

SECTION 22 10 01
PLUMBING PIPING AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI).
2. American Public Works Association (APWA): Uniform Color Code.
3. American Society of Sanitary Engineering (ASSE):
 - a. 1003, Water Pressure Reducing Valves for Potable Water Distribution Systems.
 - b. 1010, Performance Requirements for Water Hammer Arresters.
 - c. 1017, Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
 - d. 1070, Performance Requirements for Water Temperature Limiting Devices.
 - e. 1071, Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment.
4. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - b. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - c. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
 - d. A563, Standard Specification for Carbon and Alloy Steel Nuts.
 - e. B32, Standard Specification for Solder Metal.
 - f. B61, Standard Specification for Steam or Valve Bronze Castings.
 - g. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - h. C1460, Standard Specification for Shielded Transition Couplings for use with Dissimilar DWV Pipe and Fittings Above Ground.
 - i. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - j. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - k. D2241, Standard Specification for Polyvinyl Chloride (PVC) Pressure Rated Pipe (SDR Series).
 - l. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

- m. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- n. D2855, Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
- o. D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- p. E438, Standard Specification for Glasses in Laboratory Apparatus.
- q. F656, Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- 5. American Water Works Association (AWWA):
 - a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
 - b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - d. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast.
 - e. C651, Disinfecting Water Mains.
- 6. NSF International (NSF):
 - a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
 - b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
- 7. Plumbing and Drainage Institute (PDI): WH 201, Water Hammer Arresters Standard.

1.02 DESIGN REQUIREMENTS

- A. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

- 1. ICC International Plumbing Code.

1.03 SUBMITTALS

- A. Action Submittals:

- 1. Product data sheets.
- 2. Shop Drawings: Show Contractor recommended changes in location of fixtures or equipment.
- 3. Isometric riser diagrams.

B. Informational Submittals:

1. Changes in location of equipment or piping that affect connecting or adjacent work, before proceeding with the work.
2. Complete list of products proposed for installation.
3. Test records produced during testing.
4. For Polyethylene (PE) Pipe:
 - a. Certificates of qualification for persons to be fusing PE pipe.
 - b. Experience and training record of persons to be fusing PE pipe.
 - c. Testing Plan:
 - 1) Submit at least 15 days prior to testing; include following as a minimum:
 - a) Testing dates.
 - b) Piping systems and section(s) to be tested.
 - c) Method of isolation.
 - d) Method of conveying water from source to system being tested.
 - d. Certifications of Calibration: Approved testing laboratory certificate if pressure gauge for hydrostatic test has been previously used. If pressure gauge is new, no certificate is required.
 - e. Test report documentation.

PART 2 PRODUCTS

2.01 GENERAL

- A. Components and Materials in Contact with Water for Human Consumption:** Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 PIPING

- A. Piping Material:** Refer to Piping Data Sheet(s), Article Supplements, and Section 40 27 00, Process Piping—General.

2.03 HOSE VALVES AND HYDRANTS

A. PH-1, Post Hydrant:

1. Manufacturers and Products:
 - a. Zurn; 1390.
 - b. Or equal.
2. Physical Characteristics: Nonfreeze, bronze casing, 1-1/2-inch inlet and outlet, for 3 feet of bury.
3. Functional Characteristics: None.
4. Performance Characteristics: None.

B. NFWH-1, Wall Hydrant:

1. Manufacturers and Products:
 - a. J. R. Smith; Figure 5509QT.
 - b. Or equal.
2. Physical Characteristics: Nonfreeze box type with chrome-plated face, bronze casing, T-handle key, and 3/4-inch inlet and hose connection.
3. Functional Characteristics: None.
4. Performance Characteristics: None.

C. HB-1, Hydrant:

1. Manufacturers and Products:
 - a. Chicago; No. 387.
 - b. Or equal.
2. Physical Characteristics: Sill faucet, polished chrome finish, and 3/4-inch inlet and hose connection.
3. Functional Characteristics: None.
4. Performance Characteristics: None.

2.04 PIPE HANGERS AND SUPPORTS

- A. Refer to Section 40 05 15, Piping Support Systems.

2.05 INSULATION

- A. As specified in Section 22 07 00, Plumbing Piping Insulation.

2.06 VALVES

A. General:

1. Physical Characteristics:
 - a. Furnish complete with necessary operating hand wheels, chain wheels, extension stems, floor stands, worm and gear operators, operating nuts, chains, and wrenches.
 - b. Renewable Parts Including Discs, Packing, and Seats: Types as recommended by valve manufacturer for intended service.
 - c. Units shall have name of manufacturer and size of valve cast on body or bonnet or shown on a permanently attached plate in raised letters.
 - d. Brass and bronze components, including appurtenances in contact with water.
 - e. Gland Bolts on Iron Body Valves: Bronze, fitted with brass nuts.
 - f. Self-Locking Worm Gears:
 - 1) One-piece design of gear bronze material, accurately machine cut.
 - 2) Worm: Hardened alloy steel, with thread ground and polished.
 - 3) Reduction gearing shall run in a proper lubricant.
2. Galvanize handwheels.

B. Functional Characteristics:

1. Valve Operators:
 - a. Open by turning counterclockwise.
 - b. Worm and Gear Operators on Manually Operated Valves: Totally enclosed design, proportioned as to permit operation of valve under full operating head with maximum pull of 40 pounds on handwheel or crank.
 - c. Self-locking type to prevent the disc or plug from creeping.

C. Performance Characteristics:

1. Design Features:
 - a. Alloys containing less than 16 percent zinc and 2 percent aluminum.
 - b. Alloys are of the following ASTM designations:
 - 1) B61, B62, B98/B98M (Alloy A, B, or D), B139 (Alloy A), B164, B194, and B127.
 - 2) Stainless steel Alloy 18-8 may be substituted for bronze as an option with approval of contracting officer.

D. Gate Valves: Refer to Section 40 27 02, Process Valves and Operators.

- E. Globe Valves: Refer to Section 40 27 02, Process Valves and Operators.
- F. Ball Valves:
1. Refer to Section 40 27 02, Process Valves and Operators, for General Water and Air Service ball valves.
 2. 3 Inches and Smaller for Vacuum Service:
 - a. Manufacturers and Products:
 - 1) Jamesbury; Style A.
 - 2) Or equal.
 - b. Physical Characteristics: Brass body and trim, replaceable double TFE seals and seats.
 - c. Functional Characteristics: None.
 - d. Performance Characteristics: Furnish screwed ends and rate for service to 0.01 micron.
 3. Thermoplastic Ball Valves 2 Inches and Smaller for Water Service:
 - a. Manufacturers:
 - 1) Asahi/America.
 - 2) Or equal.
 - b. Physical Characteristics:
 - 1) End entry, double union design, with replaceable polytetrafluoroethylene (PTFE) seats and PTFE O-ring stem seals.
 - 2) Furnish with hand lever operator.
 - c. Functional Characteristics: None.
 - d. Performance Characteristics:
 - 1) Rated 150 psi at 105 degrees F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride (PVC) body, ball, and stem.
 - 2) Single union ball valves with flanged ends drilled to 150-pound ANSI Standard are acceptable.
 4. Deionized Water Ball Valve (1/2 Inch to 2 Inches):
 - a. Manufacturers:
 - 1) R&G Sloane Manufacturing Co., Inc.
 - 2) Or equal.
 - b. Physical Characteristics:
 - 1) True union ball valve, size as shown.
 - 2) Manufactured from virgin polypropylene using no antioxidants, plasticizers, or pigments.
 - 3) Socket-weld type electrically fused. Factory sealed in a protective wrap.
 - c. Functional Characteristics: None.
 - d. Performance Characteristics: Minimum pressure rated of 140 psi at 70 degrees F.
- G. Angle Valves 3 Inches and Smaller: Refer to Section 40 27 02, Process Valves and Operators.

- H. Check Valves 3 Inches and Smaller: Refer to Section 40 27 02, Process Valves and Operators.
- I. Balancing Valves (Recirculating Hot Water):
1. Manufacturers and Products:
 - a. Bell & Gossett; No. CB circuit setter.
 - b. Or equal.
 2. Physical Characteristics:
 - a. Bronze, calibrated balancing type with provisions for connecting a portable differential pressure meter. Meter connections shall have built-in check valves.
 - b. Construct with internal seals to prevent leakage around rotating element.
 - c. Furnish one pressure gauge type readout meter in carrying case.
 3. Functional Characteristics: An integral pointer shall register degree of valve opening.
 4. Performance Characteristics:
 - a. Rated for 125 psig working pressure at maximum temperature of 250 degrees F.
 - b. Furnish with preformed polyurethane insulation valve enclosure, suitable for use on hot water systems.
- J. Water Pressure Reducing Valves 1/2 Inch Through 2-1/2 Inches:
1. Manufacturers and Products:
 - a. Fisher; Type 75.
 - b. Or equal.
 2. Physical Characteristics: Spring controlled, with a polychloroprene diaphragm.
 3. Functional Characteristics: None.
 4. Performance Characteristics:
 - a. ASSE 1003 compliant.
 - b. Sizes and Ratings: PRV-1 3/4-inch through 2-1/2-inch IPS, maximum with inlet pressure 140 psig; outlet pressure 40 psig.
- K. Gauge Cock Valves 1/8 Inch to 3/8 Inch:
1. Manufacturers:
 - a. Ernst Gage Co.
 - b. Or equal.
 2. Physical Characteristics: Bronze body, hexagon male and female ends, and tee head.
 3. Functional Characteristics: None.
 4. Performance Characteristics: Rated for 125-pound SWP.

L. Manual Air Vent Valves:

1. Manufacturers and Products:
 - a. Bell & Gossett; No. 4V.
 - b. Or equal.
2. Physical Characteristics: With coin-operated air vent.
3. Functional Characteristics: None.
4. Performance Characteristics: None.

M. Point of Use Thermostatic Mixing Valve Assembly (3/8-inch Under Sink):

1. Manufacturers and Products:
 - a. Watts; LFUSG-B-M2.
 - b. Or equal.
2. Physical Characteristics:
 - a. Bronze body, lead free construction.
 - b. Inlets: One each, 3/8-inch compression fittings, cold and hot water.
 - c. Outlet: 3/8-inch compression fittings.
 - d. Self-contained; no electrical requirements.
3. Functional Characteristics:
 - a. Provide tempered water at 0.5 gpm to 2.25 gpm.
 - b. Set outlet at 105 degrees F maximum unless otherwise noted.
4. Performance Characteristics:
 - a. With 120 degrees F to 180 degrees F hot inlet and 39 degrees F to 85 degrees F cold inlet, deliver 80 degrees F to 105 degrees F at inlet pressures between 30 psig and 100 psig.
 - b. Rated to 150 psig maximum inlet pressure. ASSE 1070 compliant.
 - c. ASSE 1017 compliant.

N. Point of Use Emergency Thermostatic Mixing Valve Assembly (1/2 Inch):

1. Manufacturers and Products:
 - a. Leonard Valve Co.; TA-300-LF.
 - b. Or equal.
2. Physical Characteristics:
 - a. Bronze body, lead free construction.
 - b. Integral thermometer with local indication.
 - c. Inlets and Outlet: 1/2-inch NPT.
 - d. Angle check-stop valves on inlets.
 - e. Self-contained; no electrical requirements.
3. Functional Characteristics:
 - a. Provide tempered water at 2 gpm to 10 gpm.
 - b. Set outlet at 85 degrees F.

4. Performance Characteristics:
 - a. With 120 degrees F to 180 degrees F hot inlet and 39 degrees F to 85 degrees F cold inlet, deliver 80 degrees F to 100 degrees F at inlet pressures between 30 psig and 100 psig.
 - b. Rated to 125 psig maximum inlet pressure. ASSE 1071 compliance.
 - c. Compliance with ANSI Z358.1.

O. Thermostatic Mixing Valve Assembly:

1. Manufacturers and Products:
 - a. Powers Process Controls; Series 430/420 Hydroguard.
 - b. Or equal.
2. Physical Characteristics:
 - a. Components:
 - 1) High flow mixing valve for 15 gpm to 50 gpm.
 - 2) Low flow mixing valve for 3 gpm to 7 gpm.
 - 3) Pressure reducing valve.
 - 4) Pressure gauge.
 - 5) Isolation valve.
 - 6) Thermometer.
 - 7) Pipe fittings.
 - 8) Heavy-gauge steel cabinet with access door and manufacturer's standard baked enamel finish.
 - b. Inlets: One each, 3/4-inch NPT, cold and hot water.
 - c. Outlets: 1 inch NPT.
 - d. Self-contained; no electrical requirements.
3. Functional Characteristics:
 - a. Provide tempered water at 3 gpm to 50 gpm.
 - b. Set outlet at 95 degrees F.
4. Performance Characteristics:
 - a. With 140 degrees F hot inlet and 60 degrees F cold inlet, deliver 100 degrees F at inlet pressures between 30 psig and 100 psig.
 - b. ASSE 1071 compliant.

2.07 MISCELLANEOUS PIPING SPECIALTIES

A. Strainers for Water Service:

1. Manufacturers and Products:
 - a. Crane; No. 988-1/2.
 - b. Or equal.
2. Physical Characteristics:
 - a. Iron body, Y-pattern, with screwed bronze or bolted iron cap.
 - b. Screen: Heavy-gauge stainless steel or monel, 30 mesh.

3. Functional Characteristics: None.
4. Performance Characteristics: 125-pound rated.

B. Vacuum Breakers 2 Inches and Smaller:

1. Manufacturers:
 - a. Febco.
 - b. Or equal.
2. Physical Characteristics: Angle type, as required.
3. Functional Characteristics: None.
4. Performance Characteristics: ASSE 1001 compliant.

C. Water Hammer Arresters:

1. Manufacturers and Products:
 - a. Sioux Chief Mfg. Co., Inc.; Series 650 and 660.
 - b. Or equal.
2. Physical Characteristics: Type L copper tube, HHPP piston with two lubricated ethylene propylene diene monomer (EPDM) O-rings, rolled piston stop, wrought copper male thread adapter.
3. Functional Characteristics: None.
4. Performance Characteristics:
 - a. ASSE 1010 certified.
 - b. FDA approved lubricant.

D. Water Hose:

1. Manufacturers:
 - a. Goodyear.
 - b. Or equal.
2. Physical Characteristics: Furnish 50-foot lengths of 3/4-inch, 1-inch and 1-1/2-inch, EPDM black cover and EPDM tube, reinforced with two textile braids.
3. Functional Characteristics: Furnish each length with brass male and female NST hose thread couplings to fit hose nozzle(s) and hose valve(s) specified.
4. Performance Characteristics: Rated minimum working pressure of 200 psi.

E. Hose Nozzles:

1. Manufacturers:
 - a. Croker.
 - b. Or equal.
2. Physical Characteristics: Furnish 1-inch and 1-1/2-inch cast brass satin finish nozzle(s) with adjustable fog, straight-stream, and shutoff features and rubber bumper. Provide nozzle(s) with female NST hose thread.

3. Functional Characteristics: None.
4. Performance Characteristics: None.

F. Sleeves:

1. Manufacturers and Products:
 - a. J. R. Smith; Figure 1720.
 - b. Or equal.
2. Physical Characteristics: Duco coated cast iron, flashing clamp. See the Drawings to determine sizes required.
3. Functional Characteristics: None.
4. Performance Characteristics: None.

G. Flashing Sleeves for Roof Penetrations:

1. Built-Up Bituminous Roofing: Fabricate of lead as specified in Section 07 62 00, Sheet Metal Flashing and Trim.
2. Single-Ply Membrane Roofing: Pipe seals as specified in Section 07 70 01, Roof Specialties and Accessories.

H. Insulating Dielectric Unions and Flanges:

1. Manufacturers:
 - a. Epco Sales, Inc., Cleveland, OH.
 - b. Or equal.
2. Physical Characteristics:
 - a. Unions 2 Inches and Smaller: Screwed or solder-joint type.
 - b. Unions 2-1/2 Inches and Larger: Flanged type, complete with bolt insulators, dielectric gasket, bolts, and nuts.
3. Functional Characteristics: None.
4. Performance Characteristics: Galvanically compatible with piping to which attached and pressure ratings suitable for system working pressures.

I. Joint Solder:

1. Physical Characteristics: 95-5 wire solder. Lead free. Do not use cored solder.
2. Functional Characteristics: None.
3. Performance Characteristics:
 - a. ASTM B32, Grade 95 TA.
 - b. NSF certified for use in potable water.

J. Pipe Joint Sealer:

1. Physical Characteristics: Compound insoluble in water or PTFE tape.
2. Functional Characteristics: None.

3. Performance Characteristics: Approved by NFS for use in potable water.

K. Rubber Gaskets:

1. Physical Characteristics: None.
2. Functional Characteristics: None.
3. Performance Characteristics: ASTM C564.

2.08 MEASURING DEVICES

A. Thermometers:

1. Manufacturers and Products:
 - a. Trerice Co.; Model A005.
 - b. Or equal.
2. Physical Characteristics:
 - a. Organic spirit type, blue in color, with 9-inch case and scale range in degrees F, as shown.
 - b. Furnish with 3-1/2-inch stem length and separable NPT brass thermowell.
3. Functional Characteristics: None.
4. Performance Characteristics:
 - a. Adjustable angle.
 - b. Temperature Range: 30 degrees F to 180 degrees F.

B. Pressure Gauges:

1. Manufacturers and Products:
 - a. Ashcroft; Type 1008.
 - b. Or equal.
2. Physical Characteristics:
 - a. Construction: 3-1/2-inch gauge size, steel case, glass crystal, brass movement, and 1/4-inch NPT lower connection.
 - b. Furnish with 1/4-inch brass gauge cock.
3. Functional Characteristics: None.
4. Performance Characteristics: 0 kPa to 690 kPa, 0 psi to 160 psi range.

C. Temperature and Pressure Test Plugs:

1. Manufacturers:
 - a. IMAC Systems Inc.
 - b. Or equal.
2. Physical Characteristics: Supply and install where indicated a 1/4-inch fitting to receive either a temperature or pressure probe 1/8-inch OD. Fitting shall be solid brass with two valve cores of polychloroprene, fitted with a color coded cap strap with gasket.

3. Functional Characteristics:
4. Performance Characteristics:
 - a. Rated at 1,000 psi at 140 degrees F.
 - b. Polychloroprene Valve Core: Maximum 200 degrees F at 500 psi.
 - c. Nordel Valve Core: Maximum 275 degrees F at 500 psi.

D. Water Meter:

1. Manufacturers and Product:
 - a. Recordall; M170.
 - b. Or equal.
2. Physical Characteristics:
 - a. Direct magnetic drive, tamper detection seal wire screw, 2-inch diameter NPT connections.
 - b. Measuring element: Nutating disc, positive displacement.
 - c. Materials:
 - 1) Meter Housing: Lead-free bronze alloy.
 - 2) Housing Top Plates: Lead-free bronze alloy.
 - 3) Measuring Chamber: Engineered polymer.
 - 4) Disc: Engineered polymer.
 - 5) Trim: Stainless steel.
 - 6) Strainer: Engineered Polymer.
 - 7) Disc Spindle: Stainless steel.
 - 8) Magnet: Ceramic.
 - 9) Magnet Spindle: Stainless steel.
 - 10) Register Lid and Shroud: Engineered polymer, bronze.
3. Functional Characteristics:
 - a. For use in the measurement of potable cold water.
 - b. Design Operating Range: 82 gpm.
4. Performance Characteristics:
 - a. Meet or exceed registration accuracy for the low flow rates (95 percent), normal operating flow rates (100 percent, plus or minus 1.5 percent) and maximum continuous flow rate as indicated in AWWA C700.
 - b. ANSI 61 and ANSI 372 certified.
 - c. Maximum Operating Pressure: 150 psi.
 - d. Maximum Operating Temperature: 80 degrees F.

PART 3 EXECUTION

3.01 GENERAL

- A. Install plumbing systems to meet applicable plumbing code.
- B. Field Obstructions:
 - 1. Drawings do not attempt to show exact details of piping. Provide offsets around obstructions.
 - 2. Do not modify structural components, unless approved by Contracting Officer.
- C. Sleeves:
 - 1. Pipe sizes shown are nominal sizes, unless shown or specified otherwise.
 - 2. Provide piping passing through walls, floors, or ceilings with standard-weight pipe sleeves.
 - 3. Provide pipes passing through finished walls with chrome-plated canopy flanges.
 - 4. Dry pack sleeves in existing work in-place and provide finished appearance.
 - 5. Pack holes left by removal of existing piping with grout and finish to match adjacent surface.
- D. Provide unions in piping systems at connections to equipment.
- E. Provide shielded transition couplings, insulating dielectric unions and flanges between ferrous and nonferrous piping and where otherwise required for electrically insulated connection.
- F. Pipe air release valves, water-lubricated bearings, and other appurtenances having water effluent with copper tubing to nearest drain.
- G. Provide isolation valves and strainers at pressure regulators.

3.02 INSTALLATION

- A. Steel Pipe:
 - 1. Ream, clean, and remove burrs and mill scale from piping before making up.
 - 2. Seal joints with pipe joint sealer or PTFE tape.

B. Rigid PVC or CPVC:

1. Cut, make up, and install in accordance with pipe manufacturer's recommendations.
2. Ream, clean, and remove burrs from cut ends before joining pipe.
3. Lay in trench by snaking pipe from one side to other.
4. Offset: As recommended by manufacturer for maximum temperature variation between time of solvent welding and final use.
5. Do not lay pipe when temperature is below 40 degrees F or above 90 degrees F when exposed to direct sunlight.
6. Shield ends to be joined from direct sunlight prior to and during laying operation.
7. Use strap wrenches only for tightening threaded plastic joints. Do not over tighten fittings.

C. Water System Balancing: Provide a qualified registered engineer or firm specializing in testing and balancing to adjust domestic water system. Balance system for required water flows at each plumbing fixture, terminal device, and recirculating hot water loop.

D. Water Hammer Arresters:

1. Install in piping systems where shown on the Drawings and adjacent to pieces of equipment where quick closing valves are installed.
2. Install at all emergency safety showers and eyewashes.
3. Size and install in accordance with PDI-WH201.
4. Water hammer arresters to have access panels or to be otherwise accessible.

E. Valves: Install in accordance with manufacturer's recommendations.

F. Miscellaneous Piping Specialties: Install in accordance with manufacturer's recommendations.

G. Measuring Devices: Install in accordance with manufacturer's recommendations.

3.03 SANITARY AND WASTE DRAINS AND VENTS PIPING

A. Installation:

1. Set piping above floor slab true and plumb.
2. Set exposed risers as close to walls as possible.
3. Slope drain lines at minimum 2 percent slope, unless otherwise noted. Vent lines shall be installed level or sloped, with no low spots.
4. Where vent stacks pass through roof slab, fit with flashing sleeve secured to roof.

5. Extend vents minimum 1 foot above roof.
6. Provide cleanouts where shown and where required by code.

3.04 ACID-RESISTANT DRAINS AND VENTS

- A. Install in accordance with manufacturer's recommendations.
- B. Drainage Vents: Same piping system as used for acid-resistant drains.
- C. Make connections between polypropylene piping systems and other acid-resistant drainage systems with adapters recommended by manufacturer.
- D. Buried Polypropylene Pipe:
 1. Heat join and test for leakage before placing in trench.
 2. Snake slightly on long runs placed in trench.
 3. When installed in extremely hot or cold weather, make proper allowance for expansion or contraction.
- E. Buried Polypropylene Drain and Vent Pipe:
 1. Install in accordance with manufacturer's recommendations.
 2. Trench shall have a clean sand bed graded to proper pitch.
 3. Completely cover pipe with clean sand prior to backfilling.
 4. Compact sand by flooding with water.
 5. Do not permit sharp stones in backfill surrounding pipe.

3.05 HVAC CONDENSATE PIPING

- A. Set piping true and plumb.
- B. Slope piping 1/8 inch per foot minimum.

3.06 WATER SUPPLY PIPING

- A. Water supply piping includes potable W1, hot water (HW), hot water return (HWR), tempered water (TW) systems and reclaimed water (RW) systems.
- B. Flush water piping systems clean of internal debris, clean faucet aerators, and adjust plumbing fixture valves for manufacturer's recommended flow.
- C. Do not run water piping through electrical rooms, stairwells, or immediately over or within a 3-foot horizontal clearance of electrical panels, motor starters, or environmental control panels.

- D. Provide exterior water piping with minimum 1 foot of cover or install below frost line, whichever is greater.
- E. Hose Valves and Hydrants: Attach handle with setscrew and provide manufacturer's recommended gravel fill around drain hole of post hydrants.
- F. Provide valve operators with position indicators, where indicated, to show position of valve disc or plug.
- G. Provide bypass with globe valve for emergency throttling around each reducing valve.
- H. Protect buried steel pipe and fittings with a single wrap of coal-tar saturated felt in accordance with AWWA C203.
- I. Vacuum Breakers 2 Inches and Smaller: Install minimum 6 inches above flood line of equipment they serve.
- J. Provide manual air vents at high points in domestic hot water system.

3.07 INSULATION

- A. As specified in Section 22 07 00, Plumbing Piping Insulation.

3.08 HANGERS AND SUPPORTS

- A. In accordance with Section 40 05 15, Piping Support Systems.

3.09 INTERIM CLEANING

- A. Prevent accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping during fabrication and assembly.
- B. Examine piping to assure removal of foreign objects prior to assembly.
- C. Conventional commercial cleaning methods of cleaning are acceptable if method and cleaning material does not corrode, deform, swell, or otherwise alter physical properties of material being cleaned.

3.10 TESTING

- A. As specified in Section 40 80 01, Process Piping Leakage Testing.

3.11 CLEANING AND DISINFECTION

- A. Prior to final acceptance, following assembly and testing, flush pipelines with water, except for plant process air lines and instrument air lines, and remove accumulated construction debris and other foreign matter.
- B. Minimum Flushing Velocity: 2.5 feet per second.
- C. Insert cone strainers in the connections to attached equipment and leave until cleaning has been accomplished.
- D. Remove accumulated debris through drains 2 inches and larger or by dropping spools and valves.
- E. Immediately after draining flushed lines, dry piping with compressed air.
- F. Use compressed air to remove loose debris from plant process air and instrument air piping.
- G. Disinfect potable water pipelines before placing in service:
 - 1. Meet the requirements of AWWA C651, unless otherwise specified.
 - 2. Disinfecting Mixture:
 - a. A chlorine-water solution having a free chlorine residual of 40 ppm to 50 ppm.
 - b. Prepare by injecting one of the following:
 - 1) Liquid chlorine gas-water mixture.
 - 2) Dry chlorine gas.
 - 3) Calcium or sodium hypochlorite and water mixture.
 - c. Inject mixture into pipeline at a measured rate while freshwater is allowed to flow through the pipeline at a measured rate so the combined mixture of freshwater and chlorine solution or gas is of the specified strength.
 - d. Apply liquid chlorine gas-water mixture by means of a chlorinating device.
 - e. Feed dry chlorine gas through proper devices for regulating the rate of flow and providing effective diffusion of gas into water within pipe being treated.
 - f. Chlorinating devices for feeding solutions of chlorine gas or gas itself must prevent backflow of water into chlorine cylinder.
 - g. Calcium Hypochlorite: If this procedure is used, first mix dry powder with water to make a thick paste, then thin to approximately a 1 percent solution (10,000 ppm chlorine).

- h. Sodium Hypochlorite: If this procedure is used, dilute liquid with water to obtain a 1 percent solution.
- i. The following proportions of hypochlorite to water will be required:

Product	Quantity	Water
Calcium Hypochlorite ¹ (65 - 70 percent C1)	1 lb	7.5 gal
Sodium Hypochlorite ² (5.25 percent C1)	1 gal	4.25 gal
1 Known as liquid laundry bleach.		

H. Point of Application:

1. Inject chlorine mixture into pipeline to be treated at the beginning of the line through a corporation stop or suitable tap in the top of pipeline.
2. Control clean water from existing system or another source so it flows slowly into newly installed piping during chlorine application.
3. Manipulate valves so the strong chlorine solution in the line being treated will not flow back into line supplying the water. Use check valves, if necessary.

I. Retention Period:

1. Retain treated water in pipeline for a minimum of 24 hours or long enough to destroy nonspore-forming bacteria.
2. At the end of the retention period, the disinfecting mixture shall have strength of at least 10 ppm of chlorine.
3. Operate valves, hydrants, and other appurtenances during disinfection to assure disinfecting mixture is dispersed into all parts of the pipeline including dead ends, new services, and similar areas that otherwise may not receive the disinfecting solution.
4. Do not place concentrated quantities of commercial disinfectants in pipeline before filling with water.
5. After chlorination, flush water from permanent source of supply until water through pipeline is equal chemically and bacteriologically to permanent source of supply.

J. Disposal of Disinfecting Water:

1. Dispose of disinfecting water in accordance with permits and regulations. Protect the public and receiving waters from harmful or toxic concentrations of chlorine.

2. Do not allow disinfecting water to flow into a waterway without adequate dilution or other acceptable method of reducing chlorine concentrations to a safe level.

3.12 PROTECTION OF INSTALLED WORK

A. Protective Covers:

1. Provide over floor and shower drains during construction, to prevent damage to drain strainers and keep foreign material from entering drainage system.
2. Cover roof drains and emergency overflow drains during roofing process so roofing material and gravel do not enter drain piping.
3. Remove at time of Substantial Completion.

3.13 FIELD FINISHING

- #### A. In accordance with Section 40 27 00, Processing Piping—General.

3.14 PIPING IDENTIFICATION

- #### A. Refer to the Drawings and Section 40 27 00, Process Piping—General.

3.15 SUPPLEMENTS

- #### A. The supplements listed below, following “End of Section,” are a part of this specification:
1. Plumbing Piping Data Sheets.

Section Number	Title
22 10 01.02	Polyvinyl Chloride Drain Waste and Vent (PVC-DWV) Pipe and Fittings
22 10 01.06	Acid-Resistant Polypropylene Waste and Vent Pipe and Fittings

END OF SECTION