

DATE: August 12, 2024

HURST-ROSCHE, INC.
1400 E. Tremont Street
Hillsboro, Illinois 62049
217-532-3959

TO: PROSPECTIVE BIDDERS

SUBJECT: ADDENDUM NO. 1 TO THE BIDDING DOCUMENTS FOR

**NEW TOILET / CONCESSIONS BUILDING
RAMSEY CUSD #204
RAMSEY, FAYETTE COUNTY, ILLINOIS
HR # 150-0684**

This addendum forms a part of the bidding and contract documents and modifies the original bidding documents dated August 5, 2024. Acknowledge receipt of this addendum in the space provided on the Bid Form. **FAILURE TO DO SO MAY SUBJECT BIDDER TO DISQUALIFICATION.**

Upon receipt of this addendum, please sign below and email to Hurst-Rosche, Inc. at tdownen@hurst-rosche.com within 24 hours of receipt.

RECEIVED BY:	_____
	Company Name/Authorized Representative
DATE:	_____

SPECIFICATIONS

- A. SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
 - a. **ADD** Attachment #1 as a supplement to the project manual.
- B. SECTION 22 07 00 – PLUMBING INSULATION
 - a. **ADD** Attachment #2 as a supplement to the project manual.
- C. SECTION 22 11 00 – FACILITY WATER DISTRIBUTION
 - a. **ADD** Attachment #3 as a supplement to the project manual.
- D. SECTION 22 13 00 – FACILITY SANITARY SEWERAGE
 - a. **ADD** Attachment #4 as a supplement to the project manual.
- E. SECTION 22 33 00 – ELECTRIC DOMESTIC WATER HEATERS
 - a. **ADD** Attachment #5 as a supplement to the project manual.
- F. SECTION 22 40 00 – PLUMBING FIXTURES
 - a. **ADD** Attachment #6 as a supplement to the project manual.

This addendum consists of 2 pages. This addendum consists of 18 attachments for an additional 91 pages.

- G. SECTION 23 07 00 – HVAC INSULATION
 - a. **ADD** Attachment #7 as a supplement to the project manual.
- H. SECTION 23 31 00 – HVAC DUCTS AND CASINGS
 - a. **ADD** Attachment #8 as a supplement to the project manual.
- I. SECTION 23 33 00 – AIR DUCT ACCESSORIES
 - a. **ADD** Attachment #9 as a supplement to the project manual.
- J. SECTION 23 34 00 – HVAC FANS
 - a. **ADD** Attachment #10 as a supplement to the project manual.
- K. SECTION 23 37 00 – AIR OUTLET AND INLETS
 - a. **ADD** Attachment #11 as a supplement to the project manual.
- L. SECTION 23 81 26 – SPLIT-SYSTEM AIR-CONDITIONERS
 - a. **ADD** Attachment #12 as a supplement to the project manual.
- M. SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES
 - a. **ADD** Attachment #13 as a supplement to the project manual.
- N. SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
 - a. **ADD** Attachment #14 as a supplement to the project manual.
- O. SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
 - a. **ADD** Attachment #15 as a supplement to the project manual.
- P. SECTION 26 24 16 – PANELBOARDS
 - a. **ADD** Attachment #16 as a supplement to the project manual.
- Q. SECTION 26 27 26 – WIRING DEVICES
 - a. **ADD** Attachment #17 as a supplement to the project manual.
- R. SECTION 26 51 00 – INTERIOR LIGHTING
 - a. **ADD** Attachment #18 as a supplement to the project manual.

This addendum **DOES NOT** alter the previously published bid date of **Thursday, August 22, 2024, 2:00 PM**, prevailing time, at **Ramsey CUSD #204**.

Sincerely,
HURST-ROSCHE, INC.



Timothy L. Downen, AIA, LEED AP
cc: All plan holders

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Section 22 05 53

Identification for Plumbing Piping and Equipment

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Tags.
 - 3. Pipe markers.
 - 4. Ceiling tacks.
 - 5. Labels.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturers catalog literature for each product required.
- B. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Manufacturers:
 - 1. Craftmark Identification Systems.
 - 2. Safety Sign Co.
 - 3. Seton Identification Products.
- B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

- A. Plastic Tags:
 - 1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.
- B. Metal Tags:
 - 1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.
- C. Information Tags:
 - 1. 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: Typewritten letter size list of applied tags and location in anodized aluminum frame, plastic laminated.

2.3 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 - 1. 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:
 - 1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Plastic Underground Pipe Markers:
 - 1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.4 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color-coded head.
- B. Color code as follows:
 - 1. Plumbing valves: Green.

2.5 LABELS

- A. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- 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. Number tags consecutively by location.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify piping, concealed or exposed, with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. 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.

- J. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.3 SCHEDULES

A. Identification:

1. Domestic Cold Water Piping.
 - a. Identification Type: Pipe markers.
 - b. Background Color: Green.
 - c. Lettering Size: 1-1/2".
 - d. Lettering Color: White.
2. Domestic Hot (Supply&Return) Water.
 - a. Identification Type: Pipe markers.
 - b. Background Color: Green.
 - c. Lettering Size: 1-1/2".
 - d. Lettering Color: White.
3. Domestic Cold Water.
 - a. Tag Material: Brass
 - b. Tag Shape: Round
 - c. Tag Color: Natural
4. Domestic Hot (Supply&Return) Water.
 - a. Tag Material: Brass
 - b. Tag Shape: Round
 - c. Tag Color: Natural

END OF SECTION

Section 22 07 00

Plumbing Insulation

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plumbing piping insulation, jackets and accessories.

B. Related Sections:

1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 09 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
7. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
17. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
18. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
19. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
20. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. Aeroflex. Aerocell.
 - 2. Armacell, LLC. Armaflex.
 - 3. Nomaco. K-flex.

2.2 PIPE INSULATION

- A. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.3 PIPE INSULATION JACKETS

- A. PVC Plastic Pipe Jacket:
 - 1. Product Description: ASTM D1785, One piece molded type fitting covers and sheet material, off-white color.
 - 2. Thickness: 15 mil.
 - 3. Connections: Brush on welding adhesive or Pressure sensitive color matching vinyl tape.

2.4 PIPE INSULATION ACCESSORIES

- A. Covering Adhesive Mastic: Compatible with insulation.
- B. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- C. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

- D. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum or stainless steel jacket single piece construction with self-adhesive closure. Thickness to match pipe insulation.
- E. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- F. Adhesives: Compatible with insulation.

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 - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. 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. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Hot Piping Systems less than 140 degrees F:
 - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
 - 3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

- E. Inserts and Shields:
 1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
 2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
 3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

- F. Insulation Terminating Points:
 1. Condensate Piping: Insulate entire piping system and components to prevent condensation.

- G. Closed Cell Elastomeric Insulation:
 1. Push insulation on to piping.
 2. Miter joints at elbows.
 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 4. When application requires multiple layers, apply with joints staggered.
 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

- H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

- I. 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.

- J. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 SCHEDULES

- A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
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Domestic Hot Water Supply and Recirculation	P-5	1-1/4 inches and smaller	1.0
		1-1/2 inches and larger	1.5
Domestic Cold Water	P-5	1-1/4 inches and smaller	1.0
		1-1/2 inches and larger	1.5

END OF SECTION

Section 22 11 00

Facility Water Distribution

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Domestic water piping, within 5 feet of building.
2. Domestic water piping, above grade.
3. Unions and flanges.
4. Valves.
5. Pipe hangers and supports.
6. Pressure gages.
7. Pressure gage taps.
8. Thermometers.
9. Flow control valves.
10. Water pressure reducing valves.
11. Relief valves.
12. Strainers.
13. Hose bibs.
14. Hydrants.
15. Backflow preventers.
16. Water hammer arrestors.
17. Thermostatic mixing valves.
18. Diaphragm-type compression tanks.
19. System lubricated circulators.
20. Underground pipe markers.
21. Bedding and cover materials.

B. Related Sections:

1. Division 03 - Cast-In-Place Concrete: Execution requirements for placement of concrete house keeping pads specified by this section.
2. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
3. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
4. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
5. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
6. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.

Facility Water Distribution
22 11 00 - 1

7. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
8. Division 31 - Soils for Earthwork: Soils for backfill in trenches.
9. Division 31 - Aggregates for Earthwork: Aggregate for backfill in trenches.
10. Division 31 - Excavation: Product and execution requirements for excavation and backfill required by this section.
11. Division 31 - Trenching: Execution requirements for trenching required by this section.
12. Division 31 - Fill: Requirements for backfill to be placed by this section.
13. Division 33 - Disinfecting of Water Utility Distribution: Product and execution requirements for disinfection of domestic water piping beyond 5 feet (1500 mm) of building.

1.2 REFERENCES

- A. American National Standards Institute:
 1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.
- B. American Society of Mechanical Engineers:
 1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
 4. ASME B31.9 - Building Services Piping.
 5. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
 6. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- C. American Society of Sanitary Engineering:
 1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
 2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
 3. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
 4. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
 5. ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
 6. ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).
 7. ASSE 5015 - Performance Requirements for Testing Double Check Backflow Prevention Assemblies (DC) and Double Check Fire Protection Backflow Prevention Assemblies (RPDF).
- D. ASTM International:
 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

3. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. ASTM A536 - Standard Specification for Ductile Iron Castings.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
7. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
8. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
9. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
10. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
11. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
12. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
13. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
14. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
15. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
16. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
17. ASTM D 3311 - Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.
18. ASTM E1 - Standard Specification for ASTM Thermometers.
19. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
20. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
21. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
22. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
23. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
24. ASTM F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
25. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
26. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
27. ASTM F 891 - Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core.

28. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

E. American Water Works Association:

1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
5. AWWA C651 - Disinfecting Water Mains.
6. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
7. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
8. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
9. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
10. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
11. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
6. MSS SP 80 - Bronze Globe, Angle and Check Valves.
7. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
8. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
9. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

G. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

H. Plumbing and Drainage Institute:

1. PDI WH201 - Water Hammer Arrester Standard.

I. Underwriters Laboratories Inc.:

1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
 - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
 - 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
 - 4. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
 - 5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- B. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of valves and equipment.
- B. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.
- B. Perform Work in accordance with State of Illinois Plumbing Code, 2014 edition.
- C. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Furnish manufacturer's standard warranty for domestic water piping.

1.11 EXTRA MATERIALS

- A. Furnish two packing kits for each size valve, two loose keys for outside hose bibs, hose end vacuum breakers for hose bibs, and two pump seals for each pump model.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Ductile Iron Pipe: AWWA C151 C104.
 - 1. Fittings: AWWA C110, ductile iron, standard thickness.
 - 2. Joints: AWWA C111, rubber gasket with rods.
 - 3. Jackets: AWWA C105 polyethylene jacket.
- B. Copper Tubing: ASTM B88, Type K annealed.
 - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
 - 2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

- C. PVC Pipe: ASTM D1785, Schedule 40 ASTM D2241, SDR-26 for 160 psig pressure rating SDR-21 for 200 psig pressure rating, polyvinyl chloride (PVC) material.
 - 1. Fittings: ASTM D2466, Schedule 40, PVC ASTM D2464 PVC, threaded.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- D. PVC Pipe: AWWA C900 Class 150, polyvinyl chloride (PVC) material.
 - 1. Fittings: AWWA C110, ductile iron, standard thickness.
 - 2. Joints: ASTM D3139 compression gasket ring.
- E. Copper Tubing: ASTM B42, Temper H80 hard drawn or Temper O61 annealed.
 - 1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder, AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.
- F. Copper Tubing: ASTM B42, Temper O61 annealed.
 - 1. Fittings: ASME B16.26 cast bronze.
 - 2. Joints: Flared.
- G. Polyethylene Pipe: ASTM D2239 SDR 19, or ASTM D2447 Schedule 40.
 - 1. Fittings: ASTM D2609, Polyethylene.
 - 2. Joints: Mechanical with stainless steel clamps.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type L or K drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.
- B. Copper Tubing: ASTM B88, Type L or K, drawn, rolled grooved ends.
 - 1. Fittings: ASME B16.18 cast copper alloy, or ASME B16.22 wrought copper and bronze, or ASTM B584 bronze sand castings, grooved ends.
 - 2. Joints: Grooved mechanical couplings meeting ASTM F1476.
 - a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.
 - b. Gasket: Elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.
 - c. Accessories: Stainless steel bolts, nuts, and washers.

2.3 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
 - 1. Ferrous Piping: Class 150, malleable iron, threaded.
 - 2. Copper Piping: Class 150, bronze unions with soldered.

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. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
 2. Copper Piping: Class 150, slip-on bronze flanges.
 3. PVC Piping: PVC flanges.
 4. CPVC Piping: CPVC flanges.
 5. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.4 BALL VALVES

- A. Manufacturers:
1. Crane Valve, North America.
 2. Hammond Valve.
 3. Milwaukee Valve Company.
 4. NIBCO, Inc.
 5. Stockham Valves & Fittings.
- B. 2 inches and Smaller: MSS SP 110, 600 psi WOG, two piece bronze body, chrome plated brass ball, full port, teflon seats, blow-out proof stem, solder or threaded ends with union, lever handle.
- C. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, chrome plated bronze ball, full port, teflon seats, blow-out proof stem, solder or threaded ends with union, lever handle.

2.5 CHECK VALVES

- A. Horizontal Swing Check Valves:
1. Manufacturers:
 - a. Crane Valve, North America.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO, Inc.
 - e. Stockham Valves & Fittings.
 2. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
 3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.
- B. Spring Loaded Check Valves:
1. Manufacturers:
 - a. Crane Valve, North America.
 - b. Hammond Valve.

- c. Milwaukee Valve Company.
- d. NIBCO, Inc
- e. Stockham Valves & Fittings.
- 2. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.
- 3. 2-1/2 inches and Larger: MSS SP 71, Class 125, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

2.6 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Carpenter & Paterson Inc.
 - 2. Creative Systems Inc.
 - 3. Flex-Weld, Inc.
 - 4. Globe Pipe Hanger Products Inc.
 - 5. Michigan Hanger Co.
 - 6. Superior Valve Co.
- B. Plumbing Piping: Conform to ASME B31.9 ASTM F708 MSS SP 58 MSS SP 69 MSS SP 89.
- C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron Carbon steel, adjustable swivel, split ring.
- D. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
- E. Hangers for Hot Pipe, Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
- F. Hangers for Hot Pipe, Sizes 6 inches and Larger: Adjustable steel yoke, cast iron pipe roll and double hanger.
- G. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
- H. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
- I. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
- J. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamps.
- K. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
- L. Vertical Support: Steel riser clamp.

- M. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- N. 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.
- O. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
- P. Copper Pipe Support: Carbon steel ring, adjustable, copper plate.

2.7 PRESSURE GAGES

- A. Gage: ASME B40.1, UL 393, UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
 1. Case: Cast aluminum or Stainless steel.
 2. Bourdon Tube: Brass or Phosphor bronze or Type 316 stainless steel.
 3. Dial Size: 3-1/2 inch diameter.
 4. Mid-Scale Accuracy: One percent.
 5. Scale: Both psi and kPa.

2.8 PRESSURE GAGE TAPS

- A. Needle Valve: Brass or Stainless Steel, 1/4 inch NPT for minimum 300 psi.
- B. Ball Valve: Brass or Stainless Steel, 1/4 inch NPT for 250 psi.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

2.9 STEM TYPE THERMOMETERS

- A. Thermometer: ASTM E1, red appearing mercury, lens front tube, cast aluminum case with enamel finish.
 1. Size: 7-inch scale.
 2. Window: Clear glass.
 3. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
 4. Accuracy: ASTM E77 2 percent.
 5. Calibration: Both degrees F and degrees C.
- B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
 1. Size: 7 inch scale.
 2. Window: Clear glass.
 3. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
 4. Accuracy: ASTM E77 2 percent.

5. Calibration: Both degrees F and degrees C.

2.10 FLOW CONTROL VALVES

- A. Construction: Class 150, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, combination blow-down or back-flush drain.
- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 5 psi.

2.11 WATER PRESSURE REDUCING VALVES

- A. 2 inches and Smaller: MSS SP 80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded and single union ends.

2.12 RELIEF VALVES

- A. Furnish materials in accordance with State of Illinois Plumbing Code, 2014 edition.
- B. Pressure Relief:
 - 1. ANSI Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
 - 2. Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated at maximum 60 psi, UL listed for fuel oil, capacities ASME certified and labeled.
- C. Temperature and Pressure Relief:
 - 1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.13 STRAINERS

- A. 2 inch and Smaller: Threaded brass body for 175 psi CWP, Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- B. 1-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.
- C. 5 inch and Larger: Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

2.14 HOSE BIBS

- A. Manufacturers:
 - 1. Zurn.

2. Woodford.
3. Wade.
4. Haws.

- B. HB-1 Interior: Bronze or brass for installation in 4 inch wall, bronze face plate, hose thread spout, chrome plated, lockable box with tee handle, integral vacuum breaker in conformance with ASSE 1011.

2.15 HYDRANTS

A. Manufacturers:

1. Zurn.
2. Wade.
3. Watts.

- B. Wall Hydrant: ASSE 1019; non-freeze, self-draining type with polished bronze lockable recessed box hose thread spout, locks shield and removable key, and integral vacuum breaker.

2.16 BACKFLOW PREVENTERS

A. Manufacturers:

1. Zurn.
2. Watts.
3. Watts/Ames.
4. Febco.

B. Reduced Pressure Zone Backflow Preventers:

1. Comply with ASSE 1013.
2. Bronze body, with bronze internal parts and stainless steel springs.
3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two ball valves, strainer, and four test cocks.

- C. Double Check Valve Assemblies: Comply with ASSE ASSE 1015 or AWWA C510; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.17 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Zurn.
2. Watts.
3. Sioux Chief.

- B. ASSE 1010; stainless steel construction, piston type sized in accordance with PDI WH-201.
- C. Pre-charged suitable for operation in temperature range -100 to 300 degrees F and maximum 150 psi working pressure.

2.18 THERMOSTATIC MIXING VALVES

- A. Manufacturers:
 - 1. Watts.
 - 2. Bradley.
 - 3. Symmons.
 - 4. Leonard.
- B. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment. Non-emergency fixtures shall conform to ASSE 1070 to temper water to maximum 110 degrees F. Emergency fixture thermostatic mixing valves shall conform to ASSE 1071 and ANSI Z358.1.
- C. Capacity: See schedule on drawings.
- D. Accessories:
 - 1. Check valve on inlets.
 - 2. Volume control shut-off valve on outlet.
 - 3. Stem thermometer on outlet.
 - 4. Strainer stop checks on inlets.
- E. Cabinet (where indicated): 16 gage stainless steel, for recessed or surface (see schedule) mounting with keyed lock.

2.19 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Manufacturers:
 - 1. Amtrol.
 - 2. Watts.
 - 3. Taco.
- B. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 50 psig. Adjust per actual field conditions.
- D. Size: See schedule on drawings.

2.20 SYSTEM LUBRICATED CIRCULATORS

- A. Manufacturers:
 - 1. Taco.
 - 2. Armstrong.
 - 3. Bell & Gossett.
- B. Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, for 140 psig maximum working pressure, 230 degrees F maximum water temperature.
- C. Casing: Bronze with flanged pump connections.
- D. Impeller, Shaft, Rotor: Stainless Steel.
- E. Bearings: Metal Impregnated carbon (graphite) and ceramic.
- F. Motor: Impedance protected, single speed.
- G. Performance:
 - 1. See schedule on drawings.
- H. Electrical Characteristics: In accordance with Division 26 and the following:
 - 1. See schedule on drawings.

2.21 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- B. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering.

2.22 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type as specified in Division 31.
- B. Cover: Fill Type as specified in Division 31.
- C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Division 31. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

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, before assembly.

3.3 INSTALLATION - METERS

- A. Install positive displacement meters in accordance with AWWA M6, with isolating valves on inlet and outlet. Provide full line size bypass with globe valve for liquid service meters.

3.4 INSTALLATION - THERMOMETERS AND GAGES

- A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
- B. Install gage taps in piping.
- C. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage.
- 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 gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.5 INSTALLATION - HANGERS AND SUPPORTS

- A. Inserts:
 - 1. Provide inserts for placement in concrete forms.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. 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.

B. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9 ASTM F708 and MSS SP 89.
2. Support horizontal piping as schedule.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
8. Provide [copper plated hangers and supports for copper piping] [sheet lead packing between hanger or support and piping].
9. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 21 05 48.

3.6 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.
- B. Establish elevations of buried piping with not less than 3.5 ft of cover.
- C. Establish minimum separation of water from sanitary sewer piping in accordance with Illinois Plumbing code.
- D. Remove scale and dirt on inside of piping before assembly.
- E. Excavate pipe trench in accordance with Division 31.
- F. Install pipe to elevation as indicated on Drawings.
- G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
- H. Install pipe on prepared bedding.

- I. Route pipe in straight line.
- J. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- K. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
- L. Install plastic ribbon tape continuous buried 6 inches below finish grade, above pipe line; coordinate with Division 31. Refer to Section 22 05 53.
- M. Install trace wire continuous over top of pipe; coordinate with Division 31. Refer to Section 22 05 53.
- N. Pipe Cover and Backfilling:
 - 1. Backfill trench in accordance with Division 31.
 - 2. Maintain optimum moisture content of fill material to attain required compaction density.
 - 3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 4 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - 4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 5. Do not use wheeled or tracked vehicles for tamping.

3.7 INSTALLATION - ABOVE GROUND PIPING

- A. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- D. Group piping whenever practical at common elevations.
- E. Slope piping and arrange systems to drain at low points.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. 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.
- H. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 31.

- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Provide support for utility meters in accordance with requirements of utility companies.
- K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.
- L. Install domestic water piping in accordance with ASME B31.9.
- M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.
- N. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.
- O. Install unions downstream of valves and at equipment or apparatus connections.
- P. Install valves with stems upright or horizontal, not inverted.
- Q. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- R. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- S. Install globe or ball valves for throttling, bypass, or manual flow control services.
- T. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- U. Provide spring loaded check valves on discharge of water pumps.
- V. Provide flow controls in water circulating systems as indicated on Drawings.
- W. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
- X. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
- Y. Test backflow preventers in accordance with ASSE 5013 5015.
- Z. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories, sinks, washing machine outlets.

AA. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures each washroom. Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

3.8 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. Install pumps on vibration isolators.
- D. Install flexible connectors at or near pumps where piping configuration does not absorb vibration.
- E. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve, balancing valve, and shut-off valve on pump discharge.
- F. 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.

3.9 INSTALLATION - SERVICE CONNECTIONS

- A. Provide new water service complete with approved water meter with by-pass valves pressure reducing valve, 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 gage 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.

3.10 FIELD QUALITY CONTROL

- A. Test domestic water piping system in accordance with local authority having jurisdiction.

3.11 CLEANING

- A. Disinfect water distribution system in accordance with Division 33.

- B. Prior to starting work, verify system is complete, flushed and clean.
- C. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- D. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
- E. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
- F. Maintain disinfectant in system for 24 hours.
- G. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
- H. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
- I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.12 SCHEDULES

A. Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2

END OF SECTION

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. Unions and flanges.
4. Pipe hangers and supports.
5. Floor drains.
6. Floor sinks.
7. Grease interceptors.
8. Cleanouts.
9. Bedding and cover materials.

B. Related Sections:

1. Division 03 - Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
3. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
4. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
5. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
6. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
7. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
8. Division 31 - Soils for Earthwork: Soils for backfill in trenches.
9. Division 31 - Aggregates for Earthwork: Aggregate for backfill in trenches.
10. Division 31 - Excavation: Product and execution requirements for excavation and backfill required by this section.
11. Division 31 - Trenching: Execution requirements for trenching required by this section.
12. Section 31 - Fill: Requirements for backfill to be placed by this section.
13. Division 33 - Storm Utility Drainage Piping: Catch basins and manholes.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A112.21.1 - Floor Drains.

2. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
3. ASME B16.3 - Malleable Iron Threaded Fittings.
4. ASME B16.4 - Gray Iron Threaded Fittings.
5. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A536 - Standard Specification for Ductile Iron Castings.
6. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
7. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
8. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
9. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
10. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
11. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
12. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
13. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
14. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
16. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
17. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
18. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
4. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.
- B. Product Data:
 1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
 4. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
 5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of equipment and clean-outs.
- B. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Illinois Plumbing code, 2014 edition.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Soil Pipe: ASTM A74, extra heavy weight, bell and spigot ends.
 - 1. Fittings: Cast iron, ASTM A74.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hub-less.
 - 1. Fittings: Cast iron, CISPI 301.
 - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.
- C. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material, bell and spigot solvent sealed ends.
 - 1. Fittings: PVC, ASTM D2729.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- D. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.
 - 1. Fittings: ASTM D2466, Schedule 40, PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.
- E. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
 - 1. Fittings: PVC, ASTM D2665 or ASTM D3034.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron, ASTM A74.
 - 2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.
 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
 3. solder
- C. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material.
1. Fittings: ASTM D2729, PVC.
 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- D. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
1. Fittings: ASTM D2665, PVC.
 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- E. PVC Pipe: ASTM D1785 Schedule 40 or ASTM D2241 SDR-26 for not less than 150 psi pressure rating, polyvinyl chloride (PVC) material.
1. Fittings: ASTM D2466, Schedule 40, PVC.
 2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.3 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
1. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
 2. PVC Piping: PVC.
- B. Flanges for Pipe 2-1/2 inches and Larger:
1. PVC Piping: PVC flanges.
 2. Gaskets: 1/16 inch thick preformed neoprene gaskets.
- C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.4 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
1. Carpenter & Paterson Inc.
 2. Creative Systems Inc.
 3. Flex-Weld, Inc.
 4. Globe Pipe Hanger Products Inc.
 5. Michigan Hanger Co.
 6. Superior Valve Co.
- B. Drain, Waste, and Vent: Conform to ASME B31.9 ASTM F708 MSS SP 58 MSS SP 69 MSS SP 89.
- C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron Carbon steel, adjustable swivel, split ring.

- D. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
- E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- F. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
- G. Wall Support for Pipe Sizes 3 inches and Larger: Welded steel bracket and wrought steel clamp.
- H. Vertical Support: Steel riser clamp.
- I. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.5 FLOOR DRAINS

- A. Manufacturers:
 - 1. Zurn.
 - 2. Sioux Chief.
 - 3. JR Smith.
 - 4. Wade.
 - 5. Watts.
- B. Floor Drain (FD-1): ASME A112.21.1; two piece body with double drainage flange, weep holes, reversible clamping collar, and 6 inch square, adjustable nickel-bronze strainer.
- C. Floor Drain (FD-2): ASME A112.21.1; two piece body with double drainage flange, weep holes, reversible clamping collar, and 7 inch square, adjustable nickel-bronze strainer with removable perforated sediment bucket.

2.6 FLOOR SINKS

- A. Floor Sinks (FS-1): ASME A112.21.1; 16ga., 304stainless steel body and flange, pitched, 8" deep sump, 12"x12", half-open grate with stainless steel bottom dome strainer.

2.7 GREASE INTERCEPTORS (GT-1)

- A. Manufacturers:
 - 1. Schier.
 - 2. Zurn.
- B. Comply with PDI G101, ASME A112.14.3, ASME A112.14.4.
- C. Construction:
- D. Material: Polyethylene, or fiberglass reinforced plastics.
 - 1. Rough in: Above/on floor.

Accessories: Multi-weir baffle assembly, integral deep seal trap, external vented flow control device.

- E. Cover: Polyethylene, non-skid with gasket.
- F. Unit Rating: See schedule on drawings.
- G. Provide with manufacturer's manway extension(s) and high-water anchor kit.

2.8 CLEANOUTS

- A. Manufacturers:
 - 1. Zurn.
 - 2. Sioux Chief.
 - 3. JR Smith.
 - 4. Wade.
 - 5. Watts.
- B. Exterior Surfaced Areas (COTG, COTG-2): Round cast nickel bronze access frame and non-skid cover.
- C. Exterior Unsurfaced Areas (COTG, COTG-2): Line type with lacquered cast iron body and round epoxy coated cover with gasket.
- D. Interior Finished Floor Areas (COTF, COTF-2): Lacquered cast iron body with anchor flange, reversible clamping collar, 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.
- E. Interior Finished Wall Areas (COTW): Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.
- F. Interior Unfinished Accessible Areas (CO-1): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.9 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type as specified in Division 31.
- B. Cover: Fill Type as specified in Division 31.
- C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Division 31. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

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, 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.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Inserts:

1. Provide inserts for placement in concrete forms.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. 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.

B. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9 ASTM F708 and MSS SP 89.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
8. Provide sheet lead packing between hanger or support and piping.
9. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Install hangers adjacent to motor driven equipment with vibration isolation; refer to Division 21.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.
- B. Establish elevations of buried piping with not less than 2.5 ft of cover.
- C. Establish minimum separation of sanitary sewer from water piping in accordance with Illinois Plumbing code.
- D. Remove scale and dirt on inside of piping before assembly.
- E. Excavate pipe trench in accordance with Division 31.
- F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
- G. Install pipe on prepared bedding.
- H. Route pipe in straight line.
- I. Install plastic ribbon tape continuous buried 6 inches below finish grade, above pipe line; coordinate with Division 31. Refer to Section 22 05 53.
- J. Install trace wire continuous over top of pipe.
- K. Pipe Cover and Backfilling:
 - 1. Backfill trench in accordance with Division 31.
 - 2. Maintain optimum moisture content of fill material to attain required compaction density.
 - 3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 4 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - 4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 5. Do not use wheeled or tracked vehicles for tamping.

3.5 INSTALLATION - ABOVE GROUND PIPING

- A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.

- E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- G. Install piping to maintain headroom. Do not spread piping, conserve space.
- H. Group piping whenever practical at common elevations.
- I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Division 21.
- J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.
- K. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.
- L. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- N. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.
- O. Install bell and spigot pipe with bell end upstream.
- P. Sleeve pipes passing through partitions, walls and floors.
- Q. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.
- R. Support cast iron drainage piping at every joint.

3.6 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements, Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test sanitary waste and vent piping system in accordance with local authority having jurisdiction.

3.7 SCHEDULES

PIPE HANGER SPACING

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
PVC (All Sizes)	4	3/8

Note for Cast Iron Pipe: Provide close to joint on barrel. Also provide hanger at each change of direction and each branch connection.

END OF SECTION

22 33 00

Electric Domestic Water Heaters

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Commercial electric water heaters.
- B. Related Sections:
 - 1. Division 03 - Cast-In-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
 - 2. Section: 22 11 00 - Facility Water Distribution: Supply connections to domestic water heaters.
 - 3. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME PTC 25 - Pressure Relief Devices.
 - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate heat exchanger dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.
- B. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.
- C. Manufacturer's Installation Instructions: Submit mounting and support requirements.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit replacement part numbers and availability.

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Water Heaters
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1.5 QUALITY ASSURANCE

- A. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept water heaters on site in original labeled cartons. Inspect for damage.
- B. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Furnish manufacturer's standard 3-year warranty for domestic water heaters.

PART 2 PRODUCTS

2.1 COMMERCIAL ELECTRIC TANK TYPE WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith.
 - 2. Lochinvar.
 - 3. Bradford-White.
 - 4. Rheem-Ruud.
 - 5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Type: Factory-assembled and wired, electric, vertical storage.
- C. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber or polyurethane encased in corrosion-resistant steel jacket; baked-on enamel finish.
- D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.

- E. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.
- F. Performance: See schedule on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Maintain manufacturer's recommended clearances around and over water heaters.
- B. Install water heater on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than water heater base on each side. Refer to Division 03.
- C. Connect domestic hot water and domestic cold water piping to supply and return water heater connections.
- D. Install the following piping accessories. Refer to Section 22 11 00.
 - 1. On supply:
 - a. Thermometer well and thermometer.
 - b. Strainer.
 - c. Pressure gage.
 - d. Shutoff valve.
 - 2. On return:
 - a. Thermometer well and thermometer.
 - b. Pressure gage.
 - c. Shutoff valve.
- E. Install discharge piping from relief valves and drain valves to nearest floor drain.
- F. Install water heater trim and accessories furnished loose for field mounting.
- G. Install electrical devices furnished loose for field mounting.

END OF SECTION

Section 22 40 00

Plumbing Fixtures

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Lavatories.
 - 3. Hand sinks.
 - 4. Sinks.
 - 5. Mop sinks.

- B. Related Sections:
 - 1. Division 07 - Joint Protection: Product requirements for calking between fixtures and building components for placement by this section.
 - 2. Section 22 11 00 - Facility Water Distribution: Supply connections to plumbing fixtures.
 - 3. Section 22 13 00 - Facility Sanitary Sewerage: Waste connections to plumbing fixtures.
 - 4. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

- B. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

- C. American Society of Mechanical Engineers:
 - 1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
 - 2. ASME A112.18.1 - Plumbing Fixture Fittings.
 - 3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
 - 4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
 - 5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
 - 6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
 - 7. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

- A. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

- B. Manufacturer's Installation Instructions: Submit installation methods and procedures.

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C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State of Illinois Plumbing code, 2014 edition.

B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.

C. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. Furnish with manufacturer's standard warranty for plumbing fixtures.

1.9 EXTRA MATERIALS

A. Furnish two sets of faucet repair kits, flush valve service kits, lavatory supply fittings, and toilet seats.

PART 2 PRODUCTS

2.1 TANK TYPE WATER CLOSETS (WC-1)

A. Manufacturers:

1. Kohler.
2. American Standard.
3. Zurn.

- B. Bowl: ASME A112.19.2M; Accessible, floor mounted, siphon jet, vitreous china, 16.5 inches high/18 inches high (with 17-19inch seat height) close-coupled closet combination with elongated rim, vitreous china closet tank with fittings and lever flushing valve (coordinate with wide side of ADA stall), bolt caps.
- C. Seat: Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

2.2 LAVATORIES (LAV-1)

- A. Manufacturers:
 - 1. American Standard Plumbing.
 - 2. Kohler.
 - 3. Chicago Faucet Co.
 - 4. Delta Faucet Co.
 - 5. Zurn.
 - 6. T.S. Brass.
- B. Bowl: Vitreous China Wall Hung Basin: ASME A112.19.2M; vitreous china wall hung lavatory 20x18 inch minimum, with 4-inch-high back, drillings on 4 inch centers, rectangular basin with splash lip, overflow.
- C. Faucet: ASME A112.18.1; single-hole, chrome plated, mechanically metered, adjustable timing, push-button or lever operated with open grid strainer, water economy laminar flow with maximum 0.50 gpm flow.
- D. Waste Fittings: ASME A112.18.2 or ASTM F 409.
- E. For public hand washing facilities, provide tempered water through regulating device conforming to ASSE 1070.
- F. Accessories:
 - 1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
 - 2. Offset waste with perforated open strainer.
 - 3. Wheel handle quarter-turn stops.
 - 4. Flexible braided stainless-steel supplies.
 - 5. Trap and waste insulated and offset to meet ADA compliance.
- G. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

2.3 HAND SINKS (HS-1)

- A. Manufacturers:
 - 1. Elkay.
 - 2. Just.
 - 3. Advanced Tabco.
 - 4. Kohler Co.

- B. Single Compartment Bowl: ASME A112.19.3; nominal 17x15x11 inch outside dimensions, 20 gage thick, Type 304 stainless steel, wall-hung hand washing sink with stainless steel center drain, complete with faucet.
- C. Faucet (with basin): ASME A112.18.1; chrome plated centerset, splash mounted, gooseneck, water economy with maximum 2.2 gpm flow, indexed lever handles.
- D. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, wheel handle quarter-turn stops, flexible stainless steel braided supplies.

2.4 SINKS (SK-1)

- A. Manufacturers:
 - 1. Elkay.
 - 2. Just.
 - 3. Advanced Tabco.
 - 4. Kohler Co.
- B. Triple Compartment Bowl: ASME A112.19.3; free-standing, nominal 63x30x45 inch outside dimensions, 16 gage thick, 300 series stainless steel. Stainless steel legs, stainless steel drains 3-1/2 inch and tailpieces, wall back drilled for trim.
- C. Faucet: ASME A112.18.1; 8-inch (3"-8" adjustable) centers for wall mount, chrome plated combination supply fitting, water economy flow with maximum 1.5 gpm flow, 6" high, 19.5 inch reach, double-swing spout, two-hole installation, 4" wrist-blade lever handles.
- D. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.

2.5 MOP SINKS (MS-1)

- A. Manufacturers:
 - 1. Zurn.
 - 2. Fiat.
 - 3. EL Mustee.
- B. Bowl: 24 x 24 x 10-inch-high white molded stone, floor mounted, with one inch wide shoulders, vinyl bumper guard, stainless steel strainer.
- C. Trim: ASME A112.18.1 exposed wall type supply with cross or lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
- D. Accessories:
 - 1. 5 feet of 1/2 inch diameter plain end reinforced rubber hose.
 - 2. Hose clamp hanger.
 - 3. Mop hanger.

2.6 LAVATORY INSULATION KIT

- A. Product Description: Where Lavatories are noted to be insulated for ADA compliance, furnish the following: 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.

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. Confirm millwork is constructed with adequate provision for installation of counter-top lavatories and sinks.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install Work in accordance with State of Illinois Plumbing code, 2014 edition.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with quarter-turn stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall carriers and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant as specified in Division 07, color to match fixture.
- G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
- H. 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 installation.

3.5 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Do not permit use of fixtures before final acceptance.

3.8 SCHEDULES

- A. Fixture Mounting Heights:
 - 1. Water Closet:
 - a. Accessible: 18 inches (nominal) to top of seat.
 - 2. Lavatory:
 - a. Accessible: 34 inches to top of basin rim.
 - b. Standard: 36 inches to top of basin rim.
 - 3. Mop sink faucet:
 - a. 36 inches to centerline.

END OF SECTION

Section 23 07 00

HVAC Insulation

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. HVAC piping insulation, jackets and accessories.
2. HVAC ductwork insulation, jackets, and accessories.

1.2 REFERENCES

A. ASTM International:

1. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
2. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
3. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
4. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
5. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
6. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
7. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
8. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
9. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
10. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
11. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
12. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors':

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Duct insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. CertainTeed.
 - 2. Knauf.
 - 3. Johns Manville.
 - 4. Owens-Corning.
 - 5. 3M.
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. Aeroflex. Aerocell.
 - 2. Armacell, LLC. Armaflex.
 - 3. Nomaco. K-flex.

2.2 PIPE INSULATION

- A. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.3 PIPE INSULATION JACKETS

- A. Vapor Retarder Jacket:
 - 1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
 - 2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
- B. PVC Plastic Pipe Jacket:
 - 1. Product Description: ASTM D1785, One piece molded type fitting covers and sheet material, off-white color.
 - 2. Thickness: 15 mil.
 - 3. Connections: Tacks.
- C. Aluminum Pipe Jacket:
 - 1. Thickness: 0.016 inch thick sheet.
 - 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: 1/2 inch wide; 0.015 inch thick aluminum. 0.010 inch thick stainless steel.

2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- D. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.
- E. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- F. Adhesives: Compatible with insulation.

2.5 DUCTWORK INSULATION

- A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
 - 1. Thermal Conductivity: 0.25 at 75 degrees F.
 - 2. Maximum Operating Temperature: 250 degrees F.
 - 3. Density: 1.5 pound per cubic foot.

2.6 DUCTWORK INSULATION JACKETS

- A. Aluminum Duct Jacket
 - 1. ASTM B209
 - 2. Thickness: 0.016 inch thick sheet.
 - 3. Finish: Smooth.

4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

2.7 DUCTWORK INSULATION ACCESSORIES

- A. Vapor Retarder Tape:
 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- B. Vapor Retarder Lap Adhesive: Compatible with insulation.
- C. Adhesive: Waterproof, ASTM E162 fire-retardant type.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad/impact applied/welded with integral/press-on head.
- E. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- F. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping and ductwork has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Piping Systems Conveying Fluids Below Ambient Temperature:
 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- C. Inserts and Shields:
 1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.

2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
 3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
- D. Insulation Terminating Points:
1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
 2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
 3. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- E. Closed Cell Elastomeric Insulation:
1. Push insulation on to piping.
 2. Miter joints at elbows.
 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 4. When application requires multiple layers, apply with joints staggered.
 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- F. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
- G. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. **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 piping.**

3.3 INSTALLATION - DUCTWORK SYSTEMS

- A. Duct dimensions indicated on Drawings are finished inside dimensions.
- B. Insulated ductwork conveying air below ambient temperature:
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.
- C. Insulated ductwork conveying air above ambient temperature:
1. Provide with or without standard vapor retarder jacket.
 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. External Glass Fiber Duct Insulation:

1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
2. Secure insulation without vapor retarder with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

E. Ducts Exterior to Building:

1. Install insulation according to external duct insulation paragraph above.
2. Provide external 3” thick elastomer cell insulation with vapor retarder jacket. Cover with outdoor jacket finished as specified in Section with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
3. Finish with aluminum duct jacket.
4. Calk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.

3.4 SCHEDULES

A. Cooling Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Condensate Piping from Cooling Coils	P-5	All sizes	0.5
Refrigerant Suction (Aluminum Jacket)	P-5	All sizes	0.5
Refrigerant Hot Gas (Aluminum Jacket)	P-5	All sizes	0.5

B. Ductwork Insulation Schedule:

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches
Exhaust Ducts.	D-1	2.0

END OF SECTION

Section 23 31 00

HVAC Ducts And Casings

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Duct Materials.
 - 2. Insulated flexible ducts.
 - 3. Fabric ducts.
 - 4. Single wall spiral round ducts.
 - 5. Ductwork fabrication.

- B. Related Sections:
 - 1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
 - 2. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
 - 3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - 4. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 5. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
 - 6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 7. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 8. A1011/A1011M-07 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - 9. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- B. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - Fibrous Glass Duct Construction Standards.
2. SMACNA - HVAC Air Duct Leakage Test Manual.
3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 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.

1.4 SUBMITTALS

A. Product Data: Submit data for duct materials.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A and NFPA 96 standards.

1.7 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.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.
- B. Steel Ducts: ASTM A1008/A1008M /A1011/A1011M/A568/A568M.
- C. Stainless Steel Ducts: ASTM A240/A240M or ASTM A666, Type 316.
- D. Fasteners: Rivets, bolts, or sheet metal screws.
- E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 INSULATED FLEXIBLE DUCTS

- A. Product Description: Black polymer film supported by helical-wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.
 - 1. Pressure Rating: 4 inches wg positive and 0.5 inches wg negative.
 - 2. Maximum Velocity: 4000 fpm.
 - 3. Temperature Range: -20 degrees F to 175 degrees F.
 - 4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

2.3 FABRIC DUCTWORK

- A. Manufacturers.
 - 1. Design Base: Ductsox.
 - 2. FabricAir.
- B. FABRIC AIR DISPERSION SYSTEM
 - 1. Verona Fabric: Air diffusers shall be constructed of a woven fire retardant fabric complying with the following physical characteristics:
 - a. Fabric Construction: 100% Flame Retardant
 - b. Weight: 6.2 oz./yd² per ASTM D3776
 - c. Color: (Must Specify – red, white, blue, green, gray, tan, or black)
 - d. Fabric Porosity: 2 (+2/-1) cfm/ft² per ASTM D737, Frazier, Custom Porosity 6, 13 & 29 CFM cfm/ft² available.
 - e. Temperature Range: 0 degrees F to 180 degrees F
 - f. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the requirements of NFPA 90-A.
- C. SYSTEMS FABRICATION REQUIREMENTS
 - 1. Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting a 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
 - 2. Size of and location of linear vents to be specified and approved by manufacturer.

3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via zip screw fastener – supplied by contractor.
4. Inlet connection includes zipper for easy removal / maintenance.
5. Lengths to include required zippers as specified by manufacturer.
6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
7. Fabric system shall include connectors to accommodate suspension system listed below.
8. Any deviation from a straight run shall be made using a gored elbow or an efficiency tee. Normal 90 degree elbows are 5 gores and the radius of the elbow is 1.5 times the diameter of the DuctSox.

D. DESIGN PARAMETERS

1. Textile air diffusers shall be designed from 0.25” water gage minimum to 3.0” maximum, with 0.5” as the standard.
2. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
3. Design CFM, static pressure and diffuser length shall be designed or approved by the manufacturer.
4. Do not use fabric diffusers in concealed locations.
5. Use fabric diffusers only for positive pressure air distribution components of the mechanical ventilation system.

E. SUSPENSION HARDWARE

1. SkeleCore IHS with Cable: (Available for duct diameters from 8” to 60”) System shall consist of an internal 360 degree hoop system, spaced 5’ on centers. System shall be installed with a 1 row Cable located 1.5” above top center. Hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckle(s) as required. System attachment shall be made using Glides spaced 12 inches.
2. Plastic Impregnated Steel Cable
3. Adjustable Mid-Supports – Available lengths: 5’, 10’, 15’, and 30’

2.4 SINGLE WALL SPIRAL ROUND DUCTS

A. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

B. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

C. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.5 DUCTWORK FABRICATION

- A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. 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.
- 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.
- G. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.
 1. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
 2. Do not provide sealing products not bearing UL approval markings.

2.6 KITCHEN HOOD EXHAUST DUCTWORK FABRICATION

1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
2. Exposed Kitchen Hood Exhaust Ducts: Construct of stainless steel ASTM A240/A240M OR ASTM 666, type 316 using continuous external welded joints.

3. Concealed Kitchen Hood Exhaust Ducts: Construct of 16 gage carbon steel or 18 gage stainless steel ASTM A240/A240M OR ASTM 666, type 316 using continuous external welded joints.
4. Grease Duct: Provide factory built commercial grease ducts labeled and listed in accordance with UL 1978.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

- A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Install glass fiber ducts in accordance with SMACNA Fibrous Glass Duct Construction Standards. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.
- C. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.
- E. Install duct hangers and supports in accordance with Section 23 05 29.
- F. Use double nuts and lock washers on threaded rod supports.
- G. Connect flexible ducts to metal ducts with draw bands.
- H. Exhaust Outlet Locations:
 1. Minimum Distance from Property Lines: 3 feet.
 2. Minimum Distance from Building Openings: 3 feet.
 3. Minimum Distance from Outside Air Intakes: 10 feet.

3.3 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 directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

- C. Connect air outlets and inlets to supply ducts directly or with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.4 SCHEDULES

- A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
General Exhaust	Steel

- B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Exhaust	1 inch wg regardless of velocity.

END OF SECTION

Section 23 33 00

Air Duct Accessories

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Back-draft dampers.
 - 2. Duct access doors.
 - 3. Volume control dampers.
 - 4. Flexible duct connections.

- B. Related Sections:
 - 1. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

- B. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

- C. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

- D. Underwriters Laboratories Inc.:
 - 1. UL 555 - Standard for Safety for Fire Dampers.

1.3 SUBMITTALS

- A. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
 - 1. Flexible duct connections.
 - 2. Volume control dampers.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit for Fire Dampers.

1.5 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.
- B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- C. Storage: Store materials in a dry area indoor, protected from damage.
- D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 BACK-DRAFT DAMPERS

- A. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel or extruded aluminum. Blades, maximum 6 inch width, center pivoted, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.2 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.

2.3 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

- B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.
- C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.
- D. Quadrants:
 - 1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.4 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Connector: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
 - 2. Net Fabric Width: Approximately 2 inches wide.
 - 3. Metal: 3 inch wide, 24 gage galvanized steel.
- C. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs. per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify ducts and equipment installation are ready for accessories.
- 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. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.
- C. Access Doors: Install access doors at the following locations and as indicated on Drawings:
 - 1. Spaced every 50 feet of straight duct.

2. Upstream of each elbow.
3. Before and after each duct mounted fan.

D. 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. Install 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

3.3 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. Downblast centrifugal roof fans.
 - 2. Upblast centrifugal roof fans.
 - 3. Centrifugal wall fans.
 - 4. Centrifugal square inline fans.

- B. Related Sections:
 - 1. Section 23 07 00 - HVAC Insulation: Product requirements for power ventilators for placement by this section.
 - 2. Section 23 31 00 - HVAC Ducts and Casings: Product requirements for hangers for placement by this section.
 - 3. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.2 REFERENCES

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

- B. Air Movement and Control Association International, Inc.:
 - 1. AMCA 99 - Standards Handbook.
 - 2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
 - 3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - 4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
 - 5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

- C. ASTM International:
 - 1. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

- D. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
 - 2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

- E. Underwriters Laboratories Inc.:
 - 1. UL 705 - Power Ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Wind-Borne Debris Loads: Design louvers located within 30 feet of grade to withstand ASTM E1996; large missile impact test.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.
- B. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA 210.
- B. Sound Ratings: AMCA 301, tested to AMCA 300.
- C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- D. Balance Quality: Conform to AMCA 204.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Furnish two year manufacturer's warranty for fans.

PART 2 PRODUCTS

2.1 DOWNBLAST CENTRIFUGAL ROOF FANS

- A. Manufacturers:
 1. Greenheck.
 2. Loren Cook.
 3. As approved prior to bidding – minimum of 10 days prior to bid date.

- B. Fan Unit: Downblast type, direct drive, with spun aluminum housing; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
- C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- D. Motor: Open drip proof.
- E. Roof Curb: 16 inch high of galvanized steel construction with continuously welded seams and factory installed nailer strip.
- F. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 Type 1 enclosure.
- G. Accessories:
 - 1. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.
 - 2. Fan speed controller.
 - 3. As scheduled.
- H. Performance: As scheduled.
- I. Electrical Characteristics and Components:
 - 1. Electrical Characteristics: As scheduled.

2.2 CENTRIFUGAL WALL FANS

- A. Manufacturers:
 - 1. Greenheck.
 - 2. Loren Cook.
 - 3. As approved prior to bidding – minimum of 10 days prior to bid date.
- B. Fan Unit: Direct drive with spun aluminum housing; resiliently mounted motor; aluminum wire bird screen.
- C. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- D. Motor: Open drip proof.
- E. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor NEMA 250 Type 1 enclosure.
- F. Accessories:
 - 1. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.
 - 2. Fan speed controller.

- G. Performance: As scheduled.
- H. Electrical Characteristics and Components:
 - 1. Electrical Characteristics: As scheduled.

2.3 UPBLAST CENTRIFUGAL ROOF FANS

- A. Manufacturers:
 - 1. Greenheck.
 - 2. Loren Cook.
 - 3. As approved prior to bidding – minimum of 10 days prior to bid date.
- B. Fan Unit: Upblast type, direct drive, spun aluminum housing with grease tray; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
- C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- D. Motor: Open drip proof.
- E. Roof Curb: 16 inch high of galvanized steel construction with continuously welded seams and factory installed nailer strip.
- F. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor NEMA 250 Type 1 enclosure.
- G. Accessories:
 - 1. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.
 - 2. Fan speed controller.
 - 3. As scheduled.
- H. Performance: As scheduled.
- I. Electrical Characteristics and Components:
 - 1. Electrical Characteristics: As scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof curbs are installed and dimensions are as shown on shop drawings.

3.2 INSTALLATION

- A. Install backdraft dampers on inlet to roof exhaust fans.
- B. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings.

- C. Install backdraft dampers on discharge of exhaust fans and as indicated on Drawings.
- D. Provide sheaves required for final air balance.

3.3 DEMONSTRATION

- A. Demonstrate fan operation and maintenance procedures.

3.4 PROTECTION OF FINISHED WORK

- A. Do not operate fans 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. Grilles.
- B. Related Sections:
 - 1. Section 23 33 00 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.
- C. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

- A. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

- A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.
- B. Test and rate louver performance in accordance with AMCA 500.

PART 2 PRODUCTS

2.1 CEILING EXHAUST AND RETURN GRILLES

- A. Manufacturers:
 - 1. Krueger.
 - 2. Titus.

3. Price.

- B. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, horizontal face.
- C. Frame: 1 inch margin with concealed mounting.
- D. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory off-white enamel finish.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.
- F. Gymnasiums: Furnish front pivoted or welded in place blades, securely fastened to be immobile.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify inlet and outlet locations.
- B. Verify ceiling/wall systems are ready for installation.

3.2 INSTALLATION

- A. Install grilles 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. Refer to Section 23 33 00.
- C. Paint visible portion of ductwork behind air outlets and inlets matte black.
- D. Do not locate air registers, diffusers or grilles in floors of toilet or bathing rooms.

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 81 26

Split-System Air-Conditioners

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Split system air conditioning unit
 - 2. Condensing unit.

1.2 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
 - 2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- D. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

- A. Product Data: Submit data indicating:
 - 1. Cooling and heating capacities.
 - 2. Dimensions.
 - 3. Weights.
 - 4. Rough-in connections and connection requirements.
 - 5. Duct connections.
 - 6. Electrical requirements with electrical characteristics and connection requirements.
 - 7. Controls.
 - 8. Accessories.
- B. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of controls installed remotely from units.

- B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

- A. Performance Requirements: Energy Efficiency Rating (EER) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils when tested in accordance with ARI 210/240.
- B. Cooling Capacity: Rate in accordance with ARI 210/240.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- B. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.
- C. Protect units from weather and construction traffic by storing in dry, roofed location.

1.7 COORDINATION

- A. Coordinate installation of condensing units with concrete pad.
- B. Coordinate installation of air handling units with building structure.

1.8 WARRANTY

- A. Furnish five year manufacturers warranty for compressors.

PART 2 PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNITS (MSS-1/MSCU-1)

- A. Manufacturers:
 - 1. Trane
 - 2. As approved – minimum of 10 days prior to bid date.
- B. Product Description: Split system consisting of air handling unit and condensing unit including cabinet, evaporator fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, air filters, controls, air handling unit accessories, condensing unit accessories, and refrigeration specialties.

2.2 CONTROLS

- A. All capable equipment to utilize local wi-fi programmable thermostat. Otherwise furnish remote space thermostat with two stage heating and two stage cooling with automatic changeover. Furnish system selector switch off-heat-auto-cool and fan control switch auto-on.

2.3 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics: As scheduled.
- B. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify concrete pad for condensing unit is ready for unit installation.

3.2 INSTALLATION – SPLIT SYSTEM AIR CONDITIONING UNIT

- A. Install split air conditioning unit on wall.
- B. Install condensate piping with trap and route from drain pan to building exterior.
- C. Install components furnished loose for field mounting.
- D. Install connection to electrical power wiring.

3.3 INSTALLATION - CONDENSING UNIT

- A. Install condensing units on vibration isolators.
- B. Install refrigerant piping from unit to condensing unit. Install refrigerant specialties furnished with unit.
- C. Evacuate refrigerant piping and install initial charge of refrigerant.
- D. Install electrical devices furnished loose for field mounting.
- E. Install control wiring between indoor unit, condensing unit, and field installed accessories.
- F. Install connection to electrical power wiring.

3.4 CLEANING

- A. Vacuum clean coils and inside of unit cabinet.
- B. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.5 DEMONSTRATION

- A. Demonstrate mini split unit operation and maintenance.

B. Demonstrate starting, maintenance, and operation of condensing unit.

3.6 PROTECTION OF FINISHED WORK

A. Do not operate mini split units until they are clean, filters are in place, and fan has been test run under observation.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes building wire and cable; nonmetallic-sheathed cable; and wiring connectors and connections.

1.2 REFERENCES

- A. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code – 2020 Edition.

1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
 - 1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
 - 2. Stranded conductors for control circuits.
- B. Wiring Methods: Provide the following wiring methods:
 - 1. Concealed Dry Interior Locations: Use only non-metallic sheathed cable.
 - 2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
 - 3. Above Accessible Ceilings: Use only non-metallic sheathed cable.
 - 4. Underground Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

1.4 DESIGN REQUIREMENTS

- A. Conductor sizes are based on copper.

1.5 SUBMITTALS

- A. Product Data: Submit for building wire.

PART 2 PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:

1. AETNA.
2. General Cable Co.
3. Republic Wire.
4. Rome Cable.
5. Southwire.
6. Superior Essex.

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper.

D. Insulation Voltage Rating: 600 volts.

E. Insulation Temperature Rating: 90 degrees C.

F. Insulation Material: Thermoplastic.

2.2 NONMETALLIC-SHEATHED CABLE

A. Conductor: Coppe.

B. Insulation Voltage Rating: 600 volts.

2.3 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. Special Techniques--Building Wire in Raceway:
 - 1. Pull conductors into raceway at same time.
- D. Special Techniques - Wiring Connections:
 - 1. Clean conductor surfaces before installing lugs and connectors.
 - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - 3. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- E. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- F. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
- G. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.4 WIRE COLOR

- A. General:
 - 1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
 - a. Black and red for single phase circuits at 120/240 volts.
- B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
- C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
- D. Feeder Circuit Conductors: Uniquely color code each phase.
- E. Ground Conductors:
 - 1. For 6 AWG and smaller: Green.

3.5 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wire.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code – 2020 Edition.

PART 2

2.1 COORDINATION

- A. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 3 PRODUCTS

3.1 WIRE

- A. Material: Stranded copper.
- B. Grounding Electrode Conductor: Copper conductor bare.
- C. Bonding Conductor: Copper conductor insulated.

PART 4 EXECUTION

4.1 INSTALLATION

- A. Install in accordance with IEEE 142.
- B. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, and pull boxes.

1.2 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Underground More than 5 feet outside building: Provide thin-wall nonmetallic conduit. Provide cast metal boxes or nonmetallic handhole.
- C. Exposed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.3 COORDINATION

- A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 ELECTRICAL METALLIC TUBING (EMT)

- A. Product Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel, set screw type.

2.2 NONMETALLIC CONDUIT

- A. Product Description: NEMA TC 2; Schedule 40/80 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

2.3 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.

- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Cast Boxes: NEMA FB 1, Type FD, cast ferrous alloy. Furnish gasketed cover by box manufacturer.
- D. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.4 JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures: As specified in Section 26 27 16.
- C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
 - 1. Material: Cast aluminum.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- C. Identify raceway and boxes in accordance with Section 26 05 53.
- D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

- A. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- B. Bring conduit to shoulder of fittings; fasten securely.
- C. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- D. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.

- E. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate bends in metal conduit larger than 2 inch size.
- F. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

3.4 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes load centers.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.

PART 2 PRODUCTS

2.1 LOAD CENTERS

- A. Description: Circuit breaker load center, with bus ratings as indicated on Drawings.
- B. Performance:
 - 1. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical.
- C. Materials:
 - 1. Molded Case Circuit Breakers: UL 489, plug-on type thermal magnetic trip circuit breakers, with common trip handle for poles, listed as Type SWD for lighting circuits, Class A ground fault interrupter circuit breakers [as indicated on Drawings]. Do not use tandem circuit breakers.
 - 2. Enclosure: General Purpose.
- D. Box: Surface type with door.
 - 1. Finish in manufacturer's standard gray enamel.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install load centers in accordance with NEMA PB 1.1.
- B. Install load centers plumb.
- C. Height: 6 feet to top of load center.
- D. Install filler plates for unused spaces in panelboards.

- E. Provide typed circuit directory for each load center. Revise directory to reflect circuiting changes to balance phase loads.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wall occupancy switches; receptacles; and device plates and decorative box covers.

PART 2 PRODUCTS

2.1 RECEPTACLES

- A. Duplex Receptacle, Conventional Face, 20A-125V, NEMA 5-20R:
 - 1. Leviton Model 5362.
 - 2. Hubbell Model HBL 5362.
 - 3. Pass and Seymour Model 5362.
 - 4. Substitutions: Not permitted.

- B. GFCI Receptacle, Duplex, Rectangular Face, 20A-125V, NEMA 5-20R.
 - 1. End of Life Provision: when a GFCI receptacle is incapable of passing its internal test function (it can no longer provide ground fault protection) it will either:
 - a. Render itself incapable of delivering power
or
 - b. Indicate by visual or audible means that the device must be replaced.
 - 2. Duplex GFCI Receptable, Rectangular Face, 20A-125V, NEMA 5-20R.
 - a. Leviton Model 6599.
 - b. Hubbell Model GF5362.
 - c. Pass and Seymour Model 2091.

2.2 OCCUPANCY SENSOR AUTOMATIC SWITCHES

- A. Wall Switch Occupancy Sensor Switches
 - 1. The wall switch will turn lights on, automatically, when someone enters a room. It will turn lights off, automatically, when the room is vacated after a pre-set period of time.
 - 2. The wall switch is to be dual technology type: ultrasonic and infrared.
 - 3. The wall switch shall be designed to cover areas up to 2,400 square feet with 180 degree field of view coverage.
 - 4. The wall switch shall detect the types of minor, at-desk motion.
 - 5. Time-on after activation shall be user adjustable between 30 seconds and 15 minutes.
 - 6. The wall switch must be easily installed in any standard single gang junction box.
 - 7. Acceptable Manufacturers: As indicated on the drawings.

2.3 WALL PLATES

- A. Decorative Thermoplastic Cover Plate: As selected by the Architect/Engineer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify outlet boxes are installed at proper height.
- B. Verify wall openings are neatly cut and completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install devices plumb and level close to the latch side of door where possible.
- B. Install switches with OFF position down.
- C. Connect wiring device grounding terminal to outlet box with bonding jumper and or branch circuit equipment grounding conductor.
- D. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes interior light fixtures and accessories.

PART 2 PRODUCTS

2.1 INTERIOR LUMINAIRES

- A. Product Description: Complete interior/exterior luminaire assemblies, with features, options, and accessories as scheduled.
- B. Fixtures shall have the specified color finish.
- C. All fixtures shall be furnished complete with all the necessary mounting hardware to accommodate the type of mounting as indicated on the drawings for the specific fixture type.
- D. Fixtures shall have a minimum 86 CRI.
- E. Warranty
1. Provide a five-year warranty on all interior light fixtures.

2.2 LED LIGHTS

- A. LED fixture and driver shall be as follows:
1. Shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage) with no damage to the driver.
 2. Output shall be regulated to +/- 5% across published load range.
 3. Shall have a power factor greater than 0.90 for primary application to 50% of full load rating.
 4. Input current shall have a total harmonic distortion (THD) of less than 10% of full load rating.
 5. Shall have a Class A sound rating.
 6. Shall have a minimum operating temperature of -20C (-4F).
 7. Shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
 8. Driver output ripple current shall be less than 15% measured peak-to-average, with ripple frequency > 100 Hz.
 9. Driver performance requirements shall be met when operated to 50% of full load rating.
 10. Driver shall be rated for damp and dry locations.

11. Driver shall have integral common mode and differential mode surge protection of 2.5 kV.
12. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.
13. Driver shall comply with NEMA 410 for in-rush current limits.
14. Driver shall incorporate an integral means of limiting surges to the LEDs.
15. LED fixtures shall be tested and rated in accordance with IES LM79 & LM80.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- B. Install wall-mounted luminaires at height as indicated on Drawings.
- C. Install accessories furnished with each luminaire.
- D. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- E. Ground and bond interior luminaires in accordance with Section 26 05 26.

END OF SECTION