SECTION 15062

STEAM AND CONDENSATE PIPING

PART 1 – DESIGN DIRECTIVES

1.1 QUALITY ASSURANCE

A. Comply with the provisions of the following:

1. ASME B 31.9 "Building Services Piping": for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.

2. ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualification" for qualifications for welding processes and operators.

1.2 DESIGN CRITERIA

A. The campus steam distribution system is twenty psig, and the system operating pressure shall be designed for 20 psig. All system components, including systems after building pressure reducing valves, shall be designed to withstand 30 psig.

B. The designer shall not rely on lift after the steam trap when a steam trap serves a device such as a coil or heat exchanger controlled by a modulating valve. Lift may only be considered when the trap will always have full line pressure.

C. Steam mains shall have isolation valves space no further than 200' apart. Steam isolation valves larger than 6" shall be equipped with 2" ball warm-up valves.

D. Select steam safety valves for full relief of capacity of equipment served, in accordance with ASME Boiler and Pressure Vessel Code. Provide valves for use with boilers rated ASME Section I, valves for use with unfired pressure vessels, including the low pressure side of pressure reducing valves, rated for ASME Section VIII. Furnish complete with cast iron drip-pan elbow having threaded inlet and outlet with threads (FPT) conforming to ANSI B1.20.1; sized for full size of safety valve outlet connection.

E. The designer shall indicate and dimension on the drawings all expansion loops, anchors, & guides.

F. Where pressure reducing valves are utilized, the designer shall consult with the specified manufacturer's representative to insure the proposed valve is appropriate for the intended application, including turn down ratio for all expected loads.

PART 2 – PRODUCTS

2.1 PIPE, FITTING, AND JOINT MATERIALS

A. General: Refer to Part 3 Article "PIPE APPLICATIONS" for identification of where the below materials are used.

B. Steam Supply Pipe: Threaded and welded ends.

ITEM	SIZE	ASTM SPEC NO.	MATERIAL WEIGHT & TYPE
Pipe	all sizes	A53 or A106, grade B, type S	Schedule 40, ANSI B36.10
Fittings	≤2"	A197, Malleable Iron	Standard, threaded, ANSI B16.3
	>2"	A234, WPB, wrought carbon steel	Schedule 40, butt weld, ANSI B16.9
Flanges	≤2"	A105, forged carbon steel	class 150, RF, threaded, ANSI B16.5
	>2"	A105, forged carbon steel	class 150, RF, weld neck or slip on, ANSI B16.5
Bolts	All	A193, grade B7 carbon steel	Hex head (ANSI B18.2.1), B1.1, class 2A course thread
Nuts	All	A194, Grade 2H, Carbon steel	Heavy hex (ANSI B18.2.2), B1.1,class 2B course thread
Gaskets	Per flange standard	A304, stainless steel, Grafoil filled, spiral wound	class 150, RF, ring style, ANSI B16.20

C. Gravity & Pumped Condensate: Threaded and welded ends.

ITEM	SIZE	ASTM SPEC NO.	MATERIAL WEIGHT & TYPE
Pipe	≤2"	A53 or A106, grade B, type S	Schedule 80, ANSI B36.10
	>2"	A53, grade B, type S	Schedule 80, ANSI B36.10
Fittings	≤2"	A197, Malleable Iron	Extra Heavy, threaded, ANSI B16.3
	>2"	A234, WPB, wrought carbon steel	Extra Heavy, butt weld, ANSI B16.9
Flanges	≤2"	A105, forged carbon steel	class 300, RF, threaded, ANSI B16.5
	>2"	A105, forged carbon steel	class 300, RF, weld neck or slip on, ANSI B16.5
Bolts	All	A193, grade B7 carbon steel	Hex head (ANSI B18.2.1), B1.1, class 2A course thread
Nuts	All	A194, Grade 2H, Carbon steel	Heavy hex (ANSI B18.2.2), B1.1,class 2B course thread
Gaskets	Per flange standard	A304, stainless steel, Grafoil filled, spiral wound	class 150, RF, ring style, ANSI B16.20

D. Unions: ANSI B16.39, malleable-iron, class 300 for schedule 80 piping system, hexagonal stock, with ball and socket joints, metal to metal bronze seating surfaces; female threaded ends. Threads shall conform to ANSI B1.20.1.

2.2 JOINING MATERIALS

A. Welding Materials: Comply, with Section II, Part C. ASME Boiler and Pressure Vessel Code for welding and per the contractor's approved qualification record.

2.3 GENERAL DUTY VALVES

A. General duty valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division 15 Section "VALVES".

2.4 SAFETY VALVES

A. Cast iron body and bronze seat, Class 250; forged copper alloy disc and nozzle; fully enclosed stainless steel spring having an adjustable pressure range and positive shut off; threaded end connections for valves 2" and smaller, raised face flanged inlet and threaded outlet connections for valves 2–1/2" and larger. Factory set valves to relieve at 10 psi above operating pressure.

B. Manufacturers:

Manufacturer	Bronze	Cast Iron	Drip Pan Elbow
O.C. Keckley Co.	#40	#300	Drip Pan Elbow
Spence Engineering Co., Inc.	#41	#41	DPE
Spirax/Sarco	#6010	SVI	DPE

2.5 PRESSURE REGULATING VALVES

A. Pilot actuated, diaphragm type, class 250, with adjustable pressure range and positive shut off; cast iron body with flanged or threaded end connections, hardened stainless steel trim, and replaceable valve head and seat. Provide main head stem guide fitted with flushing and pressure arresting device. Provide cover over pilot diaphragm for protection against dirt accumulation.
1. Spirax/Sarco
2. Spence Engineering Co., Inc

2.6 STEAM TRAPS

A. Balanced Pressure Thermostatic Traps: Cast brass, angle pattern body, with integral union tailpiece and screw-in cap; maximum operating pressure of 25 psig; balanced pressure stainless steel or monel diaphragm or bellows element, with renewable hardened stainless steel valve head and seat.
1. Spirax/Sarco TA-125, TH-125, TV-125
2. Tunstall series ‘TA’.

B. Float and Thermostatic Traps: ASTM A 278, Class 30 cast iron body and bolted cap; renewable, stainless steel float mechanism, with renewable, hardened stainless steel head and seat; balanced pressure thermostatic air vent made of stainless steel or monel bellows with stainless steel head and seat.
1. Spirax/Sarco FT-30, FTI-30 (no substitutions)

C. Inverted Bucket Traps: ASTM A 278, Class 30 cast iron body and cap, pressure rated for 250 psi; stainless steel head and seat; stainless steel valve retainer, lever, guide pin assembly, brass or stainless steel bucket.
1. Spirax/Sarco B series.

2.7 AIR VENTS

A. Cast iron or brass body, with balanced pressure stainless steel or monel thermostatic bellows, and stainless steel heads and seats.
1. Spirax/Sarco – VS206 (steam)
2. Spirax/Sarco - 13WS (condensate).

2.8 VACUUM BREAKERS

A. Stainless steel or brass construction, factory set to open at 2" H_2O of vacuum, and shall be of a hardened ball check valve or spring restrained style. All spring style components shall be encapsulated with a protective cover.
1. Spirax/Sarco #VB14.

2.9 EXPANSION JOINTS

A. Externally pressurized bellows type expansion joints. Bellows shall be made of a minimum 3 ply multi-layer 304 stainless steel. Bellows shall be welded to the internal guide ring and housing. Expansion joint shall be preset for ambient conditions on the construction site and shall have a minimum 3/4" compensation for contraction.

B. Expansion joints shall be flanged whenever possible and shall be equipped with a drain port. Housing shall be made of carbon steel piping matching the installation.

C. Approved manufacturers are HySpan series 3500 and Pathway X-Press.

PART 3 – EXECUTION

3.1 PIPING INSTALLATIONS

A. Install drains at all low points consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.

B. Install steam supply piping at a uniform grade of 1/32" in 12" downward in the direction of flow.

C. Install condensate return piping at a uniform grade of 1/8" in 12" downward in the direction of flow.

D. Install steam branch connections to supply mains using 45º elbows on the branch with the main take-off at a 45° angle up from the main. Where the length of a branch takeoff is less than 10', pitch branch line down toward mains, 1/8" in 12".

E. Make reductions in schedule 40 pipe systems using an eccentric reducer fitting installed with the level side down.

F. Anchor piping to ensure proper direction of expansion and contraction. Install expansion loops and joints as indicated on the Drawings and/or specified.

G. Install air vent/eliminators at all high points of steam & condensate piping systems. Where necessary, pipe vent outlets to outdoors, condensate receiver, or drain.

H. Install drip legs at low points and natural drainage points in the system, such as at the ends on mains, bottoms of risers, and ahead of pressure regulators, control valves, isolation valves, pipe bends, expansion joints, at intervals not exceeding 150' where pipe is pitched down in the direction of the steam flow, a maximum of 100' where the pipe is pitched up in the direction of steam flow.

1. Drip legs, dirt pockets, and strainer blowdowns shall be equipped with drain valves (& caps) to allow removal of dirt and scale.

2. Install steam traps close (<3') to drip legs and at least 8" below the header. Drain valves serving drip legs shall be lower than the trap connection and never attached to the trap connection.

3. Drip legs shall be sized per the following schedule:

Header Size	Drip Leg Size
≤4"	Same size as header
>4" & ≤8"	4"
>10" & ≤14"	6"
>14"	8"

3.2 STEAM TRAP INSTALLATIONS

A. Install steam traps in accessible locations as close as possible to connected equipment.

B. Install isolation valve, strainer (leg vertical), and union upstream from the trap; install union, test tee with test valve, check valve, and isolation valve downstream from trap.

C. Install the inlet of F & T steam traps a minimum of 12″ below the outlet of the device served.

3.3 PRESSURE REDUCING VALVE INSTALLATIONS

A. Install pressure reducing valves as required to regulate system pressure in a location readily accessible for maintenance and inspection. Install in strict accordance with the manufacturer's recommended piping practices for straight pipe upstream and downstream of the valve. Provide a bypass around each reducing valve, with a globe valve equal in size to the area of the reducing valve seat ring. Install isolation valves and unions around each reducing valve to facilitate removal and repair of reducing valves. Unions may be omitted for reducing valves with flanged connections. Install strainers upstream for each reducing valve. Install safety valves downstream from each reducing valve set a 5 psig higher than the reduced pressure

B. Install pressure gages on both sides of each reducing valve, on the system side of the shutoff valves. On two stage reducing stations, install a drip trap and pressure gage upstream from the second stage reducing valve.

3.4 SAFETY VALVE INSTALLATIONS

A. Install relief valves in accordance with and where required by ASME B 31.1 – "Power Piping". Pipe discharge to atmosphere outside the building, without valves, and terminate vent pipe with screened air gap. Install a drip pan elbow fitting adjacent to the safety valve pipe drain connection to the nearest floor drain without valves. Comply with ASME Boiler and Pressure Vessel Code for installation requirements.

3.5 VACUUM BREAKERS

A. All steam generating devices shall be fitted with a vacuum breaker located on the coil inlet piping.

3.6 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping in accordance with ASME B 31.9. Verify all components in the piping system can withstand the pressures of testing. Isolate those components that will be damaged by excessive pressure. Clean strainers, flush system with clean water.

1. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.

2. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.

B. Hydronic testing of steam and condensate piping as follows:

1. Use air vents installed at high points in the system to release trapped air while filling the system. Use drip legs installed at low points for complete removal of the liquid.

2. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.

3. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure or city water pressure, whichever is greater. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90% of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9.

4. After the hydrostatic test pressure has been applied for at least 10 minutes, examine the system for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.

C. Air testing of steam & condensate piping as follows:

1. Remove air vents installed at high points and plug. Isolate drip legs using isolation valves. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated.

2. Subject piping system to a test pressure of 60 psig. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test.

3. After the test pressure has been applied for at least two hours, check the pressure gauge and examine the system for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat test until there are no leaks.

3.7 CLEANING

A. Refer to the DC Standards, “WATER TREATMENT SYSTEMS”.

END OF SECTION 15062