy of work on the site.

1.5 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit Pavement Marking Paint product information.

PART 2 - PRODUCTS

2.1 PAINT

A. Paint shall be white, red, blue or yellow traffic paint (or compound suitable for paved surfaces), for parking stalls, access parking space symbol (Standard), outdoor sports courts, and curbs conforming to the requirements of WSDOT Section 8-22 and 9-34.2 and City of Federal Way requirements. Paint shall be lead free.

B. Paint shall be delivered and stored in sealed containers that plainly show the designated name, formulation, or specification numbers, batch number, color, date of manufacture, manufacturer's name, formulation number and directions, all of which shall be printed legibly at time of use. The paint shall be homogeneous, easily stirred to a smooth constancy, and shall show no hard settlement or other objectionable characteristics.

2.2 DETECTABLE WARNING SURFACE

A. Detectable warning surface shall be per WSDOT Standard Plan F-45.10-05 and City of Federal Way Standards.

B. Detectable warning pavers shall be per Section 32 13 13.

2.3 CONCRETE WHEELSTOP

A. Precast commercially manufactured wheel stops 6 feet in length by 4.5 inches in height; 4000psi minimum compressive strength and per project plans. Each stop shall be reinforced with 2-#4 deformed steel reinforcing bars. Provide chamfered corners and drain slots on underside, and holes for dowel-anchoring to pavement.

B. Anchor wheelstops with #4 Epoxy Coated Rebar, embedded into the sub-grade.

2.4 SITE SIGNS

A. “Reserved Parking” ADA MUTCD (R7-801)

B. “Van Accessible” MUTCD (R7-801A)

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall furnish an experienced technician to supervise the location alignment, layout dimensions and application of pavement markings.

B. All surfaces to be marked shall be thoroughly cleaned before application of the paint or thermoplastic markings. Dust, dirt and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of the methods as required. Rubber deposits, surface laitance, and other coating adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals or mechanical abrasion as directed.

C. Paint Application:

1. Apply pavement marking to clean, dry pavement surfaces and in accordance with WSDOT Standard Specifications and manufacturer’s recommendations.
2. Application thickness shall be in accordance with WSDOT Section 8-22.3(3)F. A minimum of two applications of paint will be required to complete all paint markings.

3. Apply paint evenly to the pavement surface to be coated at the rate of 105, plus or minus 5, square feet per gallon. Apply paint to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are 50 degrees F and rising and less than 95 degrees F. Maintain paint temperature within these same limits. Apply paint pneumatically with approved equipment.
4. Provide guide lines and templates as necessary to control paint application. Take special precautions in marking letters and symbols.
5. The top of pavement markings shall be smooth and uniform. Line ends shall be square and clean. Sharply outline edges of marking.
6. The maximum drying time requirement of the paint specifications and manufactures recommendations shall be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic.
7. Discontinue painting operations if there is a deficiency in drying of the marking, until cause of the slow drying is determined and corrected.
8. Tolerances shall be in accordance with WSDOT Section 8-22.3(4).

D. Parking Area and Loading Area:
1. Parking stall and block-out striping shall be 4 inches wide painted white unless otherwise noted on the project Documents.
2. ADA parking stall symbols shall be in accordance with project Documents.
3. Thermoplastic traffic arrows shall be in accordance with the project Documents.
4. Dropoff Load/Unload stripe shall be shall be 4 inches wide painted white.
5. Stop bar and crosswalk striping shall be in accordance with the project Documents.

E. Paint shall be applied uniformly at a rate specified in WSDOT Section 8-22. All markings shall be protected from traffic until the paint is thoroughly dry. All markings shall present a clean cut, uniform, and workmanlike appearance. All marking which fail to have a uniform, satisfactory appearance shall be corrected by the Contractor at their expense.

F. Detectable warning surface shall be installed per WSDOT Standard Plan F-45.10-05, and WSDOT Standard Specifications Section 8-14.3(5).

G. Signage
1. Install signs per details and locations shown on the plans. Sign installation shall be in accordance with WSDOT Section 8-21.3(2) and MUTCD.

H. Wheel Stops
1. Install wheel stops in accordance with manufacturer’s recommendations.

I. Cleaning: Leave premises clean and free of residue of work of this Section.

END OF SECTION

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SECTION 331100 WATER UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Work includes but is not limited to the following:
   1. Connect to existing water main.
   2. Establish temporary connections.
   3. Install fire service piping, fire department connection and PIV.
   4. Connection to building piping for fire sprinkler system

B. All work shall be in accordance with:
   1. City of Federal Way Public Works Department, Development Standards (June 2024) (includes Standard Details and Standard Notes).
   2. Lakehaven Water and Sewer District (LWSD) Standards, see references below.
   3. Washington State Department of Transportation (WSDOT/APWA) “Standard Specifications for Road, Bridge and Municipal Construction” and “Standard Plans Specifications for Road, Bridge and Municipal Construction”, current editions.
   4. Where there are conflicts or differences between these standards notify Engineer. LUD District Standards shall govern unless otherwise directed by the Engineer.

C. Related Sections: Coordinate related work specified in other parts of the Project Manual, including but not limited to the following:
   1. Section 311000 – Site Preparation
   2. Section 312200 – Earthwork
   3. Section 314100 – Trench Safety

1.2 REFERENCES

A. UPC - Uniform Plumbing Code.

B. IAMPO - International Association of Plumbing and Mechanical Officials Standards.

C. AWWA - American Water Works Association Standards.

D. ANSI – American National Standards Institute.

E. NFPA – National Fire Protection Association.

F. Washington State Department of Transportation (WSDOT/APWA) “Standard Specifications for Road, Bridge and Municipal Construction” and “Standard Plans Specifications for Road, Bridge and Municipal Construction”, current editions.

G. City of Federal Way Development Standards, Rev. June 2024.

H. Lakehaven Water and Sewer District – Standard & Typical Plan Drawings Water (2025) and Water System Design Standards and Material/Construction Specifications. (2012).

1.3 PERMITS

A. The Contractor is responsible for obtaining permits required for work within the City of Federal Way right of way.

B. The Contractor is responsible for obtaining any permits and coordinating any inspections required for connection to the Lakehaven water system.

1.4 DIMENSIONS AND LAYOUTS

A. The Contractor is responsible for furnishing, setting and marking all line location stakes. A qualified layout engineer, surveyor, or technical specialist must be assigned to the Contractor's crew for this Work and shall be on site at all times when work requiring control is being performed, together with all necessary equipment, supplies, and instruments related thereto. This equipment and personnel must be available, at no additional cost to the Owner, for the purpose of verifying layout and certifying the accuracy of work on the site.

B. Once construction staking for the waterline has been placed, Contractor shall coordinate with LWSD for field review of the staked locations prior to construction.

C. The Contractor is responsible for review of all LWSD, City of Federal Way and Owner's records relative to the existing underground utilities. The Contractor is responsible for avoiding damage to these facilities and shall restore all active utilities at Contractor's own expense.

D. The Contractor is to notify the Owner’s Representative immediately if underground utilities not shown on the Site Survey are encountered.

1.5 SUBMITTALS

A. No installation of material shall be made until written approval has been obtained from the Engineer. Approval of material and equipment shall in no way preclude compliance with the plans and specifications.

B. Copies of a materials and equipment list shall also be submitted to LWSD prior to proceeding with construction. This list shall include the quantity, manufacturer, and model number (if applicable) of materials and equipment to be installed under the Contract.

C. At the request of the Inspector, the Contractor’s material suppliers may be required to furnish a certification, from a recognized testing laboratory, to certify that the material supplied, and for which the certification was requested, is in full compliance with the Contract Documents.

D. The Inspector shall have the right to reject materials and workmanship which are defective, or to require their correction. Rejected workmanship shall be promptly corrected, and rejected materials shall be removed from the premises.

E. Record Drawings:

1. One complete set of drawings shall be provided as record drawings which shall be separate, clean prints reserved for the purpose of showing a complete picture of the work as actually installed. The Contractor shall coordinate the record drawing requirements with the Utility Inspector in accordance with the Developer Extension Agreement. The record drawings shall show the location of all facilities and appurtenances to within 0.5 feet of the actual location.
2. Record drawings shall also serve as work progress plans and the Contractor shall maintain daily a daily record of work progress with neat, legible notations. These drawings shall be kept at the job site and shall be available for inspection at all times.
3. All buried piping and indicated future connections exterior to the building shall be located both by depth and by location with respect to the project benchmark. All notations on record drawings of buried pipes shall be made before backfilling of that section of pipe is started.
4. At completion of the work, the Contractor shall sign, date, and provide the record drawings to the Architect, representing that it is an accurate depiction of the work completed.

1.6 QUALITY ASSURANCE

A. The Contractor shall be competent and qualified to perform the work.

B. LWSD and the Owner's representative's, at all times, shall have access to the work and to the locations where the work is in preparation and process. The Contractor shall at all times maintain proper facilities for such access.

C. All Contractors installing, inspecting, servicing or maintaining fire protection system shall be licensed by the State Director of Fire Protection Service in accordance with Chapter 18.106.

D. Contractor is responsible for coordinating water and fire system installation with the LWSD.

E. The Contractor shall make any required corrections and file two (2) corrected copies with LWSD within one week of notification of deficient or unacceptable items.

1.7 WARRANTY

A. Two (2) year warranty shall be provided for the water line and appurtenances.

B. Two (2) year warranty shall be provided all new pavement, pavement patching and overlays over waterline work.

C. When corrections and repairs of defects are made, the Contractor shall warrant such corrections and repairs for two (2) years after acceptance of the corrections and repairs made by the LWSD.

1.8 DELIVERY, STORAGE AND HANDLING

A. Inspect material delivered to the site for damage. Store materials onsite in enclosures or under protective covering. Do not store material directly on the ground. Pipe and fitting shall be kept free of dirt and debris.

B. Store material in such a way that limits handling and affords easy accessibility thus will not be soiled with objectionable materials.

C. Handling: Handle pipe, fittings and other accessories in such a manner to ensure pipe installed is sound and undamaged. Contractor shall take special care to not damage fittings. Pipe shall be carried throughout the site and into the trench. At no time shall the Contractor or his agents drag the pipe.

PART 2 PRODUCTS

2.1 MATERIALS GENERAL

A. All water pipe, fittings and appurtenances shall be in accordance with the plans, specifications and LWSD Standards. Where there is a discrepancy, LWSD Standard and Details shall prevail.

2.2 3-INCH or GREATER WATER METER, PIPE, AND FITTINGS

A. 3-inch domestic service shall be in accordance with LWSD Std. Detail No. SP 17 and LWSD standards.

B. Ductile Iron Water Pipe shall be Class 52 cement-lined interior (ANSI A21.4), exterior coated with coal tar varnish. Pipe shall have a minimum thickness of 1/16” meeting NSF standards for potable water and exterior asphalt coated. Pipe shall conform to AWWA C151 and ANSI/APWAC105/A21.5. Each length shall be plainly marked with the manufacture’s identification, year case, thickness, class of pipe, and weight.

C. Rubber gasket pipe joints to be push on-joint (Tyton) or mechanical Joint (MJ) in accordance with ANSI/AWWA C111/A21.11. Bolts furnished for mechanical joint pipe and fittings shall be high strength ductile iron with a minimum tensile strength of 50,000 psi.

D. Flanged joints shall conform to ANSI B16.1, Class 125 drilling pattern, rate for 250 psi working pressure. Standard thickness cement lining shall be in accordance with ANSI/AWWA C104/A21.4.

E. Restrained joint pipe shall be push-on joint with “Field Lok” gaskets as furnished by U.S. Pipe or equal. The restrained joint pipe shall meet all other requirements of the non-restrained pipe. Mechanical joint restraint shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.

F. Joints shall be in accordance with the manufacture’s recommendations. Standard joint materials, including rubber ring gaskets, shall be supplied with the pipe. Material shall be suitable for the specified pipe size and pressures.

G. Fittings shall be short-bodied ductile iron complying with the applicable AWWA C110 or C153 Standard for 350 psi pressure rating for mechanical joint fittings and 250 psi pressure rating for flanged fittings. All fitting shall be cement line.

H. Couplings shall be ductile iron mechanical joint sleeves.

I. Gate Valves shall be Resilient seat ductile iron body gate valve, iron disk completely encapsulated with polyurethane rubber and bronze, non-rising stem with “O” ring seals conforming to AWWA C509 standards. The valves shall open counter-clockwise and shall be furnished with a 2-inch square operating nuts. All surfaces, interior and exterior shall be fusion bonded epoxy coated, acceptable for potable water. Valves shall be rated for a 250 psi or higher. Valves shall meet LWSD std W.4.C(2). Valves located more than 42” below finished grade shall be equipped with extension.

2.3 VALVE BOX

A. Valve Boxes shall be LWSD spec W.4.C(12).

2.4 FIRE BACKFLOW PREVENTION

A. See Plumbing and/or Fire Protection.

2.5 CONCRETE BLOCKING

A. Horizontal Thrust Blocking shall be concrete blocking shall be per LWSD Std. Detail B-22a.

B. Vertical Thrust Blocking shall be concrete blocking shall be per LWSD Std. Detail B-22a.

2.6 CONDUCTIVE WARNING TAPE

A. Conductive warning tape shall be per Section 312200.

2.7 BUILDING CONNECTIONS

A. Coordinate all building service connections with Building Mechanical.

B. Fire Protection Connection shall be in accordance with NFPA -13 and NFPA-20. Coordinate Building Sprinkler Connection as shown on mechanical drawings and with Building Sprinkler Contractor.

2.8 TRENCHING, BEDDING AND BACKFILL MATERIAL

A. Water pipe trenching shall be LWSD Std. Detail No. B-18d and LWSD specifications.

B. Bedding and Backfill material shall be LWSD, Specification Section W.5.A (11).

2.9 FOAM BLOCKING

A. Plastic Foam for pipe protection and separation between pipes shall meet the Federal Spec. PPP-C-1752B Type 1, Class 2 or approved equivalent.

2.10 FIRE DEPARTMENT CONNECTION (FDC)

A. Special provisions per South King County Fire and Rescue:
   1. All FDCs shall be located not less than eighteen (18”) inches, nor more than one-hundred-twenty (120”) inches from the finished edge of an approved fire apparatus access road.
   2. Exception: FDCs located on walls of buildings.
   3. FDCs shall be located, as approved, to allow fire apparatus to make connection to the FDC with a single one-hundred (100’) foot section of hose. Apparatus parking in this location shall be within fifty (50’) feet of a hydrant.
   4. FDCs and fire hydrants shall be located on the same side of an approved apparatus access road., unless approved otherwise.
   5. FDCs shall not be located on walls of a building.
   6. Exception: The Fire Code Official may approve locating the FDC on walls of a building provided:
      a. The location in relation to the fire hydrant and fire apparatus access road meets the intent of this policy.
      b. The location complies with IFC 912.
      c. The location is readily accessible and visible.
      d. All FDC's shall be identified as to the type of system served, building or area served.
      e. Buildings having multiple sprinkler risers shall not be permitted to have separate FDCs for each riser.
   7. FDCs shall be installed/located at the front of the building except as otherwise approved by the Fire Marshal’s Office.
   8. The inlets to the FDC shall not be less than 24 inches nor more than 48 inches above the finished grade.
   9. Each FDC shall be provided with a four (4”) inch Stortz fitting equipped with a gasket and with a minimum twenty-two (22º) degree elbow. All inlets to the FDC shall be protected with approved locking caps.
   10. The inlets to the FDC shall face the driving surface.
   11. The piping between the check valve and the outside hose coupling (FDC) shall be equipped with an approved automatic drip at the lowest point and equipped with adequate drainage.
   12. All check valves shall be accessible for service and inspection.

B. FDC sizing shall be confirmed by fire sprinkler contractor prior to procurement and construction.

2.11 POST INDICATOR VALVE (PIV)

A. Post indicator valve shall be wall mounted, adjustable vertical and meet LWSD and Fire Department Standards.

PART 3 EXECUTION

3.1 EXECUTION

A. All water construction shall be in accordance with Contract Documents and LWSD Standards.

B. Water system, including fire hydrants must be fully operational prior to building construction. Coordinate with South King County Fire and Rescue.

3.2 MATERIALS AND EQUIPMENT FURNISHED BY DISTRICT

A. The Contractor shall receive, inspect, store, and accept all District furnished items of material and equipment if applicable, subject only to latent defects. Claim shall be made in writing within five (5) days after discovery of any latent defect.

3.3 STORAGE OF MATERIALS AND EQUIPMENT

A. Materials and equipment shall be safely stored by the Contractor to ensure the preservation of their quality and fitness for the work. Stored equipment and materials shall be placed so as to facilitate inspection. The Contractor shall be responsible for all loss or damage that may occur to all materials and equipment until the same are incorporated in the work and until the completion and final acceptance of the work by the District.

3.4 EXAMINATION

A. Verify that trench is ready to receive work, and excavations, dimensions, and elevations are as indicated on Drawings.

B. Coordinate shut off and removal with LWSD and Fire Department if necessary.

C. Beginning of installation means acceptance of existing conditions.

3.5 INSTALLATIONS

A. Verify existing locations from the records of LWSD.

B. Field locate existing piping using Utility locate service.

C. Install FDC in accordance with Contract Documents.

D. General:
   1. Trench excavation, foundation bedding, and backfill for water lines shall be in accordance with Section 312200.
   2. Install pipe, fittings and appurtenances in accordance with Contract Documents.
   3. Arrange with King County LWSD for appropriate inspections.

E. All pipe installation shall conform to the Contract Documents.

F. Deflect water line as shown on plan. Maximum deflection shall be one-half the manufacture’s recommended deflection.

3.6 CONNECTIONS TO EXISTING WATER SYSTEM

A. The connection to the LWSD’s water system shall not be made until:
   1. Satisfactory water quality and pressure tests of the Extension have been made. (No temporary connections to the system for test water will be allowed without a backflow prevention device approved by the Washington State Department of Health.)

2. The Contractor has applied to the LWSD Superintendent for permission to make the connection (not less than 48 hours prior to the time requested).
3. The Contractor has received approval from the LWSD.
4. The Contractor has coordinated with LWSD such that the connection is made in the presence of a LWSD representative.

B. Connections to the existing water system shall not be made without first making the necessary arrangements with the Owner's Representative and City of Federal Way in addition to the LWSD. Contractor shall provide a minimum of 48 hours notification prior to connection. Only LWSD staff may operate valves on the existing water system.

C. Connections to existing systems shall be made in accordance with LWSD standard and specifications.

D. For connections to existing asbestos concrete water mains, the Contractor shall maintain workers exposure to the asbestos material at or below the limit prescribed in the WAC 296-62-07705 and shall be in accordance with State/Federal Guidelines and Certifications.

3.7 PIPE CROSSINGS

A. Where pipe crossings are separated by less than 12 inches, place foam blocking for separation and protection per manufacturer's recommendations.

3.8 PIPE ABANDONMENT

A. Existing pipe to be abandoned shall be in accordance with the LWSD and the Contract Documents.

3.9 FDC

A. Install FDC per project plans and Manufacturer's recommendations and in accordance with LWSD and Fire Department requirements.

3.10 INSPECTION, TESTING AND DISINFECTION

A. General
1. Inspection and test of work and materials shall be in accordance with District and other regulatory requirements and standards, and shall be strictly for the benefit of the District. No approvals, comments or suggestions issued by the Engineer, District or Inspector shall be construed to relieve the Contractor of any obligations under the Contract. All construction shall be subject to full time inspection at the sole discretion of LWSD, and other regulatory agencies.
2. Flushing and disinfection of water mains shall be in accordance with the LWSD. Testing and verification shall be approved by the City. Flushing of the water mains shall be accomplished in such a manner as not to cause flooding or downstream property damage.

B. Scheduled inspections and tests
1. The following scheduled inspections and tests shall be conducted by the Inspector:
   a. Start of construction inspection.

b. Scheduled inspections during the course of work.
c. Test inspections.
d. Final inspection.

C. End of Warranty Period inspection (to be conducted at least two weeks prior to expiration of Developer's Maintenance Bond).
1. Other Scheduled inspections and tests may be required to comply with the District Standard and specifications. Some inspections and tests may be conducted by a person or firm designed by the LWSD who has special expertise in the kind of work to be inspected.

D. Requests for inspections and tests shall give the Inspector 24-hour notice when the state of the work is such that a scheduled inspection and test can be conducted. When the inspection and test is to be conducted by authorities other than the Inspector, the Contractor shall coordinate all inspection arrangements through the Inspector.

E. Intermediate inspections and tests during construction may be conducted as deemed necessary by the Inspector and other governing authorities.

F. Questionable work: Should it be necessary for the Inspector, prior to final acceptance of the work, to make an inspection or reinspection of work already completed by removing or tearing out any portion thereof, the Contractor shall on request, promptly furnish all necessary facilities, labor and materials to do so. The Contractor shall be responsible for all costs of uncovering questionable work and corrections thereof, prior to final acceptance, which such work is found to be defective in any respect.

3.11 CORRECTION OF DEFECTIVE WORK

A. The Contractor shall promptly remove from the construction site all work or materials listed by the Inspector as failing to conform to the Contract, whether incorporated in the work or not. The Contractor shall promptly replace and re-execute such defective work in accordance with the Contract and without expense to LWSD and shall bear the expense of making good all work of others destroyed or damaged by such removal or replacement.

B. In the event the Contractor does not accomplish corrections or repairs, after reasonable notice at or within the time specified, the work may be otherwise accomplished by District and the cost thereof shall be borne by the Contractor.

C. If, as a result of the failure of the Developer to make corrections and repairs or in the event of an emergency and time does not permit the District to give notice to the Contractor before making corrections and repairs (such as where damage may result from delay in making of corrections and repairs or where loss of service to customs will result), temporary needed corrections and/or repairs may be made by LWSD and the cost thereof shall be borne by the Contractor.

D. The Contractor shall be responsible for any loss, damage, costs, and expenses incurred by the Water District resulting from defects in the work including actual damages, costs of materials and labor expended by LWSD in making emergency corrections and/or repairs, costs of engineering, inspection, legal services, and LWSD's administrative overhead costs.

END OF SECTION

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SECTION 334000 – STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes but is not limited to the following:

1. Furnish and install footing drainsof the type and sizes designated.

1.2 RELATED SECTIONS

A. Coordinate related work specified in other parts of the Project Manual, including but not limited to the following:

1. Section 01 57 13 – TESC
2. Section 31 10 00 – Site Preparation
3. Section 31 22 00 – Earthwork

1.3 REFERENCES

A. City of Federal Way – Development Standards (June 2024); 2021 Addendum to the King County Surface Water Design Manual (KCSWDM).

B. WSDOT – 2024 Standard Specifications for Road, Bridge and Municipal Construction; 2024 Standard Plans.

C. King County – 2021 King County Surface Water Design Manual (KCSWDM).

1.4 PERMITS

A. The Contractor is responsible for obtaining permits required for work within the right of way.

B. The Contractor is responsible for obtaining any permits and arranging any inspections required for connection of the storm drain to the public storm drain.

1.5 DIMENSIONS AND LAYOUTS

A. The Contractor will be responsible for furnishing, setting and marking all line location stakes. A qualified layout engineer, surveyor, or technical specialist must be assigned to the Contractor's crew for this work and shall be on site at all times when work requiring control is being performed, together with all necessary equipment, supplies and instruments related thereto. This equipment and personnel must be available, at no additional cost to the Owner, for the purpose of verifying layout and certifying the accuracy of work on the site.

B. The Contractor is responsible for review of all City and other records relative to the existing underground utilities. The Contractor is responsible for avoiding damage to these facilities and restoring all active utilities at the Contractor's own expense.

C. The Contractor is to notify the Owner’s Representative immediately of underground utilities encountered which are not shown on the drawings or Owner's survey or record drawings.

1.6 SUBMITTALS

A. Comply with Section 01 33 00.

B. No installation of material shall be made prior to until written approval has been obtained from the Engineer. Approval of material and equipment shall in no way preclude compliance with the plans and specifications.

C. Submit material product information including pipe, fittings, etc.

D. Record Drawings:

1. One complete set of drawings shall be provided as record drawings which shall be separated, clean prints reserved for the purpose of showing a complete picture of the work as actually installed. The contractor shall coordinate the record drawing requirements with the Utility Inspector in accordance with City standards.
2. Record drawings shall also serve as work progress plans and the Contractor shall maintain daily a daily record of work progress with neat, legible notations. These drawings shall be kept at the job site and shall be available for inspection at all times.
3. All buried piping and indicated future connections exterior to the building shall be located both by depth and by location with respect to the project benchmark. All notations on record drawings of buried pipes shall be made before backfilling of that section of pipe is started.
4. At completion of the work, the Contractor shall sign, date, and provide the record drawings to the Architect, representing that it is an accurate depiction of the work completed.

PART 2 - PRODUCTS

2.1 STORM DRAIN PIPE

A. Footing drain and wall drain pipe shall be Polyvinyl Chloride (PVC) Pipe, ASTM D3034 SDR 35 with two parallel rows of factory installed ½” diameter holes at 5” OC, located 120 degrees apart. Holes will face downward.

1. 90-degree bend fittings shall not be used on footing drains. Pipe bends shall be made by combination of multiple fitting of less than 90 degrees each, such as two 45 degree fittings.

2.2 BEDDING AND BACKFILL MATERIAL

A. Bedding and Backfill materials shall be in accordance with Section 31 22 00..

2.3 CONDUCTIVE WARNING TAPE

A. Conductive warning tape shall be per Section 31 22 00.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER WORK

A. Verify location from the records.

B. Before installation Contractor shall make proper provisions for site storm lines to avoid interferences with installation of other work and/or other Contractors. Any changes caused by Contractor's neglect to coordinate work shall be made by Contractor at Contractor's expense.

C. Site storm drain Drawings and Specifications shall be compared with Drawings and Specifications of other trades and any discrepancies between the documents shall be reported to the Owner’s Representative prior to installation of work.

3.2 PIPE LAYING

A. Pipe laying shall be in conformance with WSDOT Section 7-08.3(2).

3.3 PIPE CROSSINGS

A. Where pipe crossings are separated by less than 6 inches, place foam blocking for separation and protection per manufacturer's recommendations.

3.4 CLEANING AND TESTING

A. Cleaning and testing shall be in conformance with WSDOT Section 7-04.3(1) with the following exceptions:
   1. The Contractor shall be responsible for providing DVDs of video inspection.
   2. The Contractor shall be responsible for notifying the Owner's Representative 48 hours in advance of the backfill of any storm drain line.

3.5 PERMANENT CONNECTIONS TO EXISTING SYSTEMS

A. Where indicated on the plans, make permanent connections to existing storm drainage systems.

B. Where existing pipe is to be connected to a new structure, replace existing pipe and/or add fittings and pipe as necessary to provide an approved connection per WSDOT and City Standards.

END OF SECTION

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