

**SECTION 23 21 13
HYDRONIC PIPING**

PART 1 GENERAL

1.1 REFERENCES

- A. ASME BPVC Section IX - Welding and Brazing Qualifications
- B. ASME B16.3 - Malleable Iron Threaded Fittings Classes 150 and 300
- C. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings DWV
- D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings DWV
- E. ASME B31.9 - Building Services Piping
- F. AWS D1.1/D1.1M - Structural Welding Code-Steel
- G. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping Systems
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
- I. ASTM A234/A234M - Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
- J. ASTM B32 - Standard Specification for Solder Metal
- K. ASTM B88 - Standard Specification for Seamless Copper Water Tube
- L. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- M. ASTM D2466 -Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Type Fittings, Schedule 40
- N. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Type Fittings, Schedule 80
- O. ASTM D2855 - Standard Practice for Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
- P. ASTM F1476 - Standard for Performance of Gasketed Mechanical Couplings in Piping Applications.
- Q. ASTM F2389 – Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.

1.2 SUBMITTALS

- A. Submit under provisions of Section 23 05 00.
- B. Product Data: For each product used in this project, provide catalog data for pipe materials, pipefittings, valves, and accessories.
- C. Mechanical Equipment Rooms (AHU)
 - 1. Provide 3/8" scale piping drawings with ductwork shown.
- D. Air Cooled Chillers and CHW Pumps: Provide 1/4" scale piping drawings.
- E. Water Cooled Chillers, CHW and CW Pumps, and Cooling Towers: Provide 1/4" scale piping drawings.
- F. Provide welders certification of compliance with ASME BPVC Section IX and AWS D1.1.

1.3 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body
- B. Welding Materials and Procedures: Conform to ASME BPVC Section IX
- C. Welders Certification in accordance with ASME BPVC Section IX and AWS D1.1
- D. Regulatory Requirements: Conform to ASME B31.9
- E. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- F. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver valves to site in original factory packaging, labeled with manufacturer's identification.
- B. Store valves, fittings, couplings, etc in original factory packaging, and protect from weather and construction traffic.
- C. Deliver all piping, valves, and fittings to the site clean and without any debris or other foreign material in the pipe, valve, or fitting and with the open ends covered to protect from collection of dust and dirt during transportation and storage on site.
 - 1. Remove the protective cover during installation but recover all openings at the completion of the phase of work on the system and at the end of the day.

PART 2 PRODUCTS

2.1 HEATING WATER AND GLYCOL PIPING, BURIED

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black (ERW)
 - 1. Fittings: ASTM A234/A234M forged steel welding type.
 - 2. Joints: AWS D1.1 welded.
- B. Factory Pre-insulated Steel Pipe
 - 1. Carrier: ASTM A53/A53M Schedule 40 black (ERW).
 - 2. Fittings: ASTM A234/A234M forged steel welding type.
 - 3. Joints: AWS D1.1, weld, insulate, and seal per manufacturer's recommendations.
 - 4. Casing
 - a. PVC Type 1 Grade 1 ASTM D1785.
 - b. Minimum thickness shall be as follows: 0.070" for 3" pipe and smaller; 0.080" for 4" and 5" pipe; 0.100" for 6" pipe, 0.120" for 8" pipe, 0.140" for 10" pipe; 0.160" for 12" pipe; 0.180" for 14" pipe.
 - 5. Insulation
 - a. Factory foamed in-place closed-cell polyurethane foam completely filling the annulus between the steel pipe and casing.
 - b. Minimum thickness shall be 2".
 - c. For insulation ends, provide factory applied, vapor barrier mastic end seals.
 - 6. Performance specification based on Pre-insulated Piping Systems, INSUL-TEK 250 Steel.
 - a. Other pre-insulated piping systems satisfying the specifications are acceptable.

2.2 HEATING WATER AND GLYCOL PIPING, ABOVE GROUND

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black (ERW).
 - 1. Fittings: ASTM B16.3, malleable iron or ASTM A234/A234M, forged steel welding type fittings.
 - a. ASTM A536 ductile iron or factory-fabricated from ASTM A53 steel pipe, grooved ends. Basis of Design: Victaulic Company.
 - b. Installation-Ready™ fittings for Schedule 40 plain end carbon steel piping in HVAC and mechanical applications sizes NPS ½" thru 2" (DN15 thru DN50). System rated for a working pressure of 300 psi (2065 kPa), consisting of a ductile iron housing conforming to ASTM A536, Grade 65-45-12, with Installation-Ready™ ends, gasket liner, zinc-electroplated steel bolts and nuts as per ASTM A449, and 300 series stainless steel retainer. Basis of Design: Victaulic QuickVic™ SD.
 - 2. Joints: Screwed for pipe 2" and under; AWS D1.1 welded or grooved joints for pipe over 2".
- B. Copper Tubing: ASTM B88, Type L, hard drawn.
 - 1. Fittings: ASME B16.23 cast brass or ASME B16.29 solder wrought copper.

2. Joints: ASTM B32 solder Grade 95TA.

2.3 CHILLED WATER PIPING, BURIED

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black (ERW) factory pre-insulated. Performance based on INSUL-TEK 250 Steel Pre-insulated Piping System.
 1. Fittings: ASTM A234/A234M forged steel welding type, long radius.
 2. Joints: AWS D1.1 welded.
 3. Insulation Casing: PVC Type 1 Grade 1 ASTM D1785 minimum thickness shall be as follows; 0.070" for 3" pipe and smaller; 0.080" for 4" and 5" pipe; 0.100" for 6" pipe, 0.120" for 8" pipe, 0.140" for 10" pipe; 0.160" for 12" pipe; 0.180" for 14" pipe.
 4. Insulation: Factory foamed in-place minimum 2" thick closed-cell polyurethane foam annulus with vapor barrier mastic end seals.
- B. Polypropylene Pipe: ASTM F2389 Schedule 40, extruded copolymer, factory pre-insulated. Pipe and fittings shall be virgin PP-R resin with no reworked or recycled materials in the manufacturing process.
 1. Fittings: ASTM F2389 socket fusion, butt fusion.
 2. Joints: Polypropylene fusion welded.
 3. Insulation Casing: Polypropylene or PVC Type 1 Grade 1 ASTM D1785 minimum thickness shall be as follows; 0.070" for 3" pipe and smaller; 0.080" for 4" and 5" pipe; 0.100" for 6" pipe, 0.120" for 8" pipe, 0.140" for 10" pipe; 0.160" for 12" pipe; 0.180" for 14" pipe.
 4. Insulation: Factory foamed in-place minimum 2" thick closed-cell polyurethane foam annulus with vapor barrier mastic end seals.

2.4 CHILLED WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black (ERW).
 1. Fittings: ASTM B16.3, malleable iron or ASTM A234/A234M, forged steel welding type.
 - a. ASTM A536 ductile iron or factory-fabricated from ASTM A53 steel pipe, grooved ends. Basis of Design: Victaulic Company.
 - b. Installation-Ready™ fittings for Schedule 40 plain end carbon steel piping in HVAC and mechanical applications sizes NPS ½" thru 2" (DN15 thru DN50). System rated for a working pressure of 300 psi (2065 kPa), consisting of a ductile iron housing conforming to ASTM A536, Grade 65-45-12, with Installation-Ready™ ends, gasket liner, zinc-electroplated steel bolts and nuts as per ASTM A449, and 300 series stainless steel retainer. Basis of Design: Victaulic QuickVic™ SD.
 2. Joints: Screwed for pipe 2" and under; AWS D1.1 welded or grooved joints for pipe over 2".
- B. Copper Tubing: ASTM B88, Type L, hard drawn, allowed only for run-outs to individual air handling units, when size of 2" and smaller, and not exceeding 20 ft in length.
 1. Fittings: ASME B16.23 cast brass or ASME B16.29 brazed wrought copper, long radius.
 2. Joints: ASTM B32 brazed Grade 95TA.

2.5 COOLING TOWER, CONDENSER WATER PIPING, BURIED

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black (ERW) with bitumen mastic coating. No insulation required.
 1. Fittings: ASTM A234/A234M forged steel welding type.
 2. Joints: AWS D1.1

2.6 COOLING TOWER, CONDENSER WATER PIPING, ABOVE GROUND

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black (ERW).

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1. Fittings: ASTM B16.3, malleable iron or ASTM A234/A234M, forged steel welding type.
 - a. ASTM A536 ductile iron or factory-fabricated from ASTM A53 steel pipe, grooved ends. Basis of Design: Victaulic Company.
 - b. Installation-Ready™ fittings for Schedule 40 plain end carbon steel piping in HVAC and mechanical applications sizes NPS ½" thru 2" (DN15 thru DN50). System rated for a working pressure of 300 psi (2065 kPa), consisting of a ductile iron housing conforming to ASTM A536, Grade 65-45-12, with Installation-Ready™ ends, gasket liner, zinc-electroplated steel bolts and nuts as per ASTM A449, and 300 series stainless steel retainer. Basis of Design: Victaulic QuickVic™ SD.
 2. Joints: Screwed for pipe 2" and under; AWS D1.1 welded or grooved joints for pipe over 2".
- B. PVC Schedule 80 with glued joints and flanged connections to equipment as defined in ASTM-D1785 is acceptable provided operating pressures are well within manufacturer's design parameters.
- 2.7 EQUIPMENT DRAINS AND OVERFLOWS
- A. Copper Tubing: ASTM B88 Type M hard drawn.
 - B. Fittings: ASME B16.23 cast brass, or ASME B16.29 solder wrought copper.
 - C. Joints: ASTM B32 solder Grade 95TA.
 - D. PVC Pipe
 1. ASTM D1785 Schedule 40
 2. Use only for cooling towers.
 - E. Fittings: ASTM D2466 PVC
 - F. Joints: ASTM D2855 solvent weld
- 2.8 FLANGES, UNIONS, AND COUPLINGS
- A. Pipe 2" and Smaller: Use 150 psig malleable iron unions for threaded ferrous piping and bronze unions for copper pipe soldered joints.
 - B. Pipe Over 2":
 1. 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping.
 2. Grooved Joint Couplings: Two ductile iron housing segments conforming to ASTM A536, Grade 65-45-12; pressure responsive elastomer gasket, and ASTM A449 compliant bolts and nuts. Couplings shall conform to ASTM F1476: Standard for Performance of Gasketed Mechanical Couplings in Piping Applications.
 - a. Rigid Type: 12" and smaller Housings cast with offsetting, angle-pattern, bolt pads to verify proper installation upon visual confirmation of bolt pad contact with no torque requirement and to provide system rigidity and support and hanging in accordance with ANSI B31.1 and B31.9. Installation-Ready for complete installation without field disassembly, complete with grade EHP center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth, suitable for water service to 250 deg F. Basis of Design: Victaulic Style 107N.
 - b. Flexible Type: For use in locations where vibration attenuation and stress relief are required: Basis of Design: Victaulic Installation-Ready Style 177 or Style 77.
 - c. AGS two-segment couplings for pipe sizes 14" and larger, with wide-width FlushSeal® gasket and lead-in chamfer on housing key. Basis of Design: Victaulic Style W07 (rigid) and Style W77 (flexible).

2.9 GATE VALVES

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- A. Pipe 2" and Smaller: Class 150 with bronze body, bronze trim, rising stem, hand wheel, inside screw, solid disc, threaded ends.

2.10 BALL VALVES

- A. Pipe 2" and Smaller: 600 psig with brass body, brass trim, one piece body, Teflon seats and seals, lever handle with adjustable memory stop, threaded ends.
- B. For insulated lines, provide extended neck so that lever handle clears the pipe insulation.

2.11 PLUG COCKS

- A. Pipe 2" and Smaller: Bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends, set screw, one wrench operator.
- B. Pipe over 2": Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends, set screw, one wrench operator.

2.12 BUTTERFLY VALVES

- A. Pipe Over 2": Class 150, ductile iron body, 316 stainless steel disc and stem, EPT replaceable seat, lug ends, extended neck, infinite position lever handle with memory stops.
- B. For 8" and over, provide hand wheel and gear drive.
- C. For equipment isolation service, provide tapped lug ends.

2.13 SPRING LOADED CHECK VALVES

- A. Class-150 iron body bronze trim, stainless steel spring, renewable composition disc, screwed, lug, and flanged ends.

2.14 RELIEF VALVES

- A. Bronze body, Teflon seat, stainless steel stem, and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends to remove burrs, and bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly
- C. Prepare piping connections to equipment with flanges, or unions.
 - 1 Locations of flanges, unions, shall allow the easy removal of coils from air handling units, tube bundles from chillers, impellers from pumps, etc.
 - 2 The Mechanical Contractor shall correct poor piping layouts at no cost to the District and with no time extension for the mechanical contractor.
- D. After completion, fill, clean, and treat systems. Refer to Section 23 23 00.

3.2 INSTALLATION

- A. Route piping in an orderly manner, plumb and parallel to building structure, and maintain gradient.
- B. Do not locate chilled water piping directly over electrical panels or any other electrical junction box.
- C. Install piping to conserve building space, and not to interfere with the use of space and other work.
- D. Group piping whenever practical at common elevations
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance for installation of insulation, and access to valves, specialties, and fittings.
- G. Provide access at valves and fittings that are not exposed.
 - 1 Coordinate size and location of access doors with Section 08 31 99.

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- 2 Locate valves and metering devices in easily accessible locations with adequate clearance to service devices.
- H Slope piping and arrange systems to drain at low points.
 - 1 Use eccentric reducers to maintain top of pipe level.
- I Where pipe support members are welded to structural framing, scrape, brush clean, and apply one coat of zinc rich primer to welding area.
- J Prepare pipe, fittings, supports, and accessories for finish painting, refer to Section 09 91 13 & 09 91 26.
- K Install valves with stems upright or horizontal, not inverted.
 - 1 Valve handles and stems exposed to the weather shall be painted to prevent rusting.
- L Underground pipes shall be buried a minimum depth of 36" from grade to the outer surface of insulation.
 - 1 Install a plastic marking tape directly above the buried pipe along its entire run at a depth of 12" below grade.
 - 2 Refer to Section 23 05 53.
- M Joints shall not be insulated, concealed, or buried until after inspection, hydrostatic testing, and written acceptance of the piping system.
- N Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.
- O Installation of hydronic piping and specialties shall not obstruct service access and chiller component removal.
- P Seal all open pipe end at the end of each day to prevent intrusion of foreign materials into the pipes.
- Q On projects modifying existing chilled water system, remove the old inactive piping to the main chilled water source and cap.
 - 1 If the Engineer reuses existing chilled water piping, the Engineer and Owner shall examine the old insulation material for reuse.
 - 2 If found deteriorated the old insulation shall be removed and the new insulation (meeting specification requirements of the current project) shall be installed.

3.3 APPLICATION

- A Install unions downstream of screwed valves and at non-flanged equipment connections. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.
- B
- C Install brass male adapters on each side of valves in copper-piped systems.
 - 1 Sweat solders adapters to pipe.
- D For balancing and shutoff service, provide adjustable memory stops for ball valves (2" and smaller) and butterfly valves (over 2").
- E For equipment isolation service, provide ball valves (2" and smaller) and tapped lug butterfly valves (over 2").

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- F For insulated pipe, provide valves with extended necks or neck extensions of adequate length for the handles to clear the insulation without notching the insulation.
- G Provide $\frac{3}{4}$ " gate drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
 - 1 Pipe discharge to the nearest drain
- H Use dielectric fittings or couplings for dissimilar metals.
- I Use pipe dope or Teflon tape for screwed pipe connections.
- J For pipe specialties such as thermometers, gauges, etc. use welded thread-o-lets, do not tap pipe to make threads for these devices.
- K For flushing procedures, refer to Section 23 25 00.
- L For pressure testing, refer to Section 23 05 93.

END OF SECTION