SECTION 23 22 13

STEAM AND CONDENSATE PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Low pressure steam piping.
2. Low pressure steam condensate piping.
3. Medium and high pressure steam piping.
4. Medium and high pressure steam condensate piping.
5. Equipment drains and over flows.
6. Unions and flanges.
7. Pipe hangers and supports.
8. Valves.

B. Related Sections:

1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
3. Division 09 - Painting and Coating: Product requirements Painting for placement by this section.
4. Division 23 - Pipes and Tubes for HVAC Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
5. Division 23 - Expansion Fittings and Loops for HVAC Piping: Product and execution requirements for expansion compensation devices use in steam piping systems.
6. Division 23 - General-Duty Valves for HVAC Piping: Product requirements for valves for placement by this section.
7. Division 23 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports, sleeves, [and firestopping] for placement by this section.
8. Division 23 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
9. Division 23 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.
10. Division 23 - Steam and Condensate Piping Specialties: Product and execution requirements for piping specialties used in steam piping systems.
11. Division 23 - Steam Condensate Pumps: Product and execution requirements for pumps used in steam piping systems.
12. Division 23 - HVAC Water Treatment: Product and execution requirements for cleaning and chemical treatment of heating and cooling piping systems.

1.02 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.4 - Gray Iron Threaded Fittings.
3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
5. ASME B31.1 - Power Piping.
6. ASME B31.9 - Building Services Piping.
7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High- Temperature Service.
3. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
4. ASTM B32 - Standard Specification for Solder Metal.
5. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
6. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
7. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
8. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.03 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

B. Provide flanges, union, and couplings at locations requiring servicing. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

C. Provide pipe hangers and supports in accordance with ASME B31.1, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

D. Use gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Use globe valves for throttling or services.

F. Use spring loaded check valves on discharge of condensate pumps.

G. Use horizontal swing check valves for vacuum breakers and discharge of steam traps.

H. Use 3/4 inch ball valves with cap for blow downs at strainers.

I. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

J. Flexible Connectors: Use at or near pumps where piping configuration does not absorb vibration.

1.04 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Shop Drawings: Indicate schematic layout of steam and condensate piping system, including equipment, critical dimensions, and sizes.

C. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.

D. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of steam and condensate piping system pressure test.

F. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Welders' Certificate: Include welders' certification of compliance with ASME Section 9 (ASME 31.1). Each welding certification shall bear a date not more than 6 months prior to date of starting work.

1.05 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of valves equipment and accessories.

C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.1 code for installation of piping systems and ASME Section 9 for welding materials and procedures.

B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

C. Maintain one copy of each document on site.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience.

C. Design piping system hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.

1.08 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Section 01 - Product Requirements: Product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Section 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one year manufacturer warranty for valves excluding packing.

1.12 EXTRA MATERIALS

A. Section 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two packing kits for each size and valve type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

1. Safety Valves:

a. Armstrong International, Inc.

2. Pressure-Reducing Valves:

a. Armstrong International, Inc.

3. Steam Traps:

a. Armstrong International, Inc.

4. Air Vents and Vacuum Breakers:

a. Armstrong International, Inc.

5. Steam Meters:

   a. Spirax Sarco, Inc.

6. Condensate Meters:

   a. Hersey Measurement Company.
   b. ISTEC Corp.

7. Pre-insulated Steam Pipe (U.G.)

   a. Rovanco
   b. Thermal Pipe Co.
   c. Or Equal

8. Pipe and fittings shall be domestic, Australian or Canadian.

2.02 PIPING MATERIALS

A. General: Refer to Part 3 piping application articles for applications of pipe and fitting materials.

2.03 STEEL PIPE AND FITTINGS

A. Steel Pipe, NPS 3/4 through NPS 12: ASTM A 53, Type ERW (electric-resistance welded), Grade B, Schedules 40 and 80, black steel, plain ends.

   1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedules 40 and 80, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300.

C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250; raised ground face, and bolt holes spot faced.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

   1. Material Group: 1.1.
   2. End Connections: Butt welding.
   3. Facings: Raised face.

H. Flexible Connectors: Stainless-steel bellows with woven, flexible, stainless steel 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.

I. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

J. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures – (Garlock Flex-seal – RW).

K. Preinsulated pipe: Carrier pipe same as insulated pipe. Insulation shall be sectional mineral wool with K factor of 0.31 at 200° F with inner pipe supports. Outer casing shall be 10 gauge black steel. Exterior surface will be coated with two coat Fusion Bonded Epoxy system per manufacturer standard.

2.04 VALVES

A. Refer to Part 3 "Valve Applications" Article for applications of each valve.

B. Bronze Valves: NPS 2and smaller with threaded ends.

C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators - Chain wheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves and ASME B16.24 for bronze valves.

2.05 BRONZE ANGLE VALVES

A. Manufacturers:

1. NIBCO INC.
2. Or equal

B. Bronze Angel Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 2, Class 150, Bronze Angle Valves: Bronze body with Viton disc and union ring bonnet.

D. Type 2, Class 200, Bronze Angle Valves: Bronze body with Viton disc and union ring bonnet.

2.06 CAST IRON ANGLE VALVES

A. Manufacturers:

1. NIBCO, Inc.
2. Or equal.

B. Cast-Iron Angle Valves, General: MSS SP-85, Type 2

C. Class 125, Cast-Iron Angle Valves: Bronze mounted with gray iron body and bronze seats.

D. Class 250, Cast-Iron Angle Valves: Bronze mounted with gray iron body and bronze seats.

2.07 COPPER-ALLOY BALL VALVES

A. Manufacturers:

1. NIBCO Inc.
2. Or equal.

B. Copper-Alloy Ball Valves, General: MSS SP-110

C. Three Piece, Copper-Alloy Ball Valves: Bronze body with full port, stainless steel ball; Teflon seats; and 600 psig minimum CWP rating and blowout-proof stem.

2.08 BRONZE CHECK VALVES

A. Manufacturers:

1. NIBCO Inc.

B. Bronze Check Valves, General: MSS SP-80

C. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

D. Type 4, Class 200, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.09 GRAY-IRON SWING CHECK VALVES

A. Manufacturers:

1. Watts Industries, Inc.; Water Products, Div.
2. Or equal.

B. Gray-Iron Swing Check Valves, General: MSS-SP-71.

C. Type 2, Class 125, Gray-iron, swing check valves with composition to metal seats.

D. Type 2, Class 250, gray-iron, swing check valves with composition to metal seats.

2.10 SPRING-LOADED, LEFT-DISC CHECK VALVES

A. Manufacturers:

1. NIBCO, Inc.
2. Or equal.

B. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

C. Type 2, Class 250, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.

D. Type 4, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

2.11 BRONZE GATE VALVES

A. Manufacturers:

1. NIBCO INC.
2. Or equal.

B. B. Type 3, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge and union-ring bonnet.

C. C. Type 3, Class 200, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge and union-ring bonnet.

2.12 CAST-IRON GATE VALVES

A. Manufacturers:

1. NIBCO INC.
2. Or equal.

B. Cast-Iron Gate Valves, General: MSS SP-70, Type 1.

C. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.

D. Class 250, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.

2.13 BRONZE GLOBE VALVES

A. Manufacturers:

1. NIBCO INC.
2. Or equal.

B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 1, Class 200, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.

D. Type 2, Class 150, Bronze Globe Valves: Bronze body with PTFE or TFE disc and union-ring bonnet.

E. Type 2, Class 200, Bronze Globe Valves: Bronze body with PTFE or TFE disc and union-ring bonnet.

2.14 CAST-IRON GLOBE VALVES

A. Manufacturers:

1. NIBCO INC.

B. Cast-Iron Globe Valves, General: MSS SP-85.

C. Type 1, Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

D. Type 1, Class 250, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

2.15 CHAIN WHEEL ACTUATORS

A. Manufacturers:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries, Inc.
3. Or equal.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

C. Description: Valves actuation assembly with sprocket rim, brackets, and chain.

1. Sprocket Rim with Chain Guides: Ductile iron of type and size required for valve, include zinc coating.
2. Chain: Hot dip, galvanized steel of size required to fit sprocket rim.

2.16 SAFETY VALVES

A. Size and Capacity: As required for equipment according to the ASME Boiler and Pressure Vessel Code.

B. Bronze Safety Valves less than NPS 3: Class 250, with threaded inlet and outlet; forged copper-alloy disc; fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

1. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

C. Cast-Iron Safety Valves greater than NPS 1: Class 250; forged copper-alloy disc with bronze nozzle; fully enclosed, cadmium-plated steel spring with adjustable pressure range and positive shutoff; raised-face flanged inlet and threaded outlet connections; factory set and sealed.

1. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

D. Stop-Check Valves: Class 250, malleable-iron body and bonnet, cylindrical disc, removable liner and machined seat, brass-alloy stem, outside screw and yoke, polytetrafluoroethylene-impregnated packing with 2-piece packing gland assembly, flanged end connections, and cast-iron handwheel.

2.17 PRESSURE-REDUCING VALVES

A. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.

B. Valve Characteristics: Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff. Valves shall have cast-iron or stainless steel body with threaded connections for valves NPS 2 and smaller and flanged connections for valves NPS 2-1/2 and larger; and hardened stainless-steel trim, replaceable head and seat, main head stem guide fitted with flushing and pressure-arresting device, cover over pilot diaphragm, and non-asbestos gaskets.

2.18 STEAM TRAPS

A. Thermodynamic Traps: Stainless-steel body and screw-in cap; maximum operating pressure of 600 psig; stainless-steel disc and seat; threaded ends.

B. Float and Thermostatic Traps: ASTM A 126, cast-iron or stainless steel body and bolted cap; renewable, stainless-steel float mechanism with renewable, hardened stainless-steel head and seat; maximum operating pressure of 125 psig; balanced-pressure, stainless-steel or monel thermostatic bellow element. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.

C. Inverted Bucket Traps: Cast-iron or stainless steel body and cap, pressure rated for 250 psig; stainless-steel head and seat; stainless-steel valve retainer, lever, and guide pin assembly; and brass or stainless-steel bucket.

1. Strainer: Integral stainless-steel inlet strainer within the trap body.
2. Air Vent: Stainless-steel thermostatic vent.

2.19 THERMOSTATIC AIR VENTS

A. Float Vents: Cast-iron, brass or stainless steel body, seamless brass or stainless steel float, balanced-pressure thermostatic bellows, and replaceable stainless-steel seat, float, and head.

2.20 VACUUM BREAKERS

A. Vacuum Breakers: 150-psig steam working pressure, 365 deg F maximum operating temperature, brass or stainless-steel body, and stainless-steel retainer, spring, and ball; with plain or threaded outlet.

2.21 STRAINERS

A. Y-Pattern Strainers: 250-psig working steam pressure; ASTM A 126, Class B cast-iron body except for clean steam shall be stainless steel; stainless-steel screen, No. 20 mesh for NPS 2 and smaller and manufacturer's recommended perforations for NPS 2-1/2 and larger; tapped blowoff plug. Threaded connections for strainers NPS 2 and smaller and flanged connections for strainers NPS 2-1/2 and larger.

2.22 FLASH TANKS

A. Shop or factory fabricated of welded stainless steel according to the ASME Boiler and Pressure Vessel Code, for 150-psig rating; and bearing ASME label. Fabricate with tappings for vents, low-pressure steam and condensate outlets, high-pressure condensate inlet, air vent, safety valve, and legs.

2.23 METERS

A. Steam Meters: Pipeline sensor with stainless-steel wetted parts and flange connections and with a piezoelectric sensor removable and serviceable without shutting down the process.

1. Turndown Ratio: At least 10:1 with plus or minus 1 percent accuracy over full flow range.
2. Microprocessor Enclosure: NEMA 250, Type 4.

PART 3 - EXECUTION

3.01 LP STEAM PIPING APPLICATIONS (less than 15 psi)

A. Steam Piping, NPS 2 and Smaller: Schedule 40 steel pipe, with threaded joints using Class 125 cast-iron fittings / or socket weld – 3000# forged steel fittings.

B. Steam Piping, NPS 2-1/2 through NPS 12: Schedule 40 steel pipe, with welded joints using Schedule 40 wrought-steel welding fittings and Class 150 wrought-steel flanges.

C. Condensate Piping, NPS 2 and Smaller: Schedule 80 steel pipe, with threaded joints using Class 125 malleable-iron fittings / or socket weld – 3000# forged steel fittings.

D. Condensate Piping, NPS 2-1/2 through NPS 12: Schedule 80 steel pipe, with welded joints using Schedule 80 wrought-steel welding fittings and Class 150 wrought-steel flanges.

3.02 HP & MP STEAM PIPING APPLICATIONS

A. Steam Piping, NPS 2 and Smaller: Schedule 40 steel pipe, with threaded joints using Class 300 malleable-iron fittings / or socket weld forged steel fittings.

B. Steam Piping, NPS 2-1/2 through NPS 12: Schedule 40 steel pipe, with welded joints using Schedule 40 wrought-steel welding fittings and Class 150 wrought-steel flanges.

C. Condensate Piping, NPS 2 and Smaller: Schedule 80 steel pipe, with threaded joints using Class 300 malleable-iron fittings / or socket weld forged steel fittings.

D. Condensate Piping, NPS 2-1/2 through NPS 12: Schedule 80 steel pipe, with welded joints using Schedule 80 wrought-steel welding fittings and Class 150 wrought-steel flanges.

3.03 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

1. Shutoff Duty: Gate and ball valves.
2. Throttling Duty: Globe and ball valves.

B. Install shut off-duty valves at each branch connection to supply mains, at inlet connection to each steam trap, and elsewhere as indicated.

C. Valves for clean steam shall be stainless steel construction.

D. Low-Pressure / Medium Pressure Steam Piping: Use the following types of valves:

1. Angle Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 and Larger: Type 2, Class 125, cast iron.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
4. Swing Check Valves, NPS 2-1/2 and Larger: Type 2, Class 125, gray iron.
5. Gate Valves, NPS 2 and Smaller: Type 3, Class 150, bronze.
6. Gate Valves, NPS 2-1/2 and Larger: Type 1, Class 125, OS&Y, bronze-mounted cast iron.
7. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
8. Globe Valves, NPS 2-1/2 and Larger: Type 1, Class 125, bronze-mounted cast iron.

E. High-Pressure Steam Piping: Use the following types of valves:

1. Angle Valves, NPS 2 and Smaller: Type 2, Class 300, bronze.
2. Angle Valves, NPS 2-1/2 and Larger: Type 2, Class 250, cast iron.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 200, bronze.
4. Swing Check Valves, NPS 2-1/2 and Larger: Type 2, Class 250, gray iron
5. Gate Valves, NPS 2 and Smaller: Type 3, Class 200, bronze.
6. Gate Valves, NPS 2-1/2 and Larger: Type 1, Class 250, OS&Y, bronze-mounted cast iron.
7. Globe Valves, NPS 2 and Smaller: Type 1, Class 200, bronze.
8. Globe Valves, NPS 2-1/2 and Larger: Type 1, Class 250, bronze-mounted cast iron.

F. Steam Condensate Piping: Use the following types of valves:

1. Ball Valves, NPS 2-1/2" and Smaller: Three-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
4. Swing Check Valves, NPS 2-1/2 and Larger: Type 2, Class 250, gray iron.
5. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type 4, Class 150.
6. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type 2, Class 250, cast iron.
7. Gate Valves, NPS 2 and Larger: Type 1, Class 250, OS&Y, bronze-mounted cast iron.
8. Globe Valves, NPS 2 and Smaller: Type 2, Class 200 bronze.
9. Globe Valves, NPS 2-1/2 and Larger: Type 1, Class 250 bronze-mounted cast iron.
10. Plug Valves, NPS 2 and Larger: Class 150 non-lubricated-type, cast iron.

3.04 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chain wheel operators on valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation (in areas exposed to structure).

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

3.05 LP STEAM-TRAP APPLICATIONS

A. Float and Thermostatic Traps: Steam main and riser drip legs, laundry equipment, kitchen equipment, heat exchangers.

3.06 MP / HP STEAM-TRAP APPLICATIONS

A. Inverted Bucket Traps: Steam main and riser drip leg.

B. Float and Thermostatic Traps: Kitchen equipment, heat exchangers, and heating coils.

C. Thermodynamic Traps: Steam main and riser drip legs.

3.07 PIPING INSTALLATIONS

A. Refer to Division 23 "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains, consisting of NPS ½" ball valve, and short NPS ½" threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

D. Install steam supply piping at a uniform grade of 0.2 percent downward in direction of steam flow. Slope may be 0.1 percent if pipe sizes are increased one pipe size.

E. Install condensate return piping at a uniform grade of 0.2 percent downward in direction of condensate flow.

F. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

G. Unless otherwise indicated, install branch connections to steam mains using 90 degree fittings in main pipe, with the takeoff coming out the top of the main pipe. Use of 45 degree tee fittings is permissible if 90 degree fittings are impractical. If length of branch takeoff is less than 10 feet, pitch branch line down toward mains at a 0.2 percent grade.

H. Install unions in piping NPS 2 and smaller adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated.

I. Install flanges in piping NPS 2-1/2 and larger at final connections of each piece of equipment and elsewhere as indicated.

J. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, traps, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

K. Anchor piping for proper direction of expansion and contraction.

L. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, control valves, isolation valves, pipe bends, and expansion joints.

1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet where pipe is pitched down in direction of steam flow and a maximum of 150 feet where pipe is pitched up in direction of steam flow.
2. Size drip legs at vertical risers same size as pipe and extend beyond rise. Size drip legs at other locations same diameter as main. In steam mains NPS 6 and larger, dirt leg size can be reduced, but to no less than NPS 4.
3. Install valve at drip legs, dirt pockets, and strainer blow downs to allow removal of dirt and scale.
4. Install steam traps close to drip legs.

M. Pitch condensate piping down toward flash tank. If more than one condensate pipe discharges into flash tank, install a swing check valve in each line. Install thermostatic air vent at top of tank. Install inverted bucket or float and thermostatic trap at low-pressure condensate outlet, sized for three times the condensate load. Install safety valve at tank top. Install pressure gage, valve, and swing check valve on low-pressure (flash) steam outlet.

3.08 STEAM-TRAP INSTALLATION

A. Install steam traps in accessible locations as close as possible to connected equipment, but not more than 48 inches from connected equipment.

1. Unless otherwise indicated, install valve, strainer, and union upstream from trap; install union, check valve, and valve downstream from trap.

3.09 PRESSURE-REDUCING VALVE INSTALLATION

A. Install pressure-reducing valves in readily accessible location for maintenance and inspection.

B. Install bypass piping around each pressure-reducing valve, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.

C. Install valves around each pressure-reducing valve.

D. Install unions around each pressure-reducing valve having threaded-end connections.

E. Install pressure gages on low-pressure side of each pressure-reducing valve and ahead of shutoff valve. Install pressure gages downstream from globe valve on pressure-reducing valve bypass.

1. On two-stage pressure-reducing stations, install drip trap and pressure gage upstream from second stage pressure-reducing valve.

F. Install strainers upstream for each pressure-reducing valve.

G. Install safety valves downstream from each pressure-reducing valve station.

3.10 STEAM METER INSTALLATION

A. Install lengths of straight pipe upstream and downstream from meters according to steam meter manufacturer's instructions.

3.11 SAFETY VALVE INSTALLATIONS

A. Install safety valves according to ASME B31.1. Pipe safety valve discharge without valves to atmosphere outside building. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.

3.12 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 "Hangers and Supports."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 30 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 30 feet or longer on hot piping (over 300 deg F temp) 4" NPS and larger.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 30 feet or longer, supported on a trapeze on hot piping (over 300 deg F temp) 4" NPS and larger..
4. Spring hangers to support vertical runs.

C. Install hangers with the following maximum spacing and minimum rod sizes:

1 NPS 3/4: Maximum span, 9 feet; minimum rod size, 1/4 inch.
2 NPS 1: Maximum span, 9 feet; minimum rod size, 1/4 inch.
3 NPS 1-1/2: Maximum span, 12 feet; minimum rod size, 3/8 inch.
4 NPS 2: Maximum span, 13 feet; minimum rod size, 3/8 inch.
5 NPS 2-1/2: Maximum span, 14 feet; minimum rod size, 3/8 inch.
6 NPS 3: Maximum span, 15 feet; minimum rod size, 3/8 inch.
7 NPS 4: Maximum span, 17 feet; minimum rod size, 1/2 inch.
8 NPS 6: Maximum span, 21 feet; minimum rod size, 1/2 inch.
9 NPS 8: Maximum span, 24 feet; minimum rod size, 5/8 inch.

D. Support vertical runs at roof, at each floor.

3.13 PIPE JOINT CONSTRUCTION

A. Refer to Division 23 "Basic Mechanical Materials and Methods" for joint construction requirements for threaded, welded, and flanged joints.

3.14 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be same as for equipment connections.

B. Install traps and control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.

D. Install vacuum breaker downstream from control valve and bypass and close to coil inlet connection.

E. Install ports for pressure and temperature gages at coil inlet connections.

F. Install a drip leg at coil outlet.

3.15 FIELD QUALITY CONTROL

A. Pressure Test, Cleaning & Flushing Of Piping Systems

1. The piping systems are to be pre-tested for leaks in black steel pipes only with air to avoid corrosion inside the pipes during different stages of construction and water leaks in finished area. These pipes will be hydrostatically (leak) tested at the end of the project prior to flushing, cleaning and final filling of steam and condensate.
2. The steam piping system will be hydro tested at 225 psig and 150 psig for the condensate piping systems.
3. The flushing and cleaning will be done in a close loop system between the steam and the condensate lines, which extend to the tie-in locations at the pipe tunnel. To avoid plugging and over-pressurizing of delicate system components during flushing, steam traps will be removed and by-passed, and humidifiers, sterilizers, washers, and skid mounted steam equipment will also be by-passed at the steam supply shut-off valve and condensate return outlet shut-off valve.
4. All tests and cleaning to be witnessed by the Developer Design/Builder and the County's Representative and test data recorded.

B. Leak Testing In According to ASME B31.9, Chapter IV:

1. Leave joints, including welds, uninsulated and exposed for examination during air test.
2. Isolate equipment and skid mounted equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve or install blinds in flanged joints to isolate equipment.
3. Isolate safety valves at pressure reducing stations to protect against unnecessary discharge.
4. For hydrostatic test use ambient temperature water as a testing medium.
5. While filling system during hydro-test, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
6. Subject piping system to hydrostatic test pressure as shown above. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in 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 "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
7. After 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 and repeat hydrostatic test until there are no leaks.

C. Air Pre-Test

1. All systems will be tested with air in stages to a maximum of 150 PSIG, using air compressor and bottled nitrogen. The pressure will be monitored by pressure gauge to detect any leaks.
2. Each system will be pressurized initially to 10 PSIG and check for possible major leaks. After the initial check, additional pressure will be applied in increments of not more than 25 percent each, to allow time for the system to reach equilibrium at each stage until the required test pressure has been reached. The pneumatic test pressure will be continuously maintained for a minimum of 30 minutes. The systems will be checked for leakages with the pressure gauge and if loss of pressure is detected then the system will be checked for leaks with soap solution. When leaks are found, pressure will be vented and appropriate repair or replacement will be made, and the pneumatic test repeated until no leakage is found.

D. Water Test, Flush & Clean

1. These pipes to be pressure tested with water for 4 hours at the end of the project when all the mechanical installation work is complete. The hydrotest shall be done just before the piping systems are ready for flushing and cleaning and filled with steam immediately afterward to reduce air exposure time.

2. A temporary pump will be used to circulate cleaning water. The pump will be sized for flow velocity of 3 ft/sec minimum of the largest size pipe in the system. Suction strainers will be used. The flushing and cleaning procedures are as follow:

   a) Flush and drain each system with city water for 24 hours minimum to clear it from all loose material.
   b) Add TSP (trisodium phosphate), to provide 10 ppm uniform residual concentration or per water treatment Developer Design/Builder's recommendation.
   c) Circulate water for 48 hours minimum.
   d) Flush and drain system for 4 hours until conductivity readings are the same between system water and flush (city) water.

3.16 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after steam and condensate system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:
   1. Open valves to fully open position. Close bypass valves.
   2. Set temperature controls so all coils are calling for full flow.
   3. Check operation of automatic bypass valves.

END OF SECTION