

## 5.23.22 – STEAM AND CONDENSATE PIPING AND PUMPS DESIGN AND CONSTRUCTION STANDARD

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### PART 1: GENERAL

#### 1.01 Purpose:

- A. This standard is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. The responsibility of the engineer is to apply the principles of this section such that the University may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be justified through LCC analysis and submitted to the University for approval.

#### 1.02 References:

- A. ANSI/ASTM B31.1 – Power Piping
- B. ANSI/ASTM B31.9 – Building Services Piping

#### 1.03 Requirements:

- A. For the purposes of this standard steam systems shall be defined as follows:
  - 1. Low Pressure Systems: 0-15 psig and below
  - 2. High Pressure Systems: 15-165 psig and above
  - 3. Medium Pressure Systems: 165 psig and above
- B. Provide low pressure steam via a two-parallel full capacity pressure reducing stations with 75/25% pressure reducing valves (PRV's). No bypass shall be provided.
- C. Provide a tee in the condensate receiver vent line with plugged branch, just above the receiver, for University installation of a high-level float switch.
- D. Provide a capped tee in the condensate return line immediately upstream of the receiver for later use by the University.
- E. Provide a plugged opening on the low side of any condensate receiver, for installation of a thermo well for future temperature sensor by the University.
- F. Arrange the inlet piping to the condensate receiver so the University can dump condensate to floor drain before it enters the receiver.
- G. Avoid the use of plug valves in condensate systems.
- H. Provide spring-assisted, silent check valves on condensate pump discharge.

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- I. Avoid 3-1/2 and 5-inch diameter pipe.
- J. Use 316 stainless steel tubing with Swagelok fittings between the discharge of all condensate pumps and the connection at the utility tunnel.
- K. Provide shutoff valve between the receiver and each pump.
- L. Provide power to pump motors via flexible cord (not conduit) with twist-lock.
- M. Provide shutoff valves to isolate equipment, parts of systems, or vertical risers.
- N. Provide high pressure steam valve 12” and larger with an equalizing bypass valve assembly.
- O. Provide Flexitallic Model CG spiral-wound gaskets for steam and condensate flanged piping service.

**PART 2: PRODUCTS**

2.01 Steam Piping:

- A. High pressure steam:
  - 1. Piping shall be Schedule 80 black steel piping
  - 2. Fittings shall be extra heavy butt-welded type. Flanges shall be 300 lb. class welding neck type.
- B. Low and Medium pressure steam:
  - 1. Piping 1” and smaller shall be Schedule 80 black steel piping. Piping 1-1/2” and larger shall be Schedule 40 black steel piping.
  - 2. Fittings on piping 2-1/2” and larger shall be extra heavy butt-welded type. Flanges shall be 150 lb. class welding neck type. Unions shall be 150 lb. class.
  - 3. Fittings on piping 2” and smaller shall be screwed type, class 150 malleable black iron. Unions shall be 150 lb. class.

2.02 Steam Specialties:

- A. Pressure Reducing Valves:

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1. Steam pressure reducing valves shall be Spence ED (with SECO-Weld seats) or Leslie GPS-1EP. Owner to be provided with manufacturer's recommended repair kit for each steam pressure reducing valve. Pressure reducing valves 2 inches or larger shall be flanged and less than 2 inches shall be threaded. PRV pipe and fittings shall be Schedule 80, 300 lb. class, up to and including the first downstream block valve.
- B. Steam Traps:
1. Inverted bucket traps are to be used only when the condensate outlet is subject to backpressure. When condensate flows by gravity from the trap, a float and thermostatic trap shall be selected. Bucket traps on high-pressure steam to be Armstrong #2011, installed in Armstrong TVS-3000-3/4"-NPT-ALL- [engineer specify]-Htrap valve station or approved equal. Provide a separate gate valve installed between the trap valve station and the steam line
  2. Float and Thermostatic Traps shall be ASTM A126, cast iron or semi-steel body and bolted cover for 250 psig WSP; provide access to internal parts without disturbing piping; with bottom drain plug, stainless steel or bronze bellows type air vent, stainless steel or copper float, stainless steel lever and valve assembly. F&T traps used in low pressure (15psig or less) drip applications shall be rated at 30 psig to avoid lockup in event inlet pressure exceeds 15 psig. F&T traps used in process applications (coils and vessels) shall be mounted at least 10" below the process. The installation shall also include vacuum breaker sized for the application, air vent and compound pressure gauge.
  3. Thermodynamic traps are preferred over inverted bucket traps for drip applications above 30 psig when condensate flows by gravity to a receiver (the typical arrangement), prevented backpressure on the trap.
  4. Install Thermostatic steam traps to drain condensate from steam radiation units, and other similar terminal heating units. Pressure balanced type with ASTM A216 WCB cast steel body and bolted or screwed cover and integral ball joint union, for 300 psig WSP; monel or stainless steel bellows, stainless steel valve and seat; Integral stainless steel strainer. Freeze-proof type with cast iron body for 300 psig WSP, bronze bellows, stainless steel valve and seat, external adjustment. Bi-metallic type with ASTM A105 forged steel body and cover, for 300 psig WSP, bi-metal element with stainless steel components, integral Type 304 stainless steel strainer screen, and ¼ inch blow down valve.
  5. All trap station components (traps, valves, strainers) for clean steam system shall be of 316L stainless steel construction, body and trim.
- C. Steam Relief Valves:

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1. Relief valves 2" and smaller shall have brass bodies and arranged for screwed connections. Such relief valves shall be Crane No. 2501 or Spirax Sarco 6010 Brass Safety Valves for steam or approved equal. Bushings shall not be used.
2. Relief valves 2-1/2" and larger shall in the case of all medium and low pressure steam piping systems be arranged for flanged inlet and screwed outlet connections. Such relief valves shall be Consolidated Type 1511 or Spirax Sarco 252, ASME Standard Cast Iron Safety Valves, or approved equal.
3. The pressure at which each relief valve shall open is designated on the Drawings. When such valves are ordered by the Contractor, he shall definitely specify the pressure at which each relief valve is to be set. Each valve shall have a metal tag attached stamped with the valve identification plus the pressure setting.

D. Manual Valves:

1. Low and medium pressure isolation valves shall be ball valves, Zinc plated A-105 carbon steel body and stainless steel trim, R-PTFE seats, threaded 3-piece design for pipe sizes of 2" and under (flanged for sizes above 2").
2. High pressure Isolation valves shall be gate valves.

E. Strainers:

1. Strainers shall be A-105 or ductile iron threaded body for pipe sizes of 2" and under (flanged for sizes above 2"), rated for system temperature and pressure, 20-mesh stainless steel screen, with full-sized blow-off valve piped to drain.
2. Exception – Strainers upstream of control valves and PRV's shall have 100-mesh stainless steel screens.

F. Air Vents and Vacuum Breakers:

1. Provide automatic air vents with a pressure rating equal to system classification, but not less than 125 psig.
2. Provide shut off valve for maintenance of the air vent.
3. Locate all air vents and their discharge lines in accessible locations, preferably clustered.
4. Mount vacuum breakers between control valve and equipment, in vertical position with cap on top, and at the highest point of the circuit.
5. Large coils or equipment may require more than one vacuum breaker.

2.03 Condensate Return Pump:

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- A. Condensate pumping units shall be Aurora Series 220 or approved equal condensate pumping units; bronze fitted centrifugal pumps with stainless-steel shafts and Viton mechanical seals with 1750-rpm motors and cast-iron receivers. Units shall come pre-wired with mechanical alternator. Receiver shall have thermometer and sight glass. Receiver shall have a drain line to floor drain. Install condensate return pumps on housekeeping pad.
- B. Pumps shall be capable of pumping against downstream head under all operating conditions.
- C. Piping shall be Schedule 80 black steel piping.
- D. Fittings on piping 2-1/2” and larger shall be extra heavy butt-welded type. Flanges shall be class 150 welding neck type.
- E. Fittings on piping 2” and smaller shall be screwed type, class 125 black cast iron. Unions shall be 250 lb class.

**PART 3: EXECUTION**

2.01 Pipe Testing Procedures:

- A. Refer to Appendix for plumbing pipe testing procedures.

END OF STANDARD