# SECTION 15182 - STEAM AND CONDENSATE PIPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes steam and condensate piping and specialties for systems up to 125 psig, inside the building.

B. Related Sections include the following:

1. Division 15 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
2. Division 15 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
3. Division 15 Section "Valves" for general-duty gate, globe, ball, butterfly, and check valves.
4. Division 15 Section "Meters and Gages" for thermometers, flow meters, and pressure and vacuum gages.
5. Division 15 Section "Mechanical Identification" for labeling and identifying steam and condensate piping.
6. Division 15 Section "Feedwater Equipment."
7. Division 15 Section "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

### 1.3 DEFINITIONS

A. HP Systems: High-pressure systems operating at 100 psig to 125 psig or more.

B. MP Systems: Medium-pressure systems operating at 16 psig to 99 psig.

C. LP Systems: Low-pressure systems operating at less than 15 psig.

### 1.4 SUBMITTALS

A. Product Data: For each type of special-duty valve and steam trap indicated, including rated capacities and accessories.

1. Submit manufacturer sizing of traps for all major apparatus and equipment such as heat exchangers, boilers, air handling units, coils, etc.
2. Submit manufacturer's sizing of pressure reducing valves including noise criteria and considerations.

B. Shop Drawings: CAD-generated and drawn to a minimum 1/4" = 1'-0"detail fabrication and layout of piping systems, valves, traps, seismic restraints, flash tank assemblies, pipe anchors, hangers, special pipe support assemblies, alignment guides, and expansion joints and loops and their attachment to the building structure. Include dimensions, weights, loading, required clearances, and method of field assembly, components, and location and size of each field connection.

1. Fabrication, assembly, and installation including plans, elevations, sections, components, and attachments to other work.
2. Equipment installation based on equipment being used on Project.
3. Piping accessories including access panels.
4. Pitch direction and pipe elevations.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

E. Maintenance Data: For steam traps, vacuum breakers, and meters to include in maintenance manuals specified in Division 1.

## 1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1. ASME B31.1 for power piping valves includes boiler trim, boiler isolation valves, and piping distribution systems over 150 psig and/or 366 deg F.
2. ASME B31.9 for building services piping valves includes all piping distribution systems under 150 psig and/or 366 deg F from generating equipment isolation valves.

1.6 COORDINATION

A. Coordinate layout and installation of steam and condensate piping and suspension system components with other construction, including light fixtures, hydronic piping, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installation for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Safety Valves:

a. Armstrong International, Inc.
b. Kunkle Inds. Inc.; Kunkle Valve Division.
c. O.C. Keckley Co.
d. Spirax Sarco, Inc.
e. Watts Industries, Inc.; Watts Regulators.

2. Pressure-Reducing Valves:

a. Armstrong International, Inc.
b. ITT Hoffman; ITT Fluid Technology Corp.
c. Leslie Controls, Inc.
d. Spence Engineering Company, Inc.
e. Spirax Sarco, Inc.
f. Watson McDaniel.

3. Steam Traps:

a. Armstrong International, Inc.
b. Barnes & Jones, Inc.

c. Dunham-Bush, Inc.
d. ITT Hoffman; ITT Fluid Technology Corp.
e. Spirax Sarco, Inc.
f. Watson McDaniel.

4. Air Vents and Vacuum Breakers:

a. Armstrong International, Inc.
b. Barnes & Jones, Inc.
c. ITT Hoffman; ITT Fluid Technology Corp.
d. Spirax Sarco, Inc.
e. Watson McDaniel.

5. Steam Meters:

a. EMCO Flowmeters.
b. Spirax Sarco, Inc.

6. Condensate Meters:

a. Hersey Measurement Company.
b. ISTEC Corp.

## 2.2 PIPING MATERIALS

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

## 2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless), Grade B, Schedules 40 and 80, black steel, plain ends.

B. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade A 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.

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

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

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

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

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

H. 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.

I. 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.

J. 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.

K. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

## 2.4 VALVES

A. Gate, globe, check, ball, and butterfly valves are specified in Division 15 Section "Valves."

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

## 2.5 SAFETY VALVES

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

B. Bronze Safety Valves: 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: 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.

## 2.6 PRESSURE-REDUCING VALVES

A. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated. Manufacturer shall size each PRV for flows and pressures required.

B. Valve Characteristics: Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff. Valves shall have cast-iron 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, insulated jacket, mufflers or combination muffled disc, throttling orifice plate and expanding nozzle, and non-asbestos gaskets.

## 2.7 STEAM TRAPS

A. Thermostatic Traps: Class 125, bronze angle-pattern body with integral union tailpiece and screw-in cap; balanced-pressure, stainless-steel or monel bellow element; and renewable, hardened stainless-steel head and seat.

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

C. Float and Thermostatic Traps: ASTM A 126, cast-iron 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.

1. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.

D. Inverted Bucket Traps: Cast-iron 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.

E. Sizing: Provide manufacturer sizing for all traps. Sizing shall consider all appropriate applications for equipment served, especially air system coils subject to high percentage outdoor amounts. All traps shall be sized at minimum 1/2-inch differential pressure, minimum two times connected equipment load (higher rating per manufacturer's recommendations for applications subject to freeze conditions).

## 2.8 THERMOSTATIC AIR VENTS

A. Quick Vents: Cast-iron or brass body, with balanced-pressure, stainless-steel or monel thermostatic bellows and stainless-steel heads and seats.

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

## 2.9 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.

## 2.10 STRAINERS

A. Y-Pattern Strainers: 250-psig working steam pressure; ASTM A 126, Class B cast-iron body; 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.

B. Basket Strainers: 250-psig working steam pressure; ASTM A 126, Class B cast-iron body; stainless-steel screen; bolted cover; threaded connections for strainers NPS 2 and smaller and flanged connections for strainers NPS 2-1/2 and larger.

## 2.11 FLASH TANKS

A. Shop or factory fabricated of welded 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 or medium-pressure condensate inlet, air vent, safety valve, and legs. The contractor per manufacturer's recommendations and industry standards shall size flash tanks.

## 2.12 METERS

A. Steam Meters: Pipeline sensor of modified venturi design, of **[stainless-steel] [carbon-steel]** construction, for insertion in pipeline between flanges, plus or minus 1 percent accuracy over full-scale deflection, producing pressure differential proportional to square of flow rate.

B. Steam Meters: Pipeline sensor with stainless-steel wetted parts and **[wafer] [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.

C. Steam Meters: Pipeline sensor of spring-loaded, variable-area flowmeter type; density compensated; plus or minus 2 percent accuracy over full-scale deflection. Meters shall have a flow computer to display totalizer flow, flow rate, temperature, pressure, time, and date; alarms for high and low flow rate and temperature; and independent timers to store four peak flow rates and total flow. Computer shall have four, 20-mA output, ETA 232C, serial communication ports.

D. Condensate Meters: Brass body with threaded connections for meters NPS 2 and smaller and flanged connections for meters NPS 2-1/2 and larger; positive displacement turbine; magnetic coupling counter; suitable for temperatures up to 250 deg F and for 250 psig working pressure.

## PART 3 - EXECUTION

### 3.1 LOW- AND MEDIUM-PRESSURE STEAM PIPING APPLICATIONS (LESS THAN 100 PSIG)

A. Steam Piping, NPS 2 and Smaller: Schedule 40 steel pipe, with threaded joints using Class 125 cast-iron 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. Mating flanges to valves shall meet the valve class rating.

C. Condensate Piping, NPS 2 and Smaller: Schedule 80 steel pipe, with threaded joints using Class 125 malleable-iron 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. Mating flanges to valves shall meet the valve class rating.

### 3.2 HIGH-PRESSURE STEAM PIPING APPLICATIONS (100 TO 150 PSIG)

A. Steam Piping, NPS 2 and Smaller: Schedule 40 steel pipe, with threaded joints using Class 300 malleable-iron 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. Mating flanges to valves shall meet the valve class rating.

C. Condensate Piping, NPS 2 and Smaller: Schedule 80 steel pipe, with threaded joints using Class 300 malleable-iron 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. Mating flanges to valves shall meet the valve class rating.

## 3.3 CLEAN STEAM PIPING

A. Clean steam piping shall be Schedule 40, Type 316 stainless steel with all stainless steel fittings and valves.

## 3.4 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 shutoff-duty gate valves at each branch connection to supply and condensate return mains, at inlet connection to each steam trap, at inlet and outlet to each control valve, and elsewhere as indicated.

C. Install shut-off duty ball valves in gravity condensate after each trap and in pumped condensate lines up to 2 inches.

## 3.5 LP STEAM-TRAP APPLICATIONS

A. Thermostatic Traps: Convectors and finned-tube radiation.

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

C. Size and install all traps in accordance with manufacturer's instructions including condensate legs appropriate for application and apparatus served. Coordinate piping and equipment elevations necessary to meet these recommendations.

## 3.6 HP STEAM-TRAP APPLICATIONS

A. Thermostatic Traps: Convectors and finned-tube radiation.

B. Inverted Bucket Traps: Steam main and riser drip legs, and laundry equipment.

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

D. Thermodynamic Traps: Steam main and riser drip legs, and heat tracer lines.

E. Size and install all traps in accordance with manufacturer's instructions including condensate legs appropriate for application and apparatus served. Coordinate piping and equipment elevations necessary to meet these recommendations.

## 3.7 PIPING INSTALLATIONS

A. Refer to Division 15 Section "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 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.

D. Install steam supply piping at a uniform grade of 0.2 percent downward in direction of steam flow.

E. Install condensate return piping at a uniform grade of 0.4 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 45-degree fittings in main pipe, with the takeoff coming out the top of the main pipe. Use of 90-degree tee fittings is permissible if 45-degree fittings are impractical. If length of branch takeoff is less than 10 feet, pitch branch line down toward mains at a 0.4 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 gate valve at drip legs, dirt pockets, and strainer blowdowns 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, gate valve, and swing check valve on low-pressure (flash) steam outlet.

## 3.8 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 gate valve, strainer, and union upstream from trap; install union, check valve, and gate valve downstream from trap.

## 3.9 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 gate 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 15 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports. Piping support must account for expansion and contraction, vibration, seismic restraint, and dead load of piping and its contents.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring 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. Spring hangers to support vertical runs; to support horizontal runs for first 3 support points from all equipment and all support points up to 50 linear feet from all rating type equipment.
5. Curb-mounted type pipe stands and supports for piping supported on roof.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes and in accordance with MSS-SP-69:

1. NPS 3/4: Maximum span, 9 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 9 feet; minimum rod size, 3/8 inch.
3. NPS 1-1/4: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 12 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 13 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 14 feet; minimum rod size, 1/2 inch.
7. NPS 3: Maximum span, 15 feet; minimum rod size, 1/2 inch.
8. NPS 4: Maximum span, 17 feet; minimum rod size, 5/8 inch.
9. NPS 6: Maximum span, 21 feet; minimum rod size, 3/4 inch.
10. NPS 8: Maximum span, 24 feet; minimum rod size, 3/4 inch.
11. NPS 10: Maximum span, 26 feet; minimum rod size, 7/8 inch.
12. NPS 12: Maximum span, 30 feet; minimum rod size, 7/8 inch.
13. NPS 14: Maximum span, 32 feet; minimum rod size, 1 inch
14. NPS 16: Maximum span, 35 feet; minimum rod size, 1 inch.
15. NPS 18: Maximum span, 37 feet; minimum rod size, 1 inch.
16. NPS 20: Maximum span, 39 feet; minimum rod size, 1-1/4 inches.

D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

## 3.13 PIPE JOINT CONSTRUCTION

A. Refer to Division 15 Section "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. From drip leg, install properly sized traps.

## 3.15 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Chemically clean and flush system with clean water. Clean strainers.
3. Isolate equipment from piping. Install valves, caps or blinds in flanged joints at final equipment connections to isolate equipment. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve.
4. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on steam and condensate piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drip legs installed at low points for complete draining of liquid.
3. Subject piping system up to final equipment connection points to hydrostatic test pressure of 1.5 times the design pressure, minimum 100 psig, but shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Steam and condensate design pressure shall be relief valve settings, pumped condensate design pressure shall be the sum of system pump head plus system static head. 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." Expansion joints which cannot sustain the reactions due to the test pressure shall be provided with temporary restraint, or they shall be isolated from testing.
4. 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.
5. Prepare written report of testing.

C. Test and inspect field welds as follows:

1. Testing Agency: Owner will engage a qualified independent testing agency and inspecting agency to perform field inspections and tests and to prepare test reports.
2. Provide the testing agency and the engineer safe access to the site throughout the duration of the piping installation. Notify the testing agency and the engineer a minimum of 48 hours prior to the start of welding.
3. Field welds will be tested and inspected according to ASME B31.9 for steam distribution systems 150 psig and/or 366 deg F and below, and the inspection procedures listed below:

    a. Visual Inspection: Visual inspection on 100 percent of all field pipe welds. The percentage of welds inspected may be modified by the engineer of record, depending on initial results. Witness of the actual welding by the testing agency to occur on a minimum of 15 percent of all field welds.

4. Correct deficiencies in or remove and replace welds that test reports and inspections indicate does not comply with the Contract Documents at no additional cost to the owner.
5. Additional testing and inspection, at contractor's expense, will be performed by the owner's testing agency to determine compliance of corrected work with specified requirements.

## 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 coil bypass valves.
2. Set temperature controls so all coils are calling for full flow.
3. Check operation of automatic bypass valves.

## 3.17 CLEANING

A. Chemically clean and flush steam and condensate piping with clean water. Remove and clean or replace strainer screens.

END OF SECTION 15182
11/28/05