

PROJECT MANUAL
INCLUDING CONSTRUCTION SPECIFICATIONS

for

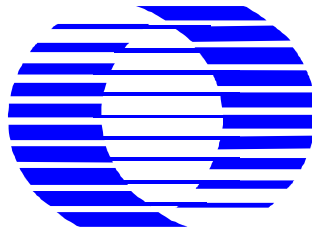
BP-S00195
TERMINAL C, PHASE 1X – AIRSIDE CONCOURSE

CONTRACT DOCUMENTS

Volume 4 OF 7
(Division 22)

ORLANDO INTERNATIONAL AIRPORT

Orlando, Florida 32827



GREATER ORLANDO AVIATION AUTHORITY

Documents Prepared and Submitted by:

HNTB Corporation
610 Crescent Executive Court / Ste. 400 / Lake Mary, FL 32746
Phone: (407)805-0355

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Painting and finishing.
 - 10. Concrete bases.
 - 11. Supports and anchorages.
 - 12. Excavation and backfill.
 - 13. Underground piping support.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PE: Polyethylene plastic.
 - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: Product data includes the manufacturer's printed literature. ALL equipment, material, product and performance data shall be CLEARLY marked to specifically identify the item(s) being submitted for inclusion in this project. Non-pertinent data shall be deleted or marked through. Any and all deviations from the requirements of the Contract Documents shall be specifically listed, and clearly shown in the submittal. Any deviations not specifically disclosed in the submittal shall be solely at the risk of the Contractor, and shall be subject to discovery at any time. Any undisclosed deviations shall be corrected by the Contractor to comply with the requirements of the Contract Documents at no additional cost to the Owner, regardless of the acceptance of the submittal by the Architect/Engineer. Submit for the following under this section:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.
- C. Shop Drawings: Shop drawings include piping system layouts, fabrication and installation drawings of supports and anchorage for materials and equipment, and coordination drawings. Shop drawings also include proposed equipment layouts, drawn to scale, indicating that proposed equipment will fit into allotted space, including service access, connections, etc.
- D. Piping Systems: Submit shop drawings for piping systems drawn at a minimum scale of ¼ inch per foot on reproducible transparencies to verify clearances and equipment locations. Show required maintenance and operational clearances. Include the following:

1. Fabrication and erection dimensions.
 2. Sleeve layout plan for all penetrations through the post tensioned concrete structure.
 3. Arrangements and sectional views.
 4. Details, including complete information for making connections to equipment.
 5. Descriptive names of equipment
 6. Modifications and options to standard equipment required by Contract Documents.
- E. Product Data: Product data includes the manufacturer's printed literature.
- F. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Regional/Local Multiplier Compliance
 - b. Extended Producer Responsibility
 - c. Leadership Extraction Practices for Recycled Content
 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Paints and Coatings
 - b. Low Emitting Materials for Adhesives and Sealants
 3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - c. Health Product Declarations (HPD's)
- G. Performance Data: Provide performance data, wiring and control diagrams.
- H. Installation Instructions: Installation instructions include detailed information, from the manufacturer, indicating specific installation requirements, instructions, and recommendations. Generic installation instructions are not acceptable. Instructions shall be the same as those included with the product when it is shipped from the factory.
- I. Written Operating Instructions: Operating instructions shall be the manufacturer's written operating instructions for the specified product. If the instructions cover more than one model or type of product they shall be clearly marked to identify the instructions that cover the product delivered to the project.
- J. Maintenance Instructions: Maintenance instructions shall be the manufacturer's printed instructions and parts lists for the equipment furnished. If the instructions cover more than one model or type of equipment they shall be marked to identify the instructions for the furnished product.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding:
 - 1. Comply with provisions in ASME B31.9, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current. Submit copy of welding procedures.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified.
- D. Code Compliance: Comply with all rules, laws, statutes, regulations, building codes, and the amendments of local, state and federal governments by the authorities having jurisdiction.
- E. ADA: Comply with the requirements of the Americans with Disabilities Act (ADA).
- F. HANDICAP ACCESS: Comply with Chapter 553, Part V, Florida Statutes, "ACCESSIBILITY BY HANDICAP PERSONS"; and the accessibility requirements manual from the Florida Board of Building Codes and Standards, Department of Community Affairs, latest Revisions.
- G. NFPA: Comply with the National Fire Codes compiled by the National Fire Protection Association.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section 08 31 13 "Access Doors and Frames."

1.8 DRAWINGS AND SPECIFICATIONS

- A. Equipment Placement: The drawings are diagrammatic, intended to show general arrangement, capacity and location of various components, equipment and devices. Reasonable changes in locations ordered by the Designer prior to the installation may be made at no additional cost.
- B. Drawing Scale: Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets, transitions and fittings may not be shown but shall be provided at no additional cost.

1.9 MANUFACTURER'S EQUIPMENT AND SYSTEMS STARTUP AND PERFORMANCE CHECKOUT

- A. At the completion of installation, and in coordination with the CxA, a factory trained representative of the equipment manufacturer shall provide start-up and checkout services. The manufacturer's representative shall examine performance information and check the equipment in operation, and sign "Check-Out Memo", (Exhibit E in Section 01 78 00 "Closeouts Submittals"). Submit a copy of the Memo for each item of equipment where indicated in individual sections of these specifications. Include a copy of the Memo in each Technical Information Brochure Binder. The "Check-Out Memo" shall be included with the performance verification data. Do not request "Instruction in Operation Conference" or request final inspection until Memos have been submitted and are acceptable to the Designer.

1.10 INSTRUCTION TO THE OWNER

- A. General: In coordination with the CxA and Section 01 91 13 "General Commissioning Requirements", Instructions to the Owner shall be accomplished by representatives of the manufacturers involved. Allow time for complete coverage of all operating procedures. Provide classroom instruction and field training in the design, operation and maintenance of the equipment and troubleshooting procedures. Explain the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar provisions of the systems. On the date of substantial completion, turn over the prime

responsibility for operation of the mechanical equipment and systems to the Owner's operating personnel.

- B. Training Period: Training period shall encompass a minimum of 8 hours of classroom and 8 hours of hands-on instructions with a maximum period of 4 hours per day. The training sessions shall be video recorded and turned over to GOAA for future use.
- C. Scheduling: Submit any remaining required items for checking at least one week before final inspection of the work. When submittal items are found acceptable, notify the Owner, in writing, that an "Instruction Conference" may proceed. Conference will be scheduled by the Owner. After the conference, copies of a memo certifying that the "Instruction Conference" and "Completed Demonstration" have been made will be signed by the Owner and the instructors, and one copy will be inserted in each submittal binder.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 MANUFACTURERS

- A. Specified Products: Manufacturer's names and product model numbers indicated on the drawings and in these specifications establish the type, style, quality, performance, and sound rating of the desired product. Listing of other manufacturers indicates that their equivalent products would be acceptable if they meet the specification requirements, the specific use and installation shown on the drawings, including space and clearance requirements, and the energy consumption and efficiency of the specified product.
- B. Space Requirements: All manufactured products furnished on this project must have the required space and service areas indicated in the manufacturer's printed literature or shown on their approved shop drawings. When the manufacturer does not indicate the space required for servicing the equipment, the space shown on the drawings or as required by the Designer must be provided.

2.3 MATERIAL AND EQUIPMENT

- A. General: Material and equipment used shall be produced by manufacturers regularly engaged in the production of similar items, and with a history of satisfactory use as judged by the Designer.
- B. Specified Equipment: Equipment shall be the capacity and types indicated. Equipment and material furnished shall be the manufacturer's standard item of production unless

specified or required to be modified to suit job conditions. Sizes, material, finish, dimensions and the capacities for the specified application shall be published in catalogs for national distribution. Ratings and capacities shall be certified by a recognized rating bureau. Products shall be complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

- C. Compatibility: Material and equipment of one and the same kind, type or classification and used for identical or similar purposes shall be made by the same manufacturer. Where more than one choice is available, select the options which are compatible with other products already selected. Compatibility is a basic general requirement of product selection.

2.4 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.5 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents: sewage ejector discharge and domestic water.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.6 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - g. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 3. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Eslon Thermoplastics.
 - b. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

2. Manufacturers:

- a. Thompson Plastics, Inc.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

- a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.

D. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

- a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

E. Adapters:

1. Tile-cast iron adapters with extra heavy cast iron hub and spigot type, equal to Josam Series 88700.

2.7 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature. Refer to specification section 22 07 00 "Plumbing insulation".

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F. Shall be listed under ASSE Standard No. 1079.

1. Manufacturers:

- a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.

- d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
- 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
- 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.

- c. Sioux Chief Manufacturing Co., Inc.
- d. Victaulic Co. of America.

2.8 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.9 SLEEVES

- 1. Sleeves (Above Grade): Sleeves shall be mild steel pipe Schedule 40 sleeves built into assembly, sized to pass pipe and covering, leaving a clear space of 1/4 inch minimum between covering and sleeve, or Proset pipe penetration system
- 2. Sleeves Installed in Exterior Walls (Below Grade): Link-seal modular seal system, or Schedule 40 steel hot dipped galvanized after fabrication or cast iron. Fabricate the sleeve with 1/4 inch x 3 inch center flange (water stop) around the outside.
- 3. Floors (Above Grade): Sleeves shall be Schedule 10 galvanized steel. When copper or steel piping penetrates concrete slabs, use Proset System for fire-rated and water pipe installations.

2.10 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.11 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi , 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.12 ROOF PENETRATIONS

- A. Any penetrations, pipes, conduits, guy wire anchors, etc. which penetrate an existing roof membrane shall have the membrane protected per architectural documents and specifications. Pitch pockets will not be allowed.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and

calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
 - l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install Link-seal modular seal system, or cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Use Proset pipe penetration system. Seal pipe penetrations with firestop materials. Refer to Division 07 Section 07 84 13 "Penetration Firestopping" for materials.
- S. Verify final equipment locations for roughing-in.

- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel or groove plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Grooved Joints: Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and recommendations. All grooved couplings, fittings, valves and specialties shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove. A factory trained field representative shall provide on-site training to

contractor's field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products

- J. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- K. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- L. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- M. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- N. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flange or grooved-joint couplings, in piping NPS 2-1/2 and larger, adjacent to flanged or grooved-ended valves and at final connection to each piece of equipment.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 MECHANICAL & PLUMBING EQUIPMENT ROOMS & CONDENSATE DRAINS

- A. Condensate from HVAC units shall be indirectly connected to a hard piped drain system via condensate floor drains with raised rim. Condensate drains shall connect into the storm system with a back water valve. For air handling unit drains, provide AC condensate trap of appropriate dimensions for operating pressure of the unit. Refer to details on HVAC drawings.
- B. When not feasible for gravity drainage connection into the storm system, shall dump into a concrete sump pit. Min size of pit shall be 16"x16"x18". Submersible condensate sump pumps shall be an Owner approved substitution to Liberty 247 VMF series shall be used. Provide float switch & warning system connected to BAS system to alarm in case of overflow. Also provide float switch in hard piped condensate trap from AC unit.
- C. When it is not feasible to install a sump pit (i.e when above an occupied floor), a premanufactured combination pump/basin secured in the corner of the HVAC closet. Use an Owner approved substitution to Liberty SPAC series sump pump package.
- D. The sump pit or pump basin will require a float switch which will turn off the respective fan coil in case of condensate overflow.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section 03 30 00 "Cast-in-Place Concrete"

3.7 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections 09 91 23 "Interior Painting" and 09 91 13 "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- C. Provide labor, materials, and equipment necessary for field prime painting. Protect flooring and equipment with drop cloths and store paint and materials in a location where directed. Using wire brush, remove oil, dirt, rust and grease before applying paint.
- D. Apply a heavy coat of bituminous solution paint on piping in concrete or cinder fill or exposed above roof and on underground joint clamps.
- E. Apply epoxy primer for steel piping, cast iron piping (except underground), and all steel and iron work.
- F. Dip in epoxy primer, uncoated hangers, supports, rods and inserts.
- G. Epoxy primer shall be Sherwin Williams product, or approved equal, in compliance with the requirements for Low Emitting Paints and Coatings.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section 05 50 00 "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place all new wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment. All wood shall be new fire rated products, scraps from the site shall not be used.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.10 EXCAVATION AND BACKFILL

- A. Excavate, backfill and restore surfaces beyond 5 ft. outside of building.
- B. If rock is encountered, excavate to 6 in. below bottom of piping and refill with well-tamped sand and gravel.
- C. Bank excavated materials adjacent to trench and properly support with sheet piling and braces.
- D. Install and maintain guards and keep excavation free of water with attendant pumping equipment.
- E. No extra compensation will be provided for quicksand, hardpan, or other material encountered in excavating, except rock on unit price basis.
- F. Remove bog or other swampy conditions encountered in excavating to 1 foot below bottom of piping and backfill with well tamped sand, finely crushed stone, or gravel.
- G. The trench width at top of pipe should not exceed the minimum size for the installed pipe diameter. Provide heavier pipe, concrete encasement or continuous concrete cradle due to extra weight of fill, if trench width is wider than minimum.
- H. Immediately after piping is installed, inspected, tested, and accepted, remove sheet piling with special care and solidly fill voids without injury to piping. Backfill in a manner to prevent future settlement. Use only good clean loam, clay, sand, or gravel that is free from frozen materials, lumps of clay, rocks, boulders, cinders, slag ashes, vegetable or organic materials, building or other debris, or refuse.
 - 1. Hand fill in 4 in. layers up to 2 ft. above pipe and remainder, fill in with 1 foot layers.
 - 2. Tamp each layer before placing next layer.
 - 3. Allow no stones larger than 2 in. in diameter in fill up to 2 ft. above piping and allow no stones larger than 4 in. in diameter in fill over 2 ft. above piping.

- I. Restore to match existing surfaces, sidewalks, pavements, curbing, lawns, and shrubs that are disturbed or damaged.
- J. Dispose of acceptable surplus excavation on site and remove surplus and unsuitable excavated materials from site as directed.

3.11 UNDERGROUND PIPING SUPPORTS

- A. Support on solid undisturbed ground; or support on concrete, brick piers or cradles where there is unsuitable ground, at trench crossings, and when crossing excavation adjacent to building wall or foundations. Concrete supports must be engineered and submitted for approval.
- B. Bottom of trenches shall be tamped hard, graded for required pitch, shaped to give uniform support to lower third of full length of pipe, and with recesses excavated for bells and joints.
- C. Support and protect piping so it remains in place without settling or damage during and from backfilling. Replace any damaged pipe.

3.12 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.13 CLEANING AND PROTECTION

- A. General: Refer to Division 01.

- B. Housekeeping: Keep interiors of duct and pipe systems clean and free from dirt, rubbish and foreign matter. Close open ends of piping and ductwork at all times throughout the installation. Install 30% efficient filter media over each return air grille and open return duct opening; change media regularly during construction when dirty to keep duct interiors clean. Prevent dust, debris and foreign material from entering the piping and ductwork.
- C. Equipment Protection: Protect fan motors, switches, equipment, fixtures, and other items from dirt, rubbish and foreign matter. Do not operate air handling equipment if the building is not clean or if dust can enter the coils or the fan housings.
- D. Equipment Cleaning: Thoroughly clean equipment and entire piping systems internally upon completion of installation and immediately prior to Submittal Completion. Open dirt pockets and strainers, blow down each piping system and clean strainer screens of accumulated debris. Remove accumulated dirt, scale, oil and foreign substances.
- E. Fixture Cleanup: Remove temporary labels, stickers, etc., from fixtures and equipment. Do not remove permanent name plates, equipment model numbers, ratings, etc.
- F. Protection of Finished Installation: Where installation is required in areas previously finished by other trades, protect the area from marring, soiling or other damage.

3.14 CORRECTION OF WORK

- A. General: At no additional cost to the Owner, rectify discrepancies between the actual installation and Contract Documents in the submittals when in the opinion of the Testing and Balancing Agency (T&B Agency) or the Designer the discrepancies will affect system balance and performance.
- B. Drive Changes: Include the cost of all pulley, belt, and drive changes, as well as balancing valves and fittings, and access panels to achieve proper system balance recommended by the T&B Agency.

END OF SECTION 22 05 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

- 2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

- D. Comply with ANSI C50.

2.3 ELECTRIC MOTOR MANUFACTURERS:

A. Manufacturers:

1. General Electric Inc.
2. Westinghouse Electric
3. Baldor Electric Company

2.4 MOTOR CHARACTERISTICS

- A. Duty: Provide motors for continuous duty conditions in which they will be required to perform; i.e., general purpose, splashproof, standard load, high torque, or any other special type as required by the equipment motor manufacturer's recommendations. Unless otherwise indicated or required, motors shall be open drip-proof type. Continuous duty at ambient temperature of 95 deg F and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- C. Unless otherwise indicated or required, motors shall be open drip-proof type.
- D. Motors installed outdoors shall be totally enclosed fan cooled (TEFC) type.
- E. Motor enclosures shall be of the type recommended by the equipment manufacturer for the specific application.
- F. All motors shall be furnished for starting in accordance with the electric utility company's requirements and shall be compatible with the motor starter and driven load. Motors shall not exceed full-rated nameplate load when operated at any point along the driven equipment's characteristic performance curve. The motor service factor shall not be used to justify exceeding nameplate amperage.
- G. Unless otherwise indicated, motors 1/3 horsepower and less shall be single phase. Motors 1/2 horsepower and larger shall be 3 phase, squirrel-cage induction type.
- H. Sound power levels for motors shall be no greater than the guidelines recommended by NEMA MG 1-2007. A motor which generates excessive noise within an occupied area of the building shall be replaced with a quieter operating motor at no additional cost to the Owner.

- I. Verify the circuit voltage and phase being furnished to the motor. All motors shall be 1800 rpm unless noted otherwise. Motors shall operate with electrical input voltage variations of plus or minus 1 percent of nameplate rating or frequency variations of plus or minus 5 percent of nameplate rating.

2.5 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.6 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.7 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Single phase motors for hard starting applications including outdoor installations shall be capacitor start/induction run or capacitor start/capacitor run type designed for the application. Motors for fans and pumps located indoor may be split phase with permanently lubricated sealed ball bearings and shall be selected for quiet operation. Motors 1/8 horsepower and below may be shaded pole type with permanently sealed bearings.

D. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.8 POWER FACTOR

A. All equipment furnished utilizing a combined electrical load of greater than 1000 watts shall have a power factor of not less than 0.90 under rated load conditions.

1. Where motors are not available with a minimum 0.90 power factor, provide motor mounted power factor correction capacitor to improve power factor to at least 0.90 under rated load condition.

2.9 MOTOR STARTERS

- A. Compliance: Motor starters included as an integral part of a factory pre-wired control panel shall be provided by the manufacturer of the equipment it serves and shall comply with the requirements of Division 26.
- B. Overload Protection: Unless otherwise indicated, all 3 phase motor starters shall be provided with thermal overload relays on each phase sized in accordance with the actual nameplate full load ampere rating. Single phase motors shall be furnished with built-in thermal protection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install material and equipment in accordance with details shown on the drawings, submittals drawings and manufacturer's instructions.

3.2 SCHEDULED HORSEPOWER

- A. Nominal Size: The horsepower scheduled or specified are those nominal sizes estimated to be required by the equipment when operating at specified duties and efficiencies. In the case of pumps and fans, these motors shall be non-overloading at any point of the performance curve.
- B. Minimum Size: Motor horsepower shall not be reduced from the scheduled size regardless of the requirements of the selected or submitted equipment.
- C. Increased Size: If the actual motor horsepower for the equipment furnished is larger than the scheduled size indicated, the proper size feeder, breaker, starter, etc. shall be provided at no additional cost to the Owner.
- D. Vibration: Motor vibration in any direction as measured at the bearing housings, when tested in accordance with NEMA Standard MG 1, shall be within the following table:

1. TABLE - VIBRATION LIMITS

UNFILTERED VIBRATION LIMITS

Speed, rpm	Rotational Frequency, Hz	Velocity, in/s peak (mm/s)
3600	60	0.15 (3.8)
1800	30	0.15 (3.8)

2. If balance weights are added to the rotor, they shall be permanently secured by welding or riveting. Machine nuts, bolts and screws are prohibited.

3.3 WIRING

- A. Power: Except for factory installed wiring all power wiring including safety disconnect switches, motor starters, over-current protection, connection to equipment, etc. shall be installed according to the requirements of Division 26, ELECTRICAL.
- B. Interlock: Unless otherwise noted, all interlock wiring, such as remote line voltage thermostats, fan speed controllers, etc. shall be installed by the supplier of that equipment. Interlock wiring shall be installed according to the requirements of Division 26, ELECTRICAL.
- C. Control: All control wiring installed in mechanical equipment rooms, fan rooms, return air plenums, etc. shall be in conduit. Low voltage control wiring may be installed without conduit in return air plenums provided the cable is plenum rated and the installation is acceptable to the authority having jurisdiction.

END OF SECTION 22 0513

SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal-bellows packless expansion joints.
 - 2. Rubber expansion joints.
 - 3. Flexible-hose expansion joints.
 - 4. Drainage piping expansion joints.
 - 5. Test tee expansion joints.
 - 6. Pipe bends and loops
 - 7. Pipe loops and swing connections.
 - 8. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.
- B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Delegated-Design Submittal: For each anchor and alignment guide, expansion fittings and loops required to comply with performance requirements and design criteria, including analysis data signed and sealed by a qualified professional engineer responsible for their preparation. The professional engineer shall be the responsibility of the installing contractor.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and bends.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Welding certificates.

D. Product Certificates: For each type of pipe expansion joint, signed by product manufacturer.

E. Maintenance Data: For pipe expansion joints to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. Steel Shapes and Plates: AWS B31.1, "Structural Welding Code - Steel."
2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 EXPANSION JOINTS

A. Metal-Bellows Packless Expansion Joints: ASTM F 1120, circular-corrugated-bellows type with external tie rods.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hyspan Precision Products, Inc.
 - b. Metraflex, Inc.
 - c. Owner approved substitution.
2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Type: Circular, corrugated bellows with external tie rods.

4. Minimum Pressure Rating: 175 psig unless otherwise indicated.
 5. Configuration: Single joint class(es) unless otherwise indicated.
 6. Expansion Joints for Copper Tubing: Single-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
 7. End Connections for Copper Tubing: Solder joint.
- B. Rubber Expansion Joints: ASTM F 1123, fabric-reinforced rubber with external control rods and complying with FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flex-Hose Co., Inc.
 - b. General Rubber Corp.
 - c. Mason Industries, Inc.; Mercer Rubber Co.
 - d. Metraflex, Inc.
 2. Arch Type: Single or multiple arches.
 3. Spherical Type: Single or multiple spheres.
 4. Pressure-temperature ratings in first three subparagraphs below are generally minimum values. Consult manufacturers' literature for options available.
 5. Minimum Pressure and Temperature Ratings for NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.
 6. Minimum Pressure and Temperature Ratings for NPS 5 and NPS 6: 140 psig at 200 deg F.
 7. Minimum Pressure and Temperature Ratings for NPS 8 to NPS 12: 140 psig at 180 deg F.
 8. Material: EPDM.
 9. End Connections: Full-faced, integral, steel flanges with steel retaining rings.
 10. Equal to Mason Industries Vibraflex.

2.3 ALIGNMENT GUIDES

- A. Description: Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hyspan Precision Products, Inc.
 - b. Metraflex, Inc.
 - c. Owner approved substitution.

2.4 MATERIALS FOR ANCHORS

- A. Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Expansion Anchors
 - 1. Smooth wall, non-self-drilling internal plug expansion type anchors constructed of AISC 12L14 steel and zinc plated in accordance with Fed. Spec. QQ-A-325 type 1, Class 3.
 - 2. Do not exceed 1/4 of average values for a specific anchor size using 2000 PSIG concrete only, for maximum working loads.
 - 3. Locate spacing and install anchors in accordance with the manufacturer's recommendations.
 - 4. Expansion anchors shall be U.L listed and equal to Hilti HDI.
- E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
 - 3. Washer and Nut: Zinc-coated steel.
- F. Concrete: Portland cement mix, 3000 psi minimum. Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.
- G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

- A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."

- B. Install expansion joints of sizes matching size of piping in which they are installed.
- C. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
- D. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.2 PIPE BEND AND LOOP INSTALLATION

- A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Attach pipe bends and loops to anchors.
 - 1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

3.3 SWING CONNECTIONS

- A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.4 ALIGNMENT-GUIDE INSTALLATION

- A. Install guides on piping adjoining pipe expansion fittings and loops.
- B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe and secure to building structure.

3.5 ANCHOR INSTALLATION

- A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Anchor Attachments:
 - 1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
 - 3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
- D. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - 1. Anchor Attachment to Steel Structural Members: Attach by welding.
 - 2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
- E. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- F. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.
- G. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION 22 0516

SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Liquid-in-glass thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.
 - 5. Test plugs.
- B. Related Sections:
 - 1. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.
- C. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

- D. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. NSF Compliance:
 - 1. Comply with NSF 61, “Drinking Water System Components – Health Effects; Sections 1 through 9” and Annex F & G for potable domestic water piping and components.

PART 2 - PRODUCTS

- 2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Thermometer:

	Piping	Insulated	Uninsulated
a.	H.O. Trerice Co	A410	A410
b.	Weiss	9VS6	9VS3-1/2
c.	Weksler	AA5L-9	AA5L-9
 - 2. Test Wells: Stainless steel with threaded plug or cap with chain, 1/2 inch NPT, and extension neck where necessary to extend above the insulation.

	Piping	Insulated	Uninsulated
a.	H.O. Trerice Co	ET6-A	ET4-A
b.	Weiss	5550-11	5550-2
c.	Weksler	L3B6	S3B4

2.3 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.

2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CUNI
4. Material for Use with Steel Piping: CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowells internal screw thread to size of thermometer connection.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

	Indoor	Outdoor
H.O. Trerice Co.	450B	650B
Weiss	4UGAN-1	---
Weksler	BA141	BA14Y
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Match pressure connection size in first subparagraph below with gage attachment size.
6. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
7. Movement: Mechanical, with link to pressure element and connection to pointer.
8. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
9. Pointer: Dark-colored metal.
10. Window: Glass.
11. Ring: Stainless steel.
12. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Pressure-Gage Fittings:

1. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.
2. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

2.5 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flow Design, Inc.
 2. Peterson Equipment Co., Inc.
 3. Sisco Manufacturing Co.
 4. Trerice, H. O. Co.
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- D. Core Inserts: One or two self-sealing rubber valves.
 1. Insert material for water service at 20 to 200 deg F shall be CR.
 2. Insert material for water service at minus 30 to plus 275 deg F shall be EPDM.
- E. Test Kit: Furnish four test kits containing one pressure gage and adaptor, two thermometers, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
 1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be 0 to 200 psig.
 2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
 3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
 4. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install liquid-in-glass thermometers in the outlet of each domestic, hot-water storage tank and where shown on drawings.
- B. Provide stainless steel separable socket in tank connections. On piping connection, provide in an oversized tee and nipple. Locate on each water heater, pre-heater, hot water tank, in outlet piping of each water heater and in outlet piping of each thermostatic tempering valve, hot water return piping, chilled water supply and return piping, and as noted.
- C. Provide the following temperature ranges for thermometers:
 - 1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
 - 2. Domestic Cold Water: 0 to 100 deg F, with 1-degree scale divisions.

3.2 GAGE APPLICATIONS

- A. Install liquid-filled-case-type pressure gages for discharge of each pressure-reducing valve.
- B. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending a minimum of 2 inches into fluid or to center of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage.
- E. Install test plugs in tees in piping.
- F. Install permanent indicators on walls or brackets in accessible and readable positions.
- G. Install connection fittings for attachment to portable indicators in accessible locations.

- H. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.
- I. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION 22 0519

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Bronze angle valves.
2. Bronze ball valves.
3. Ductile-iron, single-flange butterfly valves.
4. Ductile-iron, grooved-end butterfly valves.
5. Iron, flanged butterfly valves.
6. High-performance butterfly valves.
7. Bronze lift check valves.
8. Bronze swing check valves.
9. Iron swing check valves.
10. Iron, grooved-end swing check valves.
11. Iron, center-guided check valves.
12. Bronze gate valves.
13. Iron gate valves.
14. Lubricated plug valves.
15. Chainwheels.

- B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section 22 05 23 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water utility distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.

- B. EPDM: Ethylene propylene diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. PTFE: Polytetrafluoroethylene plastic.
- F. OS&Y: Outside screw and yoke.
- G. RS: Rising stem.
- H. SWP: Steam working pressure.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.
- B. All submitted valves must be manufactured in USA.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.

- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- C. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- D. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.
- E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
 - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- H. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
 3. Butterfly Valves: With extended neck.
- I. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
 2. Grooved: With grooves according to AWWA C606.
 3. Solder Joint: With sockets according to ASME B16.18.
 4. Threaded: With threads according to ASME B1.20.1.
- J. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE BALL VALVES

A. 2" and smaller bronze ball valves

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 2 inch and smaller: 150 psi SWP, 400 psi WOG. Standard port ball, bronze trim, cast bronze body, chromium-plated brass ball, bronze non-blowout stem, Teflon seat, double o-ring stem seals, zinc-coated steel handle with plastic coated hand grip, 90 degree operation from full open to tight shut-off.

		Threaded	Solder Joint
1)	Nibco	T-585-70	S-585-70
2)	Jamesbury	300	---
3)	Viega		

2.4 BUTTERFLY VALVES

- A. General: Valves shall be capable of bubble tight shut-off at pressure differentials of 150 psi. Valves in insulated piping shall have a minimum of 2 inch extended necks for insulation clearance.
- B. Operators: Valves 4 inch and smaller shall have steel lever latch-type actuator capable of infinite position (or minimum of 10 locking positions) and shall have adjustable memory stop. Valves 5 inch and larger shall have enclosed gear type actuator with chain wheel,

hand wheel or crank type operating mechanisms, adjustable opening and closing memory stops, and position indicator. All valves 4 inch and larger located more than 7 feet above the floor or landing shall be provided with chain wheel and chain extending to within 12 inches above the floor or landing. Provide stem extensions (in addition to insulation clearance extension) as required to place operators in an easily accessible location free of interference with adjacent piping, equipment structure, etc.

- C. 2 inch and smaller: Cast bronze body, viton seals, full port, stainless steel trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nibco
 - b. Centerline
 - c. De Zurik
- D. 2-1/2 inch and larger: Threaded and tapped lug, cast iron ASTM A126-B or ductile iron ASTM A-395 Class 60-40-18 body, bronze ASTM B-62, aluminum bronze or nylon coated disc, 416 stainless steel or phosphate coated steel shaft, and EPDM seat designed to seal against the companion flanges. Stem seals shall consist of a primary seal between the spherical disc hub and the spherical seat hub. Wafer-type are not permitted:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Centerline Series LT
 - b. De Zurik 660LR-S823
 - c. Nibco LD 2000
- E. Grooved Butterfly Valves: Ductile iron body, ductile iron disc EPDM encapsulated, stainless steel stem, minimum 300 psi working pressure:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Vic 300
 - b. Gruvlok Series 7000

2.5 BRONZE LIFT CHECK VALVES

- A. Class 125, Lift Check Valves with Nonmetallic PTFE or TFE Disc:
1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-480-Y-LF or T-480-Y-LF or a comparable product by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
- a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 584 Alloy C844, bronze.
 - e. Ends: Threaded or Solder.
 - f. Disc: PTFE, or TFE.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-413-B or T-413-B or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Y-pattern horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded or Solder.
 - f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Buna-N Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-413-W or T-413-W or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Y-pattern horizontal flow.

- d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded or Solder.
 - f. Disc: Buna-N.
- C. Class 125, Bronze Swing Check Valves with Nonmetallic TFE Disc:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-413-Y or T-413-Y or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Y-pattern horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded or Solder.
 - f. Disc: PTFE or TFE.
- D. Class 150, Bronze Swing Check Valves with Bronze Disc:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-433-B or T-433-B or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Y-pattern horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded or Solder.
 - f. Disc: Bronze.
- E. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-433-Y or T-433-Y or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.

2. Description:

- a. Standard: MSS SP-80, Type 4.
- b. CWP Rating: 300 psig.
- c. Body Design: Y-pattern horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded or Solder.
- f. Disc: PTFE or TFE.

2.7 IRON SWING CHECK VALVES

A. Class 125, Cast-Iron Swing Check Valves with Metal Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-918-B or a comparable product by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Powell Valves.

2. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

B. Class 150, Ductile-Iron Swing Check Valves with Metal Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-9138-31 or a comparable product by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Powell, Wm. Co.

2. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 285 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 395, ductile iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.

- g. Seat Ring: Asbestos free.
- h. Disc Holder: Bronze.
- i. Disc: PTFE or TFE.
- j. Gasket: Asbestos free.

C. Class 250, Iron Swing Check Valves with Metal Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-9138-31 or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell, Wm. Co.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.

2.8 IRON, GROOVED-END SWING CHECK VALVES

A. 250 CWP, Iron, Grooved-End Swing Check Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model G-917-W or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell, Wm. Co.
2. Description:
 - a. CWP Rating: 250 psig.
 - b. Body Material: Gray iron.
 - c. Seal: EPDM.
 - d. Disc: Spring-operated, stainless steel with EPDM.

B. 200 CWP, Bronze, Silent Check Valve, Lead-Free

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-910-B or a comparable product by one of the following:

- a. Metraflex.
- b. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 48, gray iron.
- d. Style: Globe, spring loaded.
- e. Ends: Flanged.
- f. Seat: Buna-N.
- g. Seat: Buna-N.
- h. Seat: Buna-N.

2.9 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-113 or T-113 or a comparable product by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Powell Valves.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or Solder.
- e. Stem: Copper-silicon bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron.

B. Class 125, RS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-111 or T-111 or a comparable product by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Powell Valves.

2. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder.
- e. Stem: Copper-silicon bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron.

C. Class 150, NRS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-136 or T-136 or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded or solder.
 - e. Stem: Copper-silicon bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

D. Class 150, RS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-134 or T-134 or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded or solder.
 - e. Stem: Copper-silicon bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

E. Class 200, RS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-154 or T-154 or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM B 61, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded or solder.
 - e. Stem: Copper-silicon bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

2.10 IRON GATE VALVES

A. Class 125, NRS, Cast-Iron Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-619 or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Cast-Iron Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-617-O or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.

- b. Powell Valves.
2. Description:
- a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- C. Class 150, NRS, Ductile-Iron Gate Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-639-31 or a comparable product by one of the following:
- a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
- a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 285 psig.
 - c. Body Material: ASTM A 395, ductile iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- D. Class 150, OS&Y, Ductile-Iron Gate Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-637-31 or a comparable product by one of the following:
- a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
- a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 285 psig.
 - c. Body Material: ASTM A 395, ductile iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.

- g. Packing and Gasket: Asbestos free.

E. Class 250, NRS, Cast-Iron Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-699 or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

F. Class 250, OS&Y, Iron Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-667-O or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

2.11 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-211-B or T-211-B or a comparable product by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
- a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder.
 - e. Stem and Disc: Copper-silicon bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron.
- B. Class 125, Bronze Globe Valves with Nonmetallic Disc:
1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-211-Y or T-211-Y or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder.
 - e. Stem: Copper-silicon bronze.
 - f. Disc: PTFE or TFE.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.
- C. Class 150, Bronze Globe Valves with Nonmetallic Disc:
1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-235-Y or T-235-Y or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded or solder.

- e. Stem: Copper-silicon bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron.

2.12 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-718-B or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-85, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Packing and Gasket: Asbestos free.

B. Class 150, Iron Globe Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-738-31 or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-85, Type I.
 - b. CWP Rating: 285 psig.
 - c. Body Material: ASTM A 395, ductile iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Packing and Gasket: Asbestos free.

C. Class 250, Iron Globe Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-768-B or a comparable product by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
- a. Standard: MSS SP-85, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Packing and Gasket: Asbestos free.

2.13 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nordstrom Valves, Inc.
2. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Venturi.
 - e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nordstrom Valves, Inc.
2. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Venturi.
 - e. Plug: Cast iron or bronze with sealant groove.

C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Venturi.
 - e. Plug: Cast iron or bronze with sealant groove.

D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Venturi.
 - e. Plug: Cast iron or bronze with sealant groove.

E. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nordstrom Valves, Inc.
 - b. Description:
 - c. Standard: MSS SP-78, Type II.

- d. CWP Rating: 400 psig.
- e. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- f. Pattern: Venturi.
- g. Plug: Cast iron or bronze with sealant groove.

F. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nordstrom Valves, Inc.
- 2. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Venturi.
 - e. Plug: Cast iron or bronze with sealant groove.

G. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
- 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Venturi.
 - e. Plug: Cast iron or bronze with sealant groove.

H. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Homestead Valve; a division of Olson Technologies, Inc.

- b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
2. Description:
- a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
 - d. Pattern: Venturi.
 - e. Plug: Cast iron or bronze with sealant groove.

2.14 CHAINWHEELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Babbitt Steam Specialty Co.
 - 2. Roto Hammer Industries.
 - 3. Trumbull Industries.
- B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
- 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - 2. Attachment: For connection to ball butterfly and plug valve stems.
 - 3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc coating.
 - 4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.

- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for ball, butterfly, gate, globe and plug valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Dielectric unions shall be provided on each side of threaded valves, check valves and circuit balancing valves, and on the upstream side of soldered valves, unions are not required on three piece full port ball valve.
- G. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.

2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 3. Throttling Service: Globe, ball, or butterfly valves.
 4. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
 7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 2. Bronze Angle Valves: Class 150, nonmetallic disc.
 3. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
 4. Bronze Lift Check Valves: Class 125, nonmetallic TFE disc.
 5. Bronze Swing Check Valves: Class 150, nonmetallic TFE disc.
 6. Bronze Gate Valves: Class 150, RS.
 7. Bronze Globe Valves: Class 150, nonmetallic disc.
- B. Pipe NPS 2-1/2 and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 2. Iron Angle Valves: Class 125.

3. Steel Ball Valves: Class 150, full-port.
4. Ductile-Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
5. Ductile-Iron, Grooved-End Butterfly Valves: 300 CWP.
6. High-Performance Butterfly Valves: Class 150, 285 CWP.
7. Iron Swing Check Valves: Class 125, metal seats.
8. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
9. Iron, Grooved-End Swing Check Valves: 300 CWP.
10. Iron, Center-Guided Check Valves: Class 125, globe, resilient seat.
11. Iron, Plate-Type Check Valves: Class 125; dual plate; resilient seat.
12. Iron Gate Valves: Class 125, OS&Y.
13. Iron Globe Valves: Class 125.

3.6 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, nonmetallic disc.
4. Bronze Gate Valves: Class 150, RS.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel Ball Valves: Class 150, full port.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
5. Iron, Grooved-End Swing Check Valves: 300 CWP.
6. Iron Gate Valves: Class 125, OS&Y.

END OF SECTION 22 05 23

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND
EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Pipe positioning systems.
 - 8. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 1 Section 01 35 46: "Indoor Air quality Management"
 - 2. Division 1 Section 01 74 23: "Final Cleaning"
 - 3. Division 1 Section 01 81 13.14: "Sustainable Design Requirements - LEED V4 BD+C"
 - 4. Division 05 Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 5. Division 22 Section 22 05 16 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry Inc.

- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.
 - 4. Pipe positioning systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Fiberglass strut systems. Include Product Data for components.
 - 4. Pipe stands. Include Product Data for components.
 - 5. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
1. AAA Technology & Specialties Co., Inc.
 2. Bergen-Power Pipe Supports.
 3. B-Line Systems, Inc.; a division of Cooper Industries.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.4 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.
- B. Manufacturers:
 - 1. Anvil International.
 - 2. Eaton, B-Line Div.
 - 3. Tyco, Unistrat Corp.

2.5 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Power-Strut Div.; Tyco International, Ltd.
 - 3. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
- C. Insulation-Insert Material for Cold Piping (outdoor cold water, storm drainage and condensate: ASTM C552, Type II cellular glass with vapor barrier.

- D. Insulation-Insert Material for Hot Piping: ASTM C553 Type I, High density Calcium silicate.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - 2. Expansion Anchors:
 - a. Smooth wall, non-self-drilling internal plug expansion type anchors constructed of AISC 12L14 steel and zinc plated in accordance with Fed. Spec. QQ-A-325 type 1, Class 3.
 - b. Do not exceed 1/4 of average values for a specific anchor size using 2000 PSIG concrete only, for maximum working loads.

- c. Locate spacing and install anchors in accordance with the manufacturer's recommendations.
- d. Expansion anchors shall be U.L. listed and equal to Hilti HDI.

2.8 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 1. Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
 1. Manufacturers:
 - a. MIRO Industries.
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 1. Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.
 - c. Portable Pipe Hangers.
 2. Base: Stainless steel.
 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:
 - a. Portable Pipe Hangers.
2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.9 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 1. C & S Mfg. Corp.
 2. HOLDRITE Corp.; Hubbard Enterprises.
 3. Samco Stamping, Inc.

2.10 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.11 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 2. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 3. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 4. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 5. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 6. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

7. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - a. Inserts shall be steel, slotted type and factory-painted.
 - 1) Single rod shall be equal to Anvil International Fig. 281.
 - 2) Multi-rod shall be equal to Carpenter Patterson Multi-Strut Concrete Inserts with Series 1000 end caps and closure strips.
 - 3) Clip form nails flush with inserts.
 - 4) Maximum loading including pipe, contents and covering shall not exceed 75% of rated insert capability.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
 16. Supports from Steel Decks:
 - a. Refer to detail on drawings for supports from steel decks.
 - b. Support piping from steel deck with metal deck ceiling bolt, equal to Carpenter and Patterson Figure 143.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Plastic Piping/Hanger Installation:
 - 1. Continuous supports may be used instead of closely spaced supports.
 - 2. Provide continuous supports constructed of galvanized steel channel, angle iron or No. 18 USSG trough supported by “Clevis” hangers at least every 8 feet for 2 inch and smaller piping, and every 10 feet for larger piping.
 - 3. Provide separate supports at fittings and valves, and brace valves against operating torque.
- C. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- D. Each metal framing system in paragraph below requires calculation and detail.
- E. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

- H. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- I. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section 22 40 00 "Plumbing Fixtures" for plumbing fixtures.
- J. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- L. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- M. Install lateral bracing with pipe hangers and supports to prevent swaying.
- N. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- O. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- Q. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 5. Pipes NPS 8 and Larger: Include wood inserts.
 6. Insert Material: Length at least as long as protective shield.
 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- R. Suspended Horizontal Piping:
1. Support piping independently from structure using heavy iron-hinged type hangers, equal to Anvil International Clevis No. 260.
 2. Provide electroplated solid-band hangers equal to Auto-Grip, for 2-inch and smaller pipe.
 3. Provide trapeze hangers of angles, angles bolted back-to-back, or channels to parallel lines of piping.
 4. Provide wall brackets for wall-supported piping, and furnish pipe saddles for floor-mounted piping.

5. Provide supports with recommended lining for glass piping.
6. Provide supports with copper lining for uninsulated copper piping.
7. Suspend piping from inserts or expansion anchors, using beam clips, steel fish plates, cantilever brackets or other accepted means. Beam clips shall be equal to Anvil International Figures 14, 87, or 134.
8. Suspend piping by rods with double nuts.
9. Provide additional steel framing as required and accepted where overhead construction does not permit fastening hanger rods in required locations.
10. Support branch fixture water piping in chases with copper-plated metal brackets, secured to studs, equal to Holdrite Nos. 102-18, 107-18, 102-26, or 101-26.

3.3 EQUIPMENT SUPPORTS

- A. Mount on or support from accepted foundations and supports, all noted equipment and related piping.
- B. Size, locate, and install noise and vibration isolation equipment in accordance with manufacturer's recommendations and after review.
- C. Select noise and vibration isolation equipment for lowest operating speed of equipment to be isolated.
- D. Ensure that lateral motion under equipment at start-up, shut-down or when unbalanced is no more than a maximum of 1/4 inch.
- E. Provide corrosion resistant mounting systems when exposed to the elements and other corrosive environments. Provide hot dip galvanized metal parts of mountings (except springs and hardware). Provide cadmium-plated and neoprene-coated springs and cadmium-plated nuts and bolts.
- F. Correct noise and vibration problems due to faulty equipment or poor workmanship, as directed, without additional charge to Owner.
- G. Steel Spring Type:
 1. Utilize bare stable springs without restraints.
 2. Provide spring with diameter not less than 80% of loaded operating height of spring.
 3. Design ends of spring so that they remain parallel during and after springs are loaded to their minimum specified deflections.

4. Provide springs with 50% travel from operating deflection before reaching solid height.
 5. Provide spring mounts with 1/4 inch thick waffled neoprene acoustical pad bonded to underside of base plate.
- H. Provide resiliently mounted equipment bases raised to operating height with a minimum of 2 inch of clearance at bottom of base prior to installing equipment.
1. Temporarily support bases on 2-inch thick (minimum) spacer blocks.
 2. Adjust mountings to transfer load from spacer blocks to mountings; remove spacer blocks after equipment installation, but immediately prior to operation.
- I. Concrete inertia blocks with adequate reinforcing steel will be provided under General Construction Work.
- J. Neoprene-In-Shear Isolation Rails: Furnish for horizontal pumps, air compressors, and vacuum pumps when supplied with fractional horsepower motors.
1. Provide top structural iron channel rails with tapped holes to accept machinery foundation bolts supported by properly loaded and located double deflection neoprene-in-shear mountings, equal to Type DNR - M.I.I.
 2. Provide mountings with 3/8 inch minimum static deflection and bolt holes for anchoring onto foundation equal to Type DNR - M.I.I.
- K. Neoprene-In-Shear Supported Concrete Inertia Bases: Provide for horizontal pumps, jockey pumps, air compressors, and vacuum pumps when supplied with one horsepower to three horsepower motors.
- L. Provide a minimum 6-inch thick concrete inertia block supported by double deflection neoprene-in-shear mountings, equal to Type ND - M.I.I., with form as noted for foundations. Bolt and grout equipment to concrete base. Provide minimum static deflection of 1/4 inch.
- M. Spring-Supported, Factory-Fabricated Inertia Bases: Provide for horizontal pumps (except fire pumps), bottom-supported vertical booster pumps, jockey pumps, rotary air compressors and vacuum pumps with five horsepower and larger motors.
1. Provide concrete inertia block with factory-fabricated steel structural perimeter frame, set on roofing paper, with equipment anchor bolt templates and mounting brackets supplied by vibration control manufacturer.

2. Provide and locate under brackets, spring supports with a minimum static deflection of 1 inch and with leveling device to raise entire isolation base 2 inch above foundation.
 3. Provide minimum thickness required for concrete inertia bases as follows:
 - a. Motor Size 5 hp to 15 hp: 6 inch.
 4. Provide assemblies, equal to Type KSL - M.I.I.
- N. Spring supported factory fabricated structural steel bases: Provide for vertical booster pumps suspended from floor slab above and through penetration.
1. Provide equipment rigidly bolted to spring supported reinforced structural base and isolated from suitable framed structural supports erected from floor slab.
 2. Provide reinforced structural steel base constructed with structural members having depth of section not less than 1/12 span between spring mountings and supplied by vibration control manufacturer.
 3. Provide a framed base to permit removal of any pump mounted on structural base.
 4. Provide structural supports erected from floor slab, sized and framed to accept spring mountings and supported loads.
 5. Piping in projected area of isolated structural pump base may be rigidly supported from isolated pump base.
 6. Provide spring mountings designed so that they are capable of supporting equipment at fixed elevation during installation, and adjusted to provide operating clearance in mountings of 1/4 inch, equal to Type SLR - M.I.I.
- O. Center of gravity (C.G.) mounted spring inertia blocks: Provide for piston type air compressors five horsepower and larger.
1. Equipment and its driving motor shall be integrally mounted on spring-supported concrete inertia blocks.
 2. Provide inertia blocks sized to provide sufficient mass so that dynamic movement of equipment block assembly will be less than 1/16 inch peak-to-peak at any connection flange. Form shall be as noted for foundations.
 3. Provide blocks and spring mountings arranged to accomplish dynamically symmetrical system with respect to total C.G. of spring assembly in all three major axes.
 4. Provide steel spring mountings consisting of bare stable springs arranged in pendulum configuration with built-in adjustable side snubbers, leveling device and 1/4 inch thick neoprene acoustical base pad.
 5. Provide mountings with a minimum static deflection corresponding to isolation efficiency of 90% at lowest equipment operating speed.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to a maximum of 1/2 inch.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.

- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
- D. Dip in epoxy primer, uncoated hangers, supports, rods, and inserts.
- E. Epoxy primer shall be Sherwin Williams product, or approved equal, in compliance with the requirements for Low Emitting Paints and Coatings in Section 01 81 13.14.

END OF SECTION 22 05 29

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 48 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Freestanding and restrained spring isolators.
 - 5. Housed spring mounts.
 - 6. Elastomeric hangers.
 - 7. Spring hangers.
 - 8. Spring hangers with vertical-limit stops.
 - 9. Pipe riser resilient supports.
 - 10. Resilient pipe guides.
 - 11. Freestanding and restrained air-mounting system.
 - 12. Restrained vibration isolation roof-curb rails.
 - 13. Restraining braces and cables.
 - 14. Steel and inertia, vibration isolation equipment bases.
 - 15. Braided Flexible pipe connectors.
 - 16. Neoprene Flexible Pipe Connectors.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- D. Life Safety and Hazardous Components - All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems and

mechanical, electrical, plumbing or fire protection systems that support the operation of or are connected to emergency power equipment including all lighting, generators, transfer switches and transformers. Hazardous components include any pipe, vessel, duct or piece of equipment that contains flammable or toxic material.

- E. Component – a part or element of an architectural, mechanical, electrical or structural system.
- F. Positive Attachment – a cast in place anchor, a drill in wedge anchor, a chemical anchor, a double sided beam clamp loaded perpendicular to the beam or a welded or bolted connection to the structure.
- G. Special Inspection – inspection of the materials, installation, fabrication or placement of components and anchorage.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 - 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
 - 4. Catalog cuts and data sheets on specific vibration isolators and restraints to be utilized showing compliance with specifications.
 - 5. An itemized list showing the items of equipment or piping to be isolated, the isolator type and model number selected, isolator loading and deflection, and reference to specific drawings showing base and construction where applicable.
 - 6. restraint calculations and structural or civil engineers stamp verifying design and calculations for seismic restraining system used.
 - 7. Drawings showing equipment base construction for each piece of equipment, including dimensions, structural member sizes and support point locations.
 - 8. Drawing showing methods of suspension, support guides for piping.
 - 9. Drawings showing methods for isolation of pipes piercing walls and slabs.
 - 10. Concrete and steel details for bases including anchor bolt locations.
 - 11. Number and location of restraints and anchors for each piece of equipment.
 - 12. Specific details of restraints including anchor bolts for mounting and maximum loading at each location, for each piece of equipment and or pipe.

- B. Delegated-Design Submittal: For vibration isolation details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, and wind restraints, and for designing vibration isolation bases.
 - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes,. Include certification that riser system has been examined for excessive stress and that none will exist.
 - 3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
- C. Coordination Drawings: Show coordination of seismic bracing for PLUMBING piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
- D. Welding certificates.
- E. Qualification Data: For professional engineer and testing agency.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based

on independent testing are preferred. Calculations (including combining shear and tensile loads) to support -restraint designs must be signed and sealed by a qualified professional engineer.

- D. It is the objective of this Specification to provide the necessary design for the seismic restraint and control of excessive noise and vibration in the buildings due to the operation of machinery or equipment, and/or due to interconnected piping. The installation of all vibration isolation units, and associated hangers and bases, shall be under the direct supervision of the vibration isolation manufacturer's representatives.
1. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
 2. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50 percent above the design deflection.
 3. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as whole by more than plus or minus 10 percent.
 4. All neoprene mountings shall have a shore hardness of 30 to 60 plus or minus 5, after minimum aging of 20 days or corresponding oven aging.

1.6 MANUFACTURER RESPONSIBILITIES

- A. Manufacturer of vibration isolation control equipment shall have the following responsibilities:
1. Determine vibration isolation restraint sizes and locations.
 2. Provide piping and equipment isolation systems restraints as scheduled or specified.
 3. Guarantee specified isolation system deflection.
 4. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
 5. Purchased and/or fabricated equipment must be designed to safely accept external forces of one-half "G" load in any direction for all rigidly and resiliently supported equipment and piping without failure and permanent displacement of the equipment. Life safety equipment including, but not limited to, fire pumps, sprinkler piping, and machinery must be capable of safely accepting external forces up to one "G" load in any direction without permanent displacement of the supported equipment. Substitution of "Internally Isolated" mechanical equipment in lieu of the specified isolation of this Section must be approved for individual equipment units and is acceptable only if above accelerations are certified in

writing by equipment manufacturer and stamped by a licensed civil or structural engineer.

1.7 CONTRACTOR RESPONSIBILITIES

- A. The Contractor performing the work on equipment in the section shall have the following responsibilities.
1. Identify the components that are part of the Quality Assurance Plan.
 2. All electrical components for standby or emergency power systems.
 3. Identify all Special inspection and Testing.
 4. List control procedures within the contractor's organization including methods and frequency of reporting and their distribution.
 5. List personnel and their qualifications exercising control over the seismic aspects of the project.
 6. Purchased and/or fabricated equipment must be designed to safely accept external forces of one "G" load in any direction for all rigidly and resiliently supported life safety or hazardous equipment components, piping and ductwork without failure and permanent displacement of the equipment.

PART 2 - PRODUCTS

- 2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
 2. Kinetics Noise Control.
 3. Mason Industries.
 4. Vibration Eliminator Co., Inc.
 5. Vibration Mountings & Controls, Inc.
- B. Vibration Isolator Types:
1. Type A: Spring isolators shall incorporate the following:
 - a. Minimum diameter of 0.8 of the loaded operating height.
 - b. Corrosion resistance where exposed to corrosive environment with:
 - 1) Springs cadmium plated or electro-galvanized.

- 2) Hardware cadmium plated.
 - 3) All other metal parts hot-dip galvanized.
- c. Reserve deflection (from loaded to solid height) of 50 percent of rated deflection.
 - d. Minimum 1/4 inch thick neoprene acoustical base pad on underside, unless designated otherwise.
 - e. Designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.
 - f. Non-resonant with equipment forcing frequencies or support structure natural frequencies.
 - g. Spring isolators to be Mason Type SLF, or as approved.
 - h. This isolator must be accompanied by seismic isolator Type II.
2. Type B: Spring isolators shall be same as Type A, except:
- a. Provide built-in vertical limit stops with minimum 1/4 inch clearance under normal operation.
 - b. Tapped holes in top plate for bolting to equipment when subject to wind load.
 - c. Capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be identical.
 - d. Adjustable and removable spring pack with separate neoprene pad isolation.
 - e. Housing shall be designed to accept 1 G of acceleration.
 - f. Mason Type SLR, or as approved.
3. Type F: Combination spring/elastomer hanger rod isolators to incorporate the following:
- a. Spring and neoprene isolator elements in a steel box retainer. Neoprene of double deflection type. Single deflection is unacceptable. Spring seated in a neoprene cup with extended rod bushing.
 - b. Characteristics of spring and neoprene as describe in Type A and Type E isolators.
 - c. Mason Type 30N, or as approved.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
 2. Kinetics Noise Control.
 3. Mason Industries.
 4. Vibration Eliminator Co., Inc.
 5. Vibration Mountings & Controls, Inc.

B. Type B-1: Integral Structural Steel Base

1. Reinforced, as required, to prevent base flexure at start-up and misalignment of drive and driven units. Centrifugal fan bases complete with motor slide rails. Drilled for drive and driven unit mounting template.
2. Mason Type M, WF, or as approved.

C. Type B-2: Concrete Inertia Base

1. Concrete inertia bases shall be formed in a structural steel perimeter base, reinforced as required to prevent flexure, misalignment of drive and driven unit or stress transfer into equipment. The base shall be complete with motor slide rails, pump base elbow supports, and complete with height saving brackets, reinforcing, equipment bolting provisions and isolators.
2. Minimum thickness of the inertia base shall be according to the following tabulation:

Motor Size (hp)	Minimum Thickness (in)
5-15	6
20-50	8

2.4 FLEXIBLE CONNECTORS

A. Elastomer Type FC-1:

1. Manufactured of nylon tire cord and EPDM both molded and cured with hydraulic presses.
2. Straight connectors shall have two spheres reinforced with a molded-in external ductile iron ring between spheres.
3. Elbow shall be long radius reducing type.
4. Rated 250 psi at 170 degrees F dropping in a straight line to 170 psi at 250 degrees F for sizes 1-1/2 inch to 12 inch elbows. Elbows shall be rated no less than 90 percent of straight connections.
5. Sizes 10 inches to 12 inches to employ control cables with neoprene end fittings isolated from anchor plates by means of 1/2 inch bridge bearing neoprene bushings.
6. Minimum safety factor, 4 to 1 at maximum pressure ratings.
7. Submittals shall include test reports.
8. Mason Type MFTNC Superflex.

2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic- and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support -Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits.

3.3 VIBRATION-CONTROL -RESTRAINT DEVICE INSTALLATION

- A. Equipment Restraints:

1. Install seismic snubbers on PLUMBING equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Piping Restraints:
1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- E. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- G. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
 9. Test and adjust air-mounting system controls and safeties.
If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 01 Section "Demonstration And Training."

3.7 PLUMBING VIBRATION-CONTROL RESTRAINT DEVICE SCHEDULE

Type of Equipment	Below Grade		Above Grade	
	Isolation Type	Deflection	Isolation Type	Deflection
Pumps up to 15 HP	D-J	0.4 inch	B or SR Type I and Base Type J	1 inch
Pumps 20 HP and Higher	B or SR Type I and Base Type B-2	1 inch	B or SR Type I and Base Type B-2	2 inches
All Piping in MER	Type I and SR Type III	1 inch	Type I and SR Type III	2 inches
Piping Flexible Connectors for Pumps	FC-1	--	FC-1	--

END OF SECTION 23 05 48

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Work in the Following Sections:
 - 1. Section 22 05 19: "Meters and Gages for Plumbing Piping"
 - 2. Section 22 05 23: "General-Duty Valves for Plumbing Piping"
 - 3. Section 22 11 16: "Domestic Water Piping"
 - 4. Section 22 11 23: "Domestic Water Pumps"
 - 5. Section 22 11 23.13: "Domestic-Water Packaged Booster Pumps"
 - 6. Section 22 13 16: "Sanitary Waste and Vent Piping"
 - 7. Section 22 14 13: "Facility Storm Drainage Piping"
 - 8. Section 22 14 29: "Sump Pumps"
 - 9. Section 22 33 00: "Electric Domestic Water Heaters"

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Signs and labels.
 - 3. Pipe labels.
 - 4. Valve tags.
 - 5. Valve charts.
 - 6. Warning Signs.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.

- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
 - D. Valve (tag) numbering scheme.
 - E. Valve Schedules: For each piping system to include in maintenance manuals.
- 1.4 QUALITY ASSURANCE
- A. Comply with local building code.
- 1.5 COORDINATION
- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
 - B. Coordinate installation of identifying devices with locations of access panels and doors.
 - C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

- 2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Seton Nameplate Corp. Style No. M45 Series or an equal product by one of the following.
 - a. Brady.
 - 2. Description:
 - a. Material and Thickness: Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - b. Letter Color: White.
 - c. Background Color: Blue.

- d. Label Size: Length and width vary for required label content, Sized 3/4 inch x 2-1/2 inch, 1 inch x 3 inch, 1-1/2 inch x 4 inch or 3 inch x 6 inch as necessary to identify item.
- e. Minimum Engraved Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- f. Fasteners: Stainless-steel rivets.
- g. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Seton Nameplate Corp. Style No. M5300 Series or an equal product by one of the following.
 - a. Brady.
2. Description:
 - a. Material and Thickness: Plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware. Outdoor grade acrylic plastic to withstand weather, abrasion, grease, acid, chemical and other corrosive conditions.
 - b. Letter Color: Black.
 - c. Background Color: White.
 - d. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - e. Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - f. Minimum Engraved Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - g. Fasteners: Stainless-steel rivets.
 - h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's name, drawing designation or unique equipment identification number, plus the project number in which the equipment was installed (e.g. BP-447).

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans and details), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3 WARNING SIGNS AND LABELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Seton Nameplate Corp. or an equal product by one of the following.
1. Brady.
- B. Description:
1. Material and Thickness: Plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 2. Letter Color: White.
 3. Background Color: Red.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 9. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4 PIPE LABELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Seton Nameplate Corp. or an equal product by one of the following.
1. Brady.
- B. Description:
1. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
 2. Comply with ANSI A13.1-1981, "Scheme for Identification of Piping Systems" and OSHA requirements, or as otherwise indicated.
 3. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
 - a. Factory fabricated, snap-on type pipe markers every 10 feet indicating system and direction of flow. The pipe markers shall be the weather-proof plastic type and shall not be used where surface temperature exceeds 160 deg F.
 - b. Pipe markers shall be equal to the following types:
 - 1) Smaller than 6 inch: Setmark SNA, completely encircling pipe.

- 2) 6 inch and larger: Setmark STR, stainless steel spring fasteners.
- 3) Adhesive type markers will not be permitted.
- 4. Pipe Label Contents: Include identification of piping service using same designations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

C. Markers: Legends or arrows painted with stencils are not acceptable. Markers must have approved color coded background, proper color of legend in relation to background color and flow arrow indicator. Markers higher than 12 feet above the floor shall have minimum 2 inch letters. Markers shall comply with the following table:

IDENTIFICATION MARKER SIZES

O.D. of Pipe or Covering	Length of Color Field	Size of Letters
3/4 to 1-1/4 inch	8 inches	1/2 inch
1-1/2 to 2 inches	8 inches	3/4 inch
2-1/2 to 6 inches	12 inches	1-1/4 inch
above 6 inches	12 inches	2 inches

1. .

2.5 VALVE TAGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Seton Nameplate Corp. or an equal product by one of the following.
 - 1. Brady
 - 2. Description:
 - a. Valve Tags: Stamped or engraved with 1/4-inch bold black letters for piping system abbreviation and 1/2-inch numbers.
 - 1) Tag Material: 2 inch square Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2) Fasteners: Aluminum wire-link chain and S-hook.

2.6 VALVE CHART

- A. For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Mount charts, diagrams, and/or lists, in aluminum frame with clear plastic lamination covering diagrams and/or lists.
 - 2. Letter and number equipment, valves and controls to correspond with designations on metal tags and/or nameplates.
 - 3. Fasten permanently in locations, as directed by Owner, with four brass screws.
 - 4. Valve-tag schedule shall be included in operation and maintenance manual.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of plumbing equipment, and for gauges, meters, valve boxes, instruments, control devices, pilot lamps, transmitters, motor controllers, and panel-mounted equipment.
- B. Locate equipment labels where accessible and visible.

3.3 SIGNS AND LABELS

- A. Write required message on, and attach warning tags to, equipment and other items where required or requested.

3.4 WARNING-SIGNS

- A. Write required message on, and attach warning tags to, equipment and other items where required or requested.

3.5 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Sections 09 91 13 "Exterior Painting" and 09 91 23 "Interior painting"
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, access hatches, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment. Pipe identification text shall be repeated at maximum intervals of 25 feet and at each point where the piping passes through a wall, floor or roof.
 - 7. Where removable ceiling tiles are provided, install buttons, tabs, or markers to identify location of concealed work and/or valves. Submit for review.
 - 8. Where two or more water distribution systems, one potable water and the other nonpotable water, are installed, each system shall be identified either by color marking or metal tags.
 - 9. Identification shall include the contents of the piping system and an arrow indicating the direction of flow.
- C. Pipe Label Designations & Color Coding:

DESIGNATION	BACKGROUND	TEXT
Domestic Cold Water	Green	White
Domestic Hot Water	Yellow	Black
Domestic Hot Water Return	Yellow	Black
Tempered Water	Yellow	Black
Tempered Water Return	Yellow	Black
Chilled Drinking Water	Green	White

DESIGNATION	BACKGROUND	TEXT
Chilled Drinking Water Return	Green	White
Storm Water	Black	White
Sanitary	Brown	White
Vent	Brown	White
Grease Waste	Grey	White
Natural Gas	Yellow	Black
Medium Pressure Natural Gas	Brown	Black

3.6 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; fixture stop valves; hose bibbs; lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a framed valve chart.
- B. Valve-Tag Application Chart: Tag valves according to size, shape, and color scheme and with captions similar to those indicated.

END OF SECTION 22 0553

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Insulation Materials:
 - a. Cellular glass.
 - b. Flexible elastomeric.
 - c. Mineral fiber.
 - d. Calcium silicate.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied jackets.
9. Tapes.
10. Securements.
11. Corner angles.

- B. Related Sections include the following:

1. Division 23 Section 23 07 19 "HVAC Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".

1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content.
 2. Product Data: Documentation for Low Emitting Materials.
 - a. Low Emitting Materials for Adhesives and Sealants.
 3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's).
 - b. Corporate Sustainability Reporting (CSR's).
- C. Shop Drawings:
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 2. Detail attachment and covering of heat tracing inside insulation.
 3. Detail insulation application at pipe expansion joints for each type of insulation.
 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 6. Detail application of field-applied jackets.
 7. Detail application at linkages of control devices.
 8. Detail field application for each equipment type.
- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
1. Sample Sizes:
 - a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
 - b. Sheet Form Insulation Materials: 12 inches square.
 - c. Jacket Materials for Pipe: 12 inches long by NPS 2.
 - d. Sheet Jacket Materials: 12 inches square.
 - e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
- E. Qualification Data: For qualified Installer.
- F. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- G. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Engineer. Use materials indicated for the completed Work.
 - 1. Piping Mockups:
 - a. One 10-foot section of NPS 2 straight pipe.
 - b. One each of a 90-degree threaded, welded, and flanged elbow.
 - c. One each of a threaded, welded, and flanged tee fitting.
 - d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
 - e. Four support hangers including hanger shield and insert.
 - f. One threaded strainer and one flanged strainer with removable portion of insulation.
 - g. One threaded reducer and one welded reducer.
 - h. One pressure temperature tap.
 - i. One mechanical coupling.
 - 2. Equipment Mockups: One tank or vessel.
 - 3. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
 - 4. Notify Engineer seven days in advance of dates and times when mockups will be constructed.
 - 5. Obtain Engineer's approval of mockups before starting insulation application.
 - 6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.

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

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.
- C. Refer to section 01 35 46 "Indoor Air Quality Management" for material storage protocol.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. All insulation, jackets and adhesives used shall comply with the requirements of ASTM E-84 with a maximum flame spread rating of 25 and a maximum smoke developed/fuel contributed rating of 50. Insulation on piping exposed in boiler rooms, mechanical equipment rooms, air handling equipment rooms, etc. or exposed on the exterior of the building shall be cellular glass.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cell-U-Foam Corporation; Ultra-CUF.
 - b. Pittsburgh Corning Corporation; Foamglas Super K.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

- H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Microlite.
 - b. Owens Corning; All-Service Duct Wrap.

- I. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; HTB 23 Spin-Glas.
 - b. Owens Corning; High Temperature Flexible Batt Insulations.
 - c. Fibrex Insulations Inc.; FBX.

- J. Mineral-Fiber, Preformed Pipe Insulation:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Owens Corning; Fiberglass Pipe Insulation.
 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

- K. Mineral-Fiber Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; MicroFlex.
 - b. Knauf Insulation; Pipe and Tank Insulation.
 - c. Owens Corning; Fiberglas Pipe and Tank Insulation.

L. Calcium Silicate:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Industrial Insulation Group (The); Thermo-12 Gold.
 - b. Johns Manville; MicroFlex.
 - c. Promat Inc.
2. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

2.3 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, available manufacturer's products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Knauf insulation ECOSEAL Plus.
 - b. Tremco, Inc.
 - c. Owner Approved CDPH compliant Substitution.

2.4 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Low Emitting Adhesives and Sealants

1. Provide Manufacturer statements that confirm the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
2. Refer to Section 01 81 13.14 "Sustainable Design Requirements – LEED v4 BD+C" for additional requirements.

- C. Cellular-Glass Adhesive: . Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company.
 - b. Alternate product meeting specified requirements and the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario for indoor applications.
 2. For indoor applications, adhesive shall comply with the requirements of section 01 81 13.14 "Sustainable Design Requirements – LEED v4 BD+C" for additional requirements.
- D. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company No.30-65.
 - b. Childers products No. CP-34.
 - c. Alternate product meeting specified requirements and the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario for indoor applications.
 2. For indoor applications, adhesive shall comply with the requirements of section 01 81 13.14 "Sustainable Design Requirements – LEED v4 BD+C" for additional requirements.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products No. CP-34.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company No. 30-65.
 - b.
 - c. Alternate product meeting specified requirements and the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario for indoor applications.
 2. For indoor applications, adhesive shall comply with the requirements of section 01 81 13.14 "Sustainable Design Requirements – LEED v4 BD+C" for additional requirements.
- F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-34.
 - b. Foster Products Corporation, H. B. Fuller Company No. 30-65.
 - c. Alternate product meeting specified requirements and the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario for indoor applications.
2. For indoor applications, adhesive shall comply with the requirements of section 01 81 13.14 "Sustainable Design Requirements – LEED v4 BD+C" for additional requirements.

2.5 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company.
 - b. Alternate product meeting specified requirements and the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario for indoor applications.
 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.08 perm at 45-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg .
 4. Solids Content: ASTM D 1644, 48 percent by volume and 62 percent by weight.
 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company No. 30-65.
 - c. Mon-Eco Industries, Inc.
 - d.
 - e. Alternate product meeting specified requirements and the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario for indoor applications.
 2. Water-Vapor Permeance: ASTM E 96, 0.08 perms at 44 mils dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 48% by volume and 62% by weight.
 5. Color: White.
- D. For indoor applications, mastics shall comply with the requirements of section 01 81 13.14 "Sustainable Design Requirements – LEED v4 BD+C" for additional requirements.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company No. CP_34.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company No. CP 30-65.
 - c. Alternate product meeting specified requirements and the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario for indoor applications.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 20 to plus 180 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall comply with the requirements of section 01 81 13.14.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company No. CP-34.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company No. CP 30-65.
 - c. Alternate product meeting specified requirements and the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario for indoor applications.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 20 to plus 180 deg F.

22 07 00 - 10

5. Color: Aluminum.
 6. For indoor applications, sealants shall comply with the requirements of section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BC + D".
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company.
 - b. Alternate product meeting specified requirements and the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario for indoor applications.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 20 to plus 180 deg F.
 5. Color: White.
 6. For indoor applications, sealants shall comply with the requirements of section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BC + D".

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.
1. Products: Subject to compliance with requirements, provide one of the following:

- a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
- b. Vimasco Corporation; Elastafab 894.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
2. Sheet and roll stock ready for shop or field sizing.
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
5. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.

- b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

2.11 SECUREMENTS

- A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 thick by 2 inches square.
 - c. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) GEMCO; Nylon Hangers.

22 07 00 - 14

- 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
 - 3) Owner approved substitution
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.

2.12 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield. Refer to Section 22 11 16 "Domestic Water Piping" for shield sizes.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services (i.e. cold water, chilled water, insulated storm water, and other frost protected services), apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.

5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 3. Protect exposed corners with secured corner angles.
 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.

- c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
 7. Stagger joints between insulation layers at least 3 inches.
 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 2. Seal longitudinal seams and end joints.
- C. Insulation Installation on Pumps:
1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter

fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.

2. Fabricate boxes from galvanized steel, at least 0.0396 inch thick (20 Gage).
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 CELLULAR-GLASS INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

22 07 00 - 24

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.10 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- D. Where PVDC jackets are indicated, install as follows:
 - 1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 - 2. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 - 3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 - 4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 - 5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.11 FINISHES

- A. Equipment and Pipe Insulation with ASJ, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections 09 91 13 "Exterior Painting" and 09 91 23 "Interior painting"
- B. .
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- C. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

- D. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- E. Do not field paint aluminum or stainless-steel jackets.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect field-insulated equipment, randomly selected by Architect and/or Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - 2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect and/or Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.13 DOMESTIC WATER BOILER BREECHING INSULATION SCHEDULE

- A. Round, exposed breeching and connector insulation: High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
- B. Round, concealed breeching and connector insulation: High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.

3.14 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- C. Domestic water pump insulation: Cellular Glass: 2 inches thick.
- D. Domestic water hydropneumatic tank insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Pipe and Tank: 1 inch thick.
- E. Domestic hot-water storage tank insulation: Mineral-fiber pipe and tank of thickness to provide an R-value of 12.5.

3.15 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces, only where noted.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
- C. Soundproof piping in walls and ceilings of as noted for insulation on respective service, except with a minimum 2 inch thick fiberglass, or as recommended by an acoustic consultant.

3.16 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water: Not required.
- B. Domestic Hot, Tempered, and Recirculated Hot and Tempered Water:
 - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Storm water and Overflow: Insulation shall be the following: Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

- D. Roof Drain and Overflow Drain Bodies: Insulation shall be the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. Pre-formed insulation for ADA traps and fittings, equal to Procap.
 - F. Condensate and Equipment Drain Water below 60 Deg F: Insulation shall be the following: Flexible Elastomeric: 3/4 inch thick.
 - G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg : Insulation shall be the following: Flexible Elastomeric: 3/4 inch thick.
- 3.17 OUTDOOR, EXPOSED, OR WITHIN AN EXPOSED PARKING GARAGE ABOVEGROUND PIPING INSULATION SCHEDULE
- A. Exposed sanitary traps: Insulation shall be the following:
 - 1. Cellular Glass: 1 inches thick on top of heat tracing
 - B. Domestic Water Piping: Insulation shall be the following:
 - 1. Cellular Glass: 1 inches thick on top of heat tracing.
- 3.18 UNDERGROUND AND ABOVE GROUND GREASE WASTE PIPING INSULATION SCHEDULE
- A. Underground and above ground grease waste: Insulation shall be the following:
 - 1. Cellular Glass: 1.5 inches thick on top of heat tracing
- 3.19 INDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 - B. If more than one material is listed, selection from materials listed is Contractor's option.
 - C. Equipment, Concealed: None.
 - D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Stucco Embossed: 0.016 inch thick.

- E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. None.
 - 2. Aluminum, Stucco Embossed with 1-1/4-Inch- Deep Corrugations 0.040 inch thick.
- F. Piping, Concealed: None.
- G. Piping, Exposed:
 - 1. Aluminum Stucco Embossed: 0.016 inch thick.

3.20 OUTDOOR AND UNDERGROUND, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Equipment, Concealed: None.
- D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Stucco Embossed with Z-Shaped Locking Seam: 0.020 inch thick.
- E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Aluminum, Stucco Embossed with 1-1/4-Inch- Deep Corrugations 0.032 inch thick.
- F. Piping, Concealed: None.
- G. Piping, Exposed:
 - 1. Aluminum, Stucco Embossed with Z-Shaped Locking Seam 0.020 inch thick.

END OF SECTION 22 0700

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes water distribution piping and related components inside the building for the domestic water piping system to 5 feet outside the building.
 - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Encasement for piping.
 - 3. Specialty valves.
 - 4. Transition fittings.
 - 5. Dielectric fittings.
 - 6. Flexible connectors.
 - 7. Water meters furnished by utility company for installation by Contractor.
 - 8. Water meters.
 - 9. Escutcheons.
 - 10. Sleeves and sleeve seals.
 - 11. Wall penetration systems.
- B. Related Section:
 - 1. Division 22 Section 22 05 23 "General Duty Valves for Plumbing Piping."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants

3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Water Samples: Specified in "Cleaning" Article.
- D. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 1. Fire-suppression-water piping.
 2. Domestic water piping.
 3. HVAC hydronic piping.
 4. HVAC ductwork.
- E. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.
- C. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be manufacturer designed and supplied by the same manufacturer as the grooved components.
 1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability
 2. Inspection Requirement for Grooved Piping Systems:
 - a. A manufacturer's factory trained representative (a direct employee of the manufacturer) shall periodically visit the job site and review the installation for best practices. This shall be at the expense of the installing contractor. The installing Contractor shall correct any identified deficiencies
 - b. Product that has been examined and has not met the visual inspection criteria for proper installation must be corrected and re-examined by Inspection Services prior to the completion of the project. Any product that has not been corrected or was not examined will not be considered as part of the successful completion of Inspection Services. Any products that require a torque per written manufacturer's installation instructions shall be verified as

torqued with a properly-certified torque wrench

- c. At the completion of system inspection, a report shall be provided to the project team and a long-term installation warranty may be provided to the Owner covering inspected joints

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owners Authorized Representative (OAR) no fewer than five days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without OAR written permission.

1.6 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

- 2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type K (**ASTM B 88M, Type B**) water tube, drawn temper.
 - 1. Copper Pressure-Seal-Joint Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems. (Propress)
2. Above ground only.
 3. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 4. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 2. Product Data: Documentation for Leadership Extraction Practices in the following:
 1. Leadership Extraction Practices for Recycled Content. Recycled Content value shall total no less than 35% post + 1/2 pre-consumer content of the material.
 2. Provide material cost data for all copper pipe.
 3. Grooved-Joint Copper Tube Appurtenances:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Victaulic
 - 2) Owner-approved Substitution
 2. Aboveground only
 3. NPS 2 to NPS 8: Fittings ASTM B 75 copper tube or ASTM B 152 wrought copper fittings with copper tubing sized grooved ends
 4. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections cast with offsetting, angle-pattern bolt pads to provide system rigidity upon visual metal-to-metal bolt pad contact with no torque requirement, coated with copper-colored enamel, Grade EHP EPDM-synthetic rubber gasket UL classified in accordance with ANSI/NSF61 for hot (180F) and cold (86F) water, and bolts and nuts. Victaulic Style 607 or Owner approved Substitution.
- B. C. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
1. Copper Pressure-Seal-Joint Fittings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems. (Propress)

2. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
3. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.4 DUCTILE-IRON PIPE AND FITTINGS

- A. Product Data: Documentation for Leadership Extraction Practices in the following:
 1. Leadership Extraction Practices for Recycled Content. Recycled Content value shall total no less than 35% post + 1/2 pre-consumer content of the material.
 2. Provide material cost data for all ductile iron pipe.
- B. Mechanical-Joint, Thickness Class 54, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.
 2. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.
 1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
 1. Gaskets: AWWA C111, rubber.
 2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.
 1. Gaskets: AWWA C111, rubber.
- D. Plain-End, Ductile-Iron Pipe: AWWA C151.
 1. Grooved-Joint, Ductile-Iron-Pipe Appurtenances:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Victaulic Company.
 - 2) Owner approved substitution.
 2. Grooved-End, Ductile-Iron Fittings: ASTM A 536, ductile-iron castings with dimensions matching pipe.

3. Grooved-End, Ductile-Iron-Pipe Couplings: AWWA C606 for ductile-iron-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.5 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.6 CORROSION-PROTECTION PIPING ENCASEMENT

- A. Encasement for Underground Metal Piping:
 1. Standards: ASTM A 674 or AWWA C105.
 2. Form: Sheet or tube.
 3. Material: LLDPE film of 0.008-inch minimum thickness, or high-density, crosslaminated PE film of 0.004-inch minimum thickness.
 4. Color: Natural.

2.7 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section 22 05 23 "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section 22 11 19 "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.8 TRANSITION FITTINGS

- A. General Requirements:

1. Same size as pipes to be joined.
 2. Pressure rating at least equal to pipes to be joined.
 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.9 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
1. Description:
 1. Pressure Rating: 150 psig at 180 deg F.
 2. End Connections: Compatible with pipes to be joined.
 2. Shall be listed under ASSE Standard No. 1079.
- C. Dielectric Flanges:
1. Description:
 1. Factory-fabricated, bolted, companion-flange assembly.
 2. Pressure Rating: 150 psig minimum.
 3. End Connections: Compatible with pipes to be joined.
- D. Dielectric-Flange Kits:
1. Description:
 1. Nonconducting materials for field assembly of companion flanges.
 2. Pressure Rating: 150 psig.
 3. Gasket: Neoprene or phenolic.
 4. Bolt Sleeves: Phenolic or polyethylene.
 5. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
1. Description:
 1. Galvanized-steel coupling.

2. Pressure Rating: 300 psig at 225 deg F.
3. End Connections: Female threaded.
4. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

1. Description:
 1. Electroplated steel nipple complying with ASTM F 1545.
 2. Pressure Rating: 300 psig at 225 deg F.
 3. End Connections: Male threaded or grooved.
 4. Lining: Inert and noncorrosive, propylene.
 5. Unlined copper-silicone casting alternative.

2.10 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.11 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

D. One Piece, Stamped Steel: Chrome-plated finish with setscrew.

E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.

- F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew.
- G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.12 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- F. Galvanized-Steel-Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- G. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.13 SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.14 WALL PENETRATION SYSTEMS

- A. Description: Wall-sleeve assembly, consisting of housing and gland, gaskets, and pipe sleeve.
 - 1. Carrier-Pipe Deflection: Up to 5 percent without leakage.
 - 2. Housing: Ductile-iron casting with hub, waterstop, anchor ring, and locking devices. Include gland, bolts, and nuts.
 - 3. Housing-to-Sleeve Gasket: EPDM rubber.
 - 4. Housing-to-Carrier-Pipe Gasket: AWWA C111, EPDM rubber.
 - 5. Pipe Sleeve: AWWA C151, ductile-iron pipe or ASTM A 53, Schedule 40, zinc-coated steel pipe.
- B. Product Data: Documentation for Leadership Extraction Practices in the following:
 - 1. Leadership Extraction Practices for Recycled Content. Recycled Content value shall total no less than 10% post + ½ pre-consumer content of the material. See concrete section 03 30 00 "Cast-In-Place Concrete" for additional information.

GROUT

- C. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- D. Characteristics: Nonshrink; recommended for interior and exterior applications.
- E. Design Mix: 5000-psi, 28-day compressive strength.
- F. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section 31 20 00 "Earth Moving for Building Slabs" for excavating, trenching, and backfilling

PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and

calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section 22 05 19 "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section 22 11 19 "Domestic Water Piping Specialties" for drain valves and strainers.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section 22 11 19 "Domestic Water Piping Specialties" for pressure-reducing valves.
- H. Install domestic water piping level and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping adjacent to equipment and specialties to allow service and maintenance.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions or grooved-joint couplings in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section 22 05 19 "Meters and Gages for Plumbing Piping" for pressure gages.
- T. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section 22 11 23 "Domestic Water Pumps" for thermostats.
- U. Install thermometers on outlet piping from each tank type water heater. Comply with requirements in Division 22 Section 22 05 19 "Meters and Gages for Plumbing Piping" for thermometers.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel or groove plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- E. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

- G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- H. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints. Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and recommendations. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be developed and supplied by the system manufacturer. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove. A factory trained field representative shall provide on-site training to contractor's field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products

3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section 22 05 23 "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section 22 11 19 "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section 22 11 19 "Domestic Water Piping Specialties" for calibrated balancing valves.

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.

2. NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.6 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.7 WATER METER INSTALLATION

A. Rough-in domestic water piping, and install water meters according to utility company's requirements.

B. Install water meters according to AWWA M6, utility company's requirements, and the following:

C. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

D. Install turbine-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

E. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 5 feet with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 6 feet with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 8 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 9 feet with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 7 feet with 3/8-inch rod.
 - 2. NPS 1-1/2: 9 feet with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
 - 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- G. Install supports for vertical steel piping every 15 feet.

- H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons on exposed piping for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
 - 5. Bare Piping in Equipment Rooms: One piece, cast brass.
 - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.11 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
 - 1. Extend sleeves 2 inches above finished floor level.
 - 2. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Use Fire Barrier water tight sealants by 3M where sleeves do not fit inside the wall.
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:

1. PVC pipe sleeves for pipes smaller than NPS 6.
2. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
3. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.

4. Sleeves for Piping Passing through Concrete Roof Slabs Steel pipe.
5. Sleeves for Piping Passing through Exterior Concrete Walls:
 1. Steel pipe sleeves for pipes smaller than NPS 6.
 2. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 3. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 4. Do not use sleeves when wall penetration systems are used.

6. Sleeves for Piping Passing through Interior Concrete Walls:
 1. Steel pipe sleeves for pipes smaller than NPS 6.
 2. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.

- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.12 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.13 WALL PENETRATION SYSTEM INSTALLATION

- A. Install wall penetration systems in new, exterior concrete walls.

- B. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

3.14 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.15 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures or applying pipe insulation.
 - 2. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.16 ADJUSTING

- A. Perform the following adjustments before operation:
 1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.17 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 1. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 2. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

3. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Clean non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 1. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 2. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.18 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges, grooved-joint couplings and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Underground, domestic water, building service piping, NPS 4 and smaller, shall be the following:
1. Soft copper tube, ASTM B 88, Type K wrought-copper solder-joint fittings; and brazed joints.
- D. Underground, domestic water, building-service piping, NPS 4 to NPS 8, shall be one of the following:
1. Push-on-joint, ductile-iron pipe; standard pattern push-on-joint fittings; and gasketed joints.
 2. SCH-80 PVC, may be used in non-traffic areas outside of the building perimeter only, socket fittings; and solvent-cemented joints.
- E. Underground, domestic water piping, NPS 2 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping, NPS 4 and smaller, shall be the following:
1. Hard copper tube, ASTM B 88, Type K, copper pressure-seal-joint fittings; and pressure-sealed joints.
 2. Hard copper tube, ASTM B 88, Type K, grooved joints (down to 2”).
- G. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type K; cast or wrought copper solder-joint fittings; and brazed joints.
 2. Hard copper tube, ASTM B 88, Type K; grooved-joint copper-tube appurtenances; and grooved joints.

3.19 VALVE SCHEDULE

- A. General:
1. Shutoff: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged or grooved ends for piping NPS 2-1/2 and larger.
 2. Throttling: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Hot-Water Circulation Piping, Balancing: Calibrated balancing valves or automatic balancing valves.
 4. Drain: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron or brass grooved-end valves may be used with grooved-end piping.

END OF SECTION 22 11 16

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Temperature-actuated water mixing valves.
 - 6. Strainers.
 - 7. Hose bibbs.
 - 8. Wall hydrants.
 - 9. Post hydrants.
 - 10. Drain valves.
 - 11. Water hammer arresters.
 - 12. Air vents.
 - 13. Trap-seal primer valves.
 - 14. Trap-seal primer systems.
- B. Related Sections include the following:
 - 1. Division 22 Section 22 0519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section 22 11 16 "Domestic Water Piping" for water meters.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
- C. ASSE Compliance: All products shall be listed under the specific ASSE standard.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1001.

3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.
7. Equal to Watts No. 288A.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts Industries, Inc.; Water Products Div.
 - b. Woodford Manufacturing Company.
 - c. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.
6. Equal to Watts No. NF8 or No. 8A.
7. Standard: ASSE 1020.
8. Operation: Continuous-pressure applications.
9. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
10. Size: As scheduled or shown.
11. Design Flow Rate: As scheduled or shown.
12. Selected Unit Flow Range Limits: As scheduled or shown.
13. Pressure Loss at Design Flow Rate: As scheduled or shown.
14. Accessories: Ball type, on inlet and outlet.

2.3 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Wilkins Division/Zurn 30
 - b. Watts Regulator Co. 288A
 - c. Febco Division/CBM 710 or 715
2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: As scheduled or shown.
5. Body: Bronze.
6. End Connections: Union, solder joint.
7. Finish: Rough bronze.

8. Atmospheric vacuum breaker shall be constructed of bronze body with plastic poppet float action as a check valve. The opening to atmosphere at a minimum pressure of 1 psig. All internal parts shall be corrosion resistant and shall be removable or replaceable without removing the unit from the line. The unit shall be suitable for temperatures up to 210 degrees F.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts Industries, Inc.; Water Products Div.
 - b. Zurn Plumbing Products Group; Wilkins Div.
 - c. Owner approved substitution.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: As scheduled or shown.
6. Design Flow Rate: As scheduled or shown.
7. Selected Unit Flow Range Limits: As scheduled or shown.
8. Pressure Loss at Design Flow Rate: As scheduled or shown.
9. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
11. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
12. The reduced pressure backflow preventer shall be a complete assembly consisting of two independently acting spring-loaded toggle lever check valves, an automatic pressure differential relief valve located between the two check valves, two shut-off valves and four test cocks. The operation shall be completely automatic. All internal parts of the toggle lever check valves and pressure differential relief valve shall be removable and replaceable without removing the backflow preventer assembly from the line.

C. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide Watts Regulator Co. LF719 for 3/4 to 2 inch and Watts Regulator Co. LF 709 for 2-1/2 to 10 inches, or approved products by one of the following:

- a. Wilkins Division/Zurn.
 - b. Hersey Products, Inc.
2. Standard: ASSE 1015.
 3. Operation: Continuous-pressure applications, unless otherwise indicated.
 4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
 5. Size: As scheduled or shown.
 6. Design Flow Rate: As scheduled or shown.
 7. Selected Unit Flow Range Limits: As scheduled or shown.
 8. Pressure Loss at Design Flow Rate: As scheduled or shown.
 9. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 11. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 12. The double check valve assembly shall be constructed of corrosion resisting materials. It shall consist of two independently acting spring-loaded poppet check valves, two isolation valves and four test cocks. All internal parts shall be accessible without removing the valves from the line.
- D. Dual-Check-Valve Backflow Preventers:
1. Subject to compliance with requirements, provide Watts SD-3 or products by one of the following:
 - a. Mueller Co.; Water Products Div.
 - b. Zurn Plumbing Products Group; Wilkins Div.
 2. Standard: ASSE 1024.
 3. Operation: Continuous-pressure applications.
 4. Size: See drawings.
 5. Body: Bronze with union inlet.
- E. Hose-Connection Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Woodford Manufacturing Company.

2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

F. Backflow-Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.4 WATER PRESSURE-REDUCING VALVES

A. Water Pressure Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McDonnell & Miller
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Spirax Sarco
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Size: As scheduled or shown.
5. Design Flow Rate: As scheduled or shown.
6. Design Inlet Pressure: As scheduled or shown.
7. Design Outlet Pressure Setting: As scheduled or shown.
8. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
9. Pressure reducing valves shall have a means of externally adjusting the outlet pressure. All internal parts subject to wear shall be replaceable without removing the valve from the piping. Valves shall have an integral low inlet pressure check valve, and shall maintain outlet pressure with varying flow and inlet pressure.
10. 2-1/2 Inch and Smaller: Valves shall be diaphragm actuated, self-contained, single seated, direct acting, spring loaded, with bronze body and stainless steel trim.
11. 3 Inch and Larger: Valves shall be external pilot operated, cast iron body, stainless steel trim, with bronze diaphragm and composition disc.
12. Valves for Booster Heater Water Supply: Include integral bypass.

13. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
14. Valves shall be capable of reducing a varying inlet pressure to a constant-flowing outlet pressure with pressures, as noted, equal to Watts No. 223 and No. SC-N223.

2.5 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. NIBCO INC.
 - b. Hammond Valve.
 - c. Red-White Valve Corp.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. NIBCO INC.
 - b. Hammond Valve.
 - c. Red-White Valve Corp.
2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hammond Valve.
 - b. NIBCO INC.
 - c. Red-White Valve Corp.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
 3. Pressure Rating: 400-psig minimum CWP.
 4. Size: NPS 2 or smaller.
 5. Body: Copper alloy.
 6. Port: Standard or full port.
 7. Ball: Chrome-plated brass.
 8. Seats and Seals: Replaceable.
 9. End Connections: Solder joint or threaded.
 10. Handle: Vinyl-covered steel with memory-setting device.
- E. Automatic Balancing Valves for Hot Water Recirculation:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic
 - b. Owner-approved Substitution
 2. Standard: Certified in accordance with ANSI/NSF 61 and 372
 3. Pressure Rating: 400 psig CWP suitable for working pressures with differential control ranges of 2-32 psi or 5-60 psi.
 4. Sizes: $\frac{1}{2}$ " and $\frac{3}{4}$ "
 5. Body: 300 Series stainless steel
 6. Accuracy: +/- 5% over 95% of the control range

2.6 TEMPERATURE-ACTUATED WATER MIXING VALVES

- A. Water-Temperature Limiting Devices:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Leonard Valve Company.
 - b. Powers; a Watts Industries Co.
 - c. Watts Industries, Inc.; Water Products Div.
 2. Standard: ASSE 1017.
 3. Pressure Rating: 125 psig.
 4. Type: Thermostatically controlled water mixing valve.
 5. Material: Bronze body with corrosion-resistant interior components.
 6. Connections: Union inlets and outlet.

7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: As scheduled or shown.
9. Tempered-Water Design Flow Rate: As scheduled or shown.
10. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Powers; a Watts Industries Co.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting or Cabinet-type as scheduled or shown, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Tempered-Water Setting: As scheduled or shown.
10. Tempered-Water Design Flow Rate: As scheduled or shown.
11. Selected Valve Flow Rate at 45-psig Pressure Drop: As scheduled or shown.
12. Pressure Drop at Design Flow Rate: As scheduled or shown.
13. Valve Finish: Rough bronze.
14. Piping Finish: Copper.
15. Cabinet: Factory-fabricated, stainless steel, for recessed or surface mounting as scheduled or shown and with hinged, stainless-steel door.

C. Manifold, Thermostatic, Water-Mixing-Valve Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Powers; a Watts Industries Co.
2. Description: Factory-fabricated, cabinet-type or exposed-mounting as scheduled or shown, thermostatically controlled, water-mixing-valve assembly in two-valve parallel arrangement.

3. Large-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
4. Intermediate-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
5. Small-Flow Parallel: Thermostatic water mixing valve.
6. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
7. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
8. Component Pressure Ratings: 125 psig minimum, unless otherwise indicated.
9. Cabinet: Factory-fabricated, stainless steel, for recessed or surface mounting as scheduled or shown and with hinged, stainless-steel door.
10. Selected Large Flow, Tempered Water Valve Size: As scheduled or shown.
11. Tempered-Water Setting: As scheduled or shown.
12. Unit Tempered-Water Design Flow Rate: As scheduled or shown.
13. Unit Minimum Tempered-Water Design Flow Rate: As scheduled or shown.
14. Selected Unit Flow Rate at 45-psig Pressure Drop: As scheduled or shown.
15. Unit Pressure Drop at Design Flow Rate: As scheduled or shown.
16. Unit Tempered-Water Outlet Size: As scheduled or shown..
17. Unit Hot- and Cold-Water Inlet Size: As scheduled or shown.
18. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.
19. Piping Finish: Copper.

D. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Powers; a Watts Industries Co.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1016, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: As scheduled or shown.
9. Tempered-Water Design Flow Rate: As scheduled or shown.

E. Primary Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Heat-Timer Corporation.
 - b. Holby Valve Co., Inc.
2. Standard: ASSE 1017, thermostatically controlled tempering valve, listed as tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze.
5. Temperature Control: Manual.
6. Inlets and Outlet: Threaded.
7. Selected Primary Water Tempering Valve Size: As scheduled or shown.
8. Tempered-Water Setting: As scheduled or shown.
9. Tempered-Water Design Flow Rate: As scheduled or shown.
10. Pressure Drop at Design Flow Rate: As scheduled or shown.
11. Tempered-Water Outlet Size: As scheduled or shown.
12. Cold-Water Inlet Size: As scheduled or shown.
13. Hot-Water Inlet Size: As scheduled or shown.
14. Valve Finish: Rough bronze.

2.7 WATER FILTERS

- A. In-line cold water filter for up to 1.3 GPM capable of removing dirt/rust, odor and scale.
 1. Equal to Aqua-Pure No. AP717.
- B. On cold water lines for the following:
 1. Coffee makers.
 2. Electric water coolers.
 3. Refrigerators.
 4. Ice makers.

2.8 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
 1. Wye type shall be full line size of the connecting pipe. Flanged wye-type shall have bolted covers in 2-1/2 through 8 inches and hinged covers in 10 inch and larger. Threaded shall have threaded gasketed caps 2 inches and smaller with NPT blowdown outlet. Provide blowdown valve.
 2. Pressure Rating: 125 psig minimum, unless otherwise indicated.

3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating for NPS 2-1/2 and larger.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
5. Screen: 304 stainless steel with round perforations, unless otherwise indicated.
6. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
 - c. Strainers NPS 5 and Larger: 0.10 inch.

7. Bronze Body with Threaded Connections:

Manufacturer and Model:

	<u>125 SWP/200 WOG</u>	<u>250 SWP/400 WOG</u>
a. Mueller Steam	351	352
b. Spirax/Sarco	BT	TBT
c. Armstrong	F4SC	A1S

8. Bronze Body with Solder Connection: Solder type wye strainers shall be class 250 SWP/400 WOG.

Manufacturer and Model:

- a. Mueller Steam Specialties 11-M
- b. Spirax/Sarco TBT
- c. O.C. Keckley Co. Style F

9. Cast Iron Body with Threaded Connection: Y-type strainers shall be class 250 SWP/300 WOG.

Manufacturer and Model:

- a. Mueller Steam Specialties 11-M
- b. Spirax/Sarco IT
- c. Armstrong Machine Co. A1SC

10. Cast Iron Body with Flanged Connections:

Manufacturer and Model:

	<u>125 SWP/200 WOG</u>	<u>250 SWP/400 WOG</u>
a. Mueller Steam Specialties	751	752
b. Spirax/Sarco	CI	AF
c. Armstrong Machine Works	A1FL-125	A1FL-250

11. Grooved Connection: Ductile iron body, minimum 300 psi working pressure.

Manufacturer and Model:

- a. Victaulic Style 732
 - b. Owner approved substitution.
12. Drain: Provide hose-end drain valve for 3/4 inch or smaller ports. Provide full size blow-down valve and hose-end drain valve if blow-down valve size is greater than 3/4 inch.
 13. 2 Inch and Smaller: Equal to Sarco Type BT or Conbraco 59 Series.
 14. 2-1/2 Inch and Larger: Equal to Sarco IF-125, or 250 psig wsp, equal to Sarco AF-250.

2.9 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms HB-2: Rough bronze, or nickel plated.
9. Finish for Service Areas HB-2: Rough bronze.
10. Finish for Finished Rooms HB-1: Chrome or nickel plated.
11. Operation for Equipment Rooms: Operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include wall flange with each chrome- or nickel-plated hose bibb.

B. Hose bibb HB-3

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Brass Mfg. No. U-25.
 - b. Potter Roemer Fire Pro.
 - s. Fire End & Crocker Corp.
2. Material: Cast brass angle valve.
3. Pressure Rating: 300 psig.

4. Operation: Rising stem with hand wheel.
5. Inlet: NPS 1 ½ female thread.
6. Outlet: NPS 1 ½ male hose thread.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - b. Watts Drainage Products Inc.
 - c. Woodford Manufacturing Company.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Chrome plated.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): One with each wall hydrant.

2.11 POST HYDRANTS

A. Nonfreeze, Sanitary-Type Post Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide J.R. Smith Model 5903 or one of the following:
 - a. Wade, Inc.
 - b. Watts Drainage Products Inc.
 - c. Woodford Manufacturing Company.
2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, exposed-outlet post hydrant.
4. Operation: Lock wheel.

5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Casing: Bronze with casing guard.
7. Inlet: NPS 3/4.
8. Outlet: Garden-hose thread complying with ASME B1.20.7.
9. Drain: Self-contained by draining into the sealed canister.
10. Vacuum Breaker: Nonremovable, drainable, hose-connection; and garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Key(s): One with each loose-key-operation wall hydrant.

2.12 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
10. Equal to NIBCO Inc. T-585-70-66-HC (threaded); NIBCO Inc. S-585-70-66-HC (solder) non-removable vacuum breaker, equal to Watts No. 8A.

2.13 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.
5. Equal to Smith Series No. 5000.
6. Provide 12-inch by 12-inch access panels for each arrester located in inaccessible location.

2.14 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.
7. 3/4 Inch, cast brass construction, 150 psig wwp, equal to Hoffman Specialty No. 78.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.15 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - b. Owner approved substitution.
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
 3. Size: NPS 1-1/4 minimum.
 4. Material: Chrome-plated, cast brass.

2.16 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. PPP Inc.
 - b. Owner approved substitution.
2. Standard: ASSE 1044,
3. Piping: NPS 3/4, ASTM B 88, Type K; copper, water tubing.
4. Cabinet: Recessed or Surface mounting steel box as scheduled or shown, with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: As scheduled or shown.
8. Size Outlets: NPS 1/2.

2.17 AQUASTATS

- A. Immersed type adjustable volatile liquid mercury tube switch equal to Mercoïd Type DA-37-2 Range 5 (1 pole single), equal to Mercoïd Type DA-37-127 Range 5 (2 pole duplex).
- B. Manufacturers:
 1. Paragon Electric Co.
 2. Tork Clock Co.
 3. General Electric Co.
 4. Sangamo Electric Co.
 5. General Controls Co.

2.18 METAL PEDESTAL PET FOUNTAINS WS-1

- A. Designed to withstand the rough conditions with steel support plate, spout locked to stainless steel receptor and protected with vandal resistant steel guard. Additional lower drinking spigot, self-closing hose bibb and attached hose and hanger.
1. Manufacturers: Subject to compliance with requirements, provide Stern Williams No. 9100-66-SS or approved products by one of the following:
 - a. MDF, Inc
 - b. Terra Bound Solutions, Inc.
 2. Body: Stainless steel.
 3. Receptor: slow draining pet fountain receptor with pebble guard drain
 4. Operation: Recessed self-closing push button valve with outside stream adjustment.
 5. Hose: 5-ft rubber.
 6. Finish: Stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- D. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

- E. Install balancing valves in locations where they can easily be adjusted.
- F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- H. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- I. Install draining-type post hydrants with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- J. Install water hammer arresters in water piping according to PDI-WH 201.
- K. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
- L. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- M. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- N. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.
- O. Set aquastats in oversized tee and nipple in hot water return line for automatically controlling hot water circulators and hot water circulating pumps.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section 26 05 26 "Grounding and Bonding for Electrical Systems."

- C. Connect wiring according to Division 26 Section "Busway – Low voltage."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Intermediate atmospheric-vent backflow preventers.
 - 2. Reduced-pressure-principle backflow preventers.
 - 3. Double-check backflow-prevention assemblies.
 - 4. Dual-check-valve backflow preventers.
 - 5. Water pressure-reducing valves.
 - 6. Calibrated balancing valves.
 - 7. Primary, thermostatic, water mixing valves.
 - 8. Manifold, thermostatic, water-mixing-valve assemblies.
 - 9. Primary water tempering valves.
 - 10. Supply-type, trap-seal primer valves.
 - 11. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 1119

22 11 19 - 20

SECTION 22 11 23 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic cold- and hot-water circulation:
 - 1. Close-coupled, horizontally mounted, in-line centrifugal pumps.
 - 2. Close-coupled, vertically mounted, in-line centrifugal pumps.
 - 3. Pump Controls where self-contained.
- B. Related Sections include the following:
 - 1. Division 22 Section 22 11 23.13 "Domestic-Water Packaged Booster Pumps" for booster systems.

1.3 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Line diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For domestic water pumps to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- D. The pump manufacturer supplying the equipment listed under this article shall provide a written guarantee covering all the equipment as well as the system performance for one year from date of shipment. The system shall not produce objectionable noise, vibration or fluctuations of system pressure when performing under head and capacity as specified.
- E. When minimum energy ratings or efficiencies are specified the pump manufacturer shall provide the equipment of the equivalent efficiencies and energy ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 CLOSE-COUPLED, HORIZONTALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Aurora.

B. Description: Factory-assembled and -tested, overhung impeller, single-stage, close-coupled, horizontally mounted, in-line centrifugal pumps as defined in ANSI/HI 1.1-1.2 and ANSI/HI 1.3; and designed for installation with pump and motor shafts mounted horizontally.

1. Pump Construction: All bronze or bronze fitted.
 - a. Casing: Radially split, cast iron, with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
 - b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, closed, and keyed to shaft.
 - c. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
 - d. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
 - e. Bearings: Oil-lubricated; bronze-journal or ball type.
2. Shaft Coupling: Rigid type if pump is provided with coupling.
3. Motor: Single speed, with grease-lubricated ball bearings. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

C. Capacities and Characteristics:

1. See pump schedule on drawings.

2.4 CLOSE-COUPLED, VERTICALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers:

1. Aurora Pump.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Armstrong Pumps Inc.

B. Description: Factory-assembled and -tested, overhung impeller, single-stage, close-coupled, vertically mounted, in-line centrifugal pumps as defined in ANSI/HI 1.1-1.2 and

ANSI/HI 1.3; and designed for installation with pump and motor shafts mounted vertically.

1. Pump Construction: Bronze fitted.
 - a. Casing: Radially split, cast iron, with wear rings and threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections. Include pump manufacturer's base attachment for mounting pump on concrete base.
 - b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, closed, and keyed to shaft.
 - c. Shaft and Shaft Sleeve: Stainless-steel shaft, with copper-alloy shaft sleeve.
 - d. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
 - e. Bearings: Oil-lubricated; bronze-journal or ball type.
2. Shaft Coupling: Rigid type if pump is provided with coupling.
3. Motor: Single speed, with grease-lubricated ball bearings; and directly mounted to pump casing. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
 - a. Lifting and Supporting Lug: Factory mounted in top of motor enclosure.

C. Capacities and Characteristics:

1. See pump schedule on drawings.

2.5 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Manufacturers:
 - a. Honeywell International, Inc.
 - b. Mercoïd.
 - c. Square D.
 - d. White-Rodgers Div.; Emerson Electric Co.
2. Type: Water-immersion sensor, for installation in hot-water circulation piping.
3. Range: 65 to 200 deg F.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: As required.
7. Settings: Start pump at 105 deg F and stop pump at 120 deg F.

8. Equal to Mercoïd Type DA-37-2 Range 5 (single pole), Mercoïd Type DA-37-127 Ranges (2 pole).

- B. Timers: Not required. Control shall be through the Division 23 Building Management System.

2.6 FLEXIBLE CONNECTORS

- A. Description: Corrugated, bronze inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze-welded to tubing. Include 125-psig minimum working-pressure rating and ends matching pump connections.

1. Equal to M.I.I. Types BSS and BB.

2.7 BUILDING-AUTOMATION-SYSTEM INTERFACE

- A. Provide auxiliary contacts in pump controllers for interface to building automation system. Include the following:

1. On-off status of each pump.
2. Alarm status.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Division 22 Section "Common Work Results for Plumbing."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.3 PUMP INSTALLATION

A. As per structural drawings.

B. Comply with ANSI/HI 1.4.

C. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

D. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

E. Install in-line, sealless; separately coupled, in-line; separately coupled, horizontally mounted, in-line; and close-coupled, horizontally mounted, in-line centrifugal pumps with motor and pump shafts horizontal.

F. Install continuous-thread hanger rods and elastomeric hangers, spring hangers, or spring hangers with vertical-limit stop as scheduled of sufficient size to support pump weight. Vibration isolation devices are specified in Division 22 Section 22 05 48 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

G. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and elastomeric hangers, spring hangers, or spring hangers with vertical-limit stop as scheduled of sufficient size to support pump weight. Vibration isolation devices are specified in Division 22 Section 22 05 29 "Vibration Controls for Plumbing Piping and Equipment." Hanger and support materials are specified in Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

H. Install vertical in-line pumps on concrete bases. Install pumps with motor and pump shafts vertical.

3.4 CONTROL INSTALLATION

A. Install immersion-type aquastats in hot-water return piping.

3.5 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - a. Separately coupled, in-line centrifugal pumps.
 - b. Separately coupled, horizontally mounted, in-line centrifugal pumps.
 - c. Close-coupled, horizontally mounted, in-line centrifugal pumps.
 - d. Close-coupled, vertically mounted, in-line centrifugal pumps.
 - 2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section 22 05 23 "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section 22 11 19 "Domestic Water Piping Specialties" for strainers.
 - 3. Install pressure gages at suction and discharge of pumps. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 22 Section 22 05 19 "Meters and Gages for Plumbing Piping" for pressure gages and gage connectors.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding"
- E. Connect wiring according to Division 26 Section "Busway - Low-Voltage"
- F. Connect aquastats to pumps that they control.
- G. Interlock pump with water heater burner and time delay relay.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.

3. Clean strainers on suction piping.
4. Set aquastats for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 11 23

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.
- B. Section also covers condensate drain piping for air conditioning system drains. All requirements within this section are applicable to condensate drain piping.
- C. Related Sections include the following:
 - 1. Division 22 Section 22 05 48 "Vibration Controls for Plumbing, Piping and Equipment."
 - 2. Division 22 Section 22 05 29 "Hangers and Supports for Plumbing, Piping and Equipment."

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.

- G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Action Submittals:
 - 1. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 “Sustainable Design Requirements – LEED V4 BD+C”
 - 2. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content.
 - 3. Product Data: Documentation for Low emitting Materials (interior only).
 - a. Low emitting Materials for Adhesives and Sealants.
- C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturer: Subject to compliance with requirements, provide products from the listed manufacturers.

2.3 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Product Data: Documentation for Leadership Extraction Practices in the following:
- a. Leadership Extraction Practices for Recycled Content.
 - b. Material Cost data for all Hubless Cast Iron Pipe and fittings.
- B. Pipe and Fittings: ASTM A 888 or CISPI 301.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
- D. Rigid, Unshielded Couplings: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 STEEL PIPE AND FITTINGS

- A. Product Data: Documentation for Leadership Extraction Practices in the following:
 - 1. Leadership Extraction Practices for Recycled Content.
 - 2. Material Cost data for all Steel Iron Pipe and fittings.
- B. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
- C. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
- D. Pressure Fittings:
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- E. Grooved-Joint Systems:
 - 1. Manufacturers:
 - a. Victaulic Co. of America.
 - b. Owner-approved substitution.
 - 2. Grooved-End, Steel-Piping Fittings: - ASTM A 106, galvanized-steel pipe; or ASTM A 536, galvanized, ductile-iron casting; with dimensions matching steel pipe.
 - 3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.6 STAINLESS-STEEL PIPE AND FITTINGS

- A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.
- B. Gaskets: Lip seals shaped to fit socket groove, with plastic backup ring.
 - 1. Material: EPDM, unless NBR is indicated.

2.7 COPPER TUBE AND FITTINGS

- A. Product Data: Documentation for Leadership Extraction Practices in the following:
 - 1. Leadership Extraction Practices for Recycled Content.
 - 2. Material Cost data for all Copper Pipe and fittings.
- B. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Types M, water tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
 - 2. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 3. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 4. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - 5. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 - 6. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
- E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.8 POLYVINYLIDENE FLUORIDE DRAINAGE PIPE AND FITTINGS

- A. PVDF Drainage Pipe and Fittings: ASTM F 1673, pipe and drainage-pattern fittings, with Schedule 40 dimensions, with fusion- and no-hub mechanical-joint ends.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
 - b. Sloane, George Fischer Inc.
 - c. Town & Country Plastics, Inc.
 - d. Zurn Plumbing Products Group; Chemical Drainage Systems.

2.9 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.
- C. Solvent Cement and Adhesive Primer:
 - 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.10 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Co.
 - d. Plastic Oddities, Inc.
 - 2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.

- c. Owner approved substitution.
- C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.
 - c. Owner approved substitution.
- D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.; DMD Div.
 - c. JCM Industries, Inc.
 - d. Romac Industries, Inc.
 - 2. Center-Sleeve Material: Manufacturer's standard.
 - 3. Gasket Material: Natural or synthetic rubber.
 - 4. Metal Component Finish: Corrosion-resistant coating or material.
- E. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. EBAA Iron Sales, Inc.
 - b. Owner approved substitution.
- F. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. EBAA Iron Sales, Inc.
 - b. Romac Industries, Inc.
 - c. Star Pipe Products; Star Fittings Div.

- G. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. SIGMA Corp.
 - b. Owner approved substitution.

- H. Dielectric Fittings:
 1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 2. Dielectric Unions:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Capitol Manufacturing Company.
 - 2) McDonald, A. Y. Mfg. Co.
 - 3) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 4) Wilkins; a Zurn company.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: 125 psig minimum at 180 deg F.
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
 3. Dielectric Flanges:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Capitol Manufacturing Company.

- 2) Matco-Norca, Inc.
- 3) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 4) Wilkins; a Zurn company.

b. Description:

- 1) Standard: ASSE 1079.
- 2) Factory-fabricated, bolted, companion-flange assembly.
- 3) Pressure Rating: 125 psig minimum at 180 deg F.
- 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving for Building Slabs" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil, waste and vent piping shall be any of the following:
 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
 2. Hubless cast-iron soil pipe and fittings standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 4. Brass pipe or tube, chrome plated, where exposed in finished areas.
- D. Underground, soil, waste, and vent shall be any of the following:
 1. Solid Wall SCH 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Aboveground grease containing waste shall be one of the following:

1. PVDF pipe with no-hub mechanical of fusion joint fittings.
2. Stainless steel pipe and fittings.
3. All grease waste piping to be protected with electric heat trace cable.

F. Underground grease containing waste shall be one of the following:

1. PVDF pipe with socket fusion joint fittings.
2. Stainless steel pipe and fittings.
3. All grease waste piping to be protected with electric heat trace cable.

G. Aboveground acid containing waste (Spitton sinks) shall be one of the following:

1. PVDF pipe with no-hub mechanical of fusion joint fittings.
2. Stainless steel pipe and fittings.

H. Sump pump discharge shall be any of the following:

1. Galvanized Steel pipe, pressure fittings, and threaded joints.

3.3 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 33 Section "Gravity Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and to NPS 6, 0.5 percent downward in direction of flow for piping NPS 8 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- M. Hubless piping shall be installed in a rigid, linear, and plumb system without any deflection at the joints either horizontally or vertically. The system shall be supported and secured to the building structure to prevent movement induced by a ten-foot head of water and its associated thrust forces.
 - 1. When horizontal hubless CI piping is suspended in excess of 18 inch by means of non-rigid hangers, provide sway bracing to prevent horizontal movement.
 - 2. For all horizontal hubless CI piping 4-inch and larger, provide sway bracing to prevent horizontal movement at every branch opening and change of direction by securing to building structure, or provide pipe clamps and rodding across coupling.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section 22 05 19 "General-Duty Valves."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Install gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install non-slam swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
 - 1. Horizontal Piping: Horizontal backwater valves.
 - 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.
 - 4. Backwater valve are specified in Division 22 Section 22 13 19 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:

- a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6: 60 inches with 3/4-inch rod.
 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 5. NPS 6: 10 feet with 5/8-inch rod.
 6. NPS 8: 10 feet with 3/4-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.

From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 13 16

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Floor drains.
 - 4. Air-admittance valves.
 - 5. Roof flashing assemblies.
 - 6. Through-penetration firestop assemblies.
 - 7. Miscellaneous sanitary drainage piping specialties.
 - 8. Flashing materials.
 - 9. Grease interceptors.
 - 10. Hair interceptors.
- B. Related Sections include the following:
 - 1. Division 22 Section 22 14 23 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.

- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
 - 1. Grease interceptors.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc., No. 7012.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation, No. Z1090.
2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted access check valve.
6. End Connections: match piping.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc., No. 7070.
 - c. MIFAB, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation, No. Z1091.
2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

- C. Combined running-trap type valve with hub and spigot body, brass cleanout. Extend cleanout up and terminate in deckplate as noted, where valve is 18 inches or less below floor.
- D. For the noted size access pit provided under the General Construction Work, where valve is 19 inch or more below floor, 3-inch thick galvanized checkered steel flush cover held down with non ferrous screws and two drop-type flush lift handles. 2-inch x 2-inch galvanized welded angle iron frame with welded stops and lugs for anchoring into concrete. Turn frame over for setting under General Construction Work.
- E. Combination Gate Valve Type: Coated cast iron hub and spigot body, removable brass flap type backwater valve and seat, and non-rising stem gate, with cast iron cover and wheel handle. Provide valves modified with required extension stem and cast iron enclosing pipe up to floor level or grade level.
- F. For Ejector Pump Discharge: Flanged IBBM swing type check valves with outside spring, 200 PSIG wog, equal to Kennedy Fig. 106LS.

2.3 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: as required to match connected piping.
 - 5. Closure: Countersunk brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Metal Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. MIFAB, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Cast bronze cleanouts. Full size up to four inch, and at least half size for larger pipes, but with four inch minimum.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Spigot.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Extra Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: as required to match connected piping.
5. Closure: Countersunk brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw or frame and cover.

2.4 FLOOR DRAINS

A. Cast-Iron Floor Drains Except as Noted:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3 with backwater valve.
3. Pattern: see drawings.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Drain-outlet type.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
11. Sediment Bucket: see drawings.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Polished bronze.
14. Top Shape: Square.
15. Dimensions of Top or Strainer: see drawings.
16. Top Loading Classification: Heavy Duty.
17. Funnel: see drawings.
18. Inlet Fitting: see drawings.
19. Trap Material: Cast iron.
20. Trap Pattern: Standard P-trap.
21. Trap Features: Cleanout and trap-seal primer valve drain connection.

B. General:

1. In accordance with ANSI A112.21.1 and where required for the following construction types. For built up membrane, provide a flashing clamp. For liquid membrane, provide a four inch wide flange. For elastomeric type floor, provide a four inch wide top flange at required height. Provide strainers with a nickel bronze finish except as noted.
2. Provide a coated cast iron body, except as noted, with integral double drainage flange and weep holes, inside caulked outlet or hub outlet for compression gasket connection, or hubless outlet except as noted.
3. Type **FD-1**, General, Shown Round: An adjustable extension neck and 6-inch diameter cast strainer, flashing clamp for membrane, equal to MIFAB 1100C, Smith No. 2010-A or Zurn ZN-415-6B. Type **SD-1**, Showers: 6-inch diameter strainers for 3-inch outlet size and five-inch diameter strainers for 2-inch outlet size.
4. Type **FD-2**, In machinery rooms and unfinished areas shown round, adjustable cast iron extension neck and tractor type top grate, equal to MIFAB F1320C, Smith No. 2320 or Zurn Z520.
5. Type **FD-3**, In machinery rooms and unfinished areas shown square, adjustable cast iron extension neck and maximum diameter bottom bar strainer on short legs, Smith No. 2230 or Zurn Z540 and MIFAB 1340, Smith 2340 for 4 inch and 6-inch outlet modified without top grate or partial grate.
6. Type **FS**, Shown square in kitchens and where noted deep cast iron body sani-floor receptor with medium duty grate, white acid resistant porcelain enamel

interior and top, complete with ABS anti-splash interior bottom dome strainer. Provide partially opened grate or funnel where required to receive indirect waste, equal to Zurn Z1910 or equal.

- a. For drains receiving single indirect waste, provide strainer with matching 4-inch diameter x 3-1/4 inch high secured funnel, equal Zurn Z-328-4.
- b. For drains receiving multiple indirect wastes, provide with matching 83 inch x 33 inch x 3 inch high secured funnel, equal to Zurn Z-329-9.
- c. Where indirect waste is too low for standard funnel, provide strainer with matching 6 inch x 2½ inch x 1 inch high secured funnel, equal to Zurn-Z329-7.
- d. Type FD-4, thorough flush drain: where indicated on the drawings provide equal to Zurn Z300, with integral double wall trap, cast iron body with acid resistant epoxy coated interior and exterior, side outlet, integral trap, seepage pan, slotted hinged grate.
- e. Type FD-5, prison cell drain: where indicated on the drawings provide equal to Zurn Z355, Dura-coated cast iron body with side outlet, integral trap, anchor flange and adjustable slotted strainer secured with spanner type vandal proof screws.
- f. FD-6, detox cell drains: where indicated on the drawings provide equal to Acorn No.1699W, 14-gauge type 304 Stainless steel body with matte finish interior, 1-inch male flushing connection, trap with 3 ½-inch seal, 2 3/8-inch O.D. waste outlet with plain end.

2.5 FUNNEL DRAINS

- A. Chrome plated bronze funnel with rolled anti-splash lip including cast brass P-trap, equal to Mifab Fig. MI-950 F. Malleable iron reducer, bottom bar strainer, steel nipple and inlet cap with hole to form anti-splash lip, cast iron P-trap with all parts galvanized.
- B. Steel welding increaser, threaded outlet, welded inlet nipple and anti-splash lip, cast iron P-trap with all parts galvanized.
- C. 4-inch x 4-inch high chrome plated bronze funnel with dome bottom strainer and P-trap, equal to MIFAB FS1520-F4, Smith Series 3820 or Zurn ZN1019-CP.
 - 1.

2.6 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch-thick, fully soldered stainless steel flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting. Refer to the architectural specifications for additional requirements.
 1. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.7 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ProSet Systems Inc.
 2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
 3. Size: Same as connected soil, waste, or vent stack.
 4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 6. Special Coating: Corrosion resistant on interior of fittings.

2.8 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
 2. Size: Same as connected waste piping with increaser fitting of size indicated.
- B. Deep-Seal Traps:
 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- D. Air-Gap Fittings:
 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 2. Body: Bronze or cast iron.
 3. Inlet: Opening in top of body.
 4. Outlet: Larger than inlet.
 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
 6. Equal to MIFAB MI-GAP-1, Smith Fig. 3951 or Zurn ZANB-1025.
- E. Sleeve Flashing Device:
 1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
 2. Size: As required for close fit to riser or stack piping.
- F. Stack Flashing Fittings:
 1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
 2. Size: Same as connected stack vent or vent stack.
- G. Vent Caps:
 1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
 2. Size: Same as connected stack vent or vent stack.
- H. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.9 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.10 SHOWER PANS

- A. 6-lbs., pure sheet lead shower pans, watertight with 6-inch standing edges and corners folded and soldered, conforming with Architect's details. Pitch bottom of pan to drain and support securely with its clamping ring.
- B. For multiple sheets, seams joining sheets lapped ½ inch minimum in direction of flow and soldered with solder sweated between sheets to depth of overlap, or welded.
- C. Paint inside and out with a heavy coat of bitumen solution paint before setting, and set on ½ inch thick smooth, non-corroding bed of one part sand and one part portland cement.
- D. Chloraloy 240, chlorinated polyethylene sheeting.
- E. Watertight with 6 inch standing edges and corners folded and solvent welded or thermally welded.
- F. Conform with Architect's details.

- G. Bottom of pan pitched to drain and securely held by its clamping ring.
- H. Seams joining sheets: lapped 1/2 inch minimum in direction of flow.

2.11 GREASE INTERCEPTORS

A. Grease Interceptors **GT**:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.14.3 and PDI-G101, for intercepting and retaining fats, oils, and greases from food-preparation or –processing wastewater.
3. Plumbing and Drainage Institute Seal: Required.
4. Body Material: Cast iron.
5. Interior Lining: Corrosion-resistant enamel.
6. Exterior Coating: Corrosion-resistant enamel.
7. Body Dimensions: as indicated on the drawings
8. Body Extension: As required.
9. Flow Rate: as indicated on the drawings Capacity in first subparagraph below is limited to 200 lb.
10. Grease Retention Capacity: as indicated on the drawings
11. Cleanout: Integral
12. Mounting: As shown on drawings.
13. Flow-Control Fitting: Required.
14. Operation: Automatic recovery.

2.12 HAIR INTERCEPTORS

A. Hair Interceptors **HT**:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Installed in SARA areas in lieu of the trap for the floor sinks serving the wash areas. Provide additional replacement bucket and screens.
3. Characteristics:
 - a. Body Material: Acid resistant composite.
 - b. Sediment bucket: PVC.
 - c. Screen: Stainless steel with 3/32– inch openings.
4. Similar to Zurn No. Z1180-SS-RS-Y.

2.13 MOTORS

- A. General requirements for motors are specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 CONCRETE BASES

- A. Where indicated on the drawings anchor grease interceptors to concrete bases.
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch centers around full perimeter of base.
 2. For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
 6. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 100 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope, but not less than 1/2-inch total depression.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

- G. Install fixture air-admittance valves on fixture drain piping.
- H. Install stack air-admittance valves at top of stack vent and vent stack piping.
- I. Install air-admittance-valve wall boxes recessed in wall.
- J. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- K. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- L. Assemble open drain fittings and install with top of hub 2 inches above floor.
- M. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- N. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- O. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- P. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- Q. Install vent caps on each vent pipe passing through roof.
- R. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- S. Install vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- T. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
 - 1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
 - 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
 - 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.

4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- U. Install wood-blocking reinforcement for wall-mounting-type specialties.
- V. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- W. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding".
- E. Connect wiring according to Division 26 Section "Busways - Low-Voltage ."

3.4 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
 - C. Set flashing on floors and roofs in solid coating of bituminous cement.
 - D. Secure flashing into sleeve and specialty clamping ring or device.
 - E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
 - F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
 - G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.5 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 1. Grease interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

END OF SECTION 22 1319

SECTION 22 13 23: STEEL REINFORCED POLYMER CONCRETE WET WELL
STRUCTURES

PART 1 – GENERAL

1.1 SUMMARY

- A. This specification shall govern for the furnishing of all work necessary for installation of reinforced polymer concrete structures to be constructed.
- B. • Constructed of Steel Reinforced Polymer Concrete per Specifications of the Steel
- C. • Approximate dimensions: 31 feet Long X 17 feet Wide X 24 feet Deep
- D. • Bottom thickness: 60"
- E. • Weight of structure 430 tons (859,000 lbs.)
- F. • Separate 12" thick polymer concrete flat top with hatch cast in to cover
- G. • Lift eyes equally spaced as required for ease of moving
- H. • 12" step of polymer concrete molded in bottom for sufficient suction clearance of pumps in wet well / pump station applications.
- I. • 50 Year Warranty
- J. • Manufactured to ASTM standards including ASTM C-990 joint detail for gasketing riser sections

1.2 REFERENCES

- A. ASTM D 6783 Standard specification for polymer concrete pipe
- B. ASTM C 890 Standard practice for minimum structural design loading precast water and wastewater structures
- C. ASTM C 990 Standard specification for joints for concrete pipe and manholes using flexible joint sealant
- D. ASTM C 923 Standard specification for resilient connectors between reinforced concrete manholes structures, pipes, and laterals
- E. ASTM C 33 Standard specification for concrete aggregates
- F. ASTM C 497 Standard test methods for concrete pipe, manhole sections,
or tile
- G. ASTM C-478 Steel reinforcing in the barrel sections and grade 60 rebar in flat slabs and square structures

1.3 SUBMITTALS

- A. Submittals shall be made in accordance with the applicable spec sections. Submittal shall be made at least 30 days prior to constructing the structure.

- B. Submit shop drawings for each structure. Drawings shall include structure number, location, rim and invert elevations, dimensions, reinforcing details, joint details, and component parts.
- C. Submit calculations signed by a Professional Engineer demonstrating the structure meets the design criteria established in the applicable spec sections.
- D. Submit Manufacturer's certification for manhole steps.
- E. Submit Manufacturer's certification for each type of frame and cover.

1.4 TOLERANCES

- A. Departure from and return to true vertical from the established structure alignment shall not exceed ½ inch per 10 feet, up to 2 inches for the total structure depth.

PART 2 – PRODUCTS (All products shall adhere to S.1726 - 21st Century Buy American Act.)

2.1 MATERIALS (per ASTM D 6783)

- A. Resin: The manufacturer shall use only polyester, or vinyl ester resin systems designed for use with this application. Resin content shall be a minimum of 7% by weight.
- B. Filler: All aggregate, sand and quartz powder shall meet the requirements of ASTM C 33, where applicable.
- C. Additives: Resin additives, such as curing agents, pigments, dyes, fillers and thixotropic agents, when used, shall not be detrimental to the structure.
- D. Elastomeric Gaskets: Gaskets, if used, shall be suitable for the service intended. All gaskets shall meet the requirement of ASTM C 443. Joint sealant, if used, shall meet the requirements of ASTM C 990.

2.2 MANUFACTURING AND PRODUCT CONSTRUCTION

- A. Structures: Components shall be manufactured by the vibratory vertical casting process resulting in a dense, non-porous, corrosion-resistant, homogeneous, composite structure. Structures shall be steel reinforced per ACI 350. Structures shall have monolithic base slabs. Cold joints are not permitted. Cast in lifting devices shall not fully penetrate the wall or require sealing.
- B. Joints: Round manhole components shall be connected with an elastomeric sealing gasket as the sole means to maintain joint water-tightness and both the gasket material and the manhole joint shall meet the requirements of ASTM

- C443. Round manholes shall utilize spigot and bell type joints incorporating either a confined O-ring or single step profile joint. Square and rectangular structures shall utilize a ship-lap joint and be sealed with a butyl rope sealant per ASTM C990 as recommended by the structure manufacturer.
- C. Pipe to Manhole Connections: Pipes shall be directly connected to all structures using resilient flexible pipe to manhole connector per ASTM C923 or casting in pipe couplers during the initial pour. Cold joint pipe stub grouting shall not be allowed unless shown on plans as such. In cases where cold joint pipe stubs are shown, they shall be grouted using a corrosion resistant grout and rubber water stop grout ring.
- D. Fittings: Cones, reducer slabs, and base slabs shall be of the same material as adjoining riser sections.
- E. Invert Channels: Invert channels shall be factory precast with polymer concrete or shipped separately and inserted during installation by the installer.
- F. Acceptable manufacturer: Manufacturer of manholes shall employ manufacturing methods and material formulation in use for a minimum of 5 years. Manufacturer shall have been actively producing polymer concrete structures under current name for a minimum of 7 years with no more than one year between projects. References demonstrating this requirement shall be submitted for review.

2.3 MANUFACTURER

- A. Steel Reinforced Polymer concrete structures shall be manufactured by U.S. Composite Pipe, Inc., (USCP) a division of Thompson Pipe Group, or comparable product from a domestic manufacturer.

2.4 DESIGN

- A. Structures shall be designed to withstand all live loads and dead loads as described in project plans and specifications. Dead loads shall include overburden load, soil side pressure and hydrostatic loading conditions. Structural design calculations shall use the steel reinforcement as the sole means of carrying the tensile loading and the polymer concrete shall only be used for the compression loading. Structure shop drawings and calculations shall be sealed by a licensed Professional Engineer.
- B. Structure wall thickness shall be designed to resist hydrostatic pressures for full depth conditions from grade to invert.
- C. Structures shall be designed with sufficient bottom anchorage and side friction to resist buoyancy. Field cast floatation collars are acceptable.

- D. The structure shall be manufactured in one class of load rating. This class shall be H-20 Wheel Load (minimum 16,000 pounds dynamic wheel load).

2.5 TESTING

- A. Structures: Structures shall be manufactured in accordance with specifications.
- B. Joints: Joints shall meet the requirements of ASTM C 990.
- C. Compressive strength: Polymer concrete shall have a minimum unconfined compressive strength of 9,000 psi when measured in accordance with ASTM C 497.

2.6 CUSTOMER INSPECTION

- A. The Owner or other designated representative shall be entitled to inspect manholes and witness the manufacturing process.

2.7 HANDLING AND SHIPPING

- A. Handling and shipping shall be performed in accordance with the Manufacturer's instructions.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Installation: The installation of wet wells and manholes shall be in accordance with the project plans and specifications and the manufacturer's recommended practices.
- B. Handling: Properly rated slings and spreader bar shall be used for lifting. The type of rigging used shall be per the manufacturer's recommendation.
- C. Jointing:
 - 1. Sealing surfaces and joint components shall be inspected for damage and cleaned of all debris.
 - 2. Place gaskets or sealant at proper location on joint.
 - 3. Use suitable equipment to handle and set structure.
 - 4. Placement and compaction of surrounding backfill material shall be applied to provide sufficient and equal side pressure on the structure.
- D. Field Tests:

1. Infiltration / Exfiltration Test: Maximum allowable leakage shall be per local specification requirements.

END OF SECTION 23 13 23

ORLANDO INTERNATIONAL AIRPORT
BP-S195: TERM C, PH 1X
CONCOURSE

STEEL REINFORCED POLYMER
CONCRETE WET WELL STRUCTURE
SECTION 22 13 23

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 13 29.01: STORMWATER PUMP STATION 1750 GPM @ 60' TDH

PART 1: GENERAL

1.1 SCOPE

- A. Pumps to be supplied as specified herein and shall be of submersible non-clog design, able to be installed in a wet pit or dry pit application and capable of passing wastewater solids suitable for use in wastewater applications.
- B. Pumps to be supplied under this specification shall be suitable for use in FM-certified explosion proof applications having heavy duty, high efficiency design.

1.2 QUALITY ASSURANCE

- A. The equipment covered under this specification shall be a standard product of proven reliability. All units specified in this specification shall be supplied by a single pump manufacturer.
- B. The pumps shall be tested in accordance with the standards of the Hydraulic Institute, ANSI/HI 11.6:2017. All testing is to be performed at the pump manufacturer's facility. A performance curve shall be completed after the test and is included in the final data package. When tested at the manufacturer's facility, pumps can be tested based on system specific duty points on request.
- C. Based upon selected test grades according to above standards, the manufacturer shall guarantee the following parameters of flow rate, total head, power, and efficiency

1.3 SUBMITALS

- A. With proposal - the pump manufacturer shall submit a typical pump outline drawing, typical cross-sectional drawing, and typical price book curve for the required conditions to demonstrate compliance with the referenced specifications.
- B. A specific Installation and Operating Instructions shall be included in the shipment.

1.4 SHIPPING, DELIVERY, STORAGE AND HANDLING

- A. Submersible pumps shall ship fully assembled.
- B. The skidded pump and related equipment shall be unloaded, stored, and installed in strict accordance with the manufacturer's Installation and Operating Instructions and reviewed in detail to implement items relating to mounting, lubrication, power requirements and pump rotation as contained in the manufacturer's Installation and Operating Instructions to insure proper warranty. If storage is planned to be longer than two months or in a harsh environment, the manufacturer's long term storage instructions must be followed.

1.5 START-UP FIELD SERVICE

- A. The pump manufacturer's representative shall include in bid at minimum one day start-up field service for the purpose of supervising pump start-up and instruction of proper pump operation and maintenance.

- B. Field/functional testing will be performed to insure proper mechanical operation at the jobsite. All testing to be used for evaluation shall be performed at the pump manufacturer's facility.

1.6 WARRANTY

- A. Pumps shall be warranted for a period of 2 years from date of shipment for defects in material and/or workmanship in accordance with the manufactures normal warranty statement.

PART 2: PRODUCT (All products shall adhere to S.1726 - 21st Century Buy American Act.)

2.0 MANUFACTURER

- A. The pumps shall be Grundfos submersible pumps, Model: S1.40.A50.540.4.62M.C.292.G.EX.D.611 or Engineers pre-approved equal.

2.1 OPERATING CONDITIONS

- A. The required units shall be non-clog, inverter-duty rated submersible pumps and the pump manufacturer shall demonstrate pump passing capability.
- B. The pump shall have a continuously rising head capacity curve from run-out flow through shutoff.
- C. The pump shall be designed to operate continuously for an extended periods at any point in the allowable operating range (AOR) of the curve without cavitation, overheating or excessive vibration. The motor nameplate horsepower rating shall not be greater than specified herein.
- D. The performance curve of the selected pump impeller shall have the head continuously rise as flow decreases throughout the entire curve from run out to maximum allowable shutoff head. Pumps vibration levels shall refer to the principals stated in the ISO 10816-7:2009 / ANSI/HI 11.6:2012 standards.

E. TABLE 1 - PERFORMANCE DATA

Pump Part Number	97660733
Number of Units Required	3
Rated Duty Point Condition	
Capacity (Flow)	1750 GPM
Total Dynamic Head (TDH)	60 Feet
Minimum Hydraulic Efficiency	58 %
Minimum Wire to Water Efficiency	50 %
Minimum Motor Efficiency (full load)	90 %
Minimum Motor HP Required	56.3 %
Maximum Pump Operating Speed	1800 RPM

Electrical Characteristics Required	
Voltage	460 Volt
Phase	3 PH
Hertz	60 Hz
FLA	76 Amps
Minimum Shutoff Head	160 Feet
Maximum NPSH Required	28 Feet
Minimum Spherical Diameter Passage Through the Impeller (in)	4" Inches
Pumped Liquid	Wastewater

2.2 GUIDE DESIGN

- A. Each pump shall have a flanged guide claw attached to the pump discharge flange by an ANSI flange connection. A replaceable Nitrile Butadiene Rubber (NBR) profile seal shall be provided as an integral part of the guide claw to form a leak-proof seal with the base discharge elbow.
- B. The pumps shall be fitted with flanges according to ASTM/ANSI B16 125lb Class for 60 Hz ANSI pumps
- C. The guide claw shall direct the pump down by two vertical guide rails to the discharge connection in a simple linear movement without tilting the pump side wards. There is no need for any personnel to enter the wet well to remove the pumps. No portion of the pump shall be supported directly on the bottom of the wet well, guide rails or lifting chain. A cast iron or fabricated steel base elbow with integral guide rail holders shall be provided. The base shall be designed with an integral 90° elbow.
- D. Pumps above 20 Hp shall be mounted on a SS foundation plate to reduce vibrations to a minimum.

2.3 PUMP CONSTRUCTION

- A. Major pump components including casing, impellers, motor frame shall be of at minimum Class 40B cast iron with smooth surfaces devoid of blowholes or other irregularities.
- B. All exposed nuts or bolts shall be 316 stainless steel. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied primer and epoxy coating finish on the exterior of the pump.
- C. Critical mating surfaces where watertight sealing is required shall be machined and fitted with NBR O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque

limit. Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal.

- D. Pump shaft shall be either high tensile steel or stainless steel. Pump and motor shall be shipped from the factory as a finished product. Pumps that are assembled outside of the manufacture's facility are not allowed.
- E. The construction should be designed so dismantling, service and re-installation can be accomplished easily.

2.4 CABLE AND CABLE ENTRY SEAL

- A. The power cable shall be sized in accordance with NEC and IEC standards to match the electrical consumption of the motor running at full load and dimensioned according to the latest IEC 60335-1 standard and shall be 49 feet and available in longer optional sizes. The outer jacket of the cable shall be chloroprene rubber.
- B. The power cable shall be 600/1,000V grade flexible stranded copper wire, insulated and overall sheathed with under-water grade compound flexible insulation. The cable shall be rated to take the full motor current under the prevailing media and ambient temperature conditions.
- C. The cable entry shield shall be watertight to a depth of 65 feet.

2.5 PUMP MOTOR

- A. The pump motor shall be an induction type, compliant motor component design with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber according to IEC class IP 68 and NEMA MG1, part 31 for operation with variable frequency drive. Stator housing to be cast iron not less than EN-JL1050/ A48 30. Oil filled motors shall not be considered acceptable.
- B. The motor shall be explosion proof and inverter duty rated Factory Mutual approved for use in Class 1, Division 1, Group C & D T4, T3C hazardous areas. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 311°F (155°C).
- C. The stator shall be trickle impregnated and heat shrunk fitted into the cast iron stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 104°F (40°C) and capable of up to 15 spaced starts per hour for.
- D. The motor shall have voltage tolerance of plus or minus 10% and variation of supply frequency plus or minus 2%. The motor shall be designed for operation up to 104°F (40°C) ambient temperature.
- E. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out. Service factor shall be 1.15 and indicated on the pump performance data sheet and the nameplate.
- F. The motor windings shall be protected with a waterproof material and shall incorporate a thermal sensor in each phase to safeguard against high winding temperatures. The thermal

sensor shall be connected into the control circuit of the starter and signals taken for continuous monitoring of winding temperature.

- G. Motor shall be capable of starting up and operate in the event of a completely flooded pumping station. Motors shall be selected to meet the maximum power required for the selected impeller at all operating conditions.
- H. Motor shall be capable of starting and accelerating the load with the applicable method of starting without exceeding the acceptable winding temperatures, when the supply voltage is in the range of 10% above of the rated motor voltage.
- I. The motor shall be suitable for soft starter.
- J. The motor shaft shall be of large diameter, lightly stressed to ensure rigidity, with impeller and bearing location shoulders and a keyway for location of the impeller.
- K. The motor shall incorporate a cut-out device to signal the control box to detect the presence of any liquid in the motor enclosure, in the form of a non-resetting moisture switch to ensure that the cause of leakage is detected and repaired.

2.6 COOLING SYSTEM

- A. Motor cooling must be achieved by a cooling jacket, using the pumped media to cool the motor. The pump impeller must be equipped with a system to ensure a pumped flow of liquid through the cooling jacket designed to prevent the liquid channels from blocking with foreign material.

2.7 BEARINGS

- A. The pump shaft shall rotate on two or more bearings. Motor bearings shall be grease lubricated for the life of the bearing. The upper motor bearing and the lower bearings shall compensate for axial thrust and radial forces and shall consist of a roller bearing and angular contact ball bearing.
- B. Pump main bearings are two angular contact ball bearing and one roller bearing with an angel ring and support bearing is a single-row deep groove ball bearing
- C. Minimum bearing life shall be L10, 100,000 hours at best efficiency point (BEP).

2.8 MECHANICAL SEALS

- A. Primary seal faces shall be silicon carbide / silicon carbide and secondary seal faces shall be silicon carbide / carbon. Two mechanical shaft seals shall reside inside a stainless steel cover positioned int the oil chamber and shall have no open springs or other parts in direct contact with the pumped liquid to prevent contact with fibers, sand, gravel, and other impurities.

2.9 PUMP SHAFT

- A. Pump shaft shall be High tensile steel, EN 1.7225.

2.10 CHANNEL IMPELLER

- A. The pump shall be equipped with channel impeller without guiding vane coupled directly to the motor shaft. The design of the channel impeller shall be smooth, leaving no obstructions or dead zones while being capable of handling a dry solids content up to 3%.
- B. The suction clearance between impeller and pump casing in channel impeller pumps shall be either adjustable or replaceable to ensure a trouble-free operation. Adjustment of suction clearance shall be maintained in accordance with the supplier's specification.
- C. To reduce vibrations and the load on the shaft seal faces, shaft and bearings to a minimum, the impeller shall be dynamically balanced to ensure that the impeller is in total balance when in operation.

2.11 VOLUTE

- A. The pump volute shall be a single piece cast iron, ASTM A48, Class 40B, with smooth passages large enough to pass any solids that may enter the impeller. The volute shall be connected to the motor housing via bolts that are incorporated into a Smart Trim system. Smart Trim is the ability to adjust the clearances between the impeller and suction cover. This shall be done without removing any parts or use of special tools

2.12 LIFTING SYSTEM

- A. Lifting bail shall be a welded stainless steel lifting bracket with stainless steel fasteners in the motor top of the pump. Bail shall be constructed of 316 stainless steel so that the pump is in proper position to connect to elbow. The guide rail system shall be 316 stainless steel.

2.13 PUMP PROTECTION

- A. Each pump shall incorporate three thermal switches, one per stator phase wind and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall be stopped, and an alarm indication shall be activated.
- B. Pumps shall have one normally closed moisture switch connected in series with the thermal switches via a common voltage supply. The moisture switches shall be incorporated into the pump to sense moisture in a dry chamber located directly above the secondary seal. The switch shall be wired in series so that if a switch opens, the motor is de-energized, and the pump is stopped. Pump shall not require the use of special monitoring.
- C. Digital inputs shall include high winding temperature, seal monitoring and over temperature

2.14 SURFACE FINISH

- A. Pump is coated with a smooth and easy to clean surface to enable wash off of sedimentation and impurities. The surfaces shall be sand-streamed at standard grade of cleanliness Sa 2 ½ and the surface painting shall be sand blast SA 2 ½ at foundry and grease and rust removing with solvent. Primary paint layer shall be epoxy 40 microns at foundry and finishing paint layer shall be dry film thickness of 150 microns. Paint is Tnemec HB 30, two-component resin modified epoxy paint.

2.15 AUTO COUPLING SYSTEM

- A. Pumps shall be equipped with a complete auto coupling system to include factory upper guide rail brackets, base elbow, guide claw. Discharge connections to be established automatically with a simple downward motion when the pump is lowered into operating position by the guide rail system. The pump shall be capable to be removed without disconnecting any fasteners.
- B. Upper guide rail bracket shall be stainless steel.
- C. Base elbow shall have a smooth interior to allow for specific solids passage. Base elbow shall be gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blowholes or other irregularities. Base elbows shall have a factory applied spray coating.

END OF SECTION 22 13 29.01

ORLANDO INTERNATIONAL AIRPORT
BP -S195: TERM C, PH 1X
CONCOURSE

STORMWATER PUMP STATION 1750 GPM @
60' TDH
SECTION 22 13 29.01

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 13 29.02: STORMWATER PUMP STATION 1600 GPM @ 60' TDH

PART 1: GENERAL

1.1 SCOPE

- A. Pumps to be supplied as specified herein and shall be of submersible non-clog design, able to be installed in a wet pit application and capable of passing wastewater solids suitable for use in wastewater applications.
- B. Pumps to be supplied under this specification shall be suitable for use in FM-certified explosion proof applications having heavy duty, high efficiency design.

1.2 QUALITY ASSURANCE

- A. The equipment covered under this specification shall be a standard product of proven reliability. All units specified in this specification shall be supplied by a single pump manufacturer.
- B. The pumps shall be tested in accordance with the standards of the Hydraulic Institute, ANSI/HI 11.6:2017, 3B. All testing is to be performed at the pump manufacturer's facility. A performance curve shall be completed after the test and is included in the final data package.

1.3 SUBMITALS

- A. With proposal - the pump manufacturer shall submit a typical pump outline drawing, typical cross-sectional drawing, and typical price book curve for the required conditions to demonstrate compliance with the referenced specifications and specific Installation and Operating Instructions shall be included in the shipment.

1.4 SHIPPING, DELIVERY, STORAGE AND HANDLING

- A. Submersible pumps shall ship fully assembled and skidded pump and related equipment shall be unloaded, stored and installed in strict accordance with the manufacturer's Installation and Operating Instructions and reviewed in detail to implement items relating to mounting, lubrication, power requirements and pump rotation as contained in the manufacturer's Installation and Operating Instructions to insure proper warranty. If storage is planned to be longer than three (3) months or in a harsh environment, the manufacturer's long term storage instructions must be followed.

1.5 START-UP FIELD SERVICE

- A. The pump manufacturer's representative shall include in bid at minimum one day start-up field service for the purpose of supervising pump start-up and instruction of proper pump operation and maintenance.
- B. Field/functional testing will be performed to insure proper mechanical operation at the jobsite. All testing to be used for evaluation shall be performed at the pump manufacturer's facility.

1.6 WARRANTY

- A. Pumps shall be warranted for a period of 2 years from defects in material and/or workmanship in accordance with the manufacturer's normal warranty statement.

PART 2: PRODUCT (All products shall adhere to S.1726 - 21st Century Buy American Act.)

2.0 MANUFACTURER

- A. The pumps shall be Grundfos submersible pumps, Model SE.A60.330.4.52H.C.EX.61R.A or Engineers pre-approved equal.

2.1 OPERATING CONDITIONS

- A. The required units shall be non-clog, inverter-duty rated submersible and shall have a continuously rising head capacity curve from run-out flow through shutoff.
- B. The pump shall be designed to operate continuously for an extended periods at any point in the allowable operating range (AOR) of the curve without cavitation, overheating or excessive vibration. The motor nameplate horsepower rating shall not be greater than specified herein.

C. TABLE 1 - PERFORMANCE DATA

Pump Part Number	99961264
Number of Units Required	3
Rated Duty Point Condition	
Capacity (Flow)	1600 GPM
Total Dynamic Head (TDH)	60 Feet
Minimum Hydraulic Efficiency	75 %
Minimum Wire to Water Efficiency	64 %
Minimum Motor Efficiency (full load)	90 %
Minimum Motor HP Required	33 HP
Maximum Pump Operating Speed	1800 RPM
Electrical Characteristics Required	
Voltage	460 Volt
Phase	3 PH
Hertz	60 Hz
FLA	40 Amps
Minimum Shutoff Head	128 Feet
Maximum NPSH Required	30 Feet

2.2 GUIDE DESIGN

- A. Each pump shall have a flanged guide claw attached to the pump discharge flange by an ANSI flange connection. A replaceable Nitrile Butadiene Rubber (NBR) profile seal shall be provided as an integral part of the guide claw to form a leak-proof seal with the base discharge elbow.

- B. The guide claw shall direct the pump down by two vertical guide rails to the discharge connection in a simple linear movement without tilting the pump side wards. There shall be no need for any personnel to enter the wet well in order to remove the pumps. No portion of the pump shall be supported directly on the bottom of the wet well, guide rails or lifting chain. A cast iron base elbow with integral guide rail holders shall be provided. The base shall be designed with an integral 90° elbow

2.3 PUMP CONSTRUCTION

- A. Major pump components including casing, impellers, motor frame shall be of at minimum Class 35B cast iron with smooth surfaces devoid of blowholes or other irregularities.
- B. All exposed nuts or bolts shall be 316 stainless steel. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied impact-resistance powder coating finish on the exterior of the pump.
- C. Critical mating surfaces where watertight sealing is required shall be machined and fitted with NBR O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit. Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal.
- D. Pump shaft shall be stainless steel. Pump and motor shall be shipped from the factory as a finished product. Pumps that are assembled outside of the manufacture's facility are not allowed.

2.4 CABLE AND CABLE ENTRY SEAL

- A. The power cable shall be sized in accordance with NEC and IEC standards and shall be 49 feet and available in longer optional sizes. The outer jacket of the cable shall be oil resistant chloroprene rubber. The cable entry shield shall be water tight to a depth of 65 feet.
- B. The pump shall prevent moisture from entering the motor via the cable core. The power cable shall be 600/1,000V grade flexible stranded copper wire, insulated and overall sheathed with under-water grade compound flexible insulation. The cable shall be rated to take the full motor current under the prevailing media and ambient temperature conditions.
- C. The entry shall be a stainless steel EN 1.4408 cable housing with leak-proof rubber sealing with double washers and have a separate protective earth (PE) conductor, a fixed terminal board and an O-ring between the stator housing and the lower bearing bracket.
- D. The power cable shall feature a separate neutral (PE) conductor to ensure optimal health and safety while installing or operating the pump.

2.5 PUMP MOTOR

- A. The pump motor shall be an induction type, Premium Efficient IE3 compatible motor component design with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber according to IEC class IP 68 and NEMA MG1, part 31 for operation with variable frequency drive. Stator housing to be ASTM A-48 Class 35B. Oil filled motors shall not be considered acceptable.
- B. The motor shall be explosion proof and inverter duty rated Factory Mutual approved for use in Class 1, Division 1, Group C & D T4, T3C hazardous areas. The stator windings and

stator leads shall be insulated with moisture resistant Class H insulation rated for 356°F (180°C). UL approved motors shall not be acceptable.

- C. The stator shall be trickle impregnated and heat shrunk fitted into the cast iron stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 104°F (40°C) and capable of up to 20 spaced starts per hour.
- D. The motor shall have voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 104°F (40°C) ambient temperature, with a temperature rise of class B not to exceed 140°F (60°C).
- E. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out. Service factor shall be 1.15 and indicated on the pump performance data sheet and the nameplate.
- F. The motors shall be provided with proprietary monitoring and control units for inclusion in the motor such as, thermal switches built in to the stator windings, moisture switch in the stator housing for continuous monitoring of motor enclosure and automatic cut-out in case of leakage.

2.6 COOLING SYSTEM

- A. Pump shall include an integral cooling system of closed loop design with nontoxic coolant, SML-3 motor liquid, corrosion resistant according to ASTM D 1384. The closed loop system shall sufficiently cool the motor with the need of being submerged in water. Coolant shall be circulated via propeller incorporated in the impeller design positively driven by the motor shaft.
- B. Stainless steel jacket shall be EN 1.4307 / 304.

2.7 BEARINGS

- A. The pump shaft shall rotate on two bearings. Motor bearings shall be grease lubricated for the life of the bearing. The upper motor bearing and the lower bearings shall compensate for axial thrust and radial forces and shall consist of a roller bearing and angular contact ball bearing.
- B. Main bearing is a double-row angular contact ball bearing and support bearing is a single-row deep groove ball bearing.
- C. Minimum bearing life shall be L10, 50,000 hours within the AOR.

2.8 MECHANICAL SEALS

- A. The double mechanical seal with primary and secondary seal built into one unit shall be a cartridge style encased in an EN 1.4408/A351 CF8M stainless steel housing. Separate upper and lower seals not built together in one unit shall not be acceptable.
- B. Primary seal faces shall be silicon carbide / silicon carbide and secondary seal faces shall be carbon / ceramic. Cartridge seal shall reside inside the seal chamber and be cooled by the coolant with the seal chamber.

2.9 PUMP SHAFT

- A. Pump shaft must have a short overhang and be dynamically balanced to eliminate shaft deflection. Pump shaft shall be duplex stainless steel EN 1.4462 / UNS 31803 to retain better corrosion resistance and tensile strength. Duplex stainless steel shaft shall have superior chemical resistance properties.

2.10 S-TUBE IMPELLER

- A. The open tube style impeller shall be of heavy duty cast iron ASTM A48 class 35B. The impeller shall be coupled directly to the motor shaft and have protected hub without any leading edges so clogging is prevented in the impeller. Impellers with leading edges shall not be allowed.
 - a. The impeller shall be trimmable to meet a specified duty point and be able to handle medium to extreme contamination of wastewater.
 - b. Impeller can be provided in advanced coatings and material variants for corrosive and aggressive applications. Optional stainless steel, EN 10283 1.4408 A351 CF8M, and high chromium white cast iron, EN 12513 EN-GJN-HB555(XCr18) A532 Class II B, are available for increased wear resistance.

2.11 S-TUBE VOLUTE

- A. The pump volute shall be a single piece cast iron, ASTM A48, Class 35B, with smooth passages large enough to pass any solids that may enter the impeller. The volute shall be connected to the motor housing via bolts that are incorporated into a Smart Trim system. Smart Trim is the ability to adjust the clearances between the impeller neck ring wear surface and pump housing. This shall be done without removing any parts or use of special tools. Minimum thru let shall be 3". Standard 125 lb. discharge connections for removable guide shoe. Standard wear rings will not be considered equal. Pumps not incorporating an easy adjustment for impeller clearance restoring factory settings will not be considered equal.

2.14 LIFTING BAIL

- A. Lifting bail shall be a solid cast EN 1.4408 / 316 stainless steel lifting bracket with lifting eye and stainless steel fasteners in the motor top of the pump. Bail shall be constructed so that the pump is in proper position to connect to elbow.

2.15 PUMP PROTECTION

- A. Each pump shall incorporate three thermal switches, one per stator phase wind and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall be stopped and an alarm indication shall be activated.
- B. Pumps shall have one normally closed moisture switch connected in series with the thermal switches via a common voltage supply. The moisture switches shall be incorporated into the pump to sense moisture in a dry chamber located directly above the secondary seal. The switch shall be wired in series so that if a switch opens, the motor is de-energized and the pump is stopped. Pump shall not require the use of special monitoring.

2.16 SURFACE FINISH

- A. Pump is coated with a smooth and easy to clean surface to enable wash off of sedimentation and impurities. The primer to all cast iron surfaces has a Cathodic electro-deposition protection. The surface coating is a two part component powder coating thickness of 100 μm .

2.17 AUTO COUPLING SYSTEM

- A. Pumps shall be equipped with a complete auto coupling system to include factory upper guide rail brackets, base elbow, guide claw. Fabricated non factory components will not be accepted.
- B. Upper guide rail bracket shall be stainless steel.
- C. Base elbow shall have a smooth interior to allow for specific solids passage. Base elbow shall be gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blowholes or other irregularities. Base elbows shall have a factory applied spray coating.

END OF SECTION 22 13 29.02

SECTION 22 13 29.03: STORM SEWERAGE PUMPS CONTROLLERS

MPE SC2000 Station Controller Specification

All products shall adhere to S.1726 - 21st Century Buy American Act.

The Controller shall control up to four pumps to perform liquid level control. The Controller shall be capable of controlling a mix of constant speed and variable speed pumps. The Controller shall be capable of alternating the pumps, shall provide lag pump delays and high and low level alarms, and shall perform both pump-down and pump-up operation.

The Controller shall be standard "off the shelf" equipment with published literature and fully tested hardware and operating program. The Controller must be field configurable from the front of the unit, and require no special tools or software to set-up or operate.

The Controller shall be UL listed as Industrial Control Equipment, UL 508.

The Controller shall accept an input signal in the following forms: a 4-20 mA analog signal, inputs from a Conductance Level Probe, or Float Switches.

All connections to the Controller shall be made to removable, "Phoenix" style combination connector/plugs.

The Controller shall be a microcontroller-based device and not require a battery to maintain the operating program. All set-up values shall be stored in non-volatile memory.

A numerical level display shall be provided on the front of the unit. It shall have a 3 digit, 7 segment LED display and show levels in feet and tenths of feet. All setup parameter values shall be viewed or changed from the front of the Controller.

The Controller shall not require an external power supply or any external I/O modules to be a fully functioning unit. An analog input (4-20mA) with zero and span adjustments shall be provided for the scaling of the wet-well level input.

The status of all of the discrete inputs shall also be viewable from the front of the unit.

All electrical connections, for power or I/O, shall be by quick disconnect phoenix style connectors.

The Controller shall have a connector for a conductance level probe of ten sensor points.

Relay outputs shall be provided as standard for high and low level alarms and for the control of up to three pumps.

If not being used, the ten conductance level probe inputs shall be available for use as ten additional discrete SCADA inputs, or for control via float switches.

The Controller shall remember which pump was in the lead position during a power outage.

MPE SC2000 Station Controller Specification

The Controller shall have 18 discrete inputs. The inputs shall be transient protected and be programmable for the following functions:

- Pump disable with HOA in OFF, or pump fault
- Freeze wet well level during a bubbler tube purge
- External Lead Pump Selector Switch
- Limit number of pump called to run on emergency power
- All Pump Disable – for connection to Phase Monitor
- Sequence Input for Lead Lag Select Switches
- High and Low Level Alarms
- Pump disable upon low level – for connection to low level float switch
- Float switch backup
- Low Level Pump Cutoff
- Start Flush Cycle
- Call Pump Last
- Inputs for user selectable SCADA functions

The Controller shall include a fault indicator on the front of the unit and retrievable fault codes to aid in troubleshooting.

A level simulation feature shall also be available from the front of the unit. The Controller shall automatically return to monitoring wetwell level after sixty seconds, if left in simulation mode.

An RS232 serial port with the Modbus RTU protocol shall be provided for SCADA. Programming shall be in place to collect and transmit the station status, and to allow for the remote control of the pumps.

The Controller shall provide an RS232 Serial Port as a standard feature, and shall have an Ethernet port available as an option.

The Pump On/Off levels, high level alarm, and low level alarm setup values shall be viewable and changeable from a remote location.

Pump elapsed time meters shall be viewable and resettable remotely, and shall be stored in non-volatile memory during a power outage.

The Controller shall be able to perform float back-up using from two to six floats.

The Controller shall be able to supply (as an option) up to four isolated 4-20mA Analog Outputs that shall be used for VFD speed control, or for sending out a copy of the level input signal.

MPE SC2000 Station Controller Specification

The Controller shall be able to supply (as an option) up to four isolated 4-20mA Auxiliary Analog Inputs to be used to collect analog data for SCADA.

The Controller shall have adjustable lag pump(s) delay.

The Controller shall have a security code that can be set to lock the parameters beyond the on – off setpoints from being changed.

The Controller shall have a parameter setting to select the number of pumps to control.

The Controller shall have a parameter setting to select the number of pumps to run at one time.

The Controller shall have a parameter setting to select the number of pumps allowed to run while on generator power.

Menu selectable alternation modes shall include:

- Standard Alternation
- Jockey pump (Pump 1 stays on when other pumps turn on)
- Jockey Pump (Pump 1 turns off when other pumps turn on)
- Split alternation (Pumps 1&2, Pumps 3&4)
- Fixed sequence (Pump 1 always lead)
- Stepped on/off (Only one pump runs at a time)

Menu selectable First-On/First-Off or First-On/Last-Off alternation sequences shall be available.

The Controller shall contain a parameter setting to allow the disabling of the automatic alternation.

The Controller shall contain a parameter to allow the Controller to be used in either a Pump Up or a Pump Down configuration.

The Controller shall have a straightforward setup for VFD Control. The parameter settings shall include parameters for Minimum Speed, Level at Minimum Speed, Pump Start Boost time.

The Controller shall provide a parameter setting to remotely set the speed of the VFD.

The Controller shall have parameters for calibrating the zero and span of the level input signal.

The Controller shall contain a parameter for setting the slave address of the Controller when used in a SCADA application.

MPE SC2000 Station Controller Specification

The Controller shall contain parameter registers for the set up of the RS232 port.

The Controller shall contain a parameter to limit malicious attempts to control the pumps remotely or to change the setup parameters.

The Controller shall be able to force lead pump position by parameter selection.

The Controller shall be able to perform an automatic flush cycle to reduce sludge build up within the wetwell.

The Controller shall have a wetwell flush cycle that is able to be remotely controlled via SCADA.

The Controller shall contain a flow calculator that provides the following:

Latest Inflow Rate

Average Daily Flow (Average of the last 7 days)

Pump Outflow Rate (Latest Rate for each pump)

The Controller shall provide a parameter setting to provide signal conditioning for the analog Level input signal.

The Controller shall provide a parameter setting to allow disabling of the low level alarm.

The Controller shall have a parameter selection to select time for time-based forced alternation.

The Controller shall contain pump disable discrete inputs shall cause the alternation routine to skip over disabled pumps. These pump disable discrete inputs shall be able to be inverted by a parameter setting.

The Controller shall contain registers for quick verification of the firmware revision level.

The Controller shall have a fault code register to aid in troubleshooting.

The Controller shall also have parameters to allow level probe to be a back-up to the analog transducer input.

The Controller shall have parameter based setup for the 18 discrete inputs.

The Controller shall contain a discrete input for connection to an external time clock to force pump alternation.

MPE SC2000 Station Controller Specification

The Controller shall have a parameter setting to allow the analog input level to be a 4-20mA signal from a transducer, a conductance level probe, or a remote level input signal from SCADA.

The Controller shall have a parameter to select the level probe type by the selection of the distance between the electrodes.

The Controller shall have a level offset parameter to enable the transducer or conductance level probe to be placed off the bottom of the wetwell, while maintaining an accurate representation of the wetwell depth.

The Controller shall have a choice of sensitivity settings for use with a conductance probe.

The Controller's unused output relays shall be able to be programmed through SCADA for additional control uses.

The Controller shall contain parameters to view the status of the Level Probe electrodes.

The Controller shall monitor the squarewave signal at the Level Probe inputs, and shall create a fault code if an improper squarewave is detected.

The Controller shall contain the ability to perform the following SCADA features:

Monitor the status of:

Wetwell Level

All Discrete Inputs

Pump On, Pump Off, High and Low Alarm Levels

Individual Pump Disable Status

All Pump Disable Status

Float Backup Status

On Generator Status

Level Probe Backup Status

Pump Forced On Status

ETMs

Relay Remote Control Status

Forced Alternation Status

Pump Run Status

Pump Forced On Status

Current Lead Pump Status

Level Probe Electrode Status

Fault Code Status

Last Fault Code Status

MPE SC2000 Station Controller Specification

Monitor the status of: (continued)

Internal 5V Power Supply Status

Internal 24V Power Supply Status

Controller Program Revision Number

Flush Cycle Operation

Flow Calculator, Latest Inflow Rate

Flow Calculator, Average Daily Flow
Flow Calculator, Outflow Rate per Pump
Flow Calculator, Daily Inflow Total for last 7 days

Control:

Remotely Change Pump On, Pump Off, High and Low Alarm Levels
Remotely Reset ETM's
Remotely Force Pumps On
Remotely Disable Pumps
Remotely Force Alternation
Remotely Select Lead Pump
Remotely Reset Fault Code Register
Remotely Reset Last Fault Code Register
Remotely Control Unused Relays
Remotely Start Wetwell Flush Cycle
Remotely Stop Wetwell Flush Cycle
Remotely Set VFD Speed

Fault Codes:

The following Fault Codes shall be available for Controller Troubleshooting:

Communication Fault
Parameter Setup Faults
Normal Operation Disabled
Pump Operation on Float Backup
Backup Float Out-of-Sequence
All Pump Disable
Level Probe Fault
Level Probe Out-of-Sequence
Pumps called to run by Level Probe Back-Up
Flow Calculator Setup Fault
VFD Speed Reference Setup Fault

MPE SC2000 Station Controller Specification

(Page 7 of 7)

The Controller shall offer the following optional features:

4-20mA Analog Level input may be ordered as an isolated input
An optional Ethernet Port that will perform both Modbus TCP and Modbus RTU protocols.

Part Number: SC2000-XX

The first "X" denotes the number of optional analog outputs (0 thru 4).
The second "X" denotes the number of optional auxiliary inputs (0 thru 4).

Part Number Options:

To order with the Analog Level Input isolated, add S to the end of part number.

To order with an Ethernet Port, add E to the end of the part number.

The SC2000-XX Controller shall be manufactured by Motor Protection Electronics of Apopka, Florida, (407) 299-3825.

END OF SECTION 22 13 29.03

Filename: C:\John\My Documents\Technical Data\Specifications\MPE SC2000 Specification 04172015
(Revision Date: 04-17-2015 includes all changes thru Firmware Revision 12)

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 14 13 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following storm drainage piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.
- B. Related Sections include the following:
 - 1. Division 22 Section 22 14 29 "Sump Pumps."

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PVC: Polyvinyl chloride plastic.
- E. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.
 - 2. Storm Drainage, Force-Main Piping: 50 psig.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Action Submittals:
 - 1. Sustainable Design Documentatio Submittals: Refer to section 01 81 13.14 Sustainable Design Requirements – LEED V4 BD+C”
 - 2. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content.
 - 3. Product Data: Documentation for Low Emitting Materials.
 - a. Low emitting Materials for Adhesives and Sealants.
- C. Shop Drawings:
- D. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.4 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber or elastomer.
- C. Calking Materials: ASTM B 29, or hemp fiber.

2.5 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Product Data: Documentation for Leadership Extraction Practices in the following:
 - 1. Leadership Extraction Practices for Recycled Content.
 - 2. Material Cost data for all Hubless Cast Iron Pipe and fittings.
- B. Pipe and Fittings: ASTM A 888 or CISPI 301.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) ANACO.
 - 2) Fernco, Inc.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.
 - 6) Dallas Specialty & Mfg. Co.
 - 7) Logan Clay Products Company (The).
 - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) ANACO.

- 2) Clamp-All Corp.
- 3) Ideal Div.; Stant Corp.
- 4) Mission Rubber Co.
- 5) Tyler Pipe; Soil Pipe Div.
- 6) Dallas Specialty & Mfg. Co.
- 7) Logan Clay Products Company (The).

2.6 DUCTILE-IRON PIPE AND FITTINGS

- A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.

2.7 STEEL PIPE AND FITTINGS

- A. Product Data: Documentation for Leadership Extraction Practices in the following:
1. Leadership Extraction Practices for Recycled Content. Recycled content value shall total no less than 35% post + ½ pre-consumer content of the material.
 2. Provide Material Cost data for all Steel Pipe and fittings.
- B. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
- C. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
- D. Pressure Fittings:
1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- E. Grooved-Joint Systems:
1. Manufacturers:
 - a. Victaulic Co. of America.

b. Owner-approved substitution

2. Grooved-End, Steel-Piping Fittings: ASTM A 106, galvanized-steel pipe; or ASTM A 536, galvanized, ductile-iron casting; with dimensions matching steel pipe.
3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.8 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.
- C. Solvent Cement and Adhesive Primer:
 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.9 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 1. Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco, Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Co.
 2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

- B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.

- C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. ANACO.

- D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.; DMD Div.
 - c. JCM Industries, Inc.
 - d. Romac Industries, Inc.
 - 2. Center-Sleeve Material: Manufacturer's standard.
 - 3. Gasket Material: Natural or synthetic rubber.
 - 4. Metal Component Finish: Corrosion-resistant coating or material.

- E. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
 - 1. Manufacturers:
 - a. EBAA Iron Sales, Inc.

- F. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - 1. Manufacturers:

- a. EBAA Iron Sales, Inc.
 - b. Romac Industries, Inc.
 - c. Star Pipe Products; Star Fittings Div.
- G. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
1. Manufacturers:
 - a. SIGMA Corp.

2.10 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch minimum thickness.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving for Building Slabs" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. All uninsulated PVC piping exposed to exterior conditions shall be painted to provide UV protection. Painting shall be as recommended by the piping manufacturer. Coordinate with GOAA for required paint color.

- D. Aboveground storm drainage piping NPS 15 and smaller for all work except Parking Garage shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and coupled joints.
- E. Aboveground storm drainage piping NSP 16 and larger shall be Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron fittings; gaskets; and gasketed joints.
- F. Aboveground storm drainage piping for Parking Garage shall be the following:
 - 1. Solid Wall SCH 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
- G. Underground storm drainage piping for all work shall be the following:
 - 1. Solid Wall SCH 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
- H. Storm drainage force mains NPS 2-1/2 and NPS 6 shall be any of the following:
 - 1. Steel pipe, pressure fittings, and threaded joints.

3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section 22 05 00 "Common Work Results for Plumbing."
- B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section 22 14 23 "Storm Drainage Piping Specialties."
- C. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section 22 05 00 "Common Work Results for Plumbing."
- E. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- G. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Install manholes in lieu of cleanouts for piping NPS 8 and larger.
- I. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- J. Install force mains at elevations indicated.
- K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- M. Hubless piping shall be installed in a rigid, linear and plumb system without any deflection at the joints either horizontally or vertically. The system shall be supported and secured to the building structure to prevent movement induced by a ten-foot head of water and its associated thrust forces.
 1. When horizontal hubless CI piping is suspended in excess of 18 inch by means of non-rigid hangers, provide sway bracing to prevent horizontal movement.
 2. For all horizontal hubless CI piping 5-inch and larger, provide sway bracing to prevent horizontal movement at every branch opening and change of direction by securing to building structure, or provide pipe clamps and rodding across coupling.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

- B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- E. Grooved Joints: Cut groove ends of pipe and assemble grooved ends of pipes, grooved-end fittings, and grooved-end-piping couplings according to AWWA C606.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section 22 05 23 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sump pump discharge.
 - 1. Install gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sump pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
 - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 - 2. Install backwater valves in accessible locations.
 - 3. Install backwater valves at all connections from air conditioning condensate drain main connection to storm system.
 - 4. Backwater valve are specified in Division 22 Section 22 14 23 "Storm Drainage Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

- b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6: 60 inches with 3/4-inch rod.
 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 5. NPS 3: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 7. NPS 6: 12 feet with 3/4-inch rod.
 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.

2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

- J. Install supports for vertical copper tubing every 10 feet.
- K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
- D. Connect force-main piping to the following:
1. Storm Sewer: To exterior force main or storm manhole.
 2. Sump Pumps: To sump pump discharge.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 14 13

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 14 23 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- a. This Section includes the following storm drainage piping specialties:
 1. Backwater valves.
 2. Cleanouts.
 3. Trench drains.
 4. Channel drainage systems.
 5. Through-penetration firestop assemblies.
 6. Roof drains.
 7. Area drains
 8. Miscellaneous storm drainage piping specialties.
 9. Flashing materials.
- b. Related Sections include the following:
 1. Division 22 Section 22 13 19 "Sanitary Waste Piping Specialties" for backwater valves, floor drains, trench drains and channel drainage systems connected to sanitary sewer, air admittance valves, FOG disposal systems, grease interceptors and removal devices, oil interceptors, and solid interceptors.

1.3 DEFINITIONS

- a. ABS: Acrylonitrile-butadiene-styrene plastic.
- b. FOG: Fats, oils, and greases.
- c. FRP: Fiberglass-reinforced plastic.
- d. HDPE: High-density polyethylene plastic.
- e. PE: Polyethylene plastic.
- f. PP: Polypropylene plastic.
- g. PUR: Polyurethane plastic.

- h. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- a. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- a. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

- a. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

- 2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 BACKWATER VALVES

- a. Horizontal, Plastic Backwater Valves :

1. Manufacturers: Subject to compliance with requirements, provide Zurn products No. BW2930 PVC or products by one of the following:

- a. Canplas LLC.
- b. IPS Corporation.
- c. NDS Inc.
- d. Oatey.
- e. Plastic Oddities; a division of Diverse Corporate Technologies.

3. Size: Same as connected piping.

4. Body: [PVC].

5. Cover: Same material as body with threaded access to check valve.

6. Check Valve: Removable swing check.

7. End Connections: Socket type.

- a. For Sump Pump Discharge: Silent, double center guided, conical spring type check valves, flanged IBBM, 200 PSIG wog, equal to Williams Hager Clow Check Valve No.

329 for NPS 3 and smaller and No. 636 for NPS 4 and larger or Milwaukee Series 8800.

2.3 CLEANOUTS

- a. Exposed Metal Cleanouts:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 3. Size: Same as connected drainage piping
 4. Body Material: as required to match connected piping.
 5. Closure: Countersunk brass plug.
 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- b. Metal Floor Cleanouts:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - e. Josam Company; Blucher-Josam Div.
 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
 3. Size: Cast bronze cleanouts. Full size up to four inch, and at least-half size for larger pipes, but with four inch minimum.
 4. Type: Adjustable housing.
 5. Body or Ferrule: Cast iron.
 6. Clamping Device: Required.
 7. Outlet Connection: Spigot.
 8. Closure: Brass plug with straight threads and gasket.
 9. Adjustable Housing Material: Cast iron.
 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 11. Frame and Cover Shape: Round.
 12. Top Loading Classification: Extra Heavy-Duty.
 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- c. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: as required to match connected piping.
5. Closure: Countersunk brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.4 TRENCH DRAINS

- a. Trench Drains **TD**:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.6.3 for trench drains.
 3. Material: Ductile or gray iron.
 4. Flange: As required.
 5. Clamping Device: As required.
 6. Outlet: As shown or as required.
 7. Grate Material: Ductile iron.
 8. Grate Finish: Painted.
 9. Dimensions of Frame and Grate: As shown or scheduled on drawings.
 10. Top Loading Classification: As shown or scheduled on drawings.
 11. Trap Material: Cast iron.
 12. Trap Pattern: Standard P-trap.
- b. Roadway type TD-2: (frame and grate), heavy duty cast iron grate with fabricated steel frame, with anchor tabs, 6-inch wide and 20-inch long sections. , equal to Zurn ZN782-Z.
- c. Walkway Type TD-1: (frame and grate), medium duty dura-coated cast iron grate with fabricated steel frame, with anchor straps, 12-inch wide and 20-inch long sections., equal to Zurn ZN-792.

2.5 CHANNEL DRAINAGE SYSTEMS

- a. Channel Drainage Systems TD-3:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hydrotech Technologies SIGMA, MAXI150.
 - b. MeaDrain Co., Supreme EN1500.
 - c. MultiDrain Systems.
 - 2. Type: Modular system of **Polymer concrete** channel sections, **heavy duty ductile iron** grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
 - a. **Standard: ASME A112.3.1, for trench drains.**
 - b. Channel Sections: Interlocking-joint..Dimensions: **6** inches wide interior. Include number of units required to form total lengths indicated.
 - c. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channels.
 - 1) Material: Ductile iron).
 - 2) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
 - d. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
 - e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.6 AREA DRAINS AD

- a. General:
 - 1. Manufacturers: Subject to compliance with requirements, provide Zurn Z512 or products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products Inc.
 - 2. Standard: ASME A112.6.3 for trench drains.
 - 3. Material: Dura coated cas iron.
 - 4. Flange: required.
 - 5. Clamping Device: required.
 - 6. Outlet: bottom.
 - 7. Grate Material: Heavy duty cast iron tractor grate.
 - 8. Top Loading Classification: heavy duty.

2.7 FUNNEL DRAINS

a. Funnel Drains FUD-1

1. Manufacturers: Subject to compliance with requirements, provide Zurn No. Z326 or approved equal by one of the following:

- a). Josam Company; Josam Div.
- b). MIFAB, Inc.
- c). Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2). Product details: Dura coated cast iron body indirect waste funnel drain.

b. Funnel Drains FUD-2

1). Manufacturers: Subject to compliance with requirements, provide Zurn No. Z325 or approved equal by one of the following:

- a). Josam Company; Josam Div.
- b). MIFAB, Inc.
- c). Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2). Product details: Dura coated cast iron body with plastic ball float, integral bronze backwater valve bushing and replaceable neoprene seat.

1. For catch basins, provide a rectangular and square grate type with a precast reinforced concrete top slab instead of tapered top, and provide a flat reinforced concrete bottom slab as noted.

- a. Curb type frame and grate 29-3/4 inch x 21-3/4 inch, equal to Flockhart Type 683 No. 60280 or Campbell No. 2540.

2.8 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

a. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.

3. Size: Same as connected pipe.

4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.

6. Special Coating: Corrosion resistant on interior of fittings.

2.9 ROOF DRAINS

- a. Metal Roof Drains RD:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.21.2M.
 3. Pattern: Roof drain.
 4. Body Material: Cast iron.
 5. Combination Flashing Ring and Gravel Stop: Not required.
 6. Flow-Control Weirs: Not required.
 7. Outlet: Bottom.
 8. Dome Material: Aluminum.
 9. Extension Collars: Required.
 10. Underdeck Clamp: Required.
 11. Sump Receiver: Required.
 12. Type **RD-2**, High capacity Deck Roof (Insulated Membrane): Dura coated cast iron body, extension collar of required height with weep holes, combination membrane flushing clam/gravel guard and low silhouette dome, equal to Zurn Z101-E. For overflow drain use 2-inch internal water dam Z-101-E-W2.
 13. Type RD-1, Deck Roof (Insulated Membrane): Combination primary and overflow drain, dura coated cast iron bodies, extension collar of required height, combination membrane flushing clam/gravel guard and low silhouette dome equal to Zurn Z-163E.
 14. Type RD-3, Canopy: Dura-Coated cast iron body with combination membrane flashing clam/gravel guard, Top set deck plate, low silhouette Poly Dome, Zurn100-DP.
 15. For Canopy overflow RD-3 type drain add four-inch high internal water dam, Zurn100-DP-W4.
 16. Type RD-4 (Promenade deck): Square top, Dura coated cast iron body with rotatable square frame, seepage openings, frame clamps and heavy duty heel-proof grate, equal to Zurn Z150-ZN.

2.10 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

- a. Expansion Joints:
1. Standard: ASME A112.21.2M.
 2. Body: Cast iron with bronze sleeve, packing, and gland.
 3. End Connections: Matching connected piping.
 4. Size: Same as connected piping.
- b. Conductor Nozzles:

1. Description: Fabricated 304 stainless steel downspout nozzle with loose slotted, hinged cover and wall anchor mounting holes.
2. Size: Same as connected conductor.
3. Acceptable manufacturers:
 - a. JR Smith No. 1775.
4.
 - b. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Zurn Plumbing Products Group

2.11 FLASHING MATERIALS

- a. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- b. Fasteners: Metal compatible with material and substrate being fastened.
- c. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- d. Solder: ASTM B 32, lead-free alloy.
- e. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- a. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- b. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- c. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- d. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

- e. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- f. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.
- g. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- h. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- i. Install roof drains at low points of roof areas and where indicated according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
 - 1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - 2. Position roof drains for easy access and maintenance.
 - 3. Coated cast iron body roof drains with an inside caulked bottom outlet, except as noted and in accordance with ANSI A112.21.2.
 - 4. For liquid membrane roofs, use four inch wide flange, for built up membrane roofs, a combined flashing flange and gravel stop; and, for steel or precast decks, a deck clamp.
 - 5. Where insulation is applied over a structural roof deck, provide an extension collar with weep holes.
 - 6. For IRMA type roofs, 4 inch high, brass gravel guard, 16 inch diameter perforated with 1/4 inch holes.
 - 7. Provide tops of drains for decks and canopies with a bronze, nickel bronze, statuary bronze finish.
 - 8. For wood construction, provide drains with flashing clamps.
- j. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- k. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- l. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- m. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- a. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

- a. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- b. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- c. Set flashing on floors and roofs in solid coating of bituminous cement.
- d. Secure flashing into sleeve and specialty clamping ring or device.
- e. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

- a. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- b. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1423

SECTION 22 14 29 - SUMP PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following sump pumps and accessories, inside the building, for building storm drainage systems, condensate drainage pumps, and also elevator sump pit pumps, oil filters and oil monitoring systems:
 - 1. Wet-pit-mounted, vertical sump pumps.
 - 2. Submersible sump pumps.
 - 3. Sump pumps.
 - 4. Packaged, pedestal and submersible, drainage pump units.
- B. See Division 22 Section "Common Work Results for Plumbing" for information regarding condensate pumps :

1.3 SUBMITTALS

- A. Product Data: For each type and size of sump pump specified. Include certified performance curves with operating points plotted on curves, and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Line diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For each sump pump to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of sump pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases and pits. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

- 2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 WET-PIT-MOUNTED, VERTICAL SUMP PUMPS

- A. Manufacturers:
 - 1. Aurora Pump; Pentair Pump Group (The).
 - 2. Federal Pump Corp.
 - 3. Flyght Pumps.
- B. Description: Factory-assembled and -tested, single-stage, centrifugal, end-suction sump pumps complying with UL 778. Vertical, separately coupled, suspended pumps complying with HI 1.1-1.2 and HI 1.3 for wet-pit-volute sump pumps.

1. Pump Arrangement: See plans and schedules.
 2. Casing: Cast iron, with screened inlet and threaded connection for NPS 2 and smaller and flanged connection for NPS 2-1/2 and larger discharge piping.
 3. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced nonclog design; overhung, single suction, keyed and secured to shaft.
 4. Pump Shaft and Sleeve Bearings: Stainless-steel shaft with bronze sleeve bearings. Include oil-lubricated, intermediate sleeve bearings at 48-inch maximum intervals if basin depth is more than 48 inches, and grease-lubricated, ball-type thrust bearings.
 5. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
- C. Pump Discharge Piping: Manufacturer's standard galvanized-steel or brass pipe.
- D. Pit Cover: Cast iron or steel with bituminous coating and strong enough to support pumps, motors, and controls. See Part 2 "Sump Pump Basins, Pits" Article for requirements.
- E. Cover Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.
- F. Motor: Single speed; grease-lubricated ball bearings. Comply with requirements in Division 22 Section 22 05 13 "Common Motor Requirements for Plumbing Equipment" with built-in thermal-overload protection appropriate for motor size and duty.
1. Mounting: On vertical, cast-iron pedestal.
- G. Controls: NEMA 250, Type 1 enclosure, pedestal-mounted float switches; with floats, float rods, and rod buttons. Include automatic alternator to alternate operation of pump units on successive cycles and to operate multiple units if one pump cannot handle load.
1. Float Guide: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
 2. High-Water Alarm: Cover-mounted, mechanical-float-switch alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- H. Capacity and Characteristics (Refer to Pump Schedule on drawings)
- 2.4 SUBMERSIBLE SUMP PUMPS
- A. Manufacturers:
1. Federal Pump Corp.
 2. Liberty Pumps.
 3. Stancor, Inc.

- B. Description: Factory-assembled and -tested, single-stage, centrifugal, end-suction, submersible, direct-connected sump pumps complying with UL 778 and HI 1.1-1.2 and HI 1.3 for submersible sump pumps.
- C. Pumps shall be duplex automatic vertical nonclog submersible centrifugal type with cast iron casing bolted to motor, and machined discharge flange, enclosed single vane nonclog type, epoxy coated, cast iron impeller mounted on motor shaft.
- D. Support pumps on machined mating flange on discharge elbow and on cast iron base. Galvanized steel guide bars complete with bracket for raising and lowering pumps or portable 'A' frame for raising and lowering pumps as scheduled.
- E. Casing: Cast iron; with cast-iron inlet strainer, legs that elevate pump to permit flow into impeller, and vertical discharge with companion flange for piping connection.
- F. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, semiopen nonclog design, overhung, single suction, keyed and secured to shaft.
- G. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings and double-mechanical seals.
- H. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection; three-conductor waterproof power cable of length required, and with grounding plug and cable-sealing assembly for connection at pump. Comply with requirements in Division 22 Section 22 05 13 "Common Motor Requirements for Plumbing Equipment."
 - 1. Moisture-Sensing Probe: Internal moisture sensor with moisture alarm.
- I. Pump Discharge Piping: Factory or field fabricated, ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe or copper tube.
- J. Basin or Pit Cover: Cast iron or steel with bituminous coating and strong enough to support controls. See Part 2 "Sump Pump Basins and Pits" Article for other requirements.
- K. Controls: NEMA 250, Type 1 enclosure, pedestal-mounted float switch; with float, float rod, and rod buttons.
- L. Controls: NEMA 250, Type 1 enclosure, pedestal-mounted float switch; with float, float rod, and rod buttons. Include automatic alternator to alternate operation of pump units on successive cycles and to operate multiple units if one pump cannot handle load.
 - 1. Float Guide: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.

2. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float switch alarm matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

M. Capacity and Characteristics: Refer to Pump Schedule on drawings.

N. Capacity and Characteristics: Refer to Pump Schedule on drawings.

2.5 SUMP PUMP PITS

A. Description: Concrete pit with sump, pipe connections, curb frame, and separate cover.

B. Sump: Construct of watertight, cast-in-place, reinforced concrete with sidewall openings for pipe connections. Cast-in-place concrete, formwork, and reinforcement are specified in Division 03 Section "Cast-in-Place Concrete."

1. Pipe Connections: Sleeved openings large enough for mechanical sleeve seals for drainage piping. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing," and drainage piping is specified in Division 22 Section "Facility Storm Drainage Piping."

C. Curb Frame and Cover:

1. Curb Frame Material: Galvanized steel.
 - a. Pattern: Z-cross-section shape with raised outer rim of height matching cover, for recessed mounting having installed cover flush with top of floor slab.
2. Cover: Fabricate with openings having gaskets, seals, and bushings, for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
 - a. Material: Cast iron.
 - b. Reinforcement: Steel or cast iron, capable of supporting foot traffic for pits installed in foot-traffic areas.
3. Coverplate or access door shall be walkway/roadway type with flush curb frame and hinged, lockable access door, hold open arm and locking device. Covers for subsoil drainage sump shall be airtight and gasketed.
4. Access door shall be large enough to allow for pulling each pump, and for access into pit.

D. Capacity and Characteristics: (Refer to Pump Schedule on drawings).

2.6 PACKAGED DRAINAGE PUMP UNITS

- A. Pedestal Units: Factory-assembled and -tested, single-stage, centrifugal, end-suction, automatic-operation, freestanding drainage pump unit.
1. Manufacturers:
 - a. Goulds Pumps; ITT Industries.
 - b. Liberty Pumps.
 - c. Little Giant Pump Co.
 - d. Sta-Rite Industries, Inc.
 - e. Zoeller Company.
 2. Pump Body: Corrosion-resistant material.
 3. Impeller: Aluminum, brass, or plastic.
 4. Motor: With built-in overload protection and mounted vertically on sump pump column. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
 5. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches, with grounding plug and cable-sealing assembly for connection at pump.
 6. Control: Float switch.

2.7 ELEVATOR PIT SUMP PUMP SYSTEM

- A. Manufacturers:
1. Stancor, Inc. – Oil Minder S/L-75 O/M ELV.
 2. Zoeller.
- B. The Pump System allows water to be automatically pumped from hydraulic elevator pits or traction elevator sumps, without danger of ejecting potentially harmful oily substances into sewer system. There shall be no need for a separate oil-water separator.
- C. The System shall be designed for easy fool-proof installation. All pump and control cables shall be factory wired into a wall mountable junction box. Provide main control panel.

2.8 FLEXIBLE CONNECTORS

- A. Manufacturers:
1. Metraflex, Inc.
 2. Owner approved substitution

- B. Description: 125-psig (860-kPa) minimum working-pressure rating and ends matching pump connection:
 - 1. Bronze Flexible Connectors: Corrugated, bronze inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to tubing.
 - 2. Stainless-Steel Flexible Connectors: Corrugated, stainless-steel inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to tubing.

2.9 BUILDING AUTOMATION SYSTEM INTERFACE

- A. Provide auxiliary contacts in pump controllers for interface to building automation system. Include the following:
 - 1. On-off status of each pump.
 - 2. Alarm status.

2.10 ALARM PANEL

- A. Remote-mounted alarm panel, equal to Weil 8301, shall consist of a single NEMA 1 enclosure complete with 3 indicating lights, reset buttons, alarm horn or bell and silencing switch. Lights shall be normally dim-glow and shall change to full-glow and sound the alarm under any of the following conditions:
 - 1. Power failure to the pump control panel.
 - 2. High water condition.
 - 3. Simultaneous two pump operation.
 - 4. Failure of either pump.
- B. Coordinate location and wiring of alarm panel with electrical contractor
- C. Wiring diagrams:
 - 1. Furnish and turn over to the Electrical Contractor, after review by the Engineer, complete wiring diagrams showing full details of the factory wiring.

2.11 CONTROL PANEL

- A. Combination unfused disconnect switch and across-the-line magnetic starter with overload protection for each phase leg, for each pump.
 - 1. Undervoltage protection.

2. 120 volt control circuit transformer, fused on primary, and grounded on secondary, with automatic transfer between each pump's incoming supply in the event of failure or shutdown of power supply to any pump. Connections to pump incoming supplies shall be made downstream of controller disconnect devices.
3. Momentary contact push buttons marked MANUAL, for bypassing automatic control when held in (JOGGING).
4. Automatic electric alternator (four lead units).
5. Moisture sensing audible and visual alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.2 CONCRETE

- A. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Division 22 Section 22 05 00 "Common Work Results for Plumbing."
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.3 SUMP PUMP INSTALLATION

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving for Building Slabs."
- B. Install sump pumps according to applicable requirements in HI 1.4.
- C. Install pumps and arrange to provide access for maintenance including removal of motors, impellers, couplings, and accessories.

- D. Suspend wet-pit-mounted, vertical sump pumps from basin and pit covers. Make direct connections to storm drainage piping.
- E. Set submersible sump pumps on basin or pit floor. Make direct connections to storm drainage piping.
- F. Install sump pump basins and connect to drainage piping. Brace interior of basins according to manufacturer's written instructions to prevent distortion or collapse during concrete placement. Set basin cover and fasten to basin top flange. Install cover so top surface is flush with finished floor.
- G. Construct sump pump pits and connect to drainage piping. Set pit curb frame recessed in and anchored to concrete. Fasten pit cover to pit curb flange. Install cover so top surface is flush with finished floor.
- H. Install packaged, pedestal, drainage pump units and make direct connection to storm drainage piping.
- I. Install packaged, submersible, drainage pump unit basins on floor or concrete base unless recessed installation is indicated. Make direct connections to storm drainage piping.
- J. Support piping so weight of piping is not supported by pumps.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in Division 22 Section 22 14 13 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to sump pumps to allow service and maintenance.
- C. Connect storm drainage piping to pumps. Install discharge piping equal to or greater than size of pump discharge piping. Refer to Division 22 Section 22 05 23 "Facility Storm Drainage Piping."
 - 1. Install flexible connectors adjacent to pumps in discharge piping.
 - 2. Install check and shutoff valves on discharge piping from each pump. Install unions on pumps having threaded pipe connections. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for drainage piping.
- D. Ground equipment according to Division 26 Section "Grounding and."

- E. Connect wiring according to Division 26 Section "Busways - Low-Voltage."

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify bearing lubrication.
 - 3. Disconnect couplings and check motors for proper direction of rotation.
 - 4. Verify that each pump is free to rotate by hand. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - 5. Verify that pump controls are correct for required application.
- B. Start pumps without exceeding safe motor power:
 - 1. Start motors.
 - 2. Open discharge valves slowly.
 - 3. Check general mechanical operation of pumps and motors.
- C. Test and adjust controls and safeties.
- D. Remove and replace damaged and malfunctioning components.
 - 1. Pump Controls: Set pump controls for automatic start, stop, and alarm operation as required for system application.
 - 2. Set field-adjustable switches and circuit-breaker trip ranges as indicated, or if not indicated, for normal operation.
- E. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 1429

SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following electric water heaters:

1. Flow-control, electric, tankless, domestic-water heaters.
2. Light duty-commercial electric, storage water heaters.
3. Commercial, storage electric water heaters.
4. Compression tanks.
5. Water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. LEED V4 BD+C Submittal:
 1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with ASHRAE/IESNA 90.1-2016, Section 7 - "Service Water Heating."
- C. Shop Drawings: Diagram power, signal, and control wiring.
- D. Product Certificates: For each type of commercial and instantaneous electric water heater, signed by product manufacturer.
- E. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- F. Source quality-control reports.

- G. Field quality-control reports.
- H. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.
- I. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- E. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- F. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" and Annex F & G.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.

- b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period(s): From date of Substantial Completion:
- a. Instantaneous, Tankless Electric Water Heaters: One year.
 - b. Light Duty-Commercial, Storage Electric Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.
 - c. Commercial. Storage Electric Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Five years.
 - d. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- 1. :
- B. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradford White Corporation.
 - b. Lochinvar Corporation.
 - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

- d. State Industries.
 2. Standard: UL 1453.
 3. Storage-Tank Construction: Steel vertical arrangement.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1.
 - e. Jacket: Steel with enameled finish.
 - f. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - g. Temperature Control: Adjustable thermostat.
 - h. Efficiency: 98%.
 - i. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - j. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 5. Special Requirements: NSF 5 construction.
- C. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradford White Corporation.
 - b. Lochinvar Corporation.
 - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - d. State Industries.

2. Standard: UL 174.
3. Storage-Tank Construction: Steel, vertical arrangement.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1.
 - e. Jacket: Steel with enameled finish.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Control: High-temperature-limit cutoff device or system.
 - j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
5. Special Requirements: NSF 5 construction with legs for off-floor installation.

D. Capacity and Characteristics: Refer to schedule on plans.

2.4 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Flow-Control, Electric, Tankless, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bosch Water Heating.
 - b. Chronomite Laboratories, Inc.
 - c. Eemax, Inc.
 - d. Stiebel Eltron, Inc.
2. Standard: UL 499 for electric, tankless, domestic-water heater heating appliance.

3. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - a. Connections: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Flow-control fitting.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
4. Support: Bracket for wall mounting.
5. Capacity and Characteristics: Refer to schedule on drawings.

2.5 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL Inc.
 - b. Honeywell International Inc.
 - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - d. State Industries.
 - e. Taco, Inc.
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
4. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: Refer to schedule on plans.
 - c. Air Precharge Pressure: Static water pressure less 5 psig, unless otherwise noted.

- ### B. Water Heater Stand and Drain-Pan Units: High-density-polyethylene-plastic, 18-inch-high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include

integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.

- C. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.
- D. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- E. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- F. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.
- G. Heat-Trap Fittings: ASHRAE 90.2.
- H. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.
 - 1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 - 2. Comply with requirements for balancing valves specified in Division 22 Section "Domestic Water Piping Specialties."
- I. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- maximum outlet pressure unless otherwise indicated.
- J. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- K. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.
- L. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- M. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

- N. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
- O. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.6 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Control" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Anchor domestic-water heaters to substrate.
- C. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."
- G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- H. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each

domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

- I. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- J. Fill electric, domestic-water heaters with water.
- K. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and tankless, electric, domestic-water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 33 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 37 00 – POTABLE WATER CABINET

PART 1 – GENERAL

1.1 GENERAL DESCRIPTION

- A. This section of the specifications covers the following components:
 - 1. Potable Water Cabinet

1.2 REFERENCES

- A. Applicable Standards:
 - 1. National Fire Protection Association (NFPA):
 - 2. National Electrical Manufacturer's Association (NEMA).
 - 3. Occupational Safety and Health Act (OSHA).
 - 4. Underwriters Laboratories (UL).
 - 5. Florida Building Code (FBC).

1.3 SUBMITTALS

- A. See section 01 3323 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1.4 QUALITY ASSURANCE

- A. NFPA Compliance.
- B. NEMA Compliance.
- C. UL Compliance: All internal components shall be UL-listed and labeled.
- D. Comply with the all applicable Local Building Codes.

PART 2 - PRODUCTS

2.1. CABINET

- A. Manufacturer: Semler Industries, Inc. Model S1-1000 or approved equal.
- B. Material: Stainless steel, Type 304, 16 gauge, #4 finish interior and exterior.
- C. Construction: Welded double wall construction throughout, including bottom and doors with 1" polystyrene insulation. Welded and ground joints, rounded corners, brushed and polished interior and exterior. Cabinet to be provided with:

1. 1-1/2" NPS fitting for drain (located at the bottom center of cabinet)
2. Penetration for 1" water connection (located at back wall of cabinet)
3. Penetration for 1" electrical connection (located at back wall of cabinet)

No support braces or equipment to be mounted on bottom of cabinet to impede drainage or cabinet cleaning.

2.2. DOORS

- A. Material: Stainless steel, Type 304, 16 gauge, #4 finish interior and exterior.
- B. Construction: Double wall construction, welded and ground joints, rounded corners, polished interior and exterior with 1" insulation between inside and outside walls. Two-point door latch with stainless steel recessed locking D-ring handle and full length stainless steel piano hinge with top mounted stainless steel door holder/closer.

2.3. MOUNTING

- A. Shall be mounted on the Passenger Boarding Bridge wheel bogie on the side closest to the aircraft.

2.4. ELECTRICAL

- A. All components mounted within the cabinet shall be UL listed or recognized, weather proof, suitable for service at 120 volts.
- B. Light: 100 watt equivalent LED fixture, weatherproof-vapor proof, with guard and on-off switch.
- C. Heaters: None
- D. 15 A. 120 VAC GFCI duplex service outlet with waterproof cover.
- E. All wiring enclosed in flexible "Sealtite" conduit or rigid galvanized conduit. Provide one (1) 115 Volt, 1 Phase, 15 amp circuit for each cabinet.
- F. Hose Reel: Hannay Model RXX60-0046-D or approved equal, 1" bronze swing joint, bronze internal piping, aluminum drum, stainless steel disks and poly-coated frame. Reel includes 1/2 HP 115 volt, explosion-proof electric rewind motor with horsepower rated momentary contact control switch. Auxiliary hand rewind crank to be provided. Adjustable reel drag brake. Reel mounted to back wall of cabinet. Reel capacity 3/4" x 300' or 1" x 200'.
- G. Potable Water Cabinet shall be NRTL listed and marked as required by federal regulations.

- H. Circuits to be provided at face of building by others. Materials, devices and equipment for electrical connection of Potable Water Cabinet shall meet Florida Building Code and U.L. requirements.

2.5. PIPING COMPONENTS

- A. Nozzle: Semler model #PWC-1-MNZ or approved equal, long barrel coupler with plug/drag cushion, stainless steel nylon coated security cable, control valve and protective bumpers.
- B. Shut-off Valve: 1" bronze ball valve with Teflon seat and stainless steel ball.
- C. Pressure Regulator: Conbraco, 1" bronze adjustable 25-75 PSI or approved equal.
- D. Pressure Gauge: 2-1/2" 0-100 PSI bronze internals and brass case.
- E. Pipe Fittings: Bronze, threaded ANSI B16.15.
- F. Piping: 1" schedule 40 Brass ASTM Specification B43-91.
- G. Connector: 1" x 8" 304 stainless steel flexible connector to relieve piping stress on hose reel swivel joint.
- H. Hose: 3/4" x 200' drinking water hose Model 075-3150 with FDA-CFR title #2 parts #170-199 or approved equal.
- I. Water connection shall be the equivalent nominal pipe size copper tubing as backflow preventor at face of building (backflow preventor by others).

PART 3 - METHOD OF MEASUREMENT

3.1 METHOD OF MEASUREMENT

- A. The potable water cabinets will be paid on a unit basis. Each unit shall include all specified components, labor, installation, required tools, etc. to make the potable water cabinets operational.

PART 4 - BASIS OF PAYMENT

4.1 BASIS OF PAYMENT

- A. Payment will be made on a unit price basis for each Potable Water Cabinet.

Item 22 37 00 – 5.1	Potable Water Cabinet	Per Each
---------------------	-----------------------	----------

END OF SECTION 22 37 00

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK IN THIS SECTION

- A. Work in this Section includes the providing of labor, materials, equipment and services necessary for a complete and safe installation in accordance with the contract documents and all applicable codes and authorities having jurisdiction for the following:
 - 1. Plumbing fixtures and trim, faucets, other fittings and related components.

1.3 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:
 - 1. Faucets for lavatories and sinks.
 - 2. Flushometers.
 - 3. Toilet seats.
 - 4. Protective shielding guards.
 - 5. Fixture supports.
 - 6. Dishwasher air-gap fittings.
 - 7. Water closets and accessories.
 - 8. Urinals and accessories.
 - 9. Lavatories and accessories.
 - 10. Stainless steel sinks and accessories.
 - 11. Water filters and accessories.
 - 12. Commercial sinks.
 - 13. Garbage disposals.
 - 14. Individual showers.
 - 15. Hot water dispensers.
 - 16. Service sinks.
 - 17. Mop receptors.
 - 18. Owner-furnished fixture trim.
 - 19. Toilet accessories.
 - 20. Emergency Eyewash Showers.

21. Eyewash Units.
22. Ablution bath.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section 22 11 19 "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 31 Section 22 11 13 "Facility Water Distribution Piping" for exterior plumbing fixtures and hydrants.

1.4 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.5 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".

C. Product data

1. Product Data for low emitting adhesives and sealants.
2. Documentation indicating flow and water consumption requirements.
3. Water flow sense label compliance.

C. Shop Drawings: Diagram power, signal, and control wiring.

D. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities; A117.1, "Specifications for making buildings and facilities accessible to and usable by physically handicapped people".

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Plastic Laundry Trays: ANSI Z124.6.
3. Plastic Mop-Service Basins: ANSI Z124.6.
4. Plastic Shower Enclosures: ANSI Z124.2.
5. Plastic Sinks: ANSI Z124.6.

6. Slip-Resistant Bathing Surfaces: ASTM F 462.
 7. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
 8. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
 9. Stainless-Steel Residential Sinks: ASME A112.19.3.
 10. Vitreous-China Fixtures: ASME A112.19.2M.
 11. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 12. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 4. Faucets: ASME A112.18.1.
 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 6. Hose-Coupling Threads: ASME B1.20.7.
 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 8. NSF Potable-Water Materials: NSF 61.
 9. Pipe Threads: ASME B1.20.1.
 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 11. Supply Fittings: ASME A112.18.1.
 12. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for shower faucets:
1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 2. Combination, Pressure-Equalizing and Thermostatic-Control Faucets: ASSE 1016.
 3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
 4. Faucets: ASME A112.18.1.
 5. Hand-Held Showers: ASSE 1014.
 6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 7. Hose-Coupling Threads: ASME B1.20.7.
 8. Manual-Control Antiscald Faucets: ASTM F 444.
 9. Pipe Threads: ASME B1.20.1.
 10. Pressure-Equalizing-Control Faucets: ASTM F 444 and ASSE 1016.
 11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 12. Thermostatic-Control Faucets: ASTM F 444 and ASSE 1016.
 13. Temperature Actuated Flow Reduction Valves for Individual Fittings: ASSE 1062.
 14. Individual Pressure Balancing In-line Valves for Individual Fixture Fittings: ASSE 1066.
 15. Automatic Temperature Control Mixing Valves: ASSE 1069.
 16. Water Temperature Limiting Devices: ASSE 1070.

17. EPA standards for water sense label requirements.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1.
 3. Dishwasher Air-Gap Fittings: ASSE 1021.
 4. Manual-Operation Flushometers: ASSE 1037.
 5. Plastic Tubular Fittings: ASTM F 409.
 6. Brass Waste Fittings: ASME A112.18.2.
 7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Disposers: ASSE 1008 and UL 430.
 2. Dishwasher Air-Gap Fittings: ASSE 1021.
 3. Flexible Water Connectors: ASME A112.18.6.
 4. Floor Drains: ASME A112.6.3.
 5. Grab Bars: ASTM F 446.
 6. Hose-Coupling Threads: ASME B1.20.7.
 7. Hot-Water Dispensers: ASSE 1023 and UL 499.
 8. Off-Floor Fixture Supports: ASME A112.6.1M.
 9. Pipe Threads: ASME B1.20.1.
 10. Plastic Toilet Seats: ANSI Z124.5.
 11. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.7 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures of unit shell.
 - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 2. Warranty Period for Commercial Applications: Five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Flushometer Tank, Repair Kits: Equal to 5 percent of amount of each type installed, but no fewer than 2 of each type.
6. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.
7. Toilet Seats: Equal to 5 percent of amount of each type installed.
8. Dry Urinal Trap-Seal Cartridges: Equal to 200 percent of amount of each type installed, but no fewer than 12 of each type.
9. Dry Urinal Trap-Seal Liquid: Equal to 1 gal for each urinal installed.

PART 2 - PRODUCTS (All products shall adhere to S.1726 - 21st Century Buy American Act.)

2.1 LAVATORY FAUCETS

A. Lavatory Faucets LF-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or by one of the following:
 - a. Hydrotek: No. H-5000E with AC adapter.
 - b. Other Owner approved WaterSense labeled substitute.
2. Description: Single-control nonmixing valve; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.35 gpm.
 - d. Centers: Single hole with 4 inches centers for three point anchoring.
 - e. Mounting: Deck, exposed.
 - f. Inlet(s): NPS 3/8 tubing, plain end.
 - g. Spout: Rigid type.
 - h. Spout Outlet: Aerator 0.35 gpm.
 - i. Operation: Sensor.
 - j. Drain: Grid.
 - k. Tempering Device: None.
 - l. Preset for 12 seconds operation.

B. Lavatory Faucets LF-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or by one of the following:
 - a. Hydrotek: No. 5000EM.
 - b. Other Owner approved WaterSense labeled substitute.
 2. Description: Single-hole deck mounted sensor operated with hot/cold mixing adjustments, with mixing valve; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 1.5 gpm.
 - d. Centers: Single hole.
 - e. Mounting: Deck, exposed.
 - f. Valve Handle(s): Not applicable.
 - g. Inlet(s): NPS 3/8 tubing, plain end.
 - h. Spout: Rigid type.
 - i. Spout Outlet: Aerator 1.5 gpm aerator.
 - j. Operation: Sensor.
 - k. Drain: Grid.
 - l. Tempering Device: Thermostatic.
 - m. Preset for 12 seconds operation.
- C. Lavatory Faucets LF-3:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or by one of the following:
 - a. Hydrotek: No. 5000EM.
 - b. Other Owner approved WaterSense labeled substitute.
 2. Description: Single-hole deck mounted sensor operated with hot/cold mixing adjustments, with mixing valve; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.35 gpm.
 - d. Centers: Single hole.
 - e. Mounting: Deck, exposed.
 - f. Valve Handle(s): Not applicable.
 - g. Inlet(s): NPS 3/8 tubing, plain end.
 - h. Spout: Rigid type.
 - i. Spout Outlet: Aerator 0.35 gpm.
 - j. Operation: Sensor.
 - k. Drain: Grid.
 - l. Tempering Device: Thermostatic.
 - m. Preset for 12 seconds operation.

D. Lavatory Supply Stops:

1. 3/8 inch lockshield angle type stops with slow compression cartridge and loose key. Wall type supply faucets shall include integral or built-in stops.

2.2 SHOWER FAUCETS

A. Shower Faucets :

1. Basis-of-Design Product: Subject to compliance with requirements, provide Speakman NEO No. SM-1000-P pressure balance Valve and trim with Kohler No. K-11637-H shower head. Complete with Kohler No. K-7397-CP 7-1/2 - inch arm, flange, or comparable product by one of the following:
 - a. American Standard Companies, Inc.
 - b. Other Owner approved WaterSense labeled substitute.
2. Description: Single-handle pressure-balance valve. Include hot- and cold-water indicators; check stops; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.
 - a. Body Material: Solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 1.5 gpm.
 - d. Diverter Valve: Integral with mixing valve.
 - e. Mounting: Exposed.
 - f. Backflow Protection Device for ADA Hand-Held Shower: Required.
 - g. Operation: Single-handle, twist or rotate control.
 - h. Antiscald Device: Integral with mixing valve.
 - i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
 - j. Supply Connections: NPS 1/2.
 - k. Shower Head Type: See plumbing fixture schedule.
 - l. Shower Head Material: Metallic with chrome-plated finish.
 - m. Spray Pattern: Adjustable.
 - n. Integral Volume Control: Not required.
 - o. Shower-Arm Flow-Control Fitting: See plumbing fixture schedule.
 - p. Temperature Indicator: Not required.

B. Shower Faucets, HSH:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler No. K-72587 - 1.5 gpm shower head and slide bar.
2. Lever diverter shall be modified for ADA shower, located adjacent to mixing valve, 48 inches maximum above floor.
3. Kohler No. K-98343-CP 36-inch chrome plated brass bar and adjustable bracket type.
4. Shower accessories

- a. Kohler No. K-98343-CP 4436-inch chrome plated brass bar and adjustable bracket type.
- b. Kohler No. K-9514 - 60-inch flexible metal shower hose and adjustable hand held shower with aerated spray.

2.3 SINK FAUCETS

A. Sink Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay No. LKD2439C or Owner approved substitution.
2. Description: Kitchen faucet without spray. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 1.5 gpm unless otherwise indicated.
 - d. Mixing Valve: Two-lever handle.
 - e. Backflow Protection Device for Hose Outlet: N/A.
 - f. Backflow Protection Device for Side Spray: N/A.
 - g. Centers: 8 inches.
 - h. Mounting: Deck.
 - i. Handle(s): Wrist blade, 4 inches.
 - j. Inlet(s): NPS 3/8 plain-end tubing.
 - k. Spout Type: Swivel gooseneck.
 - l. Spout Outlet: Aerator.
 - m. Vacuum Breaker: Not required.
 - n. Operation: manual.
 - o. Drain: Pop up.

B. Service Sink:

1. Wall-mounted combination faucet with integral stops, wall brace, pail hook, 3/4-inch hose thread end, and vacuum breaker, equal to Speakman No. SC-5811.

C. Mop Sink:

1. Wall-mounted combination faucet with integral stops, wall brace, pail hook, 3/4-inch hose thread end, and vacuum breaker, equal to Speakman No. SC-5811-RCP modified with 30-inch plain end rubber hose with wall bracket.

D. Shop Sinks:

1. Combination wall type supply fittings with vandal-proof aerator nozzle, two-inch spray head, integral stops and metal soap dish with.

- a. Swing spout, equal to Speakman No. S-5732-1S.
 - b. Gooseneck spout, equal to Speakman No. SC-5744 cross handles (aerator) with four arm handles, No. SC-5744-SO (spray head), with four arm handles.
- E. Animal Relief hose spray:
1. Single water temperature Meter-Matic cartridge valve body, Push button operation, adjustable timer setting 5-60 seconds. Installation at 48 inches maximum above floor. With flexible 60-inch long stainless steel hose and adjustable hand held shower with aerated spray.
 2. Complete installation with 44-inch chrome plated brass bar. Finish: Chrome plated or stainless steel.
 3. Manufacturer: Acorn Type 7 valve with FX type shower head.

2.4 FLUSHOMETERS

A. Flushometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hydrotek No. HB-8-128DF for toilets and H8-B1.125 for urinals, or by one of the following:
 - a. Other Owner approved WaterSense labeled substitute. .
2. Description: Flushometer for urinal and water-closet-type fixture. Include brass body with corrosion-resistant internal components, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: piston operation.
 - b. Style: Exposed.
 - c. Inlet Size: NPS 3/4 (urinal) NPS 1 (water closet).
 - d. Trip Mechanism: Hard-wired, electric-sensor actuator.
 - e. Consumption: 0.125 gal./flush (urinal); 1.1/ 1.28 gal./flush dual flush type (water closet).
 - f. Tailpiece Size: NPS 3/4 (urinal); NPS 1-1/2 (water closet).

2.5 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the Centoco Model 500ST SCC or Owner approved substitution.
2. Description: Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent.
 - b. Configuration: Open front without cover.

- c. Size: Elongated.
- d. Hinge Type: SC, self-sustaining, check.
- e. Class: Standard commercial.
- f. Color: White.

2.6 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGuire Manufacturing Co., Inc.
 - b. TRUEBRO, Inc.
 - c. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
- 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.7 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Josam Company.
- 2. MIFAB Manufacturing Inc.
- 3. Smith, Jay R. Mfg. Co.
- 4. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
- 5. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Water-Closet Supports:

- 1. Description: Combination carrier designed for accessible or standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
- 2. Concealed adjustable extra heavy cast iron combination drainage fitting and chair carriers with an adjustable base anchored to slab using all base support holes, rear anchor foot assembly for stud walls, adjustable cast iron outlet nipple and/or coupling, neoprene gasket and steel supporting bolts with chrome plated washers and cap nuts.

C. Urinal Supports:

1. Description: Type II, urinal carrier with hanger and bearing plates for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.
3. Concealed adjustable iron chair carrier with bearing plate and steel supporting bolts, with 3-inch x 1-inch rectangular uprights welded to base.

D. Lavatory Supports:

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.8 DISHWASHER AIR-GAP FITTINGS

A. Dishwasher Air-Gap Fittings :

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:
 - a. Brass Craft Mfg. Co.; a Subsidiary of Masco Corporation.
 - b. Brasstech Inc.; Newport Brass Div.
 - c. Watts Brass & Tubular; a division of Watts Regulator Co.
2. Description: Fitting suitable for use with domestic dishwashers and for deck mounting; with plastic body, chrome-plated brass cover; and capacity of at least 5 gpm; and inlet pressure of at least 5 psig at a temperature of at least 140 deg F. Include 5/8-inch- ID inlet and 7/8-inch- ID outlet hose connections.
3. Hoses: Rubber and suitable for temperature of at least 140 deg F.
 - a. Inlet Hose: 5/8-inch ID and 48 inches long.
 - b. Outlet Hose: 7/8-inch ID and 48 inches long.

2.9 WATER CLOSETS TYPE WC and HWC

- A. Basis-of-Design Product: Subject to compliance with requirements, American Standard No. 2634.101 or Owner approved substitution.
- B. Description: Accessible, wall-mounting, wall outlet, vitreous-china fixture designed for flushometer valve operation.
- C. Style: One piece.
 1. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
 2. Height: Accessible.
 3. Design Consumption: 1.1 / 1.28 gal. / flush, dual flush.
 4. Trip Mechanism: Sensor.

5. Color: White.

2.10 URINALS UR

- A. Basis-of-Design Product: Subject to compliance with requirements, Kohler No. K-4991-ER-0 or a comparable product by one of the following:
 1. American Standard Companies, Inc.
 2. Zurn Plumbing Products Group; Commercial Brass Operation.
- B. Description: Accessible and standard, wall mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 1. Type: Siphon jet.
 2. Strainer or Trapway: Integral cast strainer with integral trap.
 3. Design Consumption: 0.125 gal/flush.
 4. Color: White.
 5. Supply Spud Size: NPS 3/4.
 6. Outlet Size: NPS 2.
 7. Fixture Support: Urinal chair carrier

2.11 PUBLIC LAVATORIES

A. LAVATORY L2

1. Basis of Design Product: Subject to compliance with requirements, provide American Standard No. 9141.047 or Owner approved substitution.
2. Description: Accessible, wall-mounting, vitreous-china fixture.
 - a. Type: With back.
 - b. Size: 20 by 18-1/4 inches rectangular.
 - c. Faucet type: LF1.
 - d. Faucet Hole Punching: One hole..
 - e. Faucet Hole Location: Top.
 - f. Color: White.
 - g. Supplies: NPS 3/8 chrome-plated copper with stops.
 - h. Drain: See faucet.
 - i. Drain Piping: NPS 1-1/4 thick tubular brass waste to wall; and wall escutcheon.

B. LAVATORY L1 .

1. Basis of Design Product: Subject to compliance with requirements, provide Dupont Corian No. 810 or Owner approved substitution.
2. Description: Accessible, counter-mounting, vitreous-china fixture.

- a. Type: Corian
- b. Size: 16-1/2 by 13 BY 5-1/2 inches deep.
- c. Faucet type LF 1 for public restrooms and LF2 for Family and Nursing rooms.
- d. Faucet Hole Punching: none.
- e. Color: Bisque.
- f. Supplies: NPS 3/8 chrome-plated copper with stops.
- g. Drain: See faucet.
- h. Drain Piping: NPS 1-1/4 thick tubular brass waste to wall; and wall escutcheon.

C. LAVATORY L3

1. Basis of Design Product: Subject to compliance with requirements, provide American Standard No. 9024.001 EC or Owner approved substitution.

2. Description: Accessible, wall-mounting, vitreous-china fixture.

- a. Type: With back.
- b. Size: 20 by 18 inches rectangular.
- c. Faucet type: LF1.
- d. Faucet Hole Punching: One hole..
- e. Faucet Hole Location: Top.
- f. Color: White.
- g. Supplies: NPS 3/8 chrome-plated copper with stops.
- h. Drain: See faucet.
- i. Drain Piping: NPS 1-1/4 thick tubular brass waste to wall; and wall escutcheon.

2.12 HOT-WATER DISPENSERS

A. Instant Hot Water Dispensers, Type HWD:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or Owner approved substitution.
2. Locations: Pantry sinks.
3. Description: Gooseneck spout with lever-handle, flow control, household-type dispenser with instant on-off control; insulated, corrosion-resistant-metal storage tank that is open to atmosphere; electric heating element; chrome-plated faucet or spout; removable strainer; thermostat control for water temperature up to 190 deg F; and thermal-overload protection.
 - a. Storage Tank Capacity: 0.5 gal. minimum.
 - b. Heating Element: 750 W minimum, 115-V ac.

2.13 SINKS

A. Pantry Sinks Type P.SK:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Elkay Manufacturing Co. No. LRDA221965PD-MR2 Lustertone.
 - b. Owner approved substitute.
2. Description: One bowl 18 Gauge stainless-steel kitchen sink.
 - a. Overall Dimensions: 22" X 19-1/2" X 6-1/2" deep.
 - b. Faucet holes: two faucet and hot water dispenser.
 - c. Drain: 3-1/2-inch crumb cup.
 - a) Location: Centered in bowl.
 - c. Supplies: NPS 1/2 chrome-plated copper with stops.
 - d. Drain Piping: NPS 1-1/2 chrome-plated, cast-brass P-trap; tubular brass waste to wall; and wall escutcheon(s).

B. Service Sinks Type S.SK:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Elkay Manufacturing Co. No. ESS25202.
 - b. Owner approved substitute.
2. Description: Single bowl 14 Gauge 304 stainless-steel wall mounted sink.
 - a. Overall Dimensions: 25" X 19-1/2" X 12" deep.
 - b. Backsplash: 12" high.
 - c. Faucet holes: two.
 - d. Drain: 3-1/2-inch with strainer.
 - e. Location: Centered in bowl.
 - f. Supplies: NPS 1/2.
 - g. Drain Piping: NPS 3 cast-iron P-trap with off floor support; waste to wall; and wall escutcheon.
 - h. Faucet: refer to service sink faucet.

2.14 TOILET ACCESSORIES

- A. By general construction contractor.

2.15 SERVICE BASINS Type MS.

A. Basis-of-Design Product: Subject to compliance with requirements, provide Fiat No. TSB-100 or a comparable product by one of the following:

1. Florestone Products Co., Inc.
2. Stern-Williams Co., Inc.

B. Description: Flush-to-wall, floor-mounting, precast terrazzo fixture with rim guard.

- a. Shape: Square.
- b. Size: 24 by 24 inches.
- c. Height: 12 inches.
- d. Tiling Flange: On three sides.
- e. Rim Guard: On all top surfaces.
- f. Color: Not applicable.
- g. Drain: Grid with NPS 3 outlet.

2.16 SECURITY COMBINATION UNITS Type SCU

A. Combination Units: Front access, on floor, cabinet, with water closet and lavatory.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Acorn Engineering Company No. 1449 or comparable product by one of the following:

- a. Bradley Corporation.
- b. Metcraft Industries Inc.

2. Material: 0.078-inch- minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
3. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
4. Cabinet: Rectangular apron Four-sided apron with angled side, with backsplash and access panel.

a. Water-Closet Bowl Location: See architectural floor plans for bowl orientation.

5. Mounting: Bolts through wall sleeve into accessible service space.

6. Water Closet:

- a. Standard: IAPMO PS 61.
- b. Bowl:

- 1) Type: Elongated, with back inlet, integral trap, and blowout design with back outlet and contoured seat.
- 2) Seat Surface: ASTM A 480/A 480M, No. 7 polished finish.
- 3) Punching: Two holes for installation of separate toilet seat.
- 4) Outlet Connection: N/A.

7. Lavatory:
 - a. Standard: ASME A 112.19.3/CSA B45.4.
 - b. Location: In top of cabinet.
 - c. Receptor: Oval bowl with integral soap depression.
 - d. Hot- and Cold-Water and Bubbler Supply Valves: Mechanical-metering type with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
 - e. Filler Spout: Backsplash mounted.
 - f. Drain: Integral punched grid with NPS 1-1/4 minimum waste and trap complying with ASME A112.18.2/CSA B125.2.
8. Wall Sleeve: N/A.

2.17 EMERGENCY SHOWER WITH EYEWASH COMBINATION UNITS ESH

- A. Standard, Plumbed Emergency Shower with Eyewash Combination Units:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Bradley Corporation.
 - b. Haws Corporation.
 - c. Speakman Company.
 2. Piping:
 - a. Material: Galvanized steel, factory painted.
 - b. Unit Supply: NPS 1-1/4 minimum.
 - c. Unit Drain: Outlet at back or side near bottom.
 3. Shower:
 - a. Capacity: Not less than 20 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod.
 - d. Shower Head: Standard flow control shower head, plastic.
 - e. Mounting: Pedestal.
 4. Eyewash Unit:
 - a. Capacity: Not less than 0.4 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Spray-Head Assembly: Two receptor-mounted spray heads.
 - e. Receptor: Chrome-plated brass or stainless-steel bowl.
 - f. Mounting: Attached shower pedestal.
 - g. Drench-Hose Option: May be provided instead of eyewash unit.

- 1) Capacity: Not less than 0.4 gpm for at least 15 minutes.
- 2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
- 3) Mounting: Bracket on shower pedestal.

2.18 EYEWASH UNIT EEW

- A. Standard, Wall-Mounted, Plumbed Face/Eyewash Units:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Haws Corporation No. 7361-7461 or comparable product by one of the following:
 - a. Bradley Corporation.
 - b. Speakman Company.
 2. Capacity: Not less than 0.4 gpm for at least 15 minutes.
 3. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 4. Control-Valve Actuator: Paddle.
 5. Spray-Head Assembly: Two receptor-mounted spray heads.
 6. Receptor: Stainless-steel bowl, 11-inch Dia.
 7. Drain Piping: NPS 1-1/4 minimum, galvanized receptor drain/pedestal, complying with ANSI Z358.1.
 8. Mounting: Floor mounted pedestal type.

2.19 WASHING MACHINE OUTLET BOX

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sioux Chief No. 696-G2313XF or a comparable product by one of the following:
1. Watts.
 2. IPS Corporation.
- B. Description: Flush-to-wall, floor-mounting, precast terrazzo fixture with rim guard.
- a. Shape: Recessed, dual box combination.
 - b. Frame: White, durable.
 - c. Support: Galvanized steel bracket and box clip.
 - d. Drain: 3/4 male garden hose tread outlets.
 - e. Water connections: 1/4 turn lever handle ball valves with water hammer arresters, color coded 1/2-inch female sweat inlet connections.

2.20 ABLUTION FOOT BATH

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Wudu Mate-M or a comparable product by one of the approved manufacturers.

- B. Description: Prefabricated modular design for traditional position for seated wudu combined with optional standing positions; configured for wheelchair access,
 - a. Material: Sanitary-grade, reinforced acrylic and stainless steel.
 - b. Finish: high-quality sanitary grade acrylic.
 - c. Color: white.
 - d. Seat top: double skin, sanitary grade acrylic.
 - a. Seat post: stainless steel
 - b. Drain: Stainless steel strainer, with offset shower waste outlet.
- C. Ablution tap: Time delay wall mounted tap, with Neoperl pressure equalizing aerator, ¼ turn on/off mechanism at the end of spout, Wudu Mate #WM-TMV3 thermostatic mixing valve, chrome plated finish.

2.21 COMMERCIAL GARBAGE DISPOSAL

- A. Basis-of-Design Product: Subject to compliance with requirements, provide InSinkEratorSS-300 or a comparable product by one of the following:
 - 1. Salvajor.
 - 2. Owner approved substitute.
- B. Description: Multi-grind 2-stage technology, sound seal performance, with sink top switch.
 - a. Capacity: 34.6 OZ.
 - b. Power: 3 HP, 208-230V, 3 Phase.
 - c. Control panel InSinkErator No. AS_101:
 - 1). Automatic shut-off with power loss.
 - 2). Line disconnect.
 - 3). Programmable post-flush.
 - 4). Timer.
 - 5). Automatic regulation of water flow.

2.22 SPITTOON SINK

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kraus No. KHF200-30 or a comparable product by one of the following:
 - 1. Elkay Manufacturing Co.
 - 2. Owner approved substitute.
- B. Description: One bowl 16 Gauge stainless-steel kitchen sink with apron front.
 - 1. Installation: undermount.

2. Overall Dimensions: 29-3/4" X 20-3/4" X 10" deep.
3. Faucet holes: faucetless
4. Drain: 3-1/2-inch crumb cup.
5. Location: Centered in bowl.
6. Drain Piping: stainless steel or PVDF.

2.22 FIXTURE CONNECTION SCHEDULE

- C. Sizes of branch piping shall be not less than listed below. Actual connection sizes shall be as required by connection on fixtures.
- D. Water closets: Drain: 4 inch, vent: 2 inch, CW: 1 inch.
- E. Urinals: Drain: 2 inch, vent: 1½ inch, CW: ¾ inch.
- F. Lavatories: Drain: 1½ inch, vent: 1½ inch, CW: 3/8 inch, HW: 3/8 inch.
- G. Sinks: Drain: 2 inch, vent: 1½ inch, CW: ½ inch, HW: ½ inch.
- H. Service sinks: Drain: 3 inch, vent: 1½ inch, CW: ¾ inch, HW: ¾ inch.
- I. Mop sinks: Drain: 3 inch, vent: 1½ inch, CW: ¾ inch, HW: ¾ inch.
- J. Washing machine outlet box: Drain: 3 inch, vent: 1½ inch, CW: ¾ inch, HW: ¾ inch.
- K. Ablution Bath: Drain: 1½ inch, vent: 1½ inch, CW: ½ inch, HW: ½ inch. Ice makers: CW: 3/8 inch.
- L. Eye wash: Drain: 1½ inch, vent: 1½ inch CW: 1/2 inch.
- M. Emergency shower and eye wash combination unit: Drain outlet: 1¼ inch, CW: 1¼ inch.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
4. Lag fixture carrier base plates or feet to slab with lead expansion shields and insert bolts in all bolt holes.
5. Where wall hung water closets are supported adjacent to stud walls, provide rear anchor foot assembly bolted to slab.

Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

Install wall-mounting fixtures with tubular waste piping attached to supports.

Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

Install counter-mounting fixtures in and attached to casework.

Install fixtures level and plumb according to roughing-in drawings.

Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

- N. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach. Adjust flushometer valves to be plumb vertically.

- O. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- P. Install toilet seats on water closets.
- Q. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- R. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- S. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- T. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- U. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- V. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- W. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- X. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- Y. Ground equipment according to Division 26 Section "Grounding and Bonding."
- Z. Connect wiring according to Division 26 Section "Busways - Low-Voltage".

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

- A. Refer to section 01 74 23 “Final cleaning” for cleaning procedure protocol.
- B. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- C. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 TESTING AND COMMISSIONING

- A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Divisions 01, 23 and 26 further details.

- B. System functional testing is part of the Commissioning Process. Functional testing shall be performed by the contractor and witnessed and documented by the Commissioning Authority. Refer to Section 01 Section on Commissioning, for system functional tests and commissioning requirements.

3. 8 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4000

SECTION 22 47 00 - DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following water coolers and related components:
 - 1. Pressure water coolers.
 - 2. Fixture supports.

1.3 DEFINITIONS

- A. Accessible Electric Water Cooler: Fixture that can be approached and used by people with disabilities.
- B. Cast Polymer: Dense, cast-filled-polymer plastic.
- C. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
- D. Fitting: Device that controls flow of water into or out of fixture.
- E. Fixture: Drinking fountain or water cooler unless one is specifically indicated.
- F. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Line diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; A117.1: "Specifications for making buildings and facilities accessible to and usable by physically handicapped people" for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects; Sections 1 through 9" and Annex F & G for fixture materials that will be in contact with potable water.
- D. AHRI Standard: Comply with AHRI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. AHRI Standard: Comply with AHRI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with AHRI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filter Cartridges: Equal to 100 percent of amount installed for each type and size indicated.

PART 2 - PRODUCTS

2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 PRESSURE WATER COOLERS

- A. Water Coolers, EWC:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Filtrine No. FC-107-16-SOOOO, with TM1-05 filter or a comparable product by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Murdock Mfg.
 - e. Oasis Corporation.

2. Type EWC: Description: ARI 1010, Type PB, pressure with bubbler, Style FW, flush-to-wall water cooler.
 - a. Cabinet: All stainless steel satin finish.
 - b. Bubbler: One, with adjustable stream regulator, located on deck, soft touch button.
 - c. Control: Sensor operated.
 - d. Bottle filling station: Vandal proof, sensor activated, mounted 10 inch above lowest bowl.
 - e. Bottle rest: to be located above lowest bowl. Supply: NPS 3/8 with ball, gate, or globe valve.
 - f. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for 0.5 gph flow rate.
 - g. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
 - h. Cooling System: Electric, with precooler, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 5 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
 - 2) Electrical Characteristics: 115-V ac; single phase; 60 Hz.
 - i. ADA compliant.
 - j. Filtrine Model numbers:
 - 1) Single unit – FC-107-16, mounted at ADA height
 - 2) Double unit – FC-16-HL-VP
 - 3) Triplex unit – FC-16-HHL-VP

2.3 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Josam Co.
 2. MIFAB Manufacturing, Inc.
 3. Smith, Jay R. Mfg. Co.

4. Zurn Plumbing Products Group; Specification Drainage Operation.
 - B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
 1. Type I: Hanger-type carrier with two vertical uprights.
 2. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Use mounting frames for recessed water coolers, unless otherwise indicated.
- C. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
 1. On block walls, fasten wall hanger to 18 inch by 4 inch built-in iron backing plates,
 - a. equal to Smith No. 825 modified (tile walls) and to Smith No. 826 modified.
 2. Fasten wall hanger to concealed adjustable iron chair carrier. For block walls, use supports
 - a. equal to Smith No. 830.
 3. For stud walls, use supports

- a. equal to Smith No. 830-M31, with 3 inch by 1 inch rectangular uprights welded to base.
- C. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section 22 05 23 "General-Duty Valves for Plumbing Piping."
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section 22 05 00 "Common Work Results for Plumbing."
- G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding".
- D. Connect wiring according to Division 26 Section "Busways - Low-Voltage".

3.5 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.6 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

3.7 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 22 4700

SECTION 22 70 00 – NATURAL FUEL GAS SYSTEMS - PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Dielectric fittings.
7. Sleeves.
8. Mechanical sleeves.
9. Escutcheons.
10. Pressure gauges.
11. Low pressure switches.
12. Alarms and monitors.
13. Labeling and identification.
14. Grout.
15. Cathodic protection.
16. Concrete bases.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 125 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 125 psig minimum unless otherwise indicated.
 - 3. Minimum Operating Pressure of Service Meter: 125 psig.
- B. Natural-Gas System Pressure within Buildings: 4 inches WC to 3 psig.

1.5 SUBMITTALS

- A. Shop Drawings Provide product data for each type of the following:
 - 1. Piping
 - 2. Fittings
 - 3. Joints.
 - 4. Piping specialties
 - 5. Corrugated, stainless-steel tubing with associated components.
 - 6. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 7. Pressure regulators. Indicate pressure ratings and capacities.
 - 8. Service meters including supports
 - 9. Dielectric fittings.
 - 10. Mechanical sleeve seals.
 - 11. Escutcheons.
 - 12. Supports
- B. Coordination Drawings: Plans and details, drawn to 1/4 scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- C. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

- D. Qualification Data: For qualified professional engineer.
- E. Welding certificates.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For gas valves pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Refer to section 22 05 00.
- B. Reference Standards:
 - 1. Florida Building Code.
 - 2. NFPA No. 54 National Fuel Gas Code – latest edition.
 - 3. Local utility requirements.
 - 4. Published Specifications' standards, tests or recommended methods of trade, industry or governmental organizations.
 - 5. American Gas Association (AGA).
 - 6. Compressed Gas Association (CGA).
 - 7. Military Standard Spec. (MSS).
 - 8. Underwriters Laboratory.
 - 9. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 10. Pipe Welding Qualifications: Qualify procedures and operators according to ASME IX Boiler and Pressure Vessel Code - latest edition.
 - 11. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify Construction Manager no fewer than seven (7) days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without Construction Manager's written permission.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."
- C. Provide valved gas piping for heating, ventilating and air conditioning equipment to within ten (10) feet of equipment connections.

PART 2 - PRODUCTS

- 2.1 All products shall adhere to S.1726 - 21st Century Buy American Act.

2.2 MANUFACTURERS

- A. Exterior wall sleeves:
 - 1. Innerlinks.
 - 2. Thunderline.

- B. Steel pipe and fittings:
 - 1. Crane Co.
 - 2. National Tube Co.
 - 3. Republic Steel Co.
 - 4. Allied Steel.

- C. Fittings:
 - 1. Crane Co.
 - 2. Tube Turn.
 - 3. Walworth.
 - 4. Allied Steel.

- D. Gas vent terminals:
 - 1. Acme Scales Co., Inc.
 - 2. Richards Manufacturing.
 - 3. UPSCO, Inc.

- E. Hangers and supports:
 - 1. Anvil International.
 - 2. Michigan Hanger (Erico).
 - 3. PSI Corp.
 - 4. B-Line.
 - 5. Carpenter & Patterson, Inc.

- F. Paint:
 - 1. Sherwin Williams.
 - 2. Pittsburgh Plate Glass Co.
 - 3. Pratt & Lambert.

- G. Valves:
 - 1. Plug valves (Gas Cocks):
 - a. Conbraco Industries.
 - b. A.Y. McDonald Mfg. Co.
 - c. Crane Co.
 - d. DeZurik Healy Co.
 - e. Nordstrom Valves, Inc.
 - f. Walworth Co.

H. Natural Gas Alarms:

1. Mine Safety Appliances.

I. Carbon Monoxide Alarms:

1. Mine Safety Appliances.
2. S-Tech Division of Patrick Plastics, Inc.
3. G.E. Interlogix.
4. Kidde.

J. Pressure Gauges:

1. Trerice Co.
2. U.S. Gage.
3. Weiss.

2.3 PIPING

A. Inside steel piping:

1. For low pressure 0.5 PSIG or less use standard weight black steel pipe with 150 PSIG threaded malleable iron fittings for piping 2 in. and smaller.
2. For low pressure 0.5 PSIG or less use steel welded fittings for piping 2-1/2 in. and larger.
 - a. All in accordance with ANSI Z223.1; NFPA-54 and Florida Building Code; whichever is more stringent.
3. For pressure (0.5 PSIG to 3 PSIG) use black steel pipe and steel welded fittings for piping 4 in. and larger and threaded for piping under 4 in.
4. For pressure above 3 PSIG, all piping shall be welded.

B. Underground piping:

1. Steel pipe with Dresser type and steel welding fittings. Pre-wrap with Mill-wrapped corrosion protection extruded polyolefin coating in accordance with Gas Company requirements, equal to Energy Coating Co. or PlexCo.
2. High density polyethylene pipe and fittings in accordance with ASTM D-2513, Grades 2306, 3306, and 3408 with fusion joints only, equal to Driscopipe 8100-DRII Series.

- C. Underground drips shall be AGA and local gas company approved and shall be cast iron or tar coated welded steel pots with adjustable tar coated cast iron extension shaft and flush box with lock type extra heavy cast iron cover marked GAS DRIP.
- D. In no case shall any gas pipe be less than $\frac{3}{4}$ inch.

2.4 GAS VENT TERMINALS

- A. $\frac{3}{4}$ in. and one (1) in. aluminum threaded vent terminal with 16 x 16 mesh 0.018 gauge stainless steel screen.
- B. $1\frac{1}{4}$ in. to 4 in. standard pipe threaded elbow with 12 x 12 mesh stainless steel screen.
 - 1. Equal to UPSCO, Inc.
- C. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welded Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welded to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 - 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
 - 6. Mechanical Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Dresser Piping Specialties; Division of Dresser, Inc.
 - 2) Smith-Blair, Inc.
- b. Steel flanges and tube with epoxy finish.
 - c. Buna-nitrile seals.
 - d. Steel bolts, washers, and nuts.
 - e. Coupling shall be capable of joining steel pipe to steel pipe.
 - f. Steel body couplings installed underground on pipe shall be factory equipped with anodes.

D. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

2.5 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Corrugated stainless-steel tubing with polymer coating.
4. Operating-Pressure Rating: 0.5 psig.
5. End Fittings: Zinc-coated steel.
6. Threaded Ends: Comply with ASME B1.20.1.
7. Maximum Length: 72 inches.

B. Weatherproof Gas Vent Terminal Caps: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

C. $\frac{3}{4}$ in. and one (1) in. aluminum threaded vent terminal with 16 x 16 mesh 0.018 gauge stainless steel screen.

D. $1\frac{1}{4}$ in. to 4 in. standard pipe threaded elbow with 12 x 12 mesh stainless steel screen.

1. Equal to UPSCO, Inc.

2.6 PIPE AND TUBING JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural fuel gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.7 VALVES

- A. Manual Shut-off Valves Inside Building
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: 125 psig.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - 4. Tamperproof Feature: Locking feature for valves where required by Con. Ed.
 - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 - 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
 - 7. Threaded cast iron body, 125 PSIG wog
 - a. Equal to Nordstrom Fig. 114.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
 - 1. CWP Rating: 125 psig.
 - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - 3. Tamperproof Feature: Locking feature for valves where required by Con. Ed.
 - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
 - 5. 2½ in. to 4-in.: Flanged cast iron body lubricated tapered plug type, 175 PSIG wog.
 - a. Equal to Nordstrom Fig. 115.
 - 6. 6 in. and larger: Flanged cast iron body lubricated tapered plug type, 200 PSIG wog, worm gear operated.
 - a. Equal to Nordstrom Fig. 165.
- D. Provide 2 wrenches for each size used.
 - 1. Attach wrench to each valve.
- E. Ball Valves
 - 1. On local branches three inches and smaller, provide threaded three piece full port wafer-type ball valve with bronze body, ball stem, Teflon seats, and level handles, 300 PSIG wog.

- a. Equal to Contromatics No. C-1111-AA.
- F. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
- 1. 2 inch and smaller: Threaded brass ball valves with full port TFE seats and blowout proof stem, 600 psig wog.
 - a. Equal to NIBCO N: T-FP-600.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. NIBCO.
 - f. Perfection Corporation; a subsidiary of American Meter Company.
 - 3. Body: Bronze, complying with ASTM B 584.
 - 4. Ball: Chrome-plated bronze.
 - 5. Stem: Bronze; blowout proof.
 - 6. Seats: Reinforced TFE; blowout proof.
 - 7. Packing: Threaded-body packnut design with adjustable-stem packing.
 - 8. Ends: Threaded, flared, or socket.
 - 9. CWP Rating: 600 psig.
 - 10. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 11. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. Check Valves:
- 1. Provide bronze body swing disc check valve.
 - a. Equal to Eclipse Series 1000.
- H. Bronze Plug Valves: MSS SP-78.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond
 - b. Lee Brass Company.
 - c. McDonald, A. Y. Mfg. Co.

- d. NIBCO
 - 2. Body: Bronze, complying with ASTM B 584.
 - 3. Plug: Bronze.
 - 4. Ends: Threaded, socket, or flanged.
 - 5. Operator: Square head or lug type with tamperproof feature where indicated.
 - 6. Pressure Class: 125 psig.
 - 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

- I. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McDonald, A. Y. Mfg. Co.
 - b. Mueller Co.; Gas Products Div.
 - c. Xomox Corporation; a Crane company.

 - 2. Body: Cast iron, complying with ASTM A 126, Class B.
 - 3. Plug: Bronze or nickel-plated cast iron.
 - 4. Seat: Coated with thermoplastic.
 - 5. Stem Seal: Compatible with natural gas.
 - 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 7. Operator: Square head or lug type with tamperproof feature where indicated.
 - 8. Pressure Class: 125 psig.
 - 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

- J. Cast Lubricated Plug Valves Inside Building:
 - 1. 2-inch and smaller: Cast iron body, threaded, equal to Nordstrom Valves, Inc. Figure 114.
 - 2. 2½ inch to 4-inch: Flanged cast iron body lubricated tapered plug type, 175 PSIG wog, equal to Nordstrom Valves, Inc. Figure 115.
 - 3. Valves 2 ½ inch and larger shall be flanged.
 - 4. Provide 2 wrenches for each size used.
 - 5. Attach wrench to each valve.
 - 6. Gas Cocks:

- a. Gas cocks shall be for use only as manual gas shut-off valves at each piece of gas burning equipment; shall be of the plug type, bronze construction with check, nut and washer bottom and tee handle.
- b. Gas cocks shall be Figure 10596 as manufactured by A.Y. McDonald Mfg. Co., or Series 52 as manufactured by Conbraco Industries, Inc.
- c. Gas cocks shall only be used on piping 1 inch and smaller.

2.8 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ASCO or comparable product by one of the following:
 - a. ASCO Power Technologies, LP; Division of Emerson.
 - b. Dungs, Karl, Inc.
 - c. Eaton Corporation; Controls Div.
 - d. Eclipse Combustion, Inc.
 - e. Honeywell International Inc.
 - f. Johnson Controls.
 - g. G. Maxon.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.
7. Electrical operator for actuation by appliance automatic shutoff device.

2.9 GAS SAFETY SHUT-OFF VALVES

- ### A. Gas safety shut-off valves shall be FM & UL listed, electric motor operated, normally closed, manual reset type. Valves shall be rising stem design with a straight through flow path with metal-to-metal seat and disc arrangement. The valve seat shall be stainless steel and the disc ductile iron. Valves shall be provided with a NEMA 4 enclosure modified for Class I, Division II hazardous locations, be provided with an electrical terminal block and shall operate on 120 Volt, A.C., 60 Cycles, single phase. Valves shall meet ANSI Class VI leakage standard and shall be provided with a visual indicator to note the position of the valve whether "OPEN" or "SHUT."

- B. Gas safety shut-off valves 2" and smaller shall be threaded, 2 1/2" and larger shall be flanged. Flanged valves shall be provided with companion flange set by valve manufacturer.
 - 1. Gas safety shut-off valves 2" and smaller
 - a. Equal to Maxon Corporation Series 808.
 - 2. 2 1/2" and larger. All valves shall be provided with trim package 1-1.
 - a. Equal to Series 808-CP.
- C. Gas safety shut-off valves shall be installed in the following locations:
 - 1. On the firm gas line downstream of its meter and before any branch take-offs.
- D. Gas safety shut-off valves shall be wired to the gas leak detection system and shall function to shut off all gas supply to the building upon:
 - 1. Action of the gas leak detection system (alarm condition) would cause immediate power shut-down.
 - 2. Loss of normal electrical power.

2.10 PRESSURE REGULATORS

- A. General Requirements:
 - 1. Single stage and suitable for natural gas.
 - 2. Steel jacket and corrosion-resistant components.
 - 3. Elevation compensator.
 - 4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.
- B. Service Pressure Regulators: Comply with ANSI Z21.80.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - d. Invensys.

- e. Richards Industries; Jordan Valve Div.
 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 12. Maximum Inlet Pressure: 60 psig.
- C. Line Pressure Regulators: Comply with ANSI Z21.80.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Eclipse or comparable product by one of the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Eclipse Combustion, Inc.
 - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - e. Invensys.
 - f. Maxitrol Company.
 - g. Richards Industries; Jordan Valve Div.
 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 10. Overpressure Protection Device: Factory mounted on pressure regulator.

11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 1 psig.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Maxitrol Co. or comparable product by one of the following:
 - a. Canadian Meter Company Inc.
 - b. Eaton Corporation; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
 - e. SCP, Inc.
2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 1 psig.

2.11 GAS (SERVICE) METERS

- A. By local utility company.

2.12 DIELECTRIC FITTINGS

- A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

- f. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: 150 psig.
 3. Combination fitting of copper alloy and ferrous materials.
 4. Insulating materials suitable for natural gas.
 5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- B. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 - d. Wilkins; Zurn Plumbing Products Group.
 2. Minimum Operating-Pressure Rating: 150 psig.
 3. Combination fitting of copper alloy and ferrous materials.
 4. Insulating materials suitable for natural gas.
 5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- C. Dielectric-Flange Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 2. Minimum Operating-Pressure Rating: 150 psig.
 3. Companion-flange assembly for field assembly.
 4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
 5. Insulating materials suitable for natural gas.
 6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.13 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.14 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers: Subject to compliance with requirements, METRAFLEX or a comparable product by one the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.15 MECHANICAL GAS SLEEVES

- A. Carbon steel, zinc chromate bolts and nuts with corrosion inhibiting coating.
- B. Seal material EPDM, black in color.
- C. Pressure pates of reinforced nylon polymer.
- D. Equal to Thunderline Link Seal Model 'C'.

2.16 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.

- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Escutcheons: With set screw.
 - 1. Finish: Polished chrome-plated or rough brass.
- D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated or rough brass.
- E. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.17 PRESSURE GAUGES

- A. 4½ in. diameter, black enamel coated steel case ring with shatterproof glass, ½ in. bronze bellows with brass socket, blow out on back of case, ¼ in. bottom outlet connection, similar to Trerice No. 860 or Weksler Instruments Corp. No. BL14-PWE4-LWXX with 0 to 27 in. of water column dial, brass pressure snubber and brass tee-handle cock.
- B. Locate pressure gauges on inlet and outlet of gas booster pressure pump, at farthest point in system and as noted.

2.18 ALARMS AND MONITORS

- A. Natural Gas Monitor
 - 1. Explosion-proof stainless steel, infrared gas (carbon monoxide) detector with display, monitor controller and external power supply.
 - a. Equal to Ultima XIR Gas Monitor.
 - 2. Additional power supply to convert AC to DC.

- a. Equal to Ultima Power Supply No. 815320, 80 to 132 volts AC.
3. Wire to building management system alarm and shut down gas safety shut off valve.

2.19 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

2.20 UNDERGROUND LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

2.21 CATHODIC PROTECTION

- A. Provide a complete electrically isolated, cathodic protection system for entire length of underground gas line, including all components, suitable for temperatures and pressures involved.
- B. Prior to installation, conduct a corrosion site survey using a qualified corrosion engineer to evaluate soil conditions and establish system requirements.
- C. System shall be the sacrificial magnesium anode type with 17 lb anodes, spacing based upon soil resistivity readings, with a maximum spacing of 300 feet Pack anodes in permeable cloth bag in backfill: 75% ground hydrated gypsum, 20% powdered Wyoming bentonite, 5% anhydrous sodium sulfate.
- D. Magnesium anodes shall be high current type with magnesium wall having the following composition:
 1. Aluminum: 5.3 to 6.7%.
 2. Manganese: 0.15% minimum.

3. Zinc: 2.5 to 3.5%.
 4. Silicone: 0.3% maximum.
 5. Copper: 0.02% maximum.
 6. Nickel: 0.003% maximum.
 7. Iron: 0.003% maximum.
 8. Other impurities: 0.3% maximum.
 9. Magnesium: Remaining.
- E. Anodes shall be cast with perforated galvanized steel strap core. One end of anode shall be recessed so one end of strap is accessible for lead wire connection. Anode lead wires shall be 25 feet long, silver soldered to strap core and with a minimum 1 turns of wire at connection. Fill anode recess connection with electrical potting compound. Conductors shall be No. 12 AWG Type TW copper wire.
- F. Connectors shall be Cadwel Thermite brazing type elements for mechanically bonding conductors to steel pipe. Moisture proof all connections to piping. Splices shall be made with split bolt compression connectors and suitable protection tape.
- G. For pipe installed in sleeves, provide insulators, equal to Maloney Model 57, spaced 10-feet on centers, installed in accordance with manufacturer's recommendations. Provide insulating coupling for pipe penetrating building wall.
- H. Provide test stations housed in electrical conduit terminated in cast iron, waterproof junction boxes at ground surface. Embed in 12-inches x 12-inches x 6-inches concrete marker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

- B. Inspect natural-gas piping according to NFPA 54 Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 Fuel Gas Code requirements for prevention of accidental ignition.

3.3 INSTALLATION

- A. Install piping free from traps and with drain pocket consisting of nipple and cap at low points for inside building and drip pot for underground piping.
- B. Install shut-off valves at connection to each piece of equipment. Provide union or right and left nipple and coupling at equipment side of individual shut-off valve.
- C. Threaded Joints:
 - 1. Make-up joints with U.L. listed gas resistant Teflon tape or Teflon paste, suited for gas piping.
- D. Provide a two elbow-swing on all branches taken from a riser.
- E. Provide valve tags for piping systems indicating the operating system pressure.
- F. Color code piping at different pressures within the gas meter room. Paint fifteen (15) to five (5) psi system brown and reduced pressure piping yellow.
- G. Welders must be qualified in accordance with either API 1104 or A.S.M.E. IX Boiler and Pressure Vessel Code and as required by local code and ASW 31.1.
- H. Provide sign on the exterior of the gas meter door shall be provided with bold lettering at least 1 in. high and properly spaced with lettering and background in contrasting colors reading "Gas Meter Room - No Storage Permitted."
- I. Support horizontal gas piping as follows:
 - 1. ½ in. - 6 ft. on center.
 - 2. ¾ in. or 1 in. - 8 ft. on center.
 - 3. 1¼ in. or larger - 10 ft. on center.
 - 4. Vertical piping at every floor.

3.4 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 24 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving for Building Slabs" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in ductile iron pipe containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
- H. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- I. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- J. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified here-in Division 22 Section "Meters and Gages for Plumbing Piping."

3.5 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install escutcheons at penetrations of interior walls, ceilings, and floors.
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

- d. Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - e. Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - f. Piping in Equipment Rooms: One-piece, cast-brass type.
 - g. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
 - h. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- M. Verify final equipment locations for roughing-in.
- N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- O. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
- 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- R. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
- 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 - 3. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

- a. Exception: Tubing passing through partitions or walls does not require striker barriers.
4. Prohibited Locations:
- a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls, partitions and concrete slabs.
- S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- T. Connect branch piping from top or side of horizontal piping.
- U. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- V. Do not use natural-gas piping as grounding electrode.
- W. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- X. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."
- 3.6 VALVE INSTALLATION
- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
 - B. Install underground valves with valve boxes.
 - C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
 - D. Install anode for metallic valves in underground PE piping.
- 3.7 PIPING JOINT CONSTRUCTION
- A. Ream ends of pipes and tubes and remove burrs.

- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 120 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 120 inches; minimum rod size, 3/8 inch.
 - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 120 inches; minimum rod size, 1/2 inch.
 - 5. NPS 4 and Larger: Maximum span, 120 inches; minimum rod size, 5/8 inch.

- C. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.9 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel semigloss.
 - d. Color: Gray.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI INT 5.1E.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd semigloss.
 - d. Color: Yellow.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base.
 - 1. Construct concrete bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Use 3000-psi, 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.13 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- C. Pressure Tests:
 1. Per local code.
 2. Test low pressure systems up to 0.5 PSIG with air at 3 PSIG for a minimum of one hour.
 3. Test medium pressure systems up to 3 PSIG with air at 100 PSIG for a minimum of four hours.
 4. Test high pressure systems 3 PSIG-15 PSIG with air at 100 PSIG for a minimum of four hours.
- D. Controlled Inspection:
 1. Perform radiography test on all welds in gas service and at gas meter and piping where operating pressures exceed 3 PSIG and where required by the local utility company or code. Radiography shall be performed in accordance with API 1104 or A.S.M.E. Section IX Boiler and Pressure Vessel Code and as required by local code.
- E. Purge all piping after pressure test and all appliances after piping has been purged.
- F. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

ORLANDO INTERNATIONAL AIRPORT
BP-S195: TERM C, PH 1X – AIRSIDE
CONCOURSE

NATURAL FUEL GAS SYSTEMS - PLUMBING
SECTION 22 70 00

END OF SECTION 22 7000