PROJECT MANUAL

South King Fire & Rescue Facility Improvements

Station 66

April 13, 2017

27010 15th Ave South
Des Moines, WA 98198

By:

Rice Fergus Miller Inc
275 5th Street, Suite 100
Bremerton, Washington 98337

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END OF SECTION

ADVERSTISEMENT FOR BIDS

PUBLIC NOTICE
ADVERTISEMENT FOR BIDS
First Publication June 21, 2017, Second Publication June 28, 2017 Seattle Daily Journal of Commerce
June 23, 2017 Federal Way Mirror.

South King Fire and Rescue
Facility Improvements Station 66
Des Moines, WA

Sealed bids will be received by South King Fire and Rescue up to but not later than 2:00 pm, July 13, 2017, at the address listed below, for Facilities Improvements Station 66, at which time they shall be publicly opened and recorded.

The anticipated construction cost is approximately $ 3,689,000, 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 non-mandatory pre-bid conference will be held at Fire Station 66, 27010 15th Ave South, Des Moines, WA 98198, at 10:00 am, June 29, 2017. The conference is intended to provide a general review between bidders, owner, and architect prior to bidding the project.

Contractors may obtain plans and specifications from American Reprographics Company (ARC), 632 Broadway, Tacoma, WA 98402, telephone (800) 337-8103, fax (253) 272-4064 upon the deposit of $100.00. Please make checks payable to Rice Fergus Miller Arch. Interiors Planning. Plans must be returned in good condition within seven (7) days following bid date to obtain a refund of deposit. After seven days, no refunds will be made. Bid packets and specifications will be available for viewing at www.southkingfire.org and at 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 Facilities Improvements Station 66" and sent or delivered to:

Physical Address for Hand Delivery, Courier/Overnight Delivery and USPS:
SOUTH KING FIRE & RESCUE
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 Rice Fergus Miller, Inc., 275 5th Street, Bremerton, WA 98337, Attention Ed McManamna. Phone: 360-377-8773.

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.

SECTION 002113 - INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. INCORPORATE *Instructions to Bidders,* AIA Document A701-1997 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.C20006, or local Chapter offices.

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 and Rescue. Unsuccessful Bid-

ders 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 A101-2007 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."

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 003100 - INFORMATION AVAILABLE TO BIDDERS

PART 1 GENERAL

1.1 KING COUNTY PREVAILING WAGE RATES:

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

1. Washington State Prevailing Wage Rates – King County Effective 07/13/17.
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 003100

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: 07/13/2017

County	Trade	Job Classification	Wage	Holiday	Overtime	Note
King	Asbestos Abatement Workers	Journey Level	$45.25	5D	1H	
King	Boilermakers	Journey Level	$64.54	5N	1C	
King	Brick Mason	Journey Level	$54.32	5A	1M	
King	Brick Mason	Pointer-Caulker-Cleaner	$54.32	5A	1M	
King	Building Service Employees	Janitor	$22.84	5S	2F	
King	Building Service Employees	Traveling Waxer/Shampooer	$23.29	5S	2F	
King	Building Service Employees	Window Cleaner (Non-Scaffold)	$24.54	5S	2F	
King	Building Service Employees	Window Cleaner (Scaffold)	$27.33	5S	2F	
King	Cabinet Makers (In Shop)	Journey Level	$22.74		1	
King	Carpenters	Acoustical Worker	$55.51	5D	4C	
King	Carpenters	Bridge, Dock And Wharf Carpenters	$55.51	5D	4C	
King	Carpenters	Carpenter	$55.51	5D	4C	
King	Carpenters	Carpenters on Stationary Tools	$55.64	5D	4C	
King	Carpenters	Creosoted Material	$55.61	5D	4C	
King	Carpenters	Floor Finisher	$55.51	5D	4C	
King	Carpenters	Floor Layer	$55.51	5D	4C	
King	Carpenters	Scaffold Erector	$55.51	5D	4C	
King	Cement Masons	Journey Level	$55.56	7A	1M	
King	Divers & Tenders	Diver	$108.77	5D	4C	8A
King	Divers & Tenders	Diver On Standby	$66.05	5D	4C	
King	Divers & Tenders	Diver Tender	$59.88	5D	4C	
King	Divers & Tenders	Surface Rcv & Rov Operator	$59.88	5D	4C	
King	Divers & Tenders	Surface Rcv & Rov Operator Tender	$55.76	5A	4C	
King	Dredge Workers	Assistant Engineer	$56.44	5D	3F	
King	Dredge Workers	Assistant Mate (Deckhand)	$56.00	5D	3F	
King	Dredge Workers	Boatmen	$56.44	5D	3F	
King	Dredge Workers	Engineer Welder	$57.51	5D	3F	
King	Dredge Workers	Leverman, Hydraulic	$58.67	5D	3F	

King	Dredge Workers	Mates	$56.44	5D	3F	
King	Dredge Workers	Oiler	$56.00	5D	3F	
King	Drywall Applicator	Journey Level	$55.51	5D	1H	
King	Drywall Tapers	Journey Level	$55.66	5P	1E	
King	Electrical Fixture Maintenance Workers	Journey Level	$27.99	5L	1E	
King	Electricians - Inside	Cable Splicer	$73.20	7C	4E	
King	Electricians - Inside	Cable Splicer (tunnel)	$78.59	7C	4E	
King	Electricians - Inside	Certified Welder	$70.75	7C	4E	
King	Electricians - Inside	Certified Welder (tunnel)	$75.89	7C	4E	
King	Electricians - Inside	Construction Stock Person	$38.69	7C	4E	
King	Electricians - Inside	Journey Level	$68.30	7C	4E	
King	Electricians - Inside	Journey Level (tunnel)	$73.20	7C	4E	
King	Electricians - Motor Shop	Craftsman	$15.37		1	
King	Electricians - Motor Shop	Journey Level	$14.69		1	
King	Electricians - Powerline Construction	Cable Splicer	$73.93	5A	4D	
King	Electricians - Powerline Construction	Certified Line Welder	$67.60	5A	4D	
King	Electricians - Powerline Construction	Groundperson	$45.49	5A	4D	
King	Electricians - Powerline Construction	Heavy Line Equipment Operator	$67.60	5A	4D	
King	Electricians - Powerline Construction	Journey Level Lineperson	$67.60	5A	4D	
King	Electricians - Powerline Construction	Line Equipment Operator	$57.02	5A	4D	
King	Electricians - Powerline Construction	Pole Sprayer	$67.60	5A	4D	
King	Electricians - Powerline Construction	Powderperson	$50.76	5A	4D	
King	Electronic Technicians	Journey Level	$31.00		1	
King	Elevator Constructors	Mechanic	$85.45	7D	4A	
King	Elevator Constructors	Mechanic In Charge	$92.35	7D	4A	
King	Fabricated Precast Concrete Products	All Classifications - In-Factory Work Only	$17.20	5B	1R	
King	Fence Erectors	Fence Erector	$15.18		1	
King	Flaggers	Journey Level	$38.36	7A	3I	
King	Glaziers	Journey Level	$59.31	7L	1Y	
King	Heat & Frost Insulators And Asbestos Workers	Journeyman	$65.68	5J	4H	
King	Heating Equipment Mechanics	Journey Level	$75.46	7F	1E	
King	Hod Carriers & Mason Tenders	Journey Level	$46.66	7A	3I	
King	Industrial Power Vacuum Cleaner	Journey Level	$11.00		1	
King	Inland Boatmen	Boat Operator	$59.86	5B	1K	
King	Inland Boatmen	Cook	$56.18	5B	1K	
King	Inland Boatmen	Deckhand	$56.18	5B	1K	

King	Inland Boatmen	Deckhand Engineer	$57.26	5B	1K	
King	Inland Boatmen	Launch Operator	$58.59	5B	1K	
King	Inland Boatmen	Mate	$58.59	5B	1K	
King	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Cleaner Operator, Foamer Operator	$31.49		1	
King	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Grout Truck Operator	$11.48		1	
King	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Head Operator	$24.91		1	
King	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Technician	$19.33		1	
King	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Tv Truck Operator	$20.45		1	
King	Insulation Applicators	Journey Level	$55.51	5D	4C	
King	Ironworkers	Journeyman	$65.48	7N	1O	
King	Laborers	Air, Gas Or Electric Vibrating Screed	$45.25	7A	3I	
King	Laborers	Airtrac Drill Operator	$46.66	7A	3I	
King	Laborers	Ballast Regular Machine	$45.25	7A	3I	
King	Laborers	Batch Weighman	$38.36	7A	3I	
King	Laborers	Brick Pavers	$45.25	7A	3I	
King	Laborers	Brush Cutter	$45.25	7A	3I	
King	Laborers	Brush Hog Feeder	$45.25	7A	3I	
King	Laborers	Burner	$45.25	7A	3I	
King	Laborers	Caisson Worker	$46.66	7A	3I	
King	Laborers	Carpenter Tender	$45.25	7A	3I	
King	Laborers	Caulker	$45.25	7A	3I	
King	Laborers	Cement Dumper-paving	$46.09	7A	3I	
King	Laborers	Cement Finisher Tender	$45.25	7A	3I	
King	Laborers	Change House Or Dry Shack	$45.25	7A	3I	
King	Laborers	Chipping Gun (under 30 Lbs.)	$45.25	7A	3I	
King	Laborers	Chipping Gun(30 Lbs. And Over)	$46.09	7A	3I	
King	Laborers	Choker Setter	$45.25	7A	3I	
King	Laborers	Chuck Tender	$45.25	7A	3I	
King	Laborers	Clary Power Spreader	$46.09	7A	3I	
King	Laborers	Clean-up Laborer	$45.25	7A	3I	
King	Laborers	Concrete Dumper/chute Operator	$46.09	7A	3I	
King	Laborers	Concrete Form Stripper	$45.25	7A	3I	
King	Laborers	Concrete Placement Crew	$46.09	7A	3I	
King	Laborers	Concrete Saw Operator/core Driller	$46.09	7A	3I	
King	Laborers	Crusher Feeder	$38.36	7A	3I	

King	Laborers	Curing Laborer	$45.25	7A	3I	
King	Laborers	Demolition: Wrecking & Moving (incl. Charred Material)	$45.25	7A	3I	
King	Laborers	Ditch Digger	$45.25	7A	3I	
King	Laborers	Diver	$46.66	7A	3I	
King	Laborers	Drill Operator (hydraulic,diamond)	$46.09	7A	3I	
King	Laborers	Dry Stack Walls	$45.25	7A	3I	
King	Laborers	Dump Person	$45.25	7A	3I	
King	Laborers	Epoxy Technician	$45.25	7A	3I	
King	Laborers	Erosion Control Worker	$45.25	7A	3I	
King	Laborers	Faller & Bucker Chain Saw	$46.09	7A	3I	
King	Laborers	Fine Graders	$45.25	7A	3I	
King	Laborers	Firewatch	$38.36	7A	3I	
King	Laborers	Form Setter	$45.25	7A	3I	
King	Laborers	Gabian Basket Builders	$45.25	7A	3I	
King	Laborers	General Laborer	$45.25	7A	3I	
King	Laborers	Grade Checker & Transit Person	$46.66	7A	3I	
King	Laborers	Grinders	$45.25	7A	3I	
King	Laborers	Grout Machine Tender	$45.25	7A	3I	
King	Laborers	Groutmen (pressure)including Post Tension Beams	$46.09	7A	3I	
King	Laborers	Guardrail Erector	$45.25	7A	3I	
King	Laborers	Hazardous Waste Worker (level A)	$46.66	7A	3I	
King	Laborers	Hazardous Waste Worker (level B)	$46.09	7A	3I	
King	Laborers	Hazardous Waste Worker (level C)	$45.25	7A	3I	
King	Laborers	High Scaler	$46.66	7A	3I	
King	Laborers	Jackhammer	$46.09	7A	3I	
King	Laborers	Laserbeam Operator	$46.09	7A	3I	
King	Laborers	Maintenance Person	$45.25	7A	3I	
King	Laborers	Manhole Builder-mudman	$46.09	7A	3I	
King	Laborers	Material Yard Person	$45.25	7A	3I	
King	Laborers	Motorman-dinky Locomotive	$46.09	7A	3I	
King	Laborers	Nozzleman (concrete Pump, Green Cutter When Using Combination Of High Pressure Air & Water On Concrete & Rock, Sandblast, Gunite, Shotcrete, Water Bla	$46.09	7A	3I	
King	Laborers	Pavement Breaker	$46.09	7A	3I	
King	Laborers	Pilot Car	$38.36	7A	3I	
King	Laborers	Pipe Layer Lead	$46.66	7A	3I	
King	Laborers	Pipe Layer/tailor	$46.09	7A	3I	
King	Laborers	Pipe Pot Tender	$46.09	7A	3I	
King	Laborers	Pipe Reliner	$46.09	7A	3I	

King	Laborers	Pipe Wrapper	$46.09	7A	3I	
King	Laborers	Pot Tender	$45.25	7A	3I	
King	Laborers	Powderman	$46.66	7A	3I	
King	Laborers	Powderman's Helper	$45.25	7A	3I	
King	Laborers	Power Jacks	$46.09	7A	3I	
King	Laborers	Railroad Spike Puller - Power	$46.09	7A	3I	
King	Laborers	Raker - Asphalt	$46.66	7A	3I	
King	Laborers	Re-timberman	$46.66	7A	3I	
King	Laborers	Remote Equipment Operator	$46.09	7A	3I	
King	Laborers	Rigger/signal Person	$46.09	7A	3I	
King	Laborers	Rip Rap Person	$45.25	7A	3I	
King	Laborers	Rivet Buster	$46.09	7A	3I	
King	Laborers	Rodder	$46.09	7A	3I	
King	Laborers	Scaffold Erector	$45.25	7A	3I	
King	Laborers	Scale Person	$45.25	7A	3I	
King	Laborers	Sloper (over 20")	$46.09	7A	3I	
King	Laborers	Sloper Sprayer	$45.25	7A	3I	
King	Laborers	Spreader (concrete)	$46.09	7A	3I	
King	Laborers	Stake Hopper	$45.25	7A	3I	
King	Laborers	Stock Piler	$45.25	7A	3I	
King	Laborers	Tamper & Similar Electric, Air & Gas Operated Tools	$46.09	7A	3I	
King	Laborers	Tamper (multiple & Self-propelled)	$46.09	7A	3I	
King	Laborers	Timber Person - Sewer (lagger, Shorer & Cribber)	$46.09	7A	3I	
King	Laborers	Toolroom Person (at Jobsite)	$45.25	7A	3I	
King	Laborers	Topper	$45.25	7A	3I	
King	Laborers	Track Laborer	$45.25	7A	3I	
King	Laborers	Track Liner (power)	$46.09	7A	3I	
King	Laborers	Traffic Control Laborer	$41.02	7A	3I	8R
King	Laborers	Traffic Control Supervisor	$41.02	7A	3I	8R
King	Laborers	Truck Spotter	$45.25	7A	3I	
King	Laborers	Tugger Operator	$46.09	7A	3I	
King	Laborers	Tunnel Work-Compressed Air Worker 0-30 psi	$83.12	7A	3I	8Q
King	Laborers	Tunnel Work-Compressed Air Worker 30.01-44.00 psi	$88.15	7A	3I	8Q
King	Laborers	Tunnel Work-Compressed Air Worker 44.01-54.00 psi	$91.83	7A	3I	8Q
King	Laborers	Tunnel Work-Compressed Air Worker 54.01-60.00 psi	$97.53	7A	3I	8Q
King	Laborers	Tunnel Work-Compressed Air Worker 60.01-64.00 psi	$99.65	7A	3I	8Q
King	Laborers	Tunnel Work-Compressed Air Worker 64.01-68.00 psi	$104.75	7A	3I	8Q
King	Laborers	Tunnel Work-Compressed Air Worker 68.01-70.00 psi	$106.65	7A	3I	8Q

King	Laborers	Tunnel Work-Compressed Air Worker 70.01-72.00 psi	$108.65	7A	3I	8Q
King	Laborers	Tunnel Work-Compressed Air Worker 72.01-74.00 psi	$110.65	7A	3I	8Q
King	Laborers	Tunnel Work-Guage and Lock Tender	$46.76	7A	3I	8Q
King	Laborers	Tunnel Work-Miner	$46.76	7A	3I	8Q
King	Laborers	Vibrator	$46.09	7A	3I	
King	Laborers	Vinyl Seamer	$45.25	7A	3I	
King	Laborers	Watchman	$34.86	7A	3I	
King	Laborers	Welder	$46.09	7A	3I	
King	Laborers	Well Point Laborer	$46.09	7A	3I	
King	Laborers	Window Washer/cleaner	$34.86	7A	3I	
King	Laborers - Underground Sewer & Water	General Laborer & Topman	$45.25	7A	3I	
King	Laborers - Underground Sewer & Water	Pipe Layer	$46.09	7A	3I	
King	Landscape Construction	Irrigation Or Lawn Sprinkler Installers	$13.56		1	
King	Landscape Construction	Landscape Equipment Operators Or Truck Drivers	$28.17		1	
King	Landscape Construction	Landscaping or Planting Laborers	$17.87		1	
King	Lathers	Journey Level	$55.51	5D	1H	
King	Marble Setters	Journey Level	$54.32	5A	1M	
King	Metal Fabrication (In Shop)	Fitter	$15.86		1	
King	Metal Fabrication (In Shop)	Laborer	$11.00		1	
King	Metal Fabrication (In Shop)	Machine Operator	$13.04		1	
King	Metal Fabrication (In Shop)	Painter	$11.10		1	
King	Metal Fabrication (In Shop)	Welder	$15.48		1	
King	Millwright	Journey Level	$57.01	5D	4C	
King	Modular Buildings	Cabinet Assembly	$11.56		1	
King	Modular Buildings	Electrician	$11.56		1	
King	Modular Buildings	Equipment Maintenance	$11.56		1	
King	Modular Buildings	Plumber	$11.56		1	
King	Modular Buildings	Production Worker	$11.00		1	
King	Modular Buildings	Tool Maintenance	$11.56		1	
King	Modular Buildings	Utility Person	$11.56		1	
King	Modular Buildings	Welder	$11.56		1	
King	Painters	Journey Level	$40.60	6Z	2B	
King	Pile Driver	Journey Level	$55.76	5D	4C	
King	Plasterers	Journey Level	$53.20	7Q	1R	
King	Playground & Park Equipment Installers	Journey Level	$11.00		1	
King	Plumbers & Pipefitters	Journey Level	$76.69	6Z	1G	
King	Power Equipment Operators	Asphalt Plant Operators	$58.69	7A	3C	8P
King	Power Equipment Operators	Assistant Engineer	$55.21	7A	3C	8P
King	Power Equipment Operators	Barrier Machine (zipper)	$58.17	7A	3C	8P

King	Power Equipment Operators	Batch Plant Operator, Concrete	$58.17	7A	3C	8P
King	Power Equipment Operators	Bobcat	$55.21	7A	3C	8P
King	Power Equipment Operators	Brokk - Remote Demolition Equipment	$55.21	7A	3C	8P
King	Power Equipment Operators	Brooms	$55.21	7A	3C	8P
King	Power Equipment Operators	Bump Cutter	$58.17	7A	3C	8P
King	Power Equipment Operators	Cableways	$58.69	7A	3C	8P
King	Power Equipment Operators	Chipper	$58.17	7A	3C	8P
King	Power Equipment Operators	Compressor	$55.21	7A	3C	8P
King	Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$58.69	7A	3C	8P
King	Power Equipment Operators	Concrete Finish Machine -laser Screed	$55.21	7A	3C	8P
King	Power Equipment Operators	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure.	$57.72	7A	3C	8P
King	Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$58.17	7A	3C	8P
King	Power Equipment Operators	Conveyors	$57.72	7A	3C	8P
King	Power Equipment Operators	Cranes Friction: 200 tons and over	$60.47	7A	3C	8P
King	Power Equipment Operators	Cranes: 20 Tons Through 44 Tons With Attachments	$58.17	7A	3C	8P
King	Power Equipment Operators	Cranes: 100 Tons Through 199 Tons, Or 150' Of Boom (Including Jib With Attachments)	$59.28	7A	3C	8P
King	Power Equipment Operators	Cranes: 200 tons- 299 tons, or 250’ of boom including jib with attachments	$59.88	7A	3C	8P
King	Power Equipment Operators	Cranes: 300 tons and over or 300’ of boom including jib with attachments	$60.47	7A	3C	8P
King	Power Equipment Operators	Cranes: 45 Tons Through 99 Tons, Under 150' Of Boom (including Jib With Attachments)	$58.69	7A	3C	8P
King	Power Equipment Operators	Cranes: A-frame - 10 Tons And Under	$55.21	7A	3C	8P
King	Power Equipment Operators	Cranes: Friction cranes through 199 tons	$59.88	7A	3C	8P
King	Power Equipment Operators	Cranes: Through 19 Tons With Attachments A-frame Over 10 Tons	$57.72	7A	3C	8P
King	Power Equipment Operators	Crusher	$58.17	7A	3C	8P
King	Power Equipment Operators	Deck Engineer/deck Winches (power)	$58.17	7A	3C	8P
King	Power Equipment Operators	Derricks, On Building Work	$58.69	7A	3C	8P
King	Power Equipment Operators	Dozers D-9 & Under	$57.72	7A	3C	8P
King	Power Equipment Operators	Drill Oilers: Auger Type, Truck Or Crane Mount	$57.72	7A	3C	8P

King	Power Equipment Operators	Drilling Machine	$59.28	7A	3C	8P
King	Power Equipment Operators	Elevator And Man-lift: Permanent And Shaft Type	$55.21	7A	3C	8P
King	Power Equipment Operators	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$58.17	7A	3C	8P
King	Power Equipment Operators	Forklift: 3000 Lbs And Over With Attachments	$57.72	7A	3C	8P
King	Power Equipment Operators	Forklifts: Under 3000 Lbs. With Attachments	$55.21	7A	3C	8P
King	Power Equipment Operators	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$58.17	7A	3C	8P
King	Power Equipment Operators	Gradechecker/stakeman	$55.21	7A	3C	8P
King	Power Equipment Operators	Guardrail Punch	$58.17	7A	3C	8P
King	Power Equipment Operators	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$58.69	7A	3C	8P
King	Power Equipment Operators	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	$58.17	7A	3C	8P
King	Power Equipment Operators	Horizontal/directional Drill Locator	$57.72	7A	3C	8P
King	Power Equipment Operators	Horizontal/directional Drill Operator	$58.17	7A	3C	8P
King	Power Equipment Operators	Hydralifts/boom Trucks Over 10 Tons	$57.72	7A	3C	8P
King	Power Equipment Operators	Hydralifts/boom Trucks, 10 Tons And Under	$55.21	7A	3C	8P
King	Power Equipment Operators	Loader, Overhead 8 Yards. & Over	$59.28	7A	3C	8P
King	Power Equipment Operators	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$58.69	7A	3C	8P
King	Power Equipment Operators	Loaders, Overhead Under 6 Yards	$58.17	7A	3C	8P
King	Power Equipment Operators	Loaders, Plant Feed	$58.17	7A	3C	8P
King	Power Equipment Operators	Loaders: Elevating Type Belt	$57.72	7A	3C	8P
King	Power Equipment Operators	Locomotives, All	$58.17	7A	3C	8P
King	Power Equipment Operators	Material Transfer Device	$58.17	7A	3C	8P
King	Power Equipment Operators	Mechanics, All (leadmen - $0.50 Per Hour Over Mechanic)	$59.28	7A	3C	8P
King	Power Equipment Operators	Motor Patrol Graders	$58.69	7A	3C	8P
King	Power Equipment Operators	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$58.69	7A	3C	8P
King	Power Equipment Operators	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$55.21	7A	3C	8P
King	Power Equipment Operators	Outside Hoists (elevators And Manlifts), Air Tuggers,strato	$57.72	7A	3C	8P
King	Power Equipment Operators	Overhead, Bridge Type Crane: 20 Tons Through 44 Tons	$58.17	7A	3C	8P

King	Power Equipment Operators	Overhead, Bridge Type: 100 Tons And Over	$59.28	7A	3C	8P
King	Power Equipment Operators	Overhead, Bridge Type: 45 Tons Through 99 Tons	$58.69	7A	3C	8P
King	Power Equipment Operators	Pavement Breaker	$55.21	7A	3C	8P
King	Power Equipment Operators	Pile Driver (other Than Crane Mount)	$58.17	7A	3C	8P
King	Power Equipment Operators	Plant Oiler - Asphalt, Crusher	$57.72	7A	3C	8P
King	Power Equipment Operators	Posthole Digger, Mechanical	$55.21	7A	3C	8P
King	Power Equipment Operators	Power Plant	$55.21	7A	3C	8P
King	Power Equipment Operators	Pumps - Water	$55.21	7A	3C	8P
King	Power Equipment Operators	Quad 9, Hd 41, D10 And Over	$58.69	7A	3C	8P
King	Power Equipment Operators	Quick Tower - No Cab, Under 100 Feet In Height Based To Boom	$55.21	7A	3C	8P
King	Power Equipment Operators	Remote Control Operator On Rubber Tired Earth Moving Equipment	$58.69	7A	3C	8P
King	Power Equipment Operators	Rigger And Bellman	$55.21	7A	3C	8P
King	Power Equipment Operators	Rigger/Signal Person, Bellman (Certified)	$57.72	7A	3C	8P
King	Power Equipment Operators	Rollagon	$58.69	7A	3C	8P
King	Power Equipment Operators	Roller, Other Than Plant Mix	$55.21	7A	3C	8P
King	Power Equipment Operators	Roller, Plant Mix Or Multi-lift Materials	$57.72	7A	3C	8P
King	Power Equipment Operators	Roto-mill, Roto-grinder	$58.17	7A	3C	8P
King	Power Equipment Operators	Saws - Concrete	$57.72	7A	3C	8P
King	Power Equipment Operators	Scraper, Self Propelled Under 45 Yards	$58.17	7A	3C	8P
King	Power Equipment Operators	Scrapers - Concrete & Carry All	$57.72	7A	3C	8P
King	Power Equipment Operators	Scrapers, Self-propelled: 45 Yards And Over	$58.69	7A	3C	8P
King	Power Equipment Operators	Service Engineers - Equipment	$57.72	7A	3C	8P
King	Power Equipment Operators	Shotcrete/gunite Equipment	$55.21	7A	3C	8P
King	Power Equipment Operators	Shovel , Excavator, Backhoe, Tractors Under 15 Metric Tons.	$57.72	7A	3C	8P
King	Power Equipment Operators	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$58.69	7A	3C	8P
King	Power Equipment Operators	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	$58.17	7A	3C	8P
King	Power Equipment Operators	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$59.28	7A	3C	8P
King	Power Equipment Operators	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$59.88	7A	3C	8P
King	Power Equipment Operators	Slipform Pavers	$58.69	7A	3C	8P
King	Power Equipment Operators	Spreader, Topsider & Screedman	$58.69	7A	3C	8P
King	Power Equipment Operators	Subgrader Trimmer	$58.17	7A	3C	8P

King	Power Equipment Operators	Tower Bucket Elevators	$57.72	7A	3C	8P
King	Power Equipment Operators	Tower Crane Up To 175' In Height Base To Boom	$59.28	7A	3C	8P
King	Power Equipment Operators	Tower Crane: over 175’ through 250’ in height, base to boom	$59.88	7A	3C	8P
King	Power Equipment Operators	Tower Cranes: over 250’ in height from base to boom	$60.47	7A	3C	8P
King	Power Equipment Operators	Transporters, All Track Or Truck Type	$58.69	7A	3C	8P
King	Power Equipment Operators	Trenching Machines	$57.72	7A	3C	8P
King	Power Equipment Operators	Truck Crane Oiler/driver - 100 Tons And Over	$58.17	7A	3C	8P
King	Power Equipment Operators	Truck Crane Oiler/driver Under 100 Tons	$57.72	7A	3C	8P
King	Power Equipment Operators	Truck Mount Portable Conveyor	$58.17	7A	3C	8P
King	Power Equipment Operators	Welder	$58.69	7A	3C	8P
King	Power Equipment Operators	Wheel Tractors, Farmall Type	$55.21	7A	3C	8P
King	Power Equipment Operators	Yo Yo Pay Dozer	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Asphalt Plant Operators	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Assistant Engineer	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Barrier Machine (zipper)	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Batch Plant Operator, Concrete	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Bobcat	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Brokk - Remote Demolition Equipment	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Brooms	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Bump Cutter	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cableways	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Chipper	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Compressor	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Concrete Finish Machine -laser Screed	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure.	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$58.17	7A	3C	8P

King	Power Equipment Operators-Underground Sewer & Water	Conveyors	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cranes Friction: 200 tons and over	$60.47	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cranes: 20 Tons Through 44 Tons With Attachments	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cranes: 100 Tons Through 199 Tons, Or 150' Of Boom (Including Jib With Attachments)	$59.28	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cranes: 200 tons- 299 tons, or 250’ of boom including jib with attachments	$59.88	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cranes: 300 tons and over or 300’ of boom including jib with attachments	$60.47	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cranes: 45 Tons Through 99 Tons, Under 150' Of Boom (including Jib With Attachments)	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cranes: A-frame - 10 Tons And Under	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cranes: Friction cranes through 199 tons	$59.88	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Cranes: Through 19 Tons With Attachments A-frame Over 10 Tons	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Crusher	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Deck Engineer/deck Winches (power)	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Derricks, On Building Work	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Dozers D-9 & Under	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Drill Oilers: Auger Type, Truck Or Crane Mount	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Drilling Machine	$59.28	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Elevator And Man-lift: Permanent And Shaft Type	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Forklift: 3000 Lbs And Over With Attachments	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Forklifts: Under 3000 Lbs. With Attachments	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Gradechecker/stakeman	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Guardrail Punch	$58.17	7A	3C	8P

King	Power Equipment Operators-Underground Sewer & Water	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Horizontal/directional Drill Locator	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Horizontal/directional Drill Operator	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Hydralifts/boom Trucks Over 10 Tons	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Hydralifts/boom Trucks, 10 Tons And Under	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Loader, Overhead 8 Yards. & Over	$59.28	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Loaders, Overhead Under 6 Yards	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Loaders, Plant Feed	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Loaders: Elevating Type Belt	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Locomotives, All	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Material Transfer Device	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Mechanics, All (leadmen - $0.50 Per Hour Over Mechanic)	$59.28	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Motor Patrol Graders	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Outside Hoists (elevators And Manlifts), Air Tuggers,strato	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Overhead, Bridge Type Crane: 20 Tons Through 44 Tons	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Overhead, Bridge Type: 100 Tons And Over	$59.28	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Overhead, Bridge Type: 45 Tons Through 99 Tons	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Pavement Breaker	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Pile Driver (other Than Crane Mount)	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Plant Oiler - Asphalt, Crusher	$57.72	7A	3C	8P

King	Power Equipment Operators-Underground Sewer & Water	Posthole Digger, Mechanical	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Power Plant	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Pumps - Water	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Quad 9, Hd 41, D10 And Over	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Quick Tower - No Cab, Under 100 Feet In Height Based To Boom	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Remote Control Operator On Rubber Tired Earth Moving Equipment	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Rigger And Bellman	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Rigger/Signal Person, Bellman (Certified)	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Rollagon	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Roller, Other Than Plant Mix	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Roller, Plant Mix Or Multi-lift Materials	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Roto-mill, Roto-grinder	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Saws - Concrete	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Scraper, Self Propelled Under 45 Yards	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Scrapers - Concrete & Carry All	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Scrapers, Self-propelled: 45 Yards And Over	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Service Engineers - Equipment	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Shotcrete/gunite Equipment	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Shovel , Excavator, Backhoe, Tractors Under 15 Metric Tons.	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$59.28	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$59.88	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Slipform Pavers	$58.69	7A	3C	8P

King	Power Equipment Operators-Underground Sewer & Water	Spreader, Topsider & Screedman	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Subgrader Trimmer	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Tower Bucket Elevators	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Tower Crane Up To 175' In Height Base To Boom	$59.28	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Tower Crane: over 175’ through 250’ in height, base to boom	$59.88	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Tower Cranes: over 250’ in height from base to boom	$60.47	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Transporters, All Track Or Truck Type	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Trenching Machines	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Truck Crane Oiler/driver - 100 Tons And Over	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Truck Crane Oiler/driver Under 100 Tons	$57.72	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Truck Mount Portable Conveyor	$58.17	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Welder	$58.69	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Wheel Tractors, Farmall Type	$55.21	7A	3C	8P
King	Power Equipment Operators-Underground Sewer & Water	Yo Yo Pay Dozer	$58.17	7A	3C	8P
King	Power Line Clearance Tree Trimmers	Journey Level In Charge	$48.54	5A	4A	
King	Power Line Clearance Tree Trimmers	Spray Person	$46.03	5A	4A	
King	Power Line Clearance Tree Trimmers	Tree Equipment Operator	$48.54	5A	4A	
King	Power Line Clearance Tree Trimmers	Tree Trimmer	$43.32	5A	4A	
King	Power Line Clearance Tree Trimmers	Tree Trimmer Groundperson	$32.68	5A	4A	
King	Refrigeration & Air Conditioning Mechanics	Journey Level	$75.36	6Z	1G	
King	Residential Brick Mason	Journey Level	$54.32	5A	1M	
King	Residential Carpenters	Journey Level	$28.20		1	
King	Residential Cement Masons	Journey Level	$22.64		1	
King	Residential Drywall Applicators	Journey Level	$41.69	5D	4C	
King	Residential Drywall Tapers	Journey Level	$55.66	5P	1E	
King	Residential Electricians	Journey Level	$30.44		1	
King	Residential Glaziers	Journey Level	$39.40	7L	1H	
King	Residential Insulation Applicators	Journey Level	$26.28		1	
King	Residential Laborers	Journey Level	$23.03		1	

King	Residential Marble Setters	Journey Level	$24.09		1	
King	Residential Painters	Journey Level	$24.46		1	
King	Residential Plumbers & Pipefitters	Journey Level	$34.69		1	
King	Residential Refrigeration & Air Conditioning Mechanics	Journey Level	$75.36	6Z	1G	
King	Residential Sheet Metal Workers	Journey Level (Field or Shop)	$45.99	7F	1R	
King	Residential Soft Floor Layers	Journey Level	$45.86	5A	3D	
King	Residential Sprinkler Fitters (Fire Protection)	Journey Level	$44.98	5C	2R	
King	Residential Stone Masons	Journey Level	$54.32	5A	1M	
King	Residential Terrazzo Workers	Journey Level	$50.26	5A	1M	
King	Residential Terrazzo/Tile Finishers	Journey Level	$21.46		1	
King	Residential Tile Setters	Journey Level	$25.17		1	
King	Roofers	Journey Level	$47.51	5A	3H	
King	Roofers	Using Irritable Bituminous Materials	$50.51	5A	3H	
King	Sheet Metal Workers	Journey Level (Field or Shop)	$75.46	7F	1E	
King	Shipbuilding & Ship Repair	Boilermaker	$41.72	7M	1H	
King	Shipbuilding & Ship Repair	Carpenter	$41.06	7T	2B	
King	Shipbuilding & Ship Repair	Electrician	$41.09	7T	4B	
King	Shipbuilding & Ship Repair	Heat & Frost Insulator	$65.68	5J	4H	
King	Shipbuilding & Ship Repair	Laborer	$41.08	7T	4B	
King	Shipbuilding & Ship Repair	Machinist	$41.32	7T	4B	
King	Shipbuilding & Ship Repair	Operator	$41.03	7T	4B	
King	Shipbuilding & Ship Repair	Painter	$41.05	7T	4B	
King	Shipbuilding & Ship Repair	Pipefitter	$41.05	7T	4B	
King	Shipbuilding & Ship Repair	Rigger	$41.12	7T	4B	
King	Shipbuilding & Ship Repair	Sheet Metal	$41.04	7T	4B	
King	Shipbuilding & Ship Repair	Shipfitter	$41.12	7T	4B	
King	Shipbuilding & Ship Repair	Trucker	$41.26	7T	4B	
King	Shipbuilding & Ship Repair	Warehouse	$41.02	7T	4B	
King	Shipbuilding & Ship Repair	Welder/Burner	$41.12	7T	4B	
King	Sign Makers & Installers (Electrical)	Sign Installer	$22.92		1	
King	Sign Makers & Installers (Electrical)	Sign Maker	$21.36		1	
King	Sign Makers & Installers (Non-Electrical)	Sign Installer	$27.28		1	
King	Sign Makers & Installers (Non-Electrical)	Sign Maker	$33.25		1	
King	Soft Floor Layers	Journey Level	$45.86	5A	3D	
King	Solar Controls For Windows	Journey Level	$12.44		1	
King	Sprinkler Fitters (Fire Protection)	Journey Level	$72.89	5C	1X	
King	Stage Rigging Mechanics (Non Structural)	Journey Level	$13.23		1	

King	Stone Masons	Journey Level	$54.32	5A	1M	
King	Street And Parking Lot Sweeper Workers	Journey Level	$19.09		1	
King	Surveyors	Assistant Construction Site Surveyor	$57.72	7A	3C	8P
King	Surveyors	Chainman	$57.17	7A	3C	8P
King	Surveyors	Construction Site Surveyor	$58.69	7A	3C	8P
King	Telecommunication Technicians	Journey Level	$22.76		1	
King	Telephone Line Construction - Outside	Cable Splicer	$38.84	5A	2B	
King	Telephone Line Construction - Outside	Hole Digger/Ground Person	$21.45	5A	2B	
King	Telephone Line Construction - Outside	Installer (Repairer)	$37.21	5A	2B	
King	Telephone Line Construction - Outside	Special Aparatus Installer I	$38.84	5A	2B	
King	Telephone Line Construction - Outside	Special Apparatus Installer II	$38.03	5A	2B	
King	Telephone Line Construction - Outside	Telephone Equipment Operator (Heavy)	$38.84	5A	2B	
King	Telephone Line Construction - Outside	Telephone Equipment Operator (Light)	$36.09	5A	2B	
King	Telephone Line Construction - Outside	Telephone Lineperson	$36.09	5A	2B	
King	Telephone Line Construction - Outside	Television Groundperson	$20.33	5A	2B	
King	Telephone Line Construction - Outside	Television Lineperson/Installer	$27.21	5A	2B	
King	Telephone Line Construction - Outside	Television System Technician	$32.55	5A	2B	
King	Telephone Line Construction - Outside	Television Technician	$29.18	5A	2B	
King	Telephone Line Construction - Outside	Tree Trimmer	$36.09	5A	2B	
King	Terrazzo Workers	Journey Level	$50.26	5A	1M	
King	Tile Setters	Journey Level	$21.65		1	
King	Tile, Marble & Terrazzo Finishers	Finisher	$41.09	5A	1B	
King	Traffic Control Stripers	Journey Level	$44.85	7A	1K	
King	Truck Drivers	Asphalt Mix Over 16 Yards (W. WA-Joint Council 28)	$52.70	5D	3A	8L
King	Truck Drivers	Asphalt Mix To 16 Yards (W. WA-Joint Council 28)	$51.86	5D	3A	8L
King	Truck Drivers	Dump Truck & Trailer	$52.70	5D	3A	8L
King	Truck Drivers	Dump Truck (W. WA-Joint Council 28)	$51.86	5D	3A	8L
King	Truck Drivers	Other Trucks (W. WA-Joint Council 28)	$52.70	5D	3A	8L
King	Truck Drivers	Transit Mixer	$43.23		1	

King	Well Drillers & Irrigation Pump Installers	Irrigation Pump Installer	$17.71		1	
King	Well Drillers & Irrigation Pump Installers	Oiler	$12.97		1	
King	Well Drillers & 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.

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.

Overtime Codes Continued

1. 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.

   S. 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 hours worked on holidays and 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.

   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.

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

   G. 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 hours worked on Sunday shall be paid at two 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.

   O. All hours worked on Sundays and holidays shall be paid at one and one-half times 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.

   W. 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 first eight (8) hours worked on the fifth day shall be paid at one and one-half times the hourly rate of wage. All other hours worked on the fifth, sixth, and seventh days and on 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.

   A. 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 shift, and all work on Saturdays shall be paid at time and one-half the straight time rate. Hours worked over twelve hours (12) in a single shift and all work performed after 6:00 pm Saturday to 6:00 am Monday and holidays shall be paid at double the straight time rate of pay. Any shift starting between the hours of 6:00 pm and midnight shall receive an additional one dollar ($1.00) per hour for all hours worked that shift. The employer shall have the sole discretion to assign overtime work to employees. Primary consideration for overtime work shall be given to employees regularly assigned to the work to be performed on overtime situations. 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.

   C. 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 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 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.

Overtime Codes Continued

3. D. 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 15% over the hourly rate of wage. All other hours worked after 6:00 am 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.

   E. All hours worked Sundays and holidays shall be paid at double the hourly rate of wage. Each week, once 40 hours of straight time work is achieved, then any hours worked over 10 hours per day Monday through Saturday shall be paid at double the hourly wage rate.

   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.

   I. All 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 during a five day work week (Monday through Friday,) or a four day-ten hour work week (Tuesday through Friday,) 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 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.

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.

   B. All hours worked over twelve (12) hours per day and all hours worked on 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.

Overtime Codes Continued

4. 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.

F. 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 20% over the hourly rate of wage. All hours worked on 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.

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.

H. 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.

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).

J. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Eve Day, And Christmas Day (7).

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).

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

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).

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

E. Paid 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 a Half-Day On Christmas Eve Day. (9 1/2).

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).

I. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, And Christmas Day (7).

Holiday Codes Continued

6. 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.

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.

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.

M. Paid Holidays: New Year's Day, The Day after or before New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, And the Day after or before Christmas Day (10). 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.

R. Paid Holidays: New Year's Day, the day after or before New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day after or before Christmas Day (10). If any of the listed holidays fall on Saturday, the preceding Friday shall be observed as the holiday. If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

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.

T. Paid Holidays: New Year's Day, the Day after or before New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and The Day after or before Christmas Day. (10). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Note Codes

8. A. In addition to the hourly wage and fringe benefits, the following 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 100' To 150' -$3.00 per Foot for Each Foot Over 100 Feet
Over 150' To 220' -$4.00 per Foot for Each Foot Over 150 Feet
Over 220' -$5.00 per Foot for Each Foot Over 220 Feet

Note Codes Continued

8. C. In addition to the hourly wage and fringe benefits, the following depth premiums apply to depths of fifty feet or more:
Over 50’ To 100' -$1.00 per Foot for Each Foot Over 50 Feet
Over 100' To 150' -$1.50 per Foot for Each Foot Over 100 Feet
Over 150' To 200' -$2.00 per Foot for Each Foot Over 150 Feet
Over 200' -Divers May Name Their Own Price

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.

P. 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.

Q. 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.

R. 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.

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.

SECTION 004113 BID FORM

TO: **South King Fire and Rescue**

ADDRESS: 27010 15th Ave South, Des Moines, WA 98198

I have received Bid Documents titled "**Facility Improvements Station 66**", dated **April 13, 2017**.

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

$_____

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 addition sheets as necessary):

1) _____$_____

2) _____$_____

3) _____$_____

Provide the name of Subcontractor used for the following:

1) Heating_____

2) Ventilating & Air Conditioning _____

3) Plumbing _____

4) Electrical _____

CONTRACT TIME
The Owner anticipates Notice of Award of this contract on or about 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 **240** 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_____

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

_____

_____

END OF SECTION

SECTION 005213 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 A101-2007, 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, or local Chapter offices.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 007213 – GENERAL CONDITIONS OF THE CONTRACT

PART 1 - GENERAL

1.1 STANDARD FORM

The General *Conditions of the Contract for Construction*, AIA Document A201-2007, 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, or local Chapter offices.

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 007300 - 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 5 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 his 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:

3.7.1 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 he intends 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 his plan of construction, he shall submit his 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 his 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.

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 he 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 **One hundred dollars ($100)**. 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;

SECTION 011000 - 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. Work covered by Contract Documents.
2. Coordination with Occupants.
3. Phased Construction.
4. Work by Owner.
5. Work under separate contracts.
6. Owner-furnished products.
7. Access to site.
8. Work restrictions.
9. Specification and drawing conventions.

B. Related Requirements:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

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

1. Interior and exterior remodeling and structural, plumbing, mechanical, and electrical improvements as shown.

B. Type of Contract:

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

1.4 COORDINATION WITH OCCUPANTS

A. Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Station crews will be housed in the existing portable on the site and will utilize the station apparatus bay for vehicle storage. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
   2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
   1. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
   2. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.5 PHASED CONSTRUCTION

A. Phased construction is not required.

1.6 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 portions of existing occupants and equipment 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 perform construction operations at Project site. Those operations will 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. Security and surveillance system installation: Owner will contract with Presidio for design-build work related to door security and site surveillance.

2. Installation of chain link fence, gates, hardware, and operators.

3. Fuel tank and pump replacement.

4. Point-source vehicle exhaust system maintenance.

1.7 OWNER-FURNISHED OWNER INSTALLED PRODUCTS

A. Owner will furnish products indicated. The Work includes coordination with Owner-provided contractors or forces for installation of products.
1. Kitchen appliances.

1.8 OWNER-FURNISHED CONTRACTOR INSTALLED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.
1. Bunker Gear Lockers.
2. Bunker Gear Dryer and Extractor

1.9 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.

C. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

1.10 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 8:00 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.

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

1.11 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 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

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

1. Substitution Request Form: Standard AIA or CSI form.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. 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.
    b. 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.
    c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    d. Samples, where applicable or requested.
    e. Certificates and qualification data, 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 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.
c. High Speed Rolling Door substitutions will only be approved during the bidding period.

1.5 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

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

    a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    b. Substitution request is fully documented and properly submitted.
    c. Requested substitution is compatible with other portions of the Work.
    d. Requested substitution has been coordinated with other portions of the Work.
    e. Requested substitution provides specified warranty.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SUBSTITUTION REQUEST FORM

To: Architect: Rice Fergus Miller Architecture & Planning, PLLC
275 5th Street, Suite 100
Bremerton, Washington 98337

Project Name: Station 66 Facility Improvement

Contractor:

We hereby submit for consideration the following product instead of specified item for above project:

Section Paragraph Specified Item

Proposed Substitution:

Attachments: (If not applicable, write N/A left of item number.)

No. 1: Complete product data.
No. 2: Drawings showing dimensional changes and other change to drawings.
No. 3: Complete description of all changes to specifications.
No. 4: Description of effect on other trades, other contracts, and contract completion date.
No. 5: List of differences between proposed and specified items.
No. 6: List of names and addresses of three similar projects on which product was used, date of installation, and Architect's name and address.
No. 7: Cost impact.

Undersigned attests function and quality equivalent or superior to specified item.

Submitted by: (Person and Firm)

Date Phone Signature

Acceptance by Architect:

By:
Date:
Remarks:

Accepted
Accepted as Noted
Not Accepted

END OF SECTION

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 PROPOSAL REQUESTS

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

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

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

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 Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

1.4 CHANGE ORDER PROCEDURES

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

1.5 CONSTRUCTION CHANGE DIRECTIVE

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.3 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.

1.4 SCHEDULE OF VALUES

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

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

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

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

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

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

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

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor
    d. Name of manufacturer or fabricator
    e. Name of supplier
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

        1) Labor.
        2) Materials.
        3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. 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. If required, include evidence of insurance.

7. 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.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
10. 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.

11. 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.

1.5 APPLICATIONS FOR PAYMENT

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

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

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

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

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

    1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
    2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
    3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
    4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

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

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

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

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

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

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.

10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

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

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

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

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 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 administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

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

1.4 GENERAL COORDINATION PROCEDURES

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

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

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

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

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

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

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

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

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

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Division 01 Section "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Preparation Format: DWG, Version 2004 or later, operating in Microsoft Windows operating system.
3. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.

1.6 REQUESTS FOR INFORMATION (RFIs)

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

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

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

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716.

    1. Attachments shall be electronic files in Adobe Acrobat PDF format.

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

    1. The following Contractor-generated RFIs will be returned without action:

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

    2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
    3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

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

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

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

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

B. Preconstruction Conference: Architect will schedule and conduct Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

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

a. Tentative construction schedule.
b. Critical work sequencing and long-lead items.

c. Designation of key personnel and their duties.
d. Lines of communications.
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. Use of the premises and existing buildings.
m. Work restrictions.
n. Working hours.
o. Owner's occupancy requirements.
p. Responsibility for temporary facilities and controls.
q. Procedures for moisture and mold control.
r. Procedures for disruptions and shutdowns.
s. Construction waste management and recycling.
t. Parking availability.
u. Office, work, and storage areas.
v. Equipment deliveries and priorities.
w. First aid.
x. Security.
y. Progress cleaning.

4. Minutes: Contractor will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Deliveries.
e. Submittals.
f. Possible conflicts.
g. Compatibility requirements.
h. Time schedules.
i. Weather limitations.
j. Manufacturer's written instructions.
k. Warranty requirements.
l. Space and access limitations.

m. Testing and inspecting requirements.
n. Installation procedures.
o. Coordination with other work.
p. Required performance results.

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

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.

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

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for delivery of material samples, attic stock, and spare parts.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Owner's partial occupancy requirements.
k. Installation of Owner's furniture, fixtures, and equipment.
l. Responsibility for removing temporary facilities and controls.

4. Minutes: Contractor conducting meeting will record and distribute meeting minutes.

E. Coordination Meetings: Conduct Project coordination meetings at bi-monthly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences. This will be required for Fire Prop installation, and others a seen fit by Architect or Owner

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

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 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 administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Daily construction reports.
3. Material location reports.
4. Site condition reports.

B. Related Requirements:

1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
2. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

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

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

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. 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.

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

E. Event: The starting or ending point of an activity.

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

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

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

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
1. Three paper copies.

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

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

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

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at monthly intervals.

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

H. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

1.6 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, submittal schedule, progress reports, payment requests, and other required schedules and reports.

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

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

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

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

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

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

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. 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.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.

j. Adjusting.
k. Curing.
l. Building flush-out.
m. Startup and placement into final use and operation.

8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Permanent space enclosure.
c. Completion of mechanical installation.
d. Completion of electrical installation.
e. Substantial Completion.

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

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

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

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

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

1. Use Microsoft Project or other mutually agreed program.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing.
    j. Punch list and final completion.
    k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

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

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.3 REPORTS

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

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (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. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

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

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

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

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have

completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

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

B. Related Requirements:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

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

1. The following conditions apply:

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
b. Digital Drawing Software Program: The Contract Drawings are available in Revit (Architect’s current version).
c. Contractor shall execute Architects" Liability release form prior to receiving electronic files.

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

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

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

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

D. Identification & Information: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

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

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

    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.

k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

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

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

   a. Transmittal Form for Paper Submittals: Use AIA Document G810.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. 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.

H. 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.

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Provide a submittal for each product section and division. PDF File format is acceptable in lieu of paper copies.

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

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

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

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

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

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

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
    a. Three paper copies of Product Data unless otherwise indicated. Architect will return two copies.

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.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
3. Submit Shop Drawings in the following format:

    a. Two opaque (bond) copies of each submittal. Architect will return one copy(ies).
    b. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

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

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

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

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

E. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

F. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Submit copies to Owner, Architect, and Jurisdictions Having Authority for review.

G. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

H. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

I. 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.

J. 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.

K. 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.

L. 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.

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

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

O. 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.

P. 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.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note

corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

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

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

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

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

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

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 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. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:

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

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

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate

aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. 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 Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

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

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

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

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

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

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

1.4 CONFLICTING REQUIREMENTS

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

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

1.5 ACTION 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.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

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

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

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

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."

1.8 REPORTS AND DOCUMENTS

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

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

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

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

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

1.9 QUALITY ASSURANCE

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

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

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

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project,

whose work has resulted in construction with a record of successful in-service performance.

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

F. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. 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.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. 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 Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. 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.

F. 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.

G. 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.

H. 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.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

A. As provided by Owner.

3.2 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.3 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 Division 01 Section "Execution."

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

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

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

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 requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 TEMPORARY UTILITY INSTALLATION

A. Water Service: Connect to Owner's existing water service facilities.

B. Heating: Existing systems may be used.

C. Ventilation and Humidity Control: Existing HVAC systems may be used.

D. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

E. Lighting: Existing systems may be used.

3.2 SUPPORT FACILITIES INSTALLATION

A. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Security Enclosure and Lockup: Maintain lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

D. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

3.4 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.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

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 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. Division 01 Section "Substitution Procedures" for requests for substitutions.
   2. Division 01 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

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

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

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

1.4 ACTION SUBMITTALS

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

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 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.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.

C. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or

texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

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

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 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 general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Division 01 Section "Summary" for limits on use of Project site.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting

and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility, or 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Architect.

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

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

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

3. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

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. 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.

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.

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.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 administrative and procedural requirements for the following:

1. Recycling nonhazardous construction waste.
2. Disposing of nonhazardous construction waste.

1.3 DEFINITIONS

A. 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.

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

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

A. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

B. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

C. 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.

D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.8 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. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types of waste generated by the Work. Use Form CWM-1 for construction waste. 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. Use Form CWM-3 for construction waste. 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. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
3. 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 (Not Used)

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.

1. Comply with operation, termination, and removal requirements in Division 01 Section "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

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.

C. 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 Division 01 Section "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 Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

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.

3.3 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.

    a. Comply with requirements in Division 32 Section "Planting." for use of clean sawdust as organic mulch.

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.

a. Comply with requirements in Division 32 Section "Planting." for use of clean ground gypsum board as inorganic soil amendment.

3.4 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.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

B. Related Requirements:

1. Division 01 Section "Execution" for progress cleaning of Project site.
2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Maintenance Material Items: Provide remaining paint in legibly marked and labeled cans.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

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

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. 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.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

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 administrative and procedural requirements for preparing operation and maintenance manuals.

B. Related Requirements:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 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. 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 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. 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 of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
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.

F. 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.

G. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

H. 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.

I. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

J. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

K. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. 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.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

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 administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.

B. Related Requirements:
1. Division 01 Section "Execution" for final property survey.
2. Division 01 Section "Closeout Procedures" for general closeout procedures.
3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Final Submittal:

1) Submit two paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and two set(s) of prints.
3) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and one annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.

k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. 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.
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 attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file and one.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

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 subparagraph10.2.8:

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 and Payment Bond AIA-A312, March 1984. 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.

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 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 INFORMATIONAL SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

B. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

C. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Sleep Room Beds/Furniture.

b. Miscellaneous tools and equipment where noted on drawings.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: See Division 0 Section “Information Available to Bidders” for Limited Hazardous Materials Survey Report.

1. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

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 to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.

2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

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

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

    1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

    1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
    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 015000 "Temporary Facilities and Controls."

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
5. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
7. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Protect items from damage during transport and storage.
3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

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.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

B. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

1. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.

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 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

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

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Slab on grade.
3. Concrete walls.

B. Related Sections:

1. See General Structural Notes on structural drawings for additional information and requirements.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete".
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, C595, Type II, gray. Supplement with the following:
   a. Fly ash: ASTM C618, Class F or C.

B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2.5 CURING AND SEALING MATERIALS

A. Water: Potable.

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

C. Basis of Design: Dayton Superior; Cure & Seal 25% J22UV, or equal approved by Architect.

2.6 VAPOR BARRIERS

A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.7 RELATED MATERIALS

A. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.8 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Chamfer edges of permanently exposed concrete.

G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REMOVING AND REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.4 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams

or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3.5 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to all concrete surfaces.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

C. Slab Finishes: Match existing adjacent slab finish at all interior and exterior patched locations.

3.6 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Maintain continuity of coating and repair damage during curing period.

3.7 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports. See structural drawings for additional inspection requirements.

B. Inspections:

1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
2. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

SECTION 033713 - SHOTCRETE

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 shotcrete applied by wet-mix process.

1.3 DEFINITIONS

A. Shotcrete: Mortar or concrete pneumatically projected onto a surface at high velocity.

B. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product including reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.

B. Design Mixtures: For each shotcrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. For predampened dry-mix mixtures, indicate amounts of mixing water to be added to the dry-mix materials before mixing and conveying through the delivery hose.

C. Shop Drawings: For shotcrete installation. Include support and anchor details; reinforcement materials and grades and details of fabricating, bending, and placing reinforcement; number and location of splices; special reinforcement required for openings through shotcrete structures; formwork materials and details of formwork fabrication, assembly, and support; and locations of proposed construction joints.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and preconstruction testing service.

B. Material Certificates: For each of the following:

1. Cementitious materials.
2. Admixtures.
3. Form materials.

C. Preconstruction Test Reports: For shotcrete.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer employing nozzle operators for the Project, each of whom attains mean core grades not exceeding 2.5, according to ACI 506.2, on preconstruction tests and is ACI Shotcrete Nozzleman certified in Wet-Mix Process for Vertical Position as appropriate to the required shotcrete work.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. ACI Publications: Comply with ACI 506.2, "Specification for Shotcrete," unless modified by requirements in the Contract Documents.

D. Shotcrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design shotcrete mixtures.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing and inspections indicated below:

1. Produce shotcrete test panels before shotcrete placement according to requirements in ACI 506.2 and ASTM C 1140 for each design mixture, shooting orientation, and nozzle operator. Produce test panels with dimensions of 24 by 24 inches minimum and of average thickness of shotcrete, but not less than 3-1/2 inches.
2. From each test panel, testing agency will obtain six test specimens: one set of three specimens unreinforced and one set of three specimens reinforced. Agency will perform the following:

a. Strength Testing: Test each set of unreinforced specimens for compressive strength according to ASTM C 42/C 42M.
b. Core Grading: Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms: Form-facing panels that will provide continuous, straight, smooth, concrete surfaces. Furnish panels in largest practical sizes to minimize number of joints.

2.2 REINFORCING MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

G. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufactured according to CRSI's "Manual of Standard Practice" and as follows:

1. For uncoated reinforcement, use CRSI Class 1, plastic-protected or CRSI Class 2, stainless-steel bar supports.

2.3 SHOTCRETE MATERIALS

A. Source Limitations for Shotcrete: Obtain each color, size, type, and variety of shotcrete material and shotcrete mixture from single manufacturer with resources to provide shotcrete of consistent quality in appearance and physical properties.

B. Portland Cement: ASTM C 150, Type I or Type III. Use only one brand and type of cement for Project.

1. Fly Ash: ASTM C 618, Class C or Class F.
2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or Grade 120.

C. Blended Hydraulic Cement: ASTM C 595, Type IP.

D. Silica Fume: ASTM C 1240, amorphous silica.

E. Normal-Weight Aggregates: ASTM C 33, from a single source, and as follows:

1. Combined Aggregate Size: ACI 506R or ASTM C 1436, Grading No. 2 sieve analysis.

F. Water: Potable, complying with ASTM C 94/C 94M, free from deleterious materials that may affect color stability, setting, or strength of shotcrete.

G. Ground Wire: High-strength steel wire, 0.8 to 1.0 mm in diameter.

H. Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or [ASTM D 1752, cork or self-expanding cork.

2.4 ADMIXTURES

A. General: ASTM C 1141, Class A (liquid) or Class B (non-liquid), but limited to the following admixture materials. Provide admixtures for shotcrete that contain not more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.

1. Accelerating Admixture, Conventional: ASTM C 494/C 494M, Type C or Type E.
2. Pozzolanic Admixture: Fly ash, ground granulated blast-furnace slag, and silica fume as limited in "Shotcrete Materials" Article.
3. Coloring Admixture: Coloring agent as limited in "Shotcrete Materials" Article.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry, or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 SHOTCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of shotcrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 506.2.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based laboratory trial mixture or field test data, or both.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Cementitious Materials: Limit use of fly ash, ground granulated blast-furnace slag, and silica fume to not exceed, in combination, 25 percent of portland cement by weight.

D. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301.

E. Admixtures: When included in shotcrete design mixtures, use admixtures according to manufacturer's written instructions.

F. Design-Mixture Adjustments: Subject to compliance with requirements, shotcrete design-mixture adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.7 SHOTCRETE MIXTURES

A. Shotcrete Mixture: Proportion mixture to provide shotcrete with the following properties:

1. Compressive Strength (28 Days): 6000 psi .
2. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight wet-mix shotcrete having an air content before pumping of 8 percent with a tolerance of plus or minus 1-1/2 percent.
3. Color: As selected by Architect from manufacturer's full range.

2.8 SHOTCRETE EQUIPMENT

A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.

B. Dry-Mix Delivery Equipment: Capable of discharging aggregate-cement mixture into delivery hose under close control and maintaining continuous stream of uniformly mixed materials at required velocity to discharge nozzle. Equip discharge nozzle with manually operated water-injection system for directing even distribution of water to aggregate-cement mixture.

1. Provide uniform, steady supply of clean, compressed air to maintain constant nozzle velocity while simultaneously operating blow pipe for cleaning away rebound.
2. Provide water supply with uniform pressure at discharge nozzle to ensure uniform mixing with aggregate-cement mix. Provide water pump to system if line water pressure is inadequate.

C. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

2.9 BATCHING AND MIXING

A. Dry-Mix Process: Measure mixture proportions by weight batching according to ASTM C 94/C 94M or by volume batching complying with ASTM C 685/C 685M requirements.

1. In volume batching, adjust fine-aggregate volume for bulking. Test fine-aggregate moisture content at least once daily to determine extent of bulking.
2. Prepackaged shotcrete materials may be used at Contractor's option. Predampen prepackaged shotcrete materials and mix before use.

B. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C 94/C 94 and furnish batch ticket information.

1. Comply with ASTM C 685/C 685M when shotcrete ingredients are delivered dry and proportioned and mixed on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Concrete or Masonry: Before applying shotcrete, remove unsound or loose materials and contaminants that may inhibit shotcrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces to saturated, surface-dry condition before shotcreting.

1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper shotcrete bonding.

B. Steel: Clean steel surfaces by abrasive blasting according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

3.2 FORMS

A. General: Design, erect, support, brace, and maintain forms, according to ACI 301, to support shotcrete and construction loads and to facilitate shotcreting. Construct forms so shotcrete members and structures are secured to prevent excessive vibration or deflection during shotcreting.

1. Fabricate forms to be readily removable without impact, shock, or damage to shotcrete surfaces and adjacent materials.
2. Construct forms to required sizes, shapes, lines, and dimensions using ground wires and depth gages to obtain accurate alignment, location, and grades in finished structures. Construct forms to prevent mortar leakage but permit escape of air and rebound during shotcreting. Provide for openings, offsets, blocking, screeds, anchorages, inserts, and other features required in the Work.

B. Form openings, chases, recesses, bulkheads, keyways, and screeds in formwork. Determine sizes and locations from trades providing such items. Accurately place and securely support items built into forms.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.

C. Securely embed reinforcing anchors into existing substrates, located as required.

D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports, bolsters, chairs, spacers, and other devices as required to maintain minimum concrete cover.

E. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.

F. Install welded wire reinforcement in longest practical lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.4 JOINTS

A. General: Construct joints at locations indicated or as approved by Architect.

B. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints unless otherwise indicated.

C. Contraction Joints: Construct contraction joints in shotcrete using saw cuts 1/8-inch- (3-mm-) wide by 1/3 slab depth or joint-filler strips 1/4-inch- (6-mm-) wide by 1/3 shotcrete depth unless otherwise indicated.

1. After shotcrete has cured, remove strip inserts and clean groove of loose debris.

2. Space joints where indicated. Joint locations shall be reviewed and approved by architect and engineer prior to shotcrete installation.
3. Tool edges round on each side of strip inserts if floated or troweled finishes are required.
4. Where shooting over an existing substrate joint, align new shotcrete joint with existing joint.

3.5 ALIGNMENT CONTROL

A. Ground Wires: Install ground wires to establish thickness and planes of shotcrete surfaces. Install ground wires at corners and offsets not established by forms. Pull ground wires taut and position adjustment devices to permit additional tightening.

3.6 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by shotcrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.7 APPLICATION

A. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.

B. Moisten wood forms immediately before placing shotcrete where form coatings are not used.

C. Apply shotcrete according to ACI 506.2.

D. Apply wet-mix shotcrete materials within 90 minutes after batching.

E. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.

1. Remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.

F. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray, and prevent buildup against front face during shotcreting.

G. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete.

H. Do not permit shotcrete to sag, slough, or dislodge.

I. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.

J. Do not disturb shotcrete surfaces before beginning finishing operations.

K. Remove ground wires or other alignment-control devices after shotcrete placement.

L. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.

M. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by ACI 117, increased by a factor of two.

N. Cold-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 306.1 and as follows. Protect shotcrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. Discontinue shotcreting when ambient temperature is 40 deg F (4.4 deg C) and falling.
2. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F (10 deg C) and not more than 90 deg F (32 deg C).
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents.

O. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to recommendations of ACI 305R when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:

1. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below 90 deg F (32 deg C) for wet mix.
2. Reduce temperature of reinforcing steel and receiving surfaces below 100 deg F (38 deg C) before shotcreting.

3.8 SURFACE FINISHES

A. General: Finish shotcrete according to descriptions in ACI 506R.

B. Natural Finishes:

1. Broom Finish: Rough-textured finish obtained by screeding or cutting exposed face of shotcrete to plane with cutting rod, edge of trowel, or straightedge after initial set; followed by uniform brooming.

3.9 CURING

A. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.

B. Begin curing immediately after placing and finishing but not before free water, if any, has disappeared from shotcrete surface.

C. Curing Exposed Surfaces: Cure shotcrete by one of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Water-saturated absorptive covers or moisture-retaining covers. Lap and seal sides and ends of covers with 12-inch (300-mm) lap over adjacent covers.

2. Curing Compound: Apply uniformly in continuous operation by power spray according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Apply curing compound to natural gun finish or flash-coat shotcrete at rate of 1 gal./100 sq. ft. (1 L/2.5 sq. m).

D. Curing Formed Surfaces: Cure formed shotcrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.10 FORM REMOVAL

A. Forms not supporting weight of shotcrete may be removed after curing for 24 consecutive hours at not less than 50 deg F (10 deg C), provided shotcrete is hard enough not to be damaged by form-removal operations and provided curing and protecting operations are maintained.

1. Leave forms supporting weight of shotcrete in place until shotcrete has attained design compressive strength. Determine compressive strength of in-place shotcrete by testing representative field-cured specimens of shotcrete.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing materials are unacceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to sample materials, visually grade cores, perform tests, and submit reports during shotcreting.

B. Air Content: ASTM C 173/C 173M, volumetric method or ASTM C 231, pressure method; one test for each compressive-strength test for each mixture of air-entrained, wet-mix shotcrete measured before pumping.

C. Shotcrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

D. Test Panels: Make a test panel, reinforced as in structure, for each shotcrete mixture and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed, whichever is less. Produce test panels with dimensions of 24 by 24 inches (600 by 600 mm) minimum and of average thickness of shotcrete, but not less than 4-1/2 inches (115 mm). Testing agency will obtain sets of test specimens from each test panel.

1. Compressive Strength Testing: One set of three unreinforced specimens. Test each set of unreinforced specimens for compressive strength according to ASTM C 1140 and construction testing requirements in ACI 506.2.
2. Visual Core Grading: One set of three reinforced specimens. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

E. In-Place Shotcrete Testing: One set of three unreinforced cores for each mixture and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed, whichever is less. Test cores for compressive strength according to ACI 506.2 and ASTM C 42. Do not cut steel reinforcement.

F. Strength of shotcrete will be considered satisfactory according to the following:

1. Specimen Cores: Mean compressive strength of each set of three unreinforced cores equals or exceeds 85 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.
2. Specimen Cubes: Mean compressive strength of each set of three unreinforced cubes shall equal or exceed design compressive strength with no individual cube less than 88 percent of specified compressive strength.

3.12 REPAIRS

A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.

1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs.

2. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders.
3. Dampen surfaces and apply new shotcrete. Match adjacent color and finish.

B. Repair core holes from in-place testing according to repair provisions in ACI 301, except do not use shotcrete. Match adjacent color and finish.

3.13 CLEANING

A. Immediately remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

END OF SECTION 033713

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Miscellaneous masonry accessories.

B. Related Sections:

1. None.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.

    a. Include data on material properties.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119,

by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes as indicated in the Drawings, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
2. Density Classification: Medium weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60.

2.5 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated on drawings.

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.7 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime For reinforced masonry, use portland cement-lime mortar.
4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S .

4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.7 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.8 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.9 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 051200 - STRUCTURAL STEEL FRAMING

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. Structural steel.

B. Related Requirements:

1. None.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the Seismic-Load-Resisting System.
6. Identify demand critical welds.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Shop-Painting Applicators: Qualified according to to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.

3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Channels, Angles Shapes: ASTM A 36/A 36M.

B. Plate and Bar: ASTM A 36/A 36M.

C. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.

D. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

D. Unheaded Anchor Rods:ASTM F 1554, Grade 55, weldable.

1. Configuration: Straight.
2. Nuts: ASTM A 563 (ASTM A 563M) heavy- hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
5. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class.

E. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.

3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

F. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Finish: Plain.

G. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

H. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

I. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.3 PRIMER

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Primer: SSPC-Paint 23, latex primer.

D. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

H. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: As indicated on drawings.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
7. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
8. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
9. SSPC-SP 8, "Pickling."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and welded door frames attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: As indicated on the drawings.

B. Weld Connections: Comply with AWS D1.1/D1.1 and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

D. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 051200

SECTION 061000 - ROUGH CARPENTRY

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. Wood blocking and nailers.
2. Plywood sheathing.
3. Framing with dimension lumber.
4. Framing with engineered wood products.

B. Related Requirements:

1. See general structural notes in structural drawings for additional information and requirements.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NLGA: National Lumber Grades Authority.
2. WCLIB: West Coast Lumber Inspection Bureau.
3. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry unless otherwise indicated.

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and the following species unless noted otherwise in the structural notes and drawings:

1. Douglas fir-larch; WCLIB or WWPA.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades unless otherwise noted in the structural notes and drawings:

1. Douglas fir-larch; Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.

D. 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.

E. 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 SHEATHING

1. Wall Sheathing: Refer to Structural Drawings.

2.5 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 3 grade.
   1. Application: All interior partitions.
   2. Species:
      a. Douglas fir-larch; WCLIB, or WWPA.

B. Structural Framing:
   1. Application: Studs and plates for shear wall strengthening; studs and posts for holdown installation, joists for framing around new openings, blocking for diaphragm and shear wall nailing, blocking for metal strap installations.
   2. Species: Refer to structural drawings
   3. Grade: Refer to structural drawings

2.6 ENGINEERED WOOD PRODUCTS

A. Engineered Wood Products, General: Products shall contain no urea formaldehyde. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Parallel-Strand, Laminated-Strand, Laminated-Veneer Lumber: Refer to structural drawings.

C. Wood I-Joists: Refer to structural drawings.

D. Rim Boards: Refer to structural drawings.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064116 - PLASTIC LAMINATE CLAD ARCHITECTUAL CABINETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Plastic Laminate Clad Casework.

B. Plastic Laminate Clad Countertop.

C. Cabinet Hardware.

1.3 REFERENCES

A. AWI (Architectural Woodwork Institute) - Quality Standards.

B. BMHA A156.9 - Cabinet Hardware.

C. FS MMM-A-130 - Adhesive, Contact.

D. NEMA (National Electric Manufacturer’s Association) LD3 - High Pressure Decorative Laminates.

E. NLHA (National Hardwood Lumber Association).

F. PS 1 - Construction and Industrial Plywood.

G. PS 20 - American Softwood Lumber Standard.

1.4 SUBMITTALS FOR REVIEW

A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes.

C. Product Data: Provide data for hardware accessories.

B. Product Samples: Submit laminate for verification and edge banding options for Architects approval for each type specified. Reference the shop drawing schedule of finishes.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with AWI "Premium" quality.

1.6 ENVIRONMENTAL REQUIREMENTS

A. During and after installation of work of this section, maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 COORDINATION

A. Coordinate the work with electrical and plumbing rough-in.

PART 2 PRODUCTS

2.2 PLASTIC LAMINATE FACED CABINETS AND COUNTERTOPS

A. All hinged doors, drawers, and face panels to be manufactured with a "Reveal Overlay" design with 1/8" margins between doors and drawers. Margins between abutting cabinets to be 1/8". Scribes as shown on Drawings.

B. Laminate Materials
1. Plastic Laminate Countertops, NEMA LD-3, 0.050 inch general purpose quality.
2. Plastic Laminate General Use, NEMA LD-3, 0.030 inch general purpose quality.

3. Laminate Backing Sheet: NEMA LD-3, BK20 backing grade, undecorated plastic laminate.

C. Cabinets (HPL-1)

a. Grain Direction: Vertical.

D. Edgbanding at door and drawer faces: to match adjacent laminate, to be approved by Architect.

E. Countertops (HPL-1)

a. Grain Direction: See finish plan.

F. Edge at Plastic Laminate Countertops: Self edge to match countertop

2.3 ACCESSORIES

A. Adhesive: Type recommended by laminate manufacturer to suit application. Marine exterior grade at wet locations.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins and Screws: Of size and type to suit applications; mill finish in concealed locations and satin chrome finish in exposed locations.

C. Concealed Joint Fasteners: Threaded steel.

D. Pull out cabinet shelves and hardware at lower kitchen cabinets. Full cabinet depth extension + 3” min overextension. Heavy duty commercial quality to match application.

2.4 HARDWARE

A. Hardware items as noted below or approved equal.

B. Drawer Pulls: 4-inch wire pulls, US26D finish.

C. Drawer Slides: Accuride full extension glides #3832, Typical, and #3640 at all file drawers. Equal as approved by Architect.

D. Hinges: 5-knuckle overlay, 2 ¾" in height, 270 degree opening angle for all casework, finish: US26D.

E. Cabinet shelf supports: Knape and Vogt, #346 NP, nickel plated steel shelf support with #129 rubber cushion rest.

F. Locks: Half-mortise type with 5-pin tumbler and dead bolt, round cylinder only exposed, brass with US 26D Finish. Provide two keys per lock.

G. Locks at Pantry cabinets: Olympus lock, Inc., DCP Series, padlockable cam lock. Modify door side with steel backup plate mounted to back of door to allow for padlock to rest flat on face of steel plate. See interior elevations.

H. Grommets: Molded plastic with matching plastic caps with slot for wire passage, 2-1/2 inch diameter. Color as selected from manufacturer's full range. In addition to grommets shown on the drawings, provide additional grommets equal to 25% of those shown, to be field located by the Owner.

I. Magnetic Catches: magnet touch latches.

2.5 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

B. All cabinet box sides, bottoms, and spreaders will be 3/4 inch thick 45 pounds/cubic foot, Medium density fiberboard (MDF). All cabinet backs to be 1/2 inch thick.

C. All cabinet exteriors and all exposed surfaces of open cabinets, including shelves, to be high pressure plastic laminate.

D. Cabinet doors to be laminated both sides. Cabinet scribes and box edges to be banded with laminate to match face color. Cabinet door and drawer edges to be banded with 3 mm PVC edging, with color to match face laminate. All exposed ends of cabinets and upper cabinet bottoms to be covered with matching laminate. Use one piece for full length only.

E. Cabinet interiors and drawer interiors to be polyester faced.

F. All cabinets shelves to be adjustable by steel pins. Drill holes at both sides of cabinet, approximately 1 inch apart for the full height of the cabinet.

G. When necessary to cut and fit on site, provide materials with ample allowance for cutting.

H. Counters and Backsplashes: High pressure laminate over 3/4 inch MDF, typical. Fabricate backsplashes separately from counters. Countertops and backsplashes at wet areas to be made from plywood with waterproof glue. Countertop edge material to match countertop materials unless noted otherwise.

I. Apply laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline, flush, and smooth to the touch (no burrs); secure countertops with concealed fasteners.

J. Shelving: ¾ inch thick MDF, typical. ¾" exterior grade plywood at wet locations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

A. Set and secure casework in place; rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units, and countertops.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

3.3 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean casework, counters, shelves, hardware, fittings and fixtures.

END OF SECTION 064116

SECTION 072100 - THERMAL INSULATION

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. Foam-plastic board insulation.
2. Glass-Fiber Blanket Insulation.
3. Glass-Fiber Sound Attenuation Batt Insulation.

B. Related Sections:

1. Section 075419 “Thermoplastic Membrane Roofing”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 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 before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION (ROOF)

A. Flat closed-cell polyisocyanurate board insulation: ASTM C 1289, Type II, Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following and acceptable to membrane manufacturer:

a. Atlas Roofing Corporation.
b. Dow Chemical Company (The).
c. Equal approved by Architect.

2. Thermal Resistance: Achieve R-Value as indicated in the Drawings.

B. Tapered closed-cell polyisocyanurate board insulation. ASTM C 1289, Type II, Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following and acceptable to membrane manufacturer:

a. Atlas Roofing Corporation.
b. Dow Chemical Company (The).
c. Equal approved by Architect.

2. Thermal Resistance: Achieve R-Value as indicated in the Drawings.

3. Slope: Achieve slope as indicated in the Drawings.

2.2 GLASS-FIBER BLANKET INSULATION (WALL)

A. Unfaced, Non-Combustible Batt Insulation: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84 for combustion.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation.
    b. Dow Chemical Company (The).
    c. Equal approved by Architect.

2. Thermal Resistance: Achieve R-Value as indicated in the Drawings.

2.3 GLASS-FIBER SOUND ATTENUATION BATT INSULATION (WALL)

A. Unfaced, Non-Combustible Sound Attenuation Batt Insulation: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84 for combustion.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation.
    b. Dow Chemical Company (The).
    c. Equal approved by Architect.

2. Thickness: Provide the same thickness as that of the stud portion of the wall.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Comply with roofing manufacturer’s installation requirements for installation of rigid insulation as part of the roofing assembly.

C. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

D. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. 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.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072500 - WEATHER BARRIERS

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. Weather Resistive Barrier.
2. Water-Resistive Vapor Permeable Self-Adhered Air Barrier.
3. Fluid Applied Weather Resistive Barrier.

B. Related Requirements:

1. Section 061000 Rough Carpentry.
2. Section 075419 Thermoplastic Membrane Roofing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For weather-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WEATHER-RESISTIVE BARRIER (WRB)

A. Provide materials and related flashing and accessories by one manufacturer.

1. WRB: Fortifiber Super JumboTex 60 minute paper or approved equal.
2. Self adhesive flexible flashing: Fortifiber, Fortiflash 40 or approved equal.
3. Jamb Flashing: Fortifiber Moistop Next or approved equal.

4. Sealant: Forifiber or approved equal.

2.2 WATER-RESISTIVE VAPOR PERMEABLE SELF-ADHERED AIR BARRIER

A. Provide materials by one manufacturer.

1. Basis of Design Product: VaproShield; WrapShield SA or approved equal.

2.3 FLUID APPLIED WEATHER-RESISTIVE BARRIER

A. Provide materials by one manufacturer.

1. Manufacturer: DuPont.
   a. Product: Tyvek Fluid Applied WB.

2. Manufacturer: Prosoco.
   a. Product: R-Guard Cat 5.

PART 3 - EXECUTION

3.1 VERIFICATION

A. Verify condition of substrate and adjacent materials.

3.2 PREPARATION

A. Remove loose particles and foreign matter which might impair adhesion.

B. Clean and prime substrate to receive adhesive and sealants in accordance with manufacturer's instructions.

C. Brush, spray, or roller apply primer on substrates where self-adhesion is difficult or fails.

3.3 WATER-RESISTIVE BARRIER INSTALLATION

A. Install in accordance with manufacturer's instructions over exterior sheathing. Weather resistant membrane shall be free from holes, tears, and punctures

B. One layer of weather resistive barrier (WRB) shall be applied to all exterior walls. The weather resistive barrier shall be laid and weatherlapped in shingle-fashion to create a leak-free water-shedding layer behind siding or cladding.

C. All flashing through cladding shall be incorporated into the weather resistive barrier in watershedding, shingled fashion. All flashing components of the cladding system, including WRB, sheet metal flashing, and flexible membrane flashing shall be installed in weatherlapped, shingled fashion. The WRB shall lap down over the up-turned, vertical flange of window head flashing, and other flashings as applicable so that water will be directed to the outside of the wall cladding system and building—and not be directed into the interior of the wall assembly. Apply courses of WRB below windows so that they lap up, beneath window sill membrane flashing.

D. Repair any tears or punctures in weather resistant membrane immediately before concealment of other work.

3.4 INSTALLATION - SELF-ADHERING FLEXIBLE FLASHING AND ACCESSORIES

A. Apply self-adhering membrane and accessories in accordance to manufacturer's instructions to provide a weather proof installation.

B. Lap joints a minimum of 2 inches at side and end laps.

C. Roll surfaces to ensure full contact.

D. Do not place in contact with PVC or vinyl membranes.

END OF SECTION 072500

SECTION 072600 - VAPOR RETARDERS

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. Polyethylene vapor retarders.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 10-mil thick sheet, with maximum permeance rating of 0.1 perm.

2.2 ACCESSORIES

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Place vapor retarders on side of construction indicated on Drawings.

B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

SECTION 074646 - FIBER-CEMENT SIDING

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. Fiber-cement siding.
2. Accessories.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 072500 "Weather Barriers" for weather-resistive barriers.

1.3 COORDINATION

A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch long-by-actual-width Sample of siding.
2. 12-inch long-by-actual-width Samples of trim and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement siding.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking and deforming.
b. Deterioration of materials beyond normal weathering.

2. Warranty Period: Manufacturer's standard.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie, HardiePlank HZ10 or comparable product by one of the following:

a. James Hardie Building Products, Inc.
b. CertainTeed Corporation.
c. GAF Materials Corporation.

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Nominal Thickness: Not less than 5/16 inch.

D. Horizontal Pattern: Boards 7-1/4 to 7-1/2 inches wide in plain style.

1. Texture: Smooth.

E. Factory Finish: Manufacturer's standard primer system for field painting.

2.3 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories matching color and texture as indicated in Drawings.

B. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: Siliconized polyester coating.

C. Fasteners:

1. For fastening to metal, fasteners are ET & F 0.100 x 1.5” x .25” HP conforming with ICC ES Report 4444.

2. Fasteners shall be stainless steel.

D. Fiberglass Thermal Spacer:
1. Basis of Design: Cascadia Windows Inc., Cascadia Clip or approved equal.
2. Thermal Spacer Depth: 2 inches nominal.
3. Spacer Fasteners: As recommended by spacer manufacturer for substrate.

E. Insect Screen: Glass-Fiber Mesh Fabric, 18-by-14 or 18-by-16 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656.

1. Mesh Color: Manufacturer's standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Install fasteners no more than 24 inches o.c.

B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 075419 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL CONDITIONS

1.01 SECTION INCLUDES

A. Fully-adhered PVC roofing system including membrane, PVC flashings and other components.

1.02 Related Work

The work includes but is not limited to the installation of:

1. Substrate Preparation
2. Roof Drains
3. Vapor Barrier
4. Wood Blocking
5. Insulation
6. Separation Layers
7. Roof Membrane
8. Fasteners
9. Adhesive for Flashings
10. Roof Membrane Flashings
11. Walkways
12. Metal Flashings
13. Sealants

1.03 QUALITY ASSURANCE

A. This roofing system shall be applied only by a Roofing Applicator authorized by manufacturer prior to bid.

B. Upon completion of the installation and the delivery to manufacturer by the Applicator of certification that all work has been done in strict accordance with the contract specifications and manufacturer’s requirements, a manufacturer’s Technical Service Representative will review the installed roof system wherever a Standard or System warranty has been specified.

C. There shall be no deviation made from the Project Specification or the approved shop drawings without prior written approval by the Owner, the Owner's Representative and manufacturer.

D. All work pertaining to the installation of Sarnafil membrane and flashings shall only be completed by Applicator personnel trained and authorized by Sika Sarnafil in those procedures.

1.04 SUBMITTALS

Submit the following:

A. Copies of Specification.

B. Samples of each primary component to be used in the roof system and the manufacturer's current literature for each component.

C. Written approval by the insulation manufacturer (as applicable) for use and performance of the product in the proposed system.

D. Sample copy of manufacturer’s warranty.

E. Sample copy of Applicator's warranty.

F. Dimensioned shop drawings which shall include:

1. Outline of roof with roof size and elevations shown.
2. Profile details of flashing methods for penetrations.
3. Technical acceptance from manufacturer.

G. Certifications by manufacturers of roofing and insulating materials that all materials supplied comply with all requirements of the identified ASTM and other industry standards or practices.

H. Certification from the Applicator that the system specified meets all identified code and insurance requirements as required by the Specification.

I. Material Safety Data Sheets (MSDS)

1.05 CODE REQUIREMENTS

The Applicator shall submit evidence that the proposed roof system meets the requirements of the local building code and has been tested and approved or listed by the following test organizations. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.

A. System shall be designed to meet a minimum wind design requirements of the most recent version of ASCE 7.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.

B. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.

C. Membrane rolls shall be stored lying down on pallets and fully protected from the weather with clean canvas tarpaulins. Unvented polyethylene tarpaulins are not

accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weldability.

D. As a general rule all adhesives shall be stored at temperatures between 40 degree F and 80 degree F. Read instructions contained on adhesive canister for specific storage instructions.

E. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers or supplied by material manufacturer/supplier.

F. Any materials which the Owner's representative or manufacturer determine to be damaged are to be removed from the job site and replaced at no cost to the Owner.

1.07 JOB CONDITIONS

A. Materials may be installed under certain adverse weather conditions but only after consultation with manufacturer, as installation time and system integrity may be affected.

B. Only as much of the new roofing as can be made weather tight each day, including all flashing and detail work, shall be installed. All seams shall be cleaned and heat welded before leaving the job site that day.

C. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.

D. All surfaces to receive new insulation, membrane or flashings shall be dry. Should surface moisture occur, the Applicator shall provide the necessary equipment to dry the surface prior to application.

E. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

F. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.

G. The Applicator is cautioned that certain PVC membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with PVC membranes. The Applicator shall consult the manufacturer regarding compatibility, precautions and recommendations.

H. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Applicator shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of

plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.

I. Prior to and during application, all dirt, debris and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air or similar methods.

J. The Applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.

K. All roofing, insulation, flashings and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable City, State and Federal requirements.

L. All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Applicator and properly transported to a legal dumping area authorized to receive such material.

M. The Applicator shall take precautions that storage and application of materials and equipment does not overload the roof deck or building structure.

N. Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.

O. All rooftop contamination that is anticipated or that is occurring shall be reported to manufacturer to determine the corrective steps to be taken.

P. The Applicator shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages in writing (letter copy to manufacturer) to the Owner's Representative for corrective action prior to the installation of the roof system.

Q. Applicator shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Owner of such condition in writing for correction.

R. Site cleanup, including both interior and exterior building areas that have been affected by construction, shall be completed to the Owner's satisfaction.

S. All landscaped areas damaged by construction activities shall be repaired at no cost to the Owner.

T. The Applicator shall conduct fastener pullout tests in accordance with the latest version of the SPRI/ANSI Fastener Pullout Standard to verify condition of the deck/substrate and to confirm expected pullout values.

U. The membrane shall not be installed under the following conditions without consulting manufacturer’s Technical Dept. for precautionary steps:

1. The roof assembly permits interior air to pressurize the membrane underside.

2. Any exterior wall has 10 percent or more of the surface area comprised of opening doors or windows.
3. The wall/deck intersection permits air entry into the wall flashing area.

V. Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Adhesive odors could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.

W. Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

X. Membranes are slippery when wet or covered with snow, frost, or ice. Working on surfaces under these conditions is hazardous. Appropriate safety measures must be implemented prior to working on such surfaces. Always follow OSHA and other relevant fall protection standards when working on roofs.

1.08 WARRANTIES

A. System Warranty

Upon successful completion of the work to manufacturer's satisfaction and receipt of final payment, the System Warranty shall be issued.

B. Owner Responsibility

Owner shall notify both manufacturer and the Applicator of any leaks as they occur during the time period when both warranties are in effect.

1.09 WARRANTY DURATIONS

A. Sika Sarnafil's warranty shall be in effect for a 20 year duration.

PART 2 - PRODUCTS

2.01 GENERAL

A. The components of the Sika Sarnafil Adhered roof system are to be products of Sika Sarnafil as indicated on the Detail Drawings and specified in the Contract Documents.

B. Components to be used that are other than those supplied or manufactured by Sika Sarnafil may be submitted for review and acceptance by Sika Sarnafil. Sika Sarnafil's acceptance of any other product is only for a determination of compatibility with Sika Sarnafil products and not for inclusion in the Sika Sarnafil warranty. The specifications, installation instructions, limitations, and restrictions of the respective manufacturers must be reviewed by the Owner's Representative for acceptability for the intended use with Sika Sarnafil products.

C. Manufacturer to have a minimum of two years experience recycling their membranes at the end of their service life back into new membrane products. Provide a minimum of five reference projects.

D. Condensation or moisture migration into the roof system must be controlled so that it does not compromise the performance of the insulation and other components of the assembly. Moisture vapor tends to migrate from warmer to cooler areas. Air/vapor retarders are used to inhibit or block the flow of warm moist air into the roof system. To determine if an air/vapor barrier is necessary, a design professional with experience with air handling and moisture control should be consulted.

Special consideration should be given to construction related moisture. An example is the significant amount of moisture generated when concrete floor slabs are poured after the roof has been installed. Sika Sarnafil is not responsible for damage to the insulation when exposed to construction related moisture.

2.02 MEMBRANE

A. Basis of Design:
1. Manufacturer: Sika Sarnafil
2. Product/System: Sarnafil Roof System G410 Textured membrane, fully adhered.

B. Membrane shall conform to ASTM D4434 (latest version), “Standard for Polyvinyl Chloride Sheet Roofing,” Classification: Type III.

1. G410, 60 mil, thermoplastic membrane with fiberglass reinforcement and felt backing. Textured surface.

C. Certified Polymer Thickness

1. Membrane manufacturer is to certify that the polymer thickness is of the polymer thickness specified (see 2.02, C, 1). Certification is to be signed by the membrane manufacturer’s quality control manager. ASTM +/- tolerance for membrane thickness is not accepted.

D. Color of Membrane

1. At Textured Roof Locations: Standard Gray.

E. Typical Physical Properties

2.03 WALKWAY MEMBRANE

A. Basis of Design:
1. Manufacturer: Sika Sarnafil
2. Product/System: Sarnatred-V, thermoplastic, heat welded membrane, fully adhered.

B. Thickness: ASTM D751: 0.096 in (2.4 mm).

C. Color: Standard Gray.

D. Slip Resistance: UL 410: PASS.

2.04 FLASHING MATERIALS

A. Wall/Curb Flashing

1. Sarnafil G410-15 60 mil Membrane

   A fiberglass reinforced membrane adhered to approved substrate using Sarnacol adhesive.

2. Sarnaclad

   A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Sarnaclad is a 24 gauge, G90 galvanized metal sheet with a 20 mil unsupported Sarnafil membrane laminated on one side. The dimensions of Sarnaclad are 4 ft x 8 ft and 4 ft x 10 ft.

3. Sarnaclad

   A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Sarnaclad is a 24 gauge, G90 galvanized metal sheet with a 20 mil unsupported Sarnafil membrane laminated on one side. The dimensions of Sarnaclad are 4 ft x 8 ft and 4 ft x 10 ft.

4. Non-Typical Edge

   Project-specific perimeter edge detail reviewed and accepted for one-time use by Sika Sarnafil's Technical Department. Consult Regional Technical Manager prior to job start for review and consideration for acceptance.

B. Miscellaneous Flashings and Accessories

1. Sarnastack

   A prefabricated vent pipe flashing made from 0.048 inch (48 mil) thick Sarnafil G410 membrane. Available in five different sizes.

2. Sarnadrain-RAC

   PVC-coated, heavy-duty aluminum roof drain insert that mechanically seals to the drainpipe interior. Sarnadrain-RAC is made of 0.080 inch thick 6063 aluminum with a urethane seal installed at the end of the drainpipe. The large 14 inch x 14 inch drain strainer is also made of 0.080 inch thick aluminum stock. The flange dimensions of Sarnadrain-RAC are 18 inches x 18 inches. Provide one overflow-type at each pair of existing drains. Provide custom flange sizes as needed to suit project conditions.

3. Sarnacorners - Inside

   Prefabricated inside corners made of 0.060 inch (60 mil) thick membrane that are heat-weldable to membrane or Sarnaclad base flashings.

4. Sarnacorners - Outside

   Prefabricated outside corners made of 0.060 inch (60 mil) thick membrane that are heat-weldable to membrane or Sarnaclad base flashings.

5. Open Post Flashing

   Prefabricated post flashing, 0.048 inch (48 mil) thick, with an open seam used to flash obstructed rooftop conduits and pipes 1/2 to 1-1/4 inch in diameter. Available in 2 sizes; 1/2 to 3/4 inch and 3/4 to 1-1/4 inch diameter. Open Post Flashings are heat welded in place and terminated at the top of the penetration completing the pipe penetration detail.

6. Sikaflex-1a Sealant

   A proprietary sealant used at flashing terminations. Consult Product Data Sheet for additional information.

7. Sarnacol 2170 Adhesive

   A solvent-based reactivating adhesive used to attach membrane to flashing substrate.

8. Sarnacol 2170 VC Adhesive

   A solvent-based, low VOC, reactivating adhesive used to attach membrane to flashing substrate.

9. S327 Coverstrip

   9 inch wide precut flashing made from Sarnafil S327 polyester reinforced membrane. Used to coverstrip Sarnabar and Sarnadisc.

2.05 INSULATION/OVERLAYMENT/BARRIER BOARD

A. Coverboard: Georgia-Pacific DensDeck Prime roof board, ½ inch thickness, or equal approved by manufacturer.

B. Vapor Barrier: Sarnavap self-adhered vapor barrier, 32 mil thickness, suitable for use as a temporary roof membrane.

C. Thermal Insulation: Per Section 072100.

2.06 MISCELLANEOUS ACCESSORIES

A. Aluminum Tape

A 2 inch wide pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and the membrane and as a bond-breaker under the coverstrip at Sarnaclad joints.

B. Multi-Purpose Tape

A high performance sealant tape used with metal flashings as a preventive measure against air and wind blown moisture entry.

2.07 SEALANTS AND PITCH POCKET FILLERS

A. Sarnafil Sikaflex-1a Sealant (for termination details).

B. Depending on substrates, the following sealants are options for temporary overnight tie-ins:

1. Type III hot asphalt conforming to ASTM D312 (latest version).
2. Sarnafiller.
3. Multiple layers of roofing cement and felt.
4. Spray-applied, water-resistant urethane foam.
5. Mechanical attachment with rigid bars and compressed sealant.

2.08 MISCELLANEOUS FASTENERS AND ANCHORS

A. All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1-1/4 inch and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch and shall be approved for such use by the fastener manufacturer.

2.09 RELATED MATERIALS

A. Wood Nailer

Treated wood nailers shall be installed into the structural purlins at the perimeter of the entire roof and around such other roof projections and penetrations as specified on Project Drawings. Thickness of nailers must match the insulation thickness to achieve a smooth transition. Wood nailers shall be treated for fire and rot resistance (wolmanized or osmose treated) and be #2 quality or better lumber. Creosote or asphalt-treated wood is not acceptable. Wood nailers shall conform to Factory Mutual Loss Prevention Data Sheet 1-49. All wood shall have a maximum moisture content of 19 percent by weight on a dry-weight basis.

2.10 SHEET METAL COPINGS AND FLASHINGS

A. Sheet Metal Copings and other flashings exposed to view: 24 gage, galvanized steel with Kynar PVF2 finish. Fabricate and install with standing seam joints. Colors as selected.

B. Coping Cleats and other sheetmetal flashing not exposed to view: 22 gage, galvanized steel or stainless steel as noted on drawings. Solder watertight where indicated.

2.11 SPLASH BLOCK

A. Basis-of-Design: Amerimax; Model 3003-12.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION CONFERENCE

A. The Applicator, Owner's Representative/Designer and Manufacturer(s) shall attend a pre-construction conference.

B. The meeting shall discuss all aspects of the project including but not limited to:

1. Safety
2. Set up
3. Construction schedule
4. Contract conditions
5. Coordination of the work

3.02 SUBSTRATE CONDITION

A. Applicator shall be responsible for acceptance or provision of proper substrate to receive new roofing materials.

B. Applicator shall verify that the work done under related sections meets the following conditions:

1. Roof drains, gutters and scuppers have been reconditioned or replaced and installed properly.
2. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.
3. All surfaces are smooth and free of dirt, debris and incompatible materials.
4. All roof surfaces shall be free of water, ice and snow.

3.03 SUBSTRATE PREPARATION

The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. The Owner's Representative and Applicator shall determine the condition of the roof deck. Deteriorated decking or wet or deteriorated materials are to be removed and replaced. The Applicator shall load materials on the rooftop in such a manner as to eliminate risk of deck overload due to concentrated

weight. The Owner's Representative shall ensure that the roof deck is secured to the structural framing according to local building code and in such a manner as to resist all anticipated wind loads in that location. A structural evaluation by a licensed structural engineer should be performed to determine that the combined weight of the roofs, other collateral, and live loads do not exceed the load capacity of the structure.

The existing roof system is to be removed and recycled or otherwise legally disposed of by the applicator. Applicator is responsible for all costs associated with removing the existing roof, hauling, and dump fees.

3.04 SUBSTRATE INSPECTION

A. A dry, clean and smooth substrate shall be prepared to receive the Sika Sarnafil fully adhered roof system.

B. The Applicator shall inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.

C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

D. All roof surfaces shall be free of water, ice and snow.

E. Compressible fill material or spray, expanding urethane foam shall be used to minimize air infiltration under wood nailers for corrugated metal roof panels.

F. Sika Sarnafil shall be applied over compatible or acceptable substrates only.

3.05 VAPOR BARRIER/AIR BARRIER INSTALLATION

A. Sarnavap Self-Adhered

A. Primer Application

The substrate must be clean, dry and free of dust, grease or other contaminants. Shake well before using. Apply to clean and dry surfaces with a paint brush, roller or sprayer. Application rates will vary depending on substrate. Sarnavap Self-Adhered vapor barrier must be installed on the same day as the primer application. Acceptable substrates for primer application include wood, concrete, lightweight concrete, gypsum boards and decks. Drying time is typically 30 minutes to 3 hours.

Spraying equipment recommendations:
a) Spray tip size: between 20 and 25 mils.
b) Pressure: 1300 psi continuous

To Install:
a) Apply primer to prepared substrate.
b) Allow primer to dry completely.
c) Install Sarnavap Self-Adhered vapor barrier.

Notes:

a) Do not install when it is raining, snowing, or on wet/humid surfaces.
b) Install Sarnavap Self-Adhered Primer at temperatures 32 degree F (0 degree C) and above. Average coverage rate is 0.25 to 1.22 gallons per square (0.1 to 0.5 L per m²).
c) Install Sarnavap Self-Adhered Primer WB at temperatures 41 degree F (5 degree C) and above. Average coverage rate is 0.25 to 0.75 gallon per square (0.1 to 0.3 L per m²). KEEP FROM FREEZING.
d) Do not use Sarnavap Self-Adhered Primer WB to seal Sarnavap Self-Adhered vapor barrier membrane joints.
e) Sarnavap Self-Adhered Primer WB is not suitable for plastic surfaces.
f) Do not use Sarnavap Self-Adhered Primer WB on asphaltic boards.

1. Membrane Application Over Steel, Wood or Concrete Deck (New Construction or Reroofing with Removal of Existing Roofing):

Install Sarnavap Self-Adhered over a clean and dry substrate. In concrete deck applications concrete must be fully dry. Do not install when it is raining, snowing, or on wet/humid surfaces. Install in temperatures 14 degree F (-10 degree C) and above. The use of a primer is required on the following substrates: wood, concrete, lightweight concrete, gypsum boards and decks. On metal decks use a metal plate (6 x 42 inches - 15 x 106 cm) to support the membrane end lap between metal flutes ensuring a complete end lap seal.

a) Begin application at the bottom of the slope. Unroll Sarnavap Self-Adhered onto the substrate without adhering for alignment. Overlap each preceding sheet by 3 inches (75 mm) lengthwise following the reference line and by 6 inches (150 mm) at each end. Stagger end laps by at least 12 inches (300 mm). Do not immediately remove the silicone release sheet.

b) Once aligned, peel back a portion of the silicone release sheet and press the membrane onto the substrate for initial adherence. Hold Sarnavap Self-Adhered tight and peel back the release sheet by pulling diagonally.

c) Use a minimum 100 lb (45 kg) steel, membrane roller, by rolling in two directions to press Sarnavap Self-Adhered down into the substrate including the laps. Finish by aligning the edge of the roller with the lower end of the side laps and rolling up the membrane. Do not cut the membrane to remove air bubbles trapped under the laps. Squeeze out air bubbles by pushing the roller to the edge of the laps.

3.06 WOOD NAILER INSTALLATION

A. Install continuous wood nailers at the perimeter of the entire roof and around roof projections and penetrations as shown on the Detail Drawings.

B. Nailers shall be anchored to resist a minimum force of 300 pounds per lineal foot (4,500 Newtons per lineal meter) in any direction. Individual nailer lengths shall not be less

than 3 feet (0.9 meter) long. Nailer fastener spacing shall be at 12 inches (0.3 m) on center or 16 inches (0.4 m) on center if necessary to match the structural framing. Fasteners shall be staggered 1/3 the nailer width and installed within 6 inches (0.15 m) of each end. Two fasteners shall be installed at ends of nailer lengths. Nailer attachment shall also meet the requirements of the current Factory Mutual Loss Prevention Data Sheet 1-49.

C. Thickness shall be as required to match substrate and insulation height to allow a smooth transition.

D. Any existing nailer woodwork which is to remain shall be firmly anchored in place to resist a minimum force of 300 pounds per lineal foot (4,500 Newtons per lineal meter) in any direction and shall be free of rot, excess moisture or deterioration. Only woodwork shown to be reused in Detail Drawings shall be left in place. All other nailer woodwork shall be removed.

E. Stainless steel, corrosion resistant, fasteners are required when mechanically attaching any Sika Sarnafil product to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). When ACQ treated wood is used on steel roof decks or with metal edge detailing, a separation layer must be placed between the metal and ACQ treated wood.

3.07 INSULATION INSTALLATION

A. Insulation shall be installed according to insulation manufacturer's instructions.

B. Insulation shall be neatly cut to fit around penetrations and projections with gaps not exceeding 1/4 inch.

C. If applicable, install tapered insulation around drains creating a drain sump.

D. Do not install more insulation board than can be covered with Sarnafil membrane by the end of the day or the onset of inclement weather.

E. Use at least 2 layers of insulation when the total insulation thickness for the overlayment exceeds 2-1/2 inches. Stagger joints at least 12 inches between layers.

F. Mechanical Attachment

1. Insulation shall be mechanically fastened to the deck with approved fasteners and plates at a rate according to the insulation manufacturer's and Sika Sarnafil's recommendations for fastening rates and patterns, but not less than 1 fastener per 4 square feet . The quantity and locations of the fasteners and plates shall also cause the insulation boards to rest evenly on the roof deck/substrate. Each insulation board shall be installed tightly against the adjacent boards on all sides.

2. Fasteners are to be installed consistently in accordance with fastener manufacturer's recommendations. Fasteners are to have minimum penetration of 1

inch through the structural deck. Do not penetrate substrate at exposed eave locations.

3. Use fastener tools with a depth locator and torque-limiting attachment as recommended or supplied by fastener manufacturer to ensure proper installation.

3.08 INSTALLATION OF MEMBRANE

The surface of the insulation or substrate shall be inspected prior to installation of the Sarnafil roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.

C. Sarnacol 2170 / 2170 VC Adhesive:

1. Over the properly installed and prepared substrate surface, adhesive shall be applied using solvent-resistant 3/4 inch (19 mm) nap paint rollers. The adhesive shall be applied to the substrate at a rate according to Sika Sarnafil requirements. No adhesive is applied to the back of the G410 feltback membrane. The adhesive shall be applied in smooth, even coats with no gaps, globs, puddles or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be coated with adhesive. The first layer of adhesive shall be allowed to dry completely prior to installing a second layer of adhesive and the membrane.

2. The G410 feltback roof membrane is unrolled immediately into a second layer of wet adhesive. Adjacent to that first installed roll of membrane, another second layer of wet adhesive is applied and the second roll of membrane is immediately unrolled into it, overlapping the first roll by 3 inches (75 mm). This process is repeated throughout the roof area. Immediately after application into adhesive, each roll shall be pressed firmly in place with a minimum 100 lb (45 kg) steel, membrane roller, by rolling in two directions. Do not allow the second application of adhesive to dry at all!

3. Weld G410 coverstrips at all G410 feltback seams that do not have a factory selvage edge.

   Notes:

   a) The Applicator shall count the amount of pails of adhesive used per area per day to verify conformance to the specified adhesive rate.
   b) No adhesive shall be applied in seam areas. All membrane shall be applied in the same manner.

3.09 HOT-AIR WELDING OF SEAM OVERLAPS

A. General

1. All seams shall be hot-air welded. Seam overlaps should be 5-1/2 inches wide for Sarnadisc and Sarnadisc-XPN, and 7 inches wide for Sarnadisc-MAXLoad when

automatic machine-welding and 4 inches wide when hand-welding, except for certain details.

2. Welding equipment shall be provided by or approved by Sika Sarnafil. All mechanics intending to use the equipment shall have successfully completed a training course provided by a Sika Sarnafil Technical Service Representative prior to welding.

3. All membrane to be welded shall be clean and dry.

B. Hand-Welding

Hand-welded seams shall be completed in two stages. Hot-air welding equipment shall be allowed to warm up for at least one minute prior to welding.

1. The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.

2. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow", the hand roller is positioned perpendicular to the nozzle and rolled lightly. For straight seams, the 1-1/2 inch wide nozzle is recommended for use. For corners and compound connections, the 3/4 inch wide nozzle shall be used.

C. Machine Welding

1. Machine welded seams are achieved by the use of Sika Sarnafil's automatic welding equipment. When using this equipment, Sika Sarnafil's instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated simultaneously off the generator.

2. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.

D. Quality Control of Welded Seams

1. The Applicator shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark gray material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Applicator at locations as directed by the Owner's Representative or Sika Sarnafil's representative. One inch wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the Owner.

3.10 MEMBRANE FLASHINGS

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and Sika Sarnafil. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense. Flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.

A. Sarnacol Adhesive for Membrane Flashings

1. Over the properly installed and prepared flashing substrate, Sarnacol adhesive shall be applied according to instructions found on the Product Data Sheet. The Sarnacol adhesive shall be applied in smooth, even coats with no gaps, globs or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be flashed. The bonded sheet shall be pressed firmly in place with a hand roller.

2. No adhesive shall be applied in seam areas that are to be welded. All panels of membrane shall be applied in the same manner, overlapping the edges of the panels as required by welding techniques.

B. Install Sarnastop according to the Detail Drawings with approved fasteners into the structural deck at the base of parapets, walls and curbs.

C. Sika Sarnafil's requirements and recommendations and the specifications shall be followed. All material submittals shall have been accepted by Sika Sarnafil prior to installation.

D. All flashings shall extend a minimum of 8 inches above roofing level unless otherwise accepted in writing by the Owner's Representative and the Sika Sarnafil Technical Department.

E. All flashing membranes shall be consistently adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bitumen shall be in contact with the Sarnafil membrane.

F. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with Sarnastop at 6-8 inches on center.

G. Sarnafil flashings shall be terminated according to Sika Sarnafil recommended details.

H. All adhered flashings that exceed 30 inches in height shall receive additional securement. Consult Sika Sarnafil Technical Department for securement methods.

I. All mechanically-attached flashings that exceed 18 inches in height shall receive additional securement. Consult Sika Sarnafil Technical Department for securement methods.

3.11 METAL FLASHINGS

A. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:

1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).
2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - latest issue.

B. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.

C. Metal shall be installed to provide adequate resistance to bending to allow for normal thermal expansion and contraction.

D. Metal joints shall be watertight.

E. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate the wood nailer a minimum of 1 inch.

F. Airtight and continuous metal hook strips are required behind metal fascias. Hook strips are to be fastened 12 inches on center into the wood nailer or masonry wall.

G. Counter flashings shall overlap base flashings at least 4 inches.

H. Hook strips shall extend past wood nailers over wall surfaces by 1-1/2 inch minimum and shall be securely sealed from air entry.

3.12 SARNACLAD METAL BASE FLASHINGS/EDGE METAL

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and Sika Sarnafil. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

A. Sarnaclad metal flashings shall be formed and installed per the Detail Drawings.

1. All metal flashings shall be fastened into solid wood nailers with two rows of post galvanized flat head annular ring nails, 4 inches on center staggered. Fasteners shall penetrate the nailer a minimum of 1 inch.

2. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.

B. Adjacent sheets of Sarnaclad shall be spaced 1/4 inch apart. The joint shall be covered with 2 inch wide aluminum tape. A 4 inch minimum wide strip of Sarnafil flashing membrane shall be hot-air welded over the joint.

3.13 EDGE METAL

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and Sika Sarnafil. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

3.14 TEMPORARY CUT-OFF

All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. All temporary waterstops shall be constructed to provide a 100 percent watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation. The new membrane shall be carried into the waterstop. Waterstop shall be sealed to the deck and substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of sealant as described in Section 2.07. When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and properly disposed of off site. None of these materials shall be used in the new work.

If inclement weather occurs while a temporary waterstop is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.

If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Applicator's expense.

3.15 COMPLETION

Prior to demobilization from the site, the work shall be reviewed by the Owner's Representative and the Applicator. All defects noted and non-compliances with the Specifications or the recommendations of Sika Sarnafil shall be itemized in a punch list. These items must be corrected immediately by the Applicator to the satisfaction of the Owner's Representative and Sika Sarnafil prior to demobilization.

All Warranties referenced in this Specification shall have been submitted and have been accepted at time of contract award.

END OF SECTION 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flashings and Trim.

B. Copings.

1.2 RELATED SECTIONS

A. Section 061000 - Rough Carpentry.

B. Section 076200 – Thermoplastic Membrane Roofing.

1.3 REFERENCES

A. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

B. NRCA (National Roofing Contractors Association) - Roofing Manual.

C. SMACNA - Architectural Sheet Metal Manual.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA and NRCA standards.

1.5 QUALIFICATIONS

A. Fabricator and Installer: To establish responsibility for a weathertight system, the flashing and sheetmetal work that is a part of the particular roof system shall be done by the same installer that does that roofing work. The installer must specialize in this type of work and be able to show similar installations that have been in service for 3 years minimum.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack preformed material to prevent twisting, bending, or abrasion.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Pre-Coated Galvanized Steel: 24 gauge unless otherwise noted, Commercial Quality smooth, ASTM A446, Grade A, G90 zinc coating; PVF2 finish. Color as selected by Architect.

B. Stainless Steel: ASTM A167, Type 302 or 304, No. 2D, dull finish unless otherwise specified.

2.2 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, of sufficient length to penetrate into substrate.

B. Isolation Paint: ASTM D1187, asphalt.

C. Sealant: Polyurethane type.

D. Plastic Cement: ASTM D2822, Asphalt type with mineral fiber components, free of toxic solvents, capable of setting with 24 hours at temperatures of 75 degrees F and 50 percent RH.

E. Sealer Tape: Polyisobutylene sealer tape specifically manufactured for setting flanges.

2.3 FABRICATION OF FLASHING

A. Field measure prior to fabrication.

B. Fabricate in accordance with SMACNA Architectural Sheet Metal Manual.

C. Accurately form flashings to shapes shown and detailed, with angles and lines in true alignment.

D. Form radii nd angles true to line and surfaces free of waves and buckles.

E. Form bends to 1/16th inch inside radius.

F. Hem exposed edges of flashing minimum 1/4 inch on underside.

G. Reinforcements and Supports: Provide same material as flashing unless other material is shown. Steel, where shown or required, shall be coil coated galvanized or stainless.

H. Rigid Joints and Seams: Make joints and seams mechanically strong. Solder galvanized and stainless steel metal joints. Do not use solder to transmit stress loads.

I. Fabricated sheet metal in 10-foot maximum lengths, unless otherwise indicated.

J. At exposed ends of counterflashing furnish weathertight closures.

K. Fabricate corners in one piece with legs extending 30 inches each way to field joint. Lap, rivet, and solder corner seams weathertight.

L. Solvent clean sheet metal. Concealed surfaces shall be coated with isolation paint.

2.4 FABRICATION OF COPINGS

A. Fabricate in accordance with SMACNA Architectural Sheet Metal Manual.

B. Join coping sections with standing seam joint.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof openings, pipes or vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 INSTALLATION

A. Conform to drawing details included in the SMACNA and NRCA manuals.

B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where specifically shown on the drawings.

C. Coordinate flashing Work with roofing Work for weathertight and watertight assembly.

D. Isolate metal from wood and concrete and from dissimilar metal with two coats of specified isolation paint or tape.

E. Use only stainless steel fasteners to connect isolated dissimilar metals.

F. Joints: 10 foot maximum spacing and 2-1/2 feet from corners, butted with 3/16 inch space centered over matching 8 inch long backing plate with sealer tape in laps.

G. Set flanges of flashings and roof accessories on continuous sealer tape or in plastic roof cement on top of envelope ply of roofing. Nail flanges through sealer tape and at 3 inch maximum spacing. Touch up isolation paint on flanges.

H. Joints, Fastenings, Reinforcements, and Supports: Sized and located as required to preclude distortion or displacement due to thermal expansion and contraction.

I. Provide continuous hold-down clips at counterflashing and metal coping.

J. Install prefabricated metal copings in accordance with manufacturer's latest printed instructions. Do not penetrate fasteners through top of copings.

K. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

L. Seal metal joints watertight.

M. Anchor downspouts to wall with straps of same material as downspouts.

3.3 SCHEDULE

A. Colors: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

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. Silicon Joint Sealants.
2. Silyl-Terminated-Polyether (STPE) Joint Sealants.
3. Fire-Resistive Joint Systems

B. Related Sections:

1. Section 081113 Hollow Metal Doors and Frames.

1.3 SUBMITTALS

A. Provide in accordance with Section 013300 “Submittal Procedures”.

B. Product Data: For each joint-sealant product indicated.

C. Qualification Data: For qualified Installer.

D. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

E. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Location: All locations, except exterior doors and windows.

B. Product: Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide one of the following.

a. Dow Corning Corporation.
b. Sika Corporation U.S.
c. Tremco.
d. Equal approved by Architect.

2.3 SILYL-TERMINATED-POLYETHER (STPE) JOINT SEALANTS:

A. Location: Exterior doors and windows, both exterior and interior sides.

B. Basis of Design Product: PROSOCO R-GUARD AirDam Air and Water Barrier Sealant or approved equal.

2.4 FIRE-RESISTIVE JOINT SYSTEMS

A. Where penetrants pass through fire-resistive assemblies, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint 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 fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Fire-Resistance Rating: 1 Hour.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hilti, Inc.
b. 3M Fire Protection Products.
c. Equal approved by Architect.

2.5 JOINT SEALANT BACKING

A. General: Provide sealant backings of material 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. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 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, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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. Standard hollow metal doors and frames.
2. Hollow metal frames for stopped in glazing.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
2. Section 088000 “Glazing”.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSVSDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements. Available manufacturers offering products that may be incorporated into the work but are not limited to the following:

1. Ceco Door Products; An Assa Abloy Group Company.
2. Curries Company.
3. Equal approved by Architect.

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 indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Hollow-Metal Doors and Frames: NAAMM-HMMA 860. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches
c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.032 inch.
d. Edge Construction: Continuously welded with no visible seam.
e. Core: Steel stiffened.

f. Minimum 18 gauge steel with both lock and hinge rail edge of intermittently welded, filled and ground smooth the full height of the door.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch for frames that receive hollow-metal doors; minimum thickness of 0.042 inch for frames that receive hollow-core wood doors.
b. Construction: Fully welded.

4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Hollow-Metal Doors and Frames: NAAMM-HMMA 860. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.
2. 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, with minimum G60A60 coating.
d. Edge Construction: Continuously welded with no visible seam.
e. Core: Steel stiffened, insulated at exterior locations.
f. Minimum 16 gauge steel.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum G60A60 coating.
b. Construction: Welded.

4. Exposed Finish: Prime.

2.5 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

H. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 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. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow- Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. 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. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Three anchors per jamb up to 60 inches high.
      2) Four anchors per jamb from 60 to 90 inches high.
      3) Five anchors per jamb from 90 to 96 inches high.
      4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections. Coordinate with Owner’s security system vendor for additional hardware installation.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch thick, cold-rolled steel sheet set into 0.032-inch thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

2. See Door Schedule on Drawings for size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

C. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. 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 door silencers in frames before grouting.
    d. Remove temporary braces necessary for installation only after frames have been properly set and secured.

e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions. Solidly pack mineral-fiber insulation behind frames.
3. 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.

C. 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.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 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.

3.5 PAINT SCHEDULE

A. Paint all hollow metal doors and frames.

B. Interior: Match existing hollow metal doors.

C. Exterior: Match existing hollow metal doors.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

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. Solid-core doors with wood-veneer faces.
2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of cutouts.
2. Fire-protection ratings for fire-rated doors.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.6 WARRANTY

A. A. Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eggers Industries.
   2. Graham Wood Doors; an Assa Abloy Group company.
   3. VT Industries, Inc.
   4. Approved equal.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply WDMA I.S.1-A, "Architectural Wood Flush Doors."
   1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

C. WDMA I.S.1-A Performance Grade: Heavy Duty.

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Temperature-Rise Limit At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
   2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
   3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

E. Structural-Composite-Lumber-Core Doors (Non-Rated Doors):

1. Structural Composite Lumber: WDMA I.S.10.

    a. Screw Withdrawal, Face: 700 lbf (3100 N).
    b. Screw Withdrawal, Edge: 400 lbf (1780 N).

F. Mineral-Core Doors (Fire Rated):

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Rated and Non-Rated Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Match existing.
3. Stain: Match existing.
4. Apply medium density overlay to standard thickness, closed grain, hardwood face veneers.
5. Hardwood faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
6. MDF Faces: ANSI A208.2, Grade 150 or 160.
7. Exposed vertical and top edges: Any closed-grain hardwood.
8. Construction: Sides and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
9. WDMA I.S 1-A Performance Grade: Standard Duty.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Factory finish doors that are indicated to receive transparent finish.

D. Factory finish doors where indicated in schedules or on Drawings as factory finished.

E. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" WDMA TR-6 catalyzed polyurethane
3. Staining: As selected by Architect from manufacturer’s full range.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware”.

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083000
HIGH SPEED ROLLING DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. High-speed roll-up doors.

1.2 RELATED SECTIONS

A. None

1.3 REFERENCES

A. NEMA - National Electrical Manufacturers Association.

B. LED - Light Emitting Diode.

1.4 SYSTEM DESCRIPTION

A. Motor type: AC drive, and variable speed with soft acceleration and braking. Mechanical release lever on side column allows door to be easily opened in the event of a power failure.

1.5 SUBMITTALS

A. Submit the following:

1. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

2. Product Data: Provide general construction, component connections and details, and electrical equipment, operation instructions, and information.

3. Samples: Submit samples of door slat material.

4. Manufacturer's Installation: Indicate installation sequence and procedures, adjustment, and alignment procedures.

1.6 MAINTENANCE DATA

A. Maintenance Data: Scheduled maintenance program available to include lubrication requirements and frequency, periodic adjustments required, scheduled maintenance suggested, manufacturer’s data sheets, and equipment inter-connection diagrams.

1.7 REGULATORY REQUIREMENTS

A. Electrical components UL listed.

B. Electrical control panel NEMA approved.

1.8 QUALITY ASSURANCE

A. Furnish high-speed roll doors and all components and accessories by one manufacturer.

B. Specific door model used must have a proven track record of successful installations in similar applications of no less than 10 years. References to be provided upon request.

1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on shop drawings.

1.10 COORDINATION

A. Coordinate the work with installation of electric power and locations and sizes of conduit.

1.11 WARRANTY

A. One year parts, one year labor.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Rytec Corporation Spiral

1. Substitutions will be considered prior to bid opening only.

2.2 MATERIALS

A. Door Panel: Double-walled, aluminum slats are 6 inches high by 1-9/16” thick.

1. Integral rubber weatherseal between each individual door slat.

2. Door slats to be connected by a separate hinge system to provide additional rigidity, support and security to door curtain. Interlocking slats that allow metal-to-metal contact will not be accepted.

3. Interior and exterior of door slats to be clear anodized aluminum.

4. Four (4) full-width vision slats.

5. Insulation: Provide insulated door panels such that door U-value will meet or exceed the Washington State Energy Code minimum of 0.6.

B. Side Frames: 11 gauge, galvanized steel side frames with 14 gauge, galvanized covers.

1. Dual, full-height weatherseal to seal against both sides of the door panel.

C. Counterbalance: Counterbalance extension springs assist the motor in opening the door.

1. Up to six extension springs located within each side column, depending on the size of the door.

2. Doors using torsion springs for counterbalance, springs located within a barrel for counterbalance or doors without a counterbalance system to assist the motor will not be accepted.

D. Drive system: Three-phase, variable-speed AC Drive provides soft acceleration and deceleration.

1. Minimum 3 hp motor.

2. Mechanical release lever on side column allows push/pull manual operation of the door in the event of a power failure.

3. Doors using a motor with a clutch, brake or pump to start/stop door movement will not be accepted.

E. Travel Speed: Opens at up to 40” per second and close at 30” per second.

1. Variable speed AC drive system capable of infinitely variable speed control in both directions.

F. Electrical Controls: Housed in a UL/cUL listed, NEMA 4X rated, impact-resistant polycarbonate plastic enclosure with factory set parameters.

1. Two-line, vacuum fluorescent display provides scrolling self-diagnostic and status messaging as well as quick, straightforward installation and control adjustments.

2. Programmable inputs and outputs accommodate control applications without the need for additional electrical components.

3. Tamperproof cycle counter viewable without opening enclosure.

4. Controls to maintain a complete history of door for a minimum of two years. For ease of troubleshooting, history can be logged and encrypted onto a USB flash drive. All errors to have a time and date stamp for reference.

5. Programming and adjustments made using touchpad on face of control box.

   a. Control panels that require opening the control box, being exposed to high voltage or a portable device for programming will not be accepted.

6. On/Off selector switch on face of control box to enable and disable operation of the door.

G. Travel Limits: Door to use absolute rotary encoder to regulate door travel limits.

1. Limits to be adjustable without the use of tools from floor level at the control panel.

2. Control software to incorporate a self-adjusting limit feature, the software monitors the door position and adjusts the limits as required to maintain a proper seal.

3. Doors using mechanical limits switches or doors that require access to the operator in order to adjust limits will not be accepted.

H. Door Track: Spiral roll-up design.

1. No metal-to-metal contact between individual slats or between slats and door track. Interlocking slats that allow metal-to-metal contact will not be accepted.

2. Doors that roll onto a barrel or whose design allows metal-to-metal contact anywhere on the door will not be accepted.

I. Safety Devices:

1. Dual thru-beam photo eyes mounted at the door jamb.

2. Full-width, electric reversing edge along bottom of door instantly stops and reverses door upon contact with an object.

3. Pathwatch LED Safety Light System

a. 36” high x 0.375” wide LED light strip mounted to door side columns at eye level.

b. Amber colored lights flash to indicate the door is about to close and red lights illuminate and remain steady to indicate the door is closing.

c. Safety light system must be mounted at the door threshold at eye level for maximum visibility and safety.

K. Wireless Bottom Bar:

1. Bottom bar to be completely wireless. Reversing edge signal is carried to the door controller via radio frequency. Doors using coil cords or wired connections of any kind will not be accepted.

a. Wireless system to provide control-reliable, two-way communication between the bottom bar and the door controls for safety. During door operation, time lapse of communication between bottom bar and door controls shall not exceed 5 milliseconds.

b. Estimated battery life of wireless system to be no less than 3 years. Control box to indicate the need for battery replacement before low power is detected.

c. Wireless system to employ frequency-hopping technology to prevent “cross talk” and RFID interference.

d. Wireless system firmware to be upgradeable for future updates/enhancements without requiring additional wiring or components

L. All components factory finished.

N. Scheduled Maintenance: No lubrication of any kind required anywhere on the door or its components for the life of the door.

O. Activation: One (1) new remote open/close/stop pushbutton and reuse existing radio control.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes, tolerances, and conditions are acceptable.

3.2 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Fit and align assembly including hardware; level to plumb to provide smooth operation.

D. Coordinate with installation of electrical service.

3.3 ADJUSTING

A. Test and adjust door and operating assemblies, if necessary, for proper operation.

3.4 CLEANING

A. Clean door and components.

END OF SECTION

SECTION 083113 - ACCESS DOORS AND FRAMES

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 access doors and frames for walls and ceilings.

B. Related Requirements:

1. Section 092900 “Gypsum Board”.

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.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Recessed Access Doors with Concealed Flanges:

1. Basis-of-Design Product: L-DWR Series; Larsens Manufacturing Company or approved equal.
2. Description: Door face recessed 5/8 inch for gypsum board infill; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Ceiling.
4. Door Size: 24” x 24”.
5. Powder-Coated Steel Sheet for Door: 16 gauge, factory finished.
6. Latch and Lock: Cam latch, screwdriver operated.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 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 A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.

    a. Color: As selected by Architect from full range of industry colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes aluminum windows for exterior locations.

B. Related Requirements:

1. Section 088000 “Glazing”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

E. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.

F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period: Manufacturer’s standard warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, Fixed: Kawneer, TRACO NX-280, Casement Outswing: Kawneer, TRACO NX-210, Sliding: Kawneer NX-6400 or comparable product by one of the following:

1. Kawneer North America; an Alcoa company.
2. EFCO.
3. Equal as approved by Architect.

B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AMMA certified with label attached to each window.

B. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.28 Btu/sq. ft. x h x deg F.

C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.

2.3 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Fixed.
2. Casement Outswing.
3. Sliding.

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Insulating-Glass Units: See Section 088000 Glazing.

D. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

F. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

C. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Full, inside for project-out sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

C. Glass-Fiber Mesh Fabric: 18-by-14 or 18-by-16 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656.

1. Mesh Color: Manufacturer's standard.

2.6 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" 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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113

SECTION 087100 – DOOR HARDWARE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.1 SUMMARY

A. This section includes the following:

1. Door hardware.

B. Related Sections:

1. Section 081113 “Hollow Metal Doors and Frames”.
2. Section 081416 “Flush Wood Doors and Frames”.

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 (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 time 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-year 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 Specifications for making Buildings usable by physically handicapped people.

1.4 SUBMITTALS

A. Hardware schedule: Submit 6 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 4 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.

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.

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. The finish hardware shall have a limited warranty against defects in workmanship and operation for a period of one year from date of substantial completions and the following items are as shown:

1. Closers	Ten years mechanical, two years electrical.
2. Exit Devices:	Three years mechanical, one year electrical
3. Hinges	Life of the building.
4. Locksets	Seven years

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. Any item shown in the hardware schedule, but not listed below shall be supplied as shown unless otherwise approved by the Architect.

ITEM:	MANUFACTURER:	ACCEPTABLE SUB:
Hinges	(IVE) Ives	Mckinney, Bommer
Locks	(SCH) Schlage	None
Cylinders	(BES) Best	None
Exit Devices	(VON) Von Duprin	None
Electric Strikes	(VON) Von Duprin	HES
Closers	(LCN) LCN	None
Silencers	(IVE) Ives	Hager, Rockwood
Push & Pull Plates	(IVE) Ives	Hager, Rockwood
Kickplates	(IVE) Ives	Hager, Rockwood
Stops & Holders	(IVE) Ives	Hager, Rockwood
Overhead Stops	(GLY) Glynn-Johnson	None
Thresholds	(NGP) National Guard	Pemko, Zero
Seals & Bottoms	(NGP) National Guard	Pemko, Zero
Automatic Opener	(LCN) LCN	None
Prox Reader/Controllers	(SCE) Schlage Electonics	None
Pocket Set	(JOH) Johnson	Stanley

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 foot, 6 inch height. Add one for each additional 30 inches in height or any fraction thereof.

2. Provide 4 ½ x 4 ½ for 1 ¾" thick doors up to 36". Provide 5 x 4 ½ on doors over 36".
3. Out swinging exterior doors to have non removable (NRP) pins.
4. Pin tips, flat button, finish to match leaves

2.4 LOCKSETS, LATCHSETS, DEADBOLTS

A. Extra Heavy Duty Cylindrical Locks and Latches: as scheduled.

1. ANSI A156.2 Series 4000, Grade 1 Strength and Operational requirements.
   a. UL listed for A label and lesser class single doors up to 4ft x 8ft.
2. Meets A117.1 Accessibility Codes.
3. Latch bolts shall be steel with minimum ½" throw, deadlocking on keyed and exterior functions. ¾" throw anti-friction latch bolt on pairs of fire doors.
4. Lock case steel.
5. Lock shall incorporate one piece spring cage and spindle.
6. Locksets to be tested to exceed 3,000,000 cycles.
7. Strikes: 16 gage curved steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
8. Provide seven year warranty.
9. Lock Series and Design: Schlage ND series, "Rhodes" design.

2.5 KEYS, KEYING, AND KEY CONTROL

A. Keying shall be established at a key conference attended by the Owner/Architect and Hardware Supplier. Provide Schlage cylinders.

B. Provide permanent key schedule in a format acceptable to the Owner. All permanent keys shall be hand delivered or sent via registered mail directly to the Owner.

C. Provide Construction cylinders for exterior doors.
Provide:
3 keys per cylinders
3 control keys
12 Master keys
6 Construction keys
1 Key Cabinet RWC25S

2.6 EXIT DEVICES/PANIC HARDWARE

A. General features:

1. Independent lab-tested 1,000,000 cycles.
2. Push-through touch pad design. No exposed touch bar fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. ¾" throw deadlocking latchbolts.
4. No exposed screws to show through glass doors.

5. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
6. Releasable with 32 lb. maximum pressure under 250 lb. load to the door.

B. Specific features:

1. Lever Trim: Breakaway type, forged brass or bronze escutcheon min .130" thickness, match lockset lever design.
2. Fire-Labeled Devices: UL label indicating "Fire Exit Hardware".

2.7 CLOSERS

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 5,000,000 cycles.
4. Thru-bolts at wood doors unless doors are provided with closer blocking. Non-sized, non-handed and adjustable. Place closers inside building, stairs and rooms.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
6. Opening pressure: Exterior doors 8.5 lb., interior doors 5 lb., labeled fire doors 15 lb.
7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
8. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
9. Exterior doors do not require seasonal adjustments in temperatures from 120 degrees F to 0 degrees F, furnish data on request.
10. Non-flaming fluid will not fuel door or floor covering fires.

2.8 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. Gaskets and Sweeps
   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, 4 for pairs of doors.

2.9 HARDWARE FINISH

A. Provide the following finishes unless noted differently in hardware groups.

Locks, Latches 626
Push, pulls - 630
Hinges, Exterior 630 Interior 626
Closers Alum
Exit Devices 626
Other hardware 626
Thresholds Alum
Weatherstrip/sweeps Alum
Kickplates 630

PART 3 EXECUTION

3.1 ACCEPTABLE INSTALLERS:

A. Factory trained, certified, and carries a factory-issued card certifying that person as a “Certified Installer”. Alternative: can demonstrate suitably equivalent competence and experience.

3.2 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.

3.3 INSTALLATION

A. Install hardware per manufacturer’s instructions and recommendations. 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. Locate floor stops not more than 4 inches from the wall.
Drill pilot holes for fasteners in wood doors and/or frames.

3.4 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.

3.5 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.

3.6 DEMONSTRATION

A. Demonstrate electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures

3.7 PROTECTION/CLEANING

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.
B. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

3.8 DOOR HARDWARE SCHEDULE

HW SET: 01

3	EA	HINGE	5BB1 4.5 X 4.5
1	EA	PRIVACY SET	ND40S RHODES
2	EA	KICK PLATE	8400 10" X 34"
1	SET	SEALS	5050B
1	EA	SURFACE CLOSER	1461 EDA

HW SET: 02

3	EA	HINGE	5BB1 4.5 X 4.5
1	EA	PRIVACY SET	ND40S RHODES
1	EA	OVERHEAD STOP	90S
1	EA	KICK PLATE	8400 10" X 34"; EXTERIOR
1	SET	SEALS	5050B

HW SET: 03

3	EA	HINGE	5BB1 4.5 X 4.5
1	EA	STOREROOM SET	ND80PD RHODES
1	EA	SURFACE CLOSER	1461 EDA
2	EA	KICK PLATE	8400 10" X 34"
3	EA	DOOR SILENCERS	IVES SR64

HW SET: 04

3	EA	HINGE	5BB1 4.5 X 4.5
1	EA	STOREROOM SET	ND80PD RHODES
1	EA	SURFACE CLOSER	1461 EDA
1	EA	KICK PLATE	8400 10" X 34", INTERIOR SIDE
1	SET	SEALS	5050B
1	EA	DOOR SWEEP	C607A
1	EA	THRESHOLD	425E MS/LA
1	EA	DRIP CAP	16A

HW SET: 05

3	EA	HINGE	5BB1 4.5 X 4.5
1	EA	OFFICE SET	ND50PD RHODES
1	EA	KICK PLATE	8400 10" X 34"
3	EA	DOOR SILENCERS	IVES SR64
1	EA	OVERHEAD STOP	90S

HW SET: 06

3	EA	HINGE	5BB1 4.5 X 4.5
1	EA	STOREROOM SET	ND80PD RHODES
1	EA	SURFACE CLOSER	1461 EDA
1	EA	KICK PLATE	8400 10" X 34"; EXTERIOR SIDE
1	SET	SEALS	5050B
1	EA	DOOR SWEEP	C607A

HW SET: 07

3	EA	HINGE	5BB1 4.5 X 4.5
1	EA	PASSAGE SET	ND10S RHODES
1	EA	SURFACE CLOSER	1461 EDA
2	EA	KICK PLATE	8400 10" X 34"
1	SET	SEALS	5050B
1	EA	DOOR SWEEP	C607A
1	EA	THRESHOLD	425E MS/LA

HW SET: 08

3	EA	HINGE	5BB1 4.5 X 4.5

1	EA	PASSAGE SET	ND10S RHODES
2	EA	KICK PLATE	8400 10" X 34"
1	SET	SEALS	5050B
1	EA	OVERHEAD STOP	90S

END OF SECTION 087100

SECTION 088000 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Hollow Metal Door Vision Lites.
2. Interior and Exterior Windows.

B. Related Sections:

1. Section 081113 “Hollow Metal Doors and Frames”.
2. Section 085113 “Aluminum Windows”.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

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

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Qualification Data: For installers.

C. Product Certificates: For glass and glazing products, from manufacturer.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass and glazing gaskets.

E. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "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."

D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass 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.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.

2.3 INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Guardian Industries Corp.
2. PPE Industries
3. Oldcastle Glass.
4. Equal as approved by Architect.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.4 GLASS UNIT TYPES

A. Type G-1: Sealed Insulating Glass Units; Vision glazing, low-E.
1. Application: All exterior glazing unless otherwise indicated.
2. Substitutions: Refer to Section 016000 - Product Requirements.
   a. Other products of the basis of design manufacturer and products of other manufacturers will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.
3. Between-lite space filled with argon.
4. Thermal Resistance (U-Value): 0.28 or better.
5. Total Solar Heat Gain Coefficient: 0.40 or better.
6. Total Visible Light Transmittance: 66% or better.
7. Basis of Design: Guardian Industries Corp: www.sunguardglass.com.
8. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
   a. Tint and Coating: Clear with SunGuard SN 68 on #2 surface.
9. Inboard Lite: Annealed float glass, 1/4 inch thick.
   a. Tint: None (clear).
10. Total Thickness: 1 inch at windows, ½” overall thickness at exterior doors.
11. Glazing Method: Gasket glazing.

B. Type G-2: Single Safety Glazing; Non-fire-rated.
1. Applications: Provide this type of glazing in the following locations:

a. Glazed lites in doors.
b. Other locations required by applicable federal, state, and local codes and regulations.
c. Other locations indicated on the drawings.

2. Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch.

C. Type G-3: Single Safety Glazing; Fire Rated.
1. Applications: Provide this type of glazing in the following locations:
a. Glazed lites in fire-rated doors.
b. Other locations required by applicable federal, state, and local codes and regulations.
c. Other locations indicated on the drawings.
2. Type: Fully tempered, fire-resistance-rated float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch.
5. 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.

a. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.

6. 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 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials

for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

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.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

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.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact

with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. 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 088000

SECTION 092900 - GYPSUM BOARD

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. Interior gypsum board.

B. Related Requirements:

1. Section 099123 – “Interior Painting".
2. Section 102600 – “Wall and Door Protection”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 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.

2.2 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. USG Corporation.
5. Equal approved by Architect.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Gypsum Board, Mold-Resistant: ASTM D 3273.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

D. Gypsum Ceiling Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. American Gypsum.
2. CertainTeed Corp.

3. Georgia-Pacific Gypsum LLC.
4. USG Corporation.
5. Equal approved by Architect.

B. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: All locations unless otherwise indicated.
   2. Moisture mold resistant: Restrooms, Kitchen, and Decon room.

B. Single-Layer Application:

   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels horizontally.
   3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim: Install in the following locations:

   1. Cornerbead: Use at outside corners.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 5: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Match finish level of adjacent surfaces as required.

    b. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 – CERAMIC TILING

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. Glazed wall tile.
   2. Porcelain floor tile and base

B. Related Sections:
   1. Division 07 Section "Joint Sealants", for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Division 09 Section "Gypsum Board Assemblies", for cementitious backer units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and joint pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For accessories involving color selection.

D. Samples for Verification:

   1. Full-size sample for each tile type.
   2. Full-size units of each type of trim and accessory.

E. Qualification Data: For qualified Installer.

F. Maintenance Data to be included in maintenance materials.

1.4 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Pre-installation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store cladding and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

A. GLAZED WALL TILE PRODUCTS:

1. T-1: See finish legend for product information.
2. T-2: See finish legend for product information.

B. PORCELAIN FLOOR TILE PRODUCTS

1. PFT-1: See finish legend for product information.
2. BASE-2: See finish legend for product information.

a. Provide stainless steel cove-shaped profile for floor to wall transitions.

2.2 MATERIALS

A. Epoxy Adhesive (ANSI A118.3)
   1. Multi-component, factory prepared, 100 percent solid epoxy resin and hardener with sand or mineral filler material to be used as setting adhesive and joint filling grout for ceramic tile. Comply with ANSI A118.3 for thin-set applications for chemical resistant, water cleanable quarry tile installations.
   2. Acceptable Products:
      a. a. 100% Solids Epoxy Mortar by Custom Building Products.
      b. b. Latapoxy 300 Epoxy Adhesive by Laticrete.
      c. c. Kerapoxy 410 Chemical Resistant Epoxy Mortar by Mapei.

B. Epoxy Grout
   1. Multi-component, factory prepared, 100 percent epoxy resin and hardener with sand or mineral filler material.
   2. Color: #185 New Taupe
   3. Acceptable Products:
      a. a. 100% Solids Epoxy Grout by Custom Building Products.

C. Requests for substitutions will be considered in accordance with provisions of Section 016050.

2.3 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
   1. Products:
      a. Dow Corning Corporation; Dow Corning 786.
      b. GE Silicones; Sanitary 1700.
      c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
      d. Tremco, Inc.; Tremsil 600 White.

D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
   1. Products:
      a. Bostik; Chem-Calk 550.
      b. Mameco International, Inc.; Vulkem 245.

c. Pecora Corporation; NR-200 Urexpan.
d. Tremco, Inc.; THC-900.

2.4 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

D. Transitions: Provide standard bullnose trim pieces to finish the top of the tile. Where tiles of differing thicknesses meet up, it is acceptable to float the tiles to provide a smooth transition.

2.5 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

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 joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, 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.

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 brick-joint pattern. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

3.4 WATERPROOFING MEMBRANE

A. Prep walls and install pliable sheet-applied polyethylene waterproofing membrane and vapor-retarder
   1. Product:
      a. Schluter-Kerdi or approved equal

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

D. Provide final cleaning and sealing in accordance with section 017700.

END OF SECTION 093013

SECTION 095123 - ACOUSTICAL TILE CEILINGS

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. Acoustical tiles for interior ceilings.

B. Related Requirements:

1. Division 23 – HVAC.
2. Division 26 - Electrical.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above

ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:

1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.

B. Subject to compliance with requirements, provide products by the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. USG Corporation.
4. Equal approved by Architect.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL TILES (ACT-1)

A. Basis of Design: Armstrong World Industries Inc.; 3252, Optima Tegular.

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide tiles as follows:

1. Type and Form: Type XII, Form 2.
2. Pattern: E (lightly textured).

D. Color: White.

E. Edge Profile: Square Tegular.

F. Thickness: 1 inch.

G. Modular Size: 24 by 48 inches.

2.4 ACOUSTICAL TILES (ACT-2)

A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Classification: Provide tiles as follows:

1. Type: Type XX.
2. Pattern: CE (perforated, small holes and lightly textured).

C. Color: White.

D. Edge Profile: Square Lay-in.

E. Thickness: 5/8 inch.

F. Modular Size: 24 by 48 inches.

G. 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 D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C 635/C 635M.

2.6 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

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 complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.

1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. Finish: Painted white.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Testing Substrates: Before adhesively bonding tiles to wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

C. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to

support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.

G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.

1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches (305 mm) o.c.
3. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 ADJUSTING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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. Thermoplastic-rubber base.

B. Related Sections:

1. 096516 Resilient Sheet Flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size samples.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F .

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.

3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE (RB-1)

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Roppe Corporation, USA or equal

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Style and Location:

a. Style B, Cove: See drawings for rubber base locations.

1) Profile: Standard Toe Cove Base

C. Thickness: 1/8 inch

D. Height: 4 inches

E. Lengths: Coils in manufacturer's standard length or Cut lengths 48 inches long or coils in manufacturer's standard length.

F. Outside Corners: Job formed

G. Inside Corners: Job formed

H. Colors: As indicated by manufacturer's designations

a. 100 Black

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches.

a. Miter corners to minimize open joints.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096566 - RESILIENT ATHLETIC FLOORING

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. Interlocking, rubber floor tile.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for wall base and accessories installed with resilient athletic flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details and locations of the following:

1. Border tiles.

C. Samples: For each exposed product specified, provide the manufacturer’s standard sample size and of the same thickness indicated for the work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For sheet vinyl flooring Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resilient athletic flooring to include in maintenance manuals.

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 no fewer than 1 box, of each type, color, pattern, and size of floor tile installed.

1.7 QUALITY ASSURANCE

A. Sheet Vinyl Flooring Installer Qualifications: An experienced installer who has completed sheet vinyl flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration.

1. Store tiles on flat surfaces.
2. Store rolls upright.

PART 2 - PRODUCTS

2.1 INTERLOCKING, RUBBER FLOOR TILE (RFT-1)

A. Description: Athletic flooring consisting of modular rubber tiles with precision cut, interlocking edges, for free-lay installation.

B. Material: Recycled-rubber compound

C. Traffic-Surface Texture: Smooth

D. Size: Manufacturer's standard-size square tile

E. Thickness: 3/8 inch

F. Weight: Not less than 10 lbs. per tile

G. Border: Interlocking, beveled-edge tiles, of same material as floor tile; with bevels that transition from thickness of floor tile to surface below it; with straight outside edges; for use where flooring corners and edges do not abut vertical surfaces.

1. Border Color and Pattern: Matching floor tile

2.2 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than one test in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

D. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.

1. Do not install flooring until it is the same temperature as space where it is to be installed.

E. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOORING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.4 FLOOR TILE INSTALLATION

A. Lay out 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 square with room axis.

B. Discard broken, cracked, chipped, or deformed tiles.

C. Tile Matching: Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged if so numbered.

1. Lay tiles running in one direction

D. Free-Lay Tile: Place flooring at locations indicated with units securely interconnected and fully seated on substrate to form a smooth, level surface.

E. Provide a finish following installation of tile per manufacturer’s written recommendation.

3.5 CLEANING AND PROTECTION

1. Use cleaning methods recommended in writing by manufacturer.

B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096566

SECTION 096810 -CARPET TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Carpet Tile
2. Sheet Carpet

B. Related Sections include the following:

1. Section 096513 “Resilient Base and Accessories.”

1.3 SUBMITTALS

A. Provide in accordance with Section 013300 “Submittal Procedures”.

B. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation methods.

C. Shop Drawings: Show the following:
1. Columns, doorways, enclose walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of edge, transition, and other accessory strips.
9. Transition details to other flooring materials.

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Sheet Carpet: 12” x 12” Sample

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent.

PART 2 - PRODUCTS

2.1 CARPET TILE (CPT-1)

2.2 SHEET CARPET (CPT-2)

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, non-staining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by carpet manufacturer.

C. Transition Strips: Rubber with profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

1. Products: provide the following:

a. Manufacturer: Johnsonite or approved equal.
b. Color: as selected by Architect from manufacturer’s full range

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. 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 carpet manufacturer.
2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. 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 carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)."

B. Installation Method: As recommended in writing by carpet manufacturer for material.

C. 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.

D. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.

F. Install pattern parallel to walls and borders.

G. Install CPT-1 in monolithic pattern.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 15, and “Protection of Indoor Installations."

C. Protect carpet 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 manufacturer.

END OF SECTION 096810

SECTION 099113 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:

1. Fiber Reinforced Cement.
2. Wood.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
2. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
3. VOC content.

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 paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F 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. Kelly-Moore Paints.
2. Sherwin-Williams Company (The).
3. Approved equal.

B. Products: Subject to compliance with requirements, provide product listed in other Part 2 articles 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. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: As selected by Architect from manufacturer's full range.

2.3 PRIMERS/SEALERS

A. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.

2.4 WOOD PRIMERS

A. Primer, Latex for Exterior Wood: MPI #5.

2.5 WATER-BASED PAINTS

A. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.

2.6 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Wood: 15 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 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. Wood Substrates:

   1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI 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. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. 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. Pipe hangers and supports.
d. Metal conduit.
e. 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-Reinforced Concrete Substrates:

1. Latex System:

a. Prime Coat: Exterior Latex, MPI #10. (Prime coat not required at pre-primed siding.)
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

B. Wood Substrates: Including wood trim and previously painted glulam beams.

1. Latex System:

a. Prime Coat: Primer, latex for exterior wood, MPI #5.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete unit masonry.
2. Steel.
3. Gypsum board.
4. Wood.

B. Related Sections include the following:

1. Section 042200 – “Concrete Unit Masonry”.
2. Section 092900 – “Gypsum Board”.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for verification for each color and finish specified

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

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 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Benjamin Moore & Co.
2. Kelly-Moore Paints.
3. Parker Paint Mfg. Co. Inc.
4. Rodda Paint Co.
5. Sherwin-Williams Company (The).
6. Miller Paint.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Floor Coatings: VOC not more than 100 g/L.
5. Shellacs, Clear: VOC not more than 730 g/L.
6. Shellacs, Pigmented: VOC not more than 550 g/L.
7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
10. Floor Coatings: VOC not more than 100 g/L.
11. Shellacs, Clear: VOC not more than 730 g/L.
12. Shellacs, Pigmented: VOC not more than 550 g/L.
13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.

g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

D. Colors: As indicated in the finish legend.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that 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.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing 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.

3.5 INTERIOR PAINTING SCHEDULE

A. Concrete Unit Masonry Substrates:

1. Latex System: MPI INT 4.2A.

a. Prime Coat: Latex block filler (MPI #4).
b. Intermediate Coat: Interior latex matching topcoat (MPI #54).
c. Topcoat: Interior latex semi-gloss (MPI #54).

B. Steel Substrates:

1. High-Performance Architectural Latex System: MPI INT 5.1R.

a. Prime Coat: Quick-drying alkyd metal primer (MPI #79).
b. Intermediate Coat: High-performance architectural interior latex matching topcoat (MPI #141).
c. Topcoat: High-performance architectural interior latex semi-gloss (MPI #141).

C. Gypsum Board Substrates Standard:

1. Latex over latex primer system: MPI INT 9.2A
a. Prime Coat: Interior latex primer/sealer (MPI #50).
b. Intermediate Coat: Interior latex matching topcoat (MPI #54).
c. Topcoat: Interior latex semi-gloss (MPI #54).

D. Wood Substrates:

1. Prime Coat: Latex over alkyd primer system: MPI INT 6.2A

a. Prime Coat: Alkyd primer sealer (MPI #45).
b. Intermediate Coat: Interior latex matching topcoat (MPI #54).
c. Topcoat: Interior latex semi-gloss (MPI #54).

END OF SECTION 099123

SECTION 102600 - WALL AND DOOR PROTECTION

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 Stainless Steel Corner Guards

B. Related Requirements:
   1. Section 092900 - “Gypsum Board”.

1.3 PERFORMANCE REQUIREMENTS

A. Corner Guards: Resist lateral impact force of 100 lbs at any point without damage or permanent set.

1.4 ACTION SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: For each type of product indicating physical dimensions and features.

C. Maintenance Data: For corner guards to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 CORNER GUARDS

A. Material: 430-grade stainless steel, 16 ga. Satin finish.

B. Mounting: Adhesive

C. Size:
   1. Corner Guard: 3 ½ in x 3 ½ in. at corners (angles as shown on drawings)
   2. Corner Guard U: Custom sized “U” to cover uncased opening (90 degrees).
   3. 4 foot high, typical.

2.2 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Finish sharp edges smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that walls are ready to receive work

B. Verify that rough-in for components are correctly sized and located.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position.

B. Position corner guard as shown on drawings and adhere securely to wall surface.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

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. Washroom accessories.

B. Related Sections:

1. Section 061000 “Rough Carpentry” for wood blocking.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

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.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 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 WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. American Specialties, Inc.
4. Equal as approved by Architect.

B. Toilet Tissue (Roll) Dispenser:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; Model B-4288.
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Surface mounted.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Paper Towel (Folded) Dispenser:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; Model B-359.
2. Mounting: Recessed.
3. Minimum Capacity: 350 C-fold or 475 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.

D. Liquid-Soap Dispenser:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; Model B2111.
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Surface Mounted.
4. Capacity: 40 oz.
5. Refill Indicator: Window type.

E. Grab Bar:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B5806 x 18, B5806 x 36, B5806 x 42.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel.

    a. Finish: Smooth, No. 4 finish (satin).

4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings.

F. Seat-Cover Dispenser:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; Model B-4221.
2. Mounting: Surface mounted.
3. Minimum Capacity: 250 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).

G. Mirror Unit:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc,; Model B-165 2436
2. Frame: Stainless-steel channel.

    a. Corners: Mitered.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
    b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: 24 x 36 inches.

H. Towel Bar:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; Model B-530.
2. Mounting: Surface mounted.
3. Loading Capacity: 900 lbs.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).

I. Robe Hook:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; Model B-2116.
2. Mounting: Surface mounted.
3. Loading Capacity: 300 lbs.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).

J. ADA Pipe Cover:

1. Basis-of-Design Product: Plumberex; Handy-Shield Maxx, Model 3011.
2. Color: White.

K. Changing Bench:

1. Basis-of-Design Product: Teakworks4U; TBF-30WS.
2. Size: 30” W x 13” D.
3. Mounting: Surface mounted.
4. Loading Capacity: 300 lbs.
5. Exposed Material and Finish:
   a. Stainless steel.
   b. Teak.

2.2 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 123661 - SIMULATED STONE COUNTERTOPS

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. Quartz agglomerate countertops and backsplashes
   2. Solid surface countertops and backsplashes

B. Related Sections:
   1. 123623.13 Plastic Laminate Clad Countertops

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:
   1. One manufacturer’s standard size quartz agglomerate countertop sample
   2. One manufacturer’s standard size solid surface countertop sample

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOPS (QTZ-1)

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top

2. Backsplash: Straight, slightly eased at corner

B. Countertops: 3cm thick, quartz agglomerate with front edge built up with same material

C. Backsplashes: 3cm thick, quartz agglomerate

D. Fabrication: Fabricate tops in one piece with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

E. Basis of Design: See finish legend.

2.2 SOLID SURFACE COUNTERTOP (SOL-1)

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top

2. Backsplash: Straight, slightly eased at corner

B. Countertops: ½” thick, solid surface with front edge built up with same material

C. Backsplashes: ½” thick, solid surface

D. Fabrication: Fabricate tops in one piece with shop-applied edges unless otherwise indicated. Comply with solid surface manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly

E. Basis of Design: See finish legend.

2.3 COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

a. Cambria
b. Cosentino USA
c. Wilsonart

B. Solid Surface:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
a. Wilsonart
b. Lg Hausys
c. Corian

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install backsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION 123661

SECTION 21 00 00

FIRE SUPPRESSION GENERAL CONDITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Conform to General Conditions, Supplementary Conditions, the modifications thereto and Division 1 - General Requirements for all work.

1.2 SUMMARY

A. Design Intent:
1. System to provide coverage for entire building.
2. Provide hydraulically designed (or pipe schedule only if acceptable by authorities having jurisdiction) system to NFPA 13 occupancy requirements.
3. Determine volume and pressure of incoming water supply from water flow test data.
4. Interface system with building fire and smoke alarm systems.
5. Piping from the site connection to the flange at the base of the sprinkler riser is specifically included in Division 21 00 00.

B. **This is a design/build specification.** Provide all required design, permits, labor, materials and installation of fire protection work, complete and operable in accordance with these specifications and drawings. Work of Division 21 includes, but is not limited to, that as delineated in conceptual information shown on the drawings and the following specification sections:

21 00 00 Fire Suppression General Conditions

21 05 00 Common Work Results for Fire Suppression

21 13 13 Wet-Pipe Sprinkler Systems

1.3 CODES AND STANDARDS

A. Conform to following code and agency requirements having jurisdictional authority over fire protection installation.
1. International Building Code (IBC) with local amendments.
2. National Electrical Code (NEC) NFPA 70.
3. Requirements of OSHA.
4. National Fire Protection Association (NFPA) Codes and Standards.
5. ASTM, ASME, ANSI and NEMA standards, as referenced in subsequent sections.
6. Local Water District Requirements.
7. Local Health Department Requirements.

1.4 SUBMITTALS

A. See Division 01 - Submittal Procedures.

B. Field Test Reports: Include results of hydrostatic and flow tests with hydraulic calculations.

C. Design Data: Submit design calculations signed and sealed by NICET Level III Certified Designer.

D. Provide one electronic copy of product data submittals for all products listed under “Part 2 Products” of Division 21 and all additional products noted on drawings or required for completion of project.

E. **Submittals shall be complete in one PDF file with bookmarks for each Division. Multi-part submittals will be returned without review.**
   1. First Page: Name of Project, Owner, Location & Contracting Company.
   2. Index Page: List of specification sections with contents by Tag or item.
   3. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.
   4. Acceptable forms of delivery are:
      a. Email (for file sizes less than 10 MB)
      b. Online File Transfer: Dropbox, Google Drive or similar
      c. FTP: Architects or General Contractors file server (if available)

F. Clearly indicate on each page the equipment schedule designation (Tag) and/or specification section, as applicable. Indicate model and all accessories intended for use.

G. Equipment vendor cover page with contact information shall precede submittal by that vendor.

H. Submitted product information shall include (as applicable) but not be limited to the following information:
   1. Product description
   2. Manufacturer and model
   3. Dimensions
   4. Performance Ratings (i.e. capacity, rpm, HP, temperature)
   5. Construction Materials
   6. Ratings (i.e. UL, FM, NEMA, etc)
   7. Electrical data
   8. Vibration Isolation
   9. Controls and wiring diagrams
   10. Accessories
   11. Engineering technical data (i.e. pressure drops, leakage rates, pump curves)

1.5 SHOP DRAWINGS

A. Prepare Shop Drawings stamped and signed by a NICET Class III Certified designer. Develop in accordance with NFPA 13 and the State and Local Fire Marshals. Submit PDF copies of these drawings for approval prior to beginning work.

B. Submit shop drawings to Architect, Local Fire Marshal, and all other approving authorities. Drawings shall be approved by all agencies prior to fabrication or installation. **Drawings submitted for Architect's approval shall have been stamped approved by the Fire Department.**

C. The Contractor shall draw the design team's attention to any areas in which they contemplate deviations from the conceptual information shown on the contract documents (e.g., due to site conditions).

D. These drawings and diagrams shall show all pipe sizes as well as the manufacturer's name and catalog number of each piece of equipment used.

E. The Architect's review of such drawings shall not relieve the Contractor of responsibility for deviations from the Contract drawings or specifications, nor shall it relieve him from responsibility for errors or omission in such drawings.

F. Fire Sprinkler shop drawings shall indicate all relevant pipe, ceiling, and structural elevations and clearances. All elbows, offsets, and turns shall be clearly identified. All required access doors shall be shown. By submission of sheet fire sprinkler shop drawings, the Contractor acknowledges that coordination has been done to ensure that all ductwork and piping fits and no conflicts exist.

G. Indicate layout of piping and sprinkler locations coordinated with ceiling type, lighting, structural and mechanical. Conform to symmetrical spacing of heads and integrate into locations of lights and other ceiling devices. Center heads on ceiling tiles (+/- 1") and align in straight rows.

H. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Include building sections and a plot plan showing location of underground supply connections, outside control valves, fire department connections and other equipment to be used.

I. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation layout, mounting and support details, and piping connections.

J. Indicate layout of flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.

K. Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.

L. Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation.

M. Indicate system controls.

1.6 FIRE SPRINKLER PERMIT

A. Fire Sprinkler contractor shall prepare all documents for permit application, submit and obtain the permit from reviewing authority. All costs and fees to obtain the permit shall be paid by the Fire Sprinkler Contractor.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 13, Local and/or State Fire Marshal.

B. Perform work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of continuous representation, a stocking distributor and service representative in the State of Washington.

B. Contractor: Licensed and regularly engaged in the specialized design and installation of automatic sprinkler equipment as listed by UL or other nationally recognized testing laboratories. Minimum three years' experience and have installed at least five systems of comparable size.

C. Bids by wholesalers, suppliers or any firm whose principal business is not that of manufacturing and/or installing fire protection systems are not acceptable.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Furnish cast iron and steel valves with temporary protective coating with end caps and closures on piping and fittings. Maintain in place until installation.

C. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

1.10 FIELD MEASUREMENTS

A. Where the word 'verify' is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner.

B. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is

responsible for locating, uncovering, disposing of or maintaining existing systems.

1.11 COORDINATION

A. Visit the site and become familiar with existing conditions affecting work.

B. Verify locations of any overhead or buried utilities on or near site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

C. Mechanical drawings are diagrammatic and do not indicate all possible site conditions. The contractor shall verify all measurements, dimensions and connections on site and coordinate between trades to preclude interferences. The contractor shall provide adjustments to piping as necessary to fit conditions including but is not limited to relocation, offsets, and transitions.

D. In the event of a conflict with other trades of work, the following priority from highest to lowest shall be followed: Structural, lighting, HVAC, plumbing/piping and sprinklers. Starting with the lowest priority, the HVAC, plumbing, and sprinkler contractors shall provide whatever materials, offsets, labor etc. is required to resolve the conflict.

E. When discrepancies occur between plans and specifications, the Architect will determine which takes precedence and the Contractor shall perform the selected requirement at no additional cost.

F. Prior to ordering equipment cross-check mechanical and electrical drawings and specifications to assure proper location and electrical characteristics of connections serving mechanical and electrical equipment.

G. Advise the Architect of any modifications required to suit equipment furnished. Costs for modifications due to equipment substitution will be borne by the contractor.

H. Wherever conflicts occur between different parts of the Contract Documents the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

I. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device of fixture roughed in improperly and not positioned on implied centerlines or as required by good practice must be repositioned at no cost to the Owner.

1.12 CUTTING, FITTING, REPAIRING AND PATCHING

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where necessary for installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting, where possible, by setting sleeves, frames, etc., and by coordinating for openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for ducts and piping.

C. Cut all holes neatly and as small as possible to admit work. Perform cutting in manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

1.13 SALVAGE

A. Remove excess piping and plug or cap any unused branch connections. Remove scrap pipe and all other excess materials from the site.

B. Comply with contractor’s Construction Waste Management Plan.

1.14 EXTRA MATERIALS

A. Provide extra sprinklers under provisions of NFPA 13.

B. Furnish suitable wrenches for each sprinkler type.

C. Furnish metal storage cabinet adjacent to alarm valve. Lettered "Automatic Sprinklers - Reserve Supplies."

1.15 FINAL APPROVAL

A. Completion and approval of the following is required for final approval of systems.
1. Execution of Architect's and Engineer’s final observation reports
2. Operation and maintenance instruction
3. Operation and maintenance manuals submitted
4. Equipment cleaning
5. Record drawings submitted

B. See Division 01.

1.16 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General: In addition to requirements of Division 01, following initial operation of mechanical systems and prior to acceptance by the Architect, perform the following services.

B. At least two weeks prior to each instruction period, give written notification of readiness to proceed to the Architect and Owner, and obtain mutually acceptable dates.

C. Conduct demonstrations and instructions for the Owner's representatives, pointing out requirements for operating, servicing and maintaining equipment and systems. Describe general system operation and specific equipment functions. Cover all equipment calibration, setpoint adjustment, safeties and alarms.

D. Furnish qualifications of Contractor's personnel in charge of the instruction; foreman position is minimum acceptable. Where equipment startup is performed by supplier's or manufacturer's personnel, those personnel should also provide training on that equipment.

E. During demonstrations and instructions include and reference information from maintenance manuals and contract drawings.
   1. Provide documentation of all instruction which includes:
      a. Date and time of instruction
      b. Name, affiliation and qualifications of the instructor
      c. Name and affiliation of the attendees
      d. Topics, systems, and equipment covered
      e. Length of instruction

F. Minimum duration of instruction period is 1 hours.

1.17 OPERATING AND MAINTENANCE MANUALS

A. Contents: Furnish, in accord with Division 1, three (3) bound copies of operating and maintenance manuals to include the following:
   1. Manufacturers, suppliers, contractor names, addresses and phone numbers.
   2. Warranty service contractors' names, address and phone numbers (if different from above).
   3. Schedule and description of routine maintenance for each component to include oiling, lubrication and greasing data.
   4. Test data log.
   5. Manufacturer's cuts and rating tables, including brochures for all submittal items.
   6. Part numbers of all replaceable items.
   7. Control diagrams and operation sequence.
   8. Written guarantees.
   9. Record drawings corrected and completed.
   10. Completed equipment start-up forms and checklists.

B. Binders:
   1. Furnish typewritten or printed index and tabbed dividers between principal categories.
   2. Bind each manual in a hard-backed loose-leaf binder.

C. Imprint on cover:

1. Name of project.
2. Owner.
3. Location of project.
4. Architect.
5. Contractor.
6. Year of completion.

D. Imprint on backing:
1. Name of project.
2. Year of completion.

E. Submittals:
1. Preliminary Copies: Prior to scheduled completion of the project, submit two copies for review by the Architect.
2. Final Copies: After approval of the preliminary copies, submit three (3) finished copies to the Owner.

1.18 EQUIPMENT AND PIPE CLEANING

A. Clean interior and exterior of all equipment. Equipment shall be free of dirt, construction debris, corrosion, etc.

B. Adequate provisions shall be made during construction to eliminate dirt, debris or other material from entering and collecting inside of pipe. Any collection of material shall be thoroughly cleaned before equipment startup and if necessary before owner occupancy.

C. Clean exterior of all exposed pipe.

D. Flush entire piping system of foreign matter.

1.19 RECORD DRAWINGS

A. See Division 1.

B. Submit one DVD or CD with all drawings in PDF and AutoCAD format.

C. Show location of equipment and size of piping. Where appropriate provide tag or label identification for all valves and similar equipment. Indicate locations and elevations of exterior pipe and utility connections. Maintain continuously updated drawings during progress of project.

1.20 TESTING

A. Provide completed start-up forms and checklists.

1.21 WARRANTIES AND CONTRACTOR'S GUARANTEE

A. Furnish one year warranty from date of substantial completion for all systems unless specifically noted otherwise.

B. All work, material and equipment shall be free of defect, complete and in perfect operating order at time of delivery to Owner.

C. Without cost to Owner, **correct all defects and failures discovered within one year from date of final acceptance**, except when in the opinion of the Architect such condition is due to neglect or carelessness of the Owner.

D. The guarantee of the Contractor is independent of shorter time limits by any manufacturer of equipment he has furnished. Submit with Operation and Maintenance Manual all guarantees which exceed one year.

E. Make all necessary adjustments during first year of operation.

F. The presence of any inspector or observer during any construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

PART 2 NOT USED

PART 3 EXECUTION

3.1 DOCUMENTATION

A. Additional plan submittals to Local Fire Marshal: If additional drawing submittals are required at any time during construction contractor shall prepare and submit drawings, review with Fire Marshal, and pick up subsequent approved drawings.

3.2 INSPECTION

A. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work.

B. Should any work be enclosed or covered up before such inspection and test, Contractor shall at his own expense uncover work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Verify devices are installed and connected to fire alarm system.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe
2. Valves
3. Hangers and Support
4. Seismic Controls
5. Identification

1.2 EXPANSION AND SEISMIC DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Expansion Compensation Design Criteria:
1. Installation Temperature: 50 degrees F.
2. Fire Protection System Temperature: 90 degrees F.
3. Safety Factor: 30 percent.

C. Seismic performance: Provide seismic restraint in compliance with local jurisdiction and IBC 1613 requirements.

1.3 QUALITY ASSURANCE

A. Through penetration firestopping of fire rated assemblies: ASTM E814 with 0.10” w.g. minimum positive pressure differential. Minimum 1-hour protection.

B. Installed products shall have surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Perform work in accordance with local jurisdiction’s requirements and AWS D1.1 for welding hanger and support attachments to building structure.

D. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PRODUCTS

2.1 BURIED PIPING

A. Steel Pipe: ASTM A53 Grade B, ASTM A135, ASTM A795 Schedule 40 black.

1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASTM A234, wrought carbon steel and alloy steel; with half-lapped 10 mil polyethylene tape.
2. Cast Iron Fittings: ASME B16.1 flanges and flanged fittings.
3. Joints: AWS D1.1, welded.
4. Protection: ASME C105 polyethylene jacket with heat shrink sleeves or double layer, half-lapped 10 mil polyethylene tape to 6" above grade.

B. Copper Tubing: Type K annealed. ASTM B75, ASTM B88, ASTM B251.
1. Fittings: Cast copper alloy ASME B16.18; wrought copper and bronze, ASME B16.22. Pressure type solder joint.
2. Joints: Silver braze, AWS A5.8 Classification BCuP-3 or BCuP-4; Solder, ASTM B32 Grade 95TA.
3. Protection: ASME C105 polyethylene jacket with heat shrink sleeves or double layer, half-lapped 10 mil polyethylene tape to 6" above grade.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53 Grade B, ASTM A135, ASTM A795 Schedule 40 black; Schedule 10 UL listed light wall; ASTM A-795 Type E, Grade A Eddy-Flow or Dyna-Flow UL listed thin wall flow pipe.
1. Steel Fittings: ASME 16.9, wrought steel, butt welded; ASME B16.25, butt weld; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1 flanges and flanged fittings; ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers. Victaulic, Gruvlok or approved equal.

B. Steel Pipe: ASTM A135 Grade A, UL threadable thin wall, black.
1. Cast Iron Fittings: ASME B16.4, threaded fittings.
2. Malleable Iron Fittings: ASME B16.3 threaded type.

2.3 VALVES

A. Manufacturers: UL & FM approved by Nibco, Stockham, Milwaukee or approved equal.

B. Gate Valves:
1. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.
2. Over 4 inches: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends.

C. Ball Valves:

1. Up to and including 2 inches: Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded or sweat fitting ends.

D. Butterfly Valves:
1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper proof switch where required.
2. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends. With extended neck, hand wheel and gear drive and integral indicating device where required.

E. Check Valves:
1. Up to 2 inches: Bronze body and swing disc, rubber seat, threaded ends.
2. 2 to 4 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, grooved or flanged ends.
3. 4 inches and over: Iron body, bronze disc with stainless steel spring, resilient seal, wafer, grooved or flanged ends.

F. Drain Valves:
1. Compression Stop: Bronze with hose thread nipple and cap.
2. Ball Valve: Brass with cap and chain, 3/4 inch hose thread.

2.4 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13.

B. Hangers for Pipe Sizes 1 to 6 inch: Carbon steel, adjustable swivel, band hanger. Tolco Fig 200 or equal.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.5 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Metraflex, Mason or approved equal.

B. Steel Piping:
1. UL Listed
2. Inner Hose: Stainless Steel.

3. Exterior Sleeve: Braided stainless steel.
4. Joint: Flanged, threaded with union or welded, as specified for pipe joints.
5. Maximum offset: 3/4 inch.

2.6 FLEXIBLE SPRINKLER HOSE CONNECTIONS

A. Manufacturers: FlexHead or approved equal.

B. Performance:
1. FM Approved for its intended use pursuant to FM 1637 Approval Standard for Flexible Sprinkler Hose with Threaded End Fittings.
2. UL Listed for its intended use pursuant to UL 2443 Standard for Flexible Sprinkler Hose with Fittings for Fire Protection Service.
3. Seismically qualified for use pursuant to ICC-ES AC-156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

C. Flexible Hose Assemblies and End Fittings:
1. 100% Type 304 Stainless Steel.
2. Straight Hose Assembly or Elbow Hose Assembly.
3. ½ inch or ¾ inch outlet.
4. 175 psi / 300 psi maximum rated pressure.
5. Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter.

D. Ceiling Bracket:
1. Type G90 Galvanized Steel.
2. Direct attachment type, having integrated snap-on clip ends positively attached to the ceiling using tamper-resistant screws.
3. Flexible Hose Attachment: Removable hub type with set screw.

2.7 FIRESTOPPING-APPLIED

A. Manufacturers: RectorSeal, Dow Corning, 3M Fire Protection or approved equal.

B. General:
1. Fire stopping materials shall conform to Flame (F) and Temperature (T) ratings as required by applicable building codes and tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests for through penetrations, and ASTM E 1966 or UL 2079 for construction joints, and UL 2307 for perimeter edge joints.
2. Fire stopping material shall be free of asbestos, PCBs, ethylene glycol, and lead.
3. Do not use any product containing solvents or that requires hazardous waste disposal.
4. Fire stopping shall be performed by a contractor trained or approved by firestop manufacturer.
5. Select products with rating not less than rating of wall or floor being penetrated.

C. Single Source Responsibility: Provide firestop systems for all conditions from a single supplier.

D. Product Description: Provide Latex caulk/sealant, Silicone caulk/sealant, Intumescent Wrap Strip, Firestop Putty, Firestop Collar or Intumescent Sleeve to meet each specific application and performance requirement.

E. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

F. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
   1. Forming/Damming Materials: Mineral fiberboard, backer rod or other type recommended by Manufacturer's tested system.

2.8 MECHANICAL SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal, Thunderline Link-Seal or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.9 MECHANICAL FIRESTOPPING SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal 120 or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking intumescent synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. UL listed for 2 hour fire protection.

2.10 PIPING ACCESSORIES

A. Manufacturers: Grinnell, EMCO Wheaton, OPW or approved equal.

B. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

C. Swivel Joints: Fabricated steel, bronze, ductile Iron or cast steel body, double ball bearing race, field lubricated, with rubber or Buna-N o-ring seals.

2.11 PIPE MARKERS

A. Color and Lettering shall conform to ASME A13.1.

B. Fire service piping labels shall be red background with white lettering. Legend shall indicate service of pipe.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.1 PREPARATION - PIPING

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges, unions or grooved couplings.

3.2 INSTALLATION - PIPING

A. Install piping in accordance with NFPA 13 for sprinkler systems.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install pipe sleeve at piping penetrations through footings, partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Pipe Hangers and Supports:
1. Install in accordance with NFPA 13.
2. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
7. Install copper plated hangers and supports for copper piping.
8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

H. Slope piping and arrange systems to drain at low points.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Do not penetrate building structural members unless indicated.

K. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.

L. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

N. Install gate, ball, or butterfly valves for shut-off or isolating service.

O. Install drain valves at main shut-off valves, low points of piping and apparatus.

3.3 INSTALLATION – SEISMIC CONTROLS

A. Provide seismic restraints and hangers in compliance with NFPA 13.

B. Seismic Bracing: Follow NFPA 13 and the following.
1. Bracing shall be bidder designed to resist seismic loading.
2. Provide seismic calculations as required for Ip = 1.5.

3.4 INSTALLATION – FIRESTOPPING AND SEALS AT PARTITIONS

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings. Primers must comply with VOC limits per Green Seal standards GS-03 (1997), GS-11 (1993), or SCAQMD Rule #1113 (2004).

C. Place intumescent coating in sufficient coats to achieve rating required.

D. Clean adjacent surfaces of firestopping materials.

E. Fire Rated Surface:
1. Seal opening at floor, wall, partition, ceiling, and/or roof as follows:
a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
c. Pack void with backing material.
d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

F. Non-Rated Surfaces:
1. Seal opening through non-fire rated wall, partition, floor, ceiling, and/or roof opening as follows:
a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
2. Install escutcheons where piping penetrates non-fire rated surfaces in occupied spaces.
3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations air tight. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - IDENTIFICATION

A. Identification is not required on sprinkler branch lines and run-outs to heads.

B. Identification is required on:
1. Bulk mains
2. Incoming fire service
3. FDC piping
4. Standpipe (not in stairwell)

C. Identify service and flow direction (and pressure where more than one pressure is used). Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Install a minimum of one label for each story traversed by piping.

D. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

E. Install labels with sufficient adhesive for permanent adhesion.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Inserts:
1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.7 MANUFACTURER'S FIELD SERVICES

A. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wet-pipe sprinkler system design, installation, and certification.

1.2 SYSTEM DESCRIPTION

A. This section requires design and installation of wet pipe sprinkler systems for building fire protection.

B. Perform work in accordance with NFPA 13, state and local municipality having jurisdiction.

C. Determine volume and pressure of incoming water supply from water flow test data. Revise design when test data become available prior to submittals.

D. Interface system with building fire and smoke alarm system.

E. Provide fire department connections. Note if location(s) are indicated on Drawings.

F. Fire suppression system shall not contain ozone depleting substances such as halons, CFC's and HCFC's.

PART 2 PRODUCTS

2.1 SPRINKLERS

A. Manufacturers: Tyco, Reliable, Viking or approved equal.

B. Provide "quick response" heads in all residential occupancies.

C. Provide "quick response" heads in all light hazard occupancies.

D. Suspended T-bar Ceiling Type:
1. Type: Semi-recessed pendant type with matching escutcheon plate.
2. Sprinkler and escutcheon plate finish: Chrome plated factory finish.
3. Fusible link: Glass bulb type temperature rated for specific area hazard.

E. GWB Ceiling Type:
1. Type: Semi-recessed pendant type with matching escutcheon plate.
2. Sprinkler and escutcheon plate finish: Chrome plated factory finish.
3. Fusible link: Glass bulb type temperature rated for specific area hazard.

F. Exposed Area Type:
1. Type: Standard upright type.
2. Finish: Brass
3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

G. Side wall Type:
1. Type: Standard horizontal side wall type.
2. Sprinkler and escutcheon plate finish: Brass (exterior) \ Chrome plated (interior) factory finish.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

H. Guards: Finish matching sprinkler finish.

2.2 PIPING SPECIALTIES

A. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.

B. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts.

2.3 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Controls: Supervisory switches. Coordinate with fire alarm section of work.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13.

B. Install pressure gauges on each side of sprinkler alarm valve.

C. Install approved backflow assembly at sprinkler system water source connection.

D. Locate outside alarm on building exterior wall.

E. Place pipe runs to minimize obstruction to other work.

F. It shall be a specific requirement that insofar as possible, all sprinkler system mains and branches shall be installed as close as possible to the structural members, not the ceiling.

G. Install main piping in concealed spaces above finished ceilings or soffits; branch piping in joist space or other concealed space to sprinkler heads.

H. Center sprinklers in two directions in ceiling tile and install piping offsets.

I. Install guards on sprinklers exposed to potential damage.

J. Provide drains at system low points.

K. Hydrostatically test entire system.

L. Testing must be witnessed by Authorities having jurisdiction.

3.2 CLEANING

A. Flush entire piping system of foreign matter.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace painted sprinklers with new.

END OF SECTION

SECTION 22 00 00

PLUMBING GENERAL CONDITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Conform to General Conditions, Supplementary Conditions, the modifications thereto and Division 01 - General Requirements for all work in Division 22.

1.2 SUMMARY

A. Design Intent: New plumbing systems, fixtures, and equipment for the remodel of an existing fire station. Systems included are, but are not limited to, domestic cold water, hot water, hot water recirculation, irrigation, storm, waste, vent, natural gas, condensate and compressed air.

B. Provide labor, materials and appliances necessary for satisfactory installation of mechanical work ready to operate in strict accordance with these specifications and drawings. Work of Division 22 includes, but is not limited to, that as delineated in the following specification sections:

22 00 00 Plumbing General Conditions

22 05 00 Common Work Results for Plumbing

22 07 00 Plumbing Insulation

22 11 00 Facility Water Distribution

22 13 00 Facility Sanitary Sewerage

22 14 00 Facility Storm Drainage

22 15 00 General Service Compressed Air Systems

22 23 00 Natural-Gas Systems

22 30 00 Plumbing Equipment

22 40 00 Plumbing Fixtures

C. TEST AND BALANCE: Provided by 23 05 93. Provide all necessary coordination, assistance and documentation.

1.3 CODES AND STANDARDS

A. Conform to following code and agency requirements having jurisdictional authority over mechanical installations.
1. Uniform Plumbing Code (UPC) with local amendments.
2. International Mechanical Code (IMC) with local amendments.
3. International Building Code (IBC) with local amendments.
4. International Fuel Gas Code (IFGC) with local amendments.
5. National Electrical Code (NEC) NFPA 70.
6. Requirements of OSHA and EPA.
7. National Fire Protection Association (NFPA) Codes and Standards.
8. ASME code for construction of pressure vessels.
9. American Gas Association (AGA) Standards.
10. ASTM, ANSI and NEMA standards, as referenced in subsequent sections.
11. Local Sewer District Requirements.
12. Local Water District Requirements.
13. Local Health Department Requirements.
14. Washington State Energy Code.

1.4 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to International Building Code with local amendments, FM and UL for fire resistance ratings and surface burning characteristics.

B. Provide vibration isolation on motor driven equipment, plus connected piping.

1.5 PRODUCT SUBSTITUTIONS:

A. Manufacturers and models of equipment and material indicated herein and on drawings are those upon which mechanical design is based. Other manufacturers with products considered equal in general quality may be listed without specific model designation. Manufacturers not listed must be submitted for approval.

B. Substitutions will be evaluated based on product manufacturer only. Specific product model, specifications, options and accessories will be evaluated during submittals. Approval of a manufacturer substitution does not constitute approval of the submitted product.

C. Any equipment other than the basis of design is considered a substitution.

D. In selecting substitute equipment, the Contractor is responsible for and must guarantee equal performance and fit. Cost of redesign and all additional costs incurred to accommodate the substituted equipment shall be borne by the Contractor.

E. Unless indicated otherwise, "or approved" may be assumed for all products in Division 22.

1.6 SUBMITTALS

A. Provide one electronic copy of product data submittals for all products listed under “Part 2 Products” of Division 22 and all additional products noted on drawings or required for completion of sequence of operations.

B. **Submittals shall be complete in one PDF file with bookmarks for each Division. Multi-part submittals will be returned without review.**
   1. First Page: Name of Project, Owner, Location & Contracting Company.
   2. Index Page: List of specification sections with contents by Tag or item.
   3. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.
   4. Acceptable forms of delivery are:
      a. Email (for file sizes less than 10 MB)
      b. Online File Transfer: Dropbox, Google Drive or similar
      c. FTP: Architects or General Contractors file server (if available)

C. Clearly indicate on each page the equipment schedule designation (Tag) and/or specification section, as applicable. Indicate selected model and all accessories intended for use.

D. Equipment vendor cover page with contact information shall precede submittal by that vendor.

E. Submitted product information shall include (as applicable) but not be limited to the following information:
   1. Product description
   2. Manufacturer and model
   3. Dimensions
   4. Performance Ratings (i.e. capacity, rpm, HP, temperature)
   5. Construction Materials
   6. Ratings (i.e. UL, ASTM, NEMA, etc)
   7. Electrical data
   8. Sound level data (corresponding to scheduled values)
   9. Vibration Isolation
   10. Controls and wiring diagrams
   11. Accessories
   12. Engineering technical data (i.e. pressure drops, leakage rates, pump curves)

F. If requested by Architect or Engineer, submit Manufacturer's Installation Instructions on any equipment, procedures, or certifications so requested.

G. Do no ordering, fabrication or manufacturing of products until return of approved submittals.

1.7 SHOP DRAWINGS

A. The Contractor shall submit drawings and/or diagrams for review and for job coordination in all cases where deviation from the Contract Drawings are

contemplated because of job conditions, interference or substitution of equipment, or when requested by the Engineer for purposes of clarification of the Contractor's intent. Also submit detailed drawings, rough-in sheets, etc., for all special or custom-built items or equipment. Drawings and details under the section shall include (but not be limited to) the following, where applicable to this project:

1. Electrical interlock wiring diagrams.
2. Piping layout plans and interference details.
3. Custom sink layout.

B. By submission of plumbing shop drawings, the Contractor acknowledges that coordination has been done to ensure that all piping fits and no conflicts exist.

C. The Architect's review of shop drawings shall not relieve the Contractor of responsibility for deviations from the Contract drawings or specifications, unless he has, in writing, called the attention of the Architect to such deviations at the time of the submission, nor shall it relieve him from responsibility for errors or omission in such shop drawings.

1.8 COMMISSIONING

A. See Section 23 08 00 for roles and responsibilities of commissioning.

B. Provide all necessary commissioning assistance, equipment and documentation as required by the Commissioning Plan.

C. The duty and responsibility for all Division 22 commissioning work shall be assigned to a specific individual. Inform the General Contractor, Commissioning Professional (CCXP) of the contact information for the person so assigned.

D. Perform corrective actions needed to resolve deficiencies identified during commissioning. Record action taken on commissioning deficiency log.

1.9 PLUMBING PERMIT

A. Plumbing contractor shall prepare all documents for plumbing permit application, submit for and obtain the permit. All costs and fees to obtain the permit shall be paid by the Plumbing Contractor.

B. Contractor shall not commence work until permit is obtained. Contractor is solely responsible to insure that the permit application and any revisions are submitted in a timely manner so as not to impact project schedule.

1.10 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 – Building Services Piping for installation of piping systems and ASME Section IX – Welding and Brazing Qualifications for welding materials and procedures.

B. Perform Work in accordance with the Uniform Plumbing Code including State and local amendments.

C. Provide products requiring electrical connections listed and classified by UL as suitable for purpose specified and indicated.

D. Perform Work in accordance with Washington State Energy Code.

1.11 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.12 SEQUENCING

A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect all equipment, materials, and insulation from weather, construction traffic, dirt, water, chemicals, and damage by storing in original packaging and under cover. Where original packaging is insufficient, provide additional protection. Maintain protection in place until installation.

C. Inspect all products and materials for damage prior to installation.

D. Protect piping from all entry of foreign materials by providing temporary end caps or closures on piping and fittings. Furnish temporary protective coating on cast iron and steel valves.

E. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

F. Protect materials and finishes during handling and installation to prevent damage.

G. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

H. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.14 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.

B. Provide ventilation in areas to receive solvent cured materials.

C. Do not install underground piping or valves when bedding is wet or frozen.

D. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer. Maintain temperature during and after installation for minimum period of 24 hours.

E. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.15 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Verify by field measurements, sizes and configurations are compatible with wall construction and layout.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining existing systems.

1.16 COORDINATION

A. Visit the site and become familiar with existing conditions affecting work.

B. Verify locations of any overhead or buried utilities on or near site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining existing systems.

D. Plumbing drawings are diagrammatic and do not indicate all possible site conditions. The contractor shall verify all measurements, dimensions and connections on site and coordinate between trades to preclude interferences. The contractor shall provide adjustments to piping as necessary to fit conditions including but is not limited to relocation, offsets, and transitions.

E. In the event of a conflict with other trades of work, the following priority from highest to lowest shall be followed: Structural, lighting, HVAC, plumbing/piping and sprinklers. Starting with the lowest priority, the HVAC, plumbing, and

sprinkler contractors shall provide whatever materials, offsets, labor etc. is required to resolve the conflict.

F. When discrepancies occur between plans and specifications, the Architect will determine which takes precedence and the Contractor shall perform the selected requirement at no additional cost.

G. Prior to ordering equipment cross-check plumbing and electrical drawings and specifications to assure proper location and electrical characteristics of connections serving mechanical and electrical equipment.

H. Advise the Architect of any modifications required to suit equipment furnished. Costs for modifications due to equipment substitution will be borne by the contractor.

I. Wherever conflicts occur between different parts of the Contract Documents the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

J. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device or fixture roughed in improperly and not positioned on implied centerlines or as required by good practice must be repositioned at no cost to the Owner.

K. Where the word ‘verify’ is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner.

L. Coordinate trenching, excavating, bedding, backfilling of buried systems with requirements of this specification.

M. Coordinate wall openings, piping rough-in locations, concrete housekeeping pads, and electrical rough-in locations to accommodate Work of this Section.

1.17 CUTTING, FITTING, REPAIRING AND PATCHING

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where necessary for installation of plumbing work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting, where possible, by setting sleeves, frames, etc., and by coordinating for openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for piping.

C. Cut all holes neatly and as small as possible to admit work. Perform cutting in manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

1.18 SALVAGE

A. Remove excess piping and plug or cap any unused branch connections. Remove scrap pipe and all other excess materials from the site.

B. Comply with contractor's Construction Waste Management Plan.

1.19 ELECTRICAL

A. Motor Starters: By plumbing equipment manufacturer where factory mounted controls are provided. Variable frequency drives by Division 22, all other starters provided by Electrical Contractor.

B. Power Wiring: By Electrical Contractor.

C. Control Wiring: Responsibility of Division 22, including all line and low voltage control wiring. Owner will not entertain additional cost due to lack of coordination between Plumbing Contractor and Electrical Contractor.

1.20 PROJECT CLOSEOUT

A. Completion, submission and approval of the following is required for final project closeout.
1. Execution of Architect's and Engineer's final observation reports (punchlist)
2. Operating and Maintenance Instructions
3. Operating and Maintenance Manual
4. Equipment and Pipe Cleaning
5. Record Drawings
6. Testing
7. Commissioning
8. Warranty

B. See Division 01 for additional requirements.

1.21 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General: In addition to requirements of Division 01, following initial operation of plumbing systems and prior to acceptance by the Architect, perform the following services.

B. At least two weeks prior to each instruction period, give written notification of readiness to proceed to the Architect and Owner, and obtain mutually acceptable dates.

C. Conduct demonstrations and instructions for the Owner's representatives, pointing out requirements for operating, servicing and maintaining equipment and systems. Describe general system operation and specific equipment functions. Cover all equipment calibration, setpoint adjustment, safeties and alarms.

D. Furnish qualifications of Contractor's personnel in charge of the instruction; foreman position is minimum acceptable. Where equipment startup is performed by supplier's or manufacturer's personnel, those personnel should also provide training on that equipment.

E. During demonstrations and instructions include and reference information from maintenance manuals and contract drawings.
   1. Provide documentation of all instruction which includes:
      a. Date and time of instruction
      b. Name, affiliation and qualifications of the instructor
      c. Name and affiliation of the attendees
      d. Topics, systems, and equipment covered
      e. Length of instruction

F. Minimum duration of instruction periods:
   1. Plumbing Systems 4 hours

1.22 OPERATING AND MAINTENANCE MANUALS

A. Contents: Furnish, in accord with Division 1, three (3) bound copies of operating and maintenance manuals to include the following:
   1. Manufacturers, suppliers, contractor names, addresses and phone numbers.
   2. Warranty service contractors' names, address and phone numbers (if different from above).
   3. Schedule and description of routine maintenance for each component to include oiling, lubrication and greasing data.
   4. Test data log.
   5. Manufacturer's cuts and rating tables, including brochures for all submittal items.
   6. Part numbers of all replaceable items.
   7. Control diagrams and operation sequence.
   8. Written guarantees.
   9. Record drawings corrected and completed.
   10. Completed equipment start-up forms and checklists.

B. Operation and Maintenance Data:
   1. Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.
   2. Submit fixture, trim, exploded view and replacement parts lists.
   3. Submit replacement part numbers and availability, and nearest service depot location and telephone number.

C. Binders:
   1. Furnish typewritten or printed index and tabbed dividers between principal categories.
   2. Bind each manual in a hard-backed loose-leaf binder.

D. Imprint on cover:
   1. Name of project.

2. Owner.
3. Location of project.
4. Architect.
5. Contractor.
6. Year of completion.

E. Imprint on backing:
1. Name of project.
2. Year of completion.

F. Submittals:
1. Preliminary Copies: Prior to scheduled completion of the project, submit two copies for review by the Architect.
2. Final Copies: After approval of the preliminary copies, submit three (3) finished copies to the Owner.

1.23 EQUIPMENT AND PIPE CLEANING

A. Clean interior and exterior of all equipment. Equipment shall be free of dirt, construction debris, corrosion, etc.

B. Adequate provisions shall be made during construction to eliminate dirt, debris or other material from entering and collecting inside of pipe and equipment. Any collection of material shall be thoroughly cleaned before equipment startup and if necessary again before owner occupancy.

C. Clean exterior of all exposed pipe and equipment.

1.24 RECORD DRAWINGS

A. Submit one CD or DVD with all drawings in PDF format.

B. Show location of equipment, location and size of piping. Locate all valves and similar equipment with tag or label identification. Indicate locations and elevations of exterior pipe and utility connections. Maintain continuously updated drawings during progress of project.

C. Record actual locations of equipment, clean-outs, controlling devices, and all above grade, under-floor, and buried piping.

1.25 TESTING

A. Provide completed start-up forms and checklists.

B. Coordinate Test and Balance with Division 23 05 93. Provide all necessary assistance and documentation.

1.26 WARRANTIES AND CONTRACTOR'S GUARANTEE

A. All work, material and equipment shall be free of defect, complete and in perfect operating order at time of delivery to Owner.

B. Furnish one year warranty from date of substantial completion for all systems unless specifically noted otherwise.

C. Without cost to Owner, **correct all defects and failures discovered within one year from date of final acceptance**, except when in the opinion of the Architect a failure is due to neglect or carelessness of the Owner.

D. The guarantee of the Contractor is independent of shorter time limits by any manufacturer of equipment furnished. Submit with Operation and Maintenance Manual all guarantees that exceed one year (e.g.: water heaters).

E. Make all necessary balancing and control adjustments during first year of operation.

F. The presence of any inspector or observer during any construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

PART 2 NOT USED

PART 3 EXECUTION

3.1 DOCUMENTATION

A. Additional plan submittals to reviewing authority: If additional drawing submittals are required at any time during construction contractor shall submit drawings, review with authority, and pick up subsequent approved drawings. Engineer will revise and/or prepare drawings for submittal.

3.2 INSPECTION

A. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work.

B. Should any work be enclosed or covered up before such inspection and test, Contractor shall at his own expense uncover work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition.

3.3 FIELD QUALITY CONTROL

A. Inspect installed fire stopping for compliance with specifications and submitted schedule.

B. Inspect isolated equipment after installation for proper movement clearance.

C. Test domestic water piping system in accordance with applicable code and local authority having jurisdiction.

D. Test sanitary waste and vent piping system in accordance with applicable code and local authority having jurisdiction.

E. Test storm drainage piping system in accordance with applicable code and local authority having jurisdiction.

3.4 CLEANING

A. Clean adjacent surfaces of fire stopping materials.

B. Clean plumbing fixtures and equipment.

C. Use acceptable cleaning products per IAQ Management Plan.

3.5 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

B. Do not permit use of plumbing fixtures before final acceptance.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. General Plumbing Valves.
2. Hangers and Supports.
3. Vibration and Seismic Controls.
4. Firestopping.
5. Access Panels
6. Tags and Identification.
7. Execution

1.2 GENERAL REQUIREMENTS

A. Comply with requirements and recommendations of Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58 and SP-69.

B. Comply with Federal "Reduction of Lead in Drinking Water Act" – 2011. Pipes, pipe fittings, plumbing fittings and fixtures shall be "Lead Free" meaning not more than a weighted average of 0.25% lead in wetted surfaces.

1.3 SCOPE

A. This section includes products, assemblies and methods applicable to more than one of the systems specified in the following sections of Division 22.

1.4 MATERIALS AND EQUIPMENT

A. Where two or more units of same class of equipment are required, use products of a single manufacturer. All equipment shall be new and free from damage.

B. Provide major equipment components with manufacturer's name, address, catalog number and capacity indicated on a nameplate, securely affixed in a conspicuous place.

C. Furnish standard and fabricated hangers and supports complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

1.5 QUALITY ASSURANCE

A. Installed products shall have surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Perform work in accordance with local jurisdiction's requirements and AWS D1.1 for welding hanger and support attachments to building structure.

PART 2 PRODUCTS

2.1 GENERAL VALVE REQUIREMENTS

A. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted. Brass valves are not permitted.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

2.2 GATE VALVES

A. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham or approved equal.

B. 4 inches and Smaller: Use ball valve or butterfly valve in lieu of gate valve.

2.3 BALL VALVES

A. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham or approved equal.

B. 2 inches and Smaller: Lead-Free, NSF-61-8, UPC-IGC-157, MSS SP 110, 600 psi WOG, two piece silicon performance bronze body, bronze trim, bronze ball, full port, PTFE seats, blow-out proof stem, solder or threaded ends with union, lever handle. For insulated piping provide 2" extended handles of non-thermal conductive material. Nibco Model T/S-585-80-LF.

2.4 CHECK VALVES

A. Swing Check Valves:
   1. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham or approved equal.
   2. 2 inches and Smaller: Lead-Free, NSF-61-8, MSS SP 80, 200 psi CWP, silicone performance bronze body and cap, bronze disc with PTFE seat, Y-pattern design, solder or threaded ends. Nibco Model T/S-413-Y-LF.

B. Spring Loaded Check Valves:
   1. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham, Titan or approved equal.
   2. 2 inches and Smaller: Lead-Free, NSF-61-8, MSS SP 80, 250 psi CWP, silicone performance bronze body, in-line spring lift check, silent closing, PTFE disc, integral seat, solder or threaded ends. Nibco Model T/S-480-Y-LF.

2.5 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports with incompressible insulation inserts and shields for all piping to be insulated per 220700.
   1. Manufacturer: Pipe Shields, INC or approved equal.
   2. Material: Calcium Silicate or Uretherne per temperature application.
   3. Thickness: Insert thickness shall match required insulation thickness per 220700.

B. Plumbing Piping - DWV: Cast-iron or PVC
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   4. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   5. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
   6. Vertical Support: Steel riser clamp.
   7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   8. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water: Copper
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring, with rigid insulation inserts.
   2. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis, with rigid insulation inserts and saddle.
   3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   4. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   5. Vertical Support: Steel riser clamp.
   6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   7. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   8. Copper Pipe Support: Copper-plated, Carbon-steel ring.

D. Steel Piping: Natural Gas, LPG, Fuel Oil
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
   2. Hangers for Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   4. Vertical Support: Steel riser clamp.
   5. Floor Support for Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

E. Secondary Pipe Positioning and Supports:
1. Makeshift, field devised methods of plumbing pipe support, such as with the use of scrap framing materials, are not allowed. Support and positioning of piping shall be by means of engineered methods that comply with IAPMO PS 42-96. Hubbard "HOLDRITE" support systems or approved equal.
2. For vertical mid-span supports of piping 4” and under, use HOLDRITE Stout Brackets™ with HOLDRITE Stout Clamps or two-hole pipe clamps (MSS Type 26).
3. For plenum applications use pipe supports that meet ASTM E-84 25/50 standards, such as the HOLDRITE Flame Fighter™ or approved equal.

2.6 HANGER ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.7 INSERTS

A. Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.8 ACCESS PANELS

A. Milcor or approved equal.

B. Include an allowance for a minimum of 12 access panels.

C. Architectural grade, 14 guage frame and door, painted steel or stainless steel based on application.

2.9 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, 300 psi CWP, malleable iron, threaded.
2. Copper Piping: Class 150, 300 psi CWP, bronze unions.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
4. PVC Piping: PVC.
5. CPVC Piping: CPVC.

B. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or Schedule 80 threaded PVC pipe (ASTM D2464).

2.10 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Metraflex, Mason or approved equal.

B. Braided Stainless Steel (Pump Connection)

1. 304 Stainless Steel flexible hose, close pitch, annular corrugated.
2. 304 Stainless Steel double braided outer covering.
3. ANSI Class 150 carbon steel flanges or carbon steel male pipe thread.
4. UL listed, ANSI/NSF-61

2.11 FLASHING

A. Metal Flashing: 26 gage galvanized steel.

B. Metal Counterflashing: 22 gage galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.12 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.

C. Sealant: Acrylic

D. Size large enough to allow for movement due to expansion and to provide for continuous insulation or installation of fire sealant at fire-rated walls. Note that insulation is discontinuous at fire walls.

2.13 MECHANICAL SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal, Thunderline Link-Seal or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.14 MECHANICAL FIRESTOPPING SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal 120 or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking intumescent synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. UL listed for 2 hour fire protection.

2.15 FORMED STEEL CHANNEL

A. Manufacturers: Allied Tube & Conduit, B-Line Systems, Unistrut or approved equal.

B. Product Description: Galvanized 12 gage steel with holes 1-1/2 inches on center.

2.16 SUPPORT ACCESSORIES

A. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

B. Swivel Joints: Bronze body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

2.17 FIRESTOPPING-APPLIED

A. Manufacturers: RectorSeal, Dow Corning, 3M Fire Protection or approved equal.

B. General:
1. Fire stopping materials shall conform to Flame (F) and Temperature (T) ratings as required by applicable building codes and tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests for through penetrations, and ASTM E 1966 or UL 2079 for construction joints, and UL 2307 for perimeter edge joints.
2. Fire stopping material shall be free of asbestos, PCBs, ethylene glycol, and lead.
3. Do not use any product containing solvents or that requires hazardous waste disposal.
4. Fire stopping shall be performed by a contractor trained or approved by firestop manufacturer.
5. Select products with rating not less than rating of wall or floor being penetrated.

C. Single Source Responsibility: Provide firestop systems for all conditions from a single supplier.

D. Product Description: Provide Latex caulk/sealant, Silicone caulk/sealant, Intumescent Wrap Strip, Firestop Putty, Firestop Collar or Intumescent Sleeve to meet each specific application and performance requirement.

E. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

F. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
1. Forming/Damming Materials: Mineral fiberboard, backer rod or other type recommended by Manufacturer’s tested system.

2.18 VIBRATION ISOLATORS

A. Manufacturers: Mason, Amber Booth or approved equal.

B. Restrained Closed Spring Isolators:
1. Spring Isolators:
a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
b. Code: Color code springs for load carrying capacity.
2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.

C. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
a. 30 durometer.
b. Minimum 1/2 inch thick.
c. Maximum loading 40 psi.
d. Height of ribs: not to exceed 0.7 times width.
2. Configuration: Single layer.

D. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.

2.19 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches high.

B. Metal Tags: Brass, Aluminum or Stainless Steel with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges. Plain English designations.

C. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Plain English designations so no chart or index is required.

2.20 PIPE MARKERS

A. Color and Lettering shall conform to ASME A13.1 and UPC. Specific examples are noted in the table below.

Service	Background Color	Letter Color	Legend

Domestic Cold Water	Green	White	DOMESTIC COLD WATER
Domestic Hot Water	Green	White	DOMESTIC HOT WATER
Domestic Recirculation	Green	White	DHW RECIRC
Waste	Black	White	SANITARY SEWER
Vent	Black	White	SANITARY VENT
Condensate Drain	Black	White	CONDENSATE
Storm Drainage	Black	White	STORM
Non-potable Water (NPW)	Yellow	Black	CAUTION: NONPOTABLE WATER, DO NOT DRINK
Compressed Air	Blue	White	COMPRESSED AIR
Natural Gas	Yellow	Black	NATURAL GAS

B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, imprinted with service type in large letters, manufactured for direct burial service.

E. Underground Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with service type in large letters.

2.21 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color-coded head.

B. Color code plumbing valves green.

2.22 LOCKOUT DEVICES

A. Lockout Hasps: Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices: Nylon device preventing access to valve operator, accepting lock shackle.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Provide access to existing piping and equipment and other installations remaining active and requiring access.

B. Extend existing piping installations using materials and methods compatible with existing installations.

3.2 SURFACE PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond of adhesives or firestopping.

C. Install backing or damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before drilling or cutting structural members.

E. Degrease and clean surfaces to receive adhesive for identification materials.

3.3 INSTALLATION-CLEARANCE

A. Appliances and equipment shall be accessible for inspection, service, repair and replacement.

B. A minimum of 36” of clearance shall be provided in front of the control side of appliances and equipment. Provide additional space when required by NEC.

3.4 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.5 INSTALLATION – ACCESS PANELS

A. Furnish access panels for installation at all concealed equipment which requires service, maintenance or adjustment to include but not limited to equipment, valves, open drains, control valves and controls.

B. Provide location layout and required size for all access panels to general contractor. Layout shall be regular and consistent, maintain a uniform wall panel height of 24” centerline above finished floor, unless noted otherwise.

C. Provide fire rated access panels where installed in fire rated assembly.

D. Provide stainless steel access panels where installed in tile surfaces.

E. Furnish access panels to general contractor for installation.

F. Paint installed access panels to match wall or ceiling. Verify that panels are not painted shut.

3.6 INSTALLATION - VALVES

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access panels where valves and fittings are not accessible.

F. Insulate valves according to application in Section 22 07 00.

G. For installation of valves in domestic water systems refer to Section 22 11 00.

3.7 VALVE APPLICATIONS

A. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

B. Install globe valves for throttling, bypass, or manual flow control services.

C. Install spring loaded check valves on discharge of pumps.

3.8 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

F. Where piping is parallel and at same elevation, provide multiple pipe or trapeze hangers.

G. Adjust hangers and supports as required to bring system to proper line and grade. Piping shall be plumb with floor and parallel/perpendicular to building structure.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping, or sheet lead packing between pipe and hanger.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation. Insulated piping shall have insulation run continuous through hangers and supports with use of rigid inserts. Insulation shall be glued to both sides of insert at hangers and supports, no insulation gaps are allowed. Refer to Section 22 07 00.

M. Support of pipe, tubing and equipment shall be accomplished by means of engineered products, specific to each application. Makeshift, field devised methods shall not be allowed.

N. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

3.9 INSTALLATION – SEISMIC CONTROLS

A. Provide seismic restraints and hangers in compliance with IBC 1613 and ASCE 7.

B. Seismic Bracing: Follow IBC 1613, ASCE 7, SMACNA Seismic Restraint Manual and the following.
   1. Bracing shall be bidder designed to resist seismic loading in accord with Chapter 16 of the International Building Code, ASCE 7 or the SMACNA guideline.
   2. Provide seismic calculations as required for Ip = 1.5.

3.10 INSTALLATION-PIPING PROTECTION

A. Provide protective shield plates in concealed locations where piping, other than cast-iron or steel, is installed in studs, joists or rafters. Plates shall be 16 gage steel and cover the pipe area plus 2". Shields may be omitted if piping is more than 1-1/2" from nearest edge of structural member.

B. Prevent contact between dissimilar metals, such as copper tubing and steel, by use of copper-plated, plastic coated, or flexible materials. All supports which contact copper tubing shall be copper plated.

3.11 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members, formed steel channel or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

E. When water heaters and similar equipment are installed in a suspended application, an engineered and manufactured platform, such as the Hubbard Enterprises/HOLDRITE Suspended Water Heater Platform shall be used. Weight loading capability shall include a minimum safety factor of 2.

3.12 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around pipes penetrating equipment rooms for sound control.

C. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

D. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

E. Seal drains watertight to adjacent materials.

F. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.13 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk or fireproof airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

3.14 INSTALLATION – FIRESTOPPING AND SEALS AT PARTITIONS

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating and to uniform density and texture. Remove dam material after firestopping material has cured.

D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

E. Place intumescent coating in sufficient coats to achieve rating required.

F. Clean adjacent surfaces of firestopping materials.

G. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, ceiling, and/or roof as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

H. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition, floor, ceiling, and/or roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

2. Install escutcheons where piping penetrates non-fire rated surfaces in occupied spaces.
3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations air tight. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.15 INSTALLATION – VIBRATION ISOLATION

A. Install isolation for motor driven equipment.

B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other ends. Install in horizontal plane unless indicated otherwise.

D. Adjust equipment level.

E. Install spring hangers without binding.

F. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

G. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

3.16 INSTALLATION - IDENTIFICATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Identify nonpotable water outlets with plastic permanent mounted sign in uppercase lettering which reads, “CAUTION: NONPOTABLE WATER, DO NOT DRINK.” Signage shall be black lettering on yellow background.

E. Nameplates: Identify plumbing equipment (water heaters, pumps, heat transfer equipment, tanks, and water treatment devices) with plastic nameplates.

1. Identify in-line pumps and other small devices with name tags.
2. Identify control panels and major control components outside panels with plastic nameplates.
3. Identity description should be as numbered on drawings or plain English description. i.e. “WH-1” or “Rain Water Storage Tank”.
4. Label automatic controls, instruments, and relays. Key to control schematic.
5. Label wall controls and switches with associated equipment designation and control function, i.e. “DCP, Timer”.

F. Valve Tags: Identify valves in main and branch piping with tags.
1. Do not provide numbered tags.
2. Provide tags with plain English description of service and function. i.e. “Domestic Hot Water, Kitchen”

G. Pipe Labels: Identify piping, concealed or exposed, with plastic tape pipe markers.
1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification on straight runs including risers and drops with spacing not to exceed 20 feet.
4. Locate adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

H. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

I. Equipment and Valve Tag Index: Plain English designations so no chart or index is required.

3.17 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by firestoppping material installation.

3.18 SCHEDULES

A. Pipe Hanger Spacing

PIPE MATERIAL	MAXIMUM HANGER SPACING (Feet)	HANGER ROD DIAMETER (Inches)
Cast Iron (All Sizes)	5	3/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	3/8
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2

PVC (All Sizes)	4	3/8
Steel, 3 inches and smaller	6	1/2
Steel, 4 inches and larger	12	3/8

B. Pipe Isolation Schedule:

Pipe Size Inch	Isolated Distance from Equipment
1	120 diameters
2	90 diameters

C. Equipment isolation schedule:

ISOLATED EQUIPMENT	BASE		ISOLATOR	
	TYPE	THICKNESS	TYPE	DEFLECTION
Inline Pumps	N/A	N/A	Braided Flex	
Air Compressor	Concrete	4”	Neoprene	
Water Heater			Copper Flex	

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Piping system insulation.
2. Equipment insulation.
3. Pipe insulation jackets.
4. Equipment insulation jackets.
5. Insulation accessories including vapor retarders and accessories.

1.2 QUALITY ASSURANCE

A. Provide insulation tested for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. All systems components subject to heat loss or gain, such as, piping, storage tanks, vessels, valves etc. shall be insulated to conform with the Washington State Energy Code (as minimum).

1.3 IDENTIFICATION

A. Insulation shall bear a manufacturer's mark indicating the product R-value or K-value and thickness. This mark shall be visible after installation and shall be repeated at an interval of no more than 10 feet.

PART 2 PRODUCTS

2.1 GLASS FIBER, RIGID

A. Manufacturers: Johns Manville Micro-Lok AP-T Plus or equal by Owens-Corning, Knauf, Manson or approved equal.

B. Insulation: Rigid, noncombustible. ASTM C547.
1. 'K' factor: 0.23 at 75 degrees F.
2. Fiberglass or Earthwool with ECOSE
3. Maximum Service Temperature: 850 degrees F.
4. Maximum Moisture Absorption: 0.2 percent by volume.
5. Density: 3.0 lb/cu ft.

C. Vapor Retarder Jacket: ASJ+ or Type I, reinforced facing, paintable. Longitudinal acrylic adhesive closure system with factory supplied butt strips. ASTM C1136.

D. Rigid clamp/hanger insert: Preformed, incompressible (Calcium Silicate or similar), matching pipe size and insulation thickness.

2.2 GLASS FIBER, BLANKET

A. Manufacturers: Johns Manville Micro-Flex or equal by Owens-Corning, Knauf, Manson or approved equal.

B. Insulation: Semi-rigid, shot-free, continuous fiber, noncombustible. ASTM C1393.
1. 'K' factor: 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.
4. Density: 2.5 lb/cu ft.

C. Vapor Retarder Jacket: Type I, reinforced facing, will accept paint. Seal with pressure sensitive tape. ASTM C1136.

2.3 POLYOLEFIN INSULATION

A. Manufacturers: IMCOA or similar.

B. Polyolefin or Polyethylene pipe insulation is **NOT ACCEPTABLE** for any application.

2.4 ELASTOMERIC CELLULAR FOAM

A. Manufacturers: Armacell AP/Armaflex, Aeroflex Aerocel or approved equal.

B. Preformed flexible, closed-cell, elastomeric thermal insulation: Type I, Tubular form, self-seal or continuous, 25/50-rated, CFC free, low VOC, 'K' factor: 0.27 at 75 degrees F. ASTM C534.

C. Rigid clamp/hanger insert: Armacell Armafix, polyurethane insert and aluminum jacket, single piece with self-adhering closure.

2.5 CLOSED CELL POLYURETHANE SYSTEM (BELOW GRADE)

A. Manufacturers: Thermacor Copper-Therm or approved equal.

B. Factory-fabricated, pre-insulated piping system including copper pipe, insulation, jacket, fittings and field installed joint covers.

C. Pipe: Type K copper

D. Insulation: Rigid 2.0 lb/cu. ft. polyurethane foam, 90% closed cell, 0.15 K factor per ASTM C518, CFC-free, bonded to pipe.

E. Jacket: Extruded white PVC, virgin NSF approved Class 12454-B conforming to ASTM D-1784 Type 1 Grade 1, minimum 60 mils thick. Jacket shall be bonded to insulation.

F. Fittings: Same insulation and jacket as piping.

G. Field Joints: Insulate with urethane foam to pipe insulation thickness, jacket with PVC sleeve and seal with pressure sensitive polyethylene backed rubberized bitumen adhesive tape 30 mils thick.

H. Installation: Factory field technicians shall inspect installation, field joints and pressure testing.

2.6 PIPE INSULATION AND EQUIPMENT JACKETS

A. PVC Plastic Pipe Jacket:
1. Product Description: One piece molded type fitting covers and sheet material, off-white color. ASTM D1784.
2. Thickness: 15 mil indoor, 30 mil outdoor.
3. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping and equipment has been tested before applying insulation materials.

B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Apply insulation when building is thoroughly dry to prevent shrinkage.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulate entire piping system including fittings, valves, unions, flanges, strainers, flexible connections, pump fittings, connections to equipment and expansion joints. Use canvas jackets for valves and other irregular shapes.

D. Insulate flanges and unions with removable sections and jackets.

E. Piping Inserts and Shields:
1. Insulation shall be continuous through supports and hangers with incompressible inserts and shields. Do not directly clamp/support pipe scheduled to be insulated.
2. Shields: Galvanized steel saddle between pipe clevis hangers or pipe rollers and insulation. Minimum 6 inches long, of contour matching adjoining insulation; may be factory fabricated.
3. Inserts: Between pipe clamps, hangers or rollers and piping.
4. Insert material: Compression resistant insulating material suitable for insulation type and planned temperature range and service.
5. Glue insulation to both sides of insert.

6. Shields without inserts may be used at clevis hangers on refrigerant piping 5/8” and smaller with continuous insulation.

F. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.

G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

H. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

I. Exposed Equipment: Locate insulation and cover seams in least visible locations.

J. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

K. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

L. Finish insulation at supports, protrusions, and interruptions.

M. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

N. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.3 SCHEDULES

A. Piping: Provide on piping as listed below.

		PIPE SIZE			
Service	**Insulation Type**	**<1”**	**1" to 1-1/4”**	**1-1/2" to 4"**	**4" to 8”**
Domestic Cold Water	Glass Fiber RIGID	1/2"	1/2"	1/2"	1/2"
Domestic Hot Water	Glass Fiber RIGID	1"	1"	1-1/2"	1-1/2"
Domestic Hot Water Recirc.	Glass Fiber RIGID	1"	1"	1-1/2"	1-1/2"

Domestic water H/C/R/T outside conditioned space	Glass Fiber RIGID	1-1/2”	1-1/2”	2”	2”
Condensate Drains	RIGID / FOAM	1/2"	1/2"	1/2"	1/2"
Roof Drain & Overflow Bowls in conditioned area	Glass Fiber RIGID	1/2"	1/2"	1/2"	1/2"
Rainleader & Overflow Piping in conditioned area	Glass Fiber RIGID	1/2"	1/2"	1/2"	1/2"

1. Do not insulate direct burial rain leader.
2. Do not insulate direct burial cold water.
3. For all exterior piping applications use only Elastomeric Cellular Foam with Aluminum jacket.
4. For all below grade piping application use only insulation specifically engineered for application. (Closed Cell Polyurethane System)

B. Equipment: Provide on equipment as listed below.

Service	**Insulation Type**	**Thickness**	**Jacket**
Expansion Tank	Glass Fiber BLANKET	2”	Reinforced White-Kraft Paper

END OF SECTION

SECTION 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Domestic water piping.
2. Piping Accessories.
3. Circuit balancing valve.
4. Water pressure reducing valves.
5. Double check valve assembly
6. Reduce pressure backflow assembly.
7. Thermostatic mixing valves.
8. Pressure balanced mixing valves.

1.2 SCOPE

A. This section includes hot and cold water supply, equipment and accessories.

B. This section includes domestic hot and/or cold water consumption metering with data collection and billing software.

1.3 GENERAL REQUIREMENTS

A. Comply with Federal "Reduction of Lead in Drinking Water Act" – 2011. Pipes, pipe fittings, plumbing fittings and fixtures shall be "Lead Free" meaning not more than a weighted average of 0.25% lead in wetted surfaces.

1.4 SITE MAINS

A. Provide connections to Site water mains as indicated on drawings.

1.5 QUALITY ASSURANCE

A. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s).)

B. The mechanical press fitting manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of press fittings and crimping tools. The representative shall periodically visit the jobsite and review installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s).)

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Tubing: Type K hard drawn or annealed. ASTM B88.
1. Fittings: ASME B16.22, ASTM B75, wrought copper.
2. Joints: Brazed
a. Copper to copper: Silver/phosphorus/copper alloy (15 percent silver). AWS A5.8 BCuP-5.
b. Copper to brass or steel: AWS Bag-5 Silver (45 percent silver)

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: Type L hard drawn seamless. ASTM B88.
1. Fittings:
a. Wrought copper and bronze. ASME B16.22, ASTM B75.
b. Copper press with EPDM O-ring, ASME B16.22, 200 psi.
2. Joints:
a. Solder, lead free, 95-5 tin-antimony, or tin and silver. ASTM B32.
b. Press connection, Viega ProPress or approved equal.

B. Copper Tubing: Type L hard drawn, rolled grooved ends. ASTM B88.
1. Copper Grooved-End Fittings: ASME B75 copper tube or bronze ASTM B584 bronze castings, with copper tube dimensioned grooved ends (flaring of tube and fitting ends to IPS dimensions is not permitted).
2. Joints: Grooved mechanical couplings meeting ASTM F1476. Victaulic or approved equal.
a. Housing Clamps: ASTM A395 and ASTM A536 ductile iron cast with offsetting, angle-pattern bolt pads, copper-colored enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.
b. Gasket: Grade “EHP” EPDM.
c. Accessories: Steel bolts, nuts, and washers.
d. Design: “Installation Ready” designed for direct ‘stab’ installation onto roll grooved copper tube without prior field disassembly and no loose parts. Victaulic Style 607 QuickVic™.

2.3 PRESSURE GAUGES

A. Manufacturers: Marsh, Trerice, Weiss or approved equal.

B. Gauge: Rotary stainless steel movement, 316 stainless steel socket, front calibration adjustment, black scale on white background. ASME B40.1. Trerice 700.
1. Case: 304 stainless steel
2. Bourdon Tube and wetted parts: 316 stainless steel.
3. Dial Size: 4 inch diameter within 7' of floor, 6 inch diameter over 7'.
4. Mid-Scale Accuracy: 1/2 percent.
5. Scale: PSI.

2.4 PRESSURE GAUGE TAPS

A. Needle Valve: 316 stainless steel, 1/4 inch NPT for minimum 300 psi. Trerice 735.

B. Pulsation Damper: 316 stainless steel, 1/4 inch NPT connections. Trerice 870

C. Pressure Snubber: 316 stainless steel, 1/4 inch NPT connections. Trerice 872

D. Siphon: 316 stainless steel, 1/4 inch NPT angle or straight pattern. Trerice 885.

2.5 STEM TYPE THERMOMETERS

A. Manufacturers: Marsh, Trerice, Weiss or approved equal.

B. Thermometer: Blue appearing organic, lens front tube, cast aluminum case with epoxy finish, adjustable angle. ASTM E1. Trerice AX/BX.
1. Size: 7-inch scale within 7' of floor, 9-inch scale mounted over 7'.
2. Window: Clear.
3. Stem: 304SS, 3/4 inch NPT.
4. Accuracy: 2 percent.
5. Calibration: Degrees F.

2.6 AUTOMATIC FLOW BALANCING VALVE

A. Manufacturers: Caleffi 127 or approved equal.

B. Construction: Low-lead brass body, anti-scale polymer flow cartridge, stainless steel spring, EPDM seals. 200 psi max working pressure. 200 F max temperature.

C. Control: Working pressure ranges 2-14 psid or 2-32 psid for flows from 0.5 gpm to 5 gpm.

2.7 WATER PRESSURE REDUCING VALVES

A. Manufacturers: Watts or equal by Apollo/Conbraco, Wilkens or approved equal.

B. 2 inches and Smaller: Lead-Free cast copper silicon body with stainless steel inlet strainer, reinforced EPDM diaphragm, replaceable stainless steel seat, adjustable outlet pressure between 25-75 psi, 300 psi working pressure, 33F-160F operating temperature range. Watts LFU5B.

2.8 STRAINERS

A. Manufacturers: Apollo/Conbraco, Metraflex, Titan, Nibco or approved equal.

B. 4 inch and Smaller: Threaded or Solder, 400 PSI CWP, lead-free bronze body, Y-pattern with 20 mesh stainless steel perforated screen. Apollo 59LF.

2.9 DOUBLE CHECK VALVE ASSEMBLY (DCVA)

A. Manufacturers: Watts or equal by Apollo/Conbraco, Wilkens or approved equal. Must be listed as acceptable by the State of Washington Cross Connection Manual.

B. 2 inches and Smaller: Lead-Free. Comply with ASSE 1015; two independently operating check valves with intermediate atmospheric vent. Cast copper silicon body, positive seating captured spring check valves with inlet Y-strainer, inlet and outlet shutoff ball valves, ball valve test cocks, replaceable seats and seat discs, 175 psi working pressure, 33-180 F operating temperature range. Watts model LF007

2.10 REDUCED PRESSURE BACKFLOW PREVENTERS (RPBA)

A. Manufacturers: Watts or equal by Apollo/Conbraco, Wilkens or approved equal. Must be listed as acceptable by the State of Washington Cross Connection Manual.

B. 2 inches and Smaller: Lead-Free. Comply with ASSE 1013. Cast copper silicone body with internal pressure differential relief valve located between two positive seating captured spring check valves, inlet Y-strainer, inlet and outlet shutoff ball valves, ball valve test cocks, replaceable polymer seats and silicone seat discs, air gap drain fitting, 175 psi working pressure, 33-180 F operating temperature range. Watts model LF919.

2.11 WATER HAMMER ARRESTORS

A. Manufacturers: Wade, PPP or approved equal.

B. ASSE 1010; stainless steel or copper construction, pre-charged, bellows or piston type sized in accordance with PDI WH-201.

2.12 THERMOSTATIC MIXING VALVES

A. Manufacturers: Symmons, Lawler, Powers or approved equal.

B. Valve: Lead-Free cast brass body with [rough bronze] [chrome] finish, liquid filled thermal motor with bellows, stainless steel piston, integral temperature adjustment control.

C. Assembly: Valve and piping assembly with wall mounting bracket, pipe unions, check valve and strainer stop inlets, outlet dial thermometer, outlet ball valve. Factory assembled and tested. Certified to ASSE 1017 standard.

2.13 TEMPERING VALVE (EMERGENCY)

A. Manufacturers: Haws, Lawler, Powers or approved equal.

B. General: Prepackaged, fully engineered and tested system for providing tempered water to emergency showers and/or eyewashes. Mixing valve to close

on cold water failure and bypass cold water on hot water failure. Haws TWBS.EWE, TWBS.SHE

C. Construction: NSF 61 Lead-Free brass

D. Assembly: Valve and piping assembly with wall bracket, thermostatic mixing valve, high temperature limit valve, bypass valve, outlet temperature gauge with stainless steel stem, pipe unions. Certified to ASSE 1071 standard.

2.14 TEMPERING VALVE (PUBLIC LAV)

A. Manufacturers: Symmons, Leonard, Powers or approved equal.

B. General: Lead-Free brass and bronze body with brass and stainless steel flow control components with check stops, vandal resistant lockable handle, rough bronze finish. Certified to ASSE 1070 standard.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with groove couplings, flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

B. Provide connections to site mains as indicated on drawings.

C. Grade piping at 1/4” per foot where possible, but in no case less than 1/8” per foot. Install all main vertical soil and waste stacks with provisions for expansion and extend full size to roof line as vents.

D. Backfill trenching with pea-gravel if available at site for other purposes. If pea-gravel is unavailable, native soil may be used for backfill if all the following conditions are met.
1. All broken concrete and sharp stones (+1” dia.) to be removed from backfill soil.
2. All large stones (3’ dia. or bigger) to be removed from backfill soil.

3. Piping shall be bedded on min. 2” thickness of replaced “rock free” soil and then checked for grade.

E. Establish elevations of buried piping with not less than 3 ft of cover.

F. Establish minimum separation from other services piping in accordance with Code.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Install plastic ribbon tape continuous over top of pipe.

J. Install trace wire continuous over top of pipe.

3.3 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Install piping on interior side of building insulation.

E. Provide heat tape for all piping in unheated areas.

F. Sleeve pipe passing through partitions, walls and floors.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Protection: Where piping, other than cast iron or steel, is installed in a concealed location through holes or notches in framing (i.e. studs, joists, rafters, etc.), less than 1-1/2 from framing edge, provide shield plates. Shield plates shall be 16 gauge steel and cover the piping area within framing plus 2” on each side along framing.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

J. Provide access panel where valves and fittings are not accessible.

K. Install non-conducting dielectric connections wherever jointing dissimilar metals.

L. Slope piping and arrange systems to drain at low points. Provide hose bibb if low point is not at a plumbing fixture.

M. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

N. Insulate piping. Refer to Section 22 07 00.

O. Install pipe identification in accordance with Section 22 05 00.

3.4 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with ASME B31.9.

B. Grade piping to drain at low points. Provide hose bibb if low point is not at plumbing fixture.

C. Install water piping on interior side of building insulation. Provide heat tape for all piping in unheated areas.

D. Install water hammer arrestors on hot and cold water of each fixture group (e.g.: one arrestor may serve each service to a toilet). Select unit sizes and install in accord with PDI Standard WH-201.

3.5 VALVES

A. Use ball valves for up to 4” piping. Gate valves are not approved for use up to 4” piping. Gate valves are for 6” piping and larger only.

B. Gate valves which are part of a valve assembly are acceptable.

3.6 INSTALLATION - THERMOMETERS AND GAUGES

A. Install pressure gauges on each side of domestic water service assembly (i.e double check, PRV, etc.).

B. Install gauge taps in piping.

C. Install pressure gauges with pulsation dampers. Provide needle valve or ball valve to isolate each gauge.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.7 INSTALLATION - SERVICE CONNECTIONS

A. Provide new water service complete with approved double check back-flow preventer, pressure reducing valve, by-pass valves, pressure gauges and strainer.

B. Provide sleeve in wall for service main and support at wall with reinforced-concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

C. Provide 18 gauge galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

3.8 FIELD QUALITY CONTROL

A. Test domestic water piping system at 100 psig minimum for a period of not less than 4 hours.

3.9 CLEANING

A. Flush system with water for minimum of 60 minutes to remove all dirt and foreign materials. Use minimum of 80 psi flushing pressure.

B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

C. Bleed water from outlets to obtain distribution and test for disinfectant residual at a minimum of 15 percent of outlets.

D. Maintain disinfectant in system for 24 hours.

E. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

END OF SECTION

SECTION 22 13 00

FACILITY SANITARY SEWERAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewer piping, buried within 5 feet of building.
2. Sanitary sewer piping, above grade.
3. Condensate drains
4. Floor drains.
5. Trench drains.
6. Cleanouts.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe & Fittings: ASTM A888, CISPI 301, hub-less. Made in USA by AB&I, Charlotte or Tyler marked with collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.
1. Fittings: Long pattern cast iron.
2. Joints: Neoprene gasket ASTM C-564, all type 304 stainless steel clamp and shield assemblies, 80 in/lbs worm drive. FM-1680, Class 1, CISPI 310 and certified by NSF international. Minimum 4 clamps up to 4”, 6 clamps for 5” and larger. Husky SD 4000, Mission Heavy Weight, Clamp-All or approved equal.

B. PVC Pipe: Schedule 40 solid wall PVC, bell and spigot solvent sealed ends. NSF Standard 14, ASTM D1785, ASTM D1784.
1. Fittings: Schedule 40, PVC, ASTM D2665.
2. Joints: Solvent weld with ASTM D2564 solvent cement.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe & Fittings: ASTM A888, CISPI 301, hub-less. Made in USA by AB&I, Charlotte or Tyler marked with collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.
1. Fittings: Long pattern cast iron.
2. Joints: Neoprene gasket ASTM C-564, all type 304 stainless steel clamp and shield assemblies, 80 in/lbs worm drive. FM-1680, Class 1. Husky, Mission, Clamp-All or approved equal.

B. Copper Tube (Use only for short piping sections where dimensional constraints require thin wall pipe): ASTM B306 DWV.
1. Fittings: Long Pattern, ASME B16.23, cast bronze, or ASME B16.29, wrought copper.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver.

C. Steel Pipe (water closet connections only): Schedule 40, galvanized. ASTM A53.
1. Fittings: Cast Iron, ASME B16.4, threaded fittings.
2. Joints: Threaded.

D. **[VENT ONLY]** PVC Pipe: Schedule 40 solid wall PVC, bell and spigot solvent sealed ends (If approved by local authorities). NSF Standard 14, ASTM D1785, ASTM D1784. **Not for use in air plenum.**
1. Fittings: Schedule 40, PVC, ASTM D2665.
2. Joints: Solvent weld with ASTM D2564 solvent cement.

2.3 EQUIPMENT DRAINS (CONDENSATE)

A. Copper Tubing: Type L, hard drawn. ASTM B88.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

B. CPVC Pipe: Schedule 40. ASTM D2846. **Not for use in air plenum.**
1. Fittings: Schedule 40 CPVC. ASTM D2846.
2. Joints: Solvent weld with ASTM F493 solvent cement. ASTM D2846.

2.4 FLOOR DRAINS

A. Manufacturers: Zurn, Josam, J.R. Smith, Wade or approved equal.

B. General Service: Cast iron body, membrane clamp, adjustable collar, polished nickel bronze strainer, trap primer connection. Provide funnel where scheduled.

2.5 TRENCH DRAIN

A. Manufacturers: Zurn, J.R. Smith or approved equal.

B. Sloped modular channel sections with interlocking end, HDPE, extra heavy duty frame with anchor studs and grate lockdown, ductile iron cast bar grate.

2.6 CLEANOUTS

A. Manufacturers: Zurn, J.R. Smith, Josam, Wade or approved equal.

B. Exterior or interior vehicle areas: Heavy-Duty round coated cast iron body and cover with bronze plug.

C. Exterior Surfaced Areas: Round cast nickel bronze access frame with bronze gasket threaded plug and non-skid cover.

D. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and bronze gasket threaded plug.

E. Interior Finished Floor Areas: Type of ferrule, top and cover as required for the type of floor construction, finish surface and traffic conditions. Cleanout construction material to match waste piping with anchor flange, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas. For carpet provide marker. For cast iron construction provide bronze gasket threaded plug.

F. Interior Finished Wall Areas: Cleanout construction material to match waste piping, line type with round gasket threaded plug, and round stainless steel access cover secured with machine screw. For cast iron construction provide bronze gasket threaded plug.

G. Interior Unfinished Accessible Areas: Threaded type. Provide bolted stack cleanouts on vertical waste stacks.

2.7 FLASHING AND COUNTERFLASHING

A. 3lb. lead soldered joints and seams, 24 x 24 base pad and counterflashed into pipe.

2.8 TRAP PRIMER

A. Manufacturers: PPP, Wade, J.R. Smith, Josam, Watts, Zurn or approved equal.

B. Construction: Automatic, bronze body, integral vacuum breaker.

2.9 TRAP SEAL MAINTENANCE DEVICE

A. Manufacturers: Sure-Seal, Jay R Smith or approved equal.

B. Inline floor drain trap sealer, commercial grade, neoprene rubber diaphragm and rubber sealing gaskets.

2.10 AIR GAP FITTING

A. Manufacturers: Zurn Z-1025 or equal by J.R. Smith or approved equal.

B. Construction: Inline, fixed air gap, coated cast iron.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove scale and dirt, on inside and outside, before assembly.

B. Prepare piping connections to equipment with flanges or unions.

C. Verify and provide required extensions, clamps and drain styles to match floor construction and finish.

3.2 INSTALLATION

A. Coordinate location of floor drains in mechanical spaces with mechanical contractor equipment layout.

B. Protect floor drain strainer during construction.

C. TRAPS:
1. Install trap seal maintenance devices only where called for on plans or approved by engineer; at all other drain locations provide automatic trap primers.
2. Install automatic trap primers throughout at site drains and floor drains except those located in showers or provided with trap seal maintenance devices.
3. Provide access panels for automatic trap primers.
4. Adjust automatic trap primer pressure setting for proper operation.

D. Align square floor drains with floor tiles or parallel with walls.

E. Install interceptors with top flush with adjacent surface or grade. Provide quantity and size of vents as indicated in manufacturer's literature. Terminate vents minimum 10 feet above grade or through roof at a location determined by the architect.

3.3 CONDENSATE PIPING

A. Provide condensate piping for air-conditioning and high-efficiency gas fired equipment. Coordinate quantity required with mechanical contractor. Provide minimum 3" deep p-trap at equipment.

B. Determine best routing to nearest indirect waste using minimum 3/4" piping with minimum 1/8" per foot slope. Acceptable indirect waste locations are service sink, laundry sink, floor drain or air gap fitting into waste pipe. Provide open drain box or access panel for air gap fitting as approved by local authority. Discharge onto roof or at grade is acceptable if allowed by local code, provide splash block.

C. If proper slope cannot be achieved advise Mechanical Contractor to provide condensate pump.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

B. Provide connections to site mains as indicated on drawings.

C. Grade piping at 1/4" per foot where possible, but in no case less than 1/8" per foot. Install all main vertical soil and waste stacks with provisions for expansion and extend full size to roof line as vents.

D. Backfill trenching with pea-gravel if available at site for other purposes. If pea-gravel is unavailable, native soil may be used for backfill if all the following conditions are met.
   1. All broken concrete and sharp stones (+1" dia.) to be removed from backfill soil.
   2. All large stones (3' dia. or bigger) to be removed from backfill soil.
   3. Piping shall be bedded on min. 2" thickness of replaced "rock free" soil and then checked for grade.

E. Establish elevations of buried piping with not less than 3 ft of cover.

F. Establish minimum separation from other services piping in accordance with Code.

G. Provide piping layout to satisfy the UPC requirements for suds relief.

H. Route pipe in straight line.

I. Install pipe to allow for expansion and contraction without stressing pipe or joints.

J. Install plastic ribbon tape continuous over top of pipe.

K. Install trace wire continuous over top of pipe.

3.5 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient at 1/4" per foot where possible, but in no case less than 1/8" per foot. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Install piping on interior side of building insulation.

E. Sleeve pipe passing through partitions, walls and floors.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Protection: Where piping, other than cast iron or steel, is installed in a concealed location through holes or notches in framing (i.e. studs, joists, rafters, etc.), less than 1-1/2 from framing edge, provide shield plates. Shield plates shall be 16 gauge steel and cover the piping area within framing plus 2" on each side along framing.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

I. Provide access panel where valves and fittings are not accessible.

J. Install non-conducting dielectric connections wherever jointing dissimilar metals.

K. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Provide 1/8 inch per foot only where necessary and allowed by local jurisdiction. Maintain gradients.

L. Provide piping layout to satisfy the UPC requirements for suds relief.

M. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

N. Install piping penetrating roofed areas to maintain integrity of roof assembly.

O. Insulate piping. Refer to Section 22 07 00.

P. Install pipe identification in accordance with Section 22 05 00.

3.6 INSTALLATION - SANITARY WASTE AND VENT SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with ASME B31.9 and local plumbing code.

B. Support cast iron drainage piping at every joint.

C. Flash and counterflash. Install vents passing through roof with roof flashing and counterflashing assemblies. 3lb. lead soldered joints and seams, 24 x 24 base pad and counterflashed into pipe.

D. Install automatic trap primers throughout at floor drains except those located in showers. Provide access panel for trap primers.

E. Provide piping layout to satisfy the UPC requirements for suds relief.

F. Provide cleanouts every 50 feet and install at all locations required by code and to permit cleaning of all waste piping. Provide cleanouts full size of pipe, but no larger than 4”. Coordinate with Architect when cleanouts are located in finished rooms. Install cleanout threads with graphite. Locate cleanouts to clear cabinet work and to be easily accessible.

3.7 FIELD QUALITY CONTROL

A. Obtain written approval of local Plumbing Authority prior to covering or concealing any work.

B. Test sanitary waste and vent piping system to hydrostatic test of 10 feet head of water.

END OF SECTION

SECTION 22 14 00

FACILITY STORM DRAINAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Storm water piping, buried within 5 feet of building.
2. Storm water piping, above grade.
3. Roof drains.
4. Downspout nozzles.
5. Cleanouts.

PART 2 PRODUCTS

2.1 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe & Fittings: ASTM A888, CISPI 301, hub-less. Made in USA by AB&I, Charlotte or Tyler marked with collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.
1. Fittings: Long pattern cast iron.
2. Joints: Neoprene gasket ASTM C-564, all type 304 stainless steel clamp and shield assemblies, 80 in/lbs worm drive. FM-1680, Class 1, CISPI 310 and certified by NSF international. Minimum 4 clamps up to 4”, 6 clamps for 5” and larger. Husky SD 4000, Mission Heavy Weight, Clamp-All or approved equal.

B. PVC Pipe: Schedule 40 solid wall PVC, bell and spigot solvent sealed ends. NSF Standard 14, ASTM D1785, ASTM D1784.
1. Fittings: Schedule 40, PVC, ASTM D2665.
2. Joints: Solvent weld with ASTM D2564 solvent cement.

2.2 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A888, CISPI 301, hub-less. Made in USA by AB&I, Charlotte or Tyler marked with collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.
1. Fittings: Long pattern cast iron.
2. Joints: Neoprene gasket ASTM C-564, all type 304 stainless steel clamp and shield assemblies, 80 in/lbs worm drive. FM-1680, Class 1. Husky, Mission, Clamp-All or approved equal.

2.3 ROOF DRAINS

A. Manufacturers: Zurn, Josam, J.R. Smith, Wade or approved equal.

B. Coated cast iron body with aluminum dome, membrane flange and clamp, underdeck clamp, roof sump receiver, waterproofing flange, adjustable extension sleeve for roof insulation. On overflow drains provide 2" internal water dam.

2.4 DOWNSPOUT NOZZLE

A. Manufacturers: Zurn Z-199 or approved equal.

B. Construction: Nickel bronze body, decorative face wall flange, outlet "cow's tongue" nozzle, stainless steel screen.

2.5 CLEANOUTS

A. Manufacturers: Zurn, J.R. Smith, Josam, Wade or approved equal.

B. Exterior Surfaced Areas: Round cast nickel bronze access frame with bronze gasket threaded plug and non-skid cover.

C. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and bronze gasket threaded plug.

D. Interior Finished Floor Areas: Type of ferrule, top and cover as required for the type of floor construction, finish surface and traffic conditions. Cleanout construction material to match waste piping with anchor flange, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas. For carpet provide marker. For cast iron construction provide bronze gasket threaded plug.

E. Interior Finished Wall Areas: Cleanout construction material to match waste piping, line type with round gasket threaded plug, and round stainless steel access cover secured with machine screw. For cast iron construction provide bronze gasket threaded plug.

F. Interior Unfinished Accessible Areas: Threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify and provide required extensions, clamps and drain styles to match deck or roof construction and finish.

3.2 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

B. Provide connections to site mains as indicated on drawings.

C. Grade piping at 1/4” per foot where possible, but in no case less than 1/8” per foot. Install all main vertical soil and waste stacks with provisions for expansion and extend full size to roof line as vents.

D. Backfill trenching with pea-gravel if available at site for other purposes. If pea-gravel is unavailable, native soil may be used for backfill if all the following conditions are met.
1. All broken concrete and sharp stones (+1” dia.) to be removed from backfill soil.
2. All large stones (3’ dia. or bigger) to be removed from backfill soil.
3. Piping shall be bedded on min. 2” thickness of replaced “rock free” soil and then checked for grade.

E. Establish elevations of buried piping with not less than 3 ft of cover.

F. Establish minimum separation from other services piping in accordance with Code.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Install shutoff and drain valves at locations indicated on Drawings.

J. Install plastic ribbon tape continuous over top of pipe.

K. Install trace wire continuous over top of pipe.

3.3 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Install piping on interior side of building insulation.

E. Sleeve pipe passing through partitions, walls and floors.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Protection: Where piping, other than cast iron or steel, is installed in a concealed location through holes or notches in framing (i.e. studs, joists, rafters, etc.), less than 1-1/2 from framing edge, provide shield plates. Shield plates shall be 16 gauge steel and cover the piping area within framing plus 2” on each side along framing.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

I. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Provide 1/8 inch per foot only where necessary and allowed by local jurisdiction. Maintain gradients.

J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

K. Install piping penetrating roofed areas to maintain integrity of roof assembly.

L. Insulate piping. Refer to Section 22 07 00.

M. Install pipe identification in accordance with Section 22 05 00.

3.4 INSTALLATION - STORM DRAINAGE PIPING SYSTEMS

A. Install storm drainage piping systems in accordance with ASME B31.9 and local plumbing code.

B. Support cast iron drainage piping at every joint.

C. Roof drain flashing and counter flashing. 3lb. lead soldered joints and seams, 24 x 24 base pad.

D. Provide cleanouts every 50 feet and install at all locations required by code and to permit cleaning of all waste piping. Provide cleanouts full size of pipe, but no larger than 4”. Coordinate with Architect when cleanouts are in finished rooms. Install cleanout threads with graphite. Locate cleanouts to clear cabinet work and to be easily accessible.

3.5 FIELD QUALITY CONTROL

A. Obtain written approval of local Plumbing Authority prior to covering or concealing any work.

B. Test storm piping system to hydrostatic test of 10 feet head of water.

END OF SECTION

SECTION 22 15 00

GENERAL SERVICE COMPRESSED AIR SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Compressed air piping and accessories.
2. Compressed air outlets.
3. Air compressor and filters.
4. Air pressure reducing valve.
5. Pressure regulators.
6. Hose connectors.

1.2 SCOPE

A. Furnish and install air compressor, piping and accessories for a complete compressed air system.

1.3 MAINTENANCE MATERIALS

A. Furnish two quart containers of compressor oil for each compressor.

PART 2 PRODUCTS

2.1 COMPRESSED AIR PIPING

A. Steel Pipe: ASTM A53, Schedule 40 black, seamless. Manufactured in the USA.
1. Fittings: ASME B16.3, malleable iron Class 150, or ASTM A234, forged steel welding type, Class 150.
2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

2.2 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, 300 psi CWP, malleable iron, threaded.
2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 BALL VALVES

A. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham or approved equal.

B. 2 inches and Smaller: MSS SP 110, 600 psi CWP, bronze, two piece body, type 316 stainless steel ball, full port, Teflon (TFE) seats, blow-out proof stem, solder or threaded ends with union, lever handle. Nibco Model 585-70-66.

2.4 CHECK VALVES

A. Swing Check Valves:
1. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham or approved equal.
2. 2 inches and Smaller: MSS SP 80, Class 125, 200 psi CWP, bronze body and cap, bronze disc with TFE seat, Y-pattern design, solder or threaded ends. Nibco Model T/S-413-Y.

B. Spring Loaded Check Valves:
1. Manufacturers: NIBCO Model 480, W-910 or equal by Apollo, Hammond, Milwaukee, Stockham or approved equal.
2. 2 inches and Smaller: MSS SP 80, Class 125, 250 psi CWP, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends. Nibco Model T/S-480.

2.5 STRAINERS

A. Manufacturers: Apollo/Conbraco, Metraflex, Titan or approved equal.

B. 2 inch and Smaller: Class 250, ASTM B62 bronze body, 400 psi CWP, Y pattern with 60 mesh stainless steel perforated screen.

2.6 FLEXIBLE CONNECTORS

A. Manufacturers: Mason Industries, Metraflex or approved equal.

B. 2 inches and Smaller: Braided stainless steel hose with single layer of stainless steel exterior braiding, maximum working pressure 170 psig. Mason Industries BSS/Braided Stainless Steel Hose, GU-MN ¾” by 10” or approved.

2.7 RELIEF VALVES

A. Relief Valves: Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.8 COMPRESSED AIR OUTLETS

A. Manufacturers: Lincoln #815 or approved equal.

B. Compressed Air Outlets: Quick Connector: snap on connector with self closing valve.

2.9 HOSE REELS

A. Manufacturers: Graco XD, Reelcraft or approved equal.

B. Heavy duty type, steel construction, dual pedestal frame, powder coat finish, spring retractable, ½" inlet, ½" outlet, 300 psi rated.

C. Hose: ½", 250 psi rated.

D. Accessories:
1. Mounting bracket and stainless steel hardware.
2. Hose ball stop kit.
3. Hose inlet kit.

2.10 AIR COMPRESSOR

A. Two-stage, reciprocating compressor unit mounted on vertical receiver with air-cooled after cooler, dry-type filter silencer, condensate drain valve, isolation valve, pressure gauge, motor starter and belt guard. Quincy, Ingersoll-Rand, Joy Dresser-LeRoi or approved equal.

B. Controls:
1. Pressure Switch: Line voltage contactor to break at 150 psi with minimum differential of 20 psi.

C. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.

D. Disconnect Switch: Factory mount in control panel.

2.11 AIR PRESSURE REDUCING VALVE

A. Air Pressure Reducing Valve: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gauge. Furnish oil separator.

B. Valve Capacity: Reduce pressure from 200 psi to 30 psi, adjustable upward from reduced pressure.

2.12 PRESSURE REGULATORS

A. Manufacturers: Parker, Norgren or approved equal.

B. Pressure Regulators: Diaphragm \ Pilot operated, bronze body, direct acting, spring loaded, manual pressure setting adjustment, rated for 250 psig inlet pressure.

C. Pressure Regulators: Aluminum alloy or plastic body, diaphragm operated, direct acting, spring loaded, manual pressure setting adjustment, and rated for 250 psig inlet pressure.

2.13 PRESSURE GAUGE

A. Manufacturers: Marsh, Trerice, Weiss or approved equal.

B. Gauge: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
   1. Case: Cast aluminum.
   2. Bourdon Tube: Phosphor bronze or Type 316 stainless steel.
   3. Dial Size: 4-1/2 inch diameter within 7' of floor, 6 inch diameter over 7'.
   4. Mid-Scale Accuracy: 1/2 percent.
   5. Scale: 0-200 Psi.

2.14 COMPRESSED AIR FILTERS

A. Manufacturers: Parker Finite H, Norgren or approved equal.

B. Size filter housing using manufacturer's sizing chart base on total compressor SCFM plus 25% and scheduled pressure. Aluminum housing, chromate heads and bowls, powder painted exterior, 500 PSIG rated, nitrile seals.

C. Provide housing with differential pressure gauge and drain valve.

D. Dryer Pre-Filter: Coalescing Grade 6C, epoxy saturated, borosilicate glass micro-fiber media.

E. Post Dryer Filter: Interceptor Grace 3P, pleated cellulose, 3 micron absolute rating.

F. Outlet Filter: Coalescing Grade 6C, epoxy saturated, borosilicate glass micro-fiber media.

2.15 FLEXIBLE HOSE CONNECTORS

A. Hose Connectors: Corrugated stainless steel tubing with stainless steel wire braid covering and ends welded to inner tubing.

B. Working Pressure: 250 psig minimum.

C. End Connections:
   1. 2 inches and Smaller: Threaded steel pipe nipple.

2.16 ISOLATORS

A. Mason industries ND-C Green 140-160 pounds 0.50" maximum static deflection.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - ABOVE GROUND PIPING - COMPRESSED AIR SYSTEMS

A. Slope main piping to compressor or additional system low points at 0.5-1.0% grade.

B. Install drip legs at low points of piping system with drain valves. Locate drain values in accessible locations.

C. Install take-off to outlets from top of main, with shut off valve after take off. Slope take-off piping to outlets.

D. Install compressed air couplings, female quick connectors, and pressure gauges where outlets are indicated.

E. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

F. Cut pipe and tubing accurately and install without springing or forcing.

G. Install pipe sleeves where pipes and tubing pass through walls, floors, roofs, and partitions.

H. Protection: Where piping, other than cast iron or steel, is installed in a concealed location through holes or notches in framing (i.e. studs, joists, rafters, etc.), less than 1-1/2 from framing edge, provide shield plates. Shield plates shall be 16 gauge steel and cover the piping area within framing plus 2” on each side along framing.

I. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

J. Install pipe identification.

K. Except where indicated, install manual shut off valves with stem vertical and accessible for operation and maintenance.

L. Install strainers on inlet side of pressure reducing valves. Install pressure reducing valves with bypasses and isolation valves to allow maintenance without interruption of service.

M. Install strainers on inlet side of pressure regulators.

3.3 INSTALLATION - EQUIPMENT

A. Install system in accord with manufacturer’s requirements and recommendations.

B. Install air compressor on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than compressor base on each side.

C. Install air compressor unit on vibration isolators. Level, grout, and bolt in place.

D. Install air valve and drain connection on horizontal casing.

E. Install line size shut-off valve and anti-return check valve on compressor discharge.

F. Install replaceable cartridge type filter silencer for each compressor.

G. Install condensate drain piping to nearest floor drain. Determine best pipe routing.

H. Install bypass with valves around air dryer. Use factory insulated inlet and outlet connections.

I. Provide each air outlet with a filter. Locate filter at a sufficient height and orientation so that it can be easily serviced. Locate quick-connect fittings for ease of connection of air hoses.

3.4 FIELD QUALITY CONTROL

A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1 or ASME B31.9.

B. Verify for atmospheric pressure in piping systems, other than system under test.

C. Test entire system with dry compressed air or dry nitrogen at 150 psig for a minimum duration of 2 hours, prove tight. If loss of pressure occurs, determine cause and remake joints. Caulking or patching not permitted.

3.5 CLEANING

A. Blow systems clear of free moisture and foreign matter.

END OF SECTION

SECTION 22 23 00

NATURAL GAS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Natural gas piping buried within 5 feet of building.
2. Natural gas piping above grade.
3. Coordination with local gas company
4. Valves & Strainers.
5. Natural gas pressure regulators.

1.2 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.

C. Use ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.3 QUALITY ASSURANCE

A. Comply with requirements and recommendations of NFPA 54 and the International Fuel Gas Code.

B. Perform work in accordance with applicable code and local gas company requirements.

C. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.

1.4 COORDINATION

A. Refer to plans for meter location and coordinate with the Gas Company for installation and size. Facilitate application for gas service and pay all charges necessary for complete installation.

PART 2 PRODUCTS

2.1 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53, Schedule 40 black, seamless. Manufactured in the USA.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234, forged steel welding type.
2. Joints: 2 inch and smaller pipe - Threaded.
3. Joints: 2-1/2 inches and larger pipe – welded.

B. Steel Pipe: ASTM A53, Schedule 40 black, seamless. Manufactured in the USA.
1. Fittings: Compression type, Viega MegaPress G, ANSI LC4-2012, zinc and nickel coating, HNBR sealing element, 420 stainless steel grip ring, 304 stainless steel separator ring and smart connect feature.
2. Joints: 2 inch and smaller pipe - Viega MegaPress G Ridgid tool press.

C. Copper Tubing: Type L hard drawn. ASTM B88.
1. Fittings: Compression type, Viega ProPress G, copper alloy.
2. Joints: 2 inch and smaller pipe – Viega ProPress G Ridgid tool press.

2.2 BALL VALVES

A. Manufacturers: Nibco, Stockham, Milwaukee, or approved equal.

B. 1/2 inch to 3/4 inch (appliance shutoff valve): 1/2 psi rated for indoor appliance connections per ANSI Z21.15. Forged brass body, chrome plated brass ball, fluorocarbon o-rings, brass stem, painted aluminum lever handle. (Nibco G10)

C. 1/4 inch to 1 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port. (Nibco T585-70-UL)

D. 1-1/4 inch to 3 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, conventional port. (Nibco T580-70-UL)

2.3 FLEXIBLE PIPE CONNECTIONS

A. Tubing: Annealed, 304 stainless steel, ASTM A240

B. Fittings: Brass or stainless steel.

C. Coating: Yellow polymer.

2.4 QUICK CONNECT FITTING

A. Manufacturers: T&S or approved equal.

B. 3/4" one-way shut-off coupling and plug body. Bass body construction with stainless steel internal parts.

2.5 SOLENOID VALVE

A. Manufacturers: Alcon, Asco or approved equal.

B. Aluminum body, nitrile seal, normally closed, zero pressure rated, NEMA 2 metal enclosure, UL Listed, 120 Volt.

C. Manual push button wall mounted reset. Coordinate with alerting system.

2.6 EARTHQUAKE VALVE

A. Manufacturers: California Seismic Valves 300 series or approved equal.

B. Valve shall be full size of pipe off meter. No external electrical power required. Swing check valve arrangement with an acceleration sensitive triggering mechanism. Trip mechanism consists of steel ball. Horizontal motion of an earthquake triggers shut off. Manual reset. Sight glass indicates open or closed.

2.7 EXTERIOR WALL OUTLET

A. Manufacturer: Burnaby or approved equal.

B. Stainless steel gas outlet box with brushed finish, 1/2" NPT pipe connection, shutoff valve, 3/8” quick disconnect plug, lockable access door.

2.8 STRAINERS

A. 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

2.9 NATURAL GAS PRESSURE REDUCING VALVES

A. Manufacturers: Fisher or approved equal.

B. Product Description: Quick-reacting, low-shock natural gas, spring loaded pressure regulator, ductile Iron body, aluminum casings and orifice, nitrile diaphragm and o-rings, full internal relief, 125 psi inlet rated. Threaded or flanged ends depending on size.

PART 3 EXECUTION

3.1 GAS METERS AND DISTRIBUTION

A. Refer to plans for meter location and coordinate with the Gas Company for installation and size. Facilitate application for gas service and pay all charges necessary for complete installation.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside of pipe, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54 and the International Fuel Gas Code.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Provide flexible pipe at connections to all equipment. Use sufficient length to allow for 4" of movement.

D. Grade horizontal pipe not less than ¼" in 15 feet.

E. Route piping in orderly manner and to conserve building space and not interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Provide 6" long drip leg at bottom of vertical pipe.

H. Take from top or side of horizontal pipe.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Sleeve pipe passing through partitions, walls and floors.

K. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

L. Provide clearance for access to valves and fittings.

M. Provide access doors where valves and fittings are not exposed.

N. Do not embed any building service low pressure pipe in concrete, in masonry, or below grade. Install such pipe in Schedule 40 welded pipe sleeves and vent to roof.

O. Provide support for utility meters in accordance with requirements of utility company.

P. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

Q. Install identification on piping systems.

R. Install valves with stems upright or horizontal, not inverted.

S. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

3.4 PRESSURE REDUCING VALVES

A. Install per manufacturer's recommendations. If PRV is installed indoors determine routing to an approved location and provide independent relief pipe to outside. Size relief vent pipe full port size, ¾" minimum. Increase vent pipe size one pipe size for lengths greater than 15'. Increase vent pipe size two pipe sizes for lengths greater than 25'.

3.5 FIELD QUALITY CONTROL

A. Pressure test natural gas piping in accordance with NFPA 54 and the International Fuel Gas Code.

B. Subject pipe to air pressure of 60 psig for 30 minutes with no perceptible drop in pressure.

C. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Water heaters.
2. Diaphragm-type expansion tanks.
3. System lubricated circulators.
4. Water heater venting (Plastic)

1.2 SCOPE

A. Provide plastic venting and combustion air for water heaters and boilers in this section.

1.3 COORDINATION

A. For equipment which requires metal venting coordinate required material and location with Division 23.

1.4 QUALITY ASSURANCE

A. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by Washington State Energy Code and scheduled on drawings.

PART 2 PRODUCTS

2.1 COMMERCIAL GAS FIRED WATER HEATERS (MODULATING)

A. Manufacturers: Heat Transfer "Phoenix" or approved equal.

B. Type: Automatic, natural gas-fired, 3:1 modulating, condensing, sealed combustion, vertical storage.

C. Tank: 316L Stainless steel; 90/10 cupronickel heat exchanger; minimum 2" polyurethane thermal insulation (R-14), encased in corrosion-resistant jacket; zero clearance to combustibles. 95%-97% thermal efficiency.

D. Controls: Electronic water thermostat with adjustable temperature range from 120 to 160 degrees F with LED display; Automatic reset high temperature limiting thermostat, low water cutoff, upper hot water sensor, lower cold water sensor, gas pressure regulator, modulating burner with 3:1 turndown.

E. Accessories:
1. ASME rated tank, temperature and pressure relief valve.

2. Direct venting concentric termination kit.

2.2 DIAPHRAGM-TYPE EXPANSION TANKS

A. Manufacturers: Amtrol, Armstrong or approved equal.

B. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; with pre-charged flexible EPDM diaphragm sealed into tank; steel ring base (vertical) or saddles (horizontal)

C. Accessories: Pressure gage and air-charging fitting, tank drain.

D. Installation: Before installation, charge tank with Nitrogen gas to equal domestic water line pressure at tank. Permanently mark fill pressure on tank.

2.3 SYSTEM LUBRICATED CIRCULATORS

A. Manufacturers: Armstrong Astro 2, TACO, Grundfos or approved equal.

B. Type: Horizontal shaft, single stage, direct connected with wet rotor motor for in-line mounting, for 150 psig maximum working pressure, 230 degrees F maximum water temperature.

C. Casing: Lead-Free bronze or stainless steel with flanged pump connections. NSF 372 certified.

D. Impeller: Polyether Imide (PEI)

E. Shaft: Ceramic

F. Bearings: Ceramic

G. Bearing Seal: EPDM

H. Motor: 3-speed

I. Accessories:
1. 24 hour time clock with on/auto/off switch.
2. Clip-on aquastat with bi-metal disc, 95F on, 115F off.

PART 3 EXECUTION

3.1 INSTALLATION – WATER HEATER

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Install water heater on concrete housekeeping pad, minimum 4 inches high and 6 inches larger than water heater base on each side. For electric water heaters include incompressible insulated surface (R-10 min).

C. Anchor or strap to structure to resist horizontal displacement due to earthquake. IAPMO listed, galvanized steel, double body straps, Hubbard Quick Strap or approved equal.

D. Connect domestic hot water and domestic cold water piping to water heater connections.

E. Install the following piping accessories. Refer to Section 22 11 00.
   1. On cold water:
      a. Thermometer well and thermometer.
      b. Strainer.
      c. Pressure gage.
      d. Shutoff ball valve.
   2. On hot water:
      a. Thermometer well and thermometer.
      b. Shutoff ball valve.

F. Install discharge piping from relief valves and drain valves to nearest floor drain or indirect waste location. Determine best routing.

G. Provide pan where required or specified.

H. Install water heater trim and accessories furnished loose for field mounting.

I. Install electrical devices furnished loose for field mounting.

J. Install control wiring between water heater control panel and field mounted control devices.

3.2 INSTALLATION – NATURAL GAS OR PROPANE FUEL FIRED

A. Connect natural gas piping to water heater in accordance with NFPA 54, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.

B. Install the following piping accessories on natural gas piping connections. Refer to Section 22 23 00.
   1. Strainer.
   2. Shutoff valve.

C. Connect flue to water heater outlet, full size of outlet.

3.3 INSTALLATION - FLUE AND COMBUSTION AIR PIPING

A. Install flue and vent piping per manufacturer’s installation instructions. Note maximum allowable venting length.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Protection: Where piping, other than cast iron or steel, is installed in a concealed location through holes or notches in framing (i.e. studs, joists, rafters, etc.), less than 1-1/2 from framing edge, provide shield plates. Shield plates shall be 16 gauge steel and cover the piping area within framing plus 2" on each side along framing.

G. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

H. Provide factory vent and combustion air terminations. Flash and seal piping penetrating building exterior to maintain integrity of assembly.

I. Install pipe identification in accordance with Section 22 05 00.

3.4 INSTALLATION - PUMPS

A. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches and over.

C. Provide line sized shut-off valve and strainer on pump suction, and line sized check valve, balancing valve, and shut-off valve on pump discharge.

D. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and larger.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. General Plumbing Fixtures: Water closets, Urinals, Lavatories, Sinks, Service sinks, Bathtubs, Showers, Drinking fountains, Electric water coolers.
2. Faucets and valves
3. Emergency Fixtures: Emergency showers, Emergency Eye and Face Wash.
4. Hose bibbs & Hydrants.
5. Accessories.

1.2 SCOPE

A. This section includes all plumbing fixtures, trim and installation, to include owner furnished equipment.

1.3 REQUIREMENTS

A. All china fixtures shall be white or manufacturer's standard unless otherwise indicated.

B. Ensure that that all china fixtures install in a room or area are the exact same color and hue, especially if from different manufacturers.

C. Fixtures by type and material shall be of the same manufacturer except when scheduled or approved otherwise.

D. Tank type water closets shall have a minimum MaP (Maximum Performance) of 500 g.

E. Fixtures shall be designed or equipped to meet the following water use efficiency standards:

1.	Water closets (tank or flush valve)	1.6 GPF
2.	Shower heads	1.5 GPM
3.	Lavatory faucets (Private)	1.5 GPM
4.	Lavatory faucets (Public)	0.5 GPM
5.	Kitchen faucets	2.0 GPM
6.	Service faucets	2.0 GPM

PART 2 PRODUCTS

2.1 TANK TYPE WATER CLOSETS

A. Manufacturers: Kohler, American Standard, Toto or approved equal

B. Gravity (ADA): white, vitreous china, floor mount, 12” rough-in, 16-1/2” rim height, ADA compliant, gravity feed flush with 3” valve, elongated bowl, close-coupled closet combination, insulated vitreous china closet tank with fittings and lever flushing valve, siphon jet, 2-1/8” passageway, chrome plated bolt caps.

2.2 WATER CLOSET SEATS

A. Manufacturers: Bemis, Olsonite or approved equal.

B. Open Front: Heavy duty solid plastic, white, large molded-in bumpers, external check hinges with stainless steel posts, without cover.

2.3 LAVATORIES

A. Manufacturers: Kohler, Eljer, American Standard or approved equal.

B. Wall Hung: white, vitreous china, wall mounted, drilled for concealed arm carrier, overflow, ADA compliant. Provide with wall carrier.

C. Counter Top: white, vitreous china, self-rimming, overflow, ADA compliant.

D. Undercounter: white, vitreous china, unglazed rim for under counter mount with overflow.

2.4 SINKS

A. Manufacturers: Elkay, Just, Acorn or approved equal.

B. Single Compartment: Seamless 18 gauge. Type 304 stainless steel, self-rimming, radius corners, sound deadening undercoat.

C. Bar: Seamless 18 gauge. Type 304 stainless steel, self-rimming, radius corners, sound deadening undercoat.

D. Scullery: 14 gauge stainless steel, welded construction ground smooth, 1/4” radius corners, wall and floor mounted with tubular stainless steel legs, 8” high full length backsplash with 45 deg. slope top, 1-1/2” wide inward slopping top channel rims, integral drainboards sloped to drain, drilled for faucet and drain outlets, satin finish.

2.5 SHOWER ENCLOSURES

A. Manufacturers: Fiberfab, Aquatic, Florestone or approved equal.

B. One piece gel-coated fiberglass or acrylic shower stall with stainless steel curtain rod. Curtain rod shall be minimum 6’-3” AFF (verify with architect).

C. (ADA): One piece gel-coated fiberglass or acrylic shower stall, barrier-free with stainless steel curtain rod, folding transfer seat, stainless grab bar.

2.6 FAUCET, LAVATORY

A. Manufacturers: Chicago, Geberit, Delta HDF, Symmons or approved equal and as specifically noted below.

B. Centerset:
1. Single Handle: Polished chrome plated cast brass, deck mount, metal lever handle, ceramic mixing cartridge, temperature limit stop, 2.2 gpm aerator. Spout length, drain and hole spacing as scheduled.

2.7 FAUCET, SINK

A. Manufacturers: Chicago, Delta HDF, Symmons or approved equal.

B. Swing Spout:
1. Single Handle: Polished chrome plated cast brass, deck mount, metal lever handle, ceramic mixing cartridge, temperature limit stop. Spout length, drain and hole spacing as scheduled.

C. Gooseneck:
1. Dual Handle: Polished chrome plated cast brass, deck mount, metal indexed wristblade handles. Spout height, reach, drain and hole spacing as scheduled.

2.8 FAUCET, DECON

A. Manufacturers: T&S or approved equal.

B. Polished chrome plated brass, backsplash mount, lever handles with spring checks & color coded indexes, 14” swing spout, pre-rise spray riser with wall bracket, finger hook, spray valve and stainless spring wound rubber hose.

2.9 SHOWER/TUB VALVES

A. Manufacturers: Chicago, Delta HDF, Symmons or approved equal and as specifically noted below.

B. Shower: Pressure balancing valve that cycles from cold to hot, lever handle, chrome plated brass, intergral service stops, complete with shower head, arm and flange.

2.10 SHOWER HEADS

A. Manufacturers: Symmons, Speakman or approved equal.

B. Solid brass construction, polished chrome finish, 6-jet showerhead, infinitely adjustable spray streams with operating handle, pressure-compensating auto-flow limit to 2.0 gpm.

2.11 SHOWER HAND SPRAY

A. Manufacturers: Symmons, Alsons or approved equal.

B. Personal hand held shower with push button, on-off control, 60” double spiral metal hose, 24” stainless steel slide/grab bar, ADA adjustable slide, chrome plated vacuum breaker, chrome plated wall supply elbow.

2.12 INSTANTANEOUS HOT WATER DISPENSER

A. Manufacturers: In-Sink-Erator or approved equal.

B. 1/2 gallon insulated tank, 1.75 gal/hour capacity @ 190 F, 140-200 F adjustable thermostat, instant self-closing valve, chrome, UL listed.

2.13 EMERGENCY EYE AND FACE WASH

A. Manufacturers: Haws, Bradley, Guardian, Speakman, Acorn or approved equal.

B. Wall mounted eye/face wash with 11” stainless steel bowl, wall bracket, twin soft anti-surge eyewash heads, stainless steel face spray ring, hand flag control, chrome plated waste tailpiece and trap, dust cover, brass stay-open ball valve, in-line 50x50 mesh brass strainer, CSA certified to meet ANSI Z358.1. Include universal emergency signage 8”x11”.

2.14 HOSE BIBBS

A. Manufacturers: Woodford, Zurn, JR Smith or approved equal.

B. Interior: Bronze or brass with integral mounting flange, automatic draining, anti-siphon vacuum breaker, 3/4” hose thread, wheel handle.

C. Exterior (Freeze Proof): Automatic draining, freezeless, hose connection backflow protection, two check valves, 3/4” hose thread, loose key handle, wall clamp.

2.15 HOSE STATION

A. Manufacturers: Leonard or approved equal.

B. Hot & Cold: Panel-type recessed stainless steel cabinet with stainless steel cover, inlets with stops, check valves and color coded handles, outlet dial thermometer, vacuum breaker hose connection, stainless steel hose rack, [10] feet of 3/4" heavy duty EPDM hose with industrial rubber coated bronze nozzle.

2.16 HOSE REELS

A. Manufacturers: Graco, Reelcraft or approved equal.

B. Heavy duty type, steel construction, dual pedestal frame, powder coat finish, hand crank retractable, ¾” inlet, ¾” outlet, 300 psi rated.

C. Hose: ¾" 125 psi rated.

D. Accessories:
1. Mounting bracket and stainless steel hardware.
2. Hose inlet kit.

2.17 RECESSED VALVE BOX

A. Manufacturers: Guy Gray, Acorn, Oatey, Sioux Chief or approved equal.

B. General: Box construction shall match fire rating of wall.

C. Washing Machine: 2" drain socket, 3/4" hot & cold brass valves, wall brackets, face plate.

D. Water: 1/4 turn brass ball valve with recessed wall box, wall brackets, face plate.

2.18 FIXTURE SUPPLIES

A. Manufacturers: Brass Craft or approved equal.

B. Chrome plated brass angle stops with fixed key metal handle and chrome plated escutcheon. Chrome plated copper flexible supplies for exposed connections, braided supplies acceptable where concealed. Provide stop and supply type as applicable to specific fixtures.

2.19 TRAPS

A. Manufacturers: Brass Craft, Dearborn Brass or approved equal.

B. Adjustable type, polished chrome plated brass with escutcheon. Provide type as applicable to specific fixture installation. PVC acceptable only where concealed.

2.20 LAVATORY INSULATION KIT

A. Manufacturers: Truebro, Plumberex, or approved equal.

B. Where lavatories or sinks have exposed traps or supplies furnish the following for ADA compliance: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers, antimicrobial, with flush reusable fasteners.

2.21 CARRIERS

A. Manufacturers: Wade, J.R. Smith, Zurn, Josam or approved equal.

B. Lavatory: Provide concealed arm carriers for all wall mounted lavatories. Coated steel uprights with welded feet, cast iron adjustable headers, concealed arms, lugs for floor and wall attachment, steel sleaves, alignment truss.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify electric power is available and of correct characteristics.

C. For all lavatories and sinks verify required number of holes and hole spacing before ordering.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures and in accordance with manufacturer's details.

B. Locate fixtures in accordance with architectural drawings, details on structural drawings and/or Engineer's direction in field. Mount ADA fixtures according to dimensions on architectural drawings.

C. If drain, tailpiece, strainer or other accessories are not furnished by fixture manufacturer then provide accessories by Brass Craft or approved equal.

D. Provide vandal proof features on faucets, aerators, bubblers and pop-up waste assemblies on fixtures in public areas.

3.3 INSTALLATION

A. Install shut-off valves on water lines servicing a fixture group.

B. Support piping at stop, valve or flush valve.

C. Align fixtures and equipment installed in accord with architectural drawings.

D. Locate shower head mounting height 80” minimum from drain to centerline of head pipe.

E. Locate shower curtain rod minimum 6’-3” AFF (verify with architect).

F. Locate floor service sink (mop sink) faucet rough-in at 36” AFF.

G. Locate water recessed valve boxes for refrigerators at 18” AFF.

H. Locate water recessed valve boxes for coffee makers per architectural plans.

I. Seal fixtures to wall and floor surfaces with silicon sealant, color to match fixture.

J. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

K. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and ordering.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. Adjust flush lever or valve for intended flow rate and operation.

END OF SECTION

SECTION 23 00 00

HVAC GENERAL CONDITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Conform to General Conditions, Supplementary Conditions, the modifications thereto and Division 01 - General Requirements for all work in Division 23.

1.2 SUMMARY

A. Design Intent: Demolish existing HVAC and provide new systems for an existing fire station.

B. Provide labor, materials and appliances necessary for satisfactory installation of mechanical work ready to operate in strict accordance with these specifications and drawings. Work of Division 23 includes, but is not limited to, that as delineated in the following specification sections:

23 00 00	HVAC General Conditions
23 05 00	Common Work Results for HVAC
23 05 93	Testing, Adjusting and Balancing
23 07 00	HVAC Insulation
23 08 00	Project Commissioning
23 09 00	Instrumentation and Control for HVAC
23 23 00	Refrigerant Piping
23 31 00	HVAC Ducts and Casings
23 33 00	Air Duct Accessories
23 34 00	HVAC Fans
23 37 00	Air Outlets and Inlets
23 38 00	Ventilation Hoods
23 40 00	HVAC Filters
23 51 00	Chimney and Stacks

23 55 00 Fuel-Fired Heaters

23 72 00 Energy Recovery Units

23 81 43 Variable Refrigerant Flow, Heat Pump System

23 82 00 Terminal Heating Units

23 82 16 Duct Coils

1.3 CODES AND STANDARDS

A. Conform to following code and agency requirements having jurisdictional authority over mechanical installation.
1. Uniform Plumbing Code (UPC) with local amendments.
2. International Mechanical Code (IMC) with local amendments.
3. International Building Code (IBC) with local amendments.
4. International Fuel Gas Code (IFGC) with local amendments.
5. National Electrical Code (NEC) NFPA 70.
6. Requirements of OSHA and EPA.
7. National Fire Protection Association (NFPA) Codes and Standards.
8. ASME code for construction of pressure vessels.
9. American Gas Association (AGA) Standards.
10. ASTM, ANSI and NEMA standards, as referenced in subsequent sections.
11. Local Sewer District Requirements.
12. Local Water District Requirements.
13. Local Health Department Requirements.
14. Washington State Energy Code.

1.4 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to International Building Code with local amendments, FM, and UL for fire resistance ratings and surface burning characteristics.

B. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping and ductwork.

C. Provide minimum static deflection of isolators for equipment as follows:
1. 5 hp and less: 1 inch
2. Over 5 hp: 2 inch

1.5 PRODUCT SUBSTITUTIONS

A. Manufacturers and models of equipment and material indicated herein and on drawings are those upon which mechanical design is based. Other manufacturers with products considered equal in general quality may be listed without specific model designation. Manufacturers not listed shall be submitted for approval, see Division 01.

B. Substitutions will be evaluated based on product manufacturer only. Specific product model, specifications, options and accessories will be evaluated during submittals. Approval of a manufacturer substitution does not constitute approval of the submitted product.

C. Any equipment other than the basis of design is considered a substitution.

D. In selecting substitute equipment, the Contractor is responsible for and shall guarantee equal performance and fit. Cost of redesign and all additional costs incurred to accommodate the substituted equipment shall be borne by the Contractor.

E. Unless indicated otherwise, “or approved” may be assumed for all products in Division 23.

1.6 SUBMITTALS

A. Provide one electronic copy of product data submittals for all products listed under “Part 2 Products” of Division 23 and all additional products noted on drawings or required for completion of sequence of operations.

B. Electronic: **Submittals shall be complete in one PDF file with bookmarks for each Division. Multi-part submittals will be returned without review.**
1. First Page: Name of Project, Owner, Location & Contracting Company.
2. Index Page: List of specification sections with contents by Tag or item.
3. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.
4. Acceptable forms of delivery are:
   a. Email (for file sizes less than 10 MB)
   b. Online File Transfer: Dropbox, Google Drive or similar
   c. FTP: Architects or General Contractors file server (if available)

C. Clearly indicate on each page the equipment schedule designation (Tag) and/or specification section, as applicable. Indicate selected model and all accessories intended for use.

D. Equipment vendor cover page with contact information shall precede submittal by that vendor.

E. Submitted product information shall include (as applicable) but not be limited to the following information:
1. Product description
2. Manufacturer and model
3. Dimensions
4. Performance Ratings (i.e. capacity, rpm, HP, temperature)
5. Construction Materials
6. Ratings (i.e. UL, ASTM, NEMA, etc)
7. Electrical data
8. Sound level data (corresponding to scheduled values)
9. Vibration Isolation

10. Controls and wiring diagrams
11. Accessories
12. Engineering technical data (i.e. pressure drops, leakage rates, pump curves, fan curves)

F. If requested by Architect or Engineer, submit Manufacturer's Installation Instructions on any equipment, procedures, or certifications so requested.

G. Do no ordering, fabrication or manufacturing of products until return of approved submittals.

1.7 SHOP DRAWINGS

A. The Contractor shall submit drawings and/or diagrams for review and for job coordination in all cases where deviation from the Contract Drawings are contemplated because of job conditions, interference or substitution of equipment, or when requested by the Engineer for purposes of clarification of the Contractor's intent.

B. Submit detailed drawings, rough-in sheets, etc., for all special or custom-built items or equipment. Drawings and details under the section shall include (but not be limited to) the following, where applicable to this project:
1. Electrical interlock wiring diagrams.
2. Piping layout plans and interference details.

C. By submission of piping and ductwork shop drawings, the Contractor acknowledges that coordination has been done to ensure that all piping and ductwork fits and that no conflicts exist.

D. The Architect's review of shop drawings shall not relieve the Contractor of responsibility for deviations from the Contract drawings or specifications, unless he has, in writing, called the attention of the Architect to such deviations at the time of the submission, nor shall it relieve him from responsibility for errors or omission in such shop drawings.

1.8 COMMISSIONING

A. See Section 23 08 00 for roles and responsibilities of commissioning.

B. Provide all necessary commissioning assistance, equipment and documentation as required by the Commissioning Plan.

C. The duty and responsibility for mechanical commissioning work shall be assigned to a specific individual. Inform the General Contractor and Certified Commissioning Professional (CCXP) of the contact information for the person so assigned.

D. Perform corrective actions needed to resolve deficiencies identified during commissioning. Record action taken on commissioning deficiency log.

1.9 COMMISSIONING PLAN

A. The Commissioning Plan shall be submitted with other mechanical submittals.

B. Approval of commissioning plan is required before commencement of work.

1.10 HVAC PERMIT

A. HVAC contractor shall prepare all documents for mechanical permit application, submit for, and obtain the permit. HVAC Contractor shall pay all costs and fees to obtain the permit.

B. Contractor shall not commence work until permit is obtained. Contractor is solely responsible to insure that the permit application and any revisions are submitted in a timely manner so as not to impact project schedule.

C. Contractor shall retain services of a third party structural engineer to provide support, anchoring and seismic calculations for all applicable equipment.

1.11 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 – Building Services Piping for installation of piping systems and ASME Section IX – Welding and Brazing Qualifications for welding materials and procedures.

B. Perform Work in accordance with the International Mechanical Code including State and local amendments.

C. Provide products requiring electrical connections listed and classified by UL as suitable for purpose specified and indicated.

D. Perform Work in accordance with Washington State Energy Code.

1.12 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.13 SEQUENCING

A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect all equipment, materials, and insulation from weather, construction traffic, dirt, water, chemicals, and damage by storing in original packaging and under cover. Where original packaging is insufficient, provide additional protection. Maintain protection in place until installation.

C. Inspect all products and materials for damage prior to installation.

D. Protect piping from all entry of foreign materials by providing temporary end caps or closures on piping and fittings. Furnish temporary protective coating on cast iron and steel valves.

E. Protect heat exchangers and tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

F. Protect dampers from damage to operating linkages and blades.

G. Protect materials and finishes during handling and installation to prevent damage.

H. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

I. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

J. Comply with contractor’s construction Indoor Air Quality (IAQ) Plan.

1.15 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.

B. Provide ventilation in areas to receive solvent cured materials.

C. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer. Maintain temperature during and after installation for minimum period of 24 hours.

D. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

E. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers. Maintain temperatures during and after installation of duct sealant.

F. Maintain water integrity of roof during and after installation of chimney or vent.

G. Do not install condensing unit foundation pad when ground is frozen or muddy.

1.16 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Verify by field measurements, sizes and configurations are compatible with wall construction and layout.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining existing systems.

1.17 COORDINATION

A. Visit the site and become familiar with existing conditions affecting work.

B. Verify locations of any overhead or buried utilities on or near site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining existing systems.

D. HVAC drawings are diagrammatic and do not indicate all possible site conditions. The contractor shall verify all measurements, dimensions and connections on site and coordinate between trades to preclude interferences. The contractor shall provide adjustments to piping or ductwork as necessary to fit conditions including but is not limited to relocation, offsets, and transitions.

E. In the event of a conflict with other trades of work, the following priority from highest to lowest shall be followed: Structural, lighting, HVAC, plumbing/piping and sprinklers. Starting with the lowest priority, the HVAC, plumbing, and sprinkler contractors shall provide whatever materials, offsets, labor etc. is required to resolve the conflict.

F. When discrepancies occur between plans and specifications, the Architect will determine which takes precedence and the Contractor shall perform the selected requirement at no additional cost.

G. Prior to ordering equipment cross-check mechanical and electrical drawings and specifications to assure proper location and electrical characteristics of connections serving mechanical and electrical equipment.

H. Advise the Architect of any modifications required to suit equipment furnished. Costs for modifications due to equipment substitution will be borne by the contractor.

I. Wherever conflicts occur between different parts of the Contract Documents the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

J. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device or equipment roughed in improperly and not positioned on implied centerlines or as required by good practice shall be repositioned at no cost to the Owner.

K. Where the word 'verify' is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner.

L. Coordinate trenching, excavating, bedding, backfilling of buried systems with requirements of this specification.

M. Coordinate wall openings, piping rough-in locations, concrete housekeeping pads, and electrical rough-in locations to accommodate Work of this Section.

N. Coordinate all equipment with building control work.

O. Coordinate installation of
1. Condensing units with concrete pad and roof structure.
2. Air handling units with building structure.
3. Unit installation with roof structure, piping systems, and ceiling for unit access.
4. Roof curbs with roof structure, roof deck and roof membrane installation.

1.18 CUTTING, FITTING, REPAIRING AND PATCHING

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where necessary for installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting, where possible, by setting sleeves, frames, etc., and by coordinating for openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for ducts and piping.

C. Cut all holes neatly and as small as possible to admit work. Perform cutting in manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

1.19 SALVAGE

A. Remove excess piping and ductwork, plug or cap any unused branch connections. Remove scrap pipe and all other excess materials from the site.

B. Comply with contractor's Construction Waste Management Plan. Retain and submit all trip and tip tickets for all construction debris and waste hauling, indicating material content, tonnage, date hauled and facility to where materials were hauled.

1.20 ELECTRICAL

A. Short-Circuit Current Rating (SCCR): All HVAC and refrigeration equipment with multi-motor or combination electrical loads shall comply with NEC 110.10 & 440.4 and must include a SCCR greater than the Available Interrupting Current (AIC) of the electrical circuit serving the equipment. See electrical drawings for required AIC kA rating. Equipment SCCR may be presented in writing from the manufacturer or shown on the unit nameplate. Refrigeration or air-conditioning equipment over 60 Amps MOCP must list the SCCR on the unit nameplate. If the AIC rating is unavailable or cannot be determined provide equipment with a minimum SCCR of 10kA.

B. Motors:
1. Temperature Rating: Rated for 40 degree C environment with maximum 50 degree C temperature rise for continuous duty at full load.
2. Starting Capability: Not less than 12 starts per hour.
3. Phase Characteristics: Squirrel-cage induction poly-phase motors for 3/4 HP and larger, and capacitor-start single-phase motors for 1/2 HP and smaller. At equipment manufacturer's option, 1/6 HP and smaller may be split-phase type.
4. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
5. Enclosure Type: Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and guarded drip-proof motors where exposed to contact by employees or building occupants. Weather-protected Type I for outdoor use, Type II, where not housed.
6. Overload Protection: Built-in thermal overload protection.
7. Name Plate: Indicate full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
8. All motor efficiencies shall conform to Washington State Energy Code and NEMA MG-1.

C. Motor Starters: By mechanical equipment manufacturer where factory mounted controls are provided. Variable frequency drives by Division 23, all other starters provided by Electrical Contractor.

D. Power Wiring: By Electrical Contractor.

E. Control Wiring: Responsibility of Division 23, including all line and low voltage control wiring. Owner will not entertain additional cost due to lack of coordination between HVAC Contractor and Electrical Contractor.

1.21 EXTRA MATERIALS

A. Furnish
1. Two refrigerant oil test kits each containing everything required for conducting one test.
2. Three sets of disposable filters for each unit.
3. One set of fan belts for each unit.

1.22 PROJECT CLOSEOUT

A. Completion, submission and approval of the following is required for final project closeout.
1. Execution of Architect's and Engineer's final observation reports (punchlist)
2. Operating and Maintenance Instructions
3. Operating and Maintenance Manual
4. Equipment and Pipe Cleaning
5. Record Drawings
6. Testing
7. Commissioning
8. Warranty

B. See Division 01 for additional requirements.

1.23 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General: In addition to requirements of Division 01, following initial operation of HVAC systems and prior to acceptance by the Architect, perform the following services.

B. At least two weeks prior to each instruction period, give written notification of readiness to proceed to the Architect and Owner, and obtain mutually acceptable dates.

C. Conduct demonstrations and instructions for the Owner's representatives, pointing out requirements for operating, servicing and maintaining equipment and systems. Describe general system operation and specific equipment functions. Cover all equipment calibration, setpoint adjustment, safeties and alarms.

D. Furnish qualifications of Contractor's personnel in charge of the instruction; foreman position is minimum acceptable. Where equipment startup is performed by supplier's or manufacturer's personnel, those personnel should also provide training on that equipment.

E. During demonstrations and instructions include and reference information from maintenance manuals and contract drawings.
1. Provide documentation of all instruction which includes:
a. Date and time of instruction
b. Name, affiliation and qualifications of the instructor
c. Name and affiliation of the attendees

d. Topics, systems, and equipment covered
e. Length of instruction

F. Minimum duration of instruction periods:
1. HVAC Systems 4 hours
2. Control Systems 4 hours

1.24 OPERATING AND MAINTENANCE MANUALS

A. Contents: Furnish, in accord with Division 1, three (3) bound copies of operating and maintenance manuals to include the following:
1. Manufacturers, suppliers, contractor names, addresses and phone numbers.
2. Warranty service contractors' names, address and phone numbers (if different from above).
3. Schedule and description of routine maintenance for each component to include oiling, lubrication and greasing data.
4. Manufacturer's cuts and rating tables, including brochures for all submittal items.
5. Part numbers of all replaceable items.
6. Control diagrams and operation sequence.
7. Written guarantees.
8. Record drawings corrected and completed.
9. Completed equipment start-up forms and checklists.
10. Final copy of testing, adjusting, and balancing report.

B. Operation and Maintenance Data:
1. Include, spare parts lists, exploded assembly views for all equipment.
2. Submit installation instructions, adjustment instructions, spare parts lists, exploded assembly views for all equipment.
3. Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
4. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data. Include directions for resetting constant volume regulators.

C. Filters: Operation and Maintenance Data: Submit instructions for operation, changing, and periodic cleaning.
1.
2. Submit replacement part numbers and availability, and nearest service depot location and telephone number.

D. Binders:
1. Furnish typewritten or printed index and tabbed dividers between principal categories.
2. Bind each manual in a hard-backed loose-leaf binder.

E. Imprint on cover:
1. Name of project.
2. Owner.

3. Location of project.
4. Architect.
5. Contractor.
6. Year of completion.

F. Imprint on backing:
1. Name of project.
2. Year of completion.

G. Submittals:
1. Preliminary Copies: Prior to scheduled completion of the project, submit two copies for review by the Architect.
2. Final Copies: After approval of the preliminary copies, submit three (3) finished copies to the Owner.

1.25 EQUIPMENT AND PIPE CLEANING

A. Clean interior and exterior of all equipment. Equipment shall be free of dirt, construction debris, corrosion, etc.

B. Adequate provisions shall be made during construction to eliminate dirt, debris or other material from entering and collecting inside of pipe, ductwork and equipment. Any collection of material shall be thoroughly cleaned before equipment startup and if necessary again before owner occupancy.

C. Clean exterior of all exposed pipe and ductwork.

1.26 RECORD DRAWINGS

A. Submit one CD or DVD with all drawings in PDF format.

B. Make all notes and revisions on PDF set in red.

C. Show location of equipment, location and size of piping, location and size of ductwork. Locate all valves, control dampers and similar equipment with tag or label identification. Indicate locations and elevations of exterior pipe and utility connections. Maintain continuously updated drawings during progress of project.

D. Record actual locations of tagged valves and control dampers; include valve tag numbers. Record actual locations of flexible connectors and expansion joints.

E. Record actual locations of equipment, clean-outs, controlling devices, and all above grade, under-floor, and buried piping and ductwork. Provide dimensions from gridline or walls to indicate specific locations.

1.27 TESTING

A. Provide completed start-up forms and checklists.

B. Perform testing and balancing of HVAC systems as described in this Division and as required by applicable codes and ordinances.

C. Provide changes in sheaves, belts, and dampers as required for correct balance.

D. Provide commissioning of Control System, and all mechanical components in compliance with the applicable Energy Code, the commissioning notes on the drawings and commissioning specifications of this Division. Written verification of test to be signed by Owner's Representative

1.28 COMMISSIONING REPORT

A. Submit three (3) copies of the preliminary commissioning report as outlined on drawing commissioning notes and specifications of this Division. This report is an execution and fulfillment of the commissioning plan. This report shall be completed before the final mechanical permit inspection. At a minimum this report shall include:
1. Test and balance report
2. Complete equipment startup checklists
3. Functional test reports
4. Sequence of Operation test reports
5. O&M materials
6. Record drawings
7. Owner training documentation
8. Note any discrepancies observed during testing and any corrective actions taken or date when corrective action will be taken.
9. Note any tests which could not be performed due to weather conditions.

B. After receiving review comments from the preliminary commissioning plan make corrections indicated and submit three (3) copies of the final commissioning report. At a minimum this report shall include the information from the preliminary commissioning report and the following:
1. Corrective measures taken in response to preliminary report or field observation report.

1.29 WARRANTIES AND CONTRACTOR'S GUARANTEE

A. All work, material and equipment shall be free of defect, complete and in perfect operating order at time of delivery to Owner.

B. Furnish one year warranty from date of substantial completion for all systems unless specifically noted otherwise.

C. Without cost to Owner, **correct all defects and failures discovered within one year from date of final acceptance**, except when in the opinion of the Architect a failure is due to neglect or carelessness of the Owner.

D. The guarantee of the Contractor is independent of shorter time limits by any manufacturer of equipment furnished. Submit with Operation and Maintenance Manual all guarantees which exceed one year.

E. Make all necessary balancing and control adjustments during first year of operation.

F. The presence of any inspector or observer during any construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

PART 2 NOT USED

PART 3 EXECUTION

3.1 DOCUMENTATION

A. Additional plan submittals to reviewing authority: If additional drawing submittals are required at any time during construction contractor shall submit drawings, review with authority, and pick up subsequent approved drawings. Engineer will revise and/or prepare drawings for submittal.

3.2 INSPECTION

A. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work.

B. Should any work be enclosed or covered up before such inspection and test, Contractor shall at his own expense uncover work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition.

C. Energy Code C104 specifically requires the following inspections.
1. Mechanical Equipment Efficiency and Economizer: To be made after all equipment and controls required by the Energy Code and this specification are installed and prior to the concealment of such equipment or controls.
2. Mechanical Pipe and Duct Insulation: To be made after all pipe and duct insulation is in place, but before concealment.
3. Motor Inspections: To be made after installation of all equipment covered by the Energy Code and this specification but before concealment.

3.3 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation for proper movement clearance.

3.4 CLEANING

A. Clean adjacent surfaces of fire stopping materials.

B. Clean ductwork and equipment.

3.5 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Hangers and Supports.
2. Vibration and Seismic Controls.
3. Firestopping.
4. Access Panels
5. Tags and Identification.
6. Execution

1.2 GENERAL REQUIREMENTS

A. Comply with requirements and recommendations of Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58 and SP-69.

B. Comply with requirements and recommendations of Sheetmetal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standards.

C. Conform to requirements of IBC 1613 and SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems".

1.3 MATERIALS AND EQUIPMENT

A. Where two or more units of same class of equipment are required, use products of a single manufacturer. All equipment shall be new and free from damage.

B. Protect stored material and equipment against weather, corrosion and dirt. Protect installed mechanical components, including but not limited to piping, ductwork, and equipment against weather damage, corrosion, dirt and construction dust. Seal equipment and ductwork where and when necessary to be kept clean.

C. Provide major equipment components with manufacturer's name, address, catalog number and capacity indicated on a nameplate, securely affixed in a conspicuous place.

D. Furnish standard and fabricated hangers and supports complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

1.4 REQUIREMENTS

A. Provide incompressible inserts and shields at all piping supports on pipe to be insulated per 23 07 00.

B. Provide vibration isolation on motor driven equipment, plus connected piping.

C. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

D. Firestopping Materials: Provide to achieve fire ratings as noted on architect's drawings for adjacent construction, but not less than 1 hour fire rating. ASTM and UL.
1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.
2. Surface Burning: UL 723 with maximum flame spread / smoke developed rating of 25/50.
3. Firestop interruptions to fire rated assemblies, materials, and components.

E. Prevent contact between dissimilar metals, such as copper tubing and steel, by use of copper-plated, plastic coated, or flexible materials. All supports which contact copper tubing shall be copper plated.

F. Firestop interruptions to fire rated assemblies, materials and components.

1.5 QUALITY ASSURANCE

A. Installed products shall have surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Perform work in accordance with local jurisdiction's requirements and AWS D1.1 for welding hanger and support attachments to building structure.

C. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PRODUCTS

2.1 DUCT HANGERS AND SUPPORTS

A. Hanger straps and rods shall be in accord with SMACNA Duct Construction Standards.

B. Fasten bracing to ductwork, including riveting, bolting, and tack welding per SMACNA.

C. Provide galvanized steel band or fabricated angle iron brackets for wall supports.

D. Exposed ducts shall be supported/anchored to structure at closer spacing and using heavier materials, wherever so indicated on drawings.

E. Hanger Rods: Carbon Steel, with hex nuts and flat washers.

F. Concrete Inserts:
1. Continuous channel - Unistrut or approved.
2. Universal, malleable iron - Type 18, FS WW-H-171.

G. Beam Clamps and Attachments as required.

2.2 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports with incompressible insulation inserts and shields for all piping to be insulated per 230700.
1. Manufacturer: Pipe Shields, INC or approved equal.
2. Material: Calcium Silicate or Uretherne per temperature application.
3. Thickness: Insert thickness shall match required insulation thickness per 230700.

B. Refrigerant Piping:
1. Hangers for rigid pipe: Carbon steel, adjustable swivel, split ring with Armacell Armafix insulated rigid insert.
2. Hangers for flexible pipe: Carbon steel, adjustable, clevis with Armacell Armafix insulated rigid insert and saddle.
3. Hangers for paired flexible pipe: Carbon steel, adjustable, clevis with 1” wide overlapping steel band and saddle.

2.3 HANGER ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.4 INSERTS

A. Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.5 ACCESS PANELS

A. Milcor or approved equal.

B. Include an allowance for a minimum of 12 access panels.

C. Architectural grade, 14 guage frame and door, painted steel or stainless steel based on application.

2.6 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, 300 psi CWP, malleable iron, threaded.
2. Copper Piping: Class 150, 300 psi CWP, bronze unions.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.7 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Metraflex, Mason or approved equal.

B. Braided Refrigeration Piping Connection
1. Bronze flexible hose and bronze braided outer covering.
2. Copper sweat connections, cleaned de-greased, and bagged.
3. UL listed

2.8 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.9 EQUIPMENT CURBS

A. Manufacturers' curbs where indicated on drawings.

B. Fabricated: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1-1/2 inch thick insulation, wood nailer.

2.10 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Ductwork: 18 gage thick galvanized steel.

D. Sealant: Acrylic

E. Size large enough to allow for movement due to expansion and to provide for continuous insulation or installation of fire sealant at fire-rated walls. Note that insulation is discontinuous at fire walls.

2.11 MECHANICAL SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal, Thunderline Link-Seal or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.12 MECHANICAL FIRESTOPPING SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal 120 or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking intumescent synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. UL listed for 2 hour fire protection.

2.13 FORMED STEEL CHANNEL

A. Manufacturers: Allied Tube & Conduit, B-Line Systems, Unistrut or approved equal.

B. Product Description: Galvanized 12 gage thick steel, with holes 1-1/2 inches on center.

2.14 SUPPORT ACCESSORIES

A. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

B. Swivel Joints: Steel / Bronze body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

2.15 FIRESTOPPING-APPLIED

A. Manufacturers: RectorSeal, Dow Corning, 3M Fire Protection or approved equal.

B. General:
1. Fire stopping materials shall conform to Flame (F) and Temperature (T) ratings as required by applicable building codes and tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests for through penetrations, and ASTM E 1966 or UL 2079 for construction joints, and UL 2307 for perimeter edge joints.
2. Fire stopping material shall be free of asbestos, PCBs, ethylene glycol, and lead.
3. Do not use any product containing solvents or that requires hazardous waste disposal.

4. Fire stopping shall be performed by a contractor trained or approved by firestop manufacturer.
5. Select products with rating not less than rating of wall or floor being penetrated.

C. Single Source Responsibility: Provide firestop systems for all conditions from a single supplier.

D. Product Description: Provide Latex caulk/sealant, Silicone caulk/sealant, Intumescent Wrap Strip, Firestop Putty, Firestop Collar or Intumescent Sleeve to meet each specific application and performance requirement.

E. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

F. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
1. Forming/Damming Materials: Mineral fiberboard, backer rod or other type recommended by Manufacturer's tested system.

2.16 PENETRATIONS OF NON-RATED SURFACES

A. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

B. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

2.17 VIBRATION ISOLATORS

A. Manufacturers: Metraflex, Mason, Amber Booth or approved equal.

B. Restrained Closed Spring Isolators:
1. Spring Isolators:
a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
b. Code: Color code springs for load carrying capacity.
2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.

C. Spring Hanger:
1. Spring Isolators:

a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
b. Code: Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Housings: Incorporate [neoprene isolation pad meeting requirements for neoprene pad isolators] [rubber hanger with threaded insert].
4. Misalignment: Capable of 20 degree hanger rod misalignment.

D. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
a. 30 durometer.
b. Minimum 1/2 inch thick.
c. Maximum loading 40 psi.
d. Height of ribs: not to exceed 0.7 times width.

E. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.

2.18 SPRING ISOLATION ROOF CURB (SEISMIC)

A. Manufacturers: Mason Type SRSC, Amber Booth, Vibro-Acoustics or approved.

B. Spring isolation type with rectangular steel tube lower member, continuous upper frame within "captive: guides to resist wind and seismic forces, adjustable and removable rust-resistant steel springs mounted on 1/4" neoprene pads and having minimum deflection of 2", plated or galvanized hardware, flexible aluminum seal weatherproofing and 2" insulation on lower curb.

C. Curb shall be built to seismically contain the rooftop unit.

2.19 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches high.

B. Metal Tags: Brass, Aluminum or Stainless Steel with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges. Plain English designations.

C. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Plain English designations so no tag or valve chart is required.

2.20 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1. Specific examples are noted in the table below.

Service	Background Color	Letter Color	Legend
Refrigerant	Purple	White	R-{TYPE} REFRIGERANT (EXAMPLE: R-410A REFRIGERANT)

B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.21 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color-coded head.

B. Color code as follows:
1. HVAC equipment: Yellow.
2. Fire dampers/smoke dampers: Red.
3. Heating/cooling valves: Blue.

2.22 LOCKOUT DEVICES

A. Lockout Hasps: Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices: Nylon device preventing access to valve operator, accepting lock shackle.

2.23 PAINT

A. Factory Finished Equipment: See individual equipment specification.

B. Ductwork: Paint interior of ductwork visible through grilles and diffusers with a flat black paint. Prepare and paint surfaces in accord with Division 9.

2.24 SEISMIC SUPPORTS

A. Provide seismic support as required by IBC 1613 and local authorities.

B. Sway bracing for ductwork, piping, and equipment shall consist of steel angles, rods or pipes. Shapes, lengths and methods of attachment shall be in accord with SMACNA “Guidelines for Seismic Restraints of Mechanical Systems”.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Provide access to existing piping, ductwork, equipment and other installations remaining active and requiring access.

B. Extend existing piping and ductwork installations using materials and methods compatible with existing installations.

3.2 SURFACE PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond of adhesives or firestopping.

C. Install backing or damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before drilling or cutting structural members.

E. Degrease and clean surfaces to receive adhesive for identification materials.

3.3 INSTALLATION-CLEARANCE

A. Appliances and equipment shall be accessible for inspection, service, repair and replacement.

B. Clearance shall be provided for the replacement of filters.

C. A minimum of 30” of clearance shall be provided in front of the control side of appliances and equipment. Provide additional space when required by NEC.

D. All control components shall be accessible for inspection and replacement.

3.4 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.5 INSTALLATION - VALVES

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install valves with clearance for installation of insulation and allowing access.

D. Provide access panels where valves and fittings are not accessible.

E. Insulate valves according to application in Section 23 07 00.

3.6 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Where piping is parallel and at same elevation, provide multiple pipe or trapeze hangers.

F. Provide copper plated hangers and supports for copper piping.

G. Design hangers for pipe movement without disengagement of supported pipe.

H. Adjust hangers and supports as required to bring system to proper line and grade. Piping shall be plumb with floor and parallel/perpendicular to building structure.

I. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Insulated piping shall have insulation run continuous through hangers and supports with use of rigid inserts. Insulation shall be glued to both sides of insert at hangers and supports, no insulation gaps are allowed. Refer to Section 23 07 00.

K. Support of pipe, tubing and equipment shall be accomplished by means of engineered products, specific to each application. Makeshift, field devised methods shall not be allowed.

3.7 INSTALLATION-PIPING PROTECTION

A. Provide protective shield plates in concealed locations where piping, other than cast-iron or steel, is installed in studs, joists or rafters. Plates shall be 16 gage steel and cover the pipe area plus 2". Shields may be omitted if piping is more than 1-1/2" from nearest edge of structural member.

3.8 INSTALLATION – DUCTWORK

A. Locate hangers, supports and accessories to handle loads imposed by ductwork, and air distribution devices and with maximum spacing noted.

B. Support all ductwork to prevent sag, undue play and swing.

C. Maximum support spacing per SMACNA standards. Spacing shall not exceed 10 feet.

D. Before concrete is placed, install embedded inserts and secure firmly to form work.

E. Assemble and install hangers and supports on ductwork.

F. All supports and attachments for exposed ducts shall have non-removable fasteners.

G. Attachments to fireproofed steel structure shall be made prior to spraying of fireproofing material. If necessary to disturb fireproofing after initial spraying, provide respraying or repairs necessary to restore the integrity of the fireproofing.

H. Adjust hangers and supports as required to bring system to proper line and grade. Ductwork shall be plumb with floor and parallel/perpendicular to building structure.

3.9 INSTALLATION – SEISMIC CONTROLS

A. Provide seismic restraints and hangers for ductwork and equipment in compliance with IBC 1613 and ASCE 7.

B. Seismic Bracing is specifically required for but not limited to:
   1. All ductwork with a cross sectional area of 6 square feet or a diameter of 34 inches or greater.

C. Seismic Bracing: Follow IBC 1613, ASCE 7, SMACNA Seismic Restraint Manual and the following.
   1. Bracing shall be bidder designed to resist seismic loading in accord with Chapter 16 of the International Building Code, ASCE 7 or the SMACNA guideline.
   2. Provide seismic calculations as required for Ip = 1.5.
   3. Transverse bracing shall occur at a maximum interval of 30 feet, at each duct turn and at the end of a duct run.
   4. Longitudinal bracing shall occur at a maximum interval of 60 feet.

5. Bracing may be omitted where duct hangers are less than 12 inches in length.

3.10 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.11 INSTALLATION - FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

C. Provide curbs for roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.

D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.12 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with insulation and caulk or fireproof airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

3.13 INSTALLATION – ACCESS PANELS

A. Furnish access panels for installation at all concealed equipment which requires service, maintenance or adjustment to include but not limited to equipment, dampers, control valves, filters and controls.

B. Provide location layout and required size for all access panels to general contractor. Layout shall be regular and consistent, maintain a uniform wall panel height of 24" CL AFF, unless noted otherwise.

C. Furnish fire rated access panels where installed in fire rated assembly.

D. Provide stainless steel access panels where installed in tile surfaces.

E. Furnish access panels to general contractor for installation

F. Paint installed access panels to match wall or ceiling. Verify that panels are not painted shut.

3.14 INSTALLATION – FIRESTOPPING AND SEALS AT PARTITIONS

A. Installation of Firestop shall be performed by either a specialty contractor specializing in firestop application (FM G 4991 or UL Qualified Firestop Contractor), or general or sub-contractors with experience in similar applications and projects with installers qualified, trained, and certified by the firestop manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.

B. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

C. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

D. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

E. Install dams when required to properly contain Fire stopping materials within openings and as required to achieve required fire resistance rating. Combustible damming material must be removed after appropriate curing. Incombustible damming materials may be left as a permanent component of the Firestop system.

F. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

G. Place intumescent coating in sufficient coats to achieve rating required.

H. Clean adjacent surfaces of firestopping materials.

I. Seal openings at surface as follows:
   1. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   2. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   3. Pack void with backing material.
   4. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

3.15 INSTALLATION - PENETRATIONS OF NON-RATED SURFACES

A. Seal opening through non-fire rated wall, partition, floor, ceiling, and/or roof opening as follows:
   1. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   2. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

B. Install escutcheons where piping penetrates non-fire rated surfaces in occupied spaces.

C. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

D. Interior partitions: Seal pipe penetrations air tight. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.16 INSTALLATION-VIBRATION ISOLATION

A. Install isolation for motor driven equipment.

B. Adjust equipment level.

C. Install spring hangers without binding.

3.17 INSTALLATION - SPRING ISOLATION ROOF CURB (SEISMIC)

A. Unit supported must be solidly fastened to the top floating rail and the lower section anchored to the roof structure. Mechanical contractor to hire third party structural engineer to provide exact number and size of bolts/fasteners and provide equipment seismic calculations.

B. Provide acoustical materials in bottom of curb as shown on plan detail.

3.18 INSTALLATION – CONDENSATE

A. For all cooling coils, high efficiency gas burners and other equipment requiring condensate drainage, provide appropriately sized condensate pumps where gravity drainage is not possible or where scheduled.

B. Coordinate number and type of condensate pumps required with Plumbing Contractor.

C. Provide condensate overflow switches on cooling coils where damage to building components could occur as a result of overflow as required by IMC.

3.19 INSTALLATION-IDENTIFICATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Use plain English designations so no index or chart is required.

E. Nameplates: Identify mechanical equipment (air handling units, air terminal units, pumps, heat transfer equipment, tanks, and water treatment devices) with plastic nameplates.
1. Identify in-line pumps and other small devices with name tags.
2. Identify control panels and major control components outside panels with plastic nameplates.
3. Identity description should be as numbered on drawings or plain English description. i.e. “EF-1” or “Boiler Controls”.
4. Label automatic controls, instruments, and relays. Key to control schematic.
5. Label wall controls and switches with associated equipment designation and control function, i.e. “EF-1 Switch”.

F. Valve Tags: Identify valves in main and branch piping and radiator valves with tags.
1. Do not provide numbered tags.
2. Provide tags with plain English description of service and function. i.e. “Hot Water Supply, 2nd Floor”

G. Pipe Labels: Identify piping, concealed or exposed, with plastic tape pipe markers.
1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification on straight runs including risers and drops with spacing not to exceed 20 feet.
4. Locate adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

H. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

I. Equipment and Valve Tag Index: Plain English designations so no chart or index is required.

3.20 CLEANING

A. Contractor shall make all mechanical components free of dust and dirt prior to startup.

3.21 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.22 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	7	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SCOPE

A. Testing, adjusting and balancing of air systems.

B. Testing, adjusting and balancing of Division 22 domestic water systems.

C. Measurement of final operating conditions of above systems.

D. Duct pressure (leakage) testing as required by 23 31 00.

E. Preparation of formal report.

1.2 PERFORMANCE CRITERIA

A. Work shall be performed by approved independent testing and balancing agency.

B. Perform testing and balancing in accordance with Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). All work shall be supervised.

C. Calibrate instruments used for testing and balancing within a period of six months of start of work.

D. Mechanical contractor shall assist Balancing Agency in testing and balancing of mechanical system.

1.3 SUBMITTAL

A. Provide three (3) copies of typed and bound report to be included in Preliminary Commissioning Report.

B. Provide three (3) additional copies of updated and/or corrected report for Final Commissioning Report.

1.4 FORMAT

A. Report shall consist of test sheets similar to AABC Standard Forms for Diffusers and Grilles, Air Handling Equipment, Exhaust Fans, and Pumps (i.e., Form 12666 for Diffusers and Grilles).

B. Report shall include the following.
1. Preface suggesting abnormalities and problems encountered.
2. Instrumentation List including type, model, manufacturer, serial number, and calibration dates.

3. System Identification reporting location of equipment, zones, supply, return, and exhaust openings.
4. Record following for each piece of air handling equipment.
   a. Manufacturer, model number, and serial number.
   b. Design and manufacturer rated data.
   c. Actual CFM
   d. Suction and discharge static pressure of each fan.
   e. Outside-air and return-air total CFM.
   f. Actual operating current, voltage, and brake horsepower of each fan motor.
   g. Final RPM of each motor.
   h. Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
   i. Belt size and quantity.
   j. Static-pressure controls final operating set points.

1.5 QUALIFICATIONS

A. Work of this section shall be performed by independent Air Testing and Balance Agency specializing in testing and balancing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.

B. Agency shall provide proof of having successfully completed at least five years of specialized experience in air and hydronic system balancing. Work by this Agency shall be done under direct supervision of qualified heating and ventilating engineer employed by Agency.

C. Agency shall be approved in writing by Architect.

D. Neither Architect's engineering consultant nor anyone performing work on this Project under Division 23 shall be permitted to do this work.

1.6 ACCEPTABLE TEST AND BALANCE COMPANIES

A.	AIRTEST Co., Inc.	425-313-0172
B.	Neudorfer Engineers, Inc.	206-621-1810
C.	Hardin & Sons	253-862-6645
D.	American Air Measurement	425-788-4036

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify systems are complete and in good working order before commencing work. Then, put all systems and equipment into operation and continue operation until all adjusting, balancing, testing, demonstrations, instructions and cleaning of systems have been completed. Verify the following:
   1. Systems are started and operating in safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place or in normal position.
   15. Service and balancing valves are open.

3.2 PREPARATION

A. If requested, conduct tests in presence of Architect.

B. Instruments used by Agency shall be accurately calibrated and maintained in good working order.

C. Furnish instruments required for testing, adjusting, and balancing operations including ladders, scaffolding, additional dampers and clean filters.

D. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

E. During balancing technician's initial test of air handling systems, the Mechanical Contractor shall have his sheetmetal foreman present to assist in any drive changes or dampers necessary.

3.3 INSTALLATION TOLERANCES

A. Diffuser, register and grille air flow rates shall be measured and adjusted to deliver final flow rates within 10% and within 50 cfm of design rates.

B. Fan air flow rates shall be measured and adjusted to deliver final flow rates within 10% and within 50 cfm of design rates.

3.4 ADJUSTING

A. Ensure that clean filters, of the type specified, are installed prior to air balancing.

B. Provide additional volume dampers as necessary to accomplish design balances.

C. Set minimum position of motorized dampers for scheduled minimum outside air.

D. Check motors for proper rotation, coupling and drive alignment, belt tension and freedom from vibration, etc.

E. Provide belt drive/sheave changes to adjust fan rpm as necessary to accomplish design balances.

F. Verify recorded data represents actual measured or observed conditions.

G. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

H. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

I. Report defects and deficiencies noted during performance of services, preventing system balance.

J. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

K. After completion of testing and balancing, operate systems under normal conditions for at least two days of 8 hours each to demonstrate specified performance.

3.5 AIR SYSTEM PROCEDURE

A. Perform soloing testing and balancing functions in accordance with Associates Air Balance Council National Standards.

B. Adjust air handling and air distribution systems to obtain design supply, return, and/or exhaust air quantities.
   1. Test and adjust total system CFM by adjustment of fan speeds. Provide sheave drive changes as necessary.
   2. Perform tests at high and low speeds of variable speed systems.
   3. Adjust branch air quantities by damper regulation. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open to minimize throttling losses.
   4. Make air quantity measurements in main ducts and for outside air by Pitot tube traverse of entire cross sectional area of duct.
   5. Measure air quantities at air inlets and outlets.

C. Diffusers, Registers and Grilles:

1. Adjust air distribution to obtain uniform space temperatures free from objectionable drafts.
2. Use volume control devices to regulate air quantities only to the extent that the adjustments do not create objectionable air motion or sound levels.
3. Effect volume control by using volume dampers located in ducts.

D. Provide system schematic:
1. Identify the location and area of each grille, diffuser, register, and terminal box.
2. Record the required and actual air quantities at each outlet or inlet.
3. Record size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.

E. Air Temperature:
1. Measure wet and dry bulb air temperatures on entering and leaving side of each cooling coil and unit in cooling mode.
2. Measure dry bulb temperatures on entering and leaving side of each heating coil and unit in heating mode.

F. Pressure:
1. Measure static pressure conditions on air units, including filter and coil pressure drops, and total pressure across fan with suction and discharge pressures.
2. Make air balancing allowances for 50 percent loading of filters.
3. Measure building static pressure.

G. Electrical:
1. Record nameplate motor current and voltage.
2. Measure actual motor current and voltage at balanced condition.

H. Dampers:
1. Adjust outside air, return air, and exhaust dampers for design conditions.
2. At modulating damper locations, take measurements and balance at extreme conditions.

I. Permanently mark all outside air, supply air, and return air damper positions after balancing has been completed.

J. Smoke testing, or some other approved means, may be required to determine leak locations if air balance report indicated that any system's CFM total is less than 10 percent of design CFM. Prior to test, verify that system's duct joints have been sealed as specified and that air moving device in question is supplying required design system air flow. Architect will approve test method required. If smoke test is selected, use following procedure. Provide necessary precautions to protect those performing or observing test from being exposed to smoke.
1. Use zinc chloride smoke candles, titanium tetrachloride ampules or sticks, or other devices acceptable to Architect to generate smoke.
2. Close openings in duct except for one opening at farthest end of duct run.

3. If re-balancing is required, submit revised air test and balance reports to Architect before Substantial Completion.
4. Spot balance and rebalance shall be performed at no additional cost to Owner.

3.6 PLUMBING PROCEDURE

A. Domestic pump circulators:
1. Test total system GPM and head.
2. Adjust branch flows by circuit setters for equal flow distribution.

3.7 KITCHEN HOOD SYSTEM

A. Test and balance hood exhaust system to be equal to or greater than scheduled value. Under balance is not acceptable.

B. Test and balance make-up air system to be at least 90% of exhaust air quantity.

3.8 FINAL INSPECTION AND ADJUSTMENTS

A. System shall be balanced and reports submitted before substantial completion inspection.

B. Balancing Agency shall be represented at inspection meeting(s) by qualified testing personnel with balancing equipment and two copies of current air balancing test report.
1. Architect will choose and direct spot balancing. Differences greater than specified tolerance between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire building and submission of a new test report. In such case a new inspection will be made.
2. Perform rebalancing in presence of Architect/Engineer and subject to their approval.
3. If re-balancing is required, submit revised air test and balance reports to Architect before Substantial Completion.
4. Spot balance and rebalance shall be performed at no additional cost to Owner.

3.9 SUPPLEMENTAL WARRANTY

A. Test and balance agency shall include an extended warranty of 90 days, after occupancy, during which the Owner's representative, at his discretion, may request a recheck or resetting of any outlet, supply air or exhaust fan, as listed in test report.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Piping system insulation.
2. Equipment insulation.
3. Pipe insulation jackets.
4. Insulation accessories including vapor retarders and accessories.
5. Ductwork insulation.
6. Ductwork insulation jackets.
7. Duct liner.

1.2 QUALITY ASSURANCE

A. Insulation must have maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. All systems components subject to heat loss or gain, such as, piping, storage tanks, vessels, valves etc. shall be insulated to conform with the Washington State Energy Code (as minimum) and this section.

1.3 IDENTIFICATION

A. Insulation shall bear a manufacturer's mark indicating the product R-value or K-value and thickness. This mark shall be visible after installation and shall be repeated at an interval of no more than 10 feet.

B. External duct insulation shall be legibly printed or indentified at intervals not greater than 36 inches with name of manufacturer, R-value, thickness, flame spread and smoke-developed index.

C. R-values shall be based on insulation only at 75 F mean temperature difference.

D. For rigid or spray foam the aged R-value per inch shall be provided in submittals.

PART 2 PRODUCTS

2.1 GLASS FIBER, BLANKET

A. Manufacturers: Johns Manville Micro-Flex or equal by Owens-Corning, Knauf, Manson or approved equal.

B. Insulation: Semi-rigid, shot-free, continuous fiber, noncombustible. ASTM C1393.

1. 'K' factor: 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.
4. Density: 2.5 lb/cu ft.

C. Vapor Retarder Jacket: reinforced facing, will accept paint. Seal with pressure sensitive tape.

2.2 POLYOLEFIN INSULATION

A. Manufacturers: IMCOA or similar.

B. Polyolefin or Polyethylene pipe insulation is **NOT ACCEPTABLE** for any application.

2.3 ELASTOMERIC CELLULAR FOAM (PIPE)

A. Manufacturers: Armacell AP/Armaflex, Aeroflex Aerocel or approved equal.

B. Preformed flexible, closed-cell, elastomeric thermal insulation: Type I, Tubular form, self-seal or continuous, 25/50-rated, CFC free, low VOC, 'K' factor: 0.27 at 75 degrees F. ASTM C534.

C. Rigid clamp/hanger insert: Armacell Armafix, polyurethane insert and aluminum jacket, single piece with self-adhering closure.

2.4 FLEXIBLE GLASS FIBER DUCT LINER (SOUND LINER)

A. Manufacturers: Johns Manville Linacoustic RC or equal by Knauf, Manson or approved equal.

B. Description: Flexible duct liner, glass fiber bonded with thermosetting resin, airstream surface protected with reinforced coating.
1. ASTM E84, UL 723
2. Installed R Value: 1" R-4.2, 2" R-8.0
3. Maximum service temperature: 250 degrees F.
4. Maximum Velocity on Coated Air Side: 6,000 fpm.
5. Acrylic polymer coating to prevent dust incursion and biological growth.

C. Liner Fasteners: Galvanized steel, impact applied or welded with integral head.

D. Field coat edges with Superseal edge treatment.

2.5 ELASTOMERIC CELLULAR FOAM DUCT LINER (SOUND LINER)

A. Manufacturers: Armacell AP/Coilflex or approved equal.

B. Description: Fiber-free, non-particulating, formaldehyde-free, low VOC elastomeric form roll which conforms to duct corners without compression. Microban antimicrobial protection inhibits mold and mildew.
1. ASTM E84, UL 723

2. Installed R Value: 1” R-4.2, 1-1/2” R-6.0
3. Maximum service temperature: 180 degrees F
4. Maximum velocity: 10,000 fpm.

C. Install as a cross-section single piece fitting around corners.

D. Apply with water based adhesive.

2.6 POLYESTER DUCT LINER (SOUND LINER)

A. Manufacturers: Ductmate PolyArmor or approved equal.

B. Description: Fiberglass free, hypoallergenic polyester blanket with FSK facing.
1. ASTM E84, UL 723
2. Installed R Value: 1” R-4.2, 1-1/4” R-5, 1-1/2” R-6.0, 2” R-8.0
3. Maximum service temperature: 250 degrees F
4. Maximum velocity: 4,000 fpm.

C. Provide metal nosing and water based edge coating.

D. Apply with water based adhesive and pins.

2.7 GLASS FIBER ROUND DUCT LINER (SOUND LINER)

A. Manufacturers: Johns Manville Spiracoustic Plus or equal by Knauf, Manson or approved equal.

B. Description: High-density fiber glass board with kerfs; acrylic polymer meeting ASTM G21 impregnated surface coat. ASTM C1071.
1. ‘K’ factor: 0.23 at 75 degrees F.
2. Installed R Value: 1" R-4.3, 2” R-8.4
3. Maximum service temperature: 250 degrees F.
4. Maximum Velocity on Coated Air Side: 4,000 fpm.

2.8 ELASTOMERIC CELLULAR FOAM ROUND DUCT LINER (SOUND LINER)

A. Manufacturers: Armacell AP/Spiralflex or approved equal.

B. Description: Fiber-free, non-particulating, formaldehyde-free, low VOC elastomeric form roll which is self-supporting and conformable to round duct. Microban antimicrobial protection inhibits mold and mildew.
1. ASTM E84, UL 723
2. ‘K’ factor: 0.28 at 75 degrees F
3. Installed R Value: 1” R-4.2
4. Maximum service temperature: 180 degrees F
5. Maximum velocity: 10,000 fpm.

2.9 GLASS FIBER DUCT WRAP

A. Manufacturers: Johns Manville Microlite XG 75 or equal by Owens-Corning, Knauf, Manson or approved equal.

B. Description: Formaldehyde-free, flame-attenuated glass fibers bonded with thermosetting acrylic resin, FSK facing.
   1. ‘ASTM E84, UL 723
   2. Installed R Value: 1-1/2" R-4.2, 2” R-5.6, 3” R-8.3.
   3. Maximum Service Temperature: 250 degrees F.
   4. Density: 0.75 lb/cu ft

C. Vapor Retarder Jacket: Reinforced FSK facing. Seal with pressure sensitive 2” tape.

D. Identification: At intervals not greater than 36” print the name of manufacturer, the thermal resistance R-value at insulation thickness, the flame spread and smoke developed indexes.

2.10 PIPE INSULATION AND EQUIPMENT JACKETS

A. PVC Plastic Pipe Jacket:
   1. Product Description: One piece molded type fitting covers and sheet material, white color. ASTM D1784.
   2. Thickness: 15 mil indoor, 30 mil outdoor.
   3. Connections: Brush on welding adhesive.

B. Aluminum Pipe Jacket:
   1. Thickness: 0.016 inch thick sheet. ASTM B209.
   2. Finish: Embossed
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping and equipment has been tested before applying insulation materials.

B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Apply insulation when building is thoroughly dry to prevent shrinkage.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulate entire piping system including fittings, valves, unions, flanges, strainers, flexible connections, pump fittings, connections to equipment and expansion joints. Use canvas jackets for valves and other irregular shapes.

D. Insulate flanges and unions with removable sections and jackets.

E. Piping Inserts and Shields:
   1. Insulation shall be continuous through supports and hangers with incompressible inserts and shields. Do not directly clamp/support pipe scheduled to be insulated.
   2. Shields: Galvanized steel saddle between pipe clevis hangers or pipe rollers and insulation. Minimum 6 inches long, of contour matching adjoining insulation; may be factory fabricated.
   3. Inserts: Between pipe clamps, hangers or rollers and piping.
   4. Insert material: Compression resistant insulating material suitable for insulation type and planned temperature range and service.
   5. Glue insulation to both sides of insert.
   6. Shields without inserts may be used at clevis hangers on refrigerant piping 5/8” and smaller with continuous insulation.

F. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.

G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

H. Exterior Piping Applications: Use only elastomeric closed-cell foam insulation. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with sealant. Cover with aluminum jacket with seams located at 3 or 9 o’clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal equipment.

I. Exposed Equipment: Locate insulation and cover seams in least visible locations.

J. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

K. Finish insulation at supports, protrusions, and interruptions.

L. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

M. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

N. Insulate exhaust air ductwork where it is outside the insulated building envelope to prevent condensation.

O. For all insulated ductwork:
   1. Provide insulation with vapor retarder jackets.
   2. Finish with tape and vapor retarder jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

P. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULES

A. Piping: Provide on piping as listed below.

		PIPE SIZE			
Service	**Insulation Type**	**<1”**	**1” to <1-1/2"**	**1-1/2 to < 4"**	**4" to < 8”**
Refrigerant Suction(1)	Elastomeric Cellular FOAM	1"	1"	1-1/2"	-
Refrigerant Hot Gas	Elastomeric Cellular FOAM	1"	1"	1-1/2"	-

1. Note: Insulate Refrigerant Liquid lines same as Suction lines on all Mitsubishi brand equipment, where noted by manufacturer or called for on plans.
2. For all exterior piping applications use only Elastomeric Cellular Foam with Aluminum jacket.

B. Ductwork: Provide on ductwork as listed below. Insulation thickness is provided as reference; each application must meet minimum installed R-Value.

Service	**Location**	**Insulation Type**	**Approx. Thickness**	**Min. Installed R-Value**	**Jacket**
Supply, Return	Attic, crawlspace or uninsulated areas within building.	Glass Fiber Duct Wrap	2"	R-6	FSK
Supply, Return, Exhaust	Unconditioned Space Inside Bldg.	Glass Fiber Duct Wrap	2"	R-6	FSK
Supply	Concealed Space (3)	Glass Fiber Duct Wrap	1-1/2"	R-3.3	FSK
Supply	Exposed (4) in Space With Supply Air Temp ≤55 F or ≥105 F	Glass Fiber Duct Wrap / Duct Liner	1-1/2"	R-3.3	FSK

Outside Air	Within Building <2800 cfm (4)	Glass Fiber Duct Wrap / Duct Liner	3"	R-7	FSK
Exhaust Air	Outside the Insulated Building Envelope	Glass Fiber Duct Wrap	2"	R-6	FSK
Exhaust Air	Between backdraft damper & building exterior.	Glass Fiber Duct Wrap	3"	R-7	FSK

1. Secure duct wrap with mechanical fasteners spaced 12” on center, minimum. For horizontal ducts 24” or more in width, duct wrap shall also be secured with mechanical fasteners spaced 18” on center, on centerline of bottom of duct.
2. Insulation is not required on sound lined ductwork with sufficient insulating value.
3. Concealed space: Any space within the insulated building envelope that is concealed from view, i.e. behind ceiling, wall, shaft, soffit, etc.
4. For exposed ductwork in finished spaces which is required to be insulated provide internal liner with equivalent R-value.
5. Insulation required from exterior to shutoff damper or equipment. After damper provide R-7 insulation.

C. Equipment: Provide on equipment as listed below.

Service	Insulation Type	Thickness	R-Value	Jacket
Valves, Strainers and other piping accessories	Glass Fiber BLANKET	Per pipe schedule	-	Canvas bag with wire ties.

END OF SECTION

SECTION 23 08 00

PROJECT COMMISSIONING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Project commissioning description.
2. Project commissioning responsibilities.
3. Project commissioning documentation.
4. Commissioning Compliance Checklist

1.2 GENERAL

A. The goal of the commissioning process is to verify the proper operation, functionality and control of building systems and equipment. The by-product of this process is the commissioning plan and report which provides a confirmation record of procedures used and results obtained. The effort and goal is focused on having all systems operating efficiently and correctly.

B. The mechanical contractor shall retain a Commissioning Agent (CA) and commissioning services from one of the following companies or approved equal.

1.	AIRTEST Co., Inc.	425-313-0172
2.	Neudorfer Engineers, Inc.	206-621-1810
3.	American Air Measurement	425-788-4036

C. The mechanical contractor is responsible for the commissioning process with required documentation and shall furnish labor and material directly or through the Commissioning Agent to accomplish building commissioning as specified herein.

D. The mechanical contractor is responsible to correct deficiencies discovered during the commissioning process.

1.3 COMMISSIONING DESCRIPTION

A. The purpose of the commissioning process is to provide Owner assurance that the systems have been installed in the prescribed manner and will operate within the performance guidelines. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems to beneficial use by the Owner.

B. Commissioning includes complete and thorough investigations of mechanical systems to ensure proper installation and operation of all components and systems. It consists of but is not limited to the following elements:
1. The Commissioning Plan
2. Testing and startup of HVAC equipment and systems.
3. Testing and startup of any appropriate plumbing systems, such as water heating plants, circulation pumps and sewage ejectors.
4. Equipment control and system verification checks.

5. Air balancing.
6. Plumbing balancing, including hot water recirculation.
7. Functional performance testing.
8. Sequence of operations testing.
9. Completion of record drawings.
10. Owner training.
11. Operation & Maintenance materials.
12. Preliminary Commissioning Report with deficiencies noted.
13. Final Commissioning Report with corrective actions taken.

1.4 COMMISSIONING AGENT

A. The Commissioning Agent (CA) is the person who manages the commissioning process, prepares the Commissioning Plan, schedules and coordinates commissioning activities in execution of the Commissioning Plan and compiles the Commissioning Report.

B. The CA may directly perform commissioning functions and documentation or may observe tasks assigned to others.

C. The CA provides the Owner an unbiased, objective view of the system's installation, documentation, operation, and performance.

D. The CA will observe the Commissioning procedures and results performed by the Contractor. The Contractor is expected to verify the functional readiness of systems to be tested prior to performing the tests in the presence of the Commissioning Agent.

1.5 COMMISSIONING SUBMITTALS

A. See 23 00 00.

B. Commissioning Plan: Submit copies with mechanical submittals.
1. Narrative description of activities.
2. Start-up test procedure and checklists
3. Functional performance test checklists.
4. Commissioning schedule

C. Preliminary Commissioning Report: Submit three (3) copies at substantial completion.
1. Complete start-up checklists
2. Complete functional test reports
3. Test & Balance report
4. Deficiency report
5. Commissioning Compliance Checklist

D. Final Commissioning Report: Submit three (3) copies at project close out.
1. Preliminary Commissioning Report contents
2. Record drawings
3. Owner training report
4. Deficiency & corrective action report
5. O&M manuals

E. Complete the Commissioning Compliance Checklist and submit with the Preliminary Commissioning Report for Owner Representative review and signature. Signed checklist is required for final mechanical inspection and building certificate of occupancy. A copy of the signed checklist shall be provided to the building official.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NEBB or AABC.

B. Perform Work in accordance with ASHRAE Guideline 1.

C. Perform Work in accordance with Commercial Energy Code Section C408.

1.7 COMMISSIONING MEETINGS

A. The CA shall schedule a preliminary commissioning meeting to review the commissioning plan and schedule approximately two weeks prior to the start of commissioning work. The General Contractor, Mechanical Contractor, Electrical Contractor and Electrical Commissioning Agent, applicable sub-contractors and the Engineer shall be invited.

B. The CA shall schedule additional commissioning meetings as necessary for coordination or information with the required participants.

C. The General Contractor, Mechanical Contractor and Mechanical Sub-Contractors are required to attend commissioning meetings when requested by the CA or Engineer.

1.8 SCHEDULING

A. The CA shall prepare a schedule indicating anticipated start dates for the following:
1. Piping systems pressure testing (domestic, gas, hydronic, refrigerant).
2. Piping system flushing and cleaning.
3. Ductwork cleaning.
4. Ductwork pressure testing.
5. Kitchen hood exhaust duct light leakage testing.
6. Kitchen hood smoke capture performance test.
7. Equipment and system startups.
8. Automatic temperature control system checkout.
9. Testing, adjusting, and balancing.
10. Functional performance tests
11. System orientation and training.
12. Operation and maintenance manual submittals.

B. Schedule seasonal tests of equipment and systems during peak weather conditions (actual or simulated) to observe full-load performance.

C. Schedule occupancy sensitive tests during conditions of both minimum and maximum occupancy use.

D. Schedule such that the Preliminary Commissioning Report can be submitted to the Owner for review with written acceptance obtained prior to the final mechanical inspection and the building certificate of occupancy.

E. Within 90 days of receipt of the building certificate of occupancy, the Record Drawings, O&M Manuals, Final Balancing Report, Final Commissioning Report and documentation of completed Owner Training shall be submitted for review.

1.9 COORDINATION

A. The mechanical contractor shall verify the commissioning schedule and notify the Commissioning Agent a minimum of two weeks in advance of the following:
1. Scheduled equipment and system startups.
2. Scheduled automatic temperature control system checkout.
3. Scheduled start of testing, adjusting, and balancing work.
4. Commissioning schedule changes.

B. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

C. Coordinate commissioning of this section with Electrical commissioning.

D. Provide overall coordination and management of the commissioning program as specified herein. The commissioning process will require cooperation of the Contractor, subcontractors, vendors, Architect, Commissioning Agent, and Owner. The commissioning team shall be comprised of the following:
1. Contractor
2. Project Manager
3. Test & Balance Engineer
4. Subcontractors
5. Commissioning Agent
6. Project Engineers
7. Owner Representative(s)
8. Architect
9. Mechanical Consultant
10. Electrical Consultant

PART 2 DOCUMENTATION

2.1 COMMISSIONING PLAN

A. The Commissioning Plan shall be prepared and executed by the Commissioning Agent and at a minimum contain the following.

B. The Commissioning Plan shall be in a hard-backed loose-leaf binder with typewritten or printed index and tabbed dividers between principal categories.
1. Spine: Name of Project
2. Cover: Name of Project, Owner, Location & Commissioning Agent
3. Project Directory: Owner, Architect, Engineer, Commissioning Agent, General Contractor, Mechanical Contractor(s), Plumbing Contractor, Electrical Contractor, Test & Balance Contractor, Controls Contractor.
4. Responsible Party: Include responsible party for each contractor.

C. Narrative:

1. Describe building size, type of use and occupancy.
2. Provide an overview of the building equipment, systems, controls and their functionality.
3. Describe the activities involved in each phase of the commissioning process, including the personnel intended to accomplish each task.

D. Roles and Responsibilities:
1. Define the tasks necessary to complete the commissioning process and assign responsibility for each to a member of the commissioning team.

E. Commissioning Schedule:
1. Provide timeline of commissioning process tasks and information submittals with milestones for general scopes of work.
2. Include task for sub-contractors, contractors, vendors and CA.
3. Include owner training schedule.

F. Start-up Test Procedure and Checklists:
1. Include a list of all equipment and systems to be tested.
2. Intent: To test individual equipment for standalone function and operation.
3. Use manufacturer's startup checklist when available.
4. Utilize vendor startup and checklists for specific equipment when available.

G. Functional Performance Test checklists:
1. Intent: To test system performance and operation including controls, relays and sequences.
2. Include tests for all functions noted in Sequence of Operations.
3. Indicate conditions under which the test needs to be performed.
4. Indicate the measured criteria required to meet the performance.
5. Include space on forms to note deficiencies.

2.2 FUNCTIONAL PERFORMANCE TESTING

A. Demonstrate the correct installation and operation of each component, system, and system-to-system intertie relationship. Control systems shall be tested to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with the sequence of operation.

B. Test all system modes and all functions describe in the Sequence of Operations.

C. Test systems under full-load, part-load (if applicable) and emergency conditions (if applicable).

D. Test any redundant or automatic back-up mode.

E. Test performance of all alarms and safeties.

F. Test mode of operation upon loss of power and power restoration.

G. Service Water Heating Systems:
1. Perform testing under a minimum of 50% service load.
2. Verify function and setpoint of mixing valves.

H. Independently test all similar systems. Sampling reference systems is not acceptable.

I. Physically verify by visual inspection or calibrated meter reading the operation being tested. Control system displays shall not be used as proof of function.

2.3 PRELIMINARY COMMISSIONING REPORT

A. The Preliminary Commissioning Report shall be assembled and produced by the Commissioning Agent with information obtained from the Mechanical Contractor, Controls Contractor and Test & Balance Contractor. The report shall contain the following.

B. The Commissioning Report shall be in hard-backed loose-leaf binder(s) with typewritten or printed index and tabbed dividers between principal categories.
1. Spine: Name of Project
2. Cover: Name of Project, Owner, Location & Commissioning Agent
3. Project Directory: Owner, Architect, Engineer, Commissioning Agent, General Contractor, Mechanical Contractor(s), Test & Balance Contractor, Controls Contractor.

C. System Description: Describe building systems and their intended function(s). Include equipment associated with each system.

D. Test & Balance Report: See 23 05 93

E. Start-up Test Checklists: Include completed start-up checklists.

F. Functional Performance Test Checklists:
1. Include completed functional performance checklists.
2. Include sequence of operations checklists.
3. Record conditions under which the tests were performed.
4. Record the measured criteria.

G. Deferred tests: Indicate any tests not performed due to climatic conditions with anticipated date of completion.

H. Deficiency Report: Compile any deficiencies noted on start-up or functional performance tests on to a single report.

I. Owner Training: Include documentation of owner operating and maintenance instruction completed to date. See section 23 00 00.

J. Commissioning Compliance Checklist: This checklist included at the end of this section shall be completed and included for Owner review and signature.

2.4 FINAL COMMISSIONING REPORT

A. The Final Commissioning Report shall be assembled and produced by the Commissioning Agent with information obtained from the Mechanical Contractor, Controls Contractor and Test & Balance Contractor. The Final Commissioning Report shall contain all the information provided in the Preliminary Commissioning Report and the following.

B. The Commissioning Report shall be in hard-backed loose-leaf binder(s) with typewritten or printed index and tabbed dividers between principal categories.
   1. Spine: Name of Project
   2. Cover: Name of Project, Owner, Location & Commissioning Agent
   3. Project Directory: Owner, Architect, Engineer, Commissioning Agent, General Contractor, Mechanical Contractor(s), Test & Balance Contractor, Controls Contractor.

C. Test & Balance Report: Provide updated and/or corrected report if required.

D. Deficiency and Corrective Action Report: Include the deficiency report from the Preliminary Commissioning Report with the corrective action taken noted for each entry.

E. Owner Training: Include documentation of completed owner operating and maintenance instruction. See section 23 00 00.

F. Record Drawings: Include contractor's record drawings in each copy of the commissioning report. See section 23 00 00.

G. Operating and Maintenance Manuals: Include contractor's O&M manuals with each copy of the commissioning report. (Separate binders are OK) See section 23 00 00.

PART 3 EXECUTION

3.1 GENERAL

A. Contractor shall provide an individual to accompany the Commissioning Agent to assist, operate and/or make adjustments as necessary.

B. Contractor shall provide ladders, scaffolding, additional dampers and clean filters as required.

C. Contractor shall put all systems and equipment into operation and shall continue operation until all adjusting, balancing, testing, demonstrations, and instructions have been completed.

D. Commissioning shall not begin until systems are completed, in good working order and have been cleaned.

E. Check motors for proper rotation, coupling and drive alignment, belt tension and freedom from vibration, etc.

3.2 INSTALLATION

A. Contractor shall provide additional balancing dampers, balancing valves, access doors, test ports, and pressure and temperature taps required by Commissioning Agent or to address Commissioning deficiency.

B. Contractor shall provide replacement sheaves and belts to obtain system performance.

C. Contractor shall install test holes in ductwork and plenums as requested by Commissioning Agent for taking air measurements. Seal test holes after measurements.

D. Prior to start of functional performance testing, Contractor shall install clean filters in equipment.

3.3 SPECIFIC REQUIREMENTS

A. CA shall perform or observe and document result of kitchen hood exhaust duct light leakage testing per IMC 506.3.2.5.

B. CA shall perform or observe and document result of kitchen hood smoke capture performance test per IMC 507.16.1.

3.4 DEFICIENCIES

A. The Commissioning Agent shall report all observed system deficiencies to the Architect and General Contractor and shall include them in the Preliminary Commissioning Report.

B. The Contractor shall rectify all deficiencies, detail the corrective action(s) taken on each item, initial each item of the report as "corrected" and return the deficiency report.

C. Upon receipt of the return report, the Commissioning Agent will visit the site and inspect the corrected deficiencies. The Commissioning Agent will also initial the items of the report as "checked" and include them in the Final Commissioning Report.

D. Further site visits by the Commissioning Agent to check deficiencies not corrected in back check, will be at the Contractor’s expense.

END OF SECTION

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Thermostats.
2. Timers
3. Electric damper actuators.
4. Gas sensors

1.2 SCOPE

A. The mechanical contractor shall install a complete, properly adjusted and effective temperature control system.

B. This section includes field assembled instrumentation and temperature controls for air conditioning, heating, ventilation and exhaust systems.

C. See drawings for Sequence of Operation.

D. See Equipment Schedules and associated specification sections for controls integral to HVAC equipment.

E. Controls shall be electric/electronic systems.

F. Manufacturers of components shall be Honeywell or approved.

G. Any additional parts necessary to or incidental for a complete and operating system shall be the responsibility of the contractor.

1.3 MAINTENANCE SERVICE

A. Furnish service and maintenance of control system for one year from Date of Substantial Completion.

B. Furnish complete service of controls systems, including callbacks and service calls.

C. Furnish two complete inspections per year, one in each season, to inspect, calibrate, and adjust controls. Submit written report after each inspection.

D. Include systematic examination, adjustment, and lubrication of unit, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

E. Perform work without removing units from service during building normal occupied hours.

F. Provide emergency call back service during working hours for this maintenance period.

G. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

H. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.

1.4 QUALITY ASSURANCE

A. Control Air Damper Performance: Test in accordance with AMCA 500.

1.5 SUBMITTALS

A. Provide submittal to include six sets of control components, control diagrams and operational sequences.

PART 2 PRODUCTS

2.1 THERMOSTATS

A. Manufacturers: Honeywell (or as noted below) or approved equal.

B. Bi-metal thermostats are not allowed for any application.

C. Line Voltage Heating Thermostat (Programmable Electronic): King ESP230, Honeywell TL8230A or equal.
1. Integral manual On/Off switch, single-pole.
2. Accuracy: +/- 1.5 degrees F.
3. Load / Motor capacity rating of 22 amps, 208/240 volt.
4. Electronic thermistor temperature sensor with 40 F to 95 F range.
5. 7 day independent programmable schedules with 4 daily setpoints.
6. LCD display showing day, time, room temperature and setpoint, Green LED backlight, Red LED heat on Indicator, temperature adjustment buttons.
7. Positive off position/function to serve as NEC required disconnect.

D. Low Voltage Heating/Cooling Commercial Thermostat (Electronic Programmable): T7351F
1. Sensor Element: Thermistor.
2. Accuracy: +/- 1 degrees F.
3. 24 VAC electrical.
4. LCD backlight display.
5. 365 day programming with 2 occupied and 2 unoccupied periods per day.
6. Individual heat and cool setpoints for both occupied and unoccupied.

7. P+I+D temperature control.
8. Auxiliary subbase connection for economizer control.
9. 3 heat/3 cool conventional or heat pump operation.
10. Heat-Off-Cool-Auto system selection.

E. Room Thermostat Accessories:
1. Thermostat Guards: Locking transparent plastic mounted on separate base.

2.2 TIMERS

A. Manufacturers: Intermatic or approved equal.

B. Spring wound twist timer, 120 volt, 1 HP (20 amp inductive) rated. 'Brushed metal' gray polycarbonate faceplate. Select time range and hold as scheduled or noted in sequence.

2.3 CONTROL AIR DAMPERS

A. See Section 23 33 00.

2.4 ELECTRIC DAMPER ACTUATORS

A. Manufacturers: Belimo or approved equal.

B. Operation: Two-position or proportional as required for application. [Reversing type proportional motor], spring-return.

C. Enclosure Rating: NEMA 250 Type 2 Enclosure.

D. Mounting: Direct mount.

E. Stroke: 30 seconds end to end full stroke, 15 seconds return to normal for spring return.

F. Protection: Electronic stall protection.

G. Control Input: 0-10 VDC or 0-20 mA DC.

H. Power: Nominal 24 \ 120 volt AC.

I. Torque: Size for minimum 150 percent of required duty.

J. Duty cycle: rated for 65,000 cycles.

K. Accessories:
1. Cover mounted transformer.
2. Auxiliary potentiometer.
3. Damper linkage.
4. Direct drive feedback potentiometer.
5. Output position feedback.

6. Field selectable rotational, spring return direction, field adjustable zero and span.
7. End switch.

2.5 CO/NO2 SENSOR

A. Manufacturer: AirTest Technologies (1-888-855-8880) or approved equal.

B. Controller (CT2100): Integrated dual sensing capability for two gases with two sets of relays for fan/alarm activation. LED indication of power, fault and 2 threshold indicators for each gas channel. 2 minute low on delay, 10 min low off delay and 5 minute high on delay. NEMA 4X enclosure.

C. Integrated electrochemical CO sensor head (TR2000).

D. Remote NO2 Sensor: Electrochemical diffusion sensor in NEMA 4X enclosure, 0-10 ppm range, +/- 5% accuracy. (TR3210)

2.6 WARNING ALARM

A. Manufacturer: Edwards Signals 875 DC or approved equal.

B. Surface mount vibrating horn for heavy-duty indoor use. Corrosion resistant finish, adjustable volume, completely assembled.

2.7 ENCLOSURES

A. All enclosures to be UL listed and all metal construction. All controls and instruments logically assembled at one or more panels.

2.8 CONTROL RELAYS

A. Shall be rated for the application, with a minimum of two sets of Form C contacts, enclosed in a dust proof enclosure. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays should be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage.

2.9 WIRING

A. Electric wiring and wiring connections required for the installation of the temperature control system as herein specified, shall be provided by the temperature control contractor. All wiring shall comply with the requirements of local and national electrical codes, and with applicable requirements of Electrical Division. Install all wiring in conduit.

B. Line voltage wiring type and size shall be per NEC.

C. Low voltage wiring type and size shall be per control manufacturer’s recommendations based on application and length of run.

2.10 CONTROL POWER

A. Provide transformers to supply power for control equipment operating at less than normal lighting circuit voltage. Do not connect wiring to lighting circuits.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify building systems to be controlled are ready to operate.

B. Verify air handling units and ductwork have been accepted and air filters are in place before installing sensors in air streams.

C. Verify location of thermostats and other exposed control sensors with Drawings before installation.

3.2 COORDINATION

A. Furnish all control products to accomplish the specified sequence of operation, except those products specifically furnished under other sections.

B. Install all control products and connections, except where already installed by the equipment manufacturer.

3.3 INSTALLATION

A. General:
1. Install controls by mechanics skilled in erection of control systems employed by and under direct supervision of control manufacturer's representative.
2. Mount control equipment and devices as recommended by manufacturers and as shown on drawings; in case of conflicts between manufacturer's instructions and the drawings, consult the Project Manager for direction.
3. Fasten all equipment securely to structure. Install equipment and exposed piping and conduit runs parallel to building lines, plumb and level.

B. Wiring:
1. Provide line voltage and/or low voltage wiring as required to serve the complete system; conform to code.
2. Provide EMT or rigid conduit for exposed control wiring outside of cabinets or enclosures. Concealed low voltage wiring need not be in conduit, except in walls (see “3”).
3. Provide rigid conduit for control wiring concealed in partition walls, until conduit emerges from wall above ceilings.
4. Run low voltage control wiring separate from line voltage wiring and segregate from other systems to avoid Electromagnetic Interference (EMI).
5. All low voltage control wiring shall be home runs between components without splices.

C. Install thermostats in protective guard aspirating boxes in apparatus bay and as indicated on Drawings.

D. Install control panels adjacent to associated equipment on vibration free walls or freestanding supports. Install engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

3.4 THERMOSTATS AND SENSORS

A. Mount thermostats and other human interface devises at 48” centerline above finished floor to comply with ADA accessibility per ANSI A117.1. Align thermostats and devises with light switches and other controls.

B. Coordinate wall location of thermostats and other wall mount devises with light switches and controls provided by others. All devises in the same vicinity should be grouped at a common elevation with regular horizontal spacing intervals.

C. Mount CO/NO2 sensor controllers at 54” centerline above finished floor, CO sensor at 48” centerline above finished floor and NO2 sensor at 18” centerline above finished floor.

3.5 FIELD QUALITY CONTROL

A. After completion of installation, start-up, test and adjust each system. Submit data showing set points, final adjustments of controls and compliance with sequence of operations.

B. Conduct functional tests on complete systems, or individual portions as approved.

C. Conduct operational tests; set controls to operating conditions, record settings and readings of each control device.

D. Work in close coordination with testing and balancing Agency to set up control devices, set damper flow rates, and provide control system in perfect operating order. See Section 23 05 93.

3.6 DEMONSTRATION AND TRAINING

A. Demonstrate complete operation of systems, including sequence of operation prior to Date of Substantial Completion.

B. Not less than 60 days after beneficial occupancy by the Owner, recheck entire control system for compliance with Sequence of Operation.

C. Recheck controls for proper operation at the start of the heating season, if other than above timing, and again during the first warm weather period following winter operation.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Refrigerant piping.
2. Refrigerant moisture and liquid indicators.
3. Valves.
4. Refrigerant piping accessories.

1.2 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.

C. Provide receivers on systems as required by manufacturer's installation instructions, sized to accommodate pump down charge.

D. Flexible Connectors: Use at spring isolated air handlers and condensers greater than six tons.

E. Size piping in accord with equipment manufacturer's refrigerant piping design guidelines based on actual piping installation lengths. Use long line calculations when applicable.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.5 code for installation of refrigerant piping systems.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.
1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

2.2 UNIONS, FLANGES, AND COUPLINGS

A. Copper Pipe: Bronze, soldered joints.

2.3 REFRIGERANT MOISTURE AND LIQUID INDICATORS

A. Manufacturers: Alco Controls, Parker Hannifin, Sporlan Valve or approved equal.

B. Indicators:
1. Port: Single, UL listed.
2. Body: Copper or brass, flared or solder ends.
3. Sight glass: Color-coded paper moisture indicator and plastic cap.
4. Maximum working pressure: 500 psig
5. Maximum working temperature: 200 degrees F.

2.4 REFRIGERANT PIPING SERVICE VALVE

A. Manufacturer: Diamondback or approved equal.

B. Full port, forged brass ball valve with Schrader valve, flare connections, Teflon seals and gaskets. 700 psig rated, R-410A compatible, fully factory assembled and pressure tested.

C. Provide with insulation cover of polyethylene foam with PVC cover and tape.

2.5 REFRIGERANT STRAINERS

A. Manufacturers: Alco Controls, Parker Hannifin, Sporlan Valve or approved equal.

B. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass.

2.6 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Packless Ind, Metraflex, Mason or approved equal.

B. Braided Refrigeration Piping Connection
1. Bronze flexible hose and bronze braided outer covering.
2. Copper sweat connections, cleaned de-greased, and bagged.
3. R410a rated, 650 psi working pressure.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION PIPING SYSTEMS

A. Route piping parallel to building structure and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors.

E. Protection: Where piping, other than cast iron or steel, is installed in a concealed location through holes or notches in framing (i.e. studs, joists, rafters, etc.), less than 1-1/2 from framing edge, provide shield plates. Shield plates shall be 16 gauge steel and cover the piping area within framing plus 2” on each side along framing.

F. Use rigid Armacell Armafix pipe clamp assembly at all supports.

G. Determine equivalent line length and size piping per manufacturer’s installation instructions. Provide solenoid valve and other required piping accessories for long line installation.

H. Refrigerant piping shall not be installed in elevators, public stairways, stair landing or means of egress spaces.

I. Install pipe identification.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

K. Provide access where valves and fittings are not exposed.

L. Flood refrigerant piping system with nitrogen during brazing. Keep piping open with nitrogen flow for zero pressure while brazing.

M. Install valves with stems upright or horizontal, not inverted.

N. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.

O. Fully charge completed system with refrigerant after testing.

P. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

Q. Install refrigerant piping in accordance with ASME B31.5.

3.3 INSTALLATION-EXTERIOR PIPING

A. Protect exterior piping with application specific piping protection cover system or field fabricated GSM cover with steel angle supports.

B. Provide waterproof pipe entry into building with trim and flashing.

C. Protect exposed insulated pipe with aluminum jacket.

3.4 INSTALLATION - REFRIGERANT SPECIALTIES

A. Refrigerant Liquid Indicators: Install line size liquid indicators in main liquid line downstream of condenser.

B. Refrigerant Valves: Install service valves on compressor suction and discharge.

C. Strainers: Install shut-off valves on each side of strainer.

3.5 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test refrigeration system with dry nitrogen to 400 psig. Perform final tests at 27 inches vacuum and 400 psig using halide torch or electronic leak detector.

C. Repair leaks.

D. Retest until no leaks are detected.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ductwork
2. Kitchen Hood Ductwork
3. Duct Sealant
4. Fabrication
5. Duct Pressure Testing

1.2 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

B. Standards: Comply with most stringent requirements and recommendations of International Mechanical Code or SMACNA (Sheet Metal and Air Conditioning Contractors National Association) Duct Construction Standards for fabrication, construction and sealant of duct, fittings, and accessories.

C. Construct ductwork to NFPA 90A.

D. Construct kitchen hood ductwork to NFPA 96.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealant.

1.4 DEFINITIONS

A. Black Carbon Steel: Plain carbon steel which is not galvanized or oiled.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90.

B. Steel Ducts: ASTM A1008.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 INSULATED FLEXIBLE DUCTS

A. Manufacturers: Thermaflex M-KC or approved equal.

B. Product Description: Insulated assembly with inner duct of woven and coated fiberglass permanently bonded to coated steel wire helix, 1" fiberglass insulation and vapor barrier jacket of fiberglass reinforced metallized film laminate, UL 181 Class 1 complying with NFPA 90A & 90B.
1. Pressure Rating: 10 inches wg positive and 2 inches wg negative.
2. Maximum Velocity: 6000 fpm.
3. Temperature Range: -20 degrees F to 250 degrees F.
4. Thermal Resistance: R-4.2

C. Accessories:
1. Hanger Strap: Thermaflex FlexTie – 1-1/2” wide, adjustable, plenum rated.
2. Elbow: Thermaflex FlexFlow Elbow – One piece adjustable design installs over flex duct.

2.3 SINGLE WALL SPIRAL ROUND DUCTS

A. Manufacturers: McGill AirFlow, Semco or approved equal.

B. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

C. Joints: 16” and larger flange with gasket material.

D. Elbows: Smooth radius or 5 section, 1.5D.

E. Application: Required for all exposed round ductwork; all round ductwork 12” dia. and larger; all round ductwork with static pressure over 1” w.g.. Optional for all round ductwork.

F. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24

G. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22

2.4 SINGLE WALL ROUND DUCTS

A. Manufacturers: Ductmate GreenSeam+ or approved equal.

B. Product Description: Snap lock round duct with self-sealing butyl rubber longitudinal seam and polyurethane gasket transverse seam. No external sealant. No VOCs.

C. Joints: Male/Female with integral gasket.

D. Elbows: Smooth radius, 1.5D.

E. Application: Only allowed for low pressure ductwork with static pressure of 1" w.g. or less, less than 10" diameter and concealed. Not for use exposed.

F. Construct duct with the following minimum gages:

Diameter	Gauge
4 inches to 10 inches	26

G. Construct fittings with the following minimum gages:

Diameter	Gauge
4 inches to 10 inches	24

2.5 SINGLE WALL ROUND DUCTS (SNAP-LOCK)

A. Product Description: Product not acceptable for use.

2.6 DUCT SEALANT

A. Manufacturer: Design Polymerics, United McGill or approved equal.

B. Sealant shall be water based and formulated to withstand working temperatures of -25°F to +200°F. All sealants shall exceed 500 hours under ASTM C 732 (artificial weathering) and pass ASTM C 734 (low temperature flexibility after artificial weathering). All sealants shall be of an elastomeric nature, have a weight per gallon not to exceed 12.5, have solids by weight of 66% ± 2%, pass UL 723 with a flame spread of 5 and smoke developed of 5.

2.7 DUCTWORK FABRICATION

A. Fabricate and support rectangular and round ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide duct material, gages, reinforcing, and sealing for operating pressures corresponding to the ESP (external static pressure) of the fan system. i.e. Ductwork for a fan with and ESP of 0.75" w.g. should be constructed per SMACNA 1" w.g. pressure standard.

B. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide

airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

C. Indicated dimensions on drawings are net inside. Allow for thickness of duct lining where indicated.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

2.8 CLOTHES DRYER EXHAUST DUCTWORK

A. Rigid galvanized sheet metal of minimum 26 gauge with smooth interior finish.

2.9 KITCHEN HOOD EXHAUST DUCTWORK FABRICATION

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.

B. Concealed Kitchen Hood Exhaust Ducts: Construct of 16 gage carbon steel using continuous external welded joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Make field measurements to establish locations of hangers and supports where installation will not damage building construction.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Where ducts pass through partitions, ceilings or floors. Provide 1" clearance and insulate from structure with insulation material. Provide flanged sheet metal closure.

D. Where ducts pass through rated walls or assemblies without fire dampers, provide ¼” to 1” annular space and fill with firestop sealant. Ductwork shall be minimum 26 gauge metal.

E. Isolate joints between dissimilar metals with fiber gasket.

F. Drawings do not attempt to show all offsets in ductwork. Make such offsets as necessary for installation of work without additional cost to Owner. 15 degree maximum angle of offset.

G. Exposed ductwork shall be Appearance Grade. Ductwork located in crawl spaces, shafts, and suspended ceiling spaces are not considered exposed.
1. All round ductwork shall be spiral seam (no snap-lock joints).
2. All joints clean and workmanlike.
3. Ductwork entirely free of dents.
4. Ductwork subject to denting due to space function construct one gauge heavier than SMACNA standard for size indicated.
5. All hangers trimmed of excess metal.
6. Plumb, level, parallel or perpendicular to building structure.
7. Sealed with transparent, paintable sealant to avoid streaking.

H. Flexible Duct:
1. Install insulated flexible duct in full extended condition free of sags and kinks.
2. Use minimum length required to make connection.
3. Length shall not exceed 10 feet.
4. Supported on 36" centers with minimum 1-1/2” wide strap. Do not crush.
5. Connect flexible ducts to metal ducts with draw bands.

I. Install duct hangers and supports in accordance with Section 23 05 00.

J. Use double nuts and lock washers on threaded rod supports.

3.3 SEISMIC BRACING

A. See 23 05 00.

3.4 DUCT SEALING

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Ductwork shall be sealed using welds, gaskets, or mastic. Duct tape is not permitted as a sealant on any ducts with the exception of that on fiberglass ducts specifically made for such use.

B. For all ductwork seal all transverse joints and longitudinal seams.

C. Low pressure ductwork (less than 3” w.g.) shall be sealed to a leakage rate not to exceed 6 percent of the system airflow. All deficient ductwork shall be re-sealed until compliant.

3.5 PRESSURE (DUCT LEAKAGE) TESTING

A. Perform duct leakage rate testing in accordance with SMACNA Duct Leakage Test Procedures for the following.

1. All ductwork regardless of pressure class located exterior of the building or in an unconditioned space shall have a leakage rate of less than 6%.
2. At least 25% of all ductwork with a pressure class of 3" w.g. or more. The maximum duct leakage (CL) shall be 4.0 per Energy Code C403.2.8.3.3.

B. All ductwork found deficient by testing shall be resealed and retested until leakage compliance is reached.

C. Provide written documentation of testing to be included with the Test and Balance report, see 23 05 93. Include drawing(s) indicating where test measurements were taken.

3.6 CLOTHES DRYER DUCT INSTALLATION

A. Ducts shall terminate outside the building and be equipped with a backdraft damper. No screens shall be used at termination.

B. Ducts shall not be constructed with sheet metal screws or other fasteners that enter the airstream. Ductwork shall be metal with smooth interior finish. The male end of duct joints shall extend in the direction of airflow.

C. Dryer ducts which penetrate a wall of ceiling membrane shall be fire caulked.

D. Dryer ducts shall be supported at minimum 4 foot intervals and secured in place.

E. Provide protective shield plates where duct is in concealed locations within framing. Plates shall be 16 gage steel and cover the duct area plus 2". Shields may be omitted if duct is more than 1-1/2" from nearest edge of structural member.

3.7 KITCHEN HOOD EXHAUST DUCT INSTALLATION

A. Install kitchen range hoods and ductwork in accordance with NFPA 96.

B. Prior to duct concealment perform light leakage test on entire duct and duct to hood connection per requirements of IMC 506.3.2.5. Each weld and joint shall be inspected. If any leaks are detected, repair and retest section. Tests shall be witness and documented by the Commissioning Agent.

3.8 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers or light troffer boots to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.

C. Connect air outlets and inlets to supply ducts with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.9 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.10 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply, Return, Exhaust, Relief	Galvanized Steel
Kitchen Hood Exhaust	Black Carbon Steel
Outside Air Intake	Galvanized Steel
Exterior	Aluminum

B. Ductwork Pressure Class Schedule: Install higher pressure class than indicated where corresponding fan system ESP (external static pressure) is higher.

AIR SYSTEM	PRESSURE CLASS
Constant Volume Low Pressure Supply	Minimum 1 inch wg.
Return, Exhaust	Minimum 1 inch wg

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Dampers
2. Dryer Box
3. Duct access doors
4. Flexible duct connections

1.2 COORDINATION

A. Verify locations for access panels with Architect.

B. Coordinate damper power, control and fire alarm interface with other trades.

C. See 23 09 00 for Electric Damper Actuators.

1.3 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

PART 2 PRODUCTS

2.1 MANUAL BALANCING DAMPERS

A. Manufacturers: Ruskin, Greenheck or approved equal

B. Frames: Galvanized steel, minimum 20 gage.

C. Blades: Galvanized steel, minimum 20 gage, attached to minimum 3/8 inch shafts with locking handle quadrant. Provide 2” standoff for insulated ductwork applications.

D. Maximum Velocity: 1500 fpm.

E. Rectangular: 24” and under on a side Ruskin MD25; over 24” on a side Ruskin MD35 or equal.

F. Round: Ruskin MDRS25 or equal.

2.2 CONTROL DAMPERS

A. Manufacturers: Tamco, Ruskin, Greenheck or approved equal

B. Frame: Extruded aluminum (6063T5) channel of minimum 0.080” thickness with mounting flanges on both sides.

C. Blades: Extruded aluminum (6063T5) airfoil. Maximum blade size 6 inches wide, 48 inches long, attached to minimum 7/16 inch hex shafts.

D. Bearings: Celcon inner bearing fixed to blade pin, rotating within a polycarbonate outer bearing inserted in the frame.

E. Seals: EPDM blade seals and silicone frame seals.

F. Damper Leakage: AMCA Pressure Class 1A, maximum leakage rate of 3.0 cfm/ft^2 at 1.0 inch w.g. pressure differential.

G. Maximum Pressure Differential: 6 inches w.g.

H. Rectangular: Tamco 1000, Ruskin CD50 or equal.

I. Round: Ruskin CDRS25 or equal up to 12” diameter, for larger sizes use rectangular damper with manufacturer’s square-to-round transitions.

J. Options:
1. For dampers with a dimension over 48” provide multiple sections with jack shafts.
2. Provide parallel blade action for two position (open/closed) applications.
3. Provide opposed blade action for modulation or control applications.

2.3 INSULATED CONTROL DAMPERS

A. Manufacturers: Tamco, Ruskin, Greenheck or approved equal

B. Frame: Insulated extruded aluminum (6063T5) channel of minimum 0.080” thickness with mounting flanges on both sides.

C. Blades: Extruded aluminum (6063T5) airfoil internally insulated with expanded polyurethane foam and thermally broken. Maximum blade size 6 inches wide, 48 inches long, attached to minimum 7/16 inch hex shafts.

D. Bearings: Celcon inner bearing fixed to blade pin, rotating within a polycarbonate outer bearing inserted in the frame.

E. Seals: EPDM blade seals and silicone frame seals.

F. Damper Leakage: AMCA Pressure Class 1A, maximum leakage rate of 3.0 cfm/ft^2 at 1.0 inch w.g. pressure differential.

G. Maximum Pressure Differential: 6 inches w.g.

H. Rectangular Insulated: Tamco 9000, Ruskin CDTI-50 or equal.

I. Round: Provide rectangular damper with manufacturer's square-to-round transitions.

J. Options:
1. For dampers with a dimension over 48" provide multiple sections with jack shafts.
2. Provide parallel blade action for two position (open/closed) applications.
3. Provide opposed blade action for modulation or control applications.

2.4 REMOTE OPERATED BALANCING DAMPERS (MANUAL)

A. Manufacturers: Young, MAT or approved equal.

B. Damper:
1. Round butterfly or radial damper with external control hardware, 5020-CC, RT-250.
2. Round butterfly or radial damper with internal control hardware, 5020-CC-2, RT-150.
3. Rectangular opposed blade damper with external control hardware, 830A-CC, RT-200.
4. Rectangular opposed blade damper with internal control hardware, 830A-CC-2, RT-100.

C. Remote Damper Operator:
1. External cable control, 3" cover plate, 270-301
2. Internal cable control, 270-275
3. Remote cable wall control, 700 (where indicated).

2.5 PRESSURE INDEPENDENT VOLUME DAMPER (DUCT INSERT)

A. Manufacturer: Trox VFL

B. Circular air volume flow limiter with casing and damper blade made of high-quality plastic, UL 94. Ready-to-commission unit consists of the casing with volume flow rate setting scale and the control mechanism with stainless steel leaf spring and low-friction, silicone-free, polyurethane bellows. Easy insertion into circular ducts; secure fit ensured by a lip seal.

C. Features:
1. Mechanical self-powered
2. Aerodynamically tested and factory set to a reference volume flow rate
3. Sticker showing volume flow rates (in cfm) on each unit

D. Technical data:
1. Nominal sizes: 4 – 10 in
2. Volume flow rate range: 11-450 cfm
3. Volume flow rate control range: < 20 to 100 % of the nominal volume flow rate

4. Volume flow rate accuracy: approx. ± 10 % of the nominal volume flow rate
5. Minimum differential pressure: 0.12 in. w.g.
6. Maximum acceptable differential pressure: 1.2 in. w.g.

2.6 PRESSURE INDEPENDENT VOLUME CONTROLLER (MANUAL CONTROL)

A. Manufacturer: Trox VFC

B. Circular adjustable volume flow controller for constant flow independent of duct system pressure. Galvanized steel casing with high-quality plastic damper blade, low-friction bearings, polyurethane bellows, stainless steel leaf spring and external rotary volume flow rate setpoint knob.

C. Features:
1. Mechanical self-powered, without external power supply.
2. Volume set from external scale; no tools required.

D. Technical data:
1. Nominal sizes: 4 – 10 in
2. Volume flow rate range: 13-784 cfm
3. Volume flow rate control range: 10 to 100 % of the nominal volume flow rate
4. Volume flow rate accuracy: approx. ± 10 % of the nominal volume flow rate
5. Minimum differential pressure: 0.12 in. w.g.
6. Maximum acceptable differential pressure: 2.0 in. w.g.

2.7 COMBINATION FIRE AND SMOKE DAMPERS (INLINE)

A. Manufacturers: Ruskin FSD60/FSD60LP, FSDR60, equal by Greenheck, or approved equal.

B. Application: Provide FSD60LP (low pressure) model for dampers 14” in height and smaller. All others provide standard FSD60.

C. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S.

D. Fire Resistance: 1-1/2 hours or 3 hours depending on rating of wall.

E. Leakage Rating: Class I, maximum of 8 cfm at 4 inches wg differential pressure.

F. Damper Temperature Rating: 350 degrees F.

G. Frame: 16 gage, galvanized steel.

H. Blades:
1. Style: Airfoil-shaped, single piece, double skin.
2. Action: Opposed.
3. Orientation: Horizontal.
4. Material: Minimum 16 gage equivalent thickness, galvanized steel.

5. Width: Maximum 7 inches.

I. Bearings: Stainless steel or bronze.

J. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

K. Linkage: Concealed in frame.

L. Provide with duct transition connection.

M. Release Device: Close in controlled manner and allow damper to be reset.

N. Actuator: Belimo, electric 120 volt, 60 hertz, two-position, fail close.

O. Resetable Link Release Temperature: 165 degrees F.

P. Factory installed sleeve and mounting angles. Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.

2.8 CEILING RADIATION FIRE DAMPERS

A. Manufacturers: Greenheck, Ruskin or approved equal.

B. Fire Rating: UL 555C classified and labeled as a 1-1/2 or 3 hour ceiling damper depending on rating of ceiling.

C. Air Flow Rating: UL approved for dual directional air flow.

D. Frame: Minimum 3 inches by minimum 20 gage galvanized steel with roll formed ridge for blade stop.

E. Blades:
1. Style: Two-piece, single-thickness with blade insulation, hinged in center, and held open with fusible link.
2. Action: Butterfly.
3. Orientation: Horizontal.
4. Material: Minimum 20 gage galvanized steel.

F. Hinge: Spring stainless steel, mechanically attached to blades.

G. Mounting: Horizontal.

H. Temperature Release Device: Fusible link, 165 degrees F.

I. Pressure Drop: Maximum 0.1 inches w.g. at 500 fpm across 18 x 18 inch damper.

2.9 DRYER BOX

A. Manufacturers: Guy Gray, In-O-Vate Technologies or approved equal.

B. 22 gauge aluminized steel manufactured wall recessed dryer vent hose receptacle with opening for 4” dia. duct. UL Classified for a one hour wall. Installation per manufacturer’s instructions.

2.10 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover.
1. Less than 12 inches square, secure with sash locks.
2. Up to 18 inches Square: Furnish two hinges and two sash locks.
3. Up to 24 x 48 inches: Three hinges and two compression latches.
4. Larger Sizes: Furnish additional hinge.
5. Access panels with sheet metal screw fasteners are not acceptable.

2.11 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers: Duro-Dyne or approved equal

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Double fold “Grip-Loc” metal-to-fabric connection.

D. Indoor Connector: “Metal-Fab”, 24 ga, 3”metal - 3” fabric - 3” metal.
1. Fabric: UL listed fire-retardant Neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd, 500 lbs tensile strength.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rated walls are ready for fire damper installation.

B. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. See Section 23 34 00, paragraph 1.3 for damper installation.

C. Provide motorized in lieu of gravity back-draft dampers per Energy Code.

D. Provide control dampers where not furnished with packaged equipment.

E. Provide insulated control dampers where:
1. The damper is installed behind a louver.
2. The damper is installed in a roof penthouse or gravity ventilator.
3. The damper is unducted and open to a conditioned space.

F. Install remote operated dampers for balancing where damper is located in an inaccessible location.

G. Access Doors: Install access doors at the following locations and as indicated on Drawings:
1. Before and after each fire damper, smoke damper and combination fire and smoke damper.
2. Where access is required for a valve or damper.
3. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96.

H. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated on Drawings. Review locations prior to fabrication.

I. Install temporary duct test holes as required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

J. Install fire dampers, combination fire and smoke dampers and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
2. Install dampers square and free from racking with blades running horizontally.
3. Do not compress or stretch damper frame into duct or opening.
4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.3 INSTALLATION – PRESSURE INDEPENDENT VOLUME DAMPERS (PIVD)

A. Select devise volume setpoint closest to scheduled volume.

B. Provide devise dimension the same size as ductwork.

C. Trox VFL: Affix manufacturer’s identification sticker to duct exterior. Permanently mark set cfm on sticker.

D. Trox VFC: Mark setpoint on scale and indicate cfm.

E. Where PIVD is indicated, typically provide Trox VFL for duct sizes 4”-6” and airflow less than or equal to 100 cfm, unless noted otherwise.

F. Where PIVD is indicated, typically provide Trox VFC for duct sizes 6”-10” and airflow greater than 100 cfm, unless noted otherwise.

3.4 DEMONSTRATION

A. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fans.

1.2 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

1.3 DAMPERS

A. A gravity backdraft or motorized control damper is required on every exhaust fan.

B. Fans which are noted to operate continuously or have a capacity of 300 cfm or less shall have a gravity backdraft damper unless noted otherwise. All other fans shall have a motorized control damper.

C. See 23 33 00 for motorized control dampers.

D. Provide insulated control dampers where scheduled or where required by 23 33 00.

PART 2 PRODUCTS

2.1 CENTRIFUGAL ROOF EXHAUST FANS

A. Manufacturers: Greenheck, Cook or approved equal.

B. Construction: Spun aluminum with rigid internal support and aluminum birdscreen. Backward inclined aluminum wheel and inlet, statically and dynamically balanced.

C. Belt Drive:

1. Motor: Heavy duty ball bearing type with steel frame mounted on vibration isolators out of the air stream. Selected operating horsepower to be a maximum of 80% of rated motor horsepower without using safety factor.
2. Bearings: Pillow block type, self-aligning, permanently sealed, lubricated ball bearings, with L-10 life at 100,000 hours.
3. Shafts: Hot rolled steel, ground and polished, with key way.
4. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves selected so required rpm is obtained with sheaves set at mid-position. Matched belts, and drive rated minimum 1.5 times nameplate rating of motor.
5. Accessories:
   a. Gravity backdraft \ Motorized Control damper. (See Part I, Dampers)
   b. Insulated roof curb with liner; matched to roof slope.
   c. Curb seal.
   d. Aluminum birdscreen.
   e. NEMA disconnect switch.

D. Direct Drive:
1. Motor: Electronic Commutation DC brushless motor with internal solid state AC/DC converter circuitry and heavy duty ball bearings. Speed controllable down to 20% of full speed. Minimum 85% efficient at all speeds.
   a. Motor mounted potentiometer speed control dial.
2. Accessories:
   a. Gravity backdraft \ Motorized Control damper. (See Part I, Dampers)
   b. Insulated roof curb with liner; matched to roof slope.
   c. Curb seal.
   d. Aluminum birdscreen.
   e. NEMA disconnect switch.
   f. Speed Control

2.2 UP-BLAST CENTRIFUGAL EXHAUST FANS

A. Manufacturers: Greenheck, Cook or approved equal. UL 762 Listed.

B. Construction: Spun aluminum with rigid internal support and welded construction. Backward inclined aluminum wheel and inlet, statically and dynamically balanced. Motor cooling tube and heat baffle insulation.

C. Belt Drive:
1. Motor: Heavy duty ball bearing type with steel frame mounted on vibration isolators out of the air stream. Selected operating horsepower to be a maximum of 80% of rated motor horsepower without using safety factor.
2. Bearings: Pillow block type, self-aligning, permanently sealed, lubricated ball bearings, with L-10 life at 100,000 hours.
3. Shafts: Hot rolled steel, ground and polished, with key way.
4. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves selected so required rpm is

obtained with sheaves set at mid-position. Matched belts, and drive rated minimum 1.5 times nameplate rating of motor.

D. Accessories:
1. Insulated roof curb with liner; matched to roof slope.
2. Heat baffle
3. Curb seal.
4. NEMA disconnect switch.
5. Hinged curb kit with cables.
6. Teflon non-stick wheel coating.
7. Clean out port on windband.
8. Grease trap with drain and absorbent material.

2.3 CENTRIFUGAL INLINE FANS

A. Manufacturers: Greenheck, Cook or approved equal.

B. Construction: Square galvanized steel with duct collars, two removable access panels. Backward inclined aluminum wheel and inlet, statically and dynamically balanced.

C. Direct Drive:
1. Motor: Electronic Commutation DC brushless motor with internal solid state AC/DC converter circuitry and heavy duty ball bearings. Speed controllable down to 20% of full speed. Minimum 85% efficient at all speeds.
a. Motor mounted potentiometer speed control dial.
2. Accessories:
a. Gravity backdraft \ Motorized Control damper. (See Part I, Dampers)
b. Nema rated disconnect switch.
c. Insulated housing with 1" liner.
d. Speed Control.
e. Neoprene isolators

PART 3 EXECUTION

3.1 ROOF CURBS

A. Verify roof curbs are installed and dimensions are as instructed by manufacturer.

B. Provide sound attenuation material in curb where so indicated on drawings.

3.2 INSTALLATION

A. Secure roof fans with cadmium plated steel lag screws to roof curb.

B. Suspended Fans: Install flexible connections between inlet and outlet of fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Install safety screen where inlet or outlet is exposed.

D. Install gravity backdraft or motorized control dampers on discharge of exhaust fans and as indicated on Drawings.

E. Provide sheaves required for final air balance.

3.3 CLEANING

A. Vacuum clean inside of fan cabinet.

3.4 DEMONSTRATION

A. Demonstrate fan operation and maintenance procedures.

3.5 PROTECTION OF FINISHED WORK

A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Diffusers, Registers & Grilles
2. Louvered penthouses
3. Goosenecks

1.2 QUALITY ASSURANCE

A. Diffuser, register, and grille performance shall be tested and rated in accordance with ASHRAE 70.

B. Louver performance shall be tested and rated in accordance with AMCA 500.

PART 2 PRODUCTS

2.1 RECTANGULAR CEILING DIFFUSERS

A. Manufacturers: Titus, Price, Krueger or approved equal.

B. Type: Square, stamped, multi-core, adjustable pattern diffuser.

C. Frame: Surface mount with flat frame or T-bar lay-in.

D. Fabrication: Steel with baked enamel white finish.

2.2 LOW-FLOW RECTANGULAR CEILING DIFFUSERS

A. Manufacturers: Titus TJD or approved equal.

B. Type: Square plaque, induction nozzles.

C. Frame: Surface mount with flat frame or T-bar lay-in.

D. Fabrication: Steel with baked enamel white finish.

2.3 SWIRL CEILING DIFFUSERS

A. Manufacturers: Trox TDF-SA or approved equal.

B. Type: Ceiling swirl diffuser with square or circular face. Fixed air control blades for horizontal swirling creating high induction levels.

C. Frame: Installation frames for suspended T-bar ceilings, surface mount or freely suspended.

D. Fabrication: Galvanized steel with white powder-coated finish.

E. Accessories:
1. (H) – High-performance, side inlet plenum box, galvanized steel.
2. (O) – No damper.

2.4 SWIRL CEILING DIFFUSERS

A. Manufacturers: Trox VDW or approved equal.

B. Type: Ceiling swirl diffuser with square or circular face. Individual manually adjustable air control blades for variable direction swirling creating high induction levels.

C. Frame: Installation frames for suspended T-bar ceilings, surface mount or freely suspended.

D. Fabrication: Galvanized steel with white powder-coated finish. Black plastic adjustable air control blades.

E. Accessories:
1. (H) – High-performance, side inlet plenum box, galvanized steel.
2. (O) – No damper.

2.5 SUPPLY REGISTERS

A. Manufacturers: Titus, Price, Krueger or approved equal.

B. Type: Contoured and individually adjustable blades, 3/4" blade spacing, two-way deflection.

C. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

D. Fabrication: Steel with factory white enamel finish.

2.6 EXHAUST/ RETURN GRILLES

A. Manufacturers: Titus, Price, Krueger or approved equal.

B. Type: Fixed blades, 1/2 inch blade spacing, with blades set at 35 degrees.

C. Frame: 1-1/4 inch margin with countersunk screw mounting, welded corners.

D. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, with factory white enamel finish.

2.7 EGGCRATE EXHAUST AND RETURN GRILLES

A. Manufacturers: Titus, Price, Krueger or approved equal.

B. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch aluminum core.

C. Fabrication: Aluminum with factory white enamel finish.

D. Frame: 1-1/4 inch margin with countersunk screw mounting or channel lay-in frame for suspended grid ceilings.

2.8 LOUVERED PENTHOUSE

A. Manufacturers: Greenheck, Cook, Price or approved equal.

B. Product Description: Square Louvered type, with aluminum constructed housing; aluminum wire bird screen and insect screen; square base to suit roof curb with continuous curb gaskets.

C. Roof Curb: Galvanized steel or aluminum construction with continuously welded seams, built-in cant strips, 1 inch insulation with liner, damper tray, curb seal and factory installed nailer strip. Matched to roof pitch.

D. Motor Operated Damper: Aluminum multiple blade construction, sealed edged with offset hinge pin, nylon bearings, blades linked and motor drive, power open, spring return.

2.9 GOOSENECKS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, of minimum 18 gage aluminum. Provide termination insect screen.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify inlet and outlet locations with Architectural Plans.

B. Verify ceiling/wall type before ordering.

C. Verify diffuser air patterns are as indicated before starting air balance.

3.2 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly.

C. Paint visible portion of ductwork behind air outlets and inlets matte black

3.3 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 38 00

HOODS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Kitchen Hood

1.2 REQUIREMENTS

A. The equipment of this section shall be provided by a single vendor.

PART 2 PRODUCTS

2.1 KITCHEN HOOD

A. Manufacturers: Greenheck or approved equal.

B. Kitchen Ventilation hood shall be full compensating wall canopy with the capability to replace up to 90% of the exhausted air with fresh outside air. The hood shall be UL 710 Listed without fire damper for 400°F rated cooking appliances. Air shall be supplied through perforated panels in a manner that does not interfere with the cooking operations beneath the hood. Perforated panels shall be located on the face to ensure precise volume control and shall limit the throw to within several feet of the hood.

C. The hood exterior shall be constructed of a minimum of 18 gauge stainless steel with an embossed finish 430 SS. The hood(s) shall be constructed using the standing seam method for optimum strength. An integral 3 inch air space is provided to meet NFPA 96 clearance requirements against limited combustible walls. All seams, joints and penetrations of the hood enclosure shall be welded and/or liquid tight. All unexposed interior surfaces shall be constructed of a minimum 18 gauge corrosion resistant steel including, but not limited to ducts, plenum, and brackets.

D. The hood shall include a filter housing constructed of the same material as the hood. The filters shall be baffle type stainless, UL 1046. The filter housing shall terminate in a pitched, full length grease trough which shall drain into a removable grease container.

E. The hood shall include a Performance Enhancing Lip (PEL) to improve capture efficiency by turning air back into the hood.

F. Vapor proof, U. L. Listed incandescent light fixtures shall be pre-wired to a junction box situated at the top of the hood for field connection. Provide quantity of lights necessary to obtain 40 foot-candles on working surface.

G. Hood shall be built in accordance with National Fire Protection Association (NFPA) Bulletin #96, International Mechanical Code (IMC), and bear the National Sanitation Foundation (NSF) Seal of Approval.

2.2 CONTROL

A. Provide by hood manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 96.

3.2 TESTING

A. Review exhaust and make-up air test and balance for compliance with scheduled equipment, UL tested minimum airflows and code minimum air flows.

B. Perform smoke capture and containment test with appliances installed under hood per IMC 507.16.1. Test shall simulate cooking by producing smoke or steam. Provide written report of visual observations.

END OF SECTION

SECTION 23 40 00

FILTERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Disposable, pleated filters.
   2. Washable permanent panel filters.

1.2 PERFORMANCE REQUIREMENTS

A. Conform to ARI 850 Section 7.4.

B. Dust Spot Efficiency: Plus or minus 5 percent.

PART 2 PRODUCTS

2.1 DISPOSABLE, PLEATED FILTERS

A. Manufacturers: Camfil, Flanders, Airguard, Viledon or approved equal.

B. MERV 8: UL 900 Class 2, pleated, cotton and polyester blend, radial pleat with welded wire grid, cardboard frame. 1”, 2” & 4”. (Camfil 30/30)

C. MERV 13 (85%): UL 900 Class 2, pleated synthetic media with three layers, spunbond polyester prefilter, electrostatically spunpolycaronate microfiber middle layer and spunbond polyester downstream layer. 2” & 4” (Viledon Mini 85)

2.2 WASHABLE PERMANENT PANEL FILTERS

A. Media: 14 mesh aluminum, alternate layers of flat and herringbone crimp, four layers per inch; rod reinforced. Frame: Aluminum

PART 3 EXECUTION

3.1 INSTALLATION

A. Install filters with felt, rubber, or neoprene gaskets to prevent passage of unfiltered air around filters.

B. Do not operate fan system until filters are in place. Replace filters used during construction before testing, with clean set. Provide owner with replacement set of filters.

END OF SECTION

SECTION 23 51 00

CHIMNEYS AND STACKS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Type B double wall gas vents.
2. Single wall metal stacks.

1.2 DEFINITIONS

A. Vent: Portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

B. Vent Connector: Part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.3 SCOPE

A. Provide plastic or metal venting for equipment in this Division.

1.4 SUBMITTALS

A. Product Data: Submit data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

1.5 QUALITY ASSURANCE

A. Provide factory built vents and chimneys used for venting natural draft appliances complying with NFPA 211 and UL listed and labeled.

PART 2 PRODUCTS

2.1 TYPE B DOUBLE WALL GAS VENTS

A. Manufacturers: Metalbestos, Ampco or approved equal.

B. Fabrication: Inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, tested in compliance with UL 441.

C. Accessories: Complete stack system with fittings, thimble, storm collar, roof flashing and cap.

2.2 SINGLE WALL METAL (COMBUSTION AIR INTAKE)

A. Single wall spiral ductwork per 23 31 00.

B. Accessories: Complete stack system with fittings, storm collar, roof flashing and cap.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install flue and vent piping per manufacturer's installation instructions. Note maximum allowable venting length.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Sleeve pipe passing through partitions, walls and floors.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Protection: Where piping, other than cast iron or steel, is installed in a concealed location through holes or notches in framing (i.e. studs, joists, rafters, etc.), less than 1-1/2 from framing edge, provide shield plates. Shield plates shall be 16 gauge steel and cover the piping area within framing plus 2" on each side along framing.

F. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

G. Provide factory vent and combustion air terminations. Flash and seal piping penetrating building exterior to maintain integrity of assembly.

H. Install flue with minimum of joints. Align accurately at connections, with internal surfaces smooth.

I. Support flue from building structure, rigidly with suitable ties, braces, hangers and anchors.

J. For gas vents, maintain UL listed minimum clearances from combustibles.

K. Clean flue during installation, removing dust and debris.

END OF SECTION

SECTION 23 55 00

FUEL-FIRED HEATERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Gas fired unit heaters.

1.2 QUALITY ASSURANCE

A. Gas-Fired Unit Heater Performance Requirements: Conform to minimum efficiency prescribed when tested in accordance with ANSI Z83.8.

1.3 WARRANTY

A. Furnish five year manufacturer warranty for heat exchanger.

PART 2 PRODUCTS

2.1 GAS FIRED UNIT HEATERS

A. Manufacturers: Reznor or approved equal.

B. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:
1. Heating fuel: Natural gas fired, 83% efficiency.
2. Gas Control: Single stage.
3. Ignition System: Electric direct ignition.
4. Location: Suspended overhead.

C. Cabinet: Powdercoated galvanized steel, fully gasketed access panel with safety interlock; insulated or double panel construction; roll-formed adjustable, horizontal louvers; fan guard.

D. Supply Fan: Propeller.

E. Heat Exchanger: Multicell, 4 pass serpentine style with tubes of Type 409 stainless steel.

F. Gas Burner: One piece burner with single orifice, continuous wound stainless steel ribbon, separated-combustion, power-vented.

G. Accessories:
1. Concentric vent termination kit
2. 409 stainless steel heat exchanger

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify space is ready for installation of units and openings are as indicated on shop drawings.

3.2 INSTALLATION

A. Install units in accordance with NFPA 90A.

B. Installation - Natural Gas Piping:
   1. Connect natural gas piping in accordance with NFPA 54.
   2. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.
   3. Install the following piping accessories on natural gas piping connections.
      a. Strainer.
      b. Pressure gage.
      c. Shutoff valve.
      d. Pressure reducing valve.

C. Install vent connections in accordance with NFPA 211. Install vents and stacks.

D. Provide hangers, supports and seismic bracing for suspended units.

E. Provide operating controls.

END OF SECTION

SECTION 23 72 00

ENERGY RECOVERY UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Package ERV with core.

1.2 QUALITY ASSURANCE

A. Entire unit shall be ETL Certified per U.L. 1812 and bear an ETL sticker.

B. Energy Core shall be AHRI Certified, per Standard 1060.

1.3 COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each unit and associated electrical systems.

B. Contractor shall coordinate with roofing contractor to ensure curb unit is properly flashed.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Filters: 3 sets of disposable filters for each unit.

1.5 ELECTRICAL

A. Short-Circuit Current Rating (SCCR): All HVAC and refrigeration equipment with multi-motor or combination electrical loads shall comply with NEC 110.10 & 440.4 and must include a SCCR greater than the Available Interrupting Current (AIC) of the electrical circuit serving the equipment. See electrical drawings for required AIC kA rating. Equipment SCCR may be presented in writing from the manufacturer or shown on the unit nameplate. Refrigeration or air-conditioning equipment over 60 Amps MOCP must list the SCCR on the unit nameplate. If the AIC rating is unavailable or cannot be determined provide equipment with a minimum SCCR of 10kA.

PART 2 PRODUCTS

2.1 AIR TO AIR ENERGY RECOVERY UNIT (ERV)

A. Manufacturers: Greenheck or approved equal.

B. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, outdoor air intake weatherhood with metal mesh filters, energy core, motorized intake damper, motorized exhaust damper, sensors, curb assembly, filter assembly for intake and exhaust air, supply air blower assembly, exhaust air blower assembly and an electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

C. Cabinet: Formed double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance. Outside casing: Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvanized steel.
1. ECV-10 internal assemblies: 24 gauge, galvanized (G90) steel. Direct drive motor provided with a fabricated belly band for motor support.
2. Access doors shall be hinged.
3. Provide factory-installed duct flanges on all duct openings.

D. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181. Materials: 1 inch thick Fiberglass insulation. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
1. Location and application: Full coverage of entire cabinet exterior to include walls, roof and floor of unit. Insulation shall be of semi-rigid type and installed between inner and outer shells of all cabinet exterior components.

E. Energy Core: Energy core shall be of total enthalpy and shall be removable from the cabinet. The core shall consist of a galvanized steel framework and an energy core as specified. The core media shall be a corrugated hydroscopic resin in a galvanized steel framework and can be removable for servicing. The energy core is to have a five year warranty. Performance criteria are to be as specified in AHRI Standard 1060.

F. Supply Air and Exhaust Air blower assemblies: Blower assemblies consist of an electric motor and a direct/belt driven blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on 1.125 inch thick neoprene vibration isolators.

G. Control panel: Energy Core Ventilator shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections

H. Motorized dampers / Exhaust Air, Intake Air: Motorized dampers of insulated low leakage type shall be factory installed.

I. Sensors are part of various optional operational modes or device controllers and are to be factory supplied and installed.

J. Curb Assembly: 14 gauge galvanized steel shall provide perimeter support of the entire unit. Curb assembly shall enclose the underside of the unit and shall

be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly.

K. Blower: Supply Air and Exhaust Air blower shall be assembled onto a 14 gauge galvanized steel platform with neoprene vibration isolation devices. Assemblies shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
   1. Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.

L. Motors: Motors greater than ¾ horsepower shall be “NEMA Premium™”. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts.

M. Unit Controls: Factory-supplied controllers, thermostats and sensors. This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors

N. Remote Interface: Contractor shall provide and install a Remote Interface that functions as a remote indicator of owner-selected operating parameters and also permits remote inputting of new operating parameters. Each remote panel shall have a large LCD user interface screen similar in form and function to the screen on the DDC.

O. Sensors:
   1. Dirty Filter Sensors
   2. Temperature Sensors- OAI, EAW, RAI, OAD

P. Filters:
   1. Outside air intake weatherhood shall have permanent metal filters accessible from the exterior of the unit.
   2. 2” MERV 13 disposable pleated filters in the intake air stream
   3. 2” MERV 8 disposable pleated filters in the exhaust air stream.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof curbs are installed and dimensions are as instructed by manufacturer.

3.2 PREPARATION

A. Furnish roof curbs for installation.

3.3 INSTALLATION

A. Secure unit with cadmium plated steel lag screws to roof curb.

B. Install flexible connections between unit and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide sheaves required for final air balance.

3.4 MANUFACTURER'S FIELD SERVICES

A. Furnish services of factory trained representative for minimum of one day to start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.5 CLEANING

A. Vacuum clean coils and inside of fan cabinet.

B. Install clean filters.

3.6 DEMONSTRATION

A. Demonstrate fan operation and maintenance procedures.

3.7 PROTECTION OF FINISHED WORK

A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 81 43

AIR-COOLED, VARIABLE REFRIGERANT FLOW, MULTI-UNIT HEAT PUMP

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. System Description
2. Outdoor unit
3. Indoor units
4. Refrigerant controller
5. Digital Controls
6. Condensate Overflow Switch

1.2 MAINTENANCE SERVICE

A. Furnish service and maintenance of equipment for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments.

B. Furnish 24-hour emergency service on breakdowns and malfunctions for this maintenance period.

1.3 ELECTRICAL

A. Short-Circuit Current Rating (SCCR): All HVAC and refrigeration equipment with multi-motor or combination electrical loads shall comply with NEC 110.10 & 440.4 and must include a SCCR greater than the Available Interrupting Current (AIC) of the electrical circuit serving the equipment. See electrical drawings for required AIC kA rating. Equipment SCCR may be presented in writing from the manufacturer or shown on the unit nameplate. Refrigeration or air-conditioning equipment over 60 Amps MOCP must list the SCCR on the unit nameplate. If the AIC rating is unavailable or cannot be determined provide equipment with a minimum SCCR of 10kA.

1.4 QUALIFICATIONS

A. The system shall be installed by a Mitsubishi authorized CITY MULTI Diamond Dealer. The contractor service and install training should be performed by the manufacturer.

1.5 WARRANTY

A. System shall obtain Diamond five (5) year warranty.

B. Warranties periods shall be from date of substantial completion.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Mitsubishi CITY MULTI or approved equal.

2.2 VARIABLE REFRIGERANT FLOW ZONING SYSTEM

A. General: Variable capacity, split heat pump heat recovery air conditioning system with Variable Refrigerant Flow Zoning (VRFZ) and simultaneous heating/cooling. The system consists of an outdoor unit, BC (Branch Circuit) Controller, multiple indoor fan coil units, interconnecting refrigerant piping and product specific DDC (Direct Digital Controls). All components factory assembled, internally piped and wired, tested and ready for field assembly.

B. Quality Assurance:
1. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
2. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
3. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
4. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.
5. Warranty:
   a. The units shall be covered by the manufacturer's limited warranty for a period of one (1) year.
   b. Systems designed by a certified CITY MULTI Diamond Designer, installed by a certified CITY MULTI Diamond Dealer, and verified with a completed commissioning report submitted to Mitsubishi Electric Service Department, shall be covered by an extended manufacturer's limited warranty for a period of five (5) years.
   c. In addition the compressor shall have a manufacturer's limited warranty for a period of six (6) years.

2.3 OUTDOOR UNIT:

A. General: Units shall be equipped with multiple circuit boards that interface to the control system and shall perform all functions necessary for operation, be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.
1. Sound rating no higher than 63 dB(A).
2. Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller shall be insulated.
3. Accumulator with refrigerant level sensors and controls.
4. High pressure safety switch, over-current protection and DC bus protection.
5. Capable of operating in heating down to -4°F ambient temperature without additional low ambient controls.

6. High efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

B. Unit Cabinet: The casing shall be fabricated of galvanized steel, bonderized and finished with powder coated baked enamel.

C. Fan: Direct drive, variable speed propeller type fan with inherent protection, permanently lubricated bearings, mounted for quiet operation, raised guard and vertical discharge airflow.

D. Refrigerant: R410A refrigerant is required.

E. Coil: Nonferrous construction with lanced or corrugated plate fins on copper tubing with an integral metal guard. 4 circuits with two position valves for each circuit, except for the last stage.

F. Compressor: High performance, inverter driven, modulating capacity scroll compressor with a factory mounted crankcase heater, an inverter to modulate capacity variable down to 16%, internal thermal overload, mounted to avoid the transmission of vibration.

G. Electrical: The unit shall be controlled by integral microprocessors with the control circuit between the indoor units, BC Controller and the outdoor unit being 12VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.4 BRANCH CIRCUIT (BC) CONTROLLER:

A. General: These units shall be equipped with a circuit board that interfaces to the M-NET controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors.

B. BC Unit Cabinet: Fabricated of galvanized steel with a liquid-gas separator, multiple refrigeration control valves and two tube-in-tube heat exchangers.

C. Refrigerant valves: Each circuit shall have one (54,000 Btu/h or smaller indoor unit section) two-position liquid line valve and a two-position suction line valve. When connecting a 54,000 Btu/h or larger indoor unit section, two branch circuits shall be joined together at the branch controller to deliver an appropriate amount of refrigerant. The two refrigerant valves shall operate simultaneously. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

D. Service shut-off ball valves with Schrader port shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

E. An integral condensate pan and drain shall be provided.

F. Accessories:

1. Provide with BlueDiamond MaxiBlue condensation pump complete with reservoir and accessories. Provide power from unit.

2.5 PKFY INDOOR UNIT (wall-mounted)

A. General: Wall mounted indoor unit section with a slim silhouette and a modulating linear expansion device.

B. Indoor Unit: Factory assembled, wired and run tested with all factory wiring, piping, electronic modulating linear expansion device, control circuit board, fan motor, self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet: White finish, same for all model sizes. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining. Separate back plate which secures the unit firmly to the wall.

D. Fan: An assembly with one or two line-flow fan(s) direct driven by a single motor. Statically and dynamically balanced to run on a motor with permanently lubricated bearings. Multi-speed fan with two speeds selected by the room controller. Manual adjustable guide vane with the ability to change the airflow from side to side (left to right). Motorized air sweep louver with automatic change in airflow by directing the air up and down to provide uniform air distribution.

E. Filter: Factory installed MERV 4.

F. Coil: Nonferrous construction with smooth plate fins on copper tubing, inner grooves for high efficiency heat exchange, phos-copper or silver alloy brazed joints, pressure tested at the factory. A condensate pan and drain shall be provided under the coil. Both refrigerant lines to the PKFY indoor units shall be insulated.

G. Controls: Unit controls to be provided with unit as part of VFRZ system to perform functions necessary to operate the system. The unit shall be able to control external backup heat.

H. Accessories:
1. Provide with BlueDiamond condensation pump complete with reservoir and accessories. Provide model MicroBlue for units up to 15 MBH and MaxiBlue for units 18 MBH and larger. Provide power from fan coil unit.

2.6 PLFY INDOOR UNIT (4-way Cassette)

A. General: A cassette style indoor unit that recesses into the ceiling with a ceiling grille and a modulating linear expansion device.

B. Indoor Unit: Factory assembled, wired and run tested with all factory wiring, piping, electronic modulating linear expansion device, control circuit board, fan motor, self-diagnostic function, 3-minute time delay mechanism, an auto restart

function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet: Ceiling-recessed cassette with provisions for a field installed filtered outside air intake. Branch ducting shall be allowed from cabinet. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow. Grille vane angles shall be individually adjustable from the controller to customize the airflow pattern for the conditioned space.

D. Fan: An assembly with a turbo fan direct driven by a single motor. Statically and dynamically balanced to run on a motor with permanently lubricated bearings. Four (4) fan speeds, two of which may be selected by the room controller. Adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow. Auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.

E. Filter: Factory installed MERV 4.

F. Coil: Nonferrous construction with smooth plate fins on copper tubing, inner grooves for high efficiency heat exchange, phos-copper or silver alloy brazed joints, pressure tested at the factory. A condensate pan and drain shall be provided under the coil. Both refrigerant lines to the PLFY indoor units shall be insulated.

G. Controls: Unit controls to be provided with unit as part of VFRZ system to perform functions necessary to operate the system.

H. Accessories:
1. Factory installed condensate lift pump.

2.7 PEFY-NMAU INDOOR UNIT (Ceiling-Concealed Ducted)

A. General: A ceiling concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and a modulating linear expansion device.

B. Indoor Unit: Factory assembled, wired and run tested with all factory wiring, piping, electronic modulating linear expansion device, control circuit board, fan motor, self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet: Ceiling concealed, ducted with provisions for a field installed filtered outside air intake. Unit shall have a ducted air outlet system and ducted return air system.

D. Fan: An assembly with one or two Sirocco fan(s) direct driven by a single motor. Statically and dynamically balanced and run on a motor with permanently lubricated bearings. Three (3) fan speeds, plus Auto-Fan function.

E. Filter: MERV 8 (minimum) installed in field rack or mixing box.

F. Coil: Nonferrous construction with smooth plate fins on copper tubing, inner grooves for high efficiency heat exchange, phos-copper or silver alloy brazed joints, pressure tested at the factory. A condensate pan and drain shall be provided under the coil. The condensate shall be gravity drained from the fan coil. Both refrigerant lines to the PEFY indoor units shall be insulated.

G. Controls: Unit controls to be provided with unit as part of VFRZ system to perform functions necessary to operate the system. The unit shall be able to control external backup heat.

H. Accessories:
1. Factory installed condensate lift pump.

2.8 FILTER BOX

A. Manufacturer: MicroMetl, Mitsubishi or approved equal.

B. Manufactured and constructed specifically to match fan coil and fasten directly to return inlet of unit. Box shall be 20 ga GSM construction.

C. Filter rack shall be angled and shall accept 1”, 2” or 4” filters. Access door shall be hinged and fastened with knurled nobs such that tools are not required to open. Rack and door shall have foam gasket.

2.9 TRIM PANEL

A. Manufacturer: Mitsubishi PLFY-ITP1, PLFY-ITP2 or PMFY-ITP1

B. Ceiling cassette trim panel to adapt with t-bar ceilings. High performance ABS impact resistant polymer with a smooth white finish. Black finish optional.

2.10 REFRIGERANT PIPING SERVICE VALVE

A. Manufacturer: Diamondback or approved equal.

B. Full port, forged brass ball valve with Schrader valve, flare connections, Teflon seals and gaskets. 700 psig rated, R-410A compatible, fully factory assembled and pressure tested.

C. Provide with insulation cover of polyethylene foam with PVC cover and tape.

2.11 CONTROLS

A. General: The physical controllers shall be plastic material with a neutral color. Each remote controller, at a minimum, shall have a LCD (Liquid Crystal Display) that shows room temperature, set point, and fan speed.

B. Electrical:

1. The electrical voltage from each circuit board to the controls shall be 12 volts DC.
2. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit then to the BC controller and outdoor unit. Control wiring shall run from the indoor unit terminal block to the controller associated with that unit.
3. Wiring shall be 2-conductor 16 AWG or 18 AWG stranded wire with a shield, as defined by control drawing.

2.12 REMOTE CONTROLLERS

A. Remote controllers shall operate indoor units. The wiring for the remote controllers shall be simple, non-polar, two-wire connections. All remote controllers shall be wall-mounted with an LCD display and contain a microprocessor that constantly monitors operation to maintain smooth indoor unit operation. Set temperature shall be adjusted in increments of 1°F or 2°F, depending on the systems and controllers. In the event of an abnormality, the remote controller shall display a four-digit error code and the indoor unit address.

B. PAR-U01MEDU-J: Smart ME Remote Controller
1. Backlit touch screen.
2. Capable of controlling up to 16 indoor units (defined as 1 group).
3. Displays: Room temperature, relative humidity, operation status, setpoint.
4. Control the following operations: On/Off, Operation Mode (cool, heat, auto, dry, and fan), temperature setting, fan speed setting, setback, hold and airflow direction setting.
5. Timer settings of on/off/temperature up to 8 times in a day in 5-minute increments with an Auto Off timer and able to limit the set temperature range.
6. Room temperature shall be sensed at the Controller.

2.13 CMCN: System Controllers

A. AE-200 Centralized Controller
1. Standalone controller shall be capable of controlling up to 50 indoor units across multiple outdoor units. Controller shall be capable of controlling up to 200 indoor units across multiple outdoor unit with expansion of up to three AE-50A controllers.
2. Power shall be provided by integrated power supply.
3. Controller shall support operation superseding that of the remote controllers, system configuration, daily/weekly scheduling, monitoring of operation status, night setback setting, free contact interlock configuration and malfunction monitoring.
4. Controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of indoor units, or all indoor units. These controls shall include on/off, operation mode selection (cool, heat, auto, dry, setback and fan), temperature setting, fan speed setting, and airflow direction setting.
5. Ability to enable or disable operation of local remote controllers.

6. Allow both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed and permit/prohibit of remote controllers.
7. Controller shall be equipped with a RJ-45 Ethernet port to support interconnection with a network PC via a closed/direct Local Area Network (LAN), via an Ethernet Hub on a LAN.
8. 9" high resolution, back lit, color touch panel interface for direct graphical interface and control of system.
9. Memory back up via USB port.
10. Software functions shall be available so that the building manager can securely log into each AE-200 via the PC's web browser to support operation monitoring, scheduling, error e-mail, personal browser, and maintenance diagnostics.

B. Digital Input Digital Output (DIDO) Control Board
1. 2 digital inputs (DI) and 2 digital outputs (DO)
2. (DI) Provide status or fault monitoring.
3. (DO) Provide on/off, start/stop, enable/disable control to external equipment.
4. Interlock M-NET devices or output contacts according to input status.
5. Provide 24 VDC power.

C. Analog Input (AI) Control Board
1. 2 analog inputs (0-10 VDC or 4-20 mA).
2. Monitor temperature, pressure and/or humidity sensors.
3. Interlock M-NET devices or output contacts according to input status.
4. Provide 24 VDC power.

2.14 CONDENSATE OVERFLOW SWITCH

A. Manufacturer: Rectorseal Safe-T-Switch or approved equal.

B. Sealed, waterproof reed/magnet float switch installed on the overflow outlet of drain pans or on an auxiliary drain pan. UL 508, 24 volt AC.

2.15 CONDENSATE PUMP

A. Manufacturer: BlueDiamond MicroBlue or approved equal.

B. GyRok pump technology, 1.3 gal/hr, 16 feet hd, 6 feet lift, 17 dba. Thermistor level sensing. Capable of running dry. Provide with reservoir and ducting kit.

2.16 CONDENSATE PUMP

A. Manufacturer: BlueDiamond MaxiBlue or approved equal.

B. Rotary elastomer diaphragm technology, 3.7 gal/hr, 23 feet hd, 16.5 feet lift, 21 dba. Thermistor level sensing. Capable of running dry. Provide with reservoir and accessories.

PART 3 EXECUTION

3.1 EXAMINATION

A. Coordinate size and location of concrete pad for condensing unit. Provide inserts for mounting.

B. Coordinate size and location of sleeves or block-outs needs for refrigerant piping.

C. Determine refrigerant pipe routing to efficiently minimum run length and avoid interference.

3.2 INSTALLATION

A. Install condensate piping with trap and determine route from drain pan to nearest waste with 1/4" slope. Provide condensate pump where drain is not available or slope cannot be made.

B. Install components furnished loose for field mounting.

C. Install condensing units at grade on concrete foundations with anchors.

D. Install refrigerant piping from condensing unit(s) to branch controller(s) and from branch controller(s) to indoor units. Install refrigerant specialties furnished with unit.

E. Insulate both liquid and vapor refrigerant piping on all runs.

F. Evacuate refrigerant piping and install initial charge of refrigerant.

G. Install electrical devices furnished loose for field mounting.

H. Install control wiring between air handling unit, condensing unit, and field installed accessories.

3.3 INSTALLATION – CONTROLS

A. Set control of equipment based on room controller space temperature rather than default return air temperature.

B. Setup Ethernet access via local area network.

C. Setup output of error message via email, coordinate with owner for address.

D. Designate Fan Coils with unit tag and room/space name.

E. Setup occupied and unoccupied space temperature schedules, including second unoccupied temperature sweep. Coordinate schedules with Owner.

3.4 MANUFACTURER'S FIELD SERVICES

A. Furnish initial start-up and commissioning. During first year of operation, including routine servicing and checkout.

3.5 CLEANING

A. Vacuum clean coils and inside of unit cabinet.

B. Install new filters in indoor units at Substantial Completion.

3.6 DEMONSTRATION

A. Demonstrate system operation and maintenance.

B. Furnish services of manufacturer's technical representative for one day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days' notice to Architect/Engineer of training date.

3.7 PROTECTION OF FINISHED WORK

A. Do not operate indoor units during construction for temporary heat.

B. Do not operate indoor units until ductwork and room is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 82 00

TERMINAL HEATING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Electric heaters.

PART 2 PRODUCTS

2.1 ELECTRIC RADIANT PANEL

A. Manufacturers: Markel, Aztec or approved equal.

B. Assembly: Electric resistance graphite element imbedded between two layers of insulation, steel shell. T-bar mount, surface mount with aluminum frame or recessed mount with aluminum frame. UL listed and labeled.

C. Ceiling Panels: 24x48 inch with baked enamel white finish.

2.2 ELECTRIC INFRARED HEATER

A. Manufacturers: Black Body ThermaZone or approved equal.

B. Heavy steel construction with mounting brackets, refractory panel and grid. UL approved.

2.3 FORCED AIR WALL HEATER

A. Manufacturers: Markel, Cadet, Brasch or approved equal.

B. Heavy gauge housing and frame with sealed tubular heating element, thermal overload cut-off, fan delay switch, built-in tamperproof thermostat, vane axial blower. UL listed,

PART 3 EXECUTION

3.1 EXAMINATION

A. For recessed units, verify recess dimensions are correct size.

B. Verify wall construction is ready for installation.

C. Verify concealed blocking and supports are in place and connections are correctly located.

3.2 INSTALLATION

A. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

B. Protection: Install finished cabinet units with protective covers during remainder of construction.

C. Coordinate to assure correct recess size for recessed units.

D. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals.

3.3 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

SECTION 23 82 16

DUCT COILS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Electric coils.

PART 2 PRODUCTS

2.1 ELECTRIC COILS

A. Manufacturers: Brasch, Indeeco, Neptronic or approved equal.

B. Assembly: UL listed and labeled, with terminal control box and hinged cover, splice box, coil, casing, and controls.

C. Coil: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings and stainless steel terminals.

D. Casing: Channel frame of galvanized steel with brackets, stiffening ribs and gussets welded to frame. Flange duct connection unless noted otherwise.

E. Controls: Automatic reset thermal cut-out, built-in magnetic disconnecting contactors (3-poles), control circuit transformer and fuse, secondary replaceable thermal cut-out, air flow proving device, fused disconnect.

F. Accessories:
   1. Insulated terminal box
   2. SCR control
   3. Door interlock switch
   4. Pilot lights

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify ductwork is ready for installation.

B. Verify concealed blocking and supports are in place and connections are correctly located.

3.2 INSTALLATION

A. Install air coils in ducts and casings in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible.

B. Support air coil sections independent of ductwork on steel channel or double angle frames and secure to casings. Furnish frames for maximum three coil sections. Arrange supports to avoid piercing drain pans. Install with airtight seal between coil and duct or casing.

C. Install coils level.

D. Make connections to coils with unions and flanges.

E. Protection: Install finished cabinet units with protective covers during remainder of construction.

F. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals.

3.3 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

SECTION 260000 - ELECTRICAL GENERAL CONDITIONS

PART 1 - GENERAL

1.1 GENERAL

A. Conform to the General Conditions, Supplementary Conditions, and related work in other Divisions for all work in Division 26, 27, and 28. See Division 1 for sequence of work.

1.2 WORK INCLUDED

A. It is the intention of this division of the specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown in the plans. The work shall include all materials, appliances and apparatus not specifically mentioned herein or noted on the plans, but which are necessary to make a complete working installation of all electrical systems shown on the plans or described herein. Equipment and devices furnished and installed under other divisions of this specification (or by the Owner) shall be connected under this division. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

B. By submitting a bid, the Contractor is acknowledging that he has made a thorough examination of the Contract Documents, existing site and building conditions, and has determined that these documents do sufficiently describe the scope of construction work required under this Contract.

1.3 SCOPE OF BASIC BID

A. Included in Division 26, 27, and 28 work is all work and related items necessary to provide all electrical installations except as specifically excluded. In general, this includes all labor, equipment, tools, etc., to complete the electrical work.

1.4 RELATED WORK

A. Temporary Power and Lighting - See Section 015100.

B. Mechanical Control Wiring – See Division 23.

C. Cutting and Patching - See Division 1.

D. Trenching, backfill and asphalt work – See Division 2.

1.5 STANDARDS AND REGULATIONS

A. The work shall comply with the latest edition of the applicable Standards and Codes of the following:

ASTM	American Society for Testing and Materials
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code
---	State Electrical Code
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
U.L.	Underwriters Laboratories Inc.
IPCEA	Insulated Power Cable Engineers Associated
CBM	Certified Ballasts Manufacturers
---	Federal, State and Local Building Codes
ETL	Electrical Testing Laboratories

B. If any conflict occurs between Government adopted Code Rules and this specification, the codes are to govern. Nothing in these drawings and specifications shall be construed to permit work not conforming to governing codes. Also, this shall not be construed as relieving the Contractor from complying with any requirements of the plans and specifications which may be in excess of, but not in conflict with, requirements of the Governing Codes.

1.6 PERMITS & FEES

A. The Contractor shall obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. The Contractor shall arrange for inspection of work by the inspectors and shall give the inspectors all necessary assistance in their work of inspection.

1.7 DEFINITIONS

A. When "Provide" is used, it shall be interpreted as "furnishing and installing complete in operating condition".

B. When "Drawings" is used, it shall be interpreted as "all Contract Drawings for all Disciplines".

C. When "Contractors" is used, it shall be interpreted as the Electrical Contractor.

1.8 INTENT OF DRAWINGS

A. The electrical drawings are intended to serve as working drawings for general layout. The equipment layout is diagrammatic and unless specifically dimensioned or detailed, does not indicate all fittings, hardware or appurtenances required for a complete operating installation.

B. Anything shown on the drawings but not covered in the specifications, or anything covered in the specifications but not shown on the drawings, shall be as if covered in both. In case of conflict between the drawings and specifications, the Engineer will select the method to be used. The Contractor shall be responsible for verifying all measurements before proceeding with the work.

C. Wiring diagrams are not intended to indicate the exact course of raceways or exact location of outlets. Raceway and outlet locations are approximately correct and are subject to revision as may be necessary or desirable at the time of installation. Precise location in every case shall be subject to the Engineer's approval.

D. The contractor shall review the manufacturer provided installation instructions for each piece of equipment prior to rough-in. Any conflict between the drawings, specifications and installation instructions shall be brought to the Engineer's attention immediately. The contractor will not be paid for any reinstallation required due to failing to comply with manufacturer's recommendations or requirements unless specifically directed by the engineer, in writing, after the conflict has been identified.

1.9 PROTECTION

A. The Contractor shall store and guard all equipment before installation and shall protect same, and replace any equipment that has been damaged prior to final acceptance.

1.10 HOUSEKEEPING

A. All electrical materials shall be kept stored in an orderly fashion protected from heat, cold, and the weather.

B. All marred surfaces shall be refinished and painted after installation.

C. All debris shall be removed from premises during work, as directed, and at completion of job.

1.11 TEMPORARY USE

A. Temporary or interim use of any and all portions of the electrical system shall be under the supervision of the Electrical Contractor.

1.12 AS-BUILT DRAWINGS

A. The Contractor shall maintain, in addition to any reference drawings, an as-built set of prints, on which all deviations from the original design shall be drafted in a neat, legible manner with red colored pencil. This red lined set shall identify all drawing revisions including addenda items, change orders, and Contractor revisions. The Contractor is responsible to revise panel schedules and load calculations as required.

B. Drawings shall show locations of all concealed raceway runs larger than 1", giving the number of conductors and size of raceway. Underground ducts shall be shown with cross section elevations. All pipe, raceway, manholes or lines of other trades shall be included.

C. The Contractor shall update all references to specific products to indicate products actually installed on project. This shall include, but not be limited to, lighting fixtures, baseboard heaters, etc.

D. Upon completion of the Division 26, 27, and 28 Work, the Contractor shall deliver the red lined drawings and one set of neatly marked up as-built drawings to the Engineer for transmittal through the Engineer to the Owner.

E. Upon completion of the Division 26, 27, and 28 Work, the Contractor shall deliver the red lined drawings and one set of neatly drafted as-built drawings on electronic media in AutoCAD R-2013 format and full size pdf to the Architect.

1.13 WARRANTY

A. Provide a written warranty that the Division 26, 27, and 28 work is free from mechanical and electrical defects. Contractor shall replace and repair, to the satisfaction of the Engineer, any parts of the installation which may fail within a period of 12 months after the certificate of final acceptance, provided that such failure is due to defects in material or workmanship, or failure to follow the specifications and drawings.

1.14 INSTRUCTIONS AND MANUALS

A. A preliminary copy, complete, except for the bound cover, shall be submitted 60 days prior to completion of the project for checking and review. Five (5) bound, corrected copies shall be delivered to the Owner 20 days prior to scheduled instruction periods.

B. Manuals shall contain shop drawings, wiring diagrams, operating and maintenance instructions, replacement parts lists, and equipment nameplate data for all equipment and systems installed under the project. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation. Manuals shall contain original brochures supplied by manufacturers. Xerox copies of originals will not be accepted.

C. Each type of device provided shall be identified in the O & M Manual using the same identification as shown on the drawings and specifications. The information included must be the exact equipment installed not the complete "line" of the Manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets. Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier is not acceptable. The following information shall be provided for each device:
   1. Manufacturer's name, address and phone number.
   2. Local supplier's name, address and phone number.
   3. Complete parts lists including quantities and manufacturer's part numbers.
   4. Installation instructions.
   5. Recommended maintenance items including maintenance procedure and recommended interval of maintenance listed in hours of operation, calendar unity or other similar time unit.

D. The O & M Manual shall be assembled in a loose leaf, 3-ring, hard cover binder and electronically on compact disc. The information contained in the manuals shall be grouped in an orderly arrangement by specification index. The manuals shall have a typewritten index and divider sheets between categories with identifying tabs. The covers shall be imprinted with the name of the job, Owner, Architect, Electrical Engineer, Division 26, 27, and 28 Contractor, and year of completion. The back edge shall be imprinted with the name of the job, Owner, and year of completion. As a minimum, the following selection shall be broken out:
   1. Light Fixtures
   2. Panelboards
   3. Motor Controls
   4. Fire Alarm System
   5. Fire Station Alerting System

6. Low Voltage Lighting Control Systems
7. Stand-by Generator & transfer switch

E. Wiring Diagrams for each system shall be complete for the specific system installed under the Contract. "Typical" Line Diagrams will not be acceptable unless properly marked to indicate the exact field installation.

1.15 WORK NOT INCLUDED

A. Indicated motors, controls, and equipment as described in other divisions shall be furnished by other trades, but shall be moved, set and wired to electrical controls and power supply by the Electrical Contractor.

B. Work to be included under this Contract shall be defined on drawings and in these specifications. Any details beyond these limits are meant only to give installation clarity to that portion which is a part of this Contract.

1.16 INSTRUCTION PERIODS

A. Upon completion of the work and after all tests and final inspection of the work by the authority(s) having jurisdiction, the Contractor shall demonstrate and instruct the Owner's designated operation and maintenance personnel in the operation and maintenance of the various electrical systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or foremen knowledgeable in each system and suppliers representatives when so specified.

B. Scheduled Instruction periods shall be:

1.	Digital Lighting Control System	1/2 day
2.	Fire Alarm System	1/2 day

C. Costs for time involved by Contractor shall be included in the bid.

1.17 COMPLETION OF WORK

A. Upon completion of the Division 26, 27, and 28 work, the Contractor shall comply with requirements of Section 017000 for project closeout.

B. Arrange for and obtain all required inspections and certificates pertaining to the Division 26, 27, and 28 work and deliver the certificates to the Engineer in triplicate.

C. Prior to or at the time of final inspection, the Contractor shall, as outlined in detail in the specifications, complete the delivery of all the following items:

1. Completion Letter
2. Certificate of Final Inspection, in triplicate form.

Electrical Inspector	COMPLETION OF WORK
Fire Department	260000
3. Warranty to Owner	SUPPLEMENTARY GENERAL CONDITIONS
4. Marked Set, Electronic Media Set on CD in AutoCAD R-2013 Format, of " As-Built" Electrical Drawings	GENERAL AS-BUILT DRAWINGS 260000

5.	Panelboard and Special Equipment Shop Drawings and Final Approved List of Materials Installed	MATERIALS, GENERAL 260000
6.	Certificate of Feeders Torque Results	WIRES AND CABLES 260519
7.	Wiring diagrams, Maintenance Manuals, Operation Instructions, and Brochures	GENERAL, INSTRUCTIONS & MANUALS – 260000– 1.14

* Secure delivery instructions from Architect for delivery to Owner.

1.18 SHOP DRAWING SUBMITTALS

A. This Contractor shall submit to the Architect as described in Section 016000. When shop drawings are submitted electronically, they shall be submitted as described in Paragraph B below.
   1. Manufacturer's Catalog Data.
   2. Complete Physical and Technical Data.
   3. Wiring Diagrams.
   4. Detailed Reference (written or highlighted) noting compliance with the appropriate specification section and applicable item numbers within that section.
   5. Other Descriptive Data as required by the Architect/ Engineer.

B. The Contractor shall submit to the Architect electronic shop drawings in PDF format. Electronic Shop Drawings that are submitted without following the format as outlined below will be returned for corrections without any further review.
   1. A separate PDF file shall be submitted for each Division including All submittal items for that Division as outlined below:
      a. Division 26 – Electrical
      b. Division 28 – Electronic Safety and Security
   2. The contractor shall provide either a digital or hardware method of transporting the electronic submittal to the Architect. Files larger than 10Megabytes shall not be sent via email and shall be transferred via an FTP or similar file transfer protocol, PC compatible CD or PC compatible Thumb Drive. Divisions shall not be broken up into separate files for transfer via email.
   3. Each Specification PDF shall be submitted with the following format and salient attributes:
      a. Cover page including:
         1) Project Title as indicated on the plans
         2) Project Location including Address, City, State, Country
         3) Prime Contractor name, phone number, and email address
         4) Sub-Contractor name, phone number, and email address
         5) Specification Division Number and Title
      b. Index Page outlining each specification section included in the submittal. This list shall be linked to a corresponding Specification Section Divider for each section. This link shall enable the reviewer to jump to a specification section by clicking the item in the list.
      c. Specification Section Divider: Shop Drawings shall be divided by specification section and each section shall begin with a Divider Page outlining the Specification Number, Title, and a list of Submittal Items for the section. In the upper right hand corner of the divider page, a Link shall be provided returning the reviewer to the Index Page.

d. Each Submittal Item listed on the Specification Section Divider shall be linked to the specific item being submitted. Each Submittal Item shall be hi-lighted Yellow with a Note Reference to the specific paragraph giving the submittal requirements.
e. Each page of the submittal shall be numbered in the Bottom Right corner of the page. Page numbering shall be Roman Numerals for all pages before the First Specification Section. Each Specification Section page shall be numbered with the Specification Section number, a dash, and the page number in the Specification Section.
f. Specification items shall be specifically hi-lighted as they apply to the project rather than hi-lighting an entire product family. Items that do not apply to this project shall be crossed out with a Red X.
g. The PDF file shall be not be protected to prevent printing, selecting of text within the document, or extracting of pages from the document.

C. Shop drawings shall be submitted complete, at one time and each item indexed with dividers and separated per specification section and shall be, but not limited to the items of equipment listed below:
1. All panelboards, showing breaker arrangement with circuit numbers, relays, and panel skirts.
2. Motor starters and controls designating where items are intended to be used and equipment being controlled.
3. Disconnect Switches
4. Fuses and spare fuse cabinet
5. Lighting Fixtures (Complete)
6. Low Voltage Lighting Control Systems
7. Wiring Devices
8. Back Boxes
9. Coverplates
10. Raceways and Connectors
11. Fire Wall Penetration Seals
12. Copper Wire
13. Fire Alarm System
14. Fire Station Alerting system
15. Stand-by Diesel Generator & Automatic Transfer Switch
16. **All Specialty Systems not listed above**
17. Any other items requested by Engineer.

D. Within 10 working days after the date of the letter rejecting any items of equipment, lighting fixtures, or materials as not in accordance with the specifications, Contractor shall submit a new list of items he proposes to furnish and install in place of those items rejected. If the Contractor fails to submit this new list within the above specified time, or if any items on this second list are rejected as not being in accordance with these specifications, the Engineer may select the items which the Contractor shall furnish and install without change in Contract price or time of completion.

E. The acceptance of a manufacturer's name or product by the Engineer does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the Contract Documents. The Contractor shall be solely responsible for submitting materials at such a time to allow a minimum of two weeks for Engineer's review.

F. Electrical Drawings for the project have been developed by the Engineer using AutoCAD™ Revision 2012 software. These drawing files will be made available to the Contractor for development of shop drawings and/or "As-Builts" with a signed waiver of responsibility.

1.19 SCHEDULE OF VALUES

A. Provide Schedule of Values per Division 1 and related project requirements.

B. Division 26, 27, and 28 Breakdown: Provide schedule of values for the following categories (as a minimum):
1. Electrical Mobilization
2. Electrical Submittals
3. Electrical General Project Management, General Design, General Coordination
4. Branch Circuit Materials Rough-in
5. Branch Circuit Materials Rough in – Labor
6. Branch Circuit Trim – Materials
7. Branch Circuit Trim – Labor
8. Service Materials
9. Service Materials – Labor
10. Feeder Materials
11. Feeder Materials - Labor
12. Panelgear, Disconnects, Starters
13. Panelgear, Disconnects, Starters – Labor
14. Light Fixtures
15. Light Fixtures – Labor
16. Fire Alarm System
17. Fire Station Alerting System
18. Systems Equipment – Labor
19. Commissioning
20. Electrical Punchlist, Closeout, and Owner Training

C. The dollar value for “Electrical Punchlist, Closeout, and Owner Training” shall in no case be less than 2% of the total dollar value of the Division 26, 27, and 28 work (or as indicated in Division 1, whichever is higher). The dollar value for “Commissioning” shall in no case be less than 3.0% of the total dollar value of the Division 26, 27, and 28 work (or as indicated in Division 1, whichever is higher).

D. The Contractor is advised that in addition to payments held out for retainage and project final completion (i.e. “Electrical Punchlist, Closeout, and Owner Training”), as specified above and in Division 1, the Owner reserves the right to withhold 10% of the funds for any of the above categories until the systems (of that category) have been proven to operate as specified and have been completely tested and adjusted.

PART 2 - PRODUCTS

2.1 COMPETITIVE PRODUCTS

A. Any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Engineer, expressed in writing, is equal to that specified. However, any manufacturer not listed as an accepted Bidder for a specific item must be submitted for acceptance in writing in accordance with Section 016000.

2.2 MANUFACTURER/EQUIPMENT PRIOR APPROVALS

A. Any manufacturer/equipment not listed as an approved substitute for a specified item must be submitted for acceptance in accordance with Section 016000, in writing, with detailed information to include:
   1. Manufacturer's Catalog Data
   2. Complete Physical and Technical Data
   3. Wiring Diagrams
   4. Detailed reference (written or highlighted) noting compliance with the appropriate Specification Section and all applicable Specification item numbers within that Section
   5. Complete type written index cross referencing all proposed substitutes and specified items
   6. Detailed reference to specified items (written or highlighted) noting equal quality and performance of proposed substitute equipment
   7. Other descriptive data, as required by the Engineer

B. If substitute material is determined to be acceptable by the Engineer, it will be included in a subsequent Addenda prior to bidding. The acceptance of a manufacturer's name or product by the Engineer does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the Contract Documents.

C. Only materials which are specified or published in addenda as acceptable shall be used.

2.3 MATERIALS

A. All materials must be of the quality herein specified. All materials shall be new, of the best quality and free from defects. They shall be designed to ensure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

B. Each type of material shall be of the same make and quality. The materials furnished shall be standard products of the manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.

C. All materials shall be U.L. or E.T.L. listed for the purpose for which they are used.

D. Equipment in compliance with U.L. standards but not bearing their label is not acceptable. If the manufacturer cannot arrange for labeling of an assembled unit at the factory the unit shall be field evaluated per the Washington State Administrative Code (WAC) and the electrical inspector's requirements.

2.4 COMPLETE SYSTEM

A. All the systems mentioned shall be complete and operational in every detail except where specifically noted otherwise. Mention of certain materials in these specifications shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide a complete and operable system.

2.5 NAMEPLATES

A. Provide nameplates constructed of plastic (black on white) laminated material engraved through black surface material to white sublayer (attach with screws on NEMA 1 enclosures). EXCEPTION (1): Emergency distribution system component labeling - white letters on red background. Exception (2): Series rated systems shall be yellow background with white letters.
   1. Panelboard Labels: Refer to Section 262416
   2. Switch and Receptacle Labels: Refer to Section 262726
   3. Motor Starter and Disconnect Labels: Refer to Section 262816
   4. Special Equipment/Outlet Labels: Refer to Appropriate Sections.

B. Provide a 'yellow' label with black lettering on the ceiling grid to identify any electrical control power supply above the ceiling. (i.e. lighting control power/equipment – abbreviate 'LC')

PART 3 - EXECUTION

3.1 GENERAL

A. Careful consideration shall be given to clearances under and over beams, pipes and ducts, to provide proper headroom in all cases. Check drawings to determine heights of all suspended ceilings and size of pipe shafts where raceway and wire-ways shall run. Coordinate installation of Division 26, 27, and 28 wiring and equipment with Division 23 and other trades. Where insufficient room for proper installation appears, obtain clarification from Engineer before any installation is begun.

B. Cutting and Patching:
   1. Obtain permission from the Architect and/or Owner's Representative prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills except where space limitations prevent the use of such drills.
   2. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.2 COORDINATION

A. The Contractor is responsible for accomplishing Division 26, 27, and 28. The work shall coordinate with that of the other Contractors and/or other trades doing work in the building and shall examine all Drawings, including the several Divisions of Mechanical, Structural, Civil and Architectural, for Construction Details and necessary coordination. Specific locations of construction features and equipment shall be obtained from the Contract Documents, field measurements, and/or from the trade providing the material or equipment. No extra costs will be allowed for failure to obtain this information.

B. All conflicts shall be reported to the Engineer in writing before installation for decision and correction. Special attention is called to the following items:
   1. Door swings to the end that switches will be located on "Strike" side of the door.
   2. Location of grilles, pipes, sprinkler heads, ducts and other mechanical equipment so that all electrical outlets, lighting fixtures and other electrical outlets and equipment are clear from and in proper relation to these items.
   3. Location of cabinets, counters, and doors so that electrical outlets, lighting fixtures and equipment are clear from and in proper relation to these items.

4. Type and height of ceiling.
5. All device measurements referenced on drawings or specifications are to be centered of device unless noted otherwise.

C. The Contractor will not be paid for work requiring reinstallation due to lack of coordination or interference with other Contractors or trades. This includes, but is not limited to, removing, replacing, relocating, cutting, patching, and finishing.

D. The Contractor shall review the installation manual for each device to be installed. If a conflict appears to occur between the manufacturer's recommended installation practices and the plans or specifications, notify the Engineer immediately. Final determination shall be by the Engineer. The Contractor will not be paid for reinstallation due to failure to comply with manufacturer instructions or design documents.

E. Device and fixture locations may be changed within 15 feet without extra charge if so desired by the Engineer, before installation.

3.3 REQUESTS FOR INFORMATION (RFI)

A. It is our intent to provide a timely response for RFIs regarding Division 26, 27, and 28 Work. To further expedite this process, where a suggestion can be determined or derived at by the initiator of the RFI, it is required this suggestion be supplied with the submitted RFI. If no suggestion is given where one is possible, the RFI will be returned as incomplete.

3.4 CLEANING AND PAINTING

A. All equipment, whether exposed to the weather or stored indoors shall be covered to protect it from water, dust and dirt.

B. After installing, all metal finishes shall be cleaned and polished, cleaned of all dirt, rust, cement, plaster, grease and paint.

C. All equipment with a primer coat of paint shall be given two (2) or more coats of a finish enamel and scratched surfaces be refinished to look like new. Markings, identification and nameplates shall be replaced.

3.5 EQUIPMENT IDENTIFICATION

A. Provide identifying legible black permanent writing on all equipment, including pull boxes, to clearly indicate its use, area served, circuit identification, voltage, and any other useful data.

B. Each auxiliary system, including communications, shall be clearly labeled to indicate its function.

3.6 DEVIATION

A. Deviation from the shop drawings in construction or installation of equipment shall not be made unless Shop Drawings showing proposed deviations are submitted to and approved by the Engineer. If any equipment is furnished under this or other divisions with current, voltage or phase ratings that differ from those shown on the drawings, the Contractor shall notify the Engineer in writing immediately and shall not connect said equipment until instructed as to required changes by the Architect. No extension of time will be granted as a result of such changes.

3.7 EXCAVATIONS

A. All excavations are to be so conducted so that no walls or footings shall be disturbed in any way.

B. Remove all surplus earth not needed for backfilling and dispose of same as directed.

3.8 WIRING METHODS

A. All low voltage wiring shall be in Raceway with Junction Boxes and Fittings where concealed in walls, in inaccessible ceiling space, or where exposed in finished or unfinished areas.

B. All branch circuit wiring shall be installed in raceway with junction boxes and fittings.

C. Provide access panels as needed for pull boxes and equipment located above ceiling or behind walls.

D. Multiple feeder runs shall be rod hung, using a strut type channel with individual one hole clamps, back plates and machine screws.

E. Any low voltage cables that are not terminated at both ends shall be tagged and labeled per code.

3.9 PENETRATIONS OF FIRE RATED ELEMENTS

A. Must be made such as to retain that rating.

3.10 HANGERS AND SUPPORTS

A. Provide hangers, brackets, and suspension rods and supplementary steel to support equipment.

B. Hangers provided under other divisions shall not be used for support of Division 26, 27, and 28 equipment unless permitted by Architect/Engineer.

3.11 PAINTING

A. Painting in general will be covered under another division of this specification, except items furnished under Division 26, 27, and 28 that are scratched, marred in shipment or installation, shall be refinished by the Division 26, 27, and 28 Contractor.

3.12 WORKMANSHIP AND OBSERVATION

A. Workmanship shall be of the best quality and none but competent workers shall be employed under the supervision of a competent foreman. All completed work shall represent a neat and workmanship like appearance.

B. All work and materials shall be subject to observation at any and all times by representatives of the Engineer.

3.13 MISCELLANEOUS

A. Provide complete seismic anchorage and bracing for the lateral and vertical support of conduit and electrical equipment, as required by the International Building Code.

B. Conduits that cross seismic separations shall be installed with flexible connection suitable to accommodate conditions. Secure raceways on each side of a separation and provide a minimum of 36” length of flexible conduit to span separation.

3.14 CABLE AND WIRING ROUTED UNDERGROUND OR UNDERSLAB

A. All cables and conductors, both line voltage and low voltage, routed underground or under-slab shall be U.L. listed for installation in wet locations per NEC and WAC codes.

END OF SECTION 260000

SECTION 260005 - ELECTRICAL – EXISTING SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Portions of the existing electrical lighting, power and signal systems are to be removed as detailed on the drawings.

1.2 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

PART 2 - PRODUCTS

2.1 EXISTING MATERIALS

A. Existing materials which are a part of the building shall remain the property of the Owner.

2.2 EXISTING MATERIALS RE-INSTALLED

A. Existing materials and equipment that are removed as a part of the work or stored in surplus may be re-installed as a part of the new system subject to approval of condition suitability by the Architect/Engineer. The requirements of the specifications (i.e. installation, warranty, testing, etc.) shall apply as if the materials were new, supplied by the Contractor.

2.3 EXISTING MATERIALS NOT TO BE RE-INSTALLED

A. In coordination with the Architect/Engineer, these materials shall be made available for his inspection and decision as to whether the Owner will retain possession. Items selected for retention shall be delivered to a location on the premises selected by the Owner and turned over to him. Take reasonable care to avoid damage to this material. If the Contractor fails to conform to this requirement, he shall purchase and turn over to the Owner replacement materials of like kind and quality.

B. All material not selected for retention by the Owner and debris shall be disposed of by the Contractor. This shall include, but not be limited to, removal of PCB type ballasts and fluorescent lamps which shall be disposed of in accordance with EPA requirements.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Examine the structure, building, and conditions under which Division 26 work is to be installed for conditions detrimental to proper and timely completion of the work. Do not proceed with work until deficiencies encountered in installation have been corrected. Report any delay or difficulties encountered in installation of Division 26 work which might be unsuitable to connect with work by other divisions of this specification. Failure to report conditions shall constitute acceptance of other work as being fit and proper for the installation of Division 26 work.

B. Maintain continuity of existing circuits of equipment to remain. Existing circuits of equipment shall remain energized. Circuits which are to remain but were disturbed during demolition shall have circuits, wiring, and power restored back to original condition.

3.2 DEMOLITION

A. Switchboards, panelboards, signaling systems, other electrical equipment free standing (or surface mounted), raceway (exposed) and conductors no longer in service as a result of this Contract shall be removed. Unused raceways or sleeves shall be cut flush at ceiling, floor or wall and filled with grout.

3.3 NEW DEVICES IN REMODEL AREAS

A. Provide surface mounting for devices on existing walls. Where existing boxes are indicated to be reused, extend box as necessary and provide new devices and plates.

3.4 EXISTING PANELBOARD

A. Any modifications made to existing panels must be incorporated into the existing circuit index on the panel. If more than three circuits are modified a new typewritten index incorporating the changes to the existing index shall be installed in the existing panel.

B. Listing shall match circuit breaker arrangements, typically with odd numbers on the left and even numbers on the right. Room numbers used shall be final room numbers used in the building as verified with the Owner.

END OF SECTION 260005

SECTION 260010 - EXCAVATION AND BACKFILL FOR ELECTRICAL UNDERGROUND UTILITIES

PART 1 - GENERAL

1.1 GENERAL INCLUDES

A. Excavation and Associated Grading.

B. Trenching and Trench Protection.

C. Backfilling and Compaction.

D. Verification of Existing Utilities.

E. Protection of Utilities.

1.2 RELATED SECTIONS

A. Section 260000 – General Electrical Conditions

B. Section 260533 - Raceways

C. Section 265000 - Lighting

D. Section 283100 – Fire Alarm System

1.3 QUALITY ASSURANCE

A. Inspection of Job Conditions: Prior to starting work and during work, the installer shall examine the work by others, site and job conditions under which excavation, trenching, and backfilling for underground utilities work will be performed, and notify the General Contractor in writing of unsatisfactory conditions or work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Codes and Standards: Comply with requirements of the following codes and standards (Latest Edition) except as modified herein:

1. International Conference of Building Officials, "International Building Code".

2. Local requirements for all utility work.

3. OSHA and WISHA regulations.

4. APWA Standard Specifications.

5. National Electrical Code – NFPA 70.

1.4 RESPONSIBILITY

A. The Contractor is solely responsible for compliance with the requirements of the drawings, specifications, local codes and standards, proper construction coordination with work of other trades, and protection and worker's safety. Contractor shall advise Engineer of any discrepancy in, or disagreement with the specifications and/or drawings prior to starting work and not proceed until issue is resolved. Commencement of work shall indicate Contractor's acknowledgement of his expertise in this type of work. Any delay resulting from failure to comply with this procedure will not be basis for an extension of the completion date.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced.

B. American Society of Testing and materials (ASTM) publications:

D 422-63	Particle Size Analysis of Soils.
D 423-66	Liquid Limit of Soils.
D 424-59	Plastic Limit and Plasticity Index of Soils.
D 1557-78	Moisture Density Relations of Soils using a 10 lb. (4.54kg) Rammer and 18 inch (457 mm) Drop.
D 2167-66	Density of Soil In-Place by the Rubber Balloon Method.
D 2217-66	Wet preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Contents.
D 2487-69	Classification of Soils for Engineering Purposes.
D 2922-81	Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).
E 548-79	Generic Criteria for Use in the Evaluation of Testing and Inspection Agencies.

PART 2 - MATERIALS

2.1 SATISFACTORY MATERIALS

A. Materials classified as ASTM D2487, Unified Soil Classification System as SW, SP, GW, and GP are satisfactory for backfill use. Materials classified as SP-SM, GP-GM, GM, GC and ML are also satisfactory for backfill use provided that they contain moisture contents suitable for the intended use and are reasonably free of organic matter. Native material, not considered unsatisfactory as specified below, may comply. Except that no material shall have any object with a dimension exceeding 2 inches and no object shall be sharply angular.

2.2 UNSATISFACTORY MATERIALS

A. Materials classified in ASTM D2487, Unified Soil Classification System as PT, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse and all materials containing excessive organic matter or having moisture contents which are not suitable for the intended use, or having objects with dimensions exceeding 2 inches (boulders, etc.).

2.3 UNSTABLE MATERIAL

A. Unstable material shall consist of material too wet to properly support the utility conduit or appurtenance structure, and material identified as unsuitable in the National Electrical Code 300-5(F).

2.4 GRAVELLY SAND BORROW MATERIAL

A. Gravelly sand borrow material to provide backfill, or replace unsuitable soil, shall meet the requirements of SW, SP, GW, and GP materials, except that the maximum percentage passing the No. 200 sieve shall not exceed 5% based on the soil fraction passing the U.S. No. 4 sieve, and not contain discrete particles greater than 2 inches in diameter.

2.5 DEGREE OF COMPACTION

A. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557, Method D. Minimum compaction requirements shall be as specified in PART 3.

2.6 DRAINAGE GRAVEL

A. Shall be 3/4 inch washed gravel with no more than 2% passing 1/2 inch sieve opening.

2.7 SPECIAL BEDDING AND INITIAL BACKFILL MATERIAL

A. Minus 3/8 inch washed pea gravel.

PART 3 - EXECUTION

3.1 EXCAVATION

A. If workers enter any trench or other excavation four or more feet in depth that does not meet the open pit requirements of WSDOT Section 2.09.3(3)B, it shall be shored and cribbed. The Contractor alone shall be responsible for worker safety. All trench safety systems shall meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW.

B. Excavation of every description and of whatever substances encountered shall be performed to allow the installation of all utilities at the lines and grades as required. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material.

C. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the Owner.

D. Excavated material not required or not satisfactory for backfill shall be removed from the site and shall be disposed of off site, at the Contractor's expense, at the Contractor's waste area. Any excess satisfactory excavated materials shall not be mixed with unsatisfactory materials. Unsatisfactory materials shall not cover available suitable materials, or be disposed of in such a manner as to interfere with subsequent borrow operations.

E. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Unauthorized over-excavation shall be backfilled in accordance with paragraph 3.05 BACKFILLIING at no additional cost to the Owner.

F. The Contractor shall provide dewatering as required for installation of underground work.

3.2 TRENCH EXCAVATION

A. The trench excavation shall meet the requirements of the National Electrical Code and local utility standards.

B. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the conduit and for bedding. Stones of 2 inches or greater in any dimension, or as recommended by the conduit manufacturer, whichever is smaller, shall be removed to avoid point bearing.

C. Removal of Unsuitable Material: Where unsuitable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph 3.05 BACKFILLING. When removal of unsuitable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

D. Bedding: The bedding surface for the conduit shall provide a firm foundation of uniform density throughout the entire length of the conduit. The conduit shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular conduit or to the lower curved portion of conduit arch for the entire length of pipe or arch. When necessary, the bedding shall be taped. Provide bedding using pea gravel where noted on the drawings.

3.3 EXCAVATION FOR APPURTENANCES

A. Excavation for manholes, handholes or similar structures below grade shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.4 JACKING, BORING, AND TUNNELING

A. Unless otherwise indicated, excavation shall be by open cut, except that sections of a trench may be jacked, bored, or tunneled if the raceway, cable or duct can be safely and properly installed and backfill can be properly tamped in such sections.

3.5 BACKFILLING

A. Backfill material shall be compacted to 6" layers and as specified in Paragraph 3.06-Compaction.

B. Trench Backfill: Trenches shall be backfilled to finish grade.

C. Replacement of Unstable Material: Unstable material removed from the bottom of the trench of excavation shall be replaced with select granular material or gravel borrow placed in layers not exceeding 6 inches loose thickness.

D. Bedding and Initial Backfill: Bedding shall consist of satisfactory materials. Initial backfill shall be in 6 inch lift.

3.6 COMPACTION

A. Each layer of fill, or the excavated subgrade, shall be compacted to at least 95%, per ASTM D1557, of laboratory maximum density. Compaction shall be accomplished by approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers, or other approved compaction equipment.

3.7 PROTECTION

A. Newly graded excavated or bedded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes.

END OF SECTION 260010

SECTION 260519 - WIRES AND CABLES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all wire, cable, and terminations complete.

1.2 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

PART 2 - PRODUCTS

2.1 WIRE AND CABLE (COPPER, 600-VOLT)

A. Interior and Above Grade: All wires to be Type THW or RHW. Type THWN/THHN or XHHW wire may be utilized at Contractors option, subject to code requirements. Wire and cables shall be brought to project in original containers bearing the underwriters label. Provide Type AVA wire where conductors are subject to temperature above 167 Degrees F.

B. Underground: All conductors to be type USE. Increase Raceway size when necessary to accommodate conductors per code. Exception: Underground conductors completely contained in code recognized Raceway and boxes may be Type THW, THWN or XHHW.

2.2 SPLICES

A. Above Grade: Solderless type only. Preinsulated "twist-on" type (limited to size #10 and smaller). Bolt on compression type with application of preformed insulated cover, heat shrinkable tubing or plastic insulated tape acceptable for all sizes.

B. Below Grade: Splices below grade shall be in handholes and shall be made watertight with epoxy resin type splicing kits similar to Scotchcast.

2.3 TERMINATIONS

A. Compression set, bolted or screw terminal.

B. Conductors #12 and smaller shall utilize eye or forked tongue type compression set terminator when termination is to a bolted or screw set type terminal block or terminal cabinet.

2.4 PLASTIC CABLE TIES

A. Nylon or Equivalent, locking type.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all wiring in Raceway unless shown or specifically authorized otherwise.

3.2 WIRE SIZE

A. No. 12 AWG minimum for power and lighting circuits.

B. Provide solid wire for No. 14 AWG and smaller, and stranded conductors for No. 12 AWG and larger (600) volts.

3.3 TESTS

A. In addition to the factory testing of all equipment and cable, the Contractor shall test all wiring connections for continuity and ground before any fixtures or other loads are connected. Tests shall be made with a 500V minimum DC "Megger" type tester. If tests indicate faulty insulation (less that 2 megohms), such defects shall be corrected and tested again. Contractor shall provide all apparatus to make tests and shall bear all expenses of required testing. Routine operation tests shall be made on all pieces of equipment to demonstrate that working parts are in operating condition. Results of all tests shall be recorded and submitted to the Architect. The Contractor shall immediately replace all parts, which fail to pass the test.

B. All circuits both in and out of the building shall test out free of grounds, short circuits and other defects.

C. Check and record catalog number and ampere size of controller overload heaters installed, nameplate full-load amperes, and actual operating amperes of each motor. IMPORTANT: Submit recorded data in triplicate to the Engineer. Check proper load balance on the electrical system, direction of rotation, lubrication, and overload protection of all motors before placing in operation.

D. The final test of all equipment shall be made on dates designated by the Architect/Engineer and all readings shall be made in his presence.

E. Feeders shall be checked to ensure all phases are energized before connecting to their respective motors. Each motor shall rotate in the proper direction for its respective load. Prior to rotation test, all bearings shall be inspected for proper lubrication.

F. Minimum megger test for equipment shall be as follows:

Equipment Maximum Voltage Rating	Minimum Test Resistance
1,000-Volts or less	2 Megohms

G. Provide certification of torque values for feeder and service entrance conductors per equipment manufacturer's recommendation.

3.4 CONDUCTOR SIZES, REFERENCED ON PLANS

A. Copper, type THW or RHW unless noted.

3.5 PULLING

A. Use no mechanical means for pulling No. 8 AWG conductors and smaller. Powdered soap stone or approved spray cream shall be the only lubricant used.

3.6 STRIPPING INSULATION

A. Do not ring the cable, always pare or pencil.

3.7 TAPING

A. If used shall be half lapped synthetic tape.

3.8 CONDUCTORS IN PANELS AND SWITCHBOARDS

A. Conductors in panels, switchboards, and terminal cabinets shall be neatly grouped and formed in a manner to "Fan" into terminals with regular spacing.

3.9 CABLE SUPPORTS

A. Provide conductor support devices as required by code in vertical cable runs.

3.10 RACEWAY SIZES REFERENCED ON DRAWINGS

A. Raceways are sized for copper, type THW, unless otherwise noted. Size all Raceways per code unless specifically noted to be larger on the drawings.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. A grounding system shall be provided for neutral ground and equipment ground as required by code.

1.2 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. Copper, code size, with physical protection where subject to damage. Bare or green insulated.

2.2 GROUND RODS

A. 3/4" x 8'-0" copper clad steel.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide all grounding for electrical systems and equipment as required by codes and as specified herein.

3.2 GROUND RODS

A. Provide as shown and/or required. Connect the ground conductor to each rod.

3.3 SIZE OF GROUND WIRE

A. As required by code. Where ground wire is exposed to physical damage or is used outside of building, protect with conduit.

3.4 GROUND CONNECTION OF WATER PIPING

A. Metal internal piping shall be grounded, as part of this Contract. This includes jumpers for dielectric fittings.

3.5 GROUND CONNECTION OF BUILDING STEEL

A. Structural metal shall be grounded, as part of this Contract.

3.6 CONNECTION TO THE GROUND BUS

A. Provide connections in accordance with the codes; including but not limited to raceway systems, switchboard/panelboard frames, service neutral, separately derived systems, electrically operated equipment and devices. No device or equipment shall be connected for electrical service which has a neutral conductor connected to a grounding conductor or to the frame within the device or equipment.

3.7 METHOD OF CONNECTION

A. Make all ground connections and ground cable splices by thermal welding. Grounding lugs, where provided as standard Manufacturer's items on equipment furnished, may be used.

3.8 FLEXIBLE RACEWAY

A. Shall not be used for grounding. Install separate ground conductor in all flexible raceway.

3.9 PVC RACEWAY

A. Install separate ground conductor in all PVC raceway as required per code.

3.10 DROP CORDS

A. Shall have a grounding wire and be connected with a grounding type plug and receptacle.

END OF SECTION 260526

SECTION 260532 - OUTLET AND PULL BOXES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide outlet and pull boxes to enclose devices, permit the pulling of conductors and for wire splices and branches.

1.2 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

PART 2 - PRODUCTS

2.1 INTERIOR WIRING

A. General: Outlet and pull boxes shall be pressed drawn steel, zinc coated with plaster ring where applicable. Welded boxes not allowed. Four-inch size minimum. Large pull boxes shall be fabricated sheet steel, zinc coated or baked enamel finish, with return flange and screw retained cover.

B. Surface Metal Raceway: Boxes of same Manufacture and to match Raceway. Boxes to accommodate standard devices and device plate.

C. Concrete and Masonry: Boxes for casting in concrete or mounting in masonry walls shall be the type specifically designed for that purpose.

D. Install pull boxes so as to be accessible after completion of building construction.

E. Ceiling outlet boxes shall be galvanized octagonal 4 inch, 1-1/2 inch deep (without fixture stud), 2-1/8 inches deep (with fixture stud).

2.2 EXTERIOR WIRING

A. Above Grade: Outlet and junction boxes shall be cast or malleable iron or shall be cast of corrosion resistant alloy compatible with Raceway to which it is connected. Pull boxes shall be fabricated of heavy gauge steel and hot dipped galvanized. All boxes shall have gasketed covers.

B. Below Grade: Where exposed to earth, boxes (handholes) shall be constructed of precast concrete with size, configuration, cover, grates and reinforcing as required by the particular installation. Manufacturer: Similar to Utility Vault 3030LA with base or Fogtite J11 Type 2 with base. Lid shall be H-20 rated where installed in traffic areas. Where not exposed to earth shall comply with Paragraph 2.02A above.

C. Exterior outlet boxes shall be weather resistant and rain tight, with appropriate covers, gaskets and screws.

PART 3 - EXECUTION

3.1 ANCHORING

A. All boxes shall be firmly anchored directly or with concealed bracing to building studs or joints. Boxes must be so attached so that they will not "Rock" or "Shift" when devices are operated.

3.2 FLUSH MOUNTING

A. Except for surface mounted boxes or boxes above accessible ceilings, all boxes shall have front edge (box or plaster ring) even with the finished surface of the wall or ceiling.

3.3 ELECTRICAL OUTLETS

A. General: Coordinate the work of this section with the work of other sections and trades. Study all Drawings that form a part of this Contract and confer with various trades involved to eliminate conflicts between the work of this section and the work of other trades. Check and verify outlet locations indicated on Architectural Drawings, door swings, installation details, layouts of suspended ceilings and locations of all plumbing, heating and ventilating equipment.

B. Centered on Built-In Work: In the case of doors, cabinets, recessed or similar features, or where outlets are centered between such features, such as between a door jamb and a cabinet, make these outlet locations exact. Relocate any outlets which are located off center.

C. Vertical and Horizontal Relationships: Where more than one outlet is shown or specified to be at the same elevation or one above the other, align them exactly on centerlines horizontally or vertically. Relocate as directed all such outlets (including lighting, receptacle, power signal and thermostat outlets) which are not so installed, at no additional cost to Owner.

D. Device Outlet Height: Measure from the finished floor.

*Switches	4 Feet, Set Vertically, to Top of Box
*Receptacles, Telecommunications	18 Inches, Set Vertically to Centerline
Other	As Noted or as Directed by Architect

**Heights may vary. See Drawings for additional information*

E. Ceiling Location: For acoustical material locate outlet either at the corner joint or in the center of a panel, whichever is closer to the normal spacing. Locate all outlets in the same room in the same panel location.

F. Installed In Sound Walls: Boxes installed in sound walls shall not be installed back to back. All boxes shall be separated by one stud space and shall be interconnected with flex conduit with a 90° loop. Where stud space separation is not possible, utilize sound attenuating mastic around each box. 3M Fire Barrier Moldable Putty Pads MPP+ (2.54 mm minimum) or similar.

3.4 ELECTRICAL WORK IN COUNTERBACKS, MILLWORK AND CASEWORK

A. Provide as shown and/or specified. Provide templates, where required, to other trades for drilling and cutting to insure accurate location of electrical fixtures (outlets and devices) as verified with the Architect. Provide all wiring, devices, plates and connections required by said fixture.

3.5 CONNECTION TO EQUIPMENT

A. For equipment furnished under this or other Divisions of the Specifications, or by others. Provide outlet boxes of sizes and at locations necessary to serve such equipment. An outlet box is required if the equipment has pigtail wires for external connection, does not have space to accommodate circuit wiring used. Study equipment details to assure proper coordination.

3.6 BLANK COVERS

A. Provide blank covers or plates over all boxes not covered by equipment.

3.7 JUNCTION OR PULL BOXES

A. Pull and junction boxes shall be installed as shown, and to facilitate pulling of wire and to limit the number of bends within code requirements. Boxes shall be permanently accessible and shall be placed only at locations approved by the Architect.

B. In suspended ceiling spaces, boxes shall be supported from the structure independently from ceiling suspension system.

C. The Drawings do not necessarily show every pull or Junction Box required. The Contractor is permitted to provide boxes deemed necessary by him for his work when installed in accordance with these Specifications.

3.8 BOXES CONTAINING MULTIPLE DEVICES

A. Boxes containing emergency and normal devices are permitted only with steel barriers Manufactured especially for the purpose of dividing the box into two completely separate compartments.

B. Device Boxes Containing Multiple Devices and Wiring Rated Over 150 Volts to Ground and Over 300 Volts Between Conductors are permitted only with steel barrier manufactured especially for the purpose of dividing the box into separate compartments for each device having exposed live parts.

3.9 BOXES IN EARTH

A. Provide for all wire splices and as required to pull conductors. Boxes (handholes) shall be set in place on a 3" sand bed. Coverplates shall be flush to, and match the slope of, the final surface grade.

3.10 NAMEPLATES

A. For all line voltage junction boxes, provide legible permanent black lettering indicating circuit numbering of all wiring in junction box.

END OF SECTION 260532

SECTION 260533 - RACEWAY

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide Raceway System complete.

1.2 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

PART 2 - PRODUCTS

2.1 GALVANIZED RIGID STEEL CONDUIT (GRS)

A. General: Hot dipped galvanized.

B. Fittings: Galvanized malleable iron or noncorrosive alloy compatible with galvanized conduit. Erickson couplings, watertight split couplings (O.Z. type or equivalent) permitted. Running thread or set screw type fittings not approved.

2.2 INTERMEDIATE METAL CONDUIT (IMC)

A. General: Hot Dipped galvanized.

B. Fittings: Galvanized malleable iron or noncorrosive alloy compatible with galvanized conduit. Erickson couplings, watertight split couplings (O.Z. type or equivalent) permitted. Running thread or set screw type fittings not approved.

2.3 ELECTRICAL METALLIC TUBING (EMT)

A. General: Hot dipped galvanized.

B. Fittings: Raintight; steel or malleable iron type using a split corrugated compression ring and tightening nut or stainless steel locking disc. Steel set screw fittings are acceptable for dry locations. Indenter, drive-on and pressure cast or die cast type set screw are not acceptable.

2.4 FLEXIBLE METAL CONDUIT (FMC, LFMC)

A. Dry Locations:
   1. General: Galvanized flexible steel for dry locations only.
   2. Fittings: Malleable iron or steel, Thomas and Betts "squeeze" type or equal.

B. Damp and Wet Locations:
   1. Liquid Tight: Polyvinyl chloride (PVC) weatherproof cover over flexible steel conduit.
   2. Fittings: Thomas and Betts "liquid tight" or equal.

2.5 SURFACE METAL RACEWAY

A. Formed steel or aluminum type. Standard factory finish. Where color choice is available, consult Architect/Engineer for selection prior to ordering.

2.6 RIGID NON-METALLIC CONDUIT (PVC)

A. Schedule 40 rigid polyvinyl chloride type unless otherwise noted.

2.7 RIGID ALUMINUM CONDUIT

A. Permitted only in specified locations.

B. Fittings copper free cast aluminum.

PART 3 - EXECUTION

3.1 GENERAL

A. Install Raceway concealed in construction unless noted otherwise on the Drawings or specifically approved in writing by the Architect/Engineer.

B. Cut Raceway ends square, ream and extend maximum distance into all couplings and connectors.

C. Provide and install manufactured end caps on all Raceway ends during construction to prevent the entrance of water or dirt. Tape, as a cover, not permitted.

D. Swab out all Raceways before pulling wires.

E. All elbows for GRS and PVC Raceway shall be factory radius bends. For all other Raceway, use factory radius bends of 1-1/4" and larger diameter.

F. Raceway shall not penetrate sheet metal ducts unless permission is granted by Architect/Engineer. All sleeves shall be provided for Raceway installation.

G. Provide 2 - 3/4" C.O. stub into accessible ceiling space from all recessed panelboards or systems terminal boxes.

3.2 GALVANIZED RIGID STEEL CONDUIT

A. All Connections shall be watertight. Install for all Raceways in concrete or where subject to damage.

3.3 INTERMEDIATE METAL CONDUIT

A. Intermediate metal conduit is permitted as a substitute for galvanized rigid steel conduit except where GRS is required by code.

3.4 ELECTRICAL METALLIC TUBING

A. Install for wiring in masonry, frame construction, furred ceilings and above suspended ceilings. May be used for exposed work in unfinished areas where not subject to damage. Where construction involves masonry work, surface cut masonry units wherever such masonry units are to remain unplastered or uncovered in complete construction.

3.5 RIGID ALUMINUM CONDUIT

A. May be used in lieu of galvanized rigid steel conduit where Raceway is run above grade or inside of buildings; rigid aluminum conduit not permitted where Raceways are encased in or attached to concrete or are below grade.

3.6 RACEWAYS UNDERGROUND

A. Galvanized rigid steel conduit - painted with two coats of bitumastic paint - or galvanized rigid steel conduit with 15 mil. polyvinyl chloride (PVC) jacket (repair abrasions with PVC base paint or PVC)

B. PVC Raceways may be used for underground runs when permitted by code. Field bends, when necessary, shall be formed only with factory recommended heater. Penetrations through floor and walls shall be galvanized rigid steel conduit. PVC, if used, shall be increased in size from that shown to include code required ground wire. Bends in excess of 10 degrees shall be GRS.

C. Arrange and slope Raceways entering building to drain away from building.

D. Ground wires shall be provided in all PVC Raceway.

3.7 INSERTS, SHIELDS AND SLEEVES

A. Furnish and set in place, in advance of pouring slabs and walls, all inserts and sleeves needed to execute Division 26 equipment installation.

B. Where supports in slabs are required after wall has been poured, use a drilled-in threaded insert, installed as recommended by Manufacturer.

C. Sleeves shall be provided for all wall penetrations.

3.8 RACEWAYS THAT STUB UP THROUGH FLOOR

A. Install at such depth that the exposed Raceway is vertical and no curved section of the elbow is visible.

B. PVC Raceway shall not be stubbed through floors.

3.9 SEALING OF RACEWAY PENETRATIONS

A. Exterior Wall Surfaces Above Grade: Seal around all penetrations with caulking approved by Engineer. For concrete construction above ground level, cast Raceway in wall or core drill wall and hard pack with a mixture of equal parts of sand and cement.

B. Exterior Surfaces Below Grade: Cast Raceway into wall (or floor) or use manufactured seal assembly (such as O.Z. type "FSK") cast in place.

C. Roofs: Provide mopped, lead, roof jack where Raceway penetrates roof membrane.

D. Fire Rated Floors, Walls, Ceiling/Roofs: Concrete or masonry, seal around Raceway penetration with Dow Corning 3-6548 silicone RTV foam or approved equal. Plaster or gypsum wallboard, seal around Raceway penetration with plaster, fire tape per local Fire Marshal's requirements.

3.10 SEALING OF RACEWAYS

A. Seal interior of all Raceways which pass through buildings roofs, floors or through outside walls of the building, above or below grade. Seal on the end inside the building using duct sealing mastic, non-hardening compound type, specially designed for such service to maintain the integrity of the seal of the wall, floor or roof. Pack around the wires in the Raceways.

3.11 HANGARS FOR RACEWAYS

A. In suspended ceiling spaces Contractor may, at his option, attach 1/2" or 3/4" EMT Raceways to the ceiling suspension system where such system is structurally suitable on independent wire secured at both ends; in which case, provide clips manufactured for the purpose.

B. When more than two Raceways will use the same routing, group together on a patented channel support system (such as Unistrut).

3.12 SURFACE METAL RACEWAY

A. Install parallel to building surface (i.e., wall, ceiling, floor). Fasten to surface as recommended by Manufacturer. Mount so Raceway is in the least obvious location. Shall be used in lieu of conduit in finished areas.

3.13 FLEXIBLE CONDUIT

A. Flexible conduit shall be used only for connection to motors and equipment subject to vibration with 90 degrees loop minimum to allow for isolation and for lay-in fluorescent fixtures above T-Bar ceilings. For fixture installations, one end of flex must terminate in rough-in junction box. Flex conduit shall not be installed over 6' long or used to connect from fixture to fixture. Use liquid tight for pumps, equipment which is regularly washed down, and equipment in damp locations. Provide ground wire.

3.14 PULL CORDS

A. Nylon type shall be included in all installed empty Raceway.

END OF SECTION 260533

SECTION 260534 - METAL CLAD CABLE (TYPE MC) AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide Metal Clad (Type MC) Cable for power, control and lighting systems.

B. Provide wiring connections and terminations.

1.2 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

1.3 REGULATORY REQUIREMENTS

A. UL 1569. Products shall be tested, approved and labeled/listed by Underwriters Laboratories, Inc.

1.4 USES PERMITTED

A. MC Cable is permitted to be used for 20amp lighting and power circuits where routing is above grade, concealed and the installation meets the requirements of NEC 330.

B. MC Cable shall NOT be used for homerun circuits from the fixture, receptacle, or equipment to the panelboard. Hard conduit must be used from the panelboard to the nearest accessible ceiling space to the panelboard.

C. MC Cable shall not be used for HVAC equipment.

PART 2 - PRODUCTS

2.1 CABLE ASSEMBLY

A. Metal clad cable assemblies shall consist of 2, 3 or 4 current carrying conductors and an equipment ground conductor.

B. Conductors: Stranded Copper conductor, No. 12 AWG minimum or No. 10 AWG maximum. Installation methods shall be as specified under Part 3 - Execution.

C. Insulation: Conductor insulation shall be rated 600 volt, Type THHN, 90°C dry.

D. Fillers: Fillers shall be non-hygroscopic and non-wicking.

E. Binder: Core binder shall be corrugated polyester.

F. Sheath: The metal sheath shall be galvanized steel or aluminum. The metal sheath shall be extruded onto the cable or applied longitudinally, then wrapped and welded. The sheath shall then be corrugated for greater flexibility. The sheath shall be color coded for the voltage and phases served.

G. Jacketing: When PVC jacketing is required, the jacket shall be flame-retardant PVC with a temperature range of -40°C to 90°C.

H. Equipment Grounding Conductor: The equipment ground wire shall be of the same construction as specified in 2.02.A and 2.02.B and be at a minimum the same size as the current carrying conductors. The insulation color shall be green.

2.2 FITTINGS

A. Fittings shall be UL listed and identified for such use with metal clad continuous corrugated sheath cable, with or without PVC jacketing, as is appropriate for the installation.

B. Connectors shall be of steel or malleable iron and shall be a squeeze type clamp connector with a locknut for non-jacketed metal clad cable. Compression gland type connectors shall be used for jacketed metal clad cable.

PART 3 - EXECUTION

3.1 INSTALLATION – POWER AND LIGHTING SYSTEMS WIRING

A. All wiring shall be installed in compliance with the latest version of the National Electrical Code and all other applicable codes and standards as indicated elsewhere in these specifications.

B. Use of metal clad cable shall be permitted only for lighting, equipment and receptacle branch circuits. Metal clad cable shall not be permitted in locations designated to be hazardous Class I, II or III.

C. Metal clad cable shall be permitted only for motor circuits where the motor being served is less than ½ HP and rated for 120V, single phase. Metal clad cable is not permitted for HVAC equipment and controls.

D. Metal clad cable shall only be installed concealed within walls and above ceiling interstitial spaces. Where there is no ceiling interstitial space, metal clad cable may not be used.

E. Bends in corrugated sheath metal clad cable shall be made so that the cable will not be damaged. The radius of the curve of the inner edge of any bend shall not be less than seven (7) times the diameter of the metallic sheath.

F. Metal clad cable is not permitted to connect branch circuits to fumehoods, gas storage cabinets, or chemical storage cabinets.

G. No metal clad cable shall be installed in ventilation ducts or plenums.

H. Conductors in Enclosures: Provide neat and workmanlike installation with conductors tied with T&B Ty-Rap, Virginia Plastics, or equal, nylon wire ties in terminal cabinets, gutters and similar locations.

3.2 FITTINGS

A. Fittings used for connecting metal clad cable to boxes, light fixtures or other equipment shall be UL listed and identified for such use.

B. Cable preparation for installation of fittings shall follow manufacturer's instructions. The manufacturer's specialized tools shall be used for preparing cable ends for installation of fittings.

C. The cable end shall be cut square to ensure flush seating of the cable into the fitting. Fitting securement screws shall be properly torqued. Cable ends shall be fitted with insulating bushings intended for the type of metal clad cable being installed.

D. For jacketed metal clad cable, the outer jacket shall be removed to the length specified by the fitting manufacturer's instructions. Remove oils or solvent by-products from the outer jacket of the cable. The cable end shall be cut square to ensure flush seating of the cable into the fitting. The fitting gland nut shall be properly torqued to the manufacturer's specifications.

3.3 ARRANGEMENT AND SUPPORT

A. Metal clad cables shall be run parallel with walls or structural elements. Vertical runs shall be plumb; horizontal runs level and parallel with structure, as appropriate. Groups shall be racked together neatly with both straight runs and bends parallel and uniformly spaced.

B. Metal clad cables shall be securely fastened in place at intervals of not more than six feet, with suitable clamps or fasteners of approved type, and all vertical conduits shall be properly supported to present a mechanically rigid and secure installation.

C. Metal clad cable installed parallel to framing members, such as studs, joist, or rafters, shall be supported so that the nearest outside surface of the cable is not less than 1-1/4 inches from the nearest edge of the framing member. Where this distance cannot be maintained, the cable shall be protected by a steel plate, sleeve, or equivalent that is at least 1/16-inch thick.

D. Maintain at least 6-inch clearance between metal clad cables and other piping systems. Maintain 12-inch clearance between metal clad cables and heat sources such as flues, steam pipes, and heating appliances.

E. No metal clad cable shall be fastened to other conduits or pipes or installed so as to prevent the ready removal of other pipes or ducts for repairs.

F. Individual metal clad cables hung from roof structure or structural ceiling shall be supported by split-ring hangers and wrought-iron hanger rods. Where three (3) or more metal clad cables are suspended from the ceiling in parallel runs, use steel channels, Kindorf, Unistrut or equal, hung from 1/2-inch rods to support the conduits. The conduit on these channels shall be held in place with metal clad cable clamps designed for the particular channel that is used.

G. Secure metal clad cable support racks to concrete walls and ceilings by means of cast-in-place anchors; die-cast, rustproof alloy expansion shields; or cast flush anchors. Wooden plugs, plastic inserts, or gunpowder driven inserts shall not be used as a base to secure conduit supports.

H. Metal clad cable shall be supported immediately on each side of a bend and not more that one (1) foot from an enclosure where a run of metal clad cable ends.

I. Use of cable tray:

1. The sum of the cross-sectional areas of all cables shall not exceed the maximum allowable cable fill area allowed by NEC Tables 392.9, 392.9(E) and 392.9(F).

2. Cables shall be installed in a single layer with a maintained spacing of not less than one cable diameter between cables.

3. Ampacity of cables installed in cable tray shall meet the requirements of NEC 392.11.

3.4 INSPECTION AND TESTS

A. General: The electrical installation shall be inspected and tested to ensure safety to building occupants and operating personnel and conformity to Code

B. Measure and record insulation resistance of all power and control wiring including insulation resistance of all equipment:

1. The insulation resistance of each circuit phase-to-phase and phase-to-ground shall be measured. For circuits rated less than 600 volts, the resistance shall not be less than 2 megohms.

2. Systems rated above 240 volts shall be tested with a 1000-volt Megohmeter. Circuits rated 240 volts and below shall be tested with a 500-volt Megohmeter. The D.C. potential shall be applied for thirty (30) seconds.

C. The contractor shall record test readings and submit certified test to the Engineer for review and acceptance approval before energizing respective circuits.

END OF SECTION 260534

SECTION 260923 - NETWORK DIGITAL LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 INTRODUCTION

A. The work covered in this section is subject to all of the requirements in the general conditions of the specifications. Contractor shall coordinate all of the work in this section with all the trades covered in the other sections of the specification to provide a complete and operative system.

1.2 DESCRIPTION OF WORK

A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is defined to include low voltage lighting control panels, switch inputs, and wiring.

B. The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the project specifications.

1.3 QUALITY ASSURANCE

A. UL & ULC Approvals: The control panels shall be tested and listed under the UL 916 Energy Management Equipment standards by a nationally recognized testing laboratory.

B. NEC Compliance: The control system shall comply with all applicable National Electrical Codes regarding electrical wiring standards.

C. NEMA Compliance: The control system shall comply with all applicable portions of the NEMA standards regarding the types of electrical equipment enclosures.

D. Component Pre-Testing: All control equipment shall undergo strict inspection standards. The equipment shall be previously tested and burned-in at the factory prior to installation.

E. System Checkout: A factory-trained technician or factory-authorized personnel or Contractor shall functionally test the control system and verify performance after installation.

F. Manufacturer: Manufacturer shall have a minimum of 10 years experience in control systems. These specifications are based on the Light Network Control System from Sensor Switch, an Aquity Brands Company. Substitutions of the specified equipment will be considered providing sufficient documentation is provided to the Engineer which certifies that the equipment qualification meets the requirements of this specification.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data on lighting control system and components.

B. Shop Drawings: Submit drawings of lighting control system and accessories including, but not necessarily limited to, the low voltage relay panels, power wiring, and switch inputs.
   1. Complete layout of every space with the parts identified and wire routing
   2. Riser Diagram/System Diagram
   3. Switch Input Wiring

C. Example Contractor Startup/Commissioning Worksheet

D. Hardware and Software Operation Manuals

1.5 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. Coordinate lighting controls with BAS (building automation system) either through IP based intercommunication of system or hardwired auxiliary relay outputs.

C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.6 WARRANTY

A. All devices in lighting control system shall have a 5 year warranty.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts;
   1. Intelligent lighting control devices
   2. Standalone lighting control zones
   3. Network backbone for remote or time based operation.

B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

C. System must be able to interface directly with intelligent LED luminaires such that only CAT-5e cabling is required to interconnect luminaires with control components such as sensors and switches.

D. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and possess RJ-45 style connectors.

E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.

F. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.

G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

H. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

I. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.

J. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

K. System shall have one primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

L. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.

M. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.

N. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

O. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information via either the wired backbone.

P. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.
   1. Auto-On / Auto-Off (via occupancy sensors)
      a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
      b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
      c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
   2. Manual-On / Auto-Off (also called Semi-Automatic)
      a. Pushing a switch will turn lights on.
      b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
   3. Manual-On to Auto-On/Auto-Off
      a. Pushing a switch will turn lights on.
      b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
      c. Sequence can be reset via scheduled (ex. daily each morning) events
   4. Auto-to-Override On
      a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
      b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
      c. Sequence can be reset via scheduled (ex. daily each morning) events

5. Manual-to-Override On
   a. Pushing a switch will turn lights on.
   b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
   c. Sequence can be reset via scheduled (ex. daily each morning) events
6. Auto On / Predictive Off
   a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
   b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
   c. If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.

Q. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.

R. Control software shall enable integration with a BMS via BACnet IP.

S. Desktop or Laptop Computer shall be furnished by the school district, and software will be loaded, and tested, during system start-up and programming by factory authorized technician.

2.2 INDIVIDUAL DEVICE SPECIFICATIONS

A. Control Module (Gateway):
1. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet.
2. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.
   a. Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.
   b. Device shall automatically detect all devices downstream of it.
   c. Device shall have a standard and astronomical internal time clock.
   d. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
   e. Device shall have a USB port
   f. Each control gateway device shall be capable of linking 1500 devices to the management software.
   g. Device shall be capable of using a dedicated or DHCP assigned IP address.
   h. Network Control Gateway device shall be the following Sensor Switch model Series:
      1) GWY2

B. Networked System Occupancy Sensors:
1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.

4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
5. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
6. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
7. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
8. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
9. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
10. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
11. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
12. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
13. Sensors shall be the following Sensor Switch model numbers, with device options as specified: **nCM PDT 10 (ceiling mounted)** or **nWV PDT 16 (wall mounted)**.

C. Networked System Daylight (Photocell and or Dimming) Sensors:
1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
4. Sensor shall be the following Sensor Switch model numbers, with device options as specified: **nCM ADC** X(on/off, 0-10 VDC dimming)

D. Networked System Power (Relay) Packs:
1. Dimming Power Pack shall incorporate one Class 1 relays, contribute low voltage power to the rest of the system, and provide 0-10 VDC dimming output
2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement

6. Auxiliary relay pack shall provide cry contact output for connection to HVAC system.
7. Power (Relay) Packs and Supplies shall be the following Sensor Switch model Series: **nPP16 D**(Power Pack w/ 16A relay, and 0-10VDC dimming output); **nAR 40** (Low voltage auxiliary relay pack)

E. Networked System Wall Switches & Dimmers:
1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
2. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
3. All devices shall have two RJ-45 ports.
4. All devices shall provide toggle switch control.
5. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
6. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
7. Devices shall have custom button labeling as indicated on drawings.
8. Wall switches & dimmers shall be the following Sensor Switch model numbers, with device options as specified:
   a. **nPOD** (single on/off, capacitive touch, audible user feedback)
   b. **nPOD 2P** (dual on/off, capacitive touch, audible user feedback)
   c. **nPODM** (single on/off, push-buttons, LED user feedback)
   d. **nPODM 2P** (dual on/off, push-buttons, LED user feedback)
   e. **nPODM DX** (single on/off, single dimming raise/lower, push-buttons, LED user feedback)
   f. **nPODM 2P DX** (dual on/off, dual dimming raise/lower, push-buttons, LED user feedback)
   g. **nPODM 4P** (quad on/off, push-buttons, LED user feedback)
   h. **nPODM 4P DX** (quad on/off, quad dimming raise-lower, push-buttons, LED user feedback)

F. Networked System Graphic Wall Station:
1. Device shall have a 3.5” full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
2. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
3. Device shall enable user supplied .jpg screen saver image to be uploaded.
4. Device shall surface mount to single-gang switch box
5. Device shall have a micro-USB style connector for local computer connectivity.
6. Device shall have two RJ-45 ports for communication
7. Device shall be the following Sensor Switch model number:
   a. nPOD GFX

G. Communication Bridges:
1. Device shall surface mount to a standard 4” x 4” square junction box.
2. Device shall have 8 RJ-45 ports.
3. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
5. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
6. Communication Bridge devices shall be the following Sensor Switch model numbers:
   a. nBRG 8 (8 Ports)

2.3 EMERGENCY LIGHTING CONTROL DEVICES

A. Provide an Emergency Lighting Control Unit to allows standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building. Emergency Lighting Control Unit shall be a UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface

2.4 LIGHTING CONTROL PROFILES

A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.

B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.

C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.

D. Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.

E. All lighting control profiles shall be stored on the network control gateway device and on the software's host server.

F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.

G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.

I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.

J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.5 MANAGEMENT SOFTWARE

A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software

B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).

C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.

D. A printable network inventory report shall be available via the software.

E. A printable report detailing all system profiles shall be available via the software.

F. Software shall require all users to login with a User Name and Password.

G. Software shall provide at least three permission levels for users.

H. All sensitive stored information and privileged communication by the software shall be encrypted.

I. All device firmware and system software updates must be available for automatic download and installation via the internet.

J. Software shall be capable of managing systems interconnected via a WAN (wide area network)

2.6 LIGHTING CONTROL APPLICATIONS

A. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
   1. Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room and meeting rooms. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
   2. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
      a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
      b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
      c. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.
      d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION MEETING

A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:

1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
2. Review the specifications for low voltage control wiring and termination.
3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
4. Discuss requirements for integration with other trades.

B. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
1. Adjust time delay so that controlled area remains lighted while occupied.

C. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

D. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

3.2 COMMISSIONING SUPPORT SERVICES

A. On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.

B. The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

3.3 EQUIPMENT INSTALLATION AND DOCUMENTATION

A. Installation: The control system shall be installed and fully wired as shown on the plans by the installing Contractor. The Contractor shall complete all electrical connections to all control circuits and override wiring.

B. Documentation: The Contractor shall provide accurate "as-built" drawings to the Owner for correct programming and proper maintenance of the control system. The "as-builts" shall indicate the load controlled by each relay and the relay panel number.

C. Operation and Service Manuals: The factory shall supply all operation and service manuals as related to the design of the control system.

3.4 PRODUCT SUPPORT AND SERVICE

A. Factory Support: Factory telephone support shall be available at no cost to the Owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment. The factory shall maintain toll-free numbers for technical support for their customers.

3.5 START-UP & SUPPORT FEATURES

A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.

C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

D. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

E. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

F. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.

G. All system devices shall be capable of being given user defined names.

H. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

I. All sensor devices shall have the ability to detect improper communication wiring and blink it’s LED in a specific cadence as to alert installation/startup personnel.

3.6 SYSTEM ACCEPTANCE

A. The Contractor is responsible for complete installation of the system according to strict factory standards and requirements. The following items shall be included requirements:
   1. All system equipment shall operate in accordance with specification and industrial standard procedures.
   2. An operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to the requirements.
   3. Demonstration of program integrity during normal operation and pursuant to a power outage.
   4. Contractor shall provide a minimum of three hours training on the operation and use of the control system. Additional support services shall be negotiated between the Contractor and the building Owner or manager.

END OF SECTION 260923

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all service entrance and main distribution switchgear with equipment as shown and described, with continuous full load ampacities as indicated.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square-D

B. General Electric

C. Cutler-Hammer

D. Siemens

2.2 ENCLOSURES

A. Shall be freestanding, steel with steel angle or channel framework of adequate strength and rigidity necessary to resist all conditions of use to which it may be subjected and to support all equipment, devices and appurtenances contained therein. Front plates shall be installed in sections so that all parts of the board are front accessible without disturbing other parts. A removable lifting angle shall be provided at the top and bottom of each shipping section(s).

B. Minimum 12 gauge steel, except front panels and doors may be minimum 14 gauge.

C. Shall be front access only unless noted otherwise.

D. Provide on 3-inch housekeeping concrete pad with minimum 3-inch lip on front and sides.

E. Finish shall be factory applied; standard gray color for all exterior and interior painted surfaces. Other colors may be considered.

F. Outdoor installation shall be NEMA 3R.

2.3 SWITCHBOARD DIMENSIONS

A. Overall height of switchboards shall not exceed 90 inches (not including base channels). Length and depth shall not exceed dimensions as scaled or noted in contract documents. Manufacturers whose equipment dimensions exceed those indicated shall notify the Engineer in writing 10 days prior to bid date. These Manufacturers may not bid as "Not Conforming To Contract Documents". Contractor shall base bid only on equipment which fully compiles with contract documents. Cost of building modifications or switchboard relocations, if permitted, or other additional work required to fit larger size switchboard(s) than shown on drawings shall be borne totally by the Contractor.

2.4 SWITCHBOARD BUSBARS

A. Aluminum or copper at manufacturer's option, factory fabricated; carried to terminals for connection to service cables or busway. Brace switchboard components for symmetrical fault current shown plus a symmetrical offset (50,000 amp bracing minimum). Aluminum bus shall be tin plated over its full length.

B. Busbar Joints:
1. Busbar to busbar shall be bolted, lapped and silver or tin plated, having low contact resistance and low temperature rise. For aluminum bus bolt using Grade 5 bolts with Belleville washers.
2. Overcurrent devices shall be bolted to busbars using Grade 5 bolts and Belleville washers. Exception: Square-D I-line and 30-200A fused switches

C. Conductor connectors shall be bolted to busbars using Grade 5 bolts and Belleville washers. Where aluminum conductors are utilized for feeders the connectors shall conform with Section 260519.

D. System of Bussing: Three phase, 4 wire, full size neutral unless otherwise noted.

E. Ground Bus: Full length ground bus bonded to frame conforming to U.L. 891 for minimum size except larger as required by the code for grounding neutral conductor.

2.5 SWITCHBOARD COMPONENTS

A. Switchboards shall include (but not limited to) the following components:
1. Shall be full-fault current rated, series rating of devices is not allowed.
2. Switches and fuses or breakers as shown. If fuses are used, provide all necessary fuses and spares per Section 262813.
3. Space for future switches or breakers as shown including complete bussing and required hardware for mounting devices. Space for metering and instrumentation components, and current limiters (when required).
4. Miscellaneous appurtenances as required for a complete installation.
5. Cleats for securing all conductors.

B. When Serving as Service Entrance Equipment:
1. Shall conform to UL 869 and have a Service Entrance Type UL label
2. Shall be full-fault current rated, series rating of devices is not allowed. See drawings.
3. Where utility company metering equipment is shown, provide current transformer space, meter base(s), metering conductors and miscellaneous appurtenances as required by serving utility.
4. Shall contain surge arrestors on all phases for voltage surge protection on secondary (under 600V) electrical wiring systems. Similar to Square-D, J9200.

2.6 CIRCUIT BREAKERS

A. Circuit breakers rated 400 amperes to 800 amperes shall have continuous current/long time delay and instantaneous pickup trip adjustments. Circuit breakers rated 800 amperes and over shall have continuous current/long time delay, instantaneous and short time pickup/short time delay trip adjustments.

B. Circuit breakers rated 1200 amps or higher – Provide arc energy reduction in accordance with NEC 2014 – Article 240.87.

2.7 NAMEPLATES

A. Nameplates shall be installed on all switchboards. Each individual switch shall be identified with a nameplate adjacent to the switch, describing the load connected.

B. Provide a service entrance label nameplate on the main switchboard which includes the following:
1. Electrical Contractor
2. Date of Installation
3. Service Voltage & Bus Amperage Rating
4. Symmetrical Short Circuit Current Rating
5. Year of Manufacture

C. Lettering size shall be suitable for the size of plate and information contained. Nameplates shall be engraved plastic (3/8-inch high minimum letters). Attach with stainless steel screws.

D. Nameplate color shall be: Emergency System - white on red, normal System - white on black.

E. Provide a riser diagram drawing using non-fading ink and mylar installed under glass and attached to the exterior of the main switchboard showing feeder runs, panels, transformers and raceway sizes.

2.8 SINGLE PHASING SENSORS

A. Provide single phasing sensors to trip the main switches in the event of a single phase failure.

2.9 CLEATS

A. Provide for securing all feeder cables within the switchboard.

2.10 FIELD APPLIED HAZARD MARKINGS

A. Provide Arc Flash and Shock Hazard warning labels on all electrical panelboards, switchgear, transfer switches, fused disconnects, etc. stating the PPE level of protection, flash hazard boundary, glove class and limited, restricted and prohibited approach.

B. The label shall be permanently affixed to the equipment or wiring method and shall not be hand written.

C. The label shall be of sufficient durability to withstand the environment involved.

D. The label shall meet ANSI Z535 guidelines and requirements.

PART 3 - EXECUTION

3.1 MOUNTING

A. Shall be bolted to floor using 1/2" x 8" (minimum) black mild steel foundation anchor J-bolts and anchored similarly to building structure to prevent overturning in the event of earthquake. Provide 3" thick structural concrete "housekeeping pad". J-Bolts in the floor shall be set in the structural floor and extend through the housekeeping pad with sufficient threads to attach the switchboard.

3.2 WIRING

A. Shall conform to applicable Sections of these specifications.

B. Shall be secured to switchboard enclosure with cleats. Maximum spacing shall not exceed 24 inches.

3.3 SPACE

A. Verify space available with equipment sizes and code required working clearances prior to submittals of shop drawings

3.4 GROUNDING

A. Provide pursuant to Section 260526.

3.5 UTILITY REQUIREMENTS

A. When service switchboard includes utility company metering equipment, provide all devices and wiring to meet serving utility requirements.

3.6 TESTS

A. Torquing requirements and installation of all terminations 1,000 amps and above shall be certified by an independent testing agency.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

1.2 WORK INCLUDED

A. Provide all panelboard equipment, complete; dead front type.

PART 2 - PRODUCTS

2.1 PANELBOARD TYPE

A. Panelboards shall be rated at proper voltage and current for intended use with busbars of copper or aluminum. Panels shall be 3-phase, 4-wire, 100% neutral, unless noted otherwise. Where aluminum is utilized, all lugs shall be of an approved compression type. Provide multiple lugs where conductors in parallel or "feed through" are shown on the Drawings.

B. Conductor Connectors shall be bolted to busbars using Grade 5 bolts and Belleville washers. Feeder conductor connectors shall be rated for 75 Degree C. wire when 75 Degree C. wire is indicated. Where aluminum conductors are utilized for feeders or branch circuits the connectors shall conform to Section 260519.

C. Panelboards shall have a separate ground bus bonded to the panelboard frame.

D. Where 120-Volt, 15- or 20-Amp breakers are intended for switching loads they shall be of type rated for switching duty labeled "SWD."

2.2 ACCEPTABLE MANUFACTURERS

A. General Electric

B. Square-D

C. Siemens

D. Cutler-Hammer

2.3 CIRCUIT BREAKERS

A. The following interrupting capacity, 10,000 AIC Symmetrical shall be considered minimum. Other ratings shall be as specified on panel schedules shown on the Drawings. Series rating of breakers is not allowed.

B. Mount breakers in all panelboards so that breaker handles operate in a horizontal plane. Bolt in type only. Provide common trip on all multiple pole breakers.

C. Where noted, provide spare breakers, complete for future connection of wiring circuits. Where "Space" is indicated for breakers, provide all bussing and breaker mounting hardware in the panelboard, provide steel knockouts in dead front metal closure of unused part of panel. If any steel knockouts are removed, provide breakers in such spaces or approved cover plates. Open spaces are not permitted.

D. For multi-wire branch circuits, provide approved breaker handle ties where required by NEC 210.4.

2.4 CABINET FOR EACH PANELBOARD

A. Flush or surface, as indicated; tight closing doors without play, when latched. Where two cabinets are located adjacent to each other in finished areas, provide matching trim of the same height. Where a remote controlled switch or contactor is mounted in any panelboard, mount on same frame as panelboard interior with screw retained access door in dead front shield; common door over circuit breakers and remote controlled device. Where flush mounted, provide (2) 3/4" conduits to accessible ceiling space for future expansion.

B. All conduits for future expansion shall stub into a junction box, where located above grade, and shall be sealed in the panel.

C. Provide cabinets of sufficient dimensions to allow for future expansion and addition of circuit breakers within the panelboards as indicated on panel schedules.

D. Provide cabinet front with full-height hinged door. One door over the interior and an additional hinged dead front cover over interior and wireway (door-in-door). Full-height front cover hinged to box with concealed trim clamps. Provide flush door locks.

E. Provide lock for each cabinet door. All Electrical Distribution Equipment Locks shall be keyed identically. Key system shall match existing. Supply Owner with minimum six keys.

F. Fasten panelboard front with machine screws with oval counter-sunk heads, finish hardware quality, with escutcheons or approved trim clamps. Clamps accessible only when dead front door is open are acceptable. Surface mounted panelboards with fronts greater than 48 inches vertical dimension shall be hinged at right side in addition to hinged door over dead front.

G. Finish: Provide factory prime coat for cabinets to be located in finished areas. Where cabinets are located in unfinished areas, standard lacquer or enamel finish, gray or blue-gray color, shall be substituted for factory prime coat.

2.5 SYSTEM OF NUMBERING AND BUS ARRANGEMENT

A. Shall be as shown on the Panel Schedules on the Drawings.

2.6 PANELBOARD NAMEPLATE

A. Provide engraved and filled (or color layer - engraved through outer layer) plastic nameplate with ½-inch high characters (for panel name); attached with screws to each NEMA 1 panelboard front. White on black, include voltage, phases, wires and minimum A.I.C. Rating in 3/8-inch characters.

B. Nameplate color shall be:

Emergency System:	White letters on red
Normal System:	White letters on black

PART 3 - EXECUTION

3.1 MOUNTING

A. Secure in place with top of cabinet at 6'-0", unless otherwise noted. Top of cabinet and trim shall be level. Firmly anchor cabinets directly or with concealed bracing to Building Structure. When panels are not located in or directly on a wall, provide a support frame of formed steel channel which is anchored to the floor and Ceiling Structure. Interiors shall not be installed until Structure is totally enclosed. Where panels are mounted adjacent to each other, the top edges shall be at the same height.

3.2 CIRCUIT INDEX

A. For each branch circuit panelboard provide a typewritten index listing each circuit in the panelboard by number with its proper load designation. Mount with a transparent protective cover inside cabinet door. Listing shall match circuit breaker arrangements, typically with odd numbers on the left and even numbers on the right. Room numbers used shall be final room numbers used in the building as verified with the Owner, and not room number assigned on Plans.

3.3 CABINET PAINTING

A. Cabinets furnished as prime painting shall be field painted to match color of adjacent wall. (See Division - Painting).

3.4 SPACE

A. Verify space available with equipment sizes and Code Required Working Clearances prior to Submittal of Shop Drawings.

3.5 GROUNDING

A. Provide separate ground busbar for all panels supplying isolated ground circuits.

3.6 FEED THROUGH AND DOUBLE LUGS

A. Provide feed through or double lugs with amperage equal to the incoming feeder amperage unless shown as larger.

END OF SECTION 262416

SECTION 262419 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

1.2 WORK INCLUDED

A. Work under this section includes all requirements for motor controls to be furnished under the electrical portion of the work on all electrical motor driven equipment. Individually mounted starters shall be provided by Division 26 Contractor. Motor controls shall conform to NEMA Standards for each specific purpose.

B. The Division 26 Contractor shall furnish all motor controllers not included with equipment furnished under other divisions of these specifications or by Owner. The Division 26 Contractor shall install all motor controllers including all controllers not factory assembled into equipment furnished under other divisions of these specifications or by Owner.

1.3 MOTOR VOLTAGE INFORMATION

A. Voltages available are 480 Volt, 3-phase or 208 Volt, 3-Phase, and 115 Volt Single-Phase.

B. Circuits are designed (in general) for motors as follows:
   1. Smaller than 1/2 H.P. - 115 Volts, Single Phase 1/2 H.P. and larger - 460 or 200 Volts, 3 Phase.

C. Verify motor sizes and voltages provided under other divisions and notify General Contractor immediately if any discrepancies are noted.

1.4 REGULATORY REQUIREMENTS

A. Provide motor protection switches of the appropriate NEMA size. For units not using NEMA rating, use equivalent NEMA size.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

A. Magnetic Motor Starters: Unless noted otherwise, shall be full voltage non-reversing with three overloads sized to suit nameplate amperes of motor served, motor "On" and "Off" pilot lights, "Hands-Off-Auto" switch, and auxiliary contacts for interlocking.

B. Combination Motor Starter/Disconnect: Shall be fused switch type with all features of Paragraph A above. In addition, provide disconnect switch auxiliary contacts for disconnection of externally powered control circuits where applicable. Fuses shall be sized in accordance with motor manufacturer's requirements.

C. Manual Starters: Shall be toggle switch or push-button type, lockable in the "Off" position, with overload relays, pilot light and enclosure pursuant to Paragraph D below. Manual starters shall only be used where specifically shown or called out on the drawings and only for single phase, fractional horsepower motors.

D. Enclosures: All motor controllers shall be contained in an enclosure suitable for the environment in which the controller is mounted, and shall be weatherproof when exposed to weather.

E. Overload Devices: Shall be melting alloy or bimetallic type. One overload shall be provided for each phase. Provisions shall be made for resetting the overload devices from outside the starter enclosure. 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.

2.2 ACCEPTABLE MANUFACTURERS

A. Square D

B. Allen Bradley

C. General Electric

D. Cutler-Hammer

E. Siemens

2.3 NAMEPLATES

A. Pursuant to Section 260000, Paragraph 2.05, provide nameplates permanently attach (with screws on NEMA 1 enclosures) on each controller, nameplates with the following information: Load served, voltage, phase, short circuit rating, panel/circuit number and where applicable fuse size and type.

2.4 FAN SHUTDOWN RELAYS

A. Contractor shall provide relay(s) with sufficient contacts to shutdown all fans over 2000 cfm upon receipt of Fire Alarm. See Section 283100. Coordinate coil voltage with Fire Alarm System Supplier.

PART 3 - EXECUTION

3.1 FINISHED AREAS

A. In finished areas, mount motor protection switches flush and install suitable coverplates.

3.2 HEATERS

A. Install heaters co-related with full-load current of motors provided.

3.3 OVERLOADS

A. Set overload devices to suit motors provided.

3.4 SUPPORTS

A. Securely mount to equipment, wall or acceptable mounting frame.

3.5 FAN SHUTDOWN WIRING

A. Provide wiring interlock connections for all (over 2000 cfm) fan starter control circuits via a relay to shutdown fans upon receipt of Fire Alarm.

3.6 CONNECTION TO MECHANICAL EQUIPMENT ON ROOFS

A. The Contractor shall coordinate all roofing penetrations with the general contractor and roofing contractor to assure that the roofing warranty is maintained.

B. Attachment of conduits to the roof to serve mechanical equipment and devices shall comply with Section 260533.

3.7 MECHANICAL EQUIPMENT NAMEPLATE RATINGS

A. The Division 260000 Contractor shall verify that the nameplate ratings of the mechanical equipment, when they arrive on site, are consistent with the ampacity called out on the drawings. The Contractor shall bring any discrepancies to the Engineers attention prior to installation of conduit and wiring.

END OF SECTION 262419

SECTION 262726 - SWITCHES AND RECEPTACLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

1.2 WORK INCLUDED

A. Provide all wiring devices and plates.

B. No push-in, friction, spring type terminals allowed.

C. All devices color shall be white, unless otherwise noted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hubbell

B. Pass & Seymour

C. Leviton

D. Cooper

2.2 SWITCHES

A. "Industrial Specification Grade", quiet type, rated 277 volt, 20 amp, unless noted, with plastic handle. Single pole, double pole, 3-way, or locking type as required. Meets Fed. Spec. WS-896 Provide matching styles and colors in other devices as required for the conditions of installation. Hubbell CS1221, Cooper CSB120, Leviton 1221, and P&S 20AC1

B. Interchangeable type shall be rated same as above.

C. Momentary Contact Line Voltage Switches: Single pole, double throw, 3-wire, normally open. Rating same as above.

D. LED Dimmer: LED dimmer switch shall be rated at 16 amps), 120V or 277V, 60 hertz. Dimmer switch shall have LED vertical slide with positive “off” button. Suitable for single-pole and 3-way. Dimmer shall have a radio/TV interference filter. Dimmer shall be matched with dimming driver. See Specification Section 265000. Leviton ‘Renoir II’ series.

E. Timer Switch: Provide electronic light timer switch where indicated on drawings. The timer switch shall be connected to the room lighting and fan. The timer switch shall be programmable for time-out from 5 minutes to 2 hours. Set timer for standard 20 minutes time-out period, time scrolls up, flash off, beeper on. Manufacturer: Watt Stopper – Inteli-switch Digital Time Switch.

F. Motor rated switches: Switches serving as motor disconnecting means shall be horsepower rated with overload relays and meet requirements as stated above. See manual starters in Section 262419, 'Motor Controllers'.

G. Device plates shall be Hubbell and Cooper Type 302 stainless steel.

2.3 RECEPTACLES

A. In All Unfinished Areas & Non-occupy able spaces: Provide "Industrial Specification Grade", Duplex NEMA 5-20R configuration (20-Amp, 120-Volt) unless shown otherwise. Must have "rivetless ground" contact manufactured as an integral component of the external ground screw terminal. Meets Fed Spec. WC-596 Hubbell HBL5362, Cooper 5362, P&S 5362A, and Leviton 5362.

B. In All Finished Areas & Occupied spaces: Provide heavy duty specification grade; general purpose 20 amp. 125-volt, Nema 5-20R, 2P, 3W decora plus duplex receptacle, straight blade, commercial grade, self-grounding, back & side wired. Leviton 16352T

C. Self-Testing Ground-Fault Circuit-Interrupter Duplex Receptacles: 20A. 125V AC; 2-pole, 3 wire grounding; 10,000 amps current interrupting; green light indicator when power is 'on'; red light indicator when device is in the tripped position; Red "EOL" (end of life) indicator with rapid flash when the unit has reached end of life and/or cannot provide GFCI protection. Provide GFI receptacles where required by code.

D. Switched Receptacles: Switched receptacles shall be smooth nylon face with either 2 controlled faces or one controlled face split circuit hot tab, permanently marked for use with automatic control systems, back and side wired.

E. AFCI Tamper-Resistant Duplex Receptacles: 15 Amp. 125 volt; 20-amp feed-through, tamper resistant, AFCI; back and side wired. Leviton AFTR1.

F. Weather Resistant (WR) / Ground Fault Circuit-Interrupter (GFCI) Outdoor Duplex Receptacles: NEMA 5-20R. Hubbell GFTR201 or equal, for 20 Amp, 125-Volt AC.

G. Special Purpose Receptacles: For special purpose receptacles, see drawings for voltage, amperage, and phase. Provide with matching plug delivered to the Owner.

2.4 OCCUPANCY SENSORS

A. Provide self-adjusting occupancy sensor light switching devices for control of lighting in all rooms and offices shown on drawings. Sensors shall be ceiling or wall mounted to provide adequate coverage. Occupancy sensors shall be "Leviton", Model OSC20-M0W for ceiling mounting, OSW12-M0W for wall mounting, complete with OSP20-RD0 power pack and associated mounting hardware. Provide "Leviton" ODSOD-ID wall switch sensors where shown. Sensors shall be wired to maintain switching and circuits shown on drawings.

2.5 DEVICE PLATES

A. Interior: Plates for receptacles other than NEMA 5-20R shall have ampere rating, voltage and phase engraved in the plate. Plates for recessed boxes shall be Hubbell and Cooper Type 302 stainless steel. Attachment screws shall match finish of plate. Plates for surface mounted boxes shall be of pressed stainless steel with size to fit exactly the box used.

B. Exterior: Intermatic # WP1010MC, for vertical mount and # WP1010HMC for horizontal mount, or equivalent for receptacles. Metal cover shall be raintight while-in-use.

2.6 LABELING

A. For NEMA 5-20R receptacles, each device shall be identified with a clear label with black typing stating the panel & circuit number.

B. For receptacles other than NEMA 5-20R, the cover plate shall have the ampere rating, voltage and phase engraved on a phenolic label and attached to the cover plate.

2.7 MULTIOUTLET ASSEMBLY (WHEN SHOWN)

A. Provide assemblies complete, including necessary fittings and hardware with circuits as indicated on Plans and outlet spacing as indicated. All assemblies shall contain ground wire. Wiremold or equal.

PART 3 - EXECUTION

3.1 MOUNTING

A. Rigidly fasten each device to the outlet box at proper position with the wall to bring receptacle flush with plate or switch handle the proper distance through the plate.

3.2 ORIENTATION

A. Set Switches vertical with handle operating vertically, up position "ON".

B. Set Receptacles vertical with ground slot down.

3.3 DEVICE PLATES

A. Shall be stainless steel for each new wiring device and for each telephone and signal equipment outlet, except where equipment mounted thereon covers the outlet box completely.

B. Provide new covers on existing outlet boxes being reused.

3.4 RECEPTACLE GROUNDING

A. Provide bare bonding wire between receptacle grounding terminal and box. Plaster ear screws connecting frame to the box will not be acceptable for grounding.

B. Provide green insulated grounding conductor in all branch circuits supplying isolated ground and ground-fault circuit-interrupter type receptacles.

3.5 AMERICANS WITH DISABILITY ACCESS

A. Comply with all requirements of Washington State Americans with Disability and NEC 2014 codes.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

1.2 WORK INCLUDED

A. Provide all fuses as required. Provide three (3) spare of each size and type required. Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the jobsite or from water that may contact the fuse before the equipment is installed. Final tests and inspections shall be made prior to energization of the equipment. This shall include a thorough cleaning, tightening, and review of all electrical connections and inspection of all grounding conductors. All fuses shall be furnished by the Electrical Contractor. All fuses shall be of the same manufacturer.

PART 2 - PRODUCTS

2.1 MAINS, FEEDERS, AND BRANCH CIRCUITS

A. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284°F. melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriters Laboratories, Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1 to maintain the Engineered protection of the system components.

B. Motor Circuits: All individual motor circuits with full load amperes ratings (FLA) of 480 amperes or less shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). Larger H.P. motors shall be protected by BUSSMANN Type KRP-C Low-Peak Time-Delay Fuses of the ratings shown on the drawings. All other motors, (such as 1.0 service factor motors) shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in ratings of approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 Dual Element Time Delay or Class L.

2.2 SPARE FUSES

A. Spare fuses shall be provided with a minimum of three of each ampere rating. See Section 265000 for quantities of spare fusing required for ballasted light fixtures.

2.3 ACCEPTABLE MANUFACTURERS

A. Bussman

B. Little Fuse

PART 3 - EXECUTION

3.1 FUSES

A. Install in all fusible devices provided under this Contract.

END OF SECTION 262813

SECTION 262816 - DISCONNECTS AND FUSED SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

1.2 WORK INCLUDED

A. Provided all disconnects, fused and unfused, required by code for equipment furnished under this and other divisions of these specifications and as shown on the drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General Electric

B. Square-D

C. Siemens

D. Cutler-Hammer

2.2 DISCONNECTS

A. Switch shall be heavy-duty type, shall be quick-break and shall be horsepower rated. Switch shall have blades as required to open all ungrounded conductors and shall be single throw unless noted.

B. Enclosure shall have interlocking cover to prevent opening door when switch is closed. Door interlock shall include a defeating scheme, shall be padlockable in the "Off" position.

C. Enclosure shall be suitable for environment in which mounted. All exterior enclosures shall have a minimum raintight rating.

2.3 FUSED SWITCHES (OR FUSED DISCONNECTS)

A. Shall be as above with addition of fuse space and clips to accept only fuses as noted in Section 262813.

B. Fuses shall be sized in accordance with manufacturer's requirements of protected equipment.

2.4 NAMEPLATES

A. Provide nameplates on all enclosures and include the following information: Load served, voltage, phase, panel and circuit number. Construct and attach in accordance with Section 260000.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Secure solidly to wall or approved mounting frame. Disconnects supported only by Raceway are not acceptable.

3.2 SPLICES

A. Wiring space within enclosure shall not be used as a junction box.

3.3 INSTALLATION

A. All material installation shall be in accordance with manufacturers' recommendations and the provisions of applicable codes.

B. Fuses shall not be installed until equipment is ready to be energized.

END OF SECTION 262816

SECTION 263213.16 - EMERGENCY GENERATOR

PART 1 - GENERAL

1.1 GENERAL

A. Provide all labor, materials, and equipment to furnish, install, and place in operation the Emergency/Standby power generation system in accordance with the contract documents and manufacturer's drawings and installation instructions. All equipment shall be new, factory tested, and delivered ready for field installation.

B. The responsibility for performance to this specification shall not be divided among individual component manufacturers, but must be assumed solely by the primary manufacturer. This includes generating system design, manufacture, test, and having a local supplier responsible for service, parts, and warranty for the total system.

C. Generator set mounted subassemblies such as cooling system, base, air intake system, exhaust outlet fittings, and generator set mounted controls and switchgear shall also be designed, built, and assembled as a complete unit by the engine/generator manufacturer.

1.2 APPROVED MANUFACTURERS

A. The engine and generator shall be the product of an ISO 9001 certified manufacturer. The design is based on a Kohler engine/generator set. Any changes to the design based on other manufacturers will be the responsibility of the installing contractor at no additional cost to the owner.

B. Must meet NFPA 110, Level 1 requirements.

C. Approved Manufacturers: Onan, Kohler, Detroit Diesel, Generac Power Systems, Inc. is approved as an acceptable manufacturer.

1.3 SUBMITTALS

A. Submittals for approval shall include but not be limited to:
   1. Certification and results of Prototype Testing and Production Testing.
   2. Component List - A breakdown of all components and options.
   3. Technical Data - Manufacturer produced generator set specification or data sheet identifying make and model of engine and generator, and including relevant component design and performance data.
   4. Auxiliary Equipment - Specification or data sheets, including switchgear, transfer switch, vibration isolators, and fuel tank.
   5. Drawings - General dimensions drawings showing overall generator set measurements, mounting location, and interconnect points for load leads, fuel, exhaust, cooling and drain lines.
   6. Wiring Diagrams - Wiring diagrams, schematics and control panel outline drawings published by the manufacturer for controls and switchgear showing interconnected points and logic diagrams for use by contractor and owner.
   7. Warranty Statements - Warranty verification published by the manufacturer.

8. Apply and obtain all permitting required by the local jurisdiction for the generator.

1.4 PRODUCTION TESTS

A. The system manufacturer shall perform production tests on the complete generator set supplied at the generator set manufacturers facility. A certified report of these tests shall be available upon request at the time of the generator set order. These tests and controls shall include but not be limited to:
   1. Operation at rated kW
   2. Operation at rated kVA
   3. Transient and steady state governing
   4. Transient and steady state voltage regulation
   5. Operation of all alarm and shutdown devices

B. Single step load pickup of rated kW

1.5 PROTOTYPE TESTS

A. The system manufacturer must certify that engine, generator, controls, and switchgear have been tested as complete system of representative engineering models (not on equipment sold). Prototype testing shall include:
   1. Fuel consumption at 1/4, 1/2, 3/4, and full load
   2. Exhaust emissions
   3. Mechanical and exhaust noise
   4. Governor speed regulation at 1/4, 1/2, 3/4, and full load; and during transients
   5. Motor starting kVA
   6. Generator temperature rise in accordance with NEMA MG1-22.40
   7. Voltage regulation at 1/4, 1/2, 3/4, and full load; and during transients
   8. Harmonic analysis, voltage waveform deviation and telephone influence factor
   9. Generator short circuit capability
   10. Cooling system performance
   11. Force factor calculations
   12. Torsional analysis
   13. Linear vibration analysis
   14. Generator revolving field assembly at 2250 rpm (125% overspeed) at room temperature.

1.6 WARRANTY/SERVICE

A. A two year for the generator set shall be included to guarantee against defective material and workmanship in accordance with the manufacturer’s published warranty from date of start-up.

B. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch as required and certification in the owner’s maintenance log of repairs made and proper functioning of all systems.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. The power generating system shall conform to the following performance criteria at the site conditions:
   1. Rating - Engine brake horsepower shall be sufficient to deliver full rated generator set kW/kVA when operated at rated rpm and equipped with all engine-mounted parasitic and external loads such as radiator fans and power generators.
   2. Start Time and Load Acceptance - Engines shall start, achieve rated voltage and frequency, and be capable of accepting load within 10 seconds when properly equipped and maintained.
   3. With the power generating system at normal operating temperature, it shall accept a 100% block load, less applicable derating factors, in accordance with NFPA 110.
   4. Steady state frequency regulation shall be +/- 0.33 % with no load to full load speed droop less than 3 %.
   5. Voltage regulation shall be +/- 2% for any steady state load between no load and full load.

2.2 DIESEL ENGINE

A. The diesel engine shall be a stationary, liquid cooled, 1800-rpm, four-cycle design, vertical in-line, with dry exhaust manifolds. It shall have 6 cylinders and be manufactured in the United States. Two cycle engines are not acceptable.

2.3 ENGINE ACCESSORY EQUIPMENT

A. The engine shall be cooled by an engine mounted, vertical radiator with blower type fan, using a 50% antifreeze/coolant mixture. Antifreeze shall have a service life of 3000 hours without maintenance. The radiator shall properly cool the engine while the engine is operating at full load and 0.25 inch H2O external air restriction. The minimum ambient capability shall be 104 deg F (40 deg C).

B. Electric starting motor and control circuit capable of three complete starting cycles without overheating.

C. Mechanical, positive displacement lube oil pump with replaceable full flow filter, oil cooler, and dip stick.

D. Mechanical, positive displacement fuel transfer pump with replaceable full flow filter.

E. Fuel Filter and serviceable fuel system components shall be located to prevent fuel from spilling onto genset batteries.

F. Manually operated fuel-priming pump.

G. Replaceable dry element air filter.

H. Engine mounted electrically powered, thermostatically controlled jacket water heater sized to ensure proper starting at 0° F. Shall include isolation valves and adjustable thermostat.

I. Flexible, stainless steel exhaust connector.

J. Flexible fuel lines.

K. The use of charging alternators as the only means of charging the unit batteries is not acceptable.

L. Remote engine shut off switch mounted within lockage cover, with name plate "Emergency Generator Shut Off Switch". Attached with stainless steel screws. Locate adjacent to ATS.

M. Equipment generator with load shed capabilities to signal the Optional Standby ATS to transition to a center off position to meet NEC Article 700.

2.4 GENERATOR

A. The generator shall be close coupled, drip proof and guarded, constructed to NEMA 1 and IP 22 standards, single bearing, salient pole, revolving field, synchronous-type with amortisseur windings in the pole faces of the rotating field and skewed stator windings to produce optimum voltage waveform.

B. The generator pitch shall be selected to optimize the generator efficiency and minimize the total harmonic distortion, especially the third harmonics which are detrimental to AC motors.

C. The generator shall be capable of delivering rated kVA at 60 Hz and 0.8 PF within +/-5% of rated voltage.

D. All insulation systems shall meet NEMA MG-1 standards for Class H systems. The actual generator temperature shall be limited to Class F levels. Materials, which support fungus growth, shall not be used.

E. The revolving field coils shall be precision wet layer wound with epoxy-based material applied to each layer of magnet wire. The revolving field assembly shall be prototype tested at 2250 rpm (125% overspeed) at room temperature. The revolving field assembly shall be balanced to 0.5 mil peak-peak. The stator shall have two dips and bakes using Class H impregnating varnish.

F. The self-excited, brushless exciter shall consist of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressers shall be included to protect the rotating diodes from voltage spikes.

G. The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 2% for any constant load between no load and full load. The regulator shall be a totally solid state design which includes electronic voltage buildup, volts per Hertz regulation, three-phase sensing, over excitation protection, loss of sensing protection, temperature compensation, shall limit voltage overshoot on startup, and shall be environmentally sealed.

H. The automatic voltage regulator and all low voltage control wiring shall be located in a separate enclosure.

2.5 CIRCUIT BREAKER - GENERATOR SET MOUNTED

A. The three-pole main line circuit breakers shall be provided to protect the generator against external faults and provide a positive disconnect device at the generator output terminals. The breakers shall be UL listed with shunt trip device connected to engine/generator safety shutdowns. The breakers shall be mounted on the generator in a NEMA 1P22 guarded drip-proof enclosure, which provides direct access for cable from the top or bottom.

2.6 CONTROLS - GENERATOR SET MOUNTED

A. The control panel shall be designed and built by the engine-generator manufacturer. It shall be mounted on the generator set and incorporate 100% solid state microprocessor based control circuitry and digital instrumentation. All electronic control components are to be mounted in sealed, dust tight, watertight, metal housings. Housings which must be opened for service or setup are not acceptable. All output circuits greater than 100mA shall be fuse or circuit breaker protected. The panel shall be labeled with ISO symbols and comply with IEC 144, IP 22, and NEMA 12 for external environmental resistance, and IP 44 and NEMA 12 for resistance of the internal sealed modules. The control panel shall be capable of facing the right, left, or rear and shall be vibration isolated.

B. The panel shall include the following equipment/functions:
   1. Automatic remote start capability with mode of operation selectable from a panel-mounted 4-position switch (Stop, Manual, Automatic, Reset).
   2. Generator will accept remote signal from ATS for automatic starting and exercising.
   3. Cycle crank with adjustable "crank" and "rest" times.
   4. Adjustable cooldown timer.
   5. Emergency Stop push button requiring manual reset.
   6. Voltage adjustment potentiometer to adjust voltage +/- 5% of rated.
   7. Individual flashing LED's shall be provided. The use of a common alarm or shutdown lamp, which depends on a separate display to determine the alarm or fault condition, is not acceptable. LED annunciation shall be provided for:
      a. Overspeed (red)
      b. Overcrank (red)
      c. High Coolant temperature (red)
      d. Low Oil pressure (red)
      e. Emergency Stop (red)
      f. Low Coolant Level (red - programmable as alarm or shutdown)
   8. Digital displays shall be provided for the engine and generator parameters. These displays shall allow the simultaneous display of AC parameters and at least one (selectable) engine parameter to be displayed at the same time. Requirements for these displays are as follows:
      a. Digital display and phase selector switch for generator operational parameters. True RMS sensing of these parameters shall be utilized to minimize distortion due to non-linear loads and ensure accuracy.
      b. AC volts (+/- 0.5% accuracy)
      c. AC amps (+/- 0.5% accuracy)
      d. Hertz (+/- 0.3 Hz accuracy)

C. Digital display for:
   1. Engine RPM (+/- 0.5% accuracy)
   2. DC voltage (+/- 0.5% accuracy)
   3. Oil pressure (+/- 0.5% accuracy)
   4. Coolant temperature (+/- 0.5% accuracy)

5. Operating hours

D. Diagnostic Capability: Must provide dual level diagnostics identifying both system level and component level. The diagnostic codes shall be maintained in a history log specifying the number of occurrences, and second/minute/hr at which they occur.

E. Sensors: Sensors providing a pulse width modulated output shall be utilized for oil pressure, coolant temperature sensing and shall be protected against a fault to (+/-) battery. The usable output range of the sensor shall be limited to 5% to 95% duty cycle. Output outside the usable range shall be diagnosed as a fault condition and appropriate diagnostic shall be provided. Separate speed sensing signals shall be provided for overspeed protection and electronic governing.

F. Dry Contacts: Provide dry contacts for interface with the building energy management control system. The dry contracts shall be normally open type. The following items shall be communicated to the building energy management control system:
1. Generator is running
2. Emergency mode
3. Normal mode (no load testing)
4. Low fuel
5. Generator failure to start
6. Generator emergency shutdown

2.7 REMOTE SERIAL ANNUNCIATOR

A. Provide a remote annunciator to monitor common alarm, remote testing of the automatic transfer switch, and monitoring of the normal/emergency source.

B. Provide RS-485 cabling interface to each automatic transfer switch and generator per manufacturer's wiring diagram.

2.8 AMBIENT PARAMETERS:

A. Operating: -40C to +70C (-40 F to +158 F)

B. Storage: -55 C to +85 C (-67 F to +185 F)

C. Humidity: 0 to 100% relative humidity

D. Must be impervious to salt spray, fuel, oil and oil additives, coolant, spray cleaners, chlorinated solvents, hydrogen sulfide and methane gas, and dust.

2.9 BASE

A. The engine and generator shall be assembled to the base using vibration isolators spring/pad type. Isolators shall include seismic restraints, which comply with seismic zone 4. The generator set base shall be designed and built by the engine-generator manufacturer to resist deflection, maintain alignment, and minimize resonant linear vibration.

2.10 BASE TANK

A. The generator skid base shall contain an integral, UL listed, steel fuel storage tank with diked rupture basin for containment of fuel resulting from a tank rupture or leak. The base tank shall be UL 142 listed for “Steel Above Ground Tanks for Flammable and Combustible Liquids.”

B. The tank shall be manufactured entirely of 8-gauge steel with continuously welded seems and steel channel side beams. The tank shall have leak detection.

C. The tank shall be sized for 24 hours of generator operation at full load.

D. Provide venting of base tank as required by local jurisdiction.

E. All above ground and exposed piping shall be labeled with contents and flow direction per ANSI A13.1. Label piping every 20’ and at bends and penetrations with black letters on yellow background.

F. Accessories per International Fire Code:
1. 5 gal. fuel fill container mounted on a side of the enclosure. Fill to be piped to the fuel fill on the tank.
2. Fuel fill tube to be extended inside the tank and terminated within 6” from the bottom.
3. 90% high fuel alarm and float switch.
4. Normal vent to be extended and terminated 12’ above grade.
5. Primary and secondary emergency vents to be extended outside of the enclosure.

G. Provide a permanent sign posted at the tank documenting filling procedures and tank calibration chart.

2.11 BATTERY CHARGER

A. A dual rate 10-ampere battery charger shall be provided which shall accept 120-volt AC single-phase input to provide 12-volt DC output. It shall be fused on the AC input and DC output, incorporate current limiting circuitry, and include a DC ammeter and voltmeter. The use of a crank disconnect relay to protect the charger during starting is not acceptable. The charger shall be housed in a NEMA 1 enclosure and vibration mounted on the genset.

2.12 BATTERIES

A. 12 volt starting batteries; sized as recommended by the generator set manufacturer to comply with the starting and temperature specifications; battery cables, and base mounted battery rack shall be provided. Shall be warranted by the gen set manufacturer.

2.13 EXHAUST SILENCER

A. A critical exhaust silencer shall be sized and supplied by the engine supplier. The silencer and associated piping shall not impose more than 27 in H2O restriction.

B. The silencer shall utilize a high temperature coating system to prevent rusting and shall be mounted near the engine to minimize noise and condensation. A provision for draining moisture shall be included.

2.14 GENERATOR HOUSING

A. Provide housing enclosure around the complete generator set. Housing shall allow ample cooling air flow. The housing shall be made of heavy gauge, reinforced steel and attach directly to the generator set skid base. Service access to the engine-generator shall be through hinged doors on each side of the housing and a rear hinged door for access to the generator set control panel. Housing shall be NEMA 3R and protect from the elements, animal intrusion and unwanted entry.

B. Sound enclosure shall have a sound pressure rating between 70 and 80 dBA @ 100% load.

2.15 WIRING AND CONDUIT

A. Engine and generator control wiring shall be multi-strand annealed copper conductors encased by cross-linked polyethylene insulation resistant to heat, abrasion, oil, water, antifreeze, and diesel fuel. Wiring shall be suitable for continuous use at 120C (250F) with insulation not brittle at -50C (-60F). Each cable will be heat stamped throughout the entire length to identify the cable's origin and termination. Cables shall be enclosed in nylon flexible conduit which is slotted to allow easy access and moisture to escape. Reusable bulkhead fittings will attach the conduit to generator set mounted junction boxes.

2.16 ADDITIONAL LOCAL AUTHORITY REQUIREMENTS

A. Provide diesel, hazardous-material and no smoking signs with proper wording as required by the local Authority Having Jurisdiction.

PART 3 - CONTRACT COMPLETION

3.1 INSTALLATION/ON SITE TESTING

A. The installation shall be performed in accordance with shop drawings, specifications, and the manufacturer's instructions; and shall comply with applicable state and local codes.

B. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site. Bottom of integral base tank shall not be more than 12” above the ground.

C. The generator set shall be tested as defined below by the manufacturers authorized dealer to show it is free of any defects and will start automatically and carry full load. This testing is to be performed at the jobsite. Testing shall be completed in the presence of the owner's engineer or his appointed representative. With the exception of fuel, all consumables necessary for testing shall be furnished by the bidder. Any defects, which become evident during the test, shall be corrected by the bidder at his own expense. Scheduling of tests shall be coordinated with Owner and Engineer with 7 days maximum notice.

D. Proper operation of the following shall be demonstrated:
   1. All auxiliary equipment supplied to this specification.
   2. Starting and charging system components.
   3. All controls, engine shutdowns, and safety devices

E. Cold Start Test: The unit shall demonstrate the ability to start from a "cold" standby condition (i.e. normal standby mode with engine coolant temperature at normal temperature established by properly functioning jacketwater heater).

F. Load Bank Test: The unit shall be operated at 80% of full load rating for one hour followed by two hours operation at 100% full load. After the first half-hour stabilization period at full load, the following shall be recorded at fifteen minute intervals:
   1. Voltage and amperage (3 phase), frequency
   2. Fuel pressure, oil pressure and water temperature
   3. Exhaust gas temperature at engine exhaust outlet

G. Simulated Power Failure Test: Starting of test shall be by simulated power failure. Contractor shall test all components of generator system including transfer switch.

3.2 BASE TANK TEST

A. The following tests shall be observed by the local Fire Prevention Bureau Inspector. It is the contractor's responsibility to coordinate all witness testing with the local authority.

B. The 90% high fuel alarm and 5 gal. fuel fill container shall be tested for proper operation.

C. Prior to any filling of combustible or flammable liquids the base tank shall be pressure tested per NFPA 30, Section 2.4.2.

3.3 SERVICE MANUALS AND PARTS BOOKS

A. The system manufacturer's authorized local dealer shall furnish one copy each of the manuals and books listed below for each unit under this contract:
   1. OPERATING INSTRUCTIONS - with description and illustration of all switchgear controls and indicators; and engine and generator controls and indicators.
   2. PARTS BOOKS - that illustrates and list all assemblies, subassemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.).
   3. PREVENTATIVE MAINTENANCE INSTRUCTIONS - on the complete system that cover daily, weekly, monthly, biannual, and annual maintenance requirements and include a complete lubrication chart.
   4. ROUTINE TEST PROCEDURES - for all electronic and electrical circuits and for the main AC generator.
   5. TROUBLESHOOTING CHART - covering the complete generator set showing description of trouble, probable cause, and suggested remedy.
   6. RECOMMENDED SPARE PARTS LIST - showing all consumables anticipated to be required during routine maintenance and test.
   7. WIRING DIAGRAMS AND SCHEMATICS - showing function of all electrical components.

END OF SECTION 263213.16

SECTION 263623 - AUTOMATIC TRANSFER SWITCHES TIME DELAY NEUTRAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all automatic transfer switches. Meet UL Standard 1008.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Asco

B. Zenith

C. Kohler

2.2 TYPE

A. Transfer and retransfer to normal load shall be automatic. Automatic transfer switches shall be electrically operated, mechanically held and supplied with positive mechanical interlocking. The main contacts shall be equipped with a safe manual-override, UL 1008 listed, meeting tables 21.1, 23.1, and 23.2.

2.3 RATING

A. Shall have voltage, amperage and ampere withstand ratings as indicated on the drawings.

B. Transfer switches used to transfer from normal to emergency power shall be approved for emergency service, full ampere rated (no derating) with make rating at 20 times and break rating at 6 times full load current rating. Provide 4-pole device for switching of neutral in addition to phase conductors when generator neutral is grounded at the generator, or as indicated on the plans.

C. Service Entrance Rated

2.4 ACCESSORIES

A. The following accessories shall be provided as a minimum in addition to those normally required for proper operation.
   1. Full three phase voltage failure and phase reversal sensing. Adjusting drop out and pick up. Set at 85% drop out, 92% pick up.
   2. Signals: Two pilot lights for indicating transfer position. White - normal, yellow - emergency at transfer switch. Auxiliary contacts for remote pilot lights.
   3. Test Switch: For simulating power failure.

4. Transfer: Adjustable ride through feature of approximately 0-10 seconds for start of engine generator and transfer on mometary loss of normal source. Set at 1 second. Includes two auxiliary contacts, one N.O. and one N.C. for use for engine start signal.
5. Retransfer: Adjustable time delay (with emergency failure by-pass) of 0 to 30 minutes for retransfer to normal. Set at 15 minutes.
6. "Time Delay Neutral": Provide time delay with transfer switch in neutral position and load disconnected from either source, adjustable from 2 to 50 seconds, to prevent transfer between sources when sources are significantly out of phase. Set per Engineers instructions.
7. Main breaker, size as indicated on the drawings.

2.5 ENCLOSURE

A. Each transfer switch shall be enclosed in an enclosure suitable for the environment in which it is located, with front opening lockable door.

2.6 SHOP DRAWINGS

A. Prepare and submit detailed shop drawings for review prior to manufacture. Include the following information (written or highlighted): wiring diagrams, dimensions, front view, catalog information indicating complete electrical and mechanical characteristics and compliance with all specification items of Section 26 3623.

PART 3 - EXECUTION

3.1 MOUNTING

A. Wall mounted or free standing assembly as per plans.

3.2 OPERATION TEST

A. Provide testing of transfer system coordinated with generator set(s) and start control panel to insure proper operation of transfer devices under actual operating conditions.

3.3 SEQUENCE

A. Any automatic transfer switch sensing loss of power shall start the emergency generator set and the set shall continue to run until after all transfer switches have returned to normal power (engine cool-down timer part of emergency generator set).

3.4 OPERATIONS AND MAINTENANCE MANUALS

A. Provide pursuant to Specification Section 26 0000. Manuals shall in addition contain the following information:
   1. Recommended test intervals.
   2. Recommended service intervals.
   3. Test and service record forms showing proper intervals for tests.

4. Recommended maintenance.
5. The first page of the manual shall contain the name, address and phone number of the local representative to be called for service and parts.

3.5 INSTRUCTION

A. The Contractor shall (after one week (minimum) written notification to Architect) conduct an instruction session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Owner in conjunction with instruction period for Generator System Equipment. The session shall be conducted by a Contractor's representative thoroughly familiar with the characteristics of the system. O & M Manual information regarding the system shall be turned over to the Architect prior to scheduling the instruction session.

END OF SECTION 263623

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 260000 – General Electrical Conditions

1.2 WORK INCLUDED

A. Provide the lighting system complete and operational.

B. Recessed fixtures installed in fire-resistive ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling.

1.3 FIXTURE SCHEDULE MANUFACTURER'S SERIES NUMBERS

A. Are a design series reference and do not necessarily represent the number, size, wattage or the type of lamp, ballast or special requirements as specified hereinafter.

1.4 SUBMITTALS

A. Shall be neatly and clearly marked to indicate the fixtures, lamps and ballasts fully comply with contract documents. When substitute fixtures are submitted (if permitted) the data shall clearly cross reference (written or highlighted) that the substitute fixture complies with every detail of the specified fixture. Fixtures not fully complying with contract documents are not permitted.

PART 2 - PRODUCTS

2.1 METAL PARTS

A. Interior Fixtures: Steel or aluminum with 300°F, baked enamel finish, brushed aluminum with baked acrylic clear lacquer finish, or stainless steel with a brushed finish, manufacturer's standard color unless specified otherwise.

B. Exterior Fixtures: Corrosion resisting metal, a (non-ferrous, stainless steel or special finish) and in all cases suitable for outdoor service without tarnishing or other damage due to exposure; manufacturer's standard colors unless specified otherwise; cadmium plate all metal parts concealed by canopies, including screws, plates and brackets. All exposed fasteners shall be tamperproof.

C. Recessed Type: Fixtures shall have housing containing an integral thermal device pursuant to NEC 410.115(C).

2.2 LIGHT TRANSMITTING COMPONENTS

A. Virgin acrylic or polycarbonate plastic (0.125-inch thick overall minimum), UV stabilized or glass. Shall be contained in a captive metal frame that remains attached to the fixture when door is in open position.

2.3 SPECIAL PARTS

A. Adapters, Plates, Brackets and Anchors: Provide where required by construction features of the building to suitably mount lighting fixture. All such appurtenances and mounting methods shall be approved by the Architect/Engineer prior to fabrication and installation.

B. Low Voltage Transformers: Provide and install where required to power individual or linear runs of low voltage light fixtures.

2.4 LAMPS

A. Solid-State Lighting: Fixtures shall have a lumen maintenance life expectancy (L70) of > 50,000 hours, a CRI of > 82, and a CCT of 3500K. Each solid-state fixture model shall be tested in accordance with IES LM-79.

2.5 LED DRIVERS/POWER SUPPLIES

A. The LED drivers/power supplies shall meet the following criteria:
   1. Drive mode: Constant Current or Constant Voltage depending on the LED configuration for the light fixture.
   2. Output currents: 250 mA – 1000 mA
   3. Output voltages: 6VDC – 48VDC
   4. Input voltages: 110 to 277 VAC; 50/60 Hz.
   5. Power factor at >0.90 @ full load
   6. Line regulation accuracy: +/- 2%
   7. Load regulation accuracy: +/- 3%
   8. Greater than 80% efficient
   9. Output over-voltage, output over-current and output short circuit protection with auto recovery
   10. Limited power source output to allow for class 2 wiring.
   11. Flicker Free 0-10V Dimmable to 10% light output.
   12. Minimum of 50,000 hour rated life.
   13. IP66 rated
   14. 5 Year Warranty.
   15. Acceptable Manufacturer: Advance Xitanium or approved equal.

B. Emergency Battery Backup: Provide as indicated. Each fixture unit shall consist of an automatic power failure device, test switch operable from outside of the fixture, pilot light visible from outside the fixture, automatic code-compliance testing, and fully automatic solid-state charger in a self-contained power pack. Emergency unit shall operate unattended and require no maintenance for a period of 5 years.
   1. Constant Power Emergency Drivers for LED lamps
      a. The emergency driver shall meet the following requirements:
         1) Provide constant wattage to the LED array for 90 minutes without degradation of the light output.
         2) UL classified for factory or field installation.
         3) Universal voltage input.
         4) UL certified output class 2 compliant and automatically senses the LED array forward voltage requirements.
         5) Suitable for use in damp locations.
         6) The emergency drivers shall be manufacturer tested to assure compatibility with the LED driver within the fixture.

2.6 MOUNTING FOR PENDANT FIXTURES

A. Rigid type, with not less than 5 thread engagement at each end, consisting of iron pipe, with brass or aluminum tubing casing, or painted tubing not less than 0.040 inches thick.

B. Aircraft cable, stainless steel, sized appropriately by manufacturer for weight and seismic zone.

C. Provide a canopy for each fixture hanger except where fixture conceals the outlet box directly without a canopy.

D. Provide a safety chain for all glass pendant fixtures.

2.7 OUTDOOR LIGHTING STANDARDS

A. Provide watertight insulating fuse in the base of lighting standards to individually protect each lighting fixture; buss Style "HEB" or approved, waterproof fuseholder with Buss fuse of appropriate capacity and voltage. Provide fuse for each hot circuit wire; do not fuse neutral.

B. Provide concrete preformed round poles with base plate for bolting to concrete foundation. Natural exposed aggregate finish. Height as noted on drawings.

C. Provide concrete foundations as shown on drawings. Field verify locations with Architect prior to installation of bases.

2.8 EXIT SIGNS

A. Fronts: Cutout stencils made of minimum #20 gauge sheet steel or sheet aluminum with red glass or plastic back of the cutout. Mount fronts either on concealed hinges or pull-out type with chain catch. Removable cutout arrows shall indicate direction of travel.

PART 3 - EXECUTION

3.1 LIGHTING FIXTURES - GENERAL

A. Size and mounting height from finished floor to bottom of fixture as indicated on the drawings. Verify mounting provisions prior to the ordering of fixtures. Fixtures shall be UL listed for the location, and application in which they are installed.

B. Ceiling fixtures shall be coordinated with and suitable for installation in, on or from the ceiling as shown. Installation and support of fixtures shall be in accordance with NFPA 70 and manufacturer’s recommendations.

C. Recessed fixtures installed in seismic areas shall be installed utilizing specially designed seismic clips.

D. Suspended fixtures installed in seismic areas shall have 45° swivel hangers and shall be located with no obstructions within the 45° range in all directions. The stem, canopy and fixture shall be capable of 45° swing.

3.2 DIFFUSERS AND ENCLOSURES

A. Install lighting fixture diffusers only after construction work, painting and clean up are completed. Prior to final acceptance, remove all lamps, reflectors and diffusers, wash, rinse and reinstall.

3.3 ADJUSTMENT OF FIXTURES

A. Make all final spotlight and adjustable light settings under the direction of the Architect/Engineer during a scheduled period of time prior to the completion of the project. Include costs for all equipment and personnel expenses required for adjustment.

B. For fixtures with indirect lighting, notify Engineer prior to installation of any circumstance where the fixture lamp source will be within 12” of ceiling.

3.4 SUPPORT OF FIXTURES

A. Recessed Troffer Type: For fixtures supported by the ceiling suspension system, provide integral tabs, which rotate into position after fixture is lifted into the ceiling cavity. Provide two safety chains secured to structural members above suspended ceiling. Circuit connection shall be through use of 60-inch flexible conduit from a rigidly supported junction box. For plaster or GWB ceilings, provide a plaster frame compatible with light fixture.

B. Recessed Downlight Type: Mount in frames suitable for the ceiling, with the recessed portion of the fixture securely supported from the ceiling framing. For fixtures supported by a ceiling suspension system, provide two safety chains secured to structural members above suspended ceiling.

C. Surface and Pendant Mounted Type:

D. Where mounted on accessible ceilings, hang from structural members by means of hanger rods through ceiling or as approved.

E. Where ceiling is of insufficient strength to support weight of lighting fixture, provide additional framing to support as required. Fixtures shall be supported from structure with seismic bracing independent of ceiling.

F. For Pendant Mount Type: Provide a unistrut channel for mounting fixtures entire fixture length unless light fixture is designed specifically for supporting itself. Provide 3/8-inch thread rod secured to structural members for support of unistrut channel.

G. Continuous Runs of Fixtures: Straight when sighting from end to end, regardless of irregularities in the ceiling. Where fixtures are so installed, omit ornamental ends between sections.

3.5 LOCATION

A. Mount to the dimensions shown on the drawings. Mount at quarter points where no dimensions appear. Architect shall specify mounting locations where no dimensions appear and quarter point mounting is impractical or not indicated on the drawings.

B. Refer to details, mechanical drawings, and coordinate with mechanical Contractor for equipment and ductwork mounted in ceilings to prevent conflict with light fixtures prior to installation. If conflicts cannot be resolved with the Mechanical Contractor, notify Architect/Engineer.

3.6 SPARE FIXTURES

A. Self-Luminous Exit Sign: Provide (2) two Self-Luminous Exit Signs Lithonia # DSW1X Green or Red to match EX-1. Install at locations as directed by Architect.

3.7 CONCRETE FOUNDATIONS

A. Install at locations shown taking care to provide soil compaction same as required under paving to avoid settling and tilting of pole. Provide for all steel, concrete or aluminum poles shown. Concrete foundations shall have a minimum raceway sweeps of 90 degrees and anchor bolts shall be accurately set in foundations using a template supplied by the pole manufacturer. For concrete work and grouting, see Division 3 of the specifications. When concrete work has cured, base plates shall be leveled and grouted in place. Pole anchor bases shall then be set on base plates, leveled plumb on foundations, and secured with holding nuts.

3.8 FIXTURE TENTING

A. Contractor shall coordinate ceiling types with architectural drawings and specifications and provide equivalent fire rated enclosures above all light fixtures which penetrate rated ceilings.

END OF SECTION 265000

SECTION 270000 - LOW VOLTAGE SYSTEMS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 SCOPE AND RELATED DOCUMENTS

A. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "good quality" means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds. The Installing Vendor/Contractor shall make all corrections as needed, to the satisfaction of the Architect.

B. Provide system documentation and Owner training as specified below.

C. An important item of the construction process for this project is the Pre-Construction Kick Off Meeting, which shall take place PRIOR to Submittal of equipment data sheets.
   1. The General Contractor shall coordinate the scheduling of the meeting.
   2. The Owners representative and the Owners IT Department representative will be present for the meeting.
   3. The General Contractor, Electrical Contractor, and a representative from EACH Section shall attend this coordination meeting.
   4. The estimated time is approximate and shall be extended for each Installing Vendor as necessary.
   5. EACH Installing Vendor shall submit their list of coordination items through the Construction Channels a minimum of 14 Days in advance of the meeting for Owner review.
      a. Review EACH specific Section for the sub-section titled “Coordination” for a minimum list of items to be discussed during the Pre-Construction Kick Off Meeting

D. The requirements of the conditions of the Contract, Supplementary Conditions, General Requirements, or other work specified to provide a fully functional system for EACH specific Low Voltage Section listed below includes, but is not limited to the following sections:

			Pre-Construction Kick Off Meeting	
			Estimated time for EACH Section	Submit Questions 14 Days in Advance
1.	Section 260000	Electrical General Conditions	30	

			Pre-Construction Kick Off Meeting	
			Estimated time for EACH Section	Submit Questions 14 Days in Advance
2.	Section 270000	Low Voltage System General Requirements	15	
3.	Section 283176	Fire Alarm /Emergency Communications System	10	
4.	Section 285005	Radio Dispatch Alert and Paging System	10	

E. Applicable Standards: All work shall be performed in accordance with the latest revisions of the following standards:
1. International Building Code (latest edition).
2. International Fire Code (latest edition).
3. NEC (National Electrical Code) (latest edition).
4. Telecommunications Architectural Standards - In Washington State Government (latest edition).
5. ANSI-J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications.

F. EACH Installing Vendor for their Section shall possess a current and valid Washington State 06 Electrical Low Voltage License.

1.3 QUALITY ASSURANCE

A. Device or wiring arrangement shown on the drawings represents the intent of the system. If additional equipment (that may not be shown) is required to make a fully functional system, then provide such equipment as required.

B. Each specification section that is governed by these specifications shall be provided, installed, commissioned, and warranted by a local Installing Vendor that meet the following requirements for the equipment manufacturer that is being submitted for:
1. All equipment for EACH Specification Section shall be provided and installed by a single supplier.
2. Have installed a minimum of three (3) Systems within the past five (5) years.
3. Maintain a 24 hour emergency service program using Manufacturer Trained technicians, shall respond to service calls within 24 hours during and after the warranty period.
4. The Installing Vendor shall be Manufacturer Approved to purchase the equipment, have a local office staffed with Manufacturer Certified installers that are capable to maintain, service, and warrant the equipment being installed, who are full-time employees and are capable of programming, testing, inspecting, maintaining, warranting, inventorying parts for the life of the system, and shall be located within a 100-mile radius of the project site.
5. Offices that require staff from another “Branch Office and/or Company Office” outside of this radius, are not acceptable.

C. Prior to completion of the installation, the Installing Vendor shall provide:
   1. A preventative maintenance agreement shall, at the Owners option, become effective at the end of the warranty period.
   2. A proposal for off-site monitoring services (for systems that are applicable).

1.4 DOMESTIC PRODUCTS

A. Products shall comply with the requirements of the “Buy American Act - Construction Materials Under Trade Agreements”, current adopted edition.

1.5 SUBSTANTIAL COMPLETION

A. In addition to the “Substantial Completion” requirements, when applied to EACH of the specification sections identified in “Scope and Related Documents” listed elsewhere in this specification, this shall be defined as follows;
   1. The stage in the progress of the Work, where the Work or designated portion is sufficiently complete in accordance with the Contract Documents, so that the Owner can utilize the Work for its intended use.
   2. ALL of the requirements listed in “Testing & Complete System Functionality” shall be met. Once all conditions have been met, this shall be deemed Substantial Completion. These requirements shall be completed on or before the Substantial Completion date listed in the Contract Documents.

1.6 DOCUMENTATION

A. Document Format:
   1. All documents shall be generated on a PC. Provide these documents electronically, with the As-built Documentation, where applicable.
      a. Data sheets, installation manuals, technical documents, brochures, and user manuals may be in PDF format.
      b. Power Point Presentation(s) shall be in MS-Power Point.
      c. Test Forms and other project specific documents shall be in an editable format, either MS-Word or MS-Excel.
      d. Drawings and details shall be in AutoCAD™ 2004 or newer.

1.7 SUBMITTALS AND SHOP DRAWINGS

A. Submittals and Shop Drawings shall be provided for EACH Low Voltage System Specification Section Number and shall contain, but not be limited to the items listed below:

B. Submittals – Prior to installation of any equipment, the Installing Vendor/Contractor shall provide the Architect with seven (7) copies of submittals for approval. Provide the following:
   1. A complete materials list of the quantity of each device, the manufacturer, model number, and description of the equipment for each individual system component or device that will be provided. This list shall precede the data sheets.
      a. Each System component or device data sheet shall have and indicating arrow next to each component or device that is being submitted.

C. Additional Shop Drawing Requirements:
   1. For additional shop drawing requirements, refer to EACH Low Voltage System Specification Section Number, in addition to what is listed below.

D. Shop Drawings – Prior to installation of any equipment, the Installing Vendor/Contractor shall provide the Architect with seven (7) copies of submittals for approval.
   1. Shop Drawing Requirements: The Installing Vendors Complete and Full Size set of Shop Drawings shall be issued in the following format:
      a. They shall be clear and legible.
      b. The same sheet size as the Contract Drawings (i.e. 30” x 42”).
      c. A minimum of 1/8” text height shall be used for all text, symbol text, and subscript text.
      d. Scale of Drawings:
         1) Site Plan Drawings shall be the same scale as issued in the Contract Documents.
         2) Floor Plan Drawings shall be 1/8”=1’-0”, unless directed to do otherwise.
      e. The Electrical Legend, Wire Legend, Load and Battery Calculations, Riser Diagram, Sequence of Operation info, Wiring Details, and Mounting Details shall precede the Site Plans and Floor Plans.
      f. All sheets, including the cover, shall include a Title Block along the edge of each of the drawings, that when the drawings are rolled up, the following information shall be visible;
         1) The System specific sheet number.
         2) Project Name, specification Section Number and Section Title name.
         3) Floor Name, area, and/or section of the building (use the name of the area and/or floor description that is on the Contract Drawings).
      g. Architectural information on the Contract Drawings, shall be included on the Installing Vendor Shop Drawing, including, but not limited to; Match Lines, Grid Lines, Grid Bubbles, Key Plan, and Enlarged Floor Plans.
      h. Electrical information on the Contract Drawings shall be included on the Installing Vendor Shop Drawing, including, but not limited to; all applicable General Notes and applicable Construction Notes for each of the Floor Plans. Where Enlarged Plans are shown on the Contract Drawings, include this in Installing Vendor Shop Drawings to show the room and ALL equipment within the room, to help facilitate and coordinate the installation of the Low Voltage equipment for all systems.
   2. Cover Sheet: The first page of the shop drawings shall be a cover sheet to include the following items;
      a. Owners Project information:
         1) Site Information
            a) Name of site, address, city, and zip code of where the installation shall take place.
      b. Installing Vendors Project information:
         1) Business name.
         2) Local office address of the Installing Vendor.
         3) Primary contact person name, phone number, and email address who is responsible for the long-term management of the Owners System.
      c. Provide a “Sheet Index”, which assigns a sheet number and unique name for each sheet that is included in the shop drawing submittal package. As part of the sheet index, list every sheet that is part of the system shop drawing package. On the left side of the Sheet Index, provide two columns - “Included” and “Not Included”. Include a check box, and provide a check in each box for all sheets that are included or not included, in each submittal.

1) Each sheet shall have a System Specific Sheet Number, and shall match the Contract Drawing sheet numbering system (i.e. E4.02 shall be FA-4.02 [for Fire Alarm], E4.02 shall be LAN-4.02 [for Local Area Network]).

3. Legend Information: From Left to Right, provide the following information for EACH device:
   a. Use the symbol on the Legend of the contract drawings.
   b. List the manufacturer's name.
   c. List the manufacturer's model number.
4. Provide a logical description of the device.
   a. Provide the back box requirements and related information. At a minimum, this shall include;
      1) The height, width, and depth of each required back box for each symbol on the legend.
      2) If the device is a back box or comes with a back box (IE: control panel, power supply, enclosure, etc.) then provide the height, width, and depth of the dimensions.
      3) Indicate if this device back box is going to be installed flush, semi-flush, or surface mounted.
5. Provide a Wire Legend listing the cable manufacturer, model number, cable rating, size of conductors, quantity of conductors, and color of each conductor. Use the format in the Sample "Wire Legend", as it applies to each system (see the Sample at the end of this specification). Provide a cable identification naming scheme (as defined within these specifications).
   a. The Wire Legend shall include the Cable Manufacturer and Model Number for EACH of the following types of cables (as applicable to the project):
      1) Conduit/Raceway Cable
      2) Open Cabling
      3) Wet Rated Cable
      4) Aerial Rated Cable
      5) EACH cable and EACH cable type shall have a different letter designation.
6. Load and Battery Calculations: For EACH control Panel, Power Supply, and/or Amplifier for EACH System, at a minimum show the following Amp Draw, Circuit, and Battery calculations;
   a. The total Amp Draw load in standby or non-active mode.
   b. The total Amp Draw load with all devices active and in a maximum load condition.
   c. Provide the spare power information that is available for future additional devices and/or equipment.
      1) Include the quantities of spare circuits that are available (where applicable).
   d. Circuit calculations:
      1) The quantity of each device per circuit.
      2) The Amp Draw per device per circuit (where applicable [this is not applicable to addressable devices that receive their power from an addressable data loop. Simply include the maximum amount of devices than can be placed on each addressable loop and the amount of addressable devices that are included on each addressable loop for this project]).
      3) The total Amp Draw load per circuit.
      4) The cable length distance of each circuit.
      5) The gauge size of wire used for each circuit.
      6) The total line loss for each circuit.
      7) Factor the line loss and Amp Draw to show the actual voltage available at the end of each circuit (after the last device).
      8) Include in the design layout, the requirements of "Spare Capacity" in Part 2 of this specification (where applicable).

e. Battery Back Up:
   1) All Batteries shall be sized to provide at least 20% spare capacity. Include this information in all calculations.
   2) For Fire Alarm, include all calculations that are required by the Authority Having Jurisdiction.
f. Uninterruptible Power Supply(s) (UPS):
   1) For systems that include a UPS, provide the maximum load (allowed by the UPS manufacturer) that EACH UPS is capable of providing, and list each item and its maximum load that will be connected to the UPS. Include the total load of all equipment connected to the UPS, and list the spare capacity available.

7. Riser Diagram: Provide a System One-Line Riser Diagram that shows the entire system. List the following:
   a. List the head-end equipment and IP addressed devices. Show the connection to the "Cloud" WAN, where applicable.
      1) Show each location (the MDF and EACH designated IDF separately).
      2) Show each cable types, sizes, and quantities between the MDF and each designated IDF location.
      3) Show EACH device in the MDF and each designated IDF location (Control Panel, CPU, DVR, Server, Power Supply and Terminal Cabinet [where applicable]) for each applicable system, the room name that each major system component is located in, and show the connection to the headend equipment.
      4) Show all field devices with their respective room names and/or room numbers and connections to their associated equipment.
      5) Show all field devices with their respective address point (where applicable).
8. For the Fire Alarm System ONLY, provide a detailed Sequence of Operation matrix that meets or exceeds industry standards, and shows how the System will work. This includes, but is not limited to:
   a. All Inputs and/or Actions:
   b. All Outputs and/or Controls:
9. Provide all Mounting Details and mounting heights for:
   a. All head-end equipment.
   b. Rack(s) (where applicable).
   c. Device(s).
10. Detailed Wiring Information:
   a. Show each individual conductor color for all wiring on the point-to-point wiring diagrams for each device.
   b. Show complete scale drawings of equipment, devices, wiring diagrams, and terminations of:
      1) Each Control Panel, CPU, DVR, etc.
      2) Power Supply and/or amplifier
      3) Rack equipment (where applicable).
      4) EACH device type
      5) EACH Terminal Cabinet (where applicable)
11. Rack Layout (where applicable).
   a. Show the intended equipment layout within the Rack(s).
   b. Show blank filler plates in spaces where equipment is not installed.
   c. Indicate the rack unit size of each device or filler plate in the rack.
      1) If rack equipment is installed on the rear side of the rack, show rear view of the rack also.
12. The matrix as defined in the 'System Device Naming Matrix' of each system specification (where applicable).

13. On the shop drawings, include a letter signed by the System designer that is responsible for the design depicted in the submittals and on the shop drawings. The letter shall state that the equipment and shop drawings design conform to national, state, local codes as adopted by the local authority having jurisdiction, and meet or exceed all of the performance requirements as outlined in the specifications.
    a. Designers shall provide the following:
        1) Provide a “signature” line and signature of the designer.
        2) Provide a “printed name” line, below [or to the right] of the signature line and the printed name of the designer.
        3) Provide a “date” line, below [or to the right] of the printed name line and date of the design.
    b. For Fire Alarm Shop Drawings, include the above information and the system shall be designed by one of the following (provide a copy of the supporting documentation):
        1) NICET Level III Certified Designer
        2) Registered Professional Engineer.
14. Label and Labeling:
    a. On the drawings, label each Rack, Control Panel, CPU, DVR, Power Supply(s), and Terminal Cabinet(s) in a logical numeric sequence. (i.e. for Fire Alarm Power Supplies, list them as FAPS-1, FAPS-2, etc).
    b. Cables: Generate an alpha-numeric label for each cable type and cable run.
    c. For projects with multiple sites, all labeling shall be consistent for all sites.
15. Show floor plan layout of devices and the anticipated routing of cable runs in parallel with all structural framing in a neat and orderly fashion.
16. EACH device at EACH location shall be shown on EACH floor plan. The cabling for EACH device shall be shown from EACH device to the device that it shall be connected to. EACH cable(s) shown on the floor plan shall be identified as described in the “Wire Legend” portion listed within this specification.
    a. Floor Plans: Show all system related devices and all equipment that the system specific shop drawings will interface to, on each of the floor plans. Provide Cabling for each device and the related wire type (as shown on the “Wire Legend”) shown for each of the device(s). Where multiple devices are on the same circuit or an addressable data cable is used, show all devices and their related cable(s).
17. EOL Supervision:
    a. Indicate on the floor plan drawings where EACH of the End-Of-Line Resistor(s) is located (where applicable).
18. Addressable Device information:
    a. Show each device address next to each device (where applicable), and clearly displaying this information so that it is not confusing as to which address belongs to which device. For non-addressable devices that will be connected to an addressable module, show the device address next to each device and the addressable module that it will be connected to.
    b. List the System Address Point(s) using a logical numbering sequence for the devices on a single run.
    c. Maintain the “Spare Capacity” requirements listed elsewhere in the specifications (where applicable).
    d. Include the complete Dip Switch and/or Rotary Addressing Scheme (used to set the device address for each addressable point) on the drawings.
19. Illuminated Graphic Map(s) (where applicable) – Prior to ordering or installation of any equipment, the Installing Vendor/Contractor shall obtain written approval by the Architect. Provide the Architect with seven (7) copies of submittals for approval. These shall be submitted with the Shop Drawings, but not be bound with the Shop Drawings submittal.
    a. Provide the actual full size scale drawing and artwork that will be provided to the Owner for a final product.

b. The Drawing submittal shall be in color.

20. All drawing submittals shall be a complete and full set of the system. If drawings are required to be re-submitted, a full and complete set must be re-submitted. Partial system drawing sets will be rejected and the Installing Vendor/Contractor shall reissue a full set of drawings. Any re-submittal(s) shall be provided at the Installing Vendor/Contractors expense.
21. The Installing Vendor/Contractor is responsible for assuring that the conduit size, wire quantity, wire size, and wire type is suitable for the equipment supplied. The Installing Vendor/Contractor shall review the proper installation method(s) for each type of device/equipment with the manufacturer's representative, and the AHJ, Prior to Rough-In.
22. Provide shop drawings that are usable for trouble-shooting purposes showing equipment/device locations, conduit routing, junction boxes and connection wiring of entire system.

E. Contract drawings shall not be used as Shop Drawings.

F. The Shop Drawings shall be system specific. For example: only Fire Alarm equipment and connections to other equipment that will be interfaced to the Fire Alarm, shall be shown on the Fire Alarm drawings.

G. Floor plans for the project have been developed by the Engineer using AutoCAD™ software. These drawing files will be made available to the Installing Vendor/Contractor for development of Shop Drawings and/or As Builts for a fee of $20.00 per sheet.

1.8 GOVERNING CODES AND CONFLICTS

A. If the requirements of this section, related sections or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section, related sections, and the Drawings shall govern. However, nothing in this section, related sections or the Drawings shall be construed to permit work not forming to all governing codes and regulations.

1.9 PROJECT CONDITIONS – CIVIL PLANS

A. The Installing Vendor/Contractor shall carefully coordinate the various symbols utilized on the drawings, and shall consult the civil plans to determine site conditions in the various areas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide all equipment as defined in each specification and on the drawings.

B. All equipment, panels, power supplies, and devices shall be manufactured under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label.

C. All equipment for each system shall bear the UL label. Partial or pending listings shall not be acceptable. It shall be the Installing Vendor's responsibility to insure that these requirements are met, and replace any and all equipment up to and including the entire system, if these requirements are not met.

D. EACH of the specified Low Voltage Systems identified in Part 1 of these specifications including the design, devices and/or wiring arrangement shown on the drawings, represent that based on various equipment manufacturers. Any changes resulting from differences between the specified product and other manufacturers or substitute manufacturers, shall be the responsibility of the Installing Vendor.
   1. Substitutions of the specified equipment and/or supplier will be considered provided that sufficient documentation is provided to the Engineer which certifies that the equipment and or supplier qualification meets the requirement of these specifications. Any request for substitution shall be submitted by the Installing Vendor in writing so as to be received by the Architect not later than (10) days prior to the bid due date. Equipment that is approved by the Engineer will be issued by addendum prior to the bid date.

E. Refer to Part 1 for any equipment that is not specifically defined.

2.2 CONDITION OF MATERIAL

A. All equipment shall be new, in un-opened boxes, and be the most current model available for each component and/or device that is provided for this project. For products that use firmware, the most current version available shall be downloaded and installed at each component and/or device, prior to any programming being performed. Outdated or used equipment, as determined by the Architect, shall be removed and replaced by the Installing Vendor/Contractor at no cost to the Owner.

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. All materials shall be in working order as intended by the manufacturer, at the completion of the project.

2.3 TERMINAL CABINETS, TERMINAL STRIPS, AND ENCLOSURES

A. On-Site System Information Binder and Enclosure: EACH Specification Section identified on the first page of this specification shall have an Information Binder that shall be housed in a System Information enclosure. The enclosure shall have a hinged door with the text “(Section Title here) Information”, with each specific system name silk screened onto the enclosure door, and shall bear the Underwriters’ Laboratories “UL" label. A “T-Turn” cam lock shall be used to keep the enclosure door closed, and a key shall NOT be required to open the enclosure. Use the following Space Age Electronics model number, or approved equal.
   1. All Systems (other than Fire Alarm): Model # YD9048DBXAA. Verify with the Architect the color of the enclosure(s) prior to ordering the enclosure. There shall be no additional charge to the Owner, for changes to the color of the enclosure.
   2. For the Fire Alarm: Model # YD9049DBXAA shall be Red in color, have a hinged door, and have “Fire Alarm System Documentation” silk screened on the enclosure door.

B. Terminal Cabinets (TC):
   1. See EACH Specification for Terminal Cabinet requirements (where applicable).

C. Terminal Strips:
   1. See EACH Specification for Terminal Strip requirements (where applicable).

D. Enclosures:
   1. Each Systems Control Panel(s), Power Supply(s), TC(s), and other metal enclosures shall have the following:
      a. Use key operated locks to secure the enclosure (keyed so that a single key can lock and unlock all enclosure locks for the entire system), and provide ten (10) keys.
      b. Use some form of wire management that uses permanently secured fasteners (no double back tape), and uses reusable and adjustable Velcro style cable straps, which shall be installed approximately every four inches within each enclosure.

2.4 LABELS AND LABELING

A. The alpha-numeric labeling shall be developed by the Installing Vendor.

B. Label all equipment and cables in an identical fashion of a sequential manner.

C. The Installing Vendor proposed alpha-numeric labeling that is intended to be used to identify all components of the system shall be submitted for approval by the engineer, with the submittal of equipment data sheets.

D. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

E. Phenolic name plates shall be used for identification of the Racks, Control Panel(s), Power Supply(s), Terminal Cabinet(s), and other appurtenances of each system in a logical numeric sequence. Use an alpha-numeric name of each device for each location (created by the Installing Vendor) to identify the equipment on the Shop Drawings.
   1. The size of the plate shall be two-inches high by approximately eight-inches wide. Different colors of backgrounds may be used for each System (but Red shall only be used for Fire Alarm).
   2. The text color shall be White Letters that are 3/4-inch high and are 1/2-inch in width.

F. Labeling of Cables must be provided in the following locations: EACH System Control Panel, Power Supplies, Terminal Cabinets, Terminal Strips, Racks, other system related appurtenances, and all junction boxes. Label all cables as shown on the Installing Vendors Shop Drawings.

G. All label printing shall be machine generated using indelible ink ribbons or cartridges, self-laminating labels shall be used on cable jackets, appropriately sized to the outside diameter of the cable, and placed within view at the termination point on each end.
   1. Temporary Labels: Shall consist of the following:
      a. Using a fine point permanent style marker, Sharpie® or equivalent, to write directly onto the outer jacket of the cable or use temporary tags.
      b. The Installing Vendor/Contractor shall take all precautions to use care when pulling the cable to insure the integrity of the temporary label.
      c. Remove all temporary labels and tags, prior to installing the permanent label.
   2. Permanent Labels: Labels shall be produced using an electronic labeler. Cabling shall be marked with a permanent, electronic printed label with a self-laminating clear wrapping to cover the printed label, and shall be secured to the outer jacket of the cable.
   3. Provide Brady Model XSL-116-427 or approved equal.

2.5 SYSTEM CABLES

A. All cable(s) shall be new.

B. All cable types shall be rated to meet all code requirements for site conditions, including, but not limited to; **underground, wet, plenum, and aerial requirements as mandated per N.E.C. and local AHJ requirements**. The Installing Vendor shall be responsible for insuring that all cables meet all national codes, state codes, local codes, AHJ requirements, and each equipment manufacturer's requirements, for a reliable, fully functional, and warrantable system, as intended. Do not exceed the wiring distance limitation of the equipment, device(s), cable(s) and/or conductor(s) as recommended by the manufacturer of either the equipment and/or the cables for each installation application:
   1. Use the manufacturer recommended cables for EACH application and as required by Code (i.e. Raceway, Open Cabling, Wet and/or Aerial).
   2. All cables shall be stranded, unless otherwise noted and/or recommended otherwise in writing by the manufacturer.
      a. CAT5 through CAT7 cables are excluded.
   3. See Part 3 of this section, and of each System specification for more information.

2.6 PROOF OF DELIVERY FORM

A. When providing Equipment to the Owner, the Installing Vendor shall provide the following transmittal document and obtain the necessary signatures.
   1. The Installing Vendors Transmittal Document is defined as:
      a. Company logo.
      b. Name.
      c. Address.
      d. Telephone number.
      e. Delivery date.
      f. Installing Vendors representative name that is making the delivery.
      g. Quantity of each item.
      h. Manufacturers Name and Model Number.
      i. The exact same description of the device (as used on the shop drawings).
      j. Provide a "signature" line for the Owners representative.
      k. Provide a "printed name" line, for the Owners representative.
      l. Provide a "date" line, below for the Owners representative.

PART 3 - EXECUTION

3.1 WORK ENVIRONMENT

A. General:
   1. The Installing Vendor/Contractor shall have implemented an OSHA approved safety plan at their place of business, and is a daily practice for all staff.
      a. Avoiding an injury is the primary concern for this project. Use OSHA industry standards to avoid accidents.
   2. Coordination with Other Trades:
      a. It is the responsibility of the Installing Vendor/Contractor to coordinate with all trades for this project. Maintain all requirements for; project schedule deadlines, rough in, installation, programming, training, and insuring that the Owner receives a fully functional system as defined in this specification.

3.2 APPROVED EQUIPMENT AND PERMITS

A. No equipment shall be delivered to the job site until shop drawings have been reviewed and approved by the Architect.

B. An approved set of shop drawings shall be continuously available at the job site during construction, for review by the Architect.

C. Obtain all permits as required, prior to installation of any equipment. They shall be continuously available at the job site during construction, for review by the Architect.

3.3 CABLE INSTALLATION – GENERAL

A. Open Cable installation methods are acceptable for this project when they are above accessible ceilings or in attic spaces, provided that all requirements identified in this specification are met.

B. All cable types shall be rated to meet all code requirements for site conditions, including, but not limited to; **underground, wet, and aerial requirements as mandated per N.E.C. and local AHJ requirements**.

C. Do not exceed the wiring distance limitation of the equipment, device(s), cable(s) and/or conductor(s) as recommended by the manufacturer of either equipment and/or cables for each installation application. The Installing Vendor/Contractor shall be responsible for insuring that all cables meet all equipment manufacturers' requirements for a reliable, fully functional, and warrantable system, as intended.

D. Wiring insulation shall be one of the types required by NEC 725-16.

E. Cable Supports: Clamps, "D-Rings", "J-Hooks", Hangers, and Velcro tie-wraps are all acceptable ways to support cable. However, installation of these supports must be done with care so as not to cause crushing or distortion of the cable, nor cause tighter bends than the minimum radius permitted for each type cable.
   1. See each specific Section requirements that shall be applied to this project in addition to these requirements.

F. Allowable Cable Bend Radius and Pull Tension: In general, all cables cannot tolerate sharp bends or excessive pull tension during installation. The minimum radius bend shall be ten (10) times the cable outer diameter with no tensile load applied, and twenty (20) times the cable outer diameter with a maximum tensile load of 25ft/lbs applied during installation. The Installing Vendor/Contractor is responsible for maintaining the cable manufacturers Bend Radius and Pull Tension at all times. Corrections to cable installation shall be made to the satisfaction of the Architect at no additional cost to the Owner.

G. Service Loops and Cable Management:
   1. Comb all wires for the duration of the cable run so they are neat, orderly, do not have excessive slack, and are not tangled, prior to any service loop, continuing through any service loop, continuing into EACH Enclosure(s) and/or System Rack(s).
      a. Provide a 10'-0" service loop of EACH device cable (a minimum of 2'-0" above the accessible ceiling (within 5'-0" of plan view) above EACH device.
      b. For ceilings that are open to structure, do NOT provide a service loops, except for the following locations;
         1) MDF Rooms.
         2) IDF Rooms.

3) Electrical Rooms.
4) Storage Rooms.
5) Designated system equipment locations that are NOT in view of the public.
6) Prior to rough-in, obtain Architects approval.

2. Cable Management shall be used to bundle all cables of like kind, separated by system type.
3. See Systems Plywood Backboard Cabling, listed elsewhere in this specification for more information.

H. The Installing Vendor/Contractor shall insure that communications cable is installed with care, using techniques which prevent kinking, sharp bends, scraping, cutting, deforming the jacket, or other damage. During inspection, evidence of such damage will result in the material being declared unacceptable. The Installing Vendor/Contractor shall replace all unacceptable cabling at no additional expense to the Owner.

I. The Installing Vendor/Contractor shall order and install the exact cables as specified on the Installing Vendors Shop Drawings. If at any time during the installation and through the warranty period, it is discovered that any cable other than what is called for on the Installing Vendors drawings has been installed, the Installing Vendor/Contractor shall remove all effected cables and shall provide and install the correct cable, as required. The Installing Vendor/Contractor shall also provide the staff to monitor the building during the cable replacement period until the System is fully operational to the satisfaction of the Architect, without any additional cost to the Owner.

J. All horizontal cables shall be supported at a maximum of 4’-0” intervals with UL approved devices. At no point shall cables rest on, be tied to or otherwise secured to electrical conduit, plumbing, ventilation ductwork, accessible ceiling and/or light fixture hangers, or any other equipment. Cable shall be secured to building supports or wire hangers (at the structures ceiling) specifically designed to support cables and/or to additional blocks or anchors specifically installed for this purpose.

K. All open cabling and/or conduit shall be installed parallel or perpendicular to the structure. Open cable installations shall use insulated mounting supports or rings approved for such use. Wiring shall be installed near or on structural members as to minimize risk of physical damage by other trades or maintenance personnel servicing the equipment.

L. Installing open cabling and/or conduit on an exposed area of wall that could have been installed in a less conspicuous manner, especially where art or murals are to be painted is NOT acceptable. Any installation that does not meet this requirement will be required to be removed, and to patch and paint to match adjacent surfaces to the satisfaction of the Architect. Then install the conduit, fasteners, and wire as required by the project, at no additional cost to the Owner in an acceptable manner that meets with the Architects approval. Obtain direction from the Architect prior to rough-in, for areas that need clarification.
1. In some cases, it may be more aesthetically appealing to install conduit down the wall to the floor and either through the floor or along the floor, to be less conspicuous. Contact the Architect for further clarification.

M. Conduit type and areas where conduit will be required for this project are:
1. Provide EMT metal raceway in the following areas:
a. Always conceal conduits within walls and/or ceiling spaces wherever possible.
b. Where required by code. Provide conduit in all areas required by Code, but no less than the following locations.

c. To Accessible ceiling spaces. Provide conduit from the device to accessible ceiling space where:
   1) Devices are wall mounted.
   2) Are located on hard lid ceiling.
   3) In an inaccessible area. An inaccessible area is defined as less than 2'-0" from an accessible ceiling tile.

d. Unoccupied areas exposed to view. Unoccupied areas are defined as places that staff or the public will be in the room or area for only a few minutes, with the exception of service/maintenance personnel.
   1) This includes, but is not limited to:
      a) Mechanical rooms
      b) Electrical rooms
      c) Storage rooms
      d) Utility Room
      e) Janitorial Closet
      f) Other unoccupied rooms
   2) Install conduits to an accessible ceiling space, as defined above.
   3) Consult with the Architect for further clarification.

2. Provide conduit, junction boxes, couplers, connectors, cabling and terminations as recommended by the manufacturer and as required by code.
3. Fill Requirements: Conduit, conduit sleeves, raceways, floor boxes, device boxes, mud rings, etc., shall be furnished and installed per the Division 26 requirements. Maintain all Conduit Code Fill Requirements, and provide no less than an additional 40% spare capacity for future growth.
4. Conduit and Raceway Usage: All communications cable shall be dedicated for communications purposes, and not to be shared with other electrical wiring when required by code. Obtain written approval from EACH of the manufacturers if more than one system type is going to be installed in a single conduit.
   a. Fire Alarm Cabling shall be in a separate, dedicated raceway (where indicated on the drawings).
5. Pull Cords: Provide Nylon type pull cords in EACH Conduit raceway.
6. Provide surface mounted raceway in the following areas (For Retrofit/Remodels or as directed by the drawings or Architect):
   a. Occupied areas exposed to view. Occupied rooms. Generally, occupied areas are defined as places that staff or the public will be in the room or area for more than a few minutes.
      1) This includes, but is not limited to:
         a) Administrative areas.
         b) Office space(s).
         c) Other occupied rooms.
   b. Install conduits to an accessible ceiling space, as defined above.
   c. Size conduit(s) as required.
   d. Consult with the Architect for further clarification.
7. Surface mounted conduits of any kind may only be installed after every attempt has been made to conceal wiring and/or conduits specified within this document. Obtain prior approval from the Architect, before installing surface-mount conduit.
8. Prior to installation, contact the Architect if these instructions are not clear, or field conditions require further clarification of the intent of the installation.

N. Cable Lubricants: Lubrications specifically designed for installing cables may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned of lubricant residue.
   1. Recommended Products:
      a. Dyna-Blue.

b. American Polywater.
c. Horizontal Cabling:

O. Horizontal cable terminations shall be made at the appropriate patch panel and labeled as noted on the Outlet Schedule. At each outlet box, a sufficient length of spare cable shall be provided for terminating outlet devices such that the outlet can be easily removed and inspected. In addition, each cable shall be terminated as indicated below:
1. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-C document, manufacturer's recommendations and/or best industry practices.
2. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
3. The cable jacket shall be maintained as close as possible to the termination point.

P. Systems Plywood Backboard Cabling:
1. Cable shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate backboard space is available for current and future equipment and for cable terminations. Cables shall NOT be tie-wrapped to existing electrical conduit, existing cables, or other equipment. Minimum bend radius shall be observed.
2. Install cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Lace, Plastic or Velcro tie wrap all similarly routed cables together, and attach to the outside edge(s) of the backboard vertically and/or horizontally, then route via "square" corners over a path that will offer minimum obstruction to future installations of equipment and/or other cables.
3. See "Service Loops and Cable Management" listed within this specification for additional information.

3.4 SYSTEMS PLYWOOD BACK BOARD(s)

A. Systems plywood back board(s) shall be used to mount enclosures of any kind, to any wall or surface. The systems plywood backboard shall be securely fastened to the walls to accommodate no less than ten times the total weight of the equipment to be mounted. The systems plywood backboard shall be a minimum of 3/4", APA exterior grade Douglas Fir A-C, and fire retardant with a flame spread rating not more than 25 when tested according to ASTM E-84. Provide the systems plywood backboard from the floor up to ceiling height (not exceeding 12'-0") on all walls shown, unless otherwise noted. The entire backboard shall be painted with three (3) coats of fire retardant paint (the color shall match the adjacent surface). EACH enclosure, when mounted, shall bear a minimum of 150 pounds weight on the enclosure.

B. Mounting of equipment shall be logically placed, and shall be located at the top, bottom, left, or right portion of the systems plywood backboards to accommodate future growth of the system. Under no circumstances will the equipment be allowed to be mounted in the middle of the backboards.

3.5 GROUNDING

A. Ground all equipment per the Manufacturers recommendations, per Division 26 and as required by Code.

B. Provide grounding and bonding per ANSI-STD-J-607-A.

C. Provide (1) #3/0 green insulated copper grounding conductor in 1" conduit from the Main Electrical Room MDB Ground Busbar to the Main Distribution Frame (MDF) Telecommunication Main Grounding Busbar (TMGB).

D. Provide (1) #3/0 green insulated copper grounding conductor in 1" conduit between the MDF Room TMGB and EACH designated Intermediate Distribution Frame (IDF) location shown on the drawings and terminate on the Telecommunication Grounding Busbar (TGB).

E. Provide (1) #3/0 green insulated copper grounding conductor in 1" conduit between the EACH designated Intermediate Distribution Frame (IDF) location shown on the drawings and terminate on the Telecommunication Grounding Busbar (TGB).

F. See Section 272000 "TMGB and TGB (Telecommunication Grounding Busbars)" for additional Grounding requirements.

3.6 DEVICE RELOCATIONS

A. Device location may be changed prior to installation, within 15'-0" without extra charge, if so desired by the Architect.

3.7 INSTALLATION

A. Provide all equipment, wiring, conduit, and outlet boxes required for the installation of a complete, fully functioning, operating system in accordance with applicable local, state, national codes, AHJ requirements, the manufacturer's recommendations, these plans and specifications. All circuits not in conduit must be wired with UL listed power limited cable under NEC 725, Class II wiring. Plenum cable shall be utilized in all return air plenum ceilings.
   1. Color coded wires shall be used throughout.
   2. Wiring shall conform to the National Electrical Code Article 725.

B. Provide 120vac wiring and connections to the Control Panel(s), EACH Amplifier(s), CPU(s), DVR(s), and Power Supply(s) as required for a fully functional system, while maintaining all of the design requirements described elsewhere within each system specifications. At a minimum, this shall include the following;
   1. Multiple Power Supplies and/or the Control Panel(s) may be placed on the same circuit, while maintaining all code mandated load calculations, but shall be on circuit(s) that is dedicated for EACH System.
      a. Consult with the Architect to verify load calculations meet all code requirements.
      b. Install 120 VAC wiring and conduit as specified in Division 26.
      c. Show on the As-Built drawings, the location of each panel board that is being used to power any System equipment, and, at the panelboard, list each panelboard circuit for each system (i.e. Panelboard "x", circuit 12=FAPS-3; Circuit 14=IACP).

C. Maintain all fire wall ratings, as required.

D. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.

E. EACH manufacturer's authorized representative shall provide on-site supervision of the installation for EACH of the systems equipment for the duration of the project. This includes programming, training, and the Owners ability to use the Complete System Functionality as it was designed.

F. Install wire guards at locations as shown on the drawings and as described elsewhere within these specifications.

G. Every attempt shall be made to avoid running telecommunications close to (less than 2'-0") and/or parallel to other communication cables in the building, all lighting, and conduits containing 120vac (or greater). This shall be to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation-mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures. Avoid crossing areas horizontally just above or below any conduit and/or riser. Route cables in such a manner to allow other cables to enter the conduit and/or riser without difficulty at a later time by maintaining maximum distance from these openings. Maintain all recommended distances from other cables, as required by the manufacturer. Install cable to whichever of these two requirements are more stringent.

H. Room numbers shown on plans are architectural designs numbers for construction purposes. These numbers are NOT to be used for programming. Final system programming shall reflect the final room numbering plan and actual room signage, unless directed to otherwise in writing or as specified in another specification section. Update the As-Built Drawings to reflect the final room numbering plan and actual room signage.

3.8 MOUNTING HEIGHTS, LOCATIONS, AND SETTINGS

A. Install all equipment as recommended by the Manufacturer.

B. The installation of EACH device, enclosure, and/or control panel shall be installed so that the Maintenance Staff will be able to access, test and/or replace any component of the system. If this installation does not meet this requirement to the satisfaction of the Architect, it will not be accepted. The Installing Vendor/Contractor shall be required to remove the item, patch and paint the area to the satisfaction of the Architect, and reinstall the device, enclosure, or control panel as required to make the system easily maintainable and acceptable, at no additional cost to the Owner.

C. Control Panel(s), Power Supply(s), and Locations:
   1. Mount Control Panel(s), Power Supplies, and Enclosures (provide quantities as required) with approximately two inches of separation between the enclosures.
   2. Each enclosure, when mounted, shall meet the following criteria;
      a. Conduit shall not enter any enclosure or panel, except where conduit entry is approved by the manufacturer.
      b. Chase nipple the enclosures together. At a minimum, use two (2) 1½" conduits. Size and/or provide additional conduits as required. Provide conduits between enclosures to accommodate an additional 100% conduit fill while maintaining all NEC requirements. Avoid installing chase nipples where batteries are to be installed (contact the manufacturer and/or the Installing Vendor prior to drilling any holes). Any chase nipples installed where batteries are to be located will be rejected, and require the reinstallation as specified, up to and including installing new enclosures.
      c. The bottom of the chase nipples shall be a minimum of two-inches above the location where any batteries are to be installed.
      d. EACH enclosure door shall be able to open no less than 105°.
      e. The top of each enclosure shall be mounted at the same height of 60-inches above the finished floor and shall be level.
      f. If changes to the above requirements are preferred, contact the Architect for approval prior to rough-in.

D. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (IE: devices shall not be supported solely by suspended ceilings). Fasteners and supports shall be able to support the no less than four times the weight of the equipment and/or device.

E. Rack Equipment: EACH Rack shall be securely attached to the floor and/or wall using the manufacturer's recommended mounting hardware.

F. See each system specification for additional mounting information.

3.9 FLUSH MOUNT AND SURFACE MOUNT EQUIPMENT AND ENCLOSURE LOCATIONS

A. Prior to rough-in, consult the Architect for clarification for Flush Mount and Surface Mount locations.

B. Flush mounted equipment and enclosures shall be installed in areas where the rooms are finished such as Administrative Areas, Offices, Work Rooms, Break Room and Corridors. Provide the appropriate finish work around each enclosure as required. This type of equipment includes, but is not limited to the following:
   1. Enclosures: Typically are Control Panels, Power Supplies, etc.
      a. Provide the manufacturers flush mount Trim Rings, Adapters, and/or Brackets for this type of equipment.

C. Surface mounted equipment and enclosure shall be installed in areas where the rooms are NOT finished such as Electrical Rooms, MDF/IDF Rooms, Mechanical Rooms, or Utility Rooms. Unless otherwise noted, this equipment shall be installed on the Systems Plywood Back Boards. This type of equipment includes, but is not limited to the following:
   1. Enclosures: Typically are Control Panels, Power Supplies, etc.
   2. Punch Blocks: Typically are used with Telephone PBX and Intercom equipment.
   3. Wall Mounted and Floor Mounted Racks.

3.10 NUMBERING AND LABELING

A. Phenolic Plates:
   1. Install phenolic plates at each of the Control Panel(s), Power Supply(s), Terminal Cabinet(s), and Rack(s).
      a. All phenolic plates shall be secured to each enclosure with rivets.
      b. Install each plate 1" from the top of the enclosure, and be centered on the door. Relocate as required to avoid interfering with equipment or components within the enclosure or that may prevent the enclosure door from closing properly. The location of the phenolic plates shall be consistently installed in the same location on each system enclosure, at EACH location.

B. Terminal Cabinets:
   1. Label each termination point on the inside of EACH enclosure door. All information shall be legible, as defined by the Architect.

C. Addressable Devices/Address Point Labels (where applicable):
   1. Install the Address Label for each addressable device on or near the device. Verify with the Architect, prior to installation.
   2. Clean the surface from dust, grease, or lubricants as recommended by the manufacturer of the label.

3. The addressable label shall be able to be viewed by the general public when standing on the ground.
   a. Prior to Installation, coordinate with the Owner's Representative for exact location of how and/or where to mount the address label for EACH device type to fulfill this requirement, prior to installation.
4. Provide the following address label format:
   a. The background shall be clear (see through).
   b. The text shall be Black in color, and a minimum of ½" tall.
   c. Use Brothers or P-Touch models to produce the label.

3.11 WIRING

A. For consistency of wiring throughout the entire system equipment, if specific conductor colors are not called out in EACH system specification, then the following colors shall apply:
   1. Red is (+) Positive voltage or data bus (+) positive.
   2. Black is (-) Negative voltage or data bus (-) negative.
   3. White is common.
   4. Green is normally open or normally closed.

B. Wiring within EACH enclosure shall have the outer jacket of the cable removed to within three-inches of the cable entering the enclosure. Individual conductors from each jacketed cable shall be spirally twisted to keep them together, until they are routed into each appropriate individual terminal. Route all conductors parallel with the walls of the enclosure, make 90° turns within the enclosure, and always keep a two-inch minimum spacing from any circuit board and/or terminals.
   1. Labeling of Cables.
      a. Prior to installing any label, clean each cable with the appropriate cleaner to remove any pulling compound residue, grease, oil, dirt, etc. in order for the label to properly adhere to the cable jacket.
      b. The Label shall indicate the Device or Outlet and the area or wing of the building that the cable is being routed from. The Label shall also indicate the MDF Room or designated IDF location that the cable is being routed to.
      c. Each label shall be located on each cable that enters any enclosure or junction box, and shall be easily visible and readable.
      d. The cable numbering system shall be consistent with shop drawings.

C. End-of-Line (EOL) Resistors: Each device that is capable of being supervised by the Control Panel and/or Power Supply shall be supervised. Install equipment and/or program as required.
   1. Indicate on the As-Built drawings where EACH of the End-Of-Line Resistors is located.
   2. Each End-of-Line Resistor shall be installed at the last device on each circuit. Locating the EOL in the Control Panel and/or Power Supply is NOT acceptable.

D. The telephone dialer connections and Ethernet WAN connections shall be made by the Installing Vendor. Coordinate with the Owner for scheduling the Owners IT Department to supervise all terminations and connections.

E. All wiring routed under slab or underground shall be suitable for wet locations.

F. The Installing Vendor/Contractor shall clean all dirt and debris from the inside and the outside of EACH enclosure after completion of the installation, and prior to any testing being performed.

G. All circuits shall be identified in accordance with table below and all labels shall include wire type, quantity and circuit number. Wire code shall match approved shop drawings wire code.

Table
Example: C2HX3
C = Signal Circuit Wire
2 = Signal circuit number
H = LCD Keypad wire
X = Addressable initiating device circuit wire
3 = Addressable initiating device circuit number

3.12 SPLICE CONNECTORS AND CONNECTIONS

A. All references to splices are for cables that are 50 volts or less.

B. A continuous cable run without any splices is the preferred method. When a splice is required the following information shall apply.
   1. Cable splices are only allowed in accessible, dry locations, in a junction box or terminal cabinet suitable for the purpose. The only exception is for field devices that have wire leads (i.e. Pigtail) and require a connection of two wires at the device.
      a. Each cable end that is spliced must be labeled, as specified. (i.e.: At the splice point, “From FACP in MDF Room XXX” on one cable, and “To the East Wing RCAP” on the other cable).

C. All splices shall be performed in one of the following methods:
   1. Wire nuts shall NOT be used on this installation, will be deemed unacceptable, and shall be removed and installed as outlined below.
   2. In Junction Boxes:
      a. Either one of the following Splice Methods are acceptable:
         1) Use the Tool-less Terminal Strip, Model Number SSU00470 (Black) or SSU00471 (White), and SSU00465 (the Back Box Bracket) for use with extra deep 4S boxes. This equipment is manufactured by Space Age Electronics.
         2) Use Model DC-100-S Blue Dolphin Connectors (with Sealant), Manufactured by Dolphin Components Corporation, on all splice connections that are size 18 gauge or less. The rubber coated outer jacket of the inch-long connector shall contain non-curing sealant that fills the crimp cavity when crimped. Strip the color coded outer jacket of each individual conductor that is going to be crimped, approximately 1/8-inch shorter than the length of the crimp connector, so that when the conductors are inserted all of the way in the connector, no bare wires (or any strands of wire) are exposed or visible out of the connector.
   3. In Terminal Cabinets:
      a. In Terminal Cabinet(s) with each conductor to be landed on a separate terminal.
      b. Indicate on the Shop Drawings and As-Builts, the locations of EACH Terminal Cabinet.
      c. Maintain the “Spare Capacity” requirements, as specified.
   4. At Field Devices (where the device has wire leads and not a terminal strip).
      a. Use Model DC-100-S Blue Dolphin Connectors as described above.
   5. Spare or unused conductors shall be:
      a. Landed on terminal strips.
      b. Shall have the Blue Dolphin Connectors crimped on the end of each conductor.
         1) Field devices with pigtails shall have a Blue Dolphin Connectors crimped on the end of any unused conductor(s).

D. All conductors, if spliced, shall be ONLY spliced to the same gauge size and color of conductor. Changing of gauge size or color at any point within any cable run is strictly prohibited, and all cables will be replaced at no additional cost to the Owner, and to the satisfaction of the Architect.
   1. If the field device has wire leads, then wire as necessary at the device for proper operation. Indicate the color code change on the shop drawings per point wiring diagrams. Update any and all changes to the drawings, for accurate as-builts.

3.13 ON-SITE SYSTEM INFORMATION BINDER ENCLOSURE

A. The Installing Vendor shall install the wall mount enclosure that is labeled "(Section Title here) information". The enclosure shall be located in the administrative area or the MDF room. Verify the exact location with the Architect, prior to installation.

B. The enclosure shall have a Site specific manual, in a "D" style 3-ring binder with an 18-inch heavy-duty chain securely fastened to the inside of the enclosure.

C. See "As-Built Documentation" for more information.

3.14 TESTING & COMPLETE SYSTEM FUNCTIONALITY (SPECIFICALLY FOR THE FIRE ALARM SYSTEM ONLY)

A. The installing vendor shall notify the Architect a minimum of five (5) business days in advance of testing.

B. The warranty shall NOT begin until the following conditions have been met:
   1. Fire Alarm System Testing:
      a. The Installing Vendor shall provide two-way communication devices for their own staff, each Owners Representative, and the Architect, so that all parties can communicate as required to perform all tests.
      b. Completely fill out the 2007 Edition NFPA Fire Alarm System Record of Completion document.
      c. Obtain the AHJ signature, printed name, date, and telephone number on the Record of Completion.
      d. Obtain the AHJ signature, printed name, date, and telephone number on the Fire Alarm Permit.
      e. If the Installing Vendor fails the Fire Marshal Inspection, the following shall occur;
      f. The Installing Vendor shall make all of the necessary corrections as required, to pass the AHJ testing and inspection. Then, notify the AHJ and schedule another test, and continue making corrections until the Fire Alarm System has been accepted by the AHJ.
      g. The Installing Vendor is subject to the Close Out requirements as specified in Section 200000, Schedule of Values.
   2. As-builts:
      a. Refer to the "As-Built Documentation" of this specification for more information.
   3. Training:
      a. Refer to Section 283176 for the Training Requirements as described in "Training Materials".
   4. Complete System Functionality:
      a. After ALL the above conditions have been met, and includes each of the required signatures, this shall then be deemed that the Owners ability to use the Complete System Functionality as it was designed.

5. Warranty:
   a. The Warranty period shall now begin, and the initiating date of the Warranty period shall commence on the date of the Owners ability to use the Complete System Functionality as it was designed. Refer to the “Warranty” of this specification for more information.

C. Upon completion of the installation, testing, and Instruction & Training, the Installing Vendor shall provide the following Signed Test Forms, in the as-built documentation as required.
   1. The signed original Record of Completion
   2. The signed original Fire Alarm Permit

3.15 TESTING & COMPLETE SYSTEM FUNCTIONALITY

A. Electronic System Testing:
   1. After all equipment specified herein for the system has been completely fabricated and wired and is in operating condition in the Sound System Installing Vendor's shop, performance tests shall be conducted by the Sound System Installing Vendor on the system to determine if the installation and components comply with these specifications.
   2. The following test shall be performed and the system shall be made to meet each listed performance criterion:
   3. Overall frequency response of the complete electronic system (unequalized) shall be 20 to 20,000 Hz +2 dB. Equalizing circuits shall be temporarily set in the indicated "flat" position.
   4. Total harmonic distortion from microphone input to power amplifier output at rated power shall be less than 1% for the frequency range of 20 to 20,000 Hz
   5. The overall broadband hum and noise from 20 Hz to 20 kHz using 6 dB/octave filter at 12.47 kHz shall be at least 65 dB below the rated output from system input to output.
   6. The total system shall be installed from microphone to loudspeaker in Absolute Polarity. A positive pressure on the microphone shall produce a positive pressure from the loudspeaker.

B. Acoustical Testing:
   1. After all electronic equipment specified herein is fully installed at the job site and the speakers are fully installed, the system shall be equalized and acoustically tested by the Sound System Installing Vendor utilizing the Real Time testing technique. Personnel, test equipment, complete report, and signing shall be as described.
   2. The speakers shall be oriented and sound levels set to provide an even distribution of the Sound Field frequency response of 250 to 10,000 Hz throughout the seating area.
   3. Provide equalization to DSP (when applicable) to attain frequency response that is within +3 dB from 100 to 10,000 Hz with a 6 dB roll off below 80 Hz and above 12,500 Hz, at any seat in the audience covered by the loudspeakers.
   4. The system shall deliver a minimum of 85 dB average program level with additional 10 dB peaking margin to any seat in the audience at distortion level below 1% THD over the specified frequency range.

3.16 WARRANTY

A. See “Testing & Complete System Functionality”, listed elsewhere in these specifications, to establish the requirements and confirm when the actual warranty period shall begin.

B. The Installing Vendor shall include in the pricing of their bid that they will honor and provide EACH of the manufacturers Full Term Warranty period for the provision of replacement equipment for EACH individual device and/or component provided for this project. The completed and fully functional System, including wiring, installation, and all equipment shall be free from inherent mechanical and electrical defects. At a minimum, this shall be no less than one (1) year from the date of Complete System Functionality as defined in "Testing & Complete System Functionality" portion of this specification. Warranty service for the on-site replacement of equipment shall be provided by the system supplier's Manufacturer trained representative during normal working hours, Monday through Friday, excluding holidays, and respond for service no later than the following business day after the call was received.

C. When the manufacturer's warranty exceeds one year, the Installing Vendor shall be responsible for replacing the actual component or device for the Full Duration of the manufacturer's warranty, if the Owner or their representative chooses to take the item to the Installing Vendors place of business. If the Owner chooses to have the Installing Vendor provide on-site service, then the Installing Vendor is entitled to their standard published (or negotiated) labor rates and miscellaneous material items to replace the damaged warranty item.

D. The Installing Vendor who is authorized to provide Warranty Service for this project is defined in "Quality Assurance" located in Part 1 of this specification.

3.17 AS-BUILT DOCUMENTATION

A. The following documentation must be completed to the satisfaction of the Architect, in order to fulfill the Close Out requirements as specified in Section 260000, Schedule of Values.

B. All electronic and hard copy information submitted to the Owner shall immediately become the Owners property to use as best determined by the Owner, without any compensation to any party.

C. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings).

D. Operation and Maintenance Manuals: The Installing Vendor/Contractor shall provide three (3) sets of detailed Operation and Maintenance manuals in a "D" style 3-ring binder. The binder shall be sized to allow for 20% additional documentation. The spine of the binder shall have a clear cover with an insert clearly typed with the following label: "(Project Name, Section Number, and Section Title here) Operation and Maintenance Manual". The binder shall have a clear front cover with an insert clearly typed with the title of the spine on the binder, located at the top of the page, and centered. The following information shall also be included on the front sheet of the binder; the Project Name and Project Number, Specification Section Number and Section Title, the Owners name, the Site Name and Site Address, the Installing Vendors Name, Address, and Contact Name. These O & M Manuals shall include the following;
   1. Use color-coded numbered tabs to separate each item defined below and for each device that was installed.
      a. Provide these items in the following order.
         1) Provide an 8½" x 11" clear heavy plastic sheet in front of a Table of Contents page as the first page of the binder indicating each of the equipment or device documents contained in each tab section.
         2) The System Software User Guide.
         3) The Web Server "Web-based" software User Guide.
         4) The System Control Panel LCD Display User Guide.
         5) The Remote LCD Display User Guide (Where Applicable).

a) Provide Step-By-Step instructions for typical Basic Operation of EACH System.

6) Warranty information. The Installing Vendor shall provide Warranty information in the form of a matrix from left to right, list the following information:
   a) Use the symbol on the Legend of the contract drawings.
   b) List the actual manufacturer's name of each device shown on the Installing Vendors shop drawings.
   c) List the actual manufacturer's model number of each device shown on the Installing Vendors shop drawings.
   d) Provide the description of the device that is used for each symbol on the legend.
   e) On the matrix, indicate recommended testing frequency for each item.
   f) State the Manufacturers Full Term of the Warranty for EACH control panel, EACH power supply, and EACH device provided.
   g) Indicate where the Owner may purchase each of these devices. Provide the Business Name, Address, City, State, Zip Code, Phone Number, and list two (2) contact names.
7) A reduced copy (11"x17") of record drawings. Enlarge all notes, text, and symbols to a legible (as defined by the Architect) reading format.
8) Provide one (1) original and two (2) copies of the "Spare Parts Proof of Delivery" form that was signed by the Owners representative.
9) A printed copy of the final completed version of the (Section Number and Section Title here) technical configuration, and this document shall be dated.
10) A printed copy of the final completed version of the (Section Number and Section Title here) software 'point status report' (where applicable), and this document shall be dated.
11) Update the matrix as defined in the 'System Device Naming Matrix' for each specification section, to correct any changes that may have occurred through the course of this project. This list shall follow the above equipment list.
12) The technical date sheet for each Control Panel, Power Supply, Terminal Cabinet, field device and component installed. Use a separate tab for each of these that were supplied and/or installed.
   a) Include all testing documentation and the procedure to properly test each device. Put this document immediately behind the respective technical data sheet.
   b) Include the installation manual for each device that was installed. Put this information immediately behind the testing documentation.
13) Provide one (1) original and two (2) copies of the AHJ approved document(s).
14) Provide one (1) original and two (2) copies of the completed documents:
   a) The (Section Number, and Section Title here) - Operational Test Form.
   b) The (Section Number, and Section Title here) - Performance Test Form.
   c) The approved Governing Acceptance Form - (Section Number, and Section Title here).
   d) If the Governing Acceptance Form has not been approved, accepted, and signed by the Architect, this binder will be rejected.
15) Each binder shall not exceed three-inches in width. Use multiple binders as required. Indicate Volume 1 of X, Volume 2 or X, etc.

16) Provide the above information on six (6) CD's and label each one (with a PC generated label) "(Owners Name, Project Name, Section Number, Section Title, and the current date goes here) - Operation and Maintenance Manuals, Data Sheets, Documents, and As-Built Shop Drawings". Organize the manuals, data sheets, documents, and drawings into separate folders.
   a) Include on EACH system CD provided, the AutoCAD As-Built Drawings, located elsewhere in these specifications.
   b) EACH of the three (3) Operation and Maintenance Manuals shall have one CD securely fastened inside.
   c) Provide three (3) CD's for general As-Built documentation for the project.

E. On-Site System Information Binder: The Installing Vendor shall provide Individual Site Manual, in a "D" style 3-ring binder with an 18-inch heavy-duty chain securely fastened to the inside of the "(Section Title here) information" enclosure. See the "On-Site System Information Binder Enclosure" listed elsewhere in these specifications, for the enclosure information and location. The binder shall be sized to allow for 20% additional documentation. The spine of the binder shall have a clear cover with an insert clearly typed with the following label: "(Section Title here) information". The binder shall have a clear front cover with an insert clearly typed with the title of the spine on the front sheet, located at the top of the page, and centered. The following information shall also be included on the front sheet of the binder; the Project Name and Project Number, Specification Section Number and Section Title, the Owners name, the Site Name and Site Address, the Installing Vendors Name, Address, and Contact Name. Each binder shall include the following;

1. Use color-coded numbered tabs to separate each item defined below and for each device that was installed.
   a. Provide these items in the following order.
      1) Provide an 8½" x 11" clear heavy plastic sheet in front of a Table of Contents page as the first page of the binder indicating each of the equipment or device documents contained in each tab section.
   b. The Installing Vendor shall coordinate with the Owner to obtain the information listed below. A single sheet shall list the following items:
      1) The Site Name and Site Address.
      2) State **"In case of emergency *during* regular business hours:** (list the appropriate name and telephone number)". List the Owners Representative who should be contacted during regular business hours.
      3) State **"In case of emergency *after* regular business hours:** (list the appropriate name and telephone number)". List the Owners Representative who should be contacted after regular business hours.
      4) List the following information (where applicable). State "The monitoring of the (Section Title here) is being monitored by (list the name of the central monitoring station here), Phone Number: (list the central station phone number here) Account # (enter the account number here)".
   c. Provide each of the items identified in the operation and Maintenance Manuals, with the following exceptions. Do NOT provide:
      1) Spare Parts Proof of Delivery form.
      2) As-built Operation and Maintenance CD's of the project.

F. As-Built Drawings: The Installing Vendor shall provide three (3) sets of hard copy As-Built drawings. Drawings shall be the same size that were issued for the shop drawings and clearly indicates the following:

1. Update the Shop Drawings:
   a. To address any changes, including but not limited to the Riser, point-to-point wiring diagrams, and mounting details.

b. To accurately reflect the final installation of equipment and devices that were relocated, added or removed.
c. Update the matrix as defined in the 'System Device Naming Matrix' of the specification, to correct any changes that may have occurred through the course of this project.
d. Actual routing of all raceways.
e. Actual routing of all Open Cables.
f. Actual cable type, color, and numbers.
g. Actual splice locations.
h. Actual system wiring diagrams, connection diagrams, and interface of all components in the system.
i. Provide scale drawings of the internal components of the main panel, and each power supply. Show each circuit number coming from the terminals of each Control Panel and/or Power Supply.
j. Actual room number and programming addresses (where applicable) for all components in the system.
k. Show on the As-Built drawings the location of each panel board that is being used to power any System equipment, and list each panel board circuit used (at the device that is connected to that circuit. IE: FACP or FAPS).
l. Indicate on the As-Built drawings where EACH of the End-Of-Line Resistors is located.
m. Provide all updated As-Built drawings in AutoCAD™ 2004 format (or newer) and put this electronic files on the Operation and Maintenance Manuals CD, as described elsewhere in these specifications.

G. Provide all As-Built Documentation to the Architect prior to any Training and no less than ten (10) business days prior to project completion.

H. Any re-submittal(s) shall be provided at the Installing Vendor/Contractors expense.

Sample WIRE LEGEND													
CONDUIT/RACEWAY SINGLE CONDUCTOR								OPEN CABLE					
LETTER	FUNCTION	CONDUCT OR COLOR	AWG	QTY	TYPE	CABLE MFR	CABLE MFR PART #	CONDUCT OR COLOR	AWG	QTY	TYPE	CABLE MFG	CABLE MFR PART #
A	ADDRESSABLE INITIATING CIRCUIT	- BLACK	#16	1	THWN-SOLID				#16/2	1	16/2 – FPLP		
		+ RED	#16	1									
B	ADDRESSABLE INITIATING CIRCUIT LOOP	- BLACK	#16	2	THWN-SOLID				#16/2	2	16/2 – FPLP		
		+ RED	#16	2									
C	HORN/STROBE CIRCUIT	- BLUE	#14	1	THWN-SOLID				#14/2	1	FPLP		
		+ WHITE	#14	1									
D	HORN/STROBE CIRCUIT LOOP	- BLUE	#14	2	THWN-SOLID				#14/2	2	FPLP		
		+ WHITE	#14	2									
E	CONVENTIONAL INITIATING CIRCUIT	- BLACK	#16	1	THWN-SOLID				#16/2	1	16/2 – FPLP		
		+ YELLOW	#16	1									
F	CONVENTIONAL INITIATING CIRCUIT LOOP	- BLACK	#16	2	THWN-SOLID				#16/2	2	16/2 – FPLP		
		+ YELLOW	#16	2									
G	24V DC POWER CIRCUIT	- BLACK	#14	1	THWN-SOLID				#14/2	1	FPLP		
		+ RED	#14	1									
H	SPEAKER CIRCUIT	RED	#14/2	1	TWISTED SHIELDED FPLP W/ DRAIN				#14/2	1	TWISTED SHIELDED FPLP W/ DRAIN		
I	SPEAKER CIRCUIT LOOP	RED	#14/2	2	TWISTED SHIELDED FPLP W/ DRAIN				#14/2	2	TWISTED SHIELDED FPLP W/ DRAIN		

Sample
WIRE LEGEND

CONDUIT/RACEWAY SINGLE CONDUCTOR								OPEN CABLE					
LETTER	FUNCTION	CONDUCT OR COLOR	AWG	QTY	TYPE	CABLE MFR	CABLE MFR PART #	CONDUCT OR COLOR	AWG	QTY	TYPE	CABLE MFG	CABLE MFR PART #
J	ANNUNCIATOR CIRCUIT	BROWN BLUE	#16 #16	1 1	THWN-SOLID				#16/2	1	16/2 – FPLP		
		- BLACK	#14	1					#14/2	1	FPLP		
		+ RED	#14	1									
K	FIREMANS PHONE CIRCUIT	RED	#18/2	1	18/2 TWISTED SHIELDED FPLP W/ DRAIN				#18/2	1	18/2 TWISTED SHIELDED FPLP W/ DRAIN		
L	FIREMANS PHONE CIRCUIT LOOP	RED	#18/2	2	18/2 TWISTED SHIELDED FPLP W/ DRAIN				#18/2	2	18/2 TWISTED SHIELDED FPLP W/ DRAIN		
M	CONTROL CIRCUIT	- PURPLE	#14	1	THWN-SOLID				#14/2	1	FPLP		
		+ ORANGE	#14	1									
N	SPARE CONDUCTORS	- PURPLE	#14	2	THWN-SOLID				#14/4	2	FPLP		
		+ ORANGE	#14	2									
ADD PROJECT SPECIFIC NOTES HERE								ADD PROJECT SPECIFIC NOTES HERE					

END OF SECTION 270000

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 SCOPE

A. The installation shall include innerduct, fire rated penetration assemblies, conduit, cable tray, and wire management

B. The bonding of metallic raceways

C. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "good quality" means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

D. The system shall meet ALL of the requirements listed in Section 270000 Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

E. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 270528 includes, but is not limited to the sections identified in Section 270000.

1.3 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work specified in this Section.

B. Applicable Standards: All work shall be performed in accordance with the latest revisions of the following standards:
   1. National Electrical Manufacturers Association:
      a. NEMA FG 1 - Fiberglass Cable Tray Systems.
      b. NEMA VE 1 - Metal Cable Tray Systems.
      c. NEMA VE 2 - Cable Tray Installation Guidelines.
   2. NFPA 70: National Electrical Code
   3. ANSI/TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises
   4. ANSI/TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
   5. ANSI-J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.4 QUALITY ASSURANCE

A. Installing Contractor Qualifications:
1. Work in this section shall be performed by a licensed and bonded low voltage Installing Contractor with a minimum of five years' experience in the installation and maintenance of high speed data and voice networks. Only Installing Contractors whose primary business is that of installing, maintaining, troubleshooting, and testing Telecommunication Infrastructures shall perform this work.
2. License Classification: Installing Contractor must possess a valid Washington State 06 Electrical Low Voltage License.

1.5 GOVERNING CODES AND CONFLICTS

A. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.

1.6 PROJECT CONDITIONS - ARCHITECTURAL PLANS

A. The Installing Contractor shall carefully coordinate the various symbols utilized on the drawings and shall consult the architectural plans to determine ceiling and floor types in the various areas.

1.7 SUBMITTALS

A. Refer to specification 27 0000 Low Voltage Systems General Requirements, for additional data sheet submittal requirements and the shop drawing submittal requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See Section 270000 Low Voltage Systems General Requirements for additional requirements.

B. The Installing Contractor shall review the Site Plans, Floor Plans, Riser Diagrams, and Detail Sheets for additional work that is required to be performed by the Installing Contractor of this section.

2.2 COORDINATION

A. Refer to "Installation of Owner Furnished Equipment" for additional coordination and installation requirements.

B. Refer to "Submittals" for additional coordination requirements.

2.3 ADDITIONAL REQUIREMENTS.

A. Refer to "As-Built Drawings" listed elsewhere in this specification for additional equipment required for this project.

2.4 SEISMIC BRACING

A. Provide Seismic Bracing as required by the AHJ.

B. This includes, but is not limited to:
   1. Racks.
   2. Cable Tray.
   3. Cable Supports.

2.5 OPEN CABLING SUPPORT & HARDWARE

A. Each Cable Support shall be UL Listed for the Application and meet the TIA requirements for structured cabling systems.

B. Provide manufacturer approved mounting brackets and fasteners.

C. Do not exceed the cable support manufacturer's cable fill capacity for each type provided for this project.

D. Do not exceed the cable manufacturer's recommendations for cable suspension in open cabling environments.

E. J-Hooks shall have a galvanized finish.
   1. Manufactured by Erico CADDY: Model # CAT32HP, or approved equal. Provide quantities as required.
   2. Manufactured by Erico CADDY: Model # CAT48HP, or approved equal. Provide quantities as required.

F. Mounting Tree:
   1. Manufactured by Erico CADDY: Model # CATHPTM, or approved equal. Provide quantities as required.

G. Adjustable Cable Support:
   1. Manufactured by Erico CADDY: Model # CAT425 Series, or approved equal. Provide quantities as required.

H. Conduit Waterfalls:
   1. Conduit Waterfalls shall be used where conduits empty into cable trays.
   2. Manufactured by Panduit: Model # CWF400, or approved equal. Provide quantities as required.

I. Conduit Bushings:
   1. Conduit Bushings shall be used to protect communications cabling where conduits terminate in accessible ceiling space.
   2. Bushings shall be non-metallic to reduce cable abrasion.
   3. Manufactured by Arlington: Model #EMTXXX, or approved equal. Provide quantities as required.

2.6 FIRE RATED PENETRATIONS

A. Provide Fire Rated Penetration equipment for EACH wall that is rated for 1-Hour or more.

B. A firestop system shall be comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise of an effective block for fire, heat, vapor, and pressurized water stream.

C. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

D. Firestop systems shall be UL Classified to ASTM E814 (UL 1479).

E. Indicate on the Shop Drawings EACH location showing the proposed firestopped system location for approval, prior to installing the firestop system(s).

F. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local authorities prior to cabling system acceptance.

G. For EACH penetration, the following requirements shall apply:

H. Provide pathway for EACH Low Voltage System Cables for each individual opening.

I. Provide the quantity of pathway required for the Horizontal cables, while maintaining all code requirements. Additionally, provide (1) pathway opening for EACH System listed on the Electrical Legend. This includes, but is not limited to: Fire Alarm System, Intrusion Alarm System, Intercom System, Access Control System, CCTV System, etc.).

2.7 ADDITIONAL SYSTEM EQUIPMENT

A. See Part 3 of this specification for additional provision of system Equipment and/or Labor.

PART 3 - EXECUTION

3.1 GENERAL

A. See Section 270000 Low Voltage Systems General Requirements for additional information.

B. Prior to rough-in, coordinate with the Architect for the exact location(s).

C. Install all equipment per the manufacturer's recommendation.

3.2 PRODUCT INSPECTIONS

A. The Installing Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing correct number of pairs, and is the material ordered. Any physical damage to the cable and wire must be noted; un-uniform jacket thickness and jacket tightness should also be identified. Note any buckling of the jacket, which would indicate possible problems.

3.3 HORIZONTAL PATHWAYS

A. It is the responsibility of the contractor to ensure that ALL PATHWAYS for the permanent link of each balanced twisted pair cable shall not exceed 295' in length from work area outlet to telecommunications room patch panel.

B. To ensure this length, all pathways shall be coordinated and installed prior to pouring of any slabs or the installation of any permanent structure which would inhibit a conduit or cable tray run from being installed after the structure is complete.

C. See section 272000 for horizontal cabling types and additional requirements.

3.4 FIRE RATED PENETRATIONS

A. Install per manufacturers recommendations.

B. Maintain all Code and AHJ requirements.

3.5 PLENUMS

A. Provide metallic conduit through building plenum spaces for all cables which do not bear a CMP rated label.

3.6 WARRANTY

A. The warranty shall be direct to the end user, from the manufacturer, supported through the installing and certified Installing Contractor, and shall cover both materials and labor costs for any claims related to the warranty program. If the Installing Contractor were to default, the manufacturer will assume responsibility of employing another certified installer to maintain the existing warranty. Bids from installers or Installing Contractors who are not certified by the connecting hardware manufacturer and wire manufacturer at the time of project bid, will be rejected.

3.7 OPERATION & MAINTENANCE MANUALS (O&M'S)

A. Provide all Operation & Maintenance Manuals (O&M's) documentation as defined in Section 270000 Low Voltage Systems General Requirements and listed elsewhere in this specification.

3.8 AS-BUILT DRAWINGS

A. Provide all As-Built documentation as defined in Section 270000 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings).

C. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

D. The Installing Contractor shall provide As-Built drawings to the Architect, which clearly indicates:
   1. The floor plan of the building showing the As-Built location of conduit runs, cable tray, and terminal cabinets.

END OF SECTION 270528

SECTION 272000 - DATA AND VOICE INFRASTRUCTURE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 SCOPE

A. The Installing Contractor shall furnish and install all materials for a complete, fully functional data and voice Telecommunications Infrastructure system in accordance with this specification and the contract drawings. The system shall be in full compliance with a “Limited Lifetime Warranty”. The Installing Contractor shall be responsible for providing a complete, functional system including all necessary components, whether included in this specification or not.

B. The installation shall include Copper Category Rated Cables copper patch panels, telecommunication outlets.

C. All copper Horizontal Cables shall be terminated on patch panels in the Telecommunication Rooms (MDF and designated IDF locations) and on Telecommunications Outlets. All copper backbone cables shall be terminated on punch blocks.

D. Upon completion of installation, the Installing Contractor shall test all copper cables. All cables shall be tested as defined elsewhere within this specification.

E. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "good quality" means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

F. The system shall meet ALL of the requirements listed in Section 270000 Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

G. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 272000 includes, but is not limited to the sections identified in Section 260000 and 270000.

H. See “Horizontal Cable” located in this specification for additional work and equipment. This includes, but is not limited to; CAT6 Cabling for ALL Local Area Network (LAN) based Systems as shown on the plans, detail sheets, and riser diagrams.

1.3 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work specified in this Section.

B. Applicable Standards: All work shall be performed in accordance with the latest revisions of the following standards:
   1. BICSI Information Technology Systems Installation Methods Manual, 6th Edition
   2. BICSI Telecommunications Distribution Methods Manual, 13th Edition

3. ANSI/TIA 606-A (2002) Administration Standard for Commercial Telecommunications Infrastructure.
4. ANSI/TIA 607-B Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. EIA/TIA-455-61 (latest edition). "FOTP-61, Measurement of Fiber or Cable Attenuation Using An OTDR".
6. TIA-526-7. Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant OFSTP-7.
7. ANSI/TIA 568-C.0. "Generic Telecommunications Cabling for Customer Premises."
8. ANSI/TIA 568-C.1. "Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements."
9. ANSI/TIA 568-C.2. “Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components."
10. ANSI/TIA 568-C.3. “Optical Fiber Cabling Components Standard."
11. EIA/TIA 569-B. "Commercial Building Standard for Telecommunications Pathways and Spaces."
12. IEEE 802.3 (latest edition) "Carrier Sense Multiple Access With Collision Detection.”
13. International Building Code (latest edition).
14. International Fire Code (latest edition).
15. NEC (National Electrical Code) (latest edition).
16. Telecommunications Architectural Standards - In Washington State Government (latest edition).

1.4 QUALITY ASSURANCE

A. Installing Contractor Qualifications:
1. The Installing Contractor project manager shall hold a valid and current Registered Communications Distribution Designer (RCDD) certification issued by Building Industry Consulting Service International (BICSI). The project manager shall have a minimum of five years’ experience with projects of similar size and scope.
2. The Installing Contractor field staff installers shall hold valid and current Installation certifications issued by Building Industry Consulting Service International (BICSI) or hold documented certification of training from the manufacturer of the cabling and equipment that is being installed. The field staff shall have a minimum of five years’ experience with projects of similar size and scope.
3. The Installing Contractor shall be an Authorized Leviton Premier Network Installer Certifed Partner of the Manufacturer of the equipment being installed and shall furnish documentation showing that the Installing Contractor is trained and certified. The Installing Contractor shall be capable of providing the Owner with a documented Limited Lifetime Warranty of the equipment being installed at the time of project bid, to be approved for bidding.
4. Work in this section shall be performed by a licensed and bonded low voltage Installing Contractor with a minimum of five years’ experience in the installation and maintenance of high speed data and voice networks. Only Premier Network Installing Contractors whose primary business is that of installing, maintaining, troubleshooting, and testing Telecommunication Infrastructures shall perform this work. Sub-tier contractors performing this work shall not be allowed.
5. In order to qualify for installation of the Telecommunications Infrastructure Installing Contractor must possess the required license classification, a performance history, experience in the installation and termination of copper and optical fiber cable systems, and proof of time in business.
6. License Classification: Installing Contractor must possess a valid Washington State 06 Electrical Low Voltage License.

1.5 GOVERNING CODES AND CONFLICTS

A. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.

1.6 PROJECT CONDITIONS - ARCHITECTURAL PLANS

A. The Installing Contractor shall carefully coordinate the various symbols utilized on the drawings and shall consult the architectural plans to determine ceiling and floor types in the various areas.

1.7 SUBMITTALS

A. Refer to specification 27 00 00 Low Voltage Systems General Requirements, for additional data sheet submittal requirements and the shop drawing submittal requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See Section 270000 Low Voltage Systems General Requirements for additional requirements.

B. The Installing Contractor shall review the Site Plans, Floor Plans, Riser Diagrams, and Detail Sheets for additional work that is required to be performed by the Installing Contractor of this section.

C. Leviton / Berk-Tek manufacture the products that are used for this specification. Substitutions are not allowed for this specification.

D. All products shall be new, and brought to the job site in original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All Telecommunications cable shall bear the manufacturer's label in accordance with NEC 800 based on flammability testing as follows:
1. CMR General Purpose Communications Riser Cable.
2. CMP Plenum-rated Communications Cable.
3. And other cable ratings to comply with the National Electrical Code requirements for the installation.

E. All products shall meet the certification requirements of the warranty. All device products and all cabling products shall be of a single manufacturer.

F. Provide all equipment as defined in the specification(s) and shown on the drawings.

G. Refer to PART 1 for any equipment that is not specifically defined.

2.2 MATERIALS NOT INCLUDED (PROVIDED & INSTALLED BY OTHERS)

A. Telephone switching equipment and related appurtenances.

B. Telephones.

C. Switchers, routers, network hubs, data concentrators and other similar active electronic equipment for data communications.

D. Computers, printers, facsimile machines, modems and other similar utilization equipment.

2.3 COORDINATION

A. Refer to “Installation of Owner Furnished Equipment” for additional coordination and installation requirements.

B. Refer to “Submittals” for additional coordination requirements.

2.4 INSTALLATION OF OWNER FURNISHED EQUIPMENT

A. The Installing Contractor shall install the following Owner Furnished equipment:
   1. Wireless Access Points (WAP’s). Coordinate with the Owner as required.
      a. Install each WAP where indicated on the plans.

2.5 ADDITIONAL REQUIREMENTS.

A. Refer to “As-Built Drawings” listed elsewhere in this specification for additional equipment required for this project.

2.6 TELECOMMUNICATIONS SYSTEM DESCRIPTION

A. Provide Horizontal Cabling from each Telecommunication port to the nearest MDF or designated IDF location. Each Telecommunication Outlet type and style shall contain the quantity of Horizontal Cables identified on the Legend, unless noted otherwise.

B. Horizontal cables are to be terminated on rack-mounted patch panels of the same data speed transfer rating. Horizontal Cabling shall be to Patch Panels within each designated rack. Horizontal Cabling shall be cross-connected to backbone cables.

2.7 LABELING

A. See Section 270000 for additional label type and additional requirements.

B. The alpha-numeric labeling shall be developed by the Installing Contractor, under the direction of the Owners IT Department.

C. The Installing Contractor shall label all equipment and cables in an identical fashion of a sequential manner to the satisfaction of the Owner.

D. All label printing shall be machine generated using indelible ink ribbons or cartridges, and self-laminating labels shall be used on cable jackets appropriately sized to the outside diameter of the cable.

E. Patch panels shall have each port labeled to identify each outlet port.

2.8 TELECOMMUNICATION OUTLETS

A. Each Telecommunication Outlet type and style shall contain the quantity of Horizontal Cables identified on the Electrical Legend, unless otherwise noted.

B. Provide Horizontal Cabling from EACH Telecommunication Outlet port to the nearest MDF or designated IDF location.

C. Telecommunication Outlet:
1. Each Outlet shall accommodate individual modular ports and each modular port shall be individually removed without affecting any other port within the outlet.
2. Coordinate the labeling requirements with the Owner's IT department.
a. Outlet label identification information shall be typed text and indicate patch panel and port for each jack and shall comply with the Owners Labeling Standards. Hand written information will not be acceptable.
b. The Installing Contractor shall match the color and finish of the existing devices.

D. Modular Inserts:
1. 8-position, 8-conductor (8P8C). Individual workstation port modules and patch panel port modules shall be Category 6 rated, 8-position, 8-conductor (8P8C) for termination of conductors and shall be approved by the manufacturer.
2. 8-position, 8-conductor (8P8C). Individual Wireless Access Point (WAP) port modules and patch panel port modules shall be Category 6A rated, 8-position, 8-conductor (8P8C) for termination of conductors and shall be approved by the manufacturer.
3. EACH workstation port shall be Category 6 rated.
4. Each Wireless Access port shall be Category 6A rated.
5. Cables shall be wired in accordance with TIA/EIA-T568B, unless noted otherwise.
6. Each individual insert shall be fully compatible with the Face Plates provided.
a. Provide "DATA" identification icon tabs for each jack designated for data.
b. Manufactured by Leviton: Model # 61110-R(X)6 Series for Category 6 applications, or approved equal for all workstation outlets. Provide quantities as required. (X) Indicates color.
c. Manufactured by Leviton: Model # 6110G-R(X)6 Series for Category 6A applications, or approved equal for all Wireless Access point outlets. Provide quantities as required. (X) Indicates color.
7. Blank inserts. Fill all remaining unused ports with a blank filler insert that is approved by the manufacturer.
a. Manufactured by Leviton: Model # 41084BGB, or approved equal. Provide quantities as required.

2.9 CABLE MANAGEMENT TIES

A. Wire ties of any type shall NOT be used anywhere in this installation.

B. Bundle all Horizontal Cables together with Velcro-type tie wraps.
1. Adjustable Velcro Straps shall be used for all cable bundles.
a. Provide Velcro Straps every two-foot (approximately) above accessible ceilings, in Cable Trays (where applicable) and throughout the cable run.
b. Provide Velcro Straps every twelve-inches (approximately) within the MDF and each designated IDF location.
2. Chatsworth Products Inc. (CPI): Model # 020XX-201, or approved equal. XX indicates actual length. "06" (6-inches long for two-inch diameter cable bundles), "09" (9-inches long for three-inch diameter cable bundles), and "12" (12-inches long for four-inch diameter cable bundles). Provide quantities as required.

PART 3 - EXECUTION

3.1 GENERAL

A. See Section 270000 Low Voltage Systems General Requirements for additional information.

B. Prior to rough-in, coordinate with the Architect for the exact location(s).

C. Install all cabling, devices, and/or equipment per the manufacturer's recommendation.

3.2 PRODUCT INSPECTIONS

A. The Installing Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing correct number of pairs, and is the material ordered. Any physical damage to the cable and wire must be noted; un-uniform jacket thickness and jacket tightness should also be identified. Note any buckling of the jacket, which would indicate possible problems.

3.3 CABLE INSTALLATION - GENERAL

A. EACH CABLE RUN SHALL BE CONTINUOUS, WITHOUT ANY SPLICES, from the Telecommunications Outlet to the patch panel(s). Any cable run that does not meet this requirement shall be replaced at no additional cost to the Owner.

B. The Installing Contractor shall insure that EACH Telecommunications cable is installed with care, using techniques which prevent kinking, sharp bends, scraping cutting, deforming the jacket, or other damage. During inspection evidence of such damage will result in the material being declared unacceptable. The Installing Contractor shall replace unacceptable cabling at no additional cost to the Owner.

C. Conduit and Raceway Usage: All Telecommunications cable shall be installed in grounded metal conduit or raceway dedicated for Telecommunications purposes, when called for on the Project Drawings, and not to be shared with electrical wiring.

D. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

E. All wiring to be installed in a neat and inconspicuous manner and per local code requirements. Route wires parallel or perpendicular to the building structure using the specified cable supports. Wiring shall be installed near or on structural members as to minimize risk of physical damage by other trades or maintenance personnel servicing the equipment.

F. Cable Lubricants specifically designed for installing Telecommunications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned of lubricant residue.

G. Backboard and Rack Cable Supports: Clamps, "D-Rings", Velcro and tie-wraps are all acceptable ways to support cable. However, installation of these supports must be done with care so as not to cause crushing or distortion of the cable, nor cause tighter bends than the minimum radius permitted for each type cable.

3.4 HORIZONTAL CABLING

A. Horizontal Cables shall be dressed and terminated in accordance with TIA/EIA-568-B requirements and the cable manufacturer's recommendations.
   1. Untwisting of pairs at the termination point shall not exceed one-half an inch for Category 6 connecting hardware.
   2. Bend radius of the cable in the termination area shall not be less than the manufacturer's recommendation.
   3. The Horizontal Cable jacket shall be maintained as close as possible to the termination point.

B. Every attempt shall be made to avoid running Horizontal Cables close to (less than 24") and parallel to power raceway and wiring, or close to light fixtures.

C. When an approved cable support is used to support cable bundles, all horizontal cables shall be supported at a maximum of four-foot intervals with UL approved cable support. At no point shall cables rest on acoustic ceiling grids or panels. Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs is required, the Installing Contractor shall install clips to support the cabling.

D. The installation of Horizontal Cables around moveable devices, instruments, subpanels, etc. shall be provided with adequate support, length, protection, and flexibility so that the cable is not damaged in the event the equipment is moved.

E. Pathways:
   1. It is the responsibility of the contractor to ensure that ALL PATHWAYS for the permanent link of each balanced twisted pair cable shall not exceed 295' in length from work area outlet to telecommunications room patch panel.
   2. To ensure this length, all pathways shall be coordinated and installed prior to pouring of any slabs or the installation of any permanent structure which would inhibit a conduit or cable tray run from being installed after the structure is complete.
   3. See section 270528 for pathway types and additional requirements.

3.5 CABLE LABELING

A. Alpha-numeric numbering shall be developed by Installing Contractor, under the direction of the Owners IT Department. Label all equipment and cables in an identical fashion.

B. Patch Panel Labeling: Each terminal shall be identified and marked on the patch panel with the outlet port identification.

C. Outlet Port Labeling: Outlet labels for each port shall be identified and marked on the Outlet with the outlet port identification.

D. Horizontal Cables: Each cable shall be identified and marked with the outlet port identification near the cable termination point at the rear of the patch panel.

3.6 TESTING of Cables

A. Notification shall be given a minimum of 14 days prior to any testing so that the testing may be witnessed by the Owner.

B. An ETL certified, TIA-1152 Level IIIe (ISO/IEC 11801 Level IV) Test Meter shall be used to test all balanced twisted-pair coper cabling.

C. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.

D. Provide documentation of the following items of EACH Test Meter used:
1. Calibration certification from a third party shall be within two-years of testing (at the time that the test is performed).
2. Manufacturer of Test Meter.
3. Model Number of Test Meter.
4. Serial Number of Test Meter.

E. Copper Cables – Category 6 and 6A Cables: Each of the pairs shall be tested from the Patch Panel or Punch Block to the Outlet. The Installing Contractor shall test:
1. Wire Map.
2. Length.
3. Insertion Loss / Attenuation.
4. NEXT (Near End Cross Talk).
5. PS-NEXT (Power Sum Near End Cross Talk).
6. ACR-F Loss (Attenuation Crosstalk Ratio Far-end).
7. PS ACR-F Loss (Power Sum Attenuation Crosstalk Ratio Far-end).
8. Return Loss.
9. Propagation Delay.
10. Delay Skew.
11. The following tests are only required for CAT6A cabling:
    a. PSANEXT (Power Sum Alien NEXT)
    b. PSAACRF (Power Sum Alien ACRF)

F. Copper Cables – Category 3 or 5e Cables: Each of the pairs shall be tested from the Patch Panel or Punch Block to the Outlet. The Installing Contractor shall test:
1. Wire Map.
2. Length.
3. Insertion Loss / Attenuation.
4. NEXT (Near End Cross Talk).
5. PS-NEXT (Power Sum Near End Cross Talk).
6. ACR-F Loss (Attenuation Crosstalk Ratio Far-end).
7. PS ACR-F Loss (Power Sum Attenuation Crosstalk Ratio Far-end).
8. Return Loss.
9. Propagation Delay.
10. Delay Skew.

G. The source of each error shall be determined, corrected, and the cable re-tested. All defective cables, connectors, connections, and related appurtenances shall be replaced and re-tested at no additional cost to the Owner.

H. Submit the Test Reports in PDF format.

I. See the O & M Manual / As-built Drawings requirements in this specification and also in Section 270000 for additional requirements.

J. Acceptance of these test procedures is predicated on the Installing Contractor's use of the recommended products including, but not limited to; the specified cable type, patch panels, outlets, punch blocks, specified equipment identified in Part 2 and the installation standards of this specification. Adherence to these requirements shall be determined upon the completed installation and will be evaluated in the context of each of these factors.

3.7 FIRE RATED PENETRATIONS

A. Install per manufacturers recommendations.

B. Maintain all Code and AHJ requirements.

C. See 27 0528 for additional requirements.

3.8 WARRANTY

A. Upon final installation, a certificate providing a "Limited Lifetime Performance Warranty" shall be provided to the owner. The warranty shall be direct to the end user, from the manufacturer, supported through the installing and certified Installing Contractor, and shall cover both materials and labor costs for any claims related to the warranty program. If the Installing Contractor were to default, the manufacturer will assume responsibility of employing another certified installer to maintain the existing warranty. Bids from installers or Installing Contractors who are not Leviton Premier Network Installer certified by the connecting hardware manufacturer and wire manufacturer at the time of project bid, will be rejected.

3.9 OPERATION & MAINTENANCE MANUALS (O&M'S)

A. Provide all Operation & Maintenance Manuals (O&M's) documentation as defined in Section 270000 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. Provide hard copies of the Test Results of EACH Cable tested.

C. Provide the Test Results on CD in PDF format.

3.10 AS-BUILT DRAWINGS

A. Provide all As-Built documentation as defined in Section 270000 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.

C. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

D. The Installing Contractor shall provide As-Built drawings to the Architect, which clearly indicates:
   1. The floor plan of the building showing the As-Built location of Telecommunication Outlets and their associated Port Address(es), conduit runs, and terminal cabinets.
   2. A list of EACH Telecommunication Outlet and the associated Port Address(es) shall clearly be identified according to system labeling scheme. Show all ports and punchdowns.

END OF SECTION 272000

SECTION 283176 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Divisions 1, 26, 27, and 28 Specification Sections, apply to work of this section.

B. Phasing and Schedule: Phasing and Schedule are critical for successful completion of this project on an occupied site and it is anticipated overtime, double-shifting, or special work schedules and coordination of phased work will be required. Refer to the Phasing Plans and specifications for additional information.

1.2 WORK INCLUDED

A. It is the intention of this division of the specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical & fire alarm system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown in the plans. The work shall include all materials, appliances and apparatus not specifically mentioned herein or noted on the plans, but which are necessary to make a complete working installation of all electrical systems shown on the plans or described herein. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

B. By submitting a bid, the Contractor is acknowledging that he has made a thorough examination of the Contract Documents, existing site and building conditions, and has determined that these documents do sufficiently describe the scope of construction work required under this Contract.

1.3 STANDARDS AND REGULATIONS

A. The work shall comply with the latest edition of the applicable Standards and Codes of the following:

ASTM	American Society for Testing and Materials
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code
---	State Electrical Code
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
U.L.	Underwriters Laboratories Inc.
IPCEA	Insulated Power Cable Engineers Associated
CBM	Certified Ballasts Manufacturers
---	Federal, State and Local Building Codes
ETL	Electrical Testing Laboratories

B. If any conflict occurs between Code Rules and this specification, the codes are to govern. Nothing in these drawings and specifications shall be construed to permit work not conforming to governing codes. Also, this shall not be construed as relieving the Contractor from complying with any requirements of the plans and specifications which may be in excess of, but not in conflict with, requirements of the Governing Codes.

1.4 PERMITS & FEES

A. The Contractor shall obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. The Contractor shall arrange for inspection of work by the inspectors and shall give the inspectors all necessary assistance in their work of inspection.

B. The Contractor shall consult with and follow the requirements of the local fire marshal serving the area and shall coordinate his work with them.

C. All permits and fees for plan review, inspections, testing, etc. shall be included in the bid proposal.

1.5 DEFINITIONS

A. When "Provide" is used, it shall be interpreted as "furnishing and installing complete in operating condition".

B. When "Drawings" is used, it shall be interpreted as "all Contract Drawings for all Disciplines".

C. When "Contractors" is used, it shall be interpreted as the Fire Alarm Contractor.

1.6 INTENT OF DRAWINGS

A. The fire alarm drawings are intended to serve as working drawings for general layout. The equipment layout is diagrammatic and unless specifically dimensioned or detailed, does not indicate all fittings, hardware or appurtenances required for a complete operating installation.

B. Wiring diagrams are not intended to indicate the exact course of raceways or exact location of device. Raceway and device locations are approximately correct and are subject to revision as may be necessary or desirable at the time of installation. Precise location in every case shall be subject to the Engineer's approval.

1.7 EXISTING CONDITIONS

A. Examine the structure, building, and conditions under which Divisions 28 work is to be installed for conditions detrimental to proper and timely completion of the work. Do not proceed with work until deficiencies encountered in installation have been corrected. Report any delay or difficulties encountered in installation of Divisions 26, 27, and 28 work which might be unsuitable to connect with work. Failure to report conditions shall constitute acceptance of other work as being fit and proper for the installation of Divisions 28 work.

B. Maintain continuity of existing circuits of equipment to remain. Existing circuits of equipment shall remain energized. Circuits which are to remain but were disturbed during demolition shall have circuits, wiring, and power restored back to original condition.

1.8 DEMOLITION

A. Fire alarm system (free standing or surface mounted), raceway (exposed), and conductors, no longer in service as a result of this Contract, shall be removed. Unused raceways or sleeves shall be cut flush at ceiling, floor, or wall, and filled with grout.

1.9 PROTECTION

A. The Contractor shall store and guard all equipment before installation and shall protect same, and replace any equipment that has been damaged prior to final acceptance.

1.10 HOUSEKEEPING

A. All electrical materials shall be kept stored in an orderly fashion protected from heat, cold, and the weather.

B. All marred surfaces shall be refinished and painted after installation.

C. All debris shall be removed from premises during work, as directed, and at completion of job.

1.11 AS-BUILT DRAWINGS

A. The Contractor shall maintain, in addition to any reference drawings, an as-built set of prints, on which all deviations from the original design shall be drafted in a neat, legible manner with red colored pencil. This red lined set shall identify all drawing revisions including addenda items, change orders, and Contractor revisions.

B. The Contractor shall update all references to specific products to indicate products actually installed on project.

C. Upon completion of the Division 28 Work, the Contractor shall deliver the red lined drawings and one set of neatly drafted as-built drawings on electronic media in AutoCAD R-2012 format to the Engineer for transmittal through the Engineer to the Owner.

1.12 WARRANTY

A. Provide a written warranty that the Division 28 work is free from mechanical and electrical defects. Contractor shall replace and repair, to the satisfaction of the Engineer, any parts of the installation which may fail within a period of 12 months after the certificate of final acceptance, provided that such failure is due to defects in material or workmanship, or failure to follow the specifications and drawings.

1.13 INSTRUCTIONS AND MANUALS

A. Manuals shall contain shop drawings, wiring diagrams, operating and maintenance instructions, replacement parts lists, and equipment nameplate data for all equipment and systems installed under the project. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation. Manuals shall contain original brochures supplied by manufacturers. Xerox copies of originals will not be accepted.

B. Each type of device provided shall be identified in the O & M Manual using the same identification as shown on the drawings and specifications. The information included must be the exact equipment installed not the complete "line" of the Manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets. Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier is not acceptable. The following information shall be provided for each device:
1. Manufacturer's name, address, and phone number.

2. Local supplier's name, address, and phone number.
3. Complete parts lists including quantities and manufacturer's part numbers.
4. Installation instructions.
5. Recommended maintenance items including maintenance procedure and recommended interval of maintenance listed in hours of operation, calendar unity, or other similar time unit.

C. The O & M Manual shall be assembled in a loose leaf, 3-ring, hard cover binder. The information contained in the manuals shall be grouped in an orderly arrangement by specification index. The manuals shall have a typewritten index and divider sheets between categories with identifying tabs. The covers shall be imprinted with the name of the job, Owner, Electrical Engineer, Division 28 Contractor, and year of completion. The back edge shall be imprinted with the name of the job, Owner, and year of completion.

D. Wiring Diagrams for each system shall be complete for the specific system installed under the Contract. "Typical" Line Diagrams will not be acceptable unless properly marked to indicate the exact field installation.

1.14 WORK NOT INCLUDED

A. Work to be included under this Contract shall be defined on drawings and in these specifications. Any details beyond these limits are meant only to give installation clarity to that portion which is a part of this Contract.

1.15 INSTRUCTION PERIODS

A. Upon completion of the work and after all tests and final inspection of the work by the authority(s) having jurisdiction, the Contractor shall demonstrate and instruct the Owner's designated operation and maintenance personnel in the operation and maintenance of the fire alarm system. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or foremen knowledgeable in the fire alarm system and suppliers representatives when so specified.

B. Costs for time involved by Contractor shall be included in the bid.

1.16 COMPLETION OF WORK

A. Upon completion of the Division 28 work, the Contractor shall deliver to the Engineer a completion letter stating that he has fulfilled all the requirements of his Contract for Division 28 work as set forth in the drawings and specifications and that all items in pre-final inspection lists submitted by the Engineer have been satisfactorily completed.

B. Arrange for and obtain all required inspections and certificates pertaining to the Division 28 work and deliver the certificates to the Engineer.

1.17 SUBMITTALS AND SHOP DRAWINGS

A. General:
1. The Fire Alarm System contractor shall simultaneously submit shop drawings, voltage drop calculations, back-up battery calculations, and manufacturers data sheets to the local Authority Having Jurisdiction and Architect/ Engineer for a review and shall be approved by the Architect/ Engineer prior to the purchase, fabrication, or installation of any system components.

2. Within 10 working days after the date of the letter rejecting any items of equipment, or materials as not in accordance with the specifications, Contractor shall submit a new list of items he proposes to furnish and install in place of those items rejected. If the Contractor fails to submit this new list within the above specified time, or if any items on this second list are rejected as not being in accordance with these specifications, the Engineer may select the items which the Contractor shall furnish and install without change in Contract price or time of completion.
3. The acceptance of a manufacturer's name or product by the Engineer does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the Contract Documents. The Contractor shall be solely responsible for submitting materials at such a time to allow a minimum of two weeks for Engineer's review.
4. The Contractor is responsible for assuring that the conduit size and wire quantity, size, and type is suitable for the equipment supplied. The Contractor shall review the proper installation of each type of device with the manufacturer's representative.
5. Contractor shall submit floor plan shop drawings and complete equipment submittals (3) copies to each Fire Code Enforcing Authority as required, for approval, and pay all required review fees.

1.18 SHOP DRAWINGS

A. Prepare detailed working drawings that are not larger than the contract documents for the system layout in accordance with N.F.P.A. #72.

B. All items contained in Section 7.4 "Shop Drawings" of the latest edition of N.F.P.A. #72 adopted by the Authority Having Jurisdiction shall be included on the Fire alarm System Shop Drawings including, but not limited to the following:
1. Sheet Index.
2. Fire alarm System Component Legend.
3. Cabling Legend.
4. Alpha-numeric labeled cables based upon the "Cabling Legend" for each cable type and cable run.
5. Electrical Legend listing the electrical devices to be utilized as part of the Fire alarm System installation.
6. Site Plan.
7. Floor Plans indicating all Fire alarm System devices.
8. End-Of-Line Resistor(s) where applicable.
9. Device Address shown adjacent to each device.
10. One-Line Riser Diagram with all field devices and their respective room names, room numbers and device address.
11. "Sequence of Operations" matrix indicating all system Inputs and Outputs.
12. Mounting details and mounting heights

C. Provide "Shop Drawings" that are usable for trouble-shooting purposes showing equipment/device locations, conduit routing, junction boxes, connection cabling for the entire Fire Alarm System layout, and riser diagrams.

D. Shop Drawings shall be clear and legible with a minimum text height of 1/8" for all text.

E. A graphical scale shall be provided for each floor plan or detail on the shop drawings in accordance with N.F.P.A. #72.

F. Projects that require more than one sheet to show the entire Fire Alarm System shall require a key plan.

G. The key plan shall identify the location of the Fire alarm System that is contained on that sheet and shall contain a reference north arrow.

H. All sheets that contain a break in the building background shall contain a "Match Line" designation to indicate where the building and Fire alarm System continue, even if on the same sheet.

I. The shop drawings shall include a letter signed by either a designer or a registered professional engineer, currently employed by the system sub-contractor, responsible for the design depicted in the submittals and shop drawings. The letter shall state that the shop drawings conform to NFPA, NEC, and local codes as adopted by the local authority having jurisdiction or shall list items of non-conformance.

1.19 SUBMITTALS

A. Provide copies as specified by Division 1 and at a minimum provide six (6) sets of "Shop Drawings", Back-up Battery Calculations, Voltage Drop Calculations, Sound Calculations, Graphic Map(s), and Manufacturer's Data Sheets to the Architect/Engineer for approval prior to the purchase, fabrication, or installation of any system component. Failure to receive the Architect/Engineer approval that results in reordering of material, removal of installed system components, and the re-installation of the Fire alarm System shall not be charged as additional cost to the Owner or General Contractor.

B. Equipment Submittals for the Fire alarm System shall be presented to the Architect / Engineer for review and approval within 30 calendar days from the date of the Contract signing by the General Contractor.

C. "Shop Drawings", Back-up Battery Calculations, Voltage Drop Calculations, Sound Calculations, and the Graphic Map(s) for the Fire alarm System shall be presented to the Architect / Engineer for review and approval within 60 calendar days from the date of the Contract signing by the General Contractor.

D. Graphic Maps shall be presented for review and approval within 60 calendar days from the date of the Contract signing by the General Contractor.

E. Equipment submittals shall be broken up by "Tabbed Dividers" that shall include, at a minimum, the following:
1. Fire alarm System Control Panel.
2. Fire Alarm Remote Annunciator Panels.
3. Power Supplies.
4. Initiating Devices.
5. Notification Appliances.
6. Graphic Maps.
7. Modules.
8. Miscellaneous Equipment.

F. Equipment submittals shall include, at a minimum, the following:
1. Fire alarm System Control Panel.
2. Fire alarm System Control Panel Enclosures.
3. Fire alarm System Terminal Cabinets
4. Fire Alarm Remote Annunciator Panels.
5. Main Fire alarm System Control Panel Power Supplies.
6. Remote Audible / Visual Power Supplies.
7. Fire alarm System Digital Audio Amplifiers.
8. Back-Up Batteries.

9. Internal Battery Chargers.
10. External Battery Chargers.
11. Initiation Devices:
    a. Manual Pull Stations.
    b. Heat Detectors.
    c. Smoke Detectors.
    d. Carbon Monoxide Only Detectors.
    e. Combination Smoke / Carbon Monoxide Detectors.
    f. Multi-Criteria Detectors.
12. Notification Appliances:
    a. Strobe-Only Appliances.
    b. Combination Horn / Strobe Appliances.
    c. Low-Frequency Sounders
13. Damage Stoppers (Wire Guards).
14. Graphic Maps.
15. Monitor Modules.
16. Relay Modules.
17. Isolation Modules.
18. Transient Voltage Surge Protection.
19. Wiremold Surface Raceway.
20. Wet Rated Cables.

G. Shop drawing submittals shall include the following information:
1. Floor plans identifying all Fire alarm System components and devices.
2. Cabling / conduit routing and sizing.
3. Fire alarm System zoning.
4. Point to point cabling diagrams.
5. One-line risers.
6. Back-up Battery Calculations.
7. Voltage Drop Calculations.
8. Graphic Map Details / Artwork

H. Equipment Submittals, Back-Up Battery Calculations, Voltage Drop Calculations, Sound Calculations, and full sized color bond Graphics Maps for the Fire alarm System shall be contained within a single 3-ring hard cover binder having a typewritten index and divider sheets between categories with identifying tabs.

I. Equipment Submittals shall contain original brochures supplied by manufacturers (Xerox copies of originals will only be accepted if they are clear and legible). Each type of device provided shall be identified in the Equipment Submittals using the same identification as shown on the drawings and specifications. The information included must be the exact equipment to be installed, not the complete "line" of the manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

J. If the submittals are being delivered electronically, the Fire alarm System Contractor shall provide the following:
1. Submittal Drawings:
    a. The Submittal Drawings shall be a single PDF that is formatted to actual size (not 11x17) and collated in numerical order as designated in the title block of each drawing.
2. Equipment Submittals:
    a. The Equipment Submittal shall be a single PDF.
    b. The Equipment Submittal PDF shall contain all equipment, devices, and components that are collated for printing on 8½"x11" sized paper.
    c. The Equipment Submittal PDF shall be a searchable document.

d. The Equipment Submittal PDF shall be formatted for duplex printing with blank sheet inserted where necessary.
e. The Equipment Submittal PDF shall contain a "Table of Contents" that indicates all pieces of equipment, devices, and components contained within each "Tabbed Divider."
f. The Equipment Submittal PDF shall be bookmarked by "Tabbed Divider" and for each piece of equipment, device, and component.

3. Back-Up Battery Calculations and Voltage Drop Calculations that are submitted as part of the Equipment Submittal PDF shall be formatted to the following:
   a. Calculations shall be included at the end of the Equipment Submittal PDF under a separate "Tabbed Divider" for both Back-Up Battery Calculations and the Voltage Drop Calculations.
   b. The Equipment Submittal "Table of Contents" shall also indicate all calculations being provided for both the Back-Up Battery and the Voltage Drop Calculations
4. Back-Up Battery Calculations and Voltage Drop Calculations that are submitted as a separate PDF from the Equipment Submittal PDF:
   a. The single Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall contain all calculations that are collated for printing on 8½"x11" sized paper.
   b. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall be a searchable document.
   c. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall be formatted for duplex printing with blank sheet inserted where necessary.
   d. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall contain a "Tabbed Divider" to separate the Back-Up Battery Calculations from the Voltage Drop Calculations.
   e. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall contain a "Table of Contents" that indicates all calculations contained within each "Tabbed Divider."
   f. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall be bookmarked by "Tabbed Divider" and for each Back-Up Battery Calculation or Voltage Drop Calculation.
5. Graphic Maps:
   a. Graphics Maps shall be submitted in a PDF that is full sized to allow printing of actual sized proposed Graphics Maps.

K. Review of Fire alarm System submittal by the Engineer or Architect does not relieve the Contractor of responsibility for compliance with the intent of all contract documents and / or code.

L. Any material found to be installed without prior approval will be required to be removed and replaced with only specified approved material at Contractor's cost.

M. The contract documents shall not be used as the Fire alarm System Contractor's Shop Drawings.

N. The Fire alarm System Shop Drawings shall be system specific with only Fire alarm System equipment and connections to other equipment that will be interfaced to the Fire alarm System being shown.

O. All re-submittals shall have the areas of revision clearly marked with revision clouds. Re-submittals without revision clouds shall be rejected.

1.20 SCHEDULE OF VALUES

A. See Section 260000 for requirements.

1.21 COMPETITIVE PRODUCTS

A. Any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Engineer, expressed in writing, is equal to that specified. However, any manufacturer not listed as an accepted bidder for a specific item must be submitted for acceptance in writing and with descriptive data verifying equal quality and performance at least ten (10) working days prior to the bid date for approval.

1.22 MANUFACTURER/EQUIPMENT PRIOR APPROVALS

A. Any manufacturer/equipment not listed as an approved substitute for a specified item must be submitted for acceptance in accordance with the front end specifications, in writing, with detailed information to include:
1. Manufacturer's Catalog Data
2. Complete Physical and Technical Data
3. Wiring Diagrams
4. Detailed reference (written or highlighted) noting compliance with the appropriate Specification Section and all applicable Specification item numbers within that Section
5. Complete type written index cross referencing all proposed substitutes and specified items
6. Detailed reference to specified items (written or highlighted) noting equal quality and performance of proposed substitute equipment
7. Other descriptive data, as required by the Engineer

B. The acceptance of a manufacturer’s name or product by the Engineer does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the Contract Documents.

C. Only materials which are specified or approved as acceptable shall be used.

D. Substitutions of the specified equipment and/or supplier will be considered providing that sufficient documentation is provided to the Engineer which certifies that the equipment and/or supplier qualification meets the requirements of this specification. Any request for substitutions shall be submitted by the Contractor in writing so as to be received by the Architect not later than ten (10) days prior to the date set for the bid opening. Approval by the Engineer will be issued by addendum prior to the bid date.

E. Suppliers interested in furnishing substitute systems shall furnish to the Engineer a Riser Diagram showing size, number, type and arrangement for all interconnecting wiring with the request, for prior approval to bid. This Riser shall also be furnished to each interested bidding contractor during the bidding period.

1.23 MATERIALS

A. All materials must be of the quality herein specified. All materials shall be new, of the best quality and free from defects. They shall be designed to ensure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

B. Each type of material shall be of the same make and quality. The materials furnished shall be standard products of the manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.

C. All materials shall be U.L. or E.T.L. listed for the purpose for which they are used.

D. Equipment in compliance with U.L. standards but not bearing their label is not acceptable. If the manufacturer cannot arrange for labeling of an assembled unit at the factory the unit shall be field evaluated per the Washington State Administrative Code (WAC) and the inspector's requirements.

1.24 COMPLETE SYSTEM

A. The firm alarm system shall be complete and operational in every detail. Mention of certain materials in these specifications shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide a complete and operable system.

1.25 CUTTING AND PATCHING:

A. Obtain permission from the Owner's Representative prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills except where space limitations prevent the use of such drills.

B. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

C. In locations where recessed panels have been removed and not reinstalled, the prime contractor shall patch wall and finish to match adjacent surfaces.

1.26 REQUESTS FOR INFORMATION (RFI)

A. It is our intent to provide a timely response for RFIs regarding Division 28 Work. To further expedite this process, where a suggestion can be determined or derived at by the initiator of the RFI, it is required this suggestion be supplied with the submitted RFI. If no suggestion is given where one is possible, the RFI will be returned as incomplete. All Electrical RFIs shall be written on the form provided by the Engineer.

1.27 CLEANING AND PAINTING

A. All equipment, whether exposed to the weather or stored indoors shall be covered to protect it from water, dust and dirt.

B. After installing, all metal finishes shall be cleaned and polished, cleaned of all dirt, rust, cement, plaster, grease and paint.

C. In locations where recessed panels have been removed and not reinstalled, the prime contractor shall patch wall and finish to match adjacent surfaces.

1.28 EQUIPMENT IDENTIFICATION

A. Provide identifying engraved bakelite nameplate on all equipment, including pull boxes, to clearly indicate its use, area served, circuit identification, voltage, and any other useful data.

1.29 DEVIATION

A. Deviation from the shop drawings in construction or installation of equipment shall not be made unless Shop Drawings showing proposed deviations are submitted to and approved by the Engineer.

1.30 WIRING METHODS

A. All fire alarm wiring, where exposed, concealed in walls or above inaccessible ceilings, shall be in Raceway with Junction Boxes and Fittings.

B. It is permissible to install fire alarm low voltage cables open in D rings above accessible ceilings.

C. Where exposed in finished areas, the Contractor shall utilize Wiremold Series 700 metal raceway with all backboxes, fittings and accessories.

D. Provide access panels as needed for pull boxes and equipment located above ceiling or behind walls.

1.31 PENETRATIONS OF FIRE RATED ELEMENTS

A. Must be made such as to retain that rating. See Section 283176, 4.04.

1.32 HANGERS AND SUPPORTS

A. Provide hangers, brackets, and suspension rods and supplementary steel to support equipment.

B. Hangers provided under other divisions shall not be used for support of Division 28 equipment unless permitted by Engineer.

1.33 WORKMANSHIP AND OBSERVATION

A. Workmanship shall be of the best quality and none but competent workers shall be employed under the supervision of a competent foreman. All completed work shall represent a neat and workmanship like appearance.

B. All work and materials shall be subject to observation at any and all times by representatives of the Engineer.

1.34 MISCELLANEOUS

A. Provide complete seismic anchorage and bracing for the lateral and vertical support of conduit and electrical equipment, as required by the International Building Code.

B. Conduits that cross seismic separations shall be installed with flexible connection suitable to accommodate conditions. Secure raceways on each side of a separation and provide a minimum of 36” length of flexible conduit to span separation.

1.35 GROUNDING

A. A grounding system shall be maintained as required by code.

PART 2 - GENERAL FIRE ALARM SYSTEM REQUIREMENTS

2.1 GENERAL

A. The Fire Alarm System design for this project is based upon a Notifier Fire Alarm System and accompanying components. Substitutions shall not be allowed.

B. Provide all material, labor, equipment, design, and services necessary to perform the installation of a complete intelligent (analog) reporting, microprocessor-controlled, and addressable (digital) Fire Alarm System, in accordance with the required and advisory provisions of the latest edition of N.F.P.A. #72 accepted by the Authority Having Jurisdiction, and project specifications, except as modified herein.

C. The Fire Alarm System contractor shall simultaneously submit shop drawings, voltage drop calculations, back-up battery calculations, and manufacturers data sheets to the local Authority Having Jurisdiction and Architect/ Engineer for a review and shall be approved by the Architect/ Engineer prior to the purchase, fabrication, or installation of any system components as detailed in paragraph 1.06 of Specification Section 283176.

D. The system shall include, but not be limited to: control unit, peripherals, power supplies, alarm initiating and indicating devices, conduit, wire, fittings, and accessories required in providing a complete operating system.

E. All units shall be located in accordance with the plans.

F. The system shall be of modular design to facilitate both expansion and service and shall be microprocessor based.

G. The system shall operate as a low voltage, non-coded, class “B” Fire Alarm System.

H. The system shall be capable of supporting the design as shown in the contract documents and have 25% spare capacity for future expansion.

I. The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the project specifications.

2.2 DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The system shall be an active/interrogative type system where each addressable device is repetitively scanned, causing a signal to be transmitted to the main Fire alarm System control panel (FACP) indicating that the device and its associated circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.

C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

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. The installing company shall employ technicians on site to guide the final check-out and to ensure the systems integrity.

F. The Fire Alarm System shall be currently listed and approved by Underwriter's Laboratories Incorporated with a Local, Auxiliary, Remote Station, and Proprietary Protective Signaling Services "UUJS" Certificate of Compliance.

2.3 SYSTEM/DEVICE INTERFACE CONNECTIONS

A. The following system/device interfaces shall be connected to the Fire alarm System for auxiliary functions initiated by the Fire alarm System Control Panel and includes, but is not limited to:
1. Fire Protection Sprinkler System

2.4 SCOPE

A. A new, intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance with the specifications and drawings.

B. The new Fire Alarm System Control Panel shall be installed at the location shown on the Contract Documents.

C. The system shall be designed such that each signaling line circuit (SLC) is limited to only 80% of its total capacity at initial installation.

D. 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 B (NFPA Style A) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) as part of an addressable device connected by the SLC Circuit.
4. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
5. Notification Appliance Circuits (NAC) circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone whichever is greater.
6. Notification Appliance Circuits (NAC) and control equipment shall be arranged such that loss of any one (1) circuit will not cause the loss of any other NAC circuit in the system.

2.5 QUALITY ASSURANCE

A. Each and all items of the Fire Alarm System shall be listed as a product of the SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial or pending listings shall not be acceptable.

B. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC Article 760. All circuits must be marked in accordance with NEC Article 760-23.

C. All fire alarm equipment shall be of a single supplier and installed by an authorized factory distributor, to ensure proper component application, system uniformity, and the availability of prompt, emergency service by factory trained technicians.

D. The Fire Alarm System shall be currently listed and approved by Underwriters Laboratories, Inc. Certificate Service for Protective Signaling Services--Local, Auxiliary, Remote Station and Proprietary Signal System Listing Program. Proof of this listing shall be included with all prior approval requests. At the request of the Engineer, an UL certificate specific to this installation shall be furnished by the Fire Alarm System Sub-Contractor. The U.L. certificate shall be issued only by Fire Alarm System Sub-Contractor. Certificates issued by any company not directly associated with the installation of this project will be rejected.

E. The equipment and installation shall comply with the current applicable provisions of the following standards:
1. National Electric Code
2. National Fire Protection Standards:
   a. NFPA 71 Central Station Signaling Systems-Protected Premises Unit.
   b. NFPA 72 National Fire Alarm Code
   c. NFPA 70 National Electric Code
3. ADA Americans with Disabilities Act
4. ANSI A117 Washington Barrier Free Regulations

F. All requirements of the Local Authority Having Jurisdiction.

G. The system and all components shall be listed by Underwriters Laboratories, Inc. for use in fire protective signaling systems under the following standards as applicable:

UL 38	Manually Actuated Signaling Boxes
UL 50	Cabinets and Boxes
UL 228	Door Closer-Holders for Fire Protective Signaling Systems.
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 268A	Smoke Detectors for Duct Applications
UL 346	Waterflow Indicators for Fire Protective Signaling Systems.
UL 464	Audible Signaling Appliances
UL 521	Heat Detectors for Fire Protection
UL 864	Control Units for Fire Protective Signaling System
UL 1481	Power Supplies for Fire Protective Signaling Systems
UL 1971	Visual Notification Appliances

2.6 SERVICE

A. The equipment manufacturer representative shall have a local office staffed with trained, full-time employees who are capable of performing testing, inspection, repair maintenance services, and inventory parts for the life of the fire alarm system.

B. This organization must have a minimum of five (5) years of experience servicing fire alarm systems and shall respond to service calls within 48 hours during or after the warranty period.

C. Prior to completion of installation, the manufacturer’s representative shall provide a preventative maintenance agreement, which shall at the Owners option, become effective at the end of the 12 month warranty period.

D. Upon completion of the project, the system subcontractor shall provide to the owner, an agreement for the purpose of providing off-site monitoring services.

2.7 GENERAL OPERATION

A. Upon actuation of any initiating device (manual stations, automatic detectors, etc.) all alarm notifying units (horns, visual alarm lamps, etc.) shall operate continuously until such time as the manual station or automatic detector is restored to normal and the fire alarm control unit 'silenced'. Alarm signals shall be annunciated by point and zone at the control panel.

B. As per plans, the following additional functions shall be performed in the event of an alarm:
1. Alarms shall be annunciated at a remote annunciator.
2. Alarms shall trip the municipal system, and/or remote central station system.
3. Strobe units shall be controlled independently from audible units. Upon system silence, strobe units will continue to flash until system reset is provided.

C. Alarm circuits shall remain energized and the zone annunciation LED will continue to flash until the acknowledge switch is operated at which time the audible signaling devices will be de-energized. Should an alarm be initiated in a subsequent zone after an alarm has been acknowledged, the alarm signals shall be re-energized. The control panel shall be restored to normal by operation of a reset switch after the initiating device has been restored to normal.

2.8 FIELD PROGRAMMING

A. The system shall be programmable, configurable, and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits. All programming shall be accomplished through the standard common control panel keyboard or through the use of the CRT-2 keyboard. All field defined programs shall be stored in non-volatile memory.

B. The programming function shall be enabled with a special 5-digit password that may be defined specifically for the system when it is installed.

C. This password may be changed to a new value at any time by system's Sub-Contractor. In the event that the system's sub-contractor may define a password and then lose or forget it, the system shall be designed so that the valid password may be determined by special procedures available through the system manufacturer.

D. The system shall provide means for automatic programming of its operation to conform with certain N.F.P.A. Standards through internal software. The following N.F.P.A. operations are to be available through this means:
1. NFPA 72: National Fire Alarm Code

PART 3 - PRODUCTS

3.1 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 protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

B. All equipment and components shall be installed in strict compliance with each manufacturer's 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.

3.2 FIRE ALARM SYSTEM CONTROL PANEL

A. The Fire alarm System Control Panel
1. The Fire alarm System Control Panel shall meet the modular listing requirements of the ninth edition of UL Standard 864 "Standard for Control Units and Accessories for Fire Alarm Systems" for ease of installation, maintenance, and future expansion.
2. Each subassembly of the Fire alarm System Control Panel shall include the appropriate UL modular label. This includes all printed circuit board assemblies, power supplies, and enclosure parts.
3. The system shall provide means for all Signaling Line Circuit (SLC) devices on any Signaling Line Circuit (SLC) loop to be auto programmed into the system by specific address.
4. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
5. The Fire alarm System Control Panel shall support the following items:
6. Up to (8) Fire Alarm Remote Annunciator Panels.
7. Provide new Circuit Labels and Directory cards for panels modified and / or added.
8. The Fire alarm System Control Panel shall have a 6 amp power supply and be capable of expansion to a maximum of 54 total amps via bus connected expander modules that supervise low battery, loss off AC, and loss of communication.
9. The Fire alarm System Control Panel shall include "Form C" alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 Volts D.C.
10. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire alarm System Control Panel.
11. The Fire alarm System Control Panel shall allow for loading and editing special instructions and operating sequences as required in addition to being capable of onsite programming to accommodate and facilitate expansion, building parameter changes or changes as required by local codes.
12. Visually and audibly annunciate any "Alarm", "Trouble", or "Supervisory" condition at the operator's terminals, Fire alarm System Control Panel, and at the Fire alarm System Remote Annunciator Panels.
13. Built-in universal communicator.
14. The Fire alarm System Control Panel shall provide the following features:
    a. Supervision of all initiating signaling and notification circuits throughout the facility by way of connection to addressable control, monitor, and relay modules.
    b. Detect the activation of any initiating device and the location of the alarm condition.
    c. Operate all notification appliances and auxiliary devices as programmed.
    d. PAS pre-signal, meeting N.F.P.A. #72 requirements.
    e. Rapid manual station reporting (under 3 seconds).
    f. Shall meet N.F.P.A. #72 requirements for activation of notification circuits within 10 seconds of initiating device activation.
    g. Coding panel node notification circuits in March Time (120 PPM), Temporal (N.F.P.A. #72), and California Code
    h. Periodic detector test (conducted automatically by the software).
    i. Shall support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes).

1) Two-stage operation shall allow 20 Pulses per Minute (PPM) on alarm and 120 Pulses per Minute (PPM) after 5 minutes or when a second device activates.
2) Canadian Dual stage operation is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer.

j. Self-optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.
k. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one heat detector.
l. Coding option that will synchronize specific strobe lights designed to accept a specific "Sync Pulse".
m. Control-by-time for non-fire operations (with holiday schedules).
n. Day/night automatic adjustment of detector sensitivity.
o. Device "Blink Control" to turn off detector / module Light Emitting Diodes (LEDs) for special areas such as sleeping areas.

15. Permitted zone types that allow Input/Output linking shall be:
a. General: Up to 1,000 zones.
b. Releasing Up to 10 zones.
c. Special: Up to 10 zones.
d. Logic: Up to 1,000 zones.
e. Trouble: Up to 1,000 zones.

16. Install Synchronization modules and/or equipment as recommended by the manufacturer to meet all code requirements that are powered from a Notification Appliance Circuit (NAC) output for the following appliances:
a. Visual Notification Appliances (strobes)
b. Audible Notification Appliances (horns or speakers)
c. Multiple Low Frequency Sounder Appliances and/or standard Sounder Appliances installed within a single dwelling unit.

17. The Signaling Line Circuit (SLC) interface board shall be able to drive a "Class B" twisted unshielded circuit up to 12,500 feet in length.

18. The Fire alarm Control Panel shall be capable of communicating on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, and an inherently regenerative communication format and protocol.

B. Central Processing Unit (CPU):
1. The Fire alarm System Control Panel shall contain a microprocessor based Central Processing Unit (CPU) that shall communicate with, monitor, and control all external interfaces and annunciate A "Trouble" condition for a loss in communications for the following at a minimum:
a. Intelligent Addressable Smoke Detectors.
b. Intelligent Addressable Thermal (Heat) Detectors.
c. Addressable Modules.
d. Control Circuits.
e. Notification Appliance Circuits.
f. Transponders.
g. Annunciators.
h. Other System Controlled Devices.
i. Peripheral Equipment.

2. It shall include an EPROM for system program storage, flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.

3. Upon a loss of response from a device, the Central Processing Unit shall:
a. Sound an audible trouble
b. Illuminate a Light Emitting Diode (LED) indicating loss of communications.
c. Indicate which device or devices are not responding

d. Print the information in the history buffer.

4. The Central Processing Unit shall contain and execute all control-by-event programs for specific action to be taken if an "Alarm" condition is detected by the system that shall be held in non-volatile programmable memory and shall not be lost with system primary and secondary power failure.
5. A special program check function shall be provided to detect common operator errors.
6. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
7. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available that is capable of the following:
   a. Have the ability to off-line program the system with batch upload/download.
   b. Have the ability to upgrade the manufacturers (FLASH) system code changes.
   c. Have a verification utility, which scans the program files, identifying possible errors.
   d. Have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes.
8. The Central Processing Unit shall provide a real-time clock for time annotation of system displays, events, and history files that shall not be lost if system primary and secondary power supplies fail.
9. The Central Processing Unit's real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
10. The Central Processing Unit shall be capable of being programmed, configured, and expanded on site without requiring the use of any external programming equipment.
11. The system programming shall be "Backed Up" via an upload/download program and stored on compatible removable media.
12. The Central Processing Unit and associated equipment shall be protected from voltage surges or line transients.
13. Data transmissions between the Central Processing Unit and each peripheral device shall be continuously scanned for proper operation, reliable, and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.
14. The Central Processing Unit shall provide double pole relays for the following items:
    a. Fire Alarm
    b. System Trouble
    c. Supervisory
    d. Security
15. The Central Processing Unit shall provide one high-speed serial connection for support of network communication modules.
16. In the event of Central Processing Unit failure, all Signaling Line Circuits (SLC's) loop modules shall fallback to degrade mode.
    a. Degrade mode shall treat the corresponding Signaling Line Circuits (SLC's) loop control modules and associated detection devices as conventional two-wire operation.
    b. Activation of any initiating device in this mode shall automatically activate associated Notification Appliance Circuits.

C. System Display Interface Assembly:

1. The Fire alarm System Control Panel shall include a full featured System Display Interface Assembly that shall include the following:
   a. A backlit 80-character Liquid Crystal Display (LCD)
   b. Individual, color coded system status LEDs
   c. A full PC style QWERTY alphanumeric keypad for the field programming and control of the fire alarm system.
   d. Display custom alphanumeric labels for all intelligent devices, Addressable Modules, software zones, etc.
   e. Label information shall be stored in programmable nonvolatile memory (NVRAM).
   f. May be used to program all system operational parameters.

g. Display battery charging current and voltage.

2. It shall also provide 10 Light Emitting Diodes (LEDs), which will indicate the status of the following system parameters:
   a. AC Power: Green Led
   b. System Alarm: Red Led
   c. System Trouble: Yellow Led
   d. Signal Silence: Yellow Led
   e. Pre Alarm: Yellow Led
   f. Point Disabled: Yellow Led
   g. Cpu Failure : Yellow Led
   h. Security: Yellow Led
   i. Supervisory: Yellow Led
   j. Other Event: Yellow Light Emitting Diode (Led)
3. Two different password levels will be accessible through the System Display Interface Assembly to prevent unauthorized system control or programming.
   a. Level 1 (User): Shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager).
   b. Level 2 (Master): Shall be used for actual change of the life safety program (installer) and allow access to password change screens.
   c. These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.
4. The System Display shall include the following operator control switches:
   a. Signal Silence
   b. Lamp Test
   c. Reset
   d. Alarm Active (Drill Switch)
   e. Acknowledge
5. Depression of the Scroll Display key shall display the next event in the selected queue allowing the operator to view events by type including:
   a. Ac Power
   b. Fire Alarm
   c. Pre-Alarm Warning
   d. Security Alarm
   e. Supervisory Signal
   f. Trouble
   g. Disabled Points
   h. Alarm Silenced
   i. Controls Active
   j. Pre-Discharge
   k. Discharge
   l. Abort
6. A "PRINT SCREEN" button shall be provided for printing the event currently displayed on the 640-character Liquid Crystal Display (LCD).

D. System Reports:
   1. The Fire alarm System shall provide means to obtain a variety of reports listing all:
      a. Events
      b. "Alarm" Conditions
      c. "Trouble" Conditions
      d. "Supervisory" Conditions
      e. Security History
   2. Additional reports shall be available for the following:
      a. Last Walk Test performed

b. Detector maintenance report containing the status of each installed addressable detector
c. All Network Parameters
d. All panel settings including broad cast time
e. Event Ordering
f. Block Acknowledge
g. Panel timer values for Auto Silence
h. Silence Inhibit
i. AC Fail Delay time
j. Supervision settings for power supply
k. Supervision settings for printers
l. All programmed logic equations
m. All custom action messages
n. All non-fire and output activations (if pre-programmed for logging) all active points filtered by alarms only
o. Troubles Only
p. Supervisory Alarms
q. Pre-Alarms
r. Disabled Points
s. Activated Points
t. All installed points filtered by Signaling Line Circuits (SLC) points
u. Logic Zones
v. Annunciators
w. Releasing Zones
x. Special Zones
y. Trouble Zones

3.3 SYSTEM DISPLAY

A. The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

B. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.

C. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide ten Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, and CPU FAILURE.

D. The system display shall provide a QWERTY style keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

E. The system display shall include the following operator control switches: ACKNOWLEDGE, SIGNAL SILENCE, RESET, DRILL, and LAMP TEST. Additionally, the display interface shall allow scrolling of events by event type including, FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. A PRINT SCREEN button shall be provided for printing the event currently displayed on the 640-character LCD.

3.4 LOOP (SIGNALING LINE CIRCUIT) CONTROL MODULE

A. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.

B. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.

C. The Loop Control Module shall provide power and communicate with all intelligent addressable detectors and modules on a single pair of wires. This SLC Loop shall be capable of operating as a NFPA Style 6 (Class B) circuit.

D. The SLC interface board shall be able to drive an NFPA Style 6 twisted unshielded circuit up to 12,500 feet in length. The SLC Interface shall also be capable of driving an NFPA Style 6, no twist, no shield circuit for limited distances determined by the manufacturer. In addition, SLC wiring shall meet the listing requirements for it to exit the building or structure. "T"-tapping shall be allowed in either case.

E. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

3.5 FIRE ALARM SYSTEM CONTROL PANEL ENCLOSURES

A. The Fire alarm System Control Panel Enclosure shall be listed to UL #50 "Enclosures for Electrical Equipment, Non-Environmental Considerations", N.F.P.A. #72, and shall be approved for fire protection service.

B. The control panel enclosure shall be suitable for surface or semi-flush mounting.

C. The control panel enclosure shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

D. The back box and door shall be constructed of 0.060" steel with provisions for electrical conduit connections into the sides and top.

E. The door shall provide a key lock and include a transparent opening for viewing all indicators.

F. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.

G. The control panel enclosure shall be modular in structure for ease of installation, maintenance, and future expansion.

3.6 POWER SUPPLY

A. The Addressable Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.

B. The Addressable Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.

C. The Addressable Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.

D. The Addressable Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.

E. The Addressable Main Power Supply shall be power-limited per UL864 requirements.

3.7 TERMINAL BOXES, JUNCTION BOXES AND CABINETS

A. All boxes and cabinets shall be UL listed for their intended purpose.

B. Provide outlet and pull boxes to enclose devices, permit the pulling of conductors and for wire splices and branches.

C. Surface Metal Raceway: Boxes of same Manufacture and to match Raceway. Boxes to accommodate standard devices and device plate.

D. Install pull boxes so as to be accessible after completion of work.

E. All boxes shall be firmly anchored directly or with concealed bracing to building studs or joints. Boxes must be so attached so that they will not "Rock" or "Shift" when devices are operated.

F. Except for surface mounted boxes or boxes above accessible ceilings, all boxes shall have front edge (box or plaster ring) even with the finished surface of the wall or ceiling.

G. Provide blank covers or plates over all boxes not covered by equipment.

H. Pull and junction boxes shall be installed as shown, and to facilitate pulling of wire and to limit the number of bends within code requirements. Boxes shall be permanently accessible and shall be placed only at locations approved by the Engineer.

I. In suspended ceiling spaces, boxes shall be supported from the structure independently from ceiling suspension system.

J. The Drawings do not necessarily show every pull or Junction Box required. The Installing Vendor is permitted to provide boxes deemed necessary by him for his work when installed in accordance with these Specifications.

3.8 BATTERIES AND EXTERNAL CHARGER

A. Battery:
   1. Shall be 12 volt, Gell-Cell or AGM (Absorbed Glass Mat) type.
   2. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 15 minutes of alarm upon a normal AC power failure.
   3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

B. External Battery Charger:
   1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120/240-volt 50/60 hertz source.
   2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
   3. Shall have protection to prevent discharge through the charger.
   4. Shall have protection for overloads and short circuits on both AC and DC sides.

3.9 FIRE ALARM REMOTE ANNUNCIATOR PANEL (FARAP)

A. For the purpose of providing a remote system status display, a Fire Alarm Remote Annunciator Panel shall be provided in locations as indicated on the contract documents.

B. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.

C. The display shall be UL listed for fire alarm application with an On-line/Power LED.

D. The LCD annunciator shall display all alarm and trouble conditions in the system.

E. An audible indication of alarm shall be integral to the alphanumeric display.

F. The display shall be UL listed for fire alarm application.

G. It shall be possible to connect up to a minimum of 32 terminal mode LCD annunciators and be capable of wiring distances up to 6,000 feet from the Fire alarms Control Panel.

H. The system shall allow a minimum of 32 terminal mode LCD annunciators.

I. Up to 10 LCD annunciators shall be capable of the following system functions which shall be protected from unauthorized use by a key switch or password:
   1. Acknowledge.
   2. Signal Silence.
   3. System Reset.

J. The LED annunciator shall offer an interface to a graphic style annunciator.

K. Provide fire alarm remote annunciator panel with an integral Piezo sounder with an Alarm/Trouble switch for audible indication of alarm and trouble conditions.

L. Provide flush or surface mounted, in location as indicated on the contract documents.

M. The Fire Alarm Remote Annunciator Panel shall be programmed to clearly indicate the exact same information that is displayed at the Fire alarms Control Panel on the LCD annunciator screen.

3.10 FIELD DEVICES

A. Intelligent and Addressable Photoelectric Smoke Detectors:
   1. The intelligent photoelectric detectors shall be intelligent and addressable, and shall connect with two wires to one of the fire alarm control panel signaling line circuit loops.

2. The detectors shall use the photoelectric principle to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
3. The detectors shall be ceiling mount and shall include a twist-lock base.
4. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself, by activating a magnetic switch, or may be activated remotely on command from the control panel.
5. The detectors shall provide address-setting means on the detector head using rotary decimal switches. The detectors shall also store an internal identifying code, which the control panel shall use to identify the type of detector.
6. The detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LEDs may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of detector LEDs shall be controlled through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
7. The detector sensitivity shall be set through the fire alarm control panel, and shall be adjustable in the field through the field programming of the system.
8. Addressable smoke detectors shall provide dual (2) status 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. If required, the flashing mode operation of the detector LEDs can be programmed off via the fire control panel program.
9. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity can be automatically adjusted by the panel on a time-of-day basis.
10. 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.
11. The detectors shall be ceiling-mount and shall include a separate twist-lock base which includes a tamper proof feature.

B. Conventional Heat Detectors: Rate of rise and fixed temperature detectors shall be rated at 135 degrees F for areas of ambient temperatures of 100 degrees F or less.
   1. Detectors shall have a smooth ceiling rating of 2500 square feet and shall be installed in accordance with NFPA 72E
   2. Fixed temperature detectors rated at 194 degrees F shall be provided as indicated on the drawings or in areas subject to high ambient temperatures in excess of 100 degrees F. Smooth ceiling rating: 625 sq. ft.

C. Carbon Monoxide Detectors:
   1. Carbon Monoxide Detectors can be mounted on the wall or ceiling.
   2. Carbon Monoxide Detectors shall be flush mounted when located in finished areas.
   3. Wall mounted Carbon Monoxide Detectors installed in indoor locations shall be at 80" above the finished floor or 6" below the ceiling, whichever is lower.
   4. Carbon Monoxide Detectors shall be placed in the following locations:
      a. On every floor of a Dwelling Unit.
      b. Within 10 feet of all Dwelling Unit sleeping areas.
      c. In any room that contains a fuel-burning appliance.

D. Combination Smoke / Carbon Monoxide Detectors:
   1. Combination Smoke / Carbon Monoxide Detectors can be mounted on the wall or ceiling.

2. Carbon Monoxide Detectors shall be flush mounted when located in finished areas.
3. Wall mounted Carbon Monoxide Detectors installed in indoor locations shall be at 80" above the finished floor or 6" below the ceiling, whichever is lower.
4. Carbon Monoxide Detectors shall be placed in the following locations:
   a. On every floor of a Dwelling Unit.
   b. Within 10 feet of all Dwelling Unit sleeping areas.
   c. In any room that contains a fuel-burning appliance.

E. Monitor Modules: Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm indicating devices (any N.O. dry contact devices, including 4-wire smoke detector(s)), to one of the fire alarm control panel signaling line circuit (SLC) loops.
1. The monitor module shall mount in a 4-inch square, 2-1/8" deep electrical box, to a surface mounted back box, or directly into the fire alarm control panel.
2. The IDC zone may be wired for Style D or Style B operation. The monitor module shall provide address-setting means using rotary decimal switches and shall also store an internal identifying code, which the fire alarm control panel shall use to identify the type of device. An LED shall be provided which shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. 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.
4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits.

F. Control Module:
1. The control module shall be used to connect a conventional indicating appliance circuit of 24 VDC compatible polarized audio-visual indicating appliances to one of the NAC loops.
2. The control module shall mount in a standard 4-inch square, 2-1/8" deep electrical box.
3. The control module may also be wired as a dry contact (form C) relay.
4. Power for the relay coil shall be provided by the NAC loop to reduce wiring connection requirements.
5. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y. For speaker applications the module is rated for 50 watts at 25 or 70.7.
6. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
7. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.
8. For multiple circuit control a module shall be available that provides 6 Style B or 3 Style D control circuits.

G. Isolator Module:
1. The isolator module shall be used to isolate wire-to-wire short circuit on an SLC loop in order to limit the number of other modules or detectors that are incapacitated by the short circuit fault.
2. If a wire-to-wire short occurs, the isolator shall automatically open circuit the SLC loop.
3. When the short is corrected, the isolators shall automatically reconnect the isolated section of the SLC loop.
4. Provide isolation modules at logical junctions corresponding to architectural wings or sections of the building or campus.
5. At minimum, an isolation module shall be provided for every 50 SLC sloop devices. Should multiple, remote power supplies be required, a minimum of one isolation module shall be provided for devices served by each remote power supply.

H. Addressable Relay Module:
1. Addressable Relay Modules shall be available for HVAC control and other building functions. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
2. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

I. Addressable Manual Stations:
1. Addressable manual stations shall be provided to connect one addressable, supervised manual station to one of the fire alarm control panel signaling line circuit (SLC) loops.
2. The manual station shall, on command from the control panel, send data to the panel representing the state of the manual switch.
3. Manual fire alarm stations shall be double action type with a key operated test-reset lock, and shall be designated so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
4. All operated stations shall have a positive, visual indication of operation that cannot be reset without the use of a key. The word FIRE shall appear on the front of the stations in raised letters.
5. Stations shall be suitable for surface mounting on matching back box, or semi-flush mounting on a standard single gang box. The manual stations shall provide address-setting means using rotary decimal switches and shall also store an internal identifying code, which the control panel shall use to identify the type of device.
6. An LED shall be provided which shall flash under normal conditions, indicating that the manual station is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. The station shall provide a key reset. The key shall be the same as used for the fire control panel.
7. All addressable manual fire alarm stations shall be surface-mounted to a back box. This back box will be color coordinated with the front panel of the manual fire alarm station, and shall not allow any corner of the manual fire alarm station to protrude.
8. A mounting plate will be provided to allow the installation of an isolator/control/monitor module directly in the fire alarm control panel back box.

3.11 SOUNDER BASE ONLY APPLIANCES

A. Sounder Base Only Appliances shall be listed to UL #268 "Smoke Detectors for Fire Alarm Systems", UL #464 "Standard for Audible Signal Appliances", and be compatible with the fire alarm System Control Panel.

B. Sounder Base Only Appliances shall be provided in residential dwelling unit applications only.

C. The fire alarm System Control Panel shall be able to:
1. Distinguish the Sounder Base Only Appliance as a unique device type on the Signaling Line Circuit (SLC) loop or on a Notification Appliance Circuit (NAC).
2. When connected to a Notification Appliance Circuit (NAC), power is supervised via the Notification Appliance Circuit (NAC) circuit supervision while in standby mode (EOL resistor required for Class B operation).
3. Can command an individual sounder base or a group of sounders in a suite or other multi-room configuration to activate.
4. Capable of allowing selection of volume, tone, and group.

D. Sounder Base Only Appliances shall be capable of producing:
1. Two distinct volume levels:
a. 75 dBA at 10'-0".

b. 85 dBA at 10'-0".

2. A variety of tone patterns required by N.F.P.A. #72 for commercial and residential applications:
   a. Continuous.
   b. ANSI Temporal 3 (Smoke Alarm).
   c. ANSI Temporal 4 (CO Alarm).
   d. March Time.

E. Sounder Base Only Appliances shall include a tamper-resist feature that prevents its removal from the base without the use of a tool.

F. Sounder Base Only Appliances shall have a mechanical locking feature that prevents removal of attached sensor head.

G. Sounder Base Only Appliances shall have the following features:
1. Capability of interconnection to other sounder bases to allow activation of all sounder bases within specific dwelling units.
2. Capability of being synchronized in accordance with N.F.P.A. #72.
3. Be silenceable from the fire alarm System Control Panel.

H. Sounder Base Only Appliances shall be installed in pre-wired mounting plate that fits various junction box sizes.

3.12 LOW FREQUENCY SOUNDER ONLY APPLIANCES

A. Low Frequency Sounder Only Appliances shall be listed to UL #464 "Standard for Audible Signal Appliances", UL #1971 “Standard for Signaling Devices for the Hearing Impaired", N.F.P.A. #72, shall be approved for fire protective service, and be compatible with the fire alarm System Control Panel.

B. Low Frequency Sounder Only Appliances shall be Intelligent, Analog, and Addressable that shall connect to the fire alarm System Control Panel's Notification Appliance Circuits (NAC) or Signaling Line Circuits (SLC).

C. Low Frequency Sounder Only Appliances shall have the following characteristics:
1. Shall be 24 Volts D.C.
2. Be installed on the ceiling or on the wall.
3. Shall be red or white finished.
4. Tamper resistant construction.
5. Frequency range of 520 Hz ±10% square wave tone.
6. Permanent marking on the housing that reads "Low Frequency Sounder".
7. Shall have three (3) audibility options and an option to switch between a temporal three-pattern and a non-temporal (continuous) pattern.
8. Shall produce a nominal sound output of 76 dBA at 10'-0"
9. Shall produce a maximum sound output of 80 dBA at 10'-0".
10. Shall be plug-in type.
11. Shall terminate at a universal mounting plate.

D. Low Frequency Sounder Only Appliances installed in interior climate controlled spaces shall have an operating temperature between 32°F and 120°F.

E. If the Low Frequency Sounder Only Appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

3.13 STROBE ONLY APPLIANCES

A. Strobe Only Appliances shall be listed to UL #1638 "Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling" shall be approved for fire protective service, and be compatible with the fire alarm System Control Panel.

B. Strobe Only Appliances shall be Intelligent, Analog, and Addressable that shall connect to the fire alarm System Control Panel's Notification Appliance Circuits (NAC) or Signaling Line Circuits (SLC).

C. Strobe Only Appliances shall have the following characteristics:
1. Shall be 24 Volts D.C.
2. Be installed on the ceiling or on the wall.
3. Shall be red or white finished.
4. Tamper resistant construction.
5. Shall flash at a rate of one flash per second at 1Hz over the strobes entire operating voltage.
6. Shall be xenon / zenon flash tube type.
7. Associated lens/reflector system shall be rated at a minimum of 15 candela and meet or exceed the requirements of the Americans with Disabilities Act (ADA).
8. Shall have field selectable candela settings.
9. Shall be plug-in type.
10. Shall terminate at a universal mounting plate.
11. Shall be backward compatible.

D. Strobe Only Appliances installed in interior climate controlled spaces shall have an operating temperature between 32°F and 120°F.

E. Weatherproof Strobe Only Appliances installed outdoors or in spaces of high humidity shall have the following characteristics:
1. Shall be listed for outdoor use by UL.
2. Shall have an operating temperature between -40°F and 151°F.
3. Shall be provided with an outdoor/weatherproof back box with:
   a. Conduit entries of ½" and ¾".
   b. Weatherproof sealant per the manufacturer's recommendations to prevent moisure from entering the structure.

F. If the Strobe Only Appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

G. Provide wire guards for Strobe Only Appliances installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, or in areas subject to mechanical damage.

3.14 COMBINATION HORN / STROBE APPLIANCES

A. Combination Horn / Strobe Appliances shall be listed to UL #464 "Standard for Audible Signal Appliances", UL #1638 "Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling", UL #1971 "Standard for Signaling Devices for the Hearing Impaired", shall be approved for fire protective service, and be compatible with the fire alarm System Control Panel.

B. Combination Horn / Strobe Appliances shall be Intelligent, Analog, and Addressable that shall connect to the fire alarm System Control Panel's Notification Appliance Circuits (NAC) or Signaling Line Circuits (SLC).

C. The Horn Appliance shall be powered independently of the Strobe Appliance on a coded or non-coded power supply.

D. Combination Horn / Strobe Appliances shall have the following characteristics:
1. Shall be 24 Volts D.C.
2. Be installed on the ceiling or on the wall.
3. Shall be red or white finished.
4. Tamper resistant construction.
5. Shall have three (3) audibility options and an option to switch between a temporal three-pattern and a non-temporal (continuous) pattern.
6. Shall produce a nominal sound output of 82 dBA at 10'-0"
7. Shall produce a maximum sound output of 90 dBA at 10'-0".
8. Shall flash at a rate of one flash per second at 1Hz over the strobes entire operating voltage.
9. Shall be xenon / zenon flash tube type.
10. Associated lens/reflector system shall be rated at a minimum of 15 candela and meet or exceed the requirements of the Americans with Disabilities Act (ADA).
11. Shall have field selectable candela settings.
12. Shall be plug-in type.
13. Shall terminate at a universal mounting plate.
14. Shall be backward compatible.

E. Combination Horn / Strobe Appliances installed in interior climate controlled spaces shall have an operating temperature between 32°F and 120°F.

F. Weatherproof Combination Horn / Strobe Appliances installed outdoors or in spaces of high humidity shall have the following characteristics:
1. Shall be listed for outdoor use by UL.
2. Shall have an operating temperature between -40°F and 151°F.
3. Shall be provided with an outdoor/weatherproof back box with:
a. Conduit entries of ½" and ¾".
b. Weatherproof sealant per the manufacturer's recommendations to prevent moisture from entering the structure.

G. If the Combination Horn / Strobe Appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

H. Provide wire guards for Combination Horn / Strobe Appliances installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, or in areas subject to mechanical damage.

3.15 COMBINATION LOW FREQUENCY SOUNDER / STROBE APPLIANCES

A. Combination Low Frequency Sounder / Strobe Appliances shall be listed to UL #464 "Standard for Audible Signal Appliances", UL #1971 "Standard for Signaling Devices for the Hearing Impaired", N.F.P.A. #72, shall be approved for fire protective service, and be compatible with the fire alarm System Control Panel.

B. Combination Low Frequency Sounder / Strobe Appliances shall be Intelligent, Analog, and Addressable that shall connect to the fire alarm System Control Panel's Notification Appliance Circuits (NAC) or Signaling Line Circuits (SLC).

C. Combination Low Frequency Sounder / Strobe Appliances shall be wired as a primary signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances.

D. Combination Low Frequency Sounder / Strobe Appliances shall have the following characteristics:
   1. Shall be 24 Volts D.C.
   2. Be installed on the ceiling or on the wall.
   3. Shall be red or white finished.
   4. Tamper resistant construction.
   5. Frequency range of 520 Hz ±10% square wave tone.
   6. Permanent marking on the housing that reads "Low Frequency Sounder".
   7. Shall have three (3) audibility options and an option to switch between a temporal three-pattern and a non-temporal (continuous) pattern.
   8. Shall produce a nominal sound output of 76 dBA at 10'-0"
   9. Shall produce a maximum sound output of 80 dBA at 10'-0".
   10. Shall flash at a rate of one flash per second at 1Hz over the strobes entire operating voltage.
   11. Shall be xenon / zenon flash tube type.
   12. Associated lens/reflector system shall be rated at a minimum of 15 candela and meet or exceed the requirements of the Americans with Disabilities Act (ADA).
   13. Shall have field selectable candela settings.
   14. Shall be plug-in type.
   15. Shall terminate at a universal mounting plate.

E. Combination Low Frequency Sounder / Strobe Appliances installed in interior climate controlled spaces shall have an operating temperature between 32°F and 120°F.

F. If the Combination Low Frequency Sounder / Strobe Appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

3.16 TRANSIENT AND SURGE PROTECTION

A. If not provided as an integral part of the system power supply, an external, 120 VAC transient and surge shall be provided for protection of all components of the system.

B. Protector shall be UL listed under sections 1449, 1283 and 497A, have a minimum energy handling of 70 Joules on line to line, line to neutral and line to ground spikes.

C. Response time shall be 5 nanoseconds or less and shall begin at 140 VAC.

D. Provide (1) dedicated TVSS at each 120 Volts A.C. hard wired connection point.

3.17 WIREMOLD SURFACE RACEWAY

A. Wiremold Surface Raceway shall be meet the requirements of Underwriters Laboratories Inc. and conform to U.S. Federal Specification W-C-582.

B. Wiremold Surface Raceway shall be in accordance with N.F.P.A. #70, local requirements, and state requirements.

C. Wiremold Surface Raceway shall be constructed of steel with a minimum thickness of 0.040".

D. Wiremold Surface Raceway shall have the following features:
   1. Rugged steel raceway.
   2. Low-profile and unobtrusive appearance.
   3. Base and cover are preassembled as a one-piece unit.
   4. Surface mounting.

5. Full line of fittings.
6. Fittings have removable covers.
7. UL #5 "Standard for Surface Metal Raceways and Fittings" and ADA compliant.

3.18 GRAPHIC MAPS

A. The Graphic display shall have the following physical characteristics:
   1. The Indoor Graphic shall be a full color image with no less than the following areas (listed below) shown in different colors.
   2. The Graphic shall be secured in a black anodized aluminum frame, have Tempered Glass to protect the graphic image, and be mounted with a concealed security hanging system.
   3. The Graphics Map shall be installed directly adjacent to the Fire alarm System Remote Annunciator Panel and main Fire alarm System Control Panel.
   4. The Graphics Map shall be a minimum of 11"x17" in size, but shall be based upon the actual building footprint. Provide 1/8” text minimum.
   5. Suggested manufacturer is HR Kirkland.

B. The Graphic shall have the following features:
   1. Provide a graphical representation of the main building floor plan, all other structures, and portable buildings. At a minimum, include the information:
      a. Building name(s) (and numbers where applicable).
      b. Room names and numbers.
      c. Doors.
   2. Show the location of the FACP(s) (in Red).
   3. Show the location(s) of the FARAP(s) (in Red).
   4. Show a “You Are Here” (in Red) with an arrow pointing at the wall or area location of where Graphic Map is to be installed.
   5. Show the connections and system(s) being monitored by the Fire alarm System. Include a System Legend at the top of the Graphic for EACH of the following systems:
      a. Fire Suppression System, consisting of:
         1) Post Indicator Valve.
         2) Water Flow Switch(s).
         3) Tamper Switch(s).
         4) Pressure Switch(s).
         5) Other systems that would typically interface to the Fire alarm System.
   6. Show the “North” arrow on the drawing.
   7. For multi-story buildings, the bottom of the graphic shall be the lowest level of the building, continuing to the top of the graphic with the highest level of the building.
   8. Locate at the top of the Graphic, the image/logo and name of the Owner, approximately four-inches in height. This size of EACH image shall be consistent on EACH Graphic that is submitted.
      a. Coordinate with the Owner to obtain the graphic images and logos.
   9. EACH of the following areas on the Graphic shall be separated by a pastel Color:
      a. Administrative Areas
      b. Sleeping Rooms
      c. Hallways
      d. Multipurpose Room(s)
      e. Kitchen
      f. Restrooms
      g. Truck Bays
   10. The room numbering system depicted in all graphics and referenced in data bases generated by the Fire alarm System Contractor shall match that of the final signage and room identification system adopted by the Owner, unless specifically approved in writing otherwise, by the Architect and/or Engineer.

11. Interior Graphic Maps shall consist of the following:
    a. The full scale colored image shall be printed on the reverse side of a 10 mil polycarbonate Lexan.
    b. Standard background shall be white.
    c. The Lexan image shall mount to a rigid 1/8" substrate with removable adhesive mounts.
    d. The Graphic Map shall be secured to a black anodized aluminum frame.
    e. Provide Graphic Map with a concealed security hanging system to prevent unauthorized removal.

3.19 FIRE SPRINKLER SYSTEM CONNECTIONS

A. Provide addressable monitor modules for each fire sprinkler system device that is to be connected and monitored by the Fire alarms System consisting of the following items:
    1. Post Indicator Valve(s) (PIV)'s.
    2. Water Flow Switch(s).
    3. Tamper Switch(s).

B. Provide quantities as required by Code and by the Authority Having Jurisdiction.

C. The Fire alarm System Contractor shall provide a new electric bell. The bell shall be powered by a 24 Volts D.C. power source through the Fire alarm System Control Panel, allowing the electric bell to be on a back-up battery supply.

D. Fire protection sprinkler system tamper switches on the valve controlling the backflow preventer full forward flow test piping shall be connected to the Fire alarm System Control Panel.

PART 4 - EXECUTION

4.1 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, nor more than 48 inches above the finished floor.

4.2 WIRING

A. All wiring shall be contained in metal raceways. Wiring insulation shall be one of the types required by NEC 725-16 and shall be consistently color coded throughout the system.

B. Permanent wire markers shall be affixed to all conductors at terminations and splices. Numbering system shall be consistent with shop drawings.

C. All terminations shall be T & B "Sta-Kon" (or equivalent) self-insulated, flanged or forked tongue lugs where connected at screw type terminals. Wiring in main control cabinet shall be neatly arranged and bundled with wire ties (or equivalent).

D. Install wiring equipment in strict accordance with manufacturer's instructions. No wire other than the detector circuit shall be permitted in conduit feeding detectors unless approved.

E. Minimum wire size for 120 VAC wiring shall be #12 THHN.

F. Minimum wire size for initiating alarm circuit, i.e., pull stations, heat and smoke detectors, shall be minimum #16 twisted shielded pair FPL rated.

G. Minimum wire size for speaker and indicating circuits, i.e., horns, strobes, shall be minimum #16 shielded, twisted FPL rated cable. Indicating circuits shall be sized in accordance with manufacturer recommended voltage drop requirements, minimum size #14 AWG.

H. Provide separate raceway or shielded cable as required or recommended by system manufacturer to prevent the introduction of noise into the system.

I. All new Fire alarm System junction boxes shall be painted red and annotated “FA” on the cover in bold black print, having a minimum character font size of 2” tall X 1” wide.

J. 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, signaling line circuits, and notification appliance circuits.

K. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

L. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

M. The system shall permit the use of IDC and NAC wiring in the same conduit with the multiplex communication loop.

N. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

O. All analog voice speaker and analog telephone circuits shall use twisted/shielded pair to eliminate cross talk.

P. Connections to the communicator will be made by the Fire Alarm Vendor, in the presence of the Electrical Contractor, 1-week prior to the final acceptance test with the AHJ.

Q. All circuits shall be identified in accordance with table 3.02L with labels to include wire type, quantity and circuit number. Wire code shall match AHJ approved shop drawings wire code. Labels must be provided at the FACP and all junction boxes. Labels shall be produced using an electronic labeler.

Table 3.03 R

Example: C2HX3
C = Signal Circuit Wire
2 = Signal circuit number
H = Annunciator wire
X = Addressable initiating device circuit wire
3 = Addressable initiating device circuit number

4.3 CONDUIT

A. Conduit:
1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. All wiring in exposed areas shall be installed in conduit or raceway.
3. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
4. Wiremold fill shall not exceed 40% of the interior cross sectional area.
5. It is permissible to install fire alarm low voltage cables open in D rings above accessible ceilings.
6. 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, as per NEC Article 760.
7. Wiring for 24 volt control, alarm notification, 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.
8. Conduit 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.
9. Conduit shall be 3/4 inch (19.1 mm) minimum.

4.4 PENETRATIONS

A. Fire Resistance Rated Penetrations:
1. Where Fire alarm System conduit penetrates a fire resistance rated wall or floor assembly, the Fire alarm System Contractor shall provide a fire rated penetration that maintains the integrity and fire resistance rating of the assembly being penetrated.
2. The fire resistance rated penetrations of walls or floor assemblies shall consist of one of the following:
    a. Cabling in Conduit: Fire alarm System cabling installed in conduit shall be provided with sealant between the conduit and the wall or floor penetration
    b. Exposed Cabling: Fire alarm System cabling installed exposed shall be provide with a section of conduit (sleeve) that extends past both faces of the penetration by a minimum distance of 6". Seal both ends of conduit (sleeve) with U.L listed approved material and sealant that maintains the fire resistance rating of the assembly being penetrated. Provide fire resistance rated sealant to both sides of assembly penetration between the conduit (sleeve) and the wall or floor assembly.
    c. Exposed Cabling: Fire alarm System cabling installed exposed shall be provide with a fire resistance rated grommet that maintains the fire resistance rating of the assembly being penetrated, such as those manufactured by Specified Technologies Incorporated (STI). The grommet shall slipover the cabling and snap together to form a round grommet that can slide into the penetration. A separate grommet shall be required for each side of the assembly.

B. Non-Fire Resistance Rated Penetrations:
   1. The Non-fire resistance rated penetrations of walls or floor assemblies shall consist of one of the following:
      a. Cabling in Conduit: Fire alarm System cabling installed in conduit shall not require additional sealant between the conduit and the wall or floor penetration
      b. Exposed Cabling: Fire alarm System cabling installed exposed shall be provide with a section of conduit (sleeve) that extends past both faces of the penetration by a minimum distance of 6". Additional Sealant shall not be required.
      c. Exposed Cabling: Fire alarm System cabling installed exposed shall be provide with a Non-fire resistance rated grommet, such as those manufactured by Specified Technologies Incorporated (STI). The grommet shall slipover the cabling and snap together to form a round grommet that can slide into the penetration. A separate grommet shall be required for each side of the assembly.

C. Smoke Barrier/Partition Penetrations:
   1. Where Fire alarm System conduit penetrates a smoke barrier/partition wall or floor assembly, the Fire alarm System Contractor shall provide a smoke barrier/partition penetration that prevents the passage of smoke through the assembly being penetrated.
   2. Smoke barrier/partition penetrations of walls or floor assemblies shall consist of one of the following:
      a. Cabling in Conduit: Fire alarm System cabling installed in conduit shall be provided with sealant between the conduit and the wall or floor penetration
      b. Exposed Cabling: Fire alarm System cabling installed exposed shall be provide with a section of conduit (sleeve) that extends past both faces of the penetration by a minimum distance of 6". Seal both ends of conduit (sleeve) with U.L listed approved material and sealant that prevents the passage of smoke. Provide sealant between the conduit (sleeve) and the wall or floor assembly on both sides of assembly penetration.
      c. Exposed Cabling: Fire alarm System cabling installed exposed shall be provide with a Non-fire resistance rated grommet, such as those manufactured by Specified Technologies Incorporated (STI). The grommet shall slipover the cabling and snap together to form a round grommet that can slide into the penetration. A separate grommet shall be required for each side of the penetration.

D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local authorities prior to cabling system acceptance.

E. The Fire alarm System drawings do not specifically identify penetrations through walls, floors, platforms, and foundations.

F. The Fire alarm System Contractor shall review drawings to determine penetration locations.

G. All penetrations through walls, floors, platforms, and foundations are the responsibility of the Fire alarm System Contractor.

H. All penetrations shall have red ¾" wide bands within 1'-0" of each side of the wall/floor being penetrated.

4.5 ADDITIONAL FIELD DEVICES AND INSTALLATION LABOR

A. In order to minimize the schedule and cost impact of implementing minor changes during the course of construction, the following list of material and installation labor shall be included in this scope of work. The contractor shall include in his bid the listed materials, labor that is based on existing jobsite conditions and established construction standards, and all fees associated with documenting and executing these changes. The locations of additional field devices shall be as directed by the Engineer or Architect.

B. The material included but is not limited to for each school:

QTY	ITEM
4	Photo Electric Smoke Detector/Bases
2	Heat Detectors
1	Manual Pull Stations
4	Horn/Strobe Units
20	Device Boxes
20	4S J-boxes with blank covers
500 LF	½" EMT with 4-#14 THHN wire (includes couplers, straps, connectors, etc.)
20 Hrs.	Labor for Journeyman Electrician
1 Lot	Miscellaneous fees, tools, material, handling, O H & P

4.6 OPERATION AND MAINTENANCE MANUALS

A. Bind Operation & Maintenance Manual for the Fire alarm System in a single hard-backed binder. Spine of each binder shall have following typewritten lettering inserted:

OPERATION
AND
MAINTENANCE
MANUAL
FIRE ALARM SYSTEM

B. Operation and Maintenance Binders:
1. Binders shall be commercial quality, and shall have (3) D-style rings.
2. Binders shall have durable plastic covers with clear pockets on the cover and spine to hold labels.
3. Binders shall have a 1 inch minimum and 3 inch maximum ring size.
4. Binders shall not be filled more than 2/3 of its capacity to accommodate future revisions.
5. Where two or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the project manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operations and maintenance of each piece of equipment.

C. Operation and Maintenance manuals shall contain the following:
1. Cover: Identify each binder with a typed or printed title.
2. Project Directory: Name, address, and phone number of Architect, General Contractor, and Electrical Subcontractors. Also include complete list of equipment installed with name, address, and phone number of each vendor.
3. Table of Contents: List every item separated by a divider, using the same identification as on the divider tab.
4. Dividers: Provide heavy paper dividers with printed tabs for each section. Immediately following the divider tab include a description of product.
5. Typewritten Operation and Maintenance instructions.
6. Complete replacement parts lists.

7. Manufacturer's equipment submittal literature for all components used in the system.
8. Typewritten "Sequence of Operations".
9. Thorough testing procedures.
10. Recommended testing frequency for each item.
11. Acceptance Test Certificates.
12. Copy of as-built drawings.
    a. Where oversized drawings are necessary, fold drawings to the same size as text pages and use as foldout.
    b. If drawings are too large to be used practically as a foldout, place the drawing neatly folded in the front or rear pocket of the binder. Insert a typewritten page indicating drawing title, description of contents and drawing location in the appropriate location in the manual.
13. Warranties: Provide a copy of each warranty in the appropriate manual. Provide written data outlining the procedures to follow in the event of product failure.
14. Electronic copy of the final system program software. (USB Drive / CD)

D. Submit copies as specified by Division 1, and at a minimum, provide **three (3) copies** of Operation & Maintenance Manual to Architect and Engineer to review prior to scheduling the training session.

E. Operation and Maintenance manuals shall contain original color printed brochures supplied by manufacturers (Xerox black and white copies of originals will not be accepted).

F. The information included must be the exact equipment installed not the complete "line" of the manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

4.7 AUTOMATIC DETECTORS

A. Locate detectors not less than two (2) feet from a supply or exhaust ventilation grille.

4.8 DEVICE LOCATIONS

A. Device locations may be changed within 15 feet without extra charge, if so desired by the Engineer, before installation.

4.9 AS-BUILT DOCUMENTATION

A. Three sets of as-built drawings shall be provided by the Electrical Contractor to the Architect which clearly indicates:
1. Actual routing of all raceways.
2. Actual cable type, numbers, and routing.
3. Actual system wiring diagrams, connection diagrams, and interface of all components in the system.
4. Actual room number and programming addressed assigned for all components in the system.

B. The Contractor shall include in the maintenance manuals the following as a minimum:
1. Reduced copy (11"x17") of record drawings.
2. Cuts on all equipment and components.
3. Complete wiring diagram of system including internal workings of main panel and annunciators.
4. Acceptance test certification.

C. Following the completion of final system programming, the systems contractor shall provide to the Engineer, a hard copy printout of the final system program software or "point status report". A hard copy of the "system report" which documents the status of all active devices in the system shall also be provided.

D. Note: The room numbering system depicted in all graphics and referenced in data bases generated by the system contractor shall match that of the final signage and room identification system adopted by the Owner, unless specifically approved in writing otherwise, by the Engineer.

4.10 MOUNTING HEIGHTS AND LOCATIONS

A. Fire Alarm Control Panel (FACP):
1. The Fire alarm Control Panel shall be installed in the location indicated on the contract documents.
2. The Fire alarms Control Panel shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
3. The top of the Fire alarms Control Panel shall be located 60" above the finished floor, unless noted otherwise and shall be installed level.

B. Fire Alarm Remote Annunciator Panel (FARAP):
1. The Fire Alarm Remote Annunciator Panel(s) shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
2. The top of the Fire Alarm Remote Annunciator Panel(s) (FARAP) shall be located 48" above the finished floor, unless noted otherwise and shall be installed level.
3. The Fire Alarm Remote Annunciator Panel (FARAP) shall be located where indicated on the Contract Documents.

C. Graphics Maps:
1. Provide a graphical representation of the floor plan(s) for all structures directly adjacent to the Fire alarms Control Panel (FACP) on the opposite side of the enclosure hinge.
2. Provide a graphical representation of the floor plan(s) for all structures directly adjacent to the Fire Alarm Remote Annunciator Panel (FARAP) on the opposite side of the enclosure hinge.
3. Leave 4" to 6" of wall space between the Graphic Map and the Fire alarms Control Panel (FACP).
4. Leave 4" to 6" of wall space between the Graphic Map and the Fire Alarm Remote Annunciator Panel (FARAP).
5. The top of the Graphic Map shall be located 60" above the finished floor, unless noted otherwise.
6. The top of the Graphic Map shall be level.
7. Prior to mounting, insure the appropriate "You Are Here" location on the Graphic is installed in the correct location, in reference to the room or area of the building that it is being mounted at.
8. Use the Manufacturer provided mounting hardware and install per Manufacturer’s recommendations.

D. Initiating Devices:
1. See “Fire Alarm Legend” on the Contract Documents.

E. Notification:
1. See “Fire Alarm Legend” on the Contract Documents.

4.11 WARRANTY

A. All components, parts, and assemblies supplied by the manufacturer shall be guaranteed against defects in materials and workmanship for a period on 12 months. Warranty service shall be provided by a trained specialist of the equipment manufacturer. The specialist shall be based in a fully staffed office located within a reasonable distance from the job site. Contractor shall replace or repair defects in material or workmanship for a period of 12 months after the certification of final acceptance.

4.12 FORMAL TESTS AND INSPECTIONS

A. Do not submit a request for formal test and inspection until the preliminary test (including audibility and intelligibility testing results) are completed and corrections are made and approved.

B. Submit a written request to local fire protection authority for formal inspection at least 14 days before the inspection date.

C. An experienced technician regularly employed by the system installer shall be present during the inspection.

D. At this inspection, repeat any or all of the required tests as directed.

E. Correct defects in work provided by the Contractor and perform additional system tests until the system complies with current code and the contract requirements.

F. Furnish appliances, equipment, electricity, instruments, connecting devices and personnel for the tests.

G. Furnish Architect with three (3) copies of test certificates required by testing agencies.

4.13 FIRE ALARM SYSTEM TESTING

A. Upon completion on the system installation, the Fire alarm System Contractor shall conduct a system test for the Owner, Architect, Engineer, and Authority Having Jurisdiction (for those who wish to attend) to verify operation of the system.

B. This system test shall be conducted by a factory trained technician.

C. The Fire alarm System Contractor shall provide a minimum of (2), two-way communication devices for the system test.

D. The Fire alarm System Contractor shall completely fill out all applicable documents contained Section 7.8 "Forms" in the 2013 Edition of N.F.P.A. #72.

E. If the Fire alarm System Contractor fails the Authority Having Jurisdiction system test and inspection, the following shall occur:
   1. The Fire alarm System Contractor shall make all of the necessary corrections as required, to pass the Authority Having Jurisdiction testing and inspection.
   2. Notify the Authority Having Jurisdiction and schedule another test.
   3. Pay all associated fees for additional site visits made by the Authority Having Jurisdiction.
   4. Continue making corrections until the Fire alarm System has been accepted by the Authority Having Jurisdiction.

F. After acceptance of the system testing, the Fire alarm System Contractor shall submit a copy of approved test certificates with Authority Having Jurisdiction signature

4.14 TESTING REQUIREMENTS

A. Fire alarm Control Panel testing shall include, but is not limited to the following:
1. Verify Control Panel LED's.
2. Verify Control Panel Display.
3. Verify Control Panel Piezo-electric audible device operates.
4. Verify "Alarm" Condition at the Control Panel.
5. Verify "Trouble" Condition at the Control Panel.
6. Verify "Supervisory" Condition at the Control Panel.
7. Verify "Alarm Silence" Switch at the Control Panel.
8. Verify "Queue Switch" at the Control Panel.
9. Verify "Reset Switch" at the Control Panel.
10. Verify AC Power Failure at the Control Panel.
11. Verify Battery Trouble at the Control Panel.
12. Verify Battery Charger Output at the Control Panel.
13. Verify Battery Back-up "Draw Down" Test at the Control Panel.
14. Verify Ground Fault Condition at the Control Panel.
15. Verify Open Circuit condition at the Control Panel.
16. Verify Short Circuit condition at the Control Panel.
17. Verify Addresses match the address and location of all field devices at the Control Panel.
18. Verify Remote Annunciator Panel LED's.
19. Verify Remote Annunciator Panel Display.
20. Verify Remote Annunciator Panel Piezo-electric audible device operates.
21. Verify "Alarm" Condition at the Remote Annunciator Panel.
22. Verify "Trouble" Condition at the Remote Annunciator Panel.
23. Verify "Supervisory" Condition at the Remote Annunciator Panel.
24. Verify "Alarm Silence" Switch at the Remote Annunciator Panel.
25. Verify "Queue Switch" at the Remote Annunciator Panel.
26. Verify Remote Annunciator Panel display matches the display at the Fire alarm System Control Panel.

B. Fire alarm System Power Supply testing shall include, but is not limited to the following:
1. Verify AC Power Failure at the Power Supply.
2. Verify Battery Trouble at the Power Supply.
3. Verify Battery Charger Output at the Power Supply.
4. Verify Battery Back-up "Draw Down" Test at the Power Supply.
5. Verify Ground Fault at the Power Supply.
6. Verify Open Circuit at the Power Supply.
7. Verify Short Circuit at the Power Supply.

C. Fire alarm System Initiating Device testing shall include, but is not limited to the following:
1. Verify activation of all Manual Pull Stations initiates an "Alarm" condition at the Fire alarm System Control Panel.
2. Verify activation of all System Smoke Detectors initiate an "Alarm" condition at the Fire alarm System Control Panel.
3. Verify activation of all System Heat Detectors initiates an "Alarm" condition at the Fire alarm System Control Panel.
4. Verify activation of all Dwelling Unit Smoke Detectors initiate a "Supervisory" condition at the Fire alarm System Control Panel.
5. Verify activation of all System Carbon Monoxide Detectors initiates an "Alarm" condition at the Fire alarm System Control Panel.
6. Verify activation of all Dwelling Unit Carbon Monoxide Detectors initiates all Low Frequency Sounders within the Dwelling Unit only.

D. Fire alarm System Notification Appliance testing shall include, but is not limited to the following:
   1. Verify that all Strobes are operational and synchronized.
   2. Verify that all Horns are operational and synchronized.

E. Fire Protection System Connections testing shall include, but is not limited to the following:
   1. Verify opening of each normally closed sprinkler system control valve initiates a "Supervisory" condition at the Fire alarm System Control Panel.
   2. Verify closing of each normally open sprinkler system control valve initiates a "Supervisory" condition at the Fire alarm System Control Panel.
   3. Verify activation of all sprinkler system water flow switches initiate an "Alarm" condition at the Fire alarm System Control Panel.
   4. Verify sprinkler system electric bell actuation is less than 60 seconds from the time that each inspector's test valve is opened.

F. Initiating Device Circuits (IDC), Signaling Line Circuit (SLC), and Notification Appliance Circuit (NAC) cable testing shall include, but is not limited to the following:
   1. Loop Resistance test.
   2. Verify Open Circuit condition on Negative Leg of all circuits.
   3. Verify Open Circuit condition on Positive Leg of all circuits.
   4. Verify Open Circuit Ground condition on Negative Leg of all circuits.
   5. Verify Open Circuit Ground condition on Positive Leg of all circuits.
   6. Verify Open Circuit Cable-to-Cable Short condition in all circuits.
   7. Verify Closed Circuit Ground Fault condition in all circuits.
   8. Verify Closed Circuit Cable-to-Cable Short condition in all circuits.
   9. Verify Closed Circuit Cable-to-Cable Short and Ground condition on Negative Leg of all circuits.
   10. Verify Closed Circuit Cable-to-Cable Short and Ground condition on Positive Leg of all circuits.
   11. Verify Circuit Voltage of each circuit at maximum system operation.
   12. Verify Current Draw of each circuit at maximum system operation.
   13. Verify Class "B" wiring in all circuits.

4.15 AUDIBILITY REQUIREMENTS

A. The fire alarms system contractor shall perform audibility testing in each space of the building prior to acceptance testing.

B. Decibel readings shall be taken at a point 10'-0" from the appliance at an elevation of 5'-0" above finished floor.

C. The sound level shall meet both of the following requirements:
   1. A minimum of 15 decibels (dBs) above the average ambient sound level.
   2. A minimum of 5 decibels (dBs) above the maximum sound level having a minimum duration of 60 seconds.

D. Decibel measurements shall be taken using the "A-weighted" measurements which are relatively flat from 600 Hz to 7,000 Hz, "B-weighted" (relatively flat from 300 Hz to 4,000 Hz) and "C-weighted" (relatively flat from 700 Hz to 4,000 Hz, measurements will not be acceptable.

4.16 INSTRUCTION AND TRAINING PERIOD

A. Upon completion of the work and after all tests and inspections by the authority(s) having jurisdiction, the Fire alarms system contractor shall "Hands On" demonstrate and train the Owner's designated operation and maintenance personnel in the operation and maintenance of the Fire alarms system.

B. The Fire alarms System Contractor shall submit Operations and Maintenance Manuals to the Owner and Engineer to review prior to scheduling the instruction session.

C. The Fire alarms System Contractor shall provide a typewritten "Sequence of Operations."
   1. The sequence shall be simplified steps to operate the basic functions of the Fire alarms System.
   2. The sequence shall be laminated and attached, in clear view, to either the FACP or the adjacent wall.

D. The Fire alarms System contractor shall arrange scheduled instruction periods with the Owner's designated operation and maintenance personnel.

E. The Fire alarms Contractor shall provide for (1) editing session of the control panel programming at no cost to the Owner to address any changes required by the Owner.

F. Scheduled training periods shall be based upon complexity of the system installed, but in no case be less than 4 hours.

G. Upon request of the Owner, a Power Point presentation of the training period shall be made available by the Fire Alarm System Contractor at no additional cost to the Owner.

END OF SECTION 283176

SECTION 285005 - RADIO DISPATCH ALERT AND PAGING SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. Conform to General Conditions, Supplementary Conditions, and Division 1.

B. See Section 260000 Electrical General Conditions, and 270000, Low Voltage Systems.

1.2 PRE-SUBMITTAL MEETING

A. The Contractor is required to participate in a pre-submittal meeting for the Radio Dispatch Alert, Paging System, and Low Voltage Control Interface. Shop drawings shall include the interface requirements to the other systems listed above and the programming requirements.

1.3 DESCRIPTION

A. The work described by this specification includes the furnishing of all materials, equipment, labor to install, and the performing of all testing necessary for the installation of a Radio Dispatch Alert and Paging System complete and in proper operating condition as indicated on the drawings and/or described herein. The system contractor shall demonstrate that the system meets the specifications to the satisfaction of the Owner. The contractor shall have the responsibility for meeting the requirements of this specification. The work shall be in accordance with all provisions of the general conditions and any supplementary special conditions.

B. All major system equipment shall be supplied and installed by an authorized factory distributor. The system contractor and manufacturer shall have furnished and installed similar systems continuously for no less than five years.

C. The contractor shall furnish and install all materials even though not specifically mentioned herein, which are necessary for the proper integration of the system, so that the system shall perform the functions listed herein in compliance with all the specified requirements.

D. To qualify as a bidder, the electronics contractor shall hold the necessary licenses as issued by the State of Washington for an electrical contractor. Installation shall be made by a licensed and bonded contractor holding a valid Washington State Electrical Contractor's License. All work covered by this specification to be performed by a holder of a current State of Washington Journeyman Electrical Certificate or Specialty Electrician for low energy systems.

E. Approval request to pre-qualify for bidding of equipment not as specified herein must be received by the Architect not less than ten days prior to bid opening. Proposals shall included but not be limited to the following: Complete technical data and such samples as required to indicate that the submitted components are equivalent to the specified equipment in all material aspects; the contractor will itemize on a separate enclosure any variation from the specification referring to the section, paragraph, and item of the specification and clearly stating the variation; a list of similar previous completed projects with the names and telephone numbers of the owners, number of years in the sound reinforcement business; service staff and qualifications; and list of contractor-owned test equipment.

1.4 SCOPE OF WORK

A. Provide a speaker system with volume control that connects to the existing radio dispatch alert system.

B. These alerts shall broadcast over the paging system.

C. Connections shall be made to the Owner provide VOIP telephone system for live voice pages within the facility over the speakers.

D. The system shall provide for amplification of pre-recorded or auxiliary program material. Input(s) shall be at location(s) as shown on the drawings.

E. All equipment required to form a complete working system shall be supplied whether enumerated herein or not. All contractor design, fabrication, and installation shall be commensurate with current 'state of the art" practices in the field of sound reinforcement and public address systems.

1.5 SEQUENCE OF OPERATIONS

A. Upon receiving the radio call from the dispatch center, the Radio Dispatch Alert and Paging System shall automatically broadcast the incoming audio message over the paging system speakers, overriding any local page, and or music sources.

B. For local source pages, connections shall be made to the telephone system as such that the receptionist, or any other telephone handset as designated by the owner, may initiate pages over the paging system speakers. If during a local page, the radio dispatch alert system receives a dispatch signal, the local source page shall be switched to the incoming radio dispatch alert as a priority signal.

PART 2 - PRODUCTS

2.1 ALERTING SYSTEM EQUIPMENT & OPERATION

A. The system shall be configured for day/night volume control.
   1. Outside speakers shall be muted in night mode.
   2. Ambient noise shall be sensed with a microphone in the Apparatus Bay and the volume automatically adjusted to accommodate a ‘noisy’ environment.
   3. Volume control shall be in the installed in the Meeting Room with an alert level volume when the alerting system is activated.

B. The system shall be integrated with the overhead paging system. Any incoming alert will override any in-house page.

2.2 PAGING SYSTEM

A. The Digital Audio Platform shall be available in various I/O configurations. The processor shall accommodate (4) zones of one-way analog paging and (8) zones of IP paging.

B. Input/output options shall be as follows:
   1. (4) analog audio. Inputs/outputs

2. (4) programmable Form C relay closures
3. (4) programmable Contact Closure Inputs

C. The system shall be compatible with a VOIP telephone system.

D. Provide an Intercom/Doorplate speaker flush mounted, brushed stainless steel.
1. The call button shall be POE with a relay contact for door unlock.

E. Provide audio amplifiers as required to facilitate the quantity of zones and speakers.
1. The power amplifier shall meet or exceed the following performance criteria.
a. Input sensitivity for rated output: 1.4 V. Rated output with eight channels driven in Dual mode with 0.1% THD (20 Hz to 20 kHz):
b. 175 watts per channel into 4 ohms; 155 watts per channel into 8 ohms, and 185 watts per channel (70V). Rated output in Bridge-Mono mode with four channel pairs driven at 0.1% THD (20 Hz to 20 kHz): 350 watts per channel pair into 8 ohms; 310 watts per channel pair into 16 ohms, and 185 watts per channel pair (100V). Signal to Noise Ratio below rated power (20 Hz to 20kHz): 100 dB unweighted.
c. Phase Response: ±35 degrees from 10 Hz to 20kHz at 1 watt. Frequency Response: 20 Hz to 20kHz, ±0.5 dB at 1 watt into 8 ohms per channel in Dual mode.
d. Damping Factor: greater than 180 from 10 to 400 Hz. Crosstalk (below rated power, 20 Hz to 1 kHz): greater than 80 dB.
e. Intermodulation Distortion (60 Hz and 7 kHz at 4:1, from 163 milliwatts to full bandwidth power): less than 0.05% typical.
f. Total Harmonic Distortion at 1 watt from 20 Hz to 20 kHz: less than 0.05%.
g. Common Mode Rejection (20 Hz to 1 kHz): greater than 50 dB. DC Output Offset (shorted input): less than 5 mV.
h. Maximum Input Level (before input compression):+ 22 dBu rms. Power Draw at Idle (120 VAC mains, all channels in 4/8 ohm mode): 58 watts. Power Draw at Idle (120 VAC mains, allchannels in 70V mode): 77 watts.

2.3 CEILING MOUNTED SPEAKER

A. The loudspeaker shall be of in-ceiling design, consisting of a 114 mm (4.5 in) low frequency transducer, a 12 mm (0.5 in) tweeter, and frequency dividing network installed in an integral ported enclosure. The low frequency voice coil shall be 24 mm (1 in) in diameter and the cone shall be of lightweight injection molded graphite. Performance specification of a typical production unit shall be as follows: Measured sensitivity (SPL at 1m [3.3 ft] with 2.83V input, averaged from 100 Hz to 10 kHz) shall be at least 86 dB-SPL. Usable frequency response shall extend from 85 Hz to 25 kHz (10 dB below rated sensitivity) with no external equalization. Rated power for 8 ohm unit shall be at least 15 watts continuous pink noise power, defined as conforming to international standard IEC 268-5 (shaped pink noise with peak-to-average ratio of 6 dB) for a period of 100 continuous hours. The speaker shall have a nominal conical polar coverage pattern of 150 degrees (at -6 dB point), averaged 500 Hz to 10 kHz, and shall hold the same consistent polar coverage pattern when averaged in the intelligibility frequency band from 1 kHz to 4 kHz. The backcan shall be constructed of formed steel and the baffle of UL94V-O fire rated medium impact polystyrene. An agency-rated enclosed-terminal wiring block shall be provided on the side of the backcan to allow positive screw-down connection of wiring. The system shall include a support backing plate to reinforce the ceiling material and tile support rails for use on either 2 ft or 600 mm suspended ceiling tiles, and which can be installed from beneath the ceiling tile. Overall front face diameter shall not exceed 195 mm (7.7 in) and overall depth from the bottom of the ceiling shall not exceed 105 mm (4.1 in). The Control 24C Micro: Nominal impedance shall be 8 ohms. The loudspeaker shall weight no more than 1.6 kg (3.6 lb). The Control 24CT Micro: The loudspeaker shall be equipped with transformer for use in either 70.7V or 100V distributed-line speaker systems, with taps selectable by connecting

the input wire to the selected enclosed wiring block terminal. Taps shall be nominally 8W @ 70V, 4W @ 70V (8W @ 100V), 2W @ 70V (4W @ 100V), 1W @ 70V (2W @ 100V) and 0.5W @ 70V (1W @ 100V). The loudspeaker shall weigh no more than 2.0 kg (4.4 lb).

B. The loudspeaker shall be the JBL Model Control 24C Micro (Control 24CT Micro).

2.4 WALL AND SURFACE MOUNTED SPEAKERS

A. The loudspeaker shall consist of a 90 mm (3-1/2 in) low frequency transducer, 13 mm (1/2 in) high frequency transducer, and frequency dividing network installed in a ported enclosure. The low frequency voice coil shall be 19 mm (3/4 in) in diameter. Performance specifications of a typical production unit shall be as follows: Measured sensitivity (SPL at 1 m [3.3ft] with 2.83V input, averaged from 500 Hz to 1.5 kHz) shall be at least 86 dB-SPL. Usable frequency response shall extend from 85 Hz to 22 kHz (10 dB below rated sensitivity, in half-space, with no external equalization). Nominal impedance shall be 8 ohms. The frequency dividing network shall have a crossover frequency of 3.5 kHz. Rated power capacity shall be at least 50 watts continuous program power, defined as 3 dB above a test signal of filtered random noise conforming to international standard IEC268-5 (shaped pink noise with a peak-to-average ratio of 6 dB), for 100 continuous hours duration. The system shall be protected against damage from occasional overpowering via full range series lamps that limits the power to the network and transducers. The high frequency transducer shall be horn loaded to more evenly cover a nominal 90° horizontal by 90° vertical area. The enclosure shall be constructed of high-impact polystyrene for protection against the elements in outdoor applications, and for paintability. The grille shall be completely zinc-coated for resistance against rusting, shall be bake-painted black, and shall be secured via screws to keep it in place when facing downward. The low frequency transducer shall have a polypropelene cone and a butyl rubber surround which shall extend seamlessly over the edge of the speaker frame for protection against the elements. The high frequency transducer shall be constructed of polycarbonate, reinforced with a titanium film for additional weather resistance. The system shall withstand Mil Spec 810 testing with specified time durations for exposure to the following environments with no effect on its acoustical performance or structural integrity: salt spray (method 509.3), temperature -19°C to 49°C (method 501.3 and 502.3), 95% humidity (method 507.3) and ultra-violet (method 505.3). The system shall have an IEC 529 splashproof rating of IP-X4. For theft deterrence, the installation access area shall be hidden behind a snap-out cover, and the access area shall be on the front of the loudspeaker for ease of installation and adjustment. The loudspeaker shall be rotatable over a minimum of ±35° in all directions via a balltype mounting system. The ball mechanism shall be internal to the cabinet to allow low-profile mounting and better stability via a short moment arm. The logo shall be rotatable for proper orientation when the loudspeaker is mounted horizontally or vertically. 8. The external wiring connectors shall be spring loaded and gold plated, and shall accept bare wire, single or dual banana-type connectors with 19 mm (3/4 in) spacing. Overall cabinet dimensions shall be no greater than 193 mm (7.6 in) high by 140 mm (5.5 in) wide by 111 mm (4.4 in) deep and shall weigh no more than 1.8 kg (4 lbs). The finish shall be a paintable lightly textured black.

B. The system shall be the JBL Model Control 23 with included Invisiball® mounting system.

2.5 APPARATUS BAY AND OUTDOOR SPEAKERS

A. The horn shall be of the folded sectoral type featuring two separate air columns within the single assembly. It shall produce a horizontal beamwidth of 100 degrees and a vertical beamwidth of 60 degrees at 2.0 kHz. In addition, it shall provide useful acoustic loading at all frequencies above 250 Hz. The horn shall be constructed from a non-resonant glass fibre reinforced polyester and self-finished in an ultraviolet-inhibiting gray. A serrated, positive-lock “U” mounting bracket shall be affixed to the bell by self-locking nuts and shall provide orientation adjustment in all three planes. The horn shall possess a throat of 2.54-cm (1.00 in.) diameter and shall be provided with a 1 3/8"-18 thread for the mounting of a compression driver. The horn shall be 36.8 cm (14.5 in.) high, 69.9 cm (27.5 in.) wide and 38.1 cm (15.0 in.) deep. It shall weight no more than 3.2 kg (7.0 lb). 4.

B. The horn shall be the Electrovoice Cobreflex III folded sectoral horn. Provide with Electrovoice ID30T Driver.

2.6 VOLUME CONTROL

A. The volume control shall have a power rating of 100W and attenuation per step of 3dB. The Plate style shall be standard one-piece stainless steel. The Plate color shall be brushed stainless. The Controls shall be UL Listed (Standard UL813 and UL2043) and shall mount in an E.O. Box with a minimum inside dimension of 1.875"W x 2.688"H x 2.125"D.

B. The Volume control shall be Lowell Model LVC25 (LVC100 for common areas)

2.7 WIRING

A. All wiring shall be provided, installed & terminated by the Contractor responsible for the installation of the system.

PART 3 - INSTALLATION

3.1 WIRING INSTALLATION

A. Provide permanent identification of run destination at all raceway terminations.

B. All cables shall be continuous and splice-free for the entire length of run between designated connections and termination's.

C. All shielded cable shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels or equipment enclosures.

D. Within buildings- make splices only in designated terminal cabinets and/or on designated equipment backboards. Outside buildings-make splices only in designated manholes and/or hand holes. Protect splices outside of buildings with splicing kits equivalent to Schotchcast Re-enterable. Make splices only with connectors or terminal devices specified herein. Document all splices on Record Drawings.

E. Verify that all raceway has been de-burred and properly joined, coupled, and terminated prior to installation of cables. Verify that all raceway is clear of foreign matter and substances prior to installation of wire or cable. Inspect all conduit bends to verify proper radius. Comply with code for minimum permissible radius and maximum permissible deformation. Apply a chemically inert lubricant to all wire and cable prior to pulling in conduit. Do not subject wire and cable to tension greater than that recommended by the manufacturer. Use multi-spool rollers where cable is pulled in place around bends. Do not pull reverse bends.

F. Provide a box loop for all wire and cable routed through junction boxes or distribution panels. Provide tool formed thermal expansion loops at cable at manholes, hand holes and at both sides of all fixed mounted equipment. Cable loops and bends shall not be bent at a radius greater than that recommended by the manufacturer.

G. Secure all wire and cable run vertically for continuous distances greater than three (3) feet. Secure robust non-coaxial cables with screw flange nylon cable ties or similar approved devices appropriate to weight of cable. For all other cables, provide symmetrical conforming nonmetallic bushings or woven cable grips appropriate to weight of cable.

H. Signal Polarity Convention:
   1. Maintain consistent absolute signal polarity at all connectors, patch points and connection points accessible in the system. Where applicable, a positive polarity electrical signal shall yield positive acoustic pressure from the loudspeakers.

I. Comply with the National Electrical Code.

J. Unless you can verify that both ends of the associated cable ties to the same electrical ground plane, only connect the signal ground conductor of active levels at the source side of the audio chain.

3.2 TEST EQUIPMENT

A. Laboratory quality test equipment shall be used by the sound contractor to perform all required tests and measurements. The sound contractor shall submit to the architect a list of test equipment that he proposes to use. The following listed equipment is approved. The list is given as an indication of the quality and type of equipment required:
   1. Real Time Audio Analyzer: Hewlett-Packard model 8050, Crown model RTA2
   2. Audio Oscillator: Hewlett-Packard model 204C
   3. AC Voltmeter: Hewlett-Packard model 400EL
   4. Oscilloscope: Tektronix model 465B
   5. Impedance Bridge: Electro-Dynamics model 400
   6. Sound Level Meter: General Radio model 1565C

3.3 ELECTRONIC SYSTEM TESTING

A. After all equipment specified herein for the system has been completely fabricated and wired and is in operating condition in the sound contractor's shop, performance tests shall be conducted by the sound contractor on the system to determine of the installation and components comply with these specifications. The sound contractor shall supply competent personnel and shall use laboratory quality test instruments. A complete report for the system showing all parameters of each procedure, printer/plotter graphs or self-developing photographs of the measured results, calculations, interpretations, etc. shall be prepared. The document shall be signed by the technician responsible for the project. All tests shall be run from each system input to each system output.

B. The following test shall be performed and the system shall be made to meet each listed performance criterion:

C. Overall frequency response of the complete electronic system (unequalized) shall be 20 to 20,000 Hz +/- 3 dB. Equalizing circuits shall be temporarily set in the indicated "flat" position.

D. Total harmonic distortion from microphone input to power amplifier output at rated power shall be less than 5% for the frequency range of 20 to 20,000 Hz.

E. The overall broadband hum and noise from 20 Hz to 20 KHz using 6 dB/octave filter at 12.47 KHz shall be at least 65 dB below the rated output from system input to output.

F. After all electronic equipment specified herein is fully installed at the job site and the loudspeaker is fully installed, the system shall be equalized and acoustically tested by the sound contractor. Personnel, test equipment, complete report, and signing shall be as described under Testing and Equalization.

G. Only standardized procedures shall be used for equalizing, measurement of impedances, adjusting electrical levels, adjusting sound levels, minimizing hum, and polarity measurements, etc.

H. Each loudspeaker line shall have its total loudspeaker load measured and recorded, including its line matching transformer. Line impedance shall be measured at 100 Hz, 400 Hz, 1000 Hz, 4000 Hz, and 10,000 Hz. Total load impedance connected to an amplifier shall, under no circumstances, be less than the rated output load impedance of the power amplifier.

I. The total system shall be installed from microphone to loudspeaker in Absolute Polarity. A positive pressure on the microphone shall produce a positive pressure from the loudspeaker.

3.4 ACOUSTICAL TESTING

A. Upon completion of the installation of all loudspeakers in an area, perform the following test and record results. Correct non-conforming conditions, unless the cause is clearly outside the work of this specification, in which case submit the apparent cause to the representative of the Owner.

B. Loudspeaker Line Impedance: At terminal cabinets at equipment rooms, measure the modules of impedance of each loudspeaker line. Measure continuously over the range from at least 31 Hz to 16 kHz.

C. Loudspeaker Polarity: Test the acoustic polarity of all loudspeakers using either an Acoustic Polarity Tester or an appropriate DC Voltage with visual confirmation of polarity.

D. Freedom From Buzzes, Rattles and Objectionable Distortion: Individually apply to each loudspeaker line a slow sine wave sweep from 50 Hz to 5 kHz at a level of 6 dB below rated power amplifier output voltage. Listen carefully for buzzes, rattles and objectionable distortion.

E. Uniformity of Coverage: Apply broadband Pink Noise. Adjust level to approximately 70-80 dBA at measurement locations. Measure in 4 kHz octave band at ear level. Adjust loudspeaker aiming and amplifier level or 70 Volt loudspeaker tap as applies for uniformity of coverage.

3.5 DOCUMENTATION

A. Documentation of testing shall be provided to the engineer and shall consist of the following:

B. The test results as listed under Electronic System Testing.

C. The test results as listed under Acoustical Testing.

D. The unequalized curves of the frequency response made with the measuring microphone utilizing the nine-point testing technique.

E. The equalized curve made with the measuring microphone at position #5 of the nine point testing technique.

F. The calibrated level setting for each electronic component.

G. List of personnel and test equipment used.

H. Qualifications of personnel (formal training and experience).

3.6 GUARANTEE AND SERVICE

A. A one year warranty covering all components, equipment, and workmanship shall be submitted in writing. This warranty will begin on the final acceptance date.

B. Should any trouble develop within this one year period from the date of acceptance of the work due to inferior or faulty material and/or workmanship, or should it be discovered that the work is not in accordance with the contract, the contractor shall promptly make all required corrections without cost to the owner.

3.7 MAINTENANCE AND OPERATING MANUALS AND INSTRUCTIONS

A. The contractor shall provide two copies of an operating and servicing manual to the Owner.

B. Each operating and servicing manual shall include all information necessary for the proper servicing of the system. Included shall be as-built floor drawings, complete one-line block diagrams of the entire system with cable numbers, two-wire circuit diagrams of the system, an instruction and maintenance manual for each piece of equipment which shall include a complete schematic diagram, solid-state complements, and replacement part numbers. Each manual shall also include copies of the as-built coding used on each cable and copies of all construction drawings. All drawings, manuals, etc., shall be corrected to as-built condition. All equipment modifications shall also be indicated on the individual equipment schematics.

C. Each manual shall be bound. The complete title of each manual shall be visible on the front cover of the book.

D. After the system is totally installed (or when directed) and in proper operating condition as approved by the architect, the contractor shall provide instruction sessions as necessary to describe and demonstrate the entire system to the owner's staff, and others who will be in charge of (or otherwise related to) the system operation. This session will total approximately four hours of instruction.

END OF SECTION 285005

SECTION 312300 – EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES AND STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavating, backfilling, and compacting for utilities, including pipe, structures, and appurtenances.

B. Control of water in trenches.

C. Foundation stabilization for pipe and utility structures.

D. Pipe bedding for pipe and utility structures.

1.2 RELATED REQUIREMENTS

A. Section 312500 – Erosion and Sedimentation Control

B. Section 331100 – Water Distribution

C. Section 333000 – Sanitary Sewerage Utilities

1.3 REFERENCE STANDARDS

A. WSDOT Standard Specifications – Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction.

B. City of Des Moines, Public Works Department Development Standards, current edition.

C. Highline Water District, Standard Specifications and Details, current edition.

D. Midway Sewer District, Standard Specifications and Details, current edition.

E. ASTM D6913 – Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.

F. ANSI/ASTM D1557 – Test Methods for Laboratory Compaction Characteristics of Soil using Modified Effort.

G. ASTM C94-86 – Ready-Mixed Concrete.

H. AASHTO T176 – Plastic Fines in Graded Aggregates and Soils by use of the Sand Equivalent Test.

I. ASTM D6938 – Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 UTILITIES AND STRUCTURES DEFINITIONS

A. Unsuitable Material: Soil, organics, waste, or other material not complying with these specifications, not capable of supporting foundations, or not capable of compaction to specified density. Old fill soils and buried top soils are unsuitable.

B. Pothole: An exploratory excavation to uncover a buried utility and determine location, elevation, size, and type of material.

1.5 SUBMITTALS

A. General: Comply with Section 013000.

B. Samples: Submit minimum 50-pound sample for each material four business days prior to placing material.

C. Quality Assurance/Control Submittals:

1. Test Reports: Sieve analysis for each material.
2. Certification:

a. WSDOT pit certification for each pit.
b. Disposal site operator certification that disposal site complies with all local, state, and federal regulations.

1.6 QUALITY ASSURANCE

A. Qualifications.

1. Surveyor: Land surveyor licensed in state of Washington with experience on similar projects.
2. Construction Crew Foreman: Minimum six years' working experience and four years' experience as foreman performing similar work.

B. Regulatory Requirements:

1. All Work and material shall be in accordance with WSDOT Standard Specifications.
2. Comply with Highline Water District standards.
3. Comply with Midway Sewer District standards.

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

A. Bedding Material for Pipe: WSDOT Standard Specification Section 9-03.12(3), Gravel Backfill for Pipe Zone Bedding.

B. Foundation Material: WSDOT Standard Specifications Section 9-03.17, Class A.

C. Structural Fill: Crushed, partially crushed, or naturally occurring granular material. Free from wood waste, organics, and other extraneous or unsuitable material, in accordance with WSDOT Standard Specifications Section 9-03.14(1), Gravel Borrow. Restrict fines content to no more than 5 percent passing Number 200 sieve. On-site material is not suitable for use as structural fill.

D. Trench Backfill (Right-of-Way): WSDOT Standard Specifications Section 9-03.9(3), Crushed Surfacing Top Course (CSTC).

E. Trench Backfill: WSDOT Standard Specifications Section 9-03.19, Bank Run Gravel for Trench Backfill.

2.2 UTILITIES AND STRUCTURES SOURCE QUALITY CONTROL

A. Tests and Inspection: Provide sieve analysis in accordance with ASTM D422 for each material type. Perform tests and analyses of aggregate material in accordance with WSDOT Standard Specifications. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify as follows:

1. Verify survey benchmark and intended elevations for the Work are as indicated.
2. Verify erosion control is in place and operating properly.
3. Verify locations and elevations of existing pipes and structures at points of connection and at crossings prior to beginning Work. Pothole, expose pipes, determine invert elevations, verify with design, and inform Architect of deviations affecting design prior to mobilizing crews and beginning construction.
4. Verify location and elevation of proposed building plumbing stub out prior to beginning Work.

3.2 PREPARATION

A. Protection:

1. The majority of underground utilities will not be located through “Dial Dig.” Contractor shall provide work through utility locate company or perform Work. Call “Dial Dig” 1-800-424-5555, 48 hours (two working days) prior to beginning construction. Employ and pay for a locator service to locate and mark utilities in addition to the “DIAL DIG” service.
2. Protect and maintain existing utilities which are to remain.
3. Identify existing structural foundations near excavations. Verify excavation will not undermine footings or supports and cause damage to structures.
4. Protect plant life, lawns, trees, and other features remaining as a portion of final landscaping or preserved for erosion control.
5. Protect benchmarks, existing structures, rockeries, sidewalks, railings, paving, and curbs.
6. Protect existing structures scheduled to be demolished but occupied by the Owner.
7. Protect pavement or paved areas intended to remain from damage.
8. Use all means necessary to prevent the erosion of freshly graded areas during construction or until such a time that permanent drainage and erosion control measures are fully operational.

3.3 CONSTRUCTION

A. Grade and Alignment:

1. Identify and set required lines, levels, contours, and datum.
2. Stake alignment and grade and construct in locations shown on Drawings.
3. Comply with City of Des Moines requirements for water, sewer, and power.
4. Establish extent of excavation by area and elevation.
5. Adjust alignment and grade to accommodate conflicts and field conditions. Obtain Architect’s approval prior to adjustments.

B. Utilities And Structures, Shoring and Bracing of Excavation:

1. Provide sheeting, shoring, and bracing in accordance with state and local codes.
2. Do not use horizontal strutting below pipe barrel.
3. Do not use pipe as support for trench bracing.
4. Do not remove shoring below top of pipe.
5. Backfill immediately following removal of shoring and bracing.
6. Support adjacent structures, including utilities and pipe chases, which may be damaged by excavation Work.

C. General Excavation:

1. Perform excavation of every description and whatever substance encountered to depths, lines, and grades indicated.

2. Pile trench excavated material so surface water is prevented from flowing into excavation, and there is minimum inconvenience to Owner's access to the buildings. Provide free access to fire hydrants, water valves, meters and driveways and leave clearance to enable free flow of storm water in gutters, conduits, and natural water courses.
3. Remove and reconstruct utilities as required to perform Work.
4. Do not interfere with or excavate within pressure prism of foundations. Pressure prism is defined as a 1 horizontal to 1 vertical line projected from footing bottom.
5. Prevent movement of soil in areas supporting existing foundations, slabs, poles, underground utilities, trees, pipelines, or other structures.
6. Hand trim excavation and leave free of loose matter.
7. Correct unauthorized excavation at no cost to Owner.
8. Schedule Work to include backfilling trenches by the completion of each shift.

D. Trench Excavation:

1. Unless otherwise indicated, open cut excavations.
2. Exercise caution in operating heavy equipment over pipelines. Do not damage existing improvements.
3. Immediately repair leaks or breaks caused by construction operations at no cost to Owner and in a manner acceptable to Architect and utility owner.
4. Control side walls of excavation to minimize caving.
5. In the event the maximum allowable trench width is exceeded and depending on depth of trench, improve pipe bedding by utilizing concrete or other bedding materials as directed by Architect.
6. Excavate trench bottom to lines and grades shown with proper allowance for pipe thickness and pipe bedding. Do not permit material containing rocks or cobbles larger than 2 inches in maximum dimension within 6 inches of pipe. Remove material of this type from trench bottom and replace with foundation gravel.
7. Should excavation be carried below lines and grades as shown because of trenching operations, backfill such excavated space to proper elevation as directed by Architect, at no cost to Owner.

E. Control of Water:

1. Keep excavation free from water. Dewater as necessary.
2. Direct drainage away from excavation.
3. Grade top perimeter of excavation to prevent surface water from draining into excavation.
4. Direct runoff and water from dewatering into sedimentation filtration. Provide additional filtration necessary to prevent silt-laden water from leaving the site.

F. Pipe Bedding:

1. Place bedding on approved trench bottom before pipe is installed. Spread smoothly to support pipe uniformly. Do not use blocking to adjust pipe to grade. Dig holes for bells as required to ensure uniform support along pipe barrel.
2. Compact bedding as follows: Compact bedding to at least 95 percent maximum density as determined by ASTM D1557 under buildings, structures, and 6 feet

outside and within paved areas and sidewalks. Compact bedding in other areas to at least 90 percent maximum density as determined by ASTM D1557.

G. Backfilling and Compaction:

1. Backfill to grades, contours, levels, and elevations shown on Contract Drawings with structural fill or Trench Backfill. On-site material is not suitable for use as structural fill and Trench Backfill.
2. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
3. Place and compact backfill materials in continuous layers not exceeding 8 inches in compacted thickness.
4. Employ a placement method that does not disturb or damage utilities in trenches.
5. Condition backfill within plus or minus 3 percent of its optimum moisture content so specified compaction can be attained readily. Material containing excessive moisture, beyond moisture content for specified density as determined by laboratory compaction tests, shall not be used for backfill.
6. Raise backfill around structures evenly.
7. Finish area to uniform contour to drain properly and grade entire surface to a neat appearing surface.
8. Remove excavated on-site soil material and surplus fill material from the site to an approved contractor-provided off-site waste site.

H. Compaction:

1. Under pavements, curbs, curbs and gutters, sidewalks, and other structural improvements: 95 percent, within 2 foot vertical of finish grade and 90 percent below this level in accordance with ASTM D1557. Compact pavement bases in accordance with Section 321313.
2. Use hand-operated equipment within 6 feet of building walls.
3. Compact backfill material by towed or self-propelled mechanical compactors in uniform layers not exceeding 10 inches in loose depth.

I. Initial Backfill:

1. After pipe has been laid properly and inspected, place and compact initial backfill around pipe to a minimum depth of 8 inches over top of pipe. Place initial backfill in lifts of not more than 10 inches in compacted thickness. Bring lifts together on both sides of pipe and carefully work backfill under pipe haunches by means of a shovel, vibration, or procedures approved by Architect. Take necessary precautions to protect pipe from any damage or shifting.
2. Subsequent Backfill: Place and compact subsequent backfill material after initial backfill has been placed and approved by Architect.
3. Perform compaction within 2 feet of existing or new structures by hand-operated vibratory compactors. Compact within 6 feet of wall to 95 percent maximum density as determined by ASTM D1557.
4. Reopen trenches where settlement occurs to depths necessary for compaction; refill and compact with surface restored to grade.
5. Water settling or water jetting will not be allowed.

3.4 RESTORATION

A. Restore disturbed pavement and improvements to remain in operation.

3.5 FIELD QUALITY CONTROL

A. Obtain required inspections, tests, approvals, and location recording prior to covering or enclosing Work.

B. Site Tests:

1. Comply with City of Des Moines requirements.
2. Comply with Highline Water District requirements.
3. Comply with Midway Sewer District requirements.
4. Comply with Section 014000.
5. Compaction test performed by Owner.

C. Inspection:

1. Comply with Section 014000.
2. Comply with City of Des Moines, Midway Sewer District, and Highline Water District requirements.
3. After completion of trench and prior to placing pipe.
4. After completion of pipe and bedding, and prior to backfilling.

3.6 PROTECTION

A. Protect bottom of excavations and soil adjacent to and beneath foundations from freezing.

B. Protect excavated material and excavating foundation (subgrade) from damage due to excess moisture.

C. Take necessary precautions to protect soil from excess moisture by such means necessary, including: Construct ditches and swales to intercept surface water; cover stockpiled material; cover exposed trenches; do not expose more area than can be worked and protected; and dewater by pumping.

3.7 CLEANUP

A. Dispose of all excavated surplus or unsuitable material at a Contractor provided off-site location approved by the Owner.

B. Remove and dispose of abandoned pipe, broken pavement, and rubbish from Project site in accordance with laws, regulations, and ordinances of an approved off-site location provided by Contractor.

C. Dispose of waste, surplus, and unsuitable materials according to laws, regulations, and ordinances.

END OF SECTION 312300

SECTION 312500 – EROSION AND SEDIMENTATION CONTROL

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. Work in this section includes:

1. Silt control measures.
2. Measures to keep streets clean.
3. Polyethylene (PE) sheeting cover for exposed soil.
4. Maintaining, monitoring, and supplementing silt control and stormwater runoff control measures.
5. Dewatering.

B. Related sections include the following:

1. Section 312300 – Excavating, Backfilling, and Compacting for Utilities and Structures
2. Section 331100 – Water Distribution
3. Section 333000 – Sanitary Sewerage

1.3 REFERENCES

A. Comply with applicable provisions of the following specifications and documents:

1. WSDOT Standard Specifications – Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction.
2. City of Des Moines Public Works Department Development Standards, current edition.

1.4 SUBMITTALS

A. Product Submittals: Submit under provisions of Section 013000.

B. Disposing of Silty Water Off Site (Contractor’s option to treatment train): Prior to performing site clearing or stripping, submit letter identifying equipment available for transport. List subcontractor, if used. List method of disposal.

1.5 REGULATORY REQUIREMENTS

A. All Work and material shall be in accordance with WSDOT Standard Specifications.

B. Comply with Highline Water District, Midway Sewer District, and City of Des Moines standards.

1.6 SEQUENCING AND SCHEDULING

A. Install erosion control measures in work areas prior to any clearing, grubbing, demolition, general site grading, or other construction in the area. Erosion control items shall be installed and removed at various times throughout the duration of the project.

1.7 MAINTENANCE

A. Maintain erosion control through the duration of the project.

B. Maintain erosion control after substantial completion in accordance with this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Filter Fabric Fence: WSDOT Standard Specifications Section 9-33, Table 6: Geotextile for temporary silt fence.

B. Compost sock (Silt Sock): WSDOT Standard Plan I-30.40-01.

C. Temporary Construction Fence:

1. Six-foot-high chain link fence, new or used, in good condition.
2. Woven galvanized steel wire mesh and steel post per ASTM A392-06 Standards.
3. Post shall be 2 feet deep in ground or secured by concrete blocks in paved areas.
4. Provide 20-foot-wide gate at construction entrance.

D. Orange Protective Fence: Minimum 3 feet tall, heavy plastic, with readily visible mesh, minimum mesh width 0.4 inches. Color: Safety orange.

E. Filter Bag Inserts: Commercially manufactured filter bags specifically manufactured for silt filtering and which will provide filtering performance required.

F. Polyethylene (PE) Sheeting: WSDOT Standard Specifications Section 9-14.5(3).

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate existing utilities, avoid damage or disturbance. Call “Dial Dig 1-800-424-5555” 48 hours (two working days) before beginning construction. Employ and pay for a locator service to locate and mark utilities in addition to “DIAL DIG” service.

B. Survey limits of Work to install orange construction, chain link construction, and silt fences.

C. Protect plant life, lawns, and other features remaining as a portion of final landscaping or interim erosion control.

D. Protect benchmarks, horizontal control, existing structures, fences, paving, and curbs.

E. Perform clearing or other work required to installing erosion control.

F. Survey/layout sediment traps.

3.2 CONSTRUCTION

A. Filter Fabric Fence: Field adjust location to perimeter of clearing and stripping. Location shown on Drawings is schematic. Cast all trench excavation soils from fence installation to the Construction side of fence. Overlap filter fabric fence joints minimum 1 foot prior to backfilling trench.

B. Polyethylene Sheeting: Overlap joints minimum 28 inches. Overlap in direction of drainage and prevent water from draining onto material being protected. Secure in place to prevent movement and damage. Provide sandbags at 2.5 feet spacing and tie sand bags together with rope on slopes greater than 3:1. Minimize driving stakes through plastic.

C. Mulch: Mulch exposed soils not protected by other means. Provide continuous covering minimum depth 3 inches. Apply mulch with tackifier to prevent blowing.

3.3 ADJUSTMENTS AND REVISIONS

A. Adjust or move swales, berms, pipes, pumps, culverts, bales, and silt fences as necessary during construction.

3.4 PROTECTION AND MAINTENANCE

A. Protection:

1. Where possible, maintain natural vegetation for silt control.
2. Prevent silt-laden water from leaving site or from entering off-site storm sewer systems.
3. Stabilize slope, cut, or fill areas where Work is stopped for more than 30 days by mulching, polyethylene sheeting, or other method to prevent erosion and sediment transport.
4. Keep off-site parking areas, sidewalks and streets clean from construction activities. Keep paved surfaces clean using mechanical sweeping equipment, hand shovels, brooms, or other accepted methods suitable for removing dirt, rock, silt, and sand. No street washing will be allowed.

B. Supplementary Measures: Provide additional silt control and temporary erosion control measures required to protect soils and prevent silt-laden runoff from leaving project site.

C. Maintenance: Monitor and maintain silt control measures. Maintain temporary erosion control facilities until need for each facility is superseded by other stabilization methods or until Architect authorizes removal.

D. Inspect and repair temporary erosion control facilities. Inspect entire system to ensure proper operation a minimum of once each week, during and after storms, and prior to weekends and holidays.

END OF SECTION 312500

SECTION 321313 – ASPHALT PAVING

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. Work in this section includes:

1. Pavement removal.
2. Pavement patching.
3. Soil sterilization.
4. Aggregate base course.
5. Asphalt concrete paving.
6. Pavement marking.

B. Related sections include the following:

1. Section 312300 – Excavating, Backfilling, and Compacting for Utilities and Structures
2. Section 312500 – Erosion and Sedimentation Control
3. Section 321611 – Cement Concrete Sidewalk, Curb, and Gutters

1.3 REFERENCES

A. WSDOT Standard Specifications – Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction.

B. City of Des Moines, Public Works Department Development Standards, current edition.

C. ANSI/ASTM D1557-91 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2,700 kN-m/m3).

D. ASTM D2922-91 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods - (Shallow Depth).

E. ASTM D3017-88 – Test Method for Moisture Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

F. ASTM D1556-90 – Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

G. ASTM D2950 – Density of Bituminous Concrete in Place by Nuclear Method.

H. MUTCD – Manual on Uniform Traffic Control Devices for Streets and Highways, current edition.

1.4 SUBMITTALS

A. Comply with Section 013000.

B. Product Data: Soil residual herbicide, including hazardous waste data sheet.

C. Quality Assurance/Control Submittals: Certificates – tack coat, asphalt concrete mix. Certificate stating material complies with specifications and documentation material is approved by WSDOT.

1.5 QUALITY ASSURANCE

A. Qualifications: Paving contractor and crew foreman shall have minimum three years' experience with paving projects of this type. Submit list of projects for three years' experience. Note date, owner, type, and size of overlay and location.

B. Pre-Installation Meeting:

1. Coordinate and attend meeting prior to paving and preparation.
2. Attendees to include paving contractor, Owner, and Architect.
3. Agenda to include sequencing of Work, schedule, and responsibilities.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Comply with Section 5-04.3 of WSDOT Standard Specifications.

B. Minimum air temperature for placing asphalt paving 55 degrees F and rising.

C. Do not perform paving in rain.

1.7 SEQUENCING AND SCHEDULE

A. Maintain access to public roads and sidewalks during construction.

B. Complete Work no later than indicated on the bid proposal.

C. Schedule and coordinate Work to maintain access to occupied buildings nearby.

PART 2 - PRODUCTS

2.1 SOIL RESIDUAL HERBICIDE

A. WSDOT Standard Specifications Section 5-04.3(5)D.

B. Use only products approved by Owner.

2.2 ASPHALT CONCRETE PAVEMENT

A. Hot Mix Asphalt: HMA Cl. 1/2-inch PG 58-22 or HMA Cl. 1/2-inch PG 64-22 as specified in Section 5-04 and Section 9-03 of the WSDOT Standard Specifications. Meet requirements for Asphalt Concrete Pavement (ACP). Class B modified asphalt pavement will be considered as a substitution request.

2.3 CRUSHED SURFACING TOP COURSE (CSTC)

A. WSDOT Standard Specifications Section 9-03.9(3).

2.4 CRUSHED SURFACING BASE COURSE (CSBC)

A. WSDOT Standard Specifications Section 9-03.9(3).

2.5 TACK COAT

A. Cationic emulsified asphalt in accordance with WSDOT Standard Specifications Section 9-02.1(6).

2.6 PAINT

A. Non-reflectorized traffic line paint in accordance with WSDOT Standard Specifications Section 8-22.

B. Color:

1. Striping: White.
2. Fire lane marking: Yellow.
3. Disabled parking symbol: White on blue background, in accordance with MUTCD.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify base gradients and elevations are correct.

C. Verify subsurface Work is completed and no further excavation will be required within limits of Work.

D. Verify demolition Work within or adjacent to the Work is complete.

E. Verify heavy construction traffic is as complete as possible and traffic remaining will not damage or degrade the Work.

F. Verify fire department has been advised of restrictions to site access during Work.

G. Verify weather forecast during planned time of placement is within weather limitations.

H. Verify door locations and required clearances for swing out over walkways.

3.2 PREPARATION

A. Prepare and compact subgrade in accordance with WSDOT Standard Specifications Section 2-06.

B. Water and thoroughly mix subgrade until optimum moisture content is obtained when deficiency of moisture content exists. When excess moisture exists, rework and aerate subgrade until optimum moisture content is obtained.

C. Condition existing surface in accordance with WSDOT Standard Specifications Section 5-04.3(5).

D. Adjust top of structures, manhole covers, valve boxes, grates, cleanout covers to grade. Comply with WSDOT Standards for structures.

E. Areas receiving new paving section: Excavate, remove, and dispose of excess material. Fine grade to maintain drainage and prepare subgrade.

F. Apply herbicide to subgrade in new pavement and patching areas.

3.3 CONSTRUCTION

A. Removal and Disposal of Existing Asphalt Paving: Saw cut at limits of removal with neat, straight lines. Dispose of material removed and waste to offsite disposal area approved by Architect.

B. Base Courses:

1. Place in accordance with WSDOT Standard Specifications Section 4-04.3.
2. Spread aggregate over prepared substrate to a total compacted thickness as indicated on Drawings.
3. Place aggregate in maximum 6-inch layers and compact to 95 percent in accordance with ASTM D1557.
4. Level and contour surfaces to elevations and gradients indicated on Drawings.
5. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
6. Add water as necessary to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
7. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

C. Soil Sterilization:

1. Apply Soil Residual Herbicide in accordance with WSDOT Standard Specifications Section 5-04.3(5)D.
2. Protect surrounding area from effects of soil sterilization.
3. Do not allow toxic material to run off onto adjacent vegetation or to storm system.

D. Asphalt Concrete Pavement:

1. Construct asphalt concrete pavement in accordance with the requirements of WSDOT Standard Specifications Section 5-04.
2. Before pavement is constructed, trim pavement cuts so marginal lines will form with straight edges and vertical faces.
3. Prepare subgrade in accordance with the requirements of WSDOT Standard Specifications Section 2-06.
4. Hand tamp in areas not accessible to rolling equipment.
5. Ensure joints made during paving operations are straight, clean, vertical, and free of broken or loose material.
6. Seal all contact joints between asphalt pavement joints, curbs, walls, and drains with tack coat.
7. Back tamp exposed edges to 45 degrees.
8. Establish smooth grades with minor cuts or fills. Maintain proper drainage and correct low spots that do not currently drain.
9. Compact crushed surfacing top course to 95 percent in accordance with ASTM D1557.
10. Adjust utility structures and castings to finished grade.
11. Place asphalt pavement in accordance with this section.

E. Pavement Marking

1. Preparation:

a. Verify paving and curbing is complete and surface is ready to receive striping.
b. Verify distance between curbs to ensure adequate width for the indicated number of stalls.
c. Verify weather forecast during planned time of placement is within weather limitations.
d. Clean and prepare surface for receiving paint in accordance with WSDOT Standard Specifications Section 8-22.3(2).
e. Layout lines and symbols to spacing and locations shown on Drawings.

2. Painting: WSDOT Standard Specifications Section 8-22.3(3).
3. Handicap parking striping:

a. State and federal requirements.
b. Locations as shown on Drawings.

3.4 TOLERANCES

A. Abutting existing surfaces to be matched: within 1/8 inch.

B. Pavement areas: Generally smooth, free of depressions exceeding 3/8 inch in 10 feet. Minor deviations may be allowed if approved by Architect.

3.5 PROTECTION

A. Do not allow vehicular traffic on newly paved areas until surface has cooled to atmospheric temperature.

B. Protect surrounding area from effects of soil sterilization. Do not allow toxic material to run off onto adjacent vegetation or to storm system.

3.6 FIELD QUALITY CONTROL

A. Site Tests: Following tests will be performed by Architect.

1. Subgrade density prior to paving, Reference Section 014000.
2. Asphalt and Base Course density.
3. Compact asphalt paving in accordance with 2016 WSDOT Standard Specifications, minimum 91 percent for Rice or 95 percent for Marshall test.
4. If tests indicate Work does not meet specified requirements, Contractor shall remove Work, replace, and retest.

B. Inspection: Owner will observe the Work at the following milestones.

1. After completion of subgrade and before placing base course.
2. After placing base course and before placing asphalt.
3. After placing asphalt base and before placing additional lift of asphalt.

3.7 CLEANING

A. Clean surfaces within five days of substantial completion.

B. Dispose of all surplus, unsuitable, or waste materials according to laws, regulations, and ordinances at an approved offsite waste site obtained by Contractor.

END OF SECTION 321313

SECTION 321611 – CEMENT CONCRETE SIDEWALK, CURBS, AND GUTTERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cement concrete walkways and curbs.

B. Preparing subgrade to receive base course material for concrete walkways.

C. Base courses.

D. Cement concrete walkway paving joint.

E. Cement concrete walkway paving finishing.

F. Concrete vertical curb.

1.2 RELATED REQUIREMENTS

A. Section 015713 – Temporary Erosion and Sedimentation Control

B. Section 312300 – Excavating, Backfilling, and Compacting for Utilities and Structures

C. Section 321216 - Asphalt Paving

1.3 REFERENCE STANDARDS

A. WSDOT Standard Specifications - Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction.

B. City of Des Moines Engineering Construction Standards.

C. ACI 301 – Specifications for Structural Concrete for Building.

D. ASTM D422-90 - Method for Particle Size Analysis of Soils.

E. ANSI/ASTM D1557-91 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lb./ft3.

F. ASTM D2922-91 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods - (Shallow Depth).

G. ASTM D3017-88 - Test Method for Moisture Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

H. ASTM D1556-90 - Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data:

1. Admixtures
2. Portland cement
3. Curing compound

C. Quality Assurance/Control Submittals.

D. Design Data: Concrete mix design.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Crew Foreman: Minimum 6 years' working experience and 4 years' experience as foreman performing similar work.

B. Regulatory Requirements: Work and material shall be in accordance with WSDOT 2016 Standard Specifications.

C. The color within the concrete from separate pours shall remain consistent with minimum deviation in appearance from the concrete in approved concrete sample panels.

1.6 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Comply with WSDOT Standard Specifications Section 5-05.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Crushed Surfacing Base Course: Per Section 321313.

B. Crushed Surfacing Top Course: Per Section 321313.

C. Structural Fill: Per Section 312300.

D. Portland Cement: Type II conforming to the requirements of Section 9-01 of the WSDOT Standard Specifications.

E. Aggregates for Cement Concrete: In accordance with WSDOT Standard Specifications Section 9-03.

F. Curing material and add mixtures: In accordance with WSDOT Standard Specifications Section 9-23.

G. Joint Filler: In accordance with WSDOT Standard Specifications Section 9-04.1. Color: Gray.

H. Joint Sealant: Sikaflex 1A, match color of concrete.

I. Reinforcing Steel: In accordance with WSDOT Standard Specifications Section 9-07.

J. Soil Residual Herbicide: Per Section 321216.

K. Welded Steel Wire Fabric: Plain type, ASTM A185, plain finish, size as shown on Drawings.

L. Concrete Boom Finish equipment and materials: fiber or wire broom to meet requirements of a medium texture finish.

2.2 MIXES

A. Cement Concrete Mix: In accordance with WSDOT Standard Specifications Section 5-05.3(1). Three day mix.

2.3 SOURCE QUALITY CONTROL

A. Submit proposed mix design for review prior to commencement of Work.

B. Tests and analysis of aggregate material will be performed in accordance with WSDOT Standard Specifications.

C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:

1. Verify compacted subgrade is dry and ready to support paving and imposed loads and is approved by Owner.
2. Verify base gradients and elevations are correct.
3. Verify subsurface Work is completed and no further excavation will be required within limits of Work.
4. Verify demolition Work within or adjacent to the Work is complete.
5. Verify heavy construction traffic is as complete as possible and traffic remaining will not damage or degrade the Work.
6. Verify fire department and Owner have been advised of restrictions to site access during Work.
7. Verify weather forecast during planned time of placement is within weather limitations.

3.2 PREPARATION

A. Prepare and compact subgrade in accordance with Section 2-06 of the WSDOT Standard Specifications.

B. Water and thoroughly mix subgrade until optimum moisture content is obtained when deficiency of moisture content exists. When excess moisture exists, rework and aerate subgrade until optimum moisture content is obtained.

C. Adjust top of structures, manhole covers, valve boxes, grates, etc., to grade. Comply with City of Auburn Standards for utility structures. Comply with WSDOT Standards for other structures.

3.3 CONSTRUCTION

A. Crushed Surfacing Top Course: Per Section 321313.

B. Soil Sterilization: Per Section 321313.

C. Base Course: Per Section 321313.

D. Structural Fill: Per Section 312300.

E. Concrete Paving: In accordance with WSDOT Standard Specifications Section 5-05.

F. Forming:

1. Place and secure forms to correct location, dimension, and profile.
2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
3. Place joint fillers vertical in position in straight lines. Secure to formwork during concrete placement.

G. Placing Reinforcing:

1. Place reinforcement to achieve slab and curb alignment as detailed.
2. Extend temperature steel through expansion and contraction joints.
3. Place welded wire fabric centered in slab.
4. Provide support for reinforcing bar.

H. Construction Joints (Expansion Joints):

1. Place construction joints as needed. Minimize number of construction joints.
2. Incorporate construction joints into pattern of sidewalk or adjacent paving.
3. Fit construction joints with filler of required profile, set perpendicular to longitudinal axis of sidewalks and curbs, or as shown on Drawings.
4. Set joint fillers 3/8-inch below finish concrete surface. Fill top of joint with sealant. Place duct tape strip on top of joint filler as bond breaker prior to placing sealant.
5. Place joint filler between paving components and building or other appurtenances and to separate sidewalks from driveways and curb ramps.
6. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

I. Contraction Joints (Control Joints):

1. Joint Pattern and location: Place contraction joints as shown on Drawings.
2. Align curb and sidewalk joints.
3. Tooled “U” shaped joints with radius trowel. No smooth shoulders. Seal joint in accordance with WSDOT Standard Specifications Section 5-05.3(8)B.

J. Placing Concrete Curbs and Walks

1. Place concrete per ACI 301.
2. Hot Weather Placement: Per ACI 301.
3. Cold Weather Placement: Per ACI 306.
4. Ensure reinforcement, inserts, embedded items, and formed joints are not disturbed during concrete placement.
5. Place concrete, screed, and wood float surfaces so smooth and uniform, free of open texturing and exposed aggregate.
6. Round all edges, including edges of expansion and contraction joints, with ½-inch radius edging tool.

K. Surface Finishing:

1. Finish: Float finish followed by medium broom textured finish. For medium broom finish, draw a fiber or wire broom across concrete surface, perpendicular to the line of traffic. Textured fine lines in the broom finish shall be straight and parallel to each other.
2. Joint edges: Radius and trowel. Broom out any smooth shoulders. Retool joints filled by cement slurry.
3. Joint pattern as shown on drawings.
4. Curbs: Medium broom.

L. Color: Natural concrete color.

M. Curing: In accordance with WSDOT Standard Specifications Section 5-05.3(13). Use curing method that preserves surface finish.

3.4 FIELD QUALITY CONTROL

A. In accordance with Section 014000.

B. Site Tests:

1. Owner will perform compaction testing on subgrade and base course.
2. Owner will perform concrete testing.
3. If tests indicate work does not meet specified requirements, remove work, replace, and retest.

C. Inspection: Architect will inspect subgrade prior to placing base, completed base course prior to placing concrete, and completed form work.

3.5 CLEANING

A. Clean surfaces within five days of substantial completion.

B. Dispose of all surplus, unsuitable, or waste materials according to laws, regulations, and ordinances at a site obtained by Contractor.

3.6 PROTECTION

A. Protect concrete from effects of adverse weather and traffic during curing.

B. Keep heavy equipment and vehicular traffic off new concrete until it has attained specified strength.

END OF SECTION 321611

SECTION 331100 – WATER DISTRIBUTION

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. Work in this section includes:

1. Pipe, fittings, valves, and appurtenances.
2. Connection to existing water main.
3. Fire Department Connection (FDC).
4. Double Detector Check Valve and Vault.
5. Water services for fire sprinkler.

B. Related Sections include the following:

1. Section 312300 – Excavating, Backfilling, and Compacting for Utilities and Structures

1.3 REFERENCES

A. Highline Water District Design and Development Standards.

B. WSDOT Standard Specifications – Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction.

C. ASTM A252 – Welded and Seamless Steel Pipe Piles.

D. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

E. AWWA C105 – Polyethylene Encasement for Ductile - Iron Pipe Systems.

F. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

G. AWWA C151 – Ductile Iron Pipe.

H. AWWA C153 – Ductile-Iron Compact Fittings.

I. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.

J. AWWA C550 – Protective Epoxy Interior Coatings for Valves and Hydrants.

K. AWWA C651 – Disinfecting Water Mains.

L. NFPA 24 – Installation of Private Fire Service Mains and their Appurtenances.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Surveyor: Land surveyor licensed in state of Washington with experience surveying underground utilities.
2. Crew Foreman: Minimum six years' working experience and four years' experience as foreman performing similar work.
3. Contractor performing work for Fire Protection Sprinkler System:

    a. Licensed as a Level U or Level 3 Fire Protection Sprinkler System Contractor by the State of Washington.
    b. Have at least one person on site during construction and testing of all fire protection sprinkler system elements with a Level U or Level 3 Certificate of Competency issued by the Washington State Patrol Fire Marshal's Office.

B. Pre-Installation Meetings:

1. Schedule, coordinate, attend, and lead pre-installation meeting with Highline Water District.
2. Schedule and attend meeting prior to beginning work

1.5 SUBMITTALS

A. Comply with Section 013000.

B. Product Data: All products in this section.

1. Catalog cuts, shop drawings, and specifications for Double Detector Check Valve Assembly.

C. Operation and maintenance data for gate valves.

D. Certification: Certification of accuracy for test gage.

E. Fire Protection Sprinkler System Contractor Certification:

1. Copy of Fire Protection Sprinkler System Contractor license.
2. Copy of Certificate of Competency for person designated to be on site during fire protection sprinkler system construction.

F. Closeout Submittals: Record Drawings:

1. Record actual locations of piping mains, valves, connections, and invert elevations.
2. Record location of utilities and structures encountered and not shown or not in agreement with Drawings.
3. Record changes in soil conditions not noted on Drawings.
4. Prepare record drawings in accordance with Section 017200 and Highline Water District Requirements

1.6 REGULATORY REQUIREMENTS

A. Comply with Highline Water District Design and Development Standards.

B. Comply with NFPA requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle pipe, fittings, and specials to ensure delivery to site and final installation in undamaged condition. Do not damage pipe coating and lining. Keep pipe clean. Load and unload pipe and fittings using hoists in a manner to avoid shock or damage. Do not drop, skid, or roll pipe against other pipe. Repair any part of damaged coating or lining. Separate rejected pipe immediately from undamaged pipe. Remove damaged pipe from site within 24 hours.

1.8 SEQUENCING AND SCHEDULING

A. Notify Owner's Representative 72 hours prior to making connections to existing mains.

B. Notify Owner of service shutdown. Provide notification at least 48 hours prior to discontinuation of service, including estimated duration of shutdown.

C. Advise Fire Marshall and Owner's Representative of proposed water shut off that will affect hydrants, fire sprinkler systems, alarm systems, and other services.

D. Maintain water systems in areas of site to be occupied and remain in operation by Owner during construction.

PART 2 - PRODUCTS

2.1 GENERAL

A. Highline Water District Standard Specifications.

B. WSDOT Standard Specifications, 2016.

C. “Reduction of Lead in Drinking Water Act.”

2.2 PIPE AND FITTINGS

A. Ductile Iron Pipe: Centrifugal cast in 18-foot nominal lengths conforming to AWWA C151; cement-mortar lined conforming to AWWA C104; bituminous exterior coating conforming to AWWA C151; Standard Thickness Class 52.

B. Non-restrained Joints: Rubber gasket, push-on type or mechanical joint (MJ) conforming to AWWA C111.

C. Restrained Joints: Highline Water District standards. Use same joint restraint for push-on joints throughout project. Use same joint restraint for mechanical joints throughout project.

D. Pipe Fittings: Ductile iron short body, conform to AWWA C153, cement mortar lined in accordance with AWWA C104. Mechanical joint pressure rating 350 psi, flange joint pressure rating 250 psi.

E. Flanged Fittings: Conform to ANSI B16.1, Class 125 drilling pattern, gasket neoprene or chlorinated butyl.

2.3 TRANSITION, REDUCING, AND FLEXIBLE COUPLINGS

A. Conform to Highline Water District Construction Standards. Determine existing pipe size and order transition coupling with proper dimensions.

B. Rockwell or Romac constructed with gray iron sleeves and ductile or malleable iron followers; ductile iron or electrogalvanized steel bolts and nuts; manufacturer’s standard factory finish.

2.4 VALVES AND APPURTENANCES

A. General: Provide 2-inch square AWWA standard operating nut direct buried valves. Furnish an extended stem within 2 feet of finished grade and a 1/4-inch thick steel plate welded to stem as rock stop for direct buried valves with operating nuts installed 5 feet or more below finished grade.

B. Gate Valves, 2 inches and larger to 12 inches.

1. Seat: Resilient, wedge-type conforming to AWWA C509.
2. Stem: Non-rising with o-ring stem seals.
3. Joints: Mechanical or flange as noted on Drawings. Restrain joints where indicated on Drawings.
4. Opening Direction: Counterclockwise.
5. Pressure Rating: Service at 200 psig working and 400 psig test pressure.
6. Internal Coating: Iron surfaces and valve body with epoxy to AWWA C550.

7. Portion of gate exposed to line velocity: Rubber encapsulated, field replaceable, and with dual seal on mating body seal.
8. Installation: In any position with rated seating in both directions.
9. Marking: AWWA C 515, include name of manufacturer, year of manufacture, maximum working pressure, and valve size.

C. Valve Boxes: Cast iron, two-piece slip-type standard design with a base corresponding to size of valve, coat-tar painted by manufacturer using its standard coating; cast the word “WATER” in the cover; Rich 910 series.

2.5 POST INDICATOR VALVE

A. AWWA Standards.

B. Fire Department requirements.

C. Provide tamper switch.

D. UL/FM approved.

E. Lockable handle, heavy Plexiglas window with valve position indicator reading open or closed.

2.6 TAPPING SLEEVE

A. Cast or ductile iron body, full circle split sleeve type. Mueller.

B. Highline Water District Standards.

2.7 POLYETHYLENE FILM

A. AWWA C105.

2.8 CONCRETE

A. Type III cement, minimum compressive strength of 3,000 psi. Design mix to achieve strength prior to pressure testing.

2.9 FIRE DEPARTMENT CONNECTION (FDC)

A. Highline Water District Standards.

B. Cast Brass body, for free standing mounting on riser pipe. UL/FM approved, with clapper valve.

C. Hose connection: As shown on the Drawings. Comply with fire marshal’s requirements.

D. Pipe Connection: 4-inch-diameter, threaded for IPS.

E. Provide brass plate for mounting on riser pipe marked “AUTO SPRKR & STAND PIPE” and marked with name of building served.

F. Locking Plug: Provide a locking plug for each hose connection. Knox Locking Plug #3043, by Knox Company, (800) 552-5669.

2.10 DOUBLE DETECTOR CHECK VALVE ASSEMBLY

A. Double Detector Check Valve Assembly: Comply with Highline Water District Standard Detail 16.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive Work.

B. Verify grades are at subgrade elevation.

C. Verify erosion control is installed and functioning.

D. Verify field measurements are as shown on Drawings.

E. Verify location, size, and type of existing utilities at point of connection and at points of crossing other utilities. Pothole, expose pipes, determine invert elevations, verify with design, and inform Owner's Representative of deviations affecting design prior to mobilizing crews and beginning construction.

F. Verify and coordinate location and elevation of plumbing stub out and adjust locations to match.

3.2 PREPARATION

A. Coordinate with Owner for Water Service Installation Agreement.

B. Coordinate with Highline Water District for water connection and DDCV installation.

C. Protect surrounding Work from damage or disfiguration. Protect adjacent pavement remaining in service from damage.

D. Protect existing utilities from damage and disturbance. Provide shoring to support existing utilities and their support prism or remove and replace utilities where shoring is not practical. Removing and replacing utilities to be performed in accordance with utility Owner’s standards.

E. Erect barriers and barricades to direct and protect adjacent traffic.

F. Maintain water service to existing buildings. Coordinate with Owner and Owner's Representative to determine time and duration of required water system shutdowns.

G. Field locate and mark existing utilities, whether shown or not, prior to construction, avoid damage or disturbance. Protect, maintain, and repair, where damaged. For aid in utility location call 1-800-424-5555, 48 hours (two working days) prior to beginning construction. Dial Dig will only locate gas. Provide and pay for additional marking as required

H. Field stake alignment and grade. Comply with Highline Water District requirements.

3.3 EXECUTION

A. Excavation and Backfill: Comply with Section 312300. Provide extra width trench as necessary where deflecting pipe. Excavate to depths required to provide minimum cover as indicated on Drawings. Excavate deeper as required to accommodate changes in grade, vaults, connections, or to install pipe under existing pipelines or other utilities. Adjust pipe depth at connection to existing main. Adjust pipe profile to pass below conflicting utilities. Provide minimum 12 inch clearance. Depth Adjustments: 2 feet or less at no adjustment in cost.

B. Installation of Pipe and Fittings:

1. Inspect pipe for structural defects and defects in coating and lining before it is placed in trench. Clean pipe fittings and valves of dirt and foreign material as they are placed. Plug open ends of pipe and fittings with temporary water-tight plug whenever Work is stopped or when water in trench threatens to enter pipe. Keep groundwater from entering pipe at all times. Lay and maintain pipe to required lines with fittings and valves at required locations and valve stems plumb. Lay pipe in accordance with manufacturer’s instructions and to AWWA standards for type of pipe being installed. Construct pipelines to provide cover shown on Drawings. Slope need not be constant, but install pipelines so no high or low points exist in finished line except at locations of fire hydrants, blow offs, air/vacuum valves, or future pipe extensions.
2. Alignment of Pipe: At conflicts with other utilities, such as telephone and existing water mains, realign pipe subject to approval of Owner's Representative.
3. Cutting Pipe: Cut pipe smooth, even, and square. Remove chips and cuttings from interior of pipe. Bevel cut pipe ends to prevent damage to gaskets during installation.
4. Laying of Pipe on Curves: Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflecting joints. If pipe is shown curved on Drawings and no special fittings are shown, assume curves can be made by deflecting joints with standard lengths of pipe. Do not exceed 50 percent of manufacturer’s printed recommended deflection at each pipe joint when pipe is laid on a horizontal or vertical curve. Where field conditions require deflection or curves not anticipated by Drawings, Owner's Representative will determine methods to be used. Additional payment will not be made for laying pipe on

curves nor for field changes involving standard lengths of pipe deflected at joints. When rubber gasketed pipe is laid on a curve, join pipe in a straight alignment and deflect to the curved alignment. Make trenches wider on curves for this purpose.

C. Installation of Valves and Valve Boxes: Upon delivery at job site, open valves to prevent collection of water in valve. Clean valve interior of foreign matter and inspect both in open and closed position prior to installation. Set valves and valve boxes plumb except where otherwise indicated on the Drawings, and place valve boxes over valve or valve operator so valve box does not transmit shock or stress to valve. Tamp backfill carefully around valve box to a distance of 3 feet on sides or to undisturbed face of trench if it is closer. Provide concrete tie down at valves indicated on Drawings.

D. Reaction Blocking (Thrust Blocking): Furnish and install cast-in-place concrete reaction blocking at plugs, caps, tees, bends deflecting more than 11 degrees and where indicated on Drawings. Cast concrete directly against undisturbed trench wall. Place PE sheeting between pipe and concrete. Form blocking should not obstruct access to pipe joints or fittings. Size thrust block per detail on Drawing. Increase thrust blocking size for existing soils conditions as directed by Owner's Representative.

E. Restrained Joints: Provide restrained joints at fire hydrant laterals and pipes, joints, and fittings. Restrained joints may be used at vertical bends in lieu of gravity thrust block. Install lengths of restrained pipe from each side of fittings at vertical bends as indicated on Drawings or as determined by Owner's Representative. Install in accordance with manufacturers' recommendations.

F. Connection to Existing Water Mains :

1. Expose existing pipe and verify diameter and proper material type and sizes prior to beginning Work.
2. Highline Water District and WSDOT requirements.
3. Connection to existing water mains shall be performed by Highline Water District.
4. Use prechlorinated pipe valves and fittings.
5. Do not connect new construction to existing water mains until the new system is pressure tested, disinfected, flushed, purity tested, and approved by the Architect.

G. Flexible Couplings:

1. Install in accordance with manufacturer's instructions.
2. Wrap buried flexible couplings with two layers of PE film extending a minimum of 3 feet each side of center of flexible coupling overlap joints in film minimum 6 inches.

H. Vertical Bends:

1. Fabricate vertical bends on water main 4 inches in diameter and larger with restrained joint ductile iron pipe.

I. Fire Department Connection:

1. Install plumb, wrap portion of steel pipe below ground or in contact with concrete with cold applied tape coating in accordance with AWWA C209, orient hose connection toward street.
2. Paint standpipe in accordance with County fire department requirements
3. Provide concrete pad for base per drawings.

J. Fire Hydrants: Mark all fire hydrants not in service by covering with burlap sack.

K. Double Detector Check Valve Assembly:

1. Highline Water District Standards.
2. Coordinate with Highline Water District for by-pass meter installation.

3.4 PRESSURE TESTS

A. Highline Water District requirements.

B. Notify Owner's Representative 48 hours prior to required inspection time.

C. Provide all test equipment and personnel to prepare for and perform test.

D. Test in accordance with Section 014000.

E. Pressure Tests: Backfill pipeline sufficiently to prevent movement of pipe under pressure. Place reaction blocking and allow concrete to cure and reach specified strength before testing. Repair damage due to failures at no cost to Owner.

F. Furnish pumps, test gages, plugs, saddles, corporation stops, miscellaneous hose, piping, and other equipment necessary to fill pipeline with water and complete hydrostatic test. Furnish 4.5 inch minimum diameter test gage having 0 to 300 psi range with 1/4 of 1 percent accuracy accompanied with certifications of accuracy from a laboratory approved by Owner's Representative. Fill water main only through a backflow prevention device supplied by Contractor and approved by City of Des Moines.

G. Prior to testing, fill pipeline with water and allow to stand under pressure sufficient time to allow escape of air and, if applicable, allow pipe lining to absorb water.

H. Test pipelines and connecting piping in sections between temporary caps or valves by admitting water to the line gradually to full test pressure. Testing against closed valves will be permitted provided pressure differential across valve does not exceed rated working pressure of valve.

I. Hydrostatically test water mains and appurtenances 6 inches in diameter and larger at 200 psi. Apply test pressure at low end of section of water main being tested. Vent air in pipe prior to test.

J. Test by pressurizing main to required pressure, stop pump for 15 minutes, and then pressurize main to test pressure again. Observe section being tested to detect any visible leakage. Use clean container for holding water for pressurizing main being tested. Sterilize makeup water by adding chlorine to concentration of 50 mg/l. Accurately determine water quantity required to restore pressure by pumping through positive displacement water meter with a sweep unit hand registering 1 gallon per revolution. Use meter approved by City of Des Moines and WSDOT. Test acceptability will be determined as follows: Comply with City of Des Moines and WSDOT standards. There shall not be an appreciable or abrupt loss in pressure during 15-minute test period.

K. Limit sections to be tested normally to 1,600 feet. Owner's Representative may require the first section of pipe, not less than 1,000 feet in length, be tested in order to qualify crew and material. Do not continue pipe laying more than an additional 1,000 feet until first section has been tested successfully.

L. Perform hydrostatic tests on every complete section of water main between valves, or as directed by Owner's Representative. Each valve side shall withstand same test pressure as pipe, with no active pressure in pipe section beyond closed valves. Make tests with hydrant auxiliary gate valves open and pressure against hydrant valve. After test is completed, each gate valve will be acceptable if there is no immediate loss of pressure on gage when pressure is applied to valve being checked. Verify pressure differential across valve does not exceed rated test pressure of valve.

M. When hydrants are included with section of main pipe to be tested, conduct testing in two separate tests as follows:

1. Test No. 1 - Water main gate valves and hydrant auxiliary gate valves closed, with hydrant operating stem valves and hose ports wide open.
2. Test No. 2 - Water main gate valves and hydrant operating stem valves tightly closed but hydrant auxiliary gate valves and hose ports wide open.

N. Correct visible leakage detected regardless of allowable leakage specified above. Should tested section fail to meet pressure test successfully as specified, locate and repair defects and retest pipeline at no cost to Owner.

O. Prior to notifying Owner's Representative to witness pressure test, have equipment set up completely, ready for operation, and have tested successfully to ensure pipe is in satisfactory condition.

3.5 DISINFECTION OF WATER MAINS

A. Before being placed in service, chlorinate and obtain a satisfactory bacteriological report for new water mains and repaired portions of, or extensions to, existing mains.

B. Flush pipe (including private fire lines not receiving sterilization) prior to being disinfected to remove solids or contaminated material that may have become lodged in pipe. If no hydrant is installed at end of main, provide a tap large enough to develop a velocity of at least 2.6 fps in main. Provide taps required for temporary or permanent

release of air and chlorination or flushing purposes. Where dry calcium hypochlorite is used for disinfection of pipe, perform flushing after disinfection. Dispose of treated water flushed from mains and neutralize wastewater for protection of aquatic life in receiving water before disposal into any natural drainage channel. Dispose disinfecting solution during test to Owner's Representative's and local authorities' satisfaction. If approved by sewer system owner and Owner's Representative, disposal may be made to any available sanitary sewer provided rate of disposal will not overload sewer.

C. Sterilization: Highline Water District Standards.

D. Preventing Reverse Flow: Do not make connections between existing distribution system and pipelines not disinfected and constructed under this Contract without a DSHS approved back flow preventer installed in connecting line.

E. Chlorinating Connections to Existing Water Mains: Follow chlorinating procedure as specified in AWWA C651. Swab closure fittings with a very strong chlorine solution (5 to 6 percent Cl).

3.6 FINAL FLUSHING AND TESTING OF MAINS

A. Following chlorination, flush treated water from newly laid pipe until replacement water throughout its length shows, upon test, absence of chlorine. In the event chlorine is normally used in supply source, then tests shall show a residual not in excess of that carried in system.

B. Dispose of chlorinated water in accordance with DOE and Department of Fish and Wildlife requirements. Neutralize water for protection of aquatic life in the receiving water before disposal into drainage system.

C. Locate a sample tap ahead of flushing hose for convenience and sanitary sampling.

D. Before placing lines into service, a satisfactory report shall be received from a certified test lab on samples collected from representative points in new system. Samples shall be collected and bacteriological tests obtained by the Contractor. Costs of water sample analysis shall be borne by Contractor as incidental Work to water main installations.

E. Should initial treatment result in an unsatisfactory bacteriological test, repeat original chlorination procedure until satisfactory results are obtained. Failure to obtain a satisfactory bacteriological test will be considered as failure to keep pipe clean during construction or to chlorinate the main as specified. Additional chlorination required to obtain satisfactory test result shall be completed at no additional cost to Owner.

END OF SECTION 331100

SECTION 333000 - SANITARY SEWERAGE

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. Work in this section includes:

1. Sanitary side sewers.
2. Sanitary sewer clean outs.
3. Connection to existing sanitary sewer system.
4. Oil/water separator

B. Related sections include the following:

1. Section 312300 - Excavating, Backfilling, and Compacting for Utilities and Structures
2. Section 312500 - Erosion and Sedimentation Control

1.3 REFERENCES

A. WSDOT Standard Specifications - Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction.

B. WSDOT Standard Plans - Washington State Department of Transportation 2014. Standard Plans for Road, Bridge, and Municipal Construction.

C. Midway Sewer District Construction Standards and Oil/Water Separator Permit.

D. ASTM D3034 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

E. AWWA C151 - Ductile Iron Pipe.

F. AWWA C153 - Ductile-Iron Compact Fittings.

G. ASTM C564 Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

1.4 DEFINITION

A. Side Sewer: That portion of a sewer line constructed from the main sanitary sewer line to 5 feet outside the building line.

1.5 SUBMITTALS

A. Comply with Section 013000.

B. Product Data: Manufacturers' literature and specifications for pipe, fittings, castings, and manholes.

C. Certification: Certification of accuracy for test gage.

D. Record Drawings:

1. Submit under provisions of Section 017200.
2. Accurately record actual locations of pipe runs and connections.
3. Provide field survey of all inverts and structure lid elevations.
4. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
5. Prepare record drawings.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Surveyor: Land surveyor licensed in state of Washington with experience surveying underground utilities.
2. Crew Foreman: Minimum six years' working experience and four years' experience as foreman performing similar work.

B. Regulatory Requirements: Comply with Midway Sewer District requirements.

C. Pre-Installation Meetings: Schedule, coordinate, attend, and lead pre-installation meeting.

1.7 SEQUENCING AND SCHEDULING

A. Maintain sanitary sewer in areas of site to be occupied and remain in operation by Owner during construction.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle pipe, fittings, and appurtenances in such a manner as to ensure delivery to the project site and final installation in a sound, undamaged condition. Keep the pipe clean. Load and unload pipe using hoists in a manner to avoid shock or damage, and under no circumstances shall they be dropped, skidded, or rolled against other pipe. Damaged items shall be rejected and removed from the site within 24 hours.

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with Midway Sewer District Standards.

B. Comply with WSDOT Standard Specifications.

2.2 PRODUCTS

A. PVC Pipe:

1. Bell-and-spigot type with rubber gasket joints conforming to the requirements of Section 9-05.12(1) of the WSDOT Standard Specifications. Schedule: SDR 35.
2. Lengths: Manufactured and provided in nominal lengths of not less than 10 feet or more than 20 feet. Use shorter pipe lengths to meet special conditions where shown on the Drawings or as approved.
3. Pipe Condition: New. No sun-yellowed pipe will be allowed.
4. Fittings: Compatible with the pipe, injection molded, gasket type, manufactured in accordance with ASTM D3034. Do not use solvent welded joints.

B. Ductile Iron Pipe: In accordance with Section 331100.

C. Transition Couplings:

1. Transition joints in non-pressure sewers between similar or dissimilar materials of equal or unequal size shall be made water and gas tight by means of an approved connector or adapter of the compression seal type.
2. The connector or adapter shall be manufactured of preformed elastomeric material conforming to the applicable sections of ASTM C425, C564 or Dl869.
3. Install as recommended and specified by the manufacturer.
4. PVC to concrete connection shall be an epoxy/sand sealer, cast in boot, manufactured saddle, or “donut” gasket.
5. Comply with Midway Sewer District and WSDOT Standards.

D. Cleanouts:

1. In accordance with WSDOT Standard Plans B-85.40-00.

2. Casting

   a. Load ratings: HS20.
   b. Locking type.
   c. Lettering ”SEWER.”

3. Ring and Cover: WSDOT Standard Plan B-30.70.03.

E. Tracer Wire and Tracer Tape: Tracer wire shall be TWHN or TWHH #10. Tape shall be sewer tracer tape or magnetic sewer tracer tape.

F. Coalescing Plate Oil/Water Separator: 253-CPS Coalescing plate oil/water separator by Oldcastle Precast, (888) 895-3227, or approved substitute.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify excavation is ready to receive Work and excavations; dimensions, and elevations as indicated on Drawings.

B. Verify existing utilities have been marked.

C. Verify erosion control is in place and operating properly.

D. Verify inverts at points of connection and verify minimum grade can be maintained. Pothole, expose pipes, determine invert elevations, verify with design, and inform the Architect of deviations affecting design prior to mobilizing crews and beginning construction.

E. Verify and coordinate location and elevation of plumbing stub out and adjust locations to match.

3.2 PREPARATION

A. Protect elements surrounding Work of this section from damage or disfiguration.

B. Protect existing utilities from damage and disturbance. Provide shoring to support existing utilities and their support prism or remove and replace utilities where shoring is not practical. Removing and replacing to be performed per utility Owner’s standards.

C. Erect barriers and barricades to direct and protect adjacent traffic.

D. Maintain sewer service to existing buildings.

E. Field locate and mark existing utilities, whether shown or not, prior to construction, avoid damage or disturbance. Protect, maintain, and repair, where damaged. For aid in utility location call 1-800-424-5555, 48 hours (two working days) prior to beginning

construction. Dial Dig will only locate gas. Provide and pay for additional marking as required

F. Field stake alignment and grade.

3.3 INSTALLATION

A. Excavation, Foundation, and Bedding: In accordance with Section 312300.

B. Pipe Installation:

1. Comply with Midway Sewer District and WSDOT Standards.
2. Follow manufacturer's installation procedures.
3. Lay pipe to line and grade indicated on Drawings.
4. Maintain line and grade for straight sections with laser beam operated by qualified personnel. Check line and grade constantly. If they do not meet specified limits, stop work immediately and remedy the cause before proceeding.
5. All PVC and concrete pipe, including side sewer stubs, shall have tracer wire and sewer tracer tape. Tracer shall be 18 inches below ground level.

C. Cleanouts:

1. Comply with WSDOT Standards.
2. Construct plumb and level.
3. Adjust top to finish grade. Verify top of cleanout elevation.

D. Side Sewers:

1. Comply with Midway Sewer District and WSDOT requirements.
2. Side sewer slope need not be constant but shall have a continuously descending grade of no less than 1 percent. No flat spots or sags.
3. Provide detection wire and tracer tape continuously along service from main to building.
4. Tracer wire shall be continuous, unbroken wire without joints. Bring wire to surface at cleanout and wrap around top of cleanout pipe three times.

E. Oil/Water Separator:

1. Install per manufacturer's instructions.

F. Backfilling: In accordance with Section 312300.

3.4 TOLERANCES

A. Variance from established line and grade for gravity sewers shall not be greater than 1/32 of an inch per inch of pipe diameter and not to exceed 1/2 inch, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of

joining surface and pipe interior surface does not exceed 1/64 of an inch per inch of pipe diameter or 1/2 inch maximum.

B. Allowable deviation shall not be accumulative.

3.5 FIELD QUALITY CONTROL

A. Comply with Section 014000.

B. Comply with Midway Sewer District and WSDOT requirements.

C. Inspection: Architect will observe the work at the following milestones: Completion of pipe, cleanouts, and bedding, and prior to backfilling.

3.6 CLEANING

A. Comply with Midway Sewer District and WSDOT requirements.

B. Clean with jet or flushing ball and inspect for obstructions prior to testing.

C. Prevent debris and foreign matter from entering sewer system. Provide screen at downstream end of cleaning to trap debris. Remove and dispose of debris.

3.7 PROTECTION

A. Protect Work, pipe, and bedding from damage or displacement until backfilling operation is in progress.

B. Protect completed work from damage.

END OF SECTION 333000