

SECTION 15180
HYDRONIC HVAC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 General Requirements, apply to work specified in this Section.
- B. Requirements of Section 15050, "Basic Mechanical Materials and Methods", apply to this section.

1.02 SUMMARY

- A. This Section includes piping systems for hot water heating, chilled water cooling, cold water make-up, blow-down drain lines, and condensate drain piping. Piping materials and equipment specified in this Section include:
 - 1. Pipes, fittings, and specialties.
 - 2. Special duty valves.
 - 3. Hydronic specialties.
- B. Related Work Specified in Other Sections:
 - 1. Materials and methods for sealing pipe penetrations through basement walls, and fire barriers: Division 7 Section, "Firestopping".
 - 2. Labeling and identification of hydronic piping system: Division 15 "Mechanical Identification"
 - 3. Gate, globe, ball, butterfly, and check valves: Division 15 Section "Valves"
 - 4. Thermometers, flow meters, and pressure gages: Division 15 Section "Meters and Gages"
 - 5. Pipe Supports: Division 15 Section "Hangers and Supports"
 - 6. Flexible pipe connections: Division 15 Section "Vibration Control and Seismic Restraints".
 - 7. Pipe insulation: Division 15 Section "Mechanical Insulation"
 - 8. Pumps, motors, and accessories for hydronic systems: Division 15 Section "HVAC Pumps"
 - 9. Temperature control valves and sensors: Division 15 Section "Direct Digital Controls"
 - 10. Procedures for hydronic systems adjusting and balancing: Division 15 Section "Testing, Adjusting and Balancing"
- C. Products installed but not furnished under this Section include temperature control valves and wells for immersion temperature control devices.
 - 1. Locate and install temperature control valves and devices as directed by the temperature control contractor.

1.03 DEFINITIONS

- A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

1.04 SYSTEM DESCRIPTION

- A. General: The hydronic piping systems are the "water-side" of an air-and-water or all-water heating and air conditioning system. Hydronic piping systems specified in this Section include the hot water, energy recovery water, and chilled water piping systems. This system is classified by ASHRAE as a Low Water Temperature, Forced, Recirculating system.

1.05 SUBMITTALS

- A. Product Data, including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties and accessories, and installation instructions for each hydronic specialty and special duty valve specified.
 - 1. Furnish flow and pressure drop curves for diverting fittings and calibrated plug valves, based on manufacturer's testing.
- B. Maintenance Data for hydronic specialties and special duty valves, for inclusion in operating and maintenance manual specified in Division 1 and Division-15 Section "Basic Mechanical Materials and Methods."
- C. Welders' certificates certifying that welders meet the quality requirements specified in Quality Assurance below.
- D. Certification of compliance with ASTM and ANSI manufacturing requirements for pipe, fittings, and specialties.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: comply with the provisions of the following:
 - 1. ASME B 31.9 "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
 - 2. ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualification" for qualifications for welding processes and operators.
 - 4. IBC 2003 Building & Mechanical Code

1.07 SEQUENCING AND SCHEDULING

- A. Work closely with the temperature control contractor to coordinate installation of temperature control devices.
- B. Cooperate and work closely with the Testing, Adjusting and Balancing contractor to coordinate the start-up and correct operation of the installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pipe and Pipe Fittings: Subject to compliance with requirements, provide products from one of the following:
 - 1. Allied Tube and Conduit, A Grinnell Co.
 - 2. American Ductile Iron Pipe, Div. Of American Cast Iron Pipe Co.
 - 3. Grinnell Corp.
 - 4. Tyler Pipe
 - 5. Nibco, Inc.
 - 6. Stockham

- B. Calibrated Plug Valves: Subject to compliance with requirements, provide products from one of the following:
 - 1. Bell & Gossett ITT; Fluid Handling Div.
 - 2. Taco, Inc.

- C. Pump Discharge Valves: Subject to compliance with requirements, provide products from one of the following:
 - 1. Amtrol, Inc.
 - 2. Armstrong, Inc.
 - 3. Bell & Gossett ITT; Fluid Handling Div.
 - 4. Taco, Inc.

- D. Flow-Balancing Valves: Subject to compliance with requirements, provide products from one of the following:
 - 1. "Circuit Setter", Bell & Gossett, Inc.
 - 2. "Circuit Setter", Taco, Inc.

- E. Safety Relief Valves: Subject to compliance with requirements, provide products from one of the following:
 - 1. Amtrol, Inc.
 - 2. Bell & Gossett ITT; Fluid Handling Div.
 - 3. Spirax Sarco
 - 4. Watts Regulator Co.

- F. Pressure Reducing Valves: Subject to compliance with requirements, provide products from one of the following:
 - 1. Amtrol, Inc.
 - 2. Armstrong, Inc.
 - 3. Bell & Gossett ITT; Fluid Handling Div.
 - 4. Taco, Inc.

- G. Air Vents (manual and automatic): Subject to compliance with requirements, provide products from one of the following:
 - 1. Armstrong Machine Works.
 - 2. Bell & Gossett ITT; Fluid Handling Div.
 - 3. Hoffman Specialty ITT; Fluid Handling Div.

4. Spirax Sarco.
- H. Pump Suction Diffuser: Subject to compliance with requirements, provide products from one of the following:
1. Amtrol, Inc.
 2. Bell & Gossett ITT; Fluid Handling Div.
 3. Taco, Inc.
- I. Diverting Fittings: Subject to compliance with requirements, provide products from one of the following:
1. Amtrol, Inc.
 2. Bell & Gossett ITT; Fluid Handling Div.
 3. Taco, Inc.
- J. Y-Pattern Strainers: Subject to compliance with requirements, provide products from one of the following:
1. Armstrong Machine Works.
 2. Hoffman Specialty ITT; Fluid Handling Div.
 3. Metraflex Co.
 4. Spirax Sarco.
 5. Watts Regulator Co.

2.02 PIPE AND TUBING MATERIALS

- A. General: Refer to Part 3 Article "Pipe Applications" for identification of where the below materials are used.
- B. Drawn Temper Copper Tubing: ASTM B 88, Type L.
- C. Steel Pipe: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, plain ends.
1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, carbon steel.

2.03 FITTINGS

- A. Cast-Iron Threaded Fittings: ANSI B16.4, Class 125, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.
- B. Malleable-Iron Threaded Fittings: ANSI B16.3, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.
- C. Wrought-Steel Fittings: ASTM A 234, seamless or welded, for welded joints.
- D. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.
- E. Cast-Iron Threaded Flanges: ASME B16.1, Class 125; raised ground face, bolt holes spot faced.
- F. Cast Bronze Flanges: ANSI B16.24, Class 150; raised ground face, bolt holes spot faced.

- G. Wrought-Steel Flanges and Flanged Fittings: ANSI B16.5, including bolts, nuts, and gaskets of the following material group, end connection and facing:
 1. Material Group: 1.1.
 2. End Connections: Butt Welding.
 3. Facings: Raised face.
- H. Wrought-Copper Unions: ASME B 16.2
- I. Malleable-Iron Unions: ANSI B16.39, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends. Threads shall conform to ANSI B1.20.1.

2.04 GENERAL DUTY VALVES

- A. General duty valves (i.e. gate globe ball check and butterfly valves) are specified in Division 15 Section "Valves". Special duty valves are specified in this Section by their generic name; refer to Part 3, VALVE APPLICATIONS, for specific uses and applications for each valve specified.

2.05 SPECIAL DUTY VALVES

- A. Calibrated Plug Valves: 125 psig water working pressure, 250 deg F maximum operating temperature, bronze body, plug valve with calibrated orifice. Provide with connections for portable differential pressure meter with integral check valves and seals. Valve shall have integral pointer and calibrated scale to register degree of valve opening. Valves 2 inch and smaller shall have threaded connections and valves 2-1/2 inch and larger shall have flanged connections.
- B. Pump Discharge Valves: 175 psig working pressure, 300 deg F maximum operating temperature, cast-iron body, bronze disc and seat, stainless steel stem and spring, and "Teflon" packing. Valves shall have flanged connections and straight or angle pattern as indicated. Features shall include non-slam check valve with spring-loaded weighted disc, and calibrated adjustment feature to permit regulation of pump discharge flow and shutoff.
- C. Pressure Reducing Valves: diaphragm operated cast-iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shut-down, and noncorrosive valve seat and stem. Select valve size capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure and have the capability for field adjustment.
- D. Safety Relief Valves: 125 psig working pressure and 250 deg F. maximum operating temperature; designed, manufactured, tested, and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code. Valve body shell e cast-iron, with all wetted internal working parts made of brass and rubber. Select valve to suit actual system pressure.
- E. Combined Pressure/Temperature Relief Valves: diaphragm operated, with low inlet pressure check valve, inlet strainer removable without system shut-down, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure and have the capability for field adjustment. Safety relief valve designed, manufactured, tested, and labeled in accordance with the requirements of

Section IV of the ASME Boiler and Pressure Vessel Code. Valve body shall be cast-iron or brass, with all wetted internal working parts made of brass and rubber; 125 psig working pressure and 250 deg F maximum operating temperature. Select valve to suit actual system pressure. Provide with fast fill feature for filling hydronic system.

2.06 HYDRONIC SPECIALTIES

- A. Manual Air Vent: bronze body and nonferrous internal parts; 150 psig working pressure, 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; and having 1/8 inch discharge connection and 1/2 inch inlet connection.
- B. Automatic Air Vent: designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150 psig working pressure, 240 deg F operating temperature; and having 1/4 inch discharge connection and 1/2 inch inlet connection.
- C. Pump Suction Diffusers: cast-iron body, with threaded connections for 2 inch and smaller, flanged connections for 2-1/2 inch and larger; 175 psig working pressure 300 deg F. maximum operating temperature; and complete with the following features:
 - 1. Inlet vanes with length 2-1/2 times pump suction diameter or greater.
 - 2. Cylinder strainer with 3/16 inch diameter openings with total free area equal to or greater than 5 times cross-sectional area of pump suction, designed to withstand pressure differential equal to pump shutoff head.
 - 3. Disposable fine mesh strainer to fit over cylinder strainer.
 - 4. Permanent magnet, located in flow stream, removable for cleaning.
 - 5. Adjustable foot support, designed to carry weight of suction piping.
 - 6. Blowdown tapping in bottom; gage tapping in side.
- D. Flow Balancing Valve: Flow-balancing systems include calibrated flow element, separate meter, hoses or tubing, valves, fittings, and conversion chart that is compatible with flow element, meter and system fluid.
 - 1. Flow range of flow-measuring element and meter covers operating range of equipment or system where used.
 - 2. Portable Meters: Differential-pressure gage and two twelve foot hoses in carrying case with handle.
 - a. Scale: In inches of water unless otherwise indicated.
 - b. Accuracy: Plus or minus two percent between 20 to 80 percent of range.
 - 3. Include complete operating instructions with each meter.
- E. Diverting Fittings: cast iron body with threaded ends, or wrought copper with solder ends; 125 psig working pressure, 250 deg F maximum operating temperature. Indicate flow direction on fitting.
- F. Y-Pattern Strainers: 125 psig working pressure cast-iron body (ASTM A 126, Class B), flanged ends for 2-1/2 inch and larger, threaded connections for 2 inch and smaller, bolted cover, perforated Type 304 stainless steel basket, and bottom drain connection.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine rough-in for piping systems to verify actual locations of piping connections prior to installation.
- B. Install HVAC equipment level and plumb, according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.

3.02 PIPE APPLICATIONS

- A. Hot Water, Energy Recovery Water and Chilled Water 2 Inches and Smaller: Type L, drawn copper tubing with wrought copper fittings and soldered or threaded joints.
- B. Hot Water and Energy Recovery Water 2-1/2 Inches and Larger: Steel pipe with welded and flanged joints and fittings.
- C. Chilled Water 2-1/2 Inches and Larger: Steel pipe with welded and flanged joints and fittings.
- D. Condensate Drain lines: Type L drawn-temper copper tubing with soldered joints.

3.03 PIPING INSTALLATIONS

- A. Install piping in accordance with Division 15 Section "Basic Mechanical Materials and Methods".
- B. Use fittings for all changes in direction and all branch connections.
- C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- D. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- E. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- F. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- G. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4 inch ball valve, and short 3/4 inch threaded nipple and cap.
- H. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials.
- I. Install piping at a uniform grade of 1 inch in 40 feet upward in the direction of flow.
- J. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.

- K. Install branch connections to mains using Tee fittings in main with take-off out the bottom of the main, except for up-feed risers which shall have take-off out the top of the main line.
- L. Install unions in pipes 2 inch and smaller, adjacent to each valve, at final connections each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- M. Install flanges on valves, apparatus, and equipment having 2-1/2 inch and larger connections.
- N. Install strainers on the supply side of each control valve, pressure reducing valve, pressure regulating valve, solenoid valve, inline pump, and elsewhere as indicated. Install nipple and ball valve in blow down connection of strainers 2 inch and larger.
- O. Anchor piping to ensure proper direction of expansion and contraction. Expansion loops and joints are indicated on the Drawings and specified in Division-15.

3.04 VALVE APPLICATIONS

- A. Install calibrated plug valves on the outlet of each heating or cooling element and elsewhere as required to facilitate system balancing.
- B. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.
- C. Install pump discharge valves with stem in upward position; allow clearance above stem for check mechanism removal.
- D. Install flow balancing valves on the outlet of each heating or cooling element and elsewhere as required to facilitate system balancing. Include test ports on all balancing valves to facilitate balancing instrument measurements.
- E. Install temperature control valves as directed by temperature control contractor. Extend line size piping to and from temperature control valves.
 1. Install shut-off valves and unions before and after control valves.
 2. Install line size strainer before control valves.
 3. Unless otherwise indicated, provide line size by-pass around control valves with union.

3.05 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in the system, at heat transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points in the system, heat transfer coils, and elsewhere as required for system air venting, within the mechanical room(s). Refer to details for locations requiring automatic air vents.
- C. Install pump discharge valves in horizontal or vertical position with stem in upward position. Allow clearance above stem for check mechanism removal.
- D. Provide connections for chemical water treatment equipment, provided by others, in each hydronic system where indicated

3.06 EQUIPMENT CONNECTIONS

- A. The Drawings indicate the general arrangement of piping, fittings and specialties.
- B. Make all indicated connections while arranging piping to allow effective servicing and maintenance.
- C. Install control valves in accessible locations close to equipment.
- D. Install bypass piping with globe valve around control valve. Where multiple, parallel control valves are installed, only one bypass is required.

3.07 FIELD QUALITY CONTROL

- A. Prepare hydronic piping in accordance with ASME B 31.9 and as follows:
 - 1. Leave joints including welds uninsulated and exposed for examination during the test.
 - 2. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
 - 3. Flush system with clean water. Clean strainers.
 - 4. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
 - 5. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during test.
- B. Test hydronic piping as follows:
 - 1. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping system components.
 - 2. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points for complete removal of liquid.
 - 3. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.
 - 4. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either

90 percent of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code For Pressure Piping, Building Services Piping.

5. After the hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.
- C. Comply with USM IDAT per section 01810.

3.08 ADJUSTING AND CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris; repair damaged finishes, including chips, scratches, and abrasions.
- B. Ensure that system is operational, filled, started, and vented prior to cleaning. Place terminal control valves in OPEN position during cleaning. Use water meter to record capacity in each system.
- C. Add cleaning chemicals as recommended by manufacturer.
 1. Hot-Water Heating System: Apply heat while circulating, slowly raising system to design temperature; maintain for a minimum of 12 hours. Remove heat and allow to cool; drain and refill with clean water. Circulate for 6 hours at design temperature, then drain. Refill with clean water and repeat until system cleaner is removed.
- D. Clean and flush hydronic piping systems. Remove, clean, and replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.
- E. Mark calibrated name plates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

3.09 START-UP, ADJUSTMENT, & TESTING

- A. Coordinate initial chemical treatment with Owners chemical treatment contractor.
- B. Check expansion tanks to determine that they are appropriately pressurized and that the system is completely full of water.
- C. Before operating the system perform these steps:
 1. Open valves to full open position. Close coil bypass valves.
 2. Remove and clean strainers.
 3. Check pump for proper direction of rotation.
 4. Set automatic fill valves for required system pressure.
 5. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
 6. Set temperature controls so all coils are calling for full flow.

7. Check operation of automatic bypass valves.
 8. Check and set operating temperatures of boilers to design requirements.
- D. Review data in Operating and Maintenance Manuals. Refer to Division 1 Section "Project Closeout".
- E. Schedule training with Owner through the architect, with at least 7 days advance notice.

END OF SECTION 15180