

**SECTION 23 21 13**  
**HYDRONIC PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Heating hot water piping in heating equipment room (EB-135) at building 100.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 13 05 41, SEISMIC RESTRAINTS FOR NON-STRUCTURAL COMPONENTS.
- D. Section 22 35 00, HEAT EXCHANGERS AND FILTER PACKAGE.
- E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- F. Section 23 07 11, HVAC AND BOILER PLANT INSULATIONS.

**1.3 QUALITY ASSURANCE**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Pipe and tubing, with specification, class or type, and schedule.
  - 2. Pipe fittings, including miscellaneous adapters and special fittings.
  - 3. Flanges, gaskets and bolting.
  - 4. Valves of all types.
- C. As-Built Drawings: Provide drawing as follows for hydronic piping.
  - 1. One wall-mounted stick file for prints. Mount stick file in the Room ECC room along with control diagram stick file.
  - 2. One set of reproducible drawings.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
  - B1.20.1-83(R2006).....Pipe Threads, General Purpose (Inch)
  - B16.3-11.....Malleable Iron Threaded Fittings: Class 150 and 300
  - B16.4-11.....Gray Iron Threaded Fittings
  - B16.5-09.....Pipe Flanges and Flanged Fittings: NPS 1/ through NPS 24 Metric/Inch Standard

- B16.9-07.....Factory-Made Wrought Buttwelding Fittings
- B16.11-11.....Forged Fittings, Socket-Welding and Threaded
- B16.18-12.....Cast Copper Alloy Solder Joint Pressure Fittings
- B16.22-01 (R2010).....Wrought Copper and Copper Alloy Solder-Joint  
Pressure Fittings
- B16.24-11.....Cast Copper Alloy Pipe Flanges and Flanged  
Fittings, Class 150, 300, 400, 600, 900, 1500  
and 2500
- B16.39-09.....Malleable Iron Threaded Pipe Unions, Classes  
150, 250, and 300
- B16.42-11.....Ductile Iron Pipe Flanges and Flanged Fittings,  
Class 150 and 300
- B31.1-12.....Power Piping
- C. American Society for Testing and Materials (ASTM):
  - A47-09.....Ferritic Malleable Iron Castings
  - A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated,  
Welded and Seamless
  - A106-11.....Seamless Carbon Steel Pipe for High-Temperature  
Service
  - A307-10 ..... Carbon Steel Bolts and Studs, 60,000 PSI Tensile  
Strength
  - A536-09 ..... Standard Specification for Ductile Iron Castings
  - B88-09 ..... Seamless Copper Water Tube
- D. American Welding Society (AWS):
  - B2.1-09.....Welding Procedure and Performance Qualifications
- E. Manufacturers Standardization Society (MSS) of the Valve and Fitting  
Industry, Inc.:
  - SP-67-11.....Butterfly Valves
  - SP-110-10.....Ball Valves Threaded, Socket-Welding, Solder  
Joint, Grooved and Flared Ends

## **PART 2 - PRODUCTS**

### **2.1 PIPE AND EQUIPMENT SUPPORTS**

- A. Provide in accordance with Section 13 05 41, SEISMIC RESTRAINTS FOR NON-  
STRUCTURAL COMPONENTS.

### **2.2 PIPE AND TUBING**

- A. Heating Hot Water Piping: Steel, ASTM A53, Grade B, seamless or ERW;  
ASTM A106 Grade B, Seamless; Schedule 40.
- B. Copper water tube option: ASTM B88, Type L, hard drawn for 20mm (3/4  
inch) and larger.

### **2.3 FITTINGS FOR STEEL PIPE**

- A. 50 mm (2 inches) and Smaller: Screwed or welded joints.
  - 1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.
  - 2. Forged steel, socket welding or threaded: ASME B16.11.
  - 3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron, except for steam and steam condensate piping. Provide 300 pound malleable iron, ASME B16.3 for steam and steam condensate piping. Cast iron fittings or piping is not acceptable for steam and steam condensate piping. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
  - 4. Unions: ASME B16.39.
  - 5. Water hose connection adapter: Brass, pipe thread to 20 mm (3/4 inch) garden hose thread, with hose cap nut.
- B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints.
  - 1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
  - 2. Welding flanges and bolting: ASME B16.5:
    - a. Water service: Weld neck or slip-on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).
    - b. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.
- C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.

### **2.4 FITTINGS FOR COPPER TUBING**

- A. Joints:
  - 1. Solder Joints: Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.
  - 2. Mechanically formed tee connection in water and drain piping: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch

tube in a single process to provide free flow where the branch tube penetrates the fitting.

- B. Bronze Flanges and Flanged Fittings: ASME B16.24.
- C. Fittings: ANSI/ASME B16.18 cast copper or ANSI/ASME B16.22 solder wrought copper.
- D. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.
- E. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.
- F. Temperature Rating, 121 degrees C (250 degrees F) for steam condensate and as required for steam service.

## **2.5 DIELECTRIC FITTINGS**

- A. Provide where copper tubing and ferrous metal pipe are joined.
- B. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.
- C. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.
- D. Temperature Rating, 99 degrees C (210 degrees F).

## **2.6 SCREWED JOINTS**

- A. Pipe Thread: ASME B1.20.
- B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

## **2.7 VALVES**

- A. Asbestos packing is not acceptable.
- B. All valves of the same type shall be products of a single manufacturer.
- C. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.
- D. Shut-Off Valves
  - 1. Ball Valves (Pipe sizes 2" and smaller): MSS-SP 110, screwed or solder connections, brass or bronze body with chrome-plated ball with full port and Teflon seat at 2760 kPa (400 psig) working pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.
  - 2. Butterfly Valves (Pipe Sizes 2-1/2" and larger): Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation. MSS-SP 67, flange lug type end rated 1205 kPa (175 psig) working pressure at 93 degrees C (200 degrees F). Valves shall be ANSI Leakage Class VI and rated for bubble tight shut-off to 150 psi full valve pressure rating. Valve shall be rated for dead end service and bi-directional flow

capability to full rated pressure. Not permitted for direct buried pipe applications.

- a. Body: Cast iron, ASTM A126, Class B.
- b. Disc: 316 Stainless Steel.
- c. Stem: 416 Stainless Steel for full cut disc.
- d. Seat: EPDM
- e. Bearing: Bronze for full cut disc.
- f. Upper Stem Bushing: Polyester
- g. Upper Stem Seal: NBR
- h. Temperature Range: -40 Degree F to 250 Degree F.
- i. Electric Actuators: 90 Degree operation of ¼ turn valves, suitable for On/Off duty, thermal overload motor protection, manual override wheel, limit switches setting, non-spring return, NEMA 4X enclosure with Factory Mutual (FM) explosion proof, 120 VAC power, single phase, and field interchangeable. The actuator shall be suitable for network interfaces including ProfiBus, AS Interface, LonWorks, DeviceNet, and Fieldbus Foundation.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.
- B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.
- C. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- D. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope steam, condensate and drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep

bottom of sloped piping flat.

- E. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended.
- F. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.
- G. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.
- H. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:
  - 1. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.
- I. Where copper piping is connected to steel piping, provide dielectric connections.

### **3.2 PIPE JOINTS**

- A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1.
- B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.
- C. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

### **3.3 SEISMIC BRACING**

- A. Provide in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

### **3.4 LEAK TESTING ABOVEGROUND PIPING**

- A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the COR in accordance with the specified requirements. Testing shall be performed in accordance with the specification requirements.
- B. An operating test at design pressure, and for hot systems, design maximum temperature.

C. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

### **3.5 FLUSHING AND CLEANING PIPING SYSTEMS**

A. Water Piping: No flushing or chemical cleaning required. Accomplish cleaning by pulling all strainer screens and cleaning all scale/dirt legs during start-up operation.

### **3.6 OPERATING AND PERFORMANCE TEST AND INSTRUCTION**

A. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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