

SECTION 232113  
HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes piping, special-duty valves, and hydronic specialties for hot-water heating systems, chilled-water cooling systems and condensate drains.

1.2 SUBMITTALS

- A. Product Data: Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

1.4 COORDINATION

- A. Coordinate pipe sleeve installations for foundation wall penetrations.
- B. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations.
- C. Coordinate pipefitting pressure classes with products specified in related Sections.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.
- B. Copper Tube and Fittings:
  - 1. Drawn-Temper Copper Tubing: ASTM B 88, Type L
  - 2. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

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3. DWV Copper Tubing: ASTM B 306, Type DWV.
4. Wrought-Copper Fittings: ASME B16.22.
5. Wrought-Copper Unions: ASME B16.22.
6. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
7. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

C. Steel Pipe and Fittings:

1. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade B, Schedule 40, black steel, plain ends.
2. Steel Pipe, NPS 2-1/2 through NPS 4: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.
3. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.
4. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125
5. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150
6. Malleable-Iron Unions: ASME B16.39; Class 150.
7. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250; raised ground face, and bolt holes spot faced.
8. Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47, Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.
9. Grooved Mechanical-Joint Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
10. Flexible Connectors: Stainless steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.
11. Packed, Slip, Expansion Joints: 150-psig minimum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, packing ring, packing, limit rods, flanged ends, and chrome-plated finish on slip-pipe telescoping section.
12. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

D. CPVC Plastic Pipe: ASTM F 441, Schedules 40 and 80, plain ends.

1. PVC Plastic Pipe Fittings: Socket-type pipefittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.
2. CPVC Solvent Cement: ASTM F 493.

E. PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80, plain ends.

1. PVC Plastic Pipe Fittings: Socket-type pipefittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.
2. PVC Solvent Cement: ASTM D 2564.

2.2 VALVES AND SPECIALTIES

- A. Calibrated Balancing Valves, NPS 2 and Smaller: bronze disc valves with precision machined orifice, pressure-gauge connections having integral check valves and thread protectors, Bell and Gossett "Circuit Setter", Model CB, complete with preformed insulation.
- B. Balancing Plug Valves, NPS 2 and Smaller: 125# W.O.G., cast iron body, bronze plug and washer.
- C. Ball Valves: Brass body, stainless steel ball and stem, Teflon seat and seals, screwed three-piece body
- D. Gate Valves: Class 125 bronze body, rising stem, union bonnet, solid wedge disc, screwed body
- E. Globe Valves: Class 125 bronze body, bronze disc rising stem, screwed body
- F. Check Valves: Class 200 bronze body, regrinding, swing type, screwed body
- G. Pipe Plugs: Class 125 brass hex head, threaded.
- H. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.
- I. 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; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.
- J. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. Capacity; with fill funnel and inlet, outlet, and drain valves.
  - 1. Chemicals: Provide initial chemical charge formulated and based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.
- K. Diverting Fittings: 125-psig working pressure; 250 deg F maximum operating temperature; cast-iron body with threaded ends, or wrought copper with soldered ends. Indicate flow direction on fitting.
- L. Y-Pattern Strainers: Class 250 cast iron body, "Y" type, ASTM A278, with perforated Monel screen – 4 mesh/inch., screwed body.
- M. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.
- N. Gaskets: 1/16" thick Garlock Blue-Gard #3000
- O. Bolts and Nuts: Carbon steel machine bolts and hex. nuts, ASTM A307, Grade B

- P. Thread Sealant: Teflon tape

### PART 3 - EXECUTION

#### 3.1 PIPING APPLICATIONS

- A. Hot and Chilled Water: Aboveground, use steel pipe and threaded fittings, Schedule 40.
- B. Condensate Drain Lines: Type L drawn-temper copper tubing with soldered joints or Schedule 40, PVC pipe with solvent-welded joints.

#### 3.2 VALVE APPLICATIONS

- A. Unless otherwise indicated, use the following general-duty valve types for applications indicated:
  - 1. Shutoff Duty: Ball or OS&Y gate.
  - 2. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty globe valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
  - 3. Install check valves at each pump discharge and elsewhere as required to control flow direction.
  - 4. Install Y-pattern strainers at each pump discharge and elsewhere as indicated.
- B. Unless otherwise indicated, use the following special-duty valve types for applications indicated:
  - 1. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as indicated or as required to facilitate system balancing.
  - 2. Install high point automatic air vents and manual vacuum breakers at the high point of each chilled water and heating water piping system.
  - 3. Install 3/4" low point drains at the low point of each chilled water and heating water piping system. Drains shall be plugged to prevent accidental discharge.

#### 3.3 PIPING INSTALLATIONS

- A. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- B. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- C. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- D. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

- E. Install strainers on supply side of each in-line pump and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers.
- F. Anchor piping for proper direction for expansion and contraction.
- G. Install ½” OS&Y gate valves at the system high point for manual vacuum relief.

### 3.4 HANGERS AND SUPPORTS

- A. Comply with requirements below for maximum spacing of supports. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
  - 5. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
    - a. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
    - b. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
    - c. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
    - d. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
    - e. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
    - f. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 6. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
    - a. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
    - b. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
    - c. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
    - d. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
    - e. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
    - f. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 7. Elastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
  - 8. Support vertical runs at 10-foot intervals.

### 3.5 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

1. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.
2. Install air separator and strainer in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install blowdown piping with gate valve; extend to nearest drain.
3. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above floor. Install feeder in bypass line, off main, using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be same as for equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for pressure and temperature gages at coil inlet connections.

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

### 3.8 ADJUSTING

- A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.
- B. Perform these adjustments before TAB balancing:
  1. Open valves to fully open position. Close coil bypass valves.
  2. Check pump for proper direction of rotation.
  3. Set automatic fill valves for required system pressure.
  4. Check air and vacuum vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  5. Set temperature controls so all coils are calling for full flow.
  6. Check operation of automatic bypass valves.
  7. Check and set operating temperatures of boilers and chillers to design requirements.
  8. Lubricate motors and bearings.

### 3.9 CLEANING

- A. Flush hydronic piping systems with compressed air and clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

3.10 TESTING

- A. Inspect and test piping and components prior to the application of insulation. Isolate installed piping systems and pressurize with ten-psi compressed air. Inspect threaded connections with a soapy water solution (bubble test).
- B. Fill installed piping systems with clean water. Energize pumps and visibly inspect piping for leakage.
- C. Verify no unusual noises or vibrations are present. Verify condensate drains drain effectively.
- D. Repair leaks by brazing or replacing fittings. Repair unusual noises or vibrations. After inspection and approval by the Contract representative, proceed to the application of pipe insulation.

END OF SECTION 232113