232233 STEAM SPECIALTIES

Part 1 – GENERAL

1.1 Description

A. This section details the guidelines and expectations for the design characteristics of the steam and condensate distribution on Johns Hopkins University Homewood Campus. Project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification and approval from the JHFRE Engineering and Energy Department, it is expected that these guidelines will govern the design and specifications.

1.2 Submittals

A. Coordinate with the Project Manager/Engineering Department to determine the intended operational needs of heating systems. Investigate the feasibility of cost savings opportunities where appropriate such as heat reclaim of exhaust air or process conditioning; and demand control ventilation. Where directed by the Project Manager/JHFRE, space shall be allocated for future boilers, pumps, converters and associated headers and piping systems taking into account minimal impact to existing operations.

1.3 The main campus steam loop is produced from the Power House in the South Plant, supplied by 6 boilers (4 Watertube, 1 “summer” Firetube and 1 Watertube Heat Recovery Steam Generator). All Watertube boilers have been fitted with new low NOx burners after 2012. Wyman complex has a separate loop served by 2 boilers in the Wyman plant. The South Plant has a total capacity of 179,000PPH and the Wyman Plant has a total capacity of 16,000MBH.

1.4 Quality Assurance

A. Our steam meets the following criteria:

1. Steam must be free of harmful materials.
2. Must meet Food and Drug Administration, (FDA) requirements for use with food.
3. Exhibit a pH of between 8.8 and 9.2 standard pH units.
4. Exhibit conductivity of less than 5ppm as measured at 77 °F.
5. Exhibit a cat ion conductivity of less than 0.5ppm as measured at 77 °F.
6. Exhibit a Silica concentration of less than 20ppb.
7. Exhibit an Iron concentration of less than 15ppb.
8. Exhibit a Sodium concentration of less than 10ppb.

B. Condensate must meet ALL of the following criteria:

1. Must be free of oil, grease and their harmful materials.

2. Exhibit a conductivity of less than 10ppm as measured at 77 °F.

3. Exhibit a Silica concentration of less than 20ppb.

4. Exhibit a pH of at least 7 and less than 9 standard pH units.

C. Single-pipe systems must not be used for comfort heating. For safety purposes, low-pressure steam 15psig and below must be used where terminal equipment is installed in occupied areas. High or medium-pressure above 15psig steam unit heaters may be used for space heating in areas such as garages, warehouses, and hangars where the discharge outlets are a minimum of 13' above floor level.

D. The steam supply and steam condensate return distribution system shall be sized conservatively with minimal line pressure losses at maximum design load plus allowances for warm-up and future growth. All valves, traps, equipment and specialties shall include warm-up factors and estimated inlet and outlet pressures. Steam condensate shall be collected and returned to the central plant.

E. Connection to the site distribution piping system shall be achieved by extending the existing utility tunnel to the building or by installing steam and condensate pipes in an accessible pipe trench between the utility tunnel and the building wall.

F. Steam traps shall be sized for the particular application. Trap bypass valves shall not be installed; if redundancy or additional capacity is required, dual traps shall be installed. All traps, except those on radiation heating equipment, shall be located a minimum 6" below the equipment they serve.

G. Steam pressure-reducing valves (PRV) stations shall be provided near the steam service entrance into the building. Secondary and/or remote PRVs within the building shall be avoided. Second-stage PRVs may be installed in mechanical penthouses/rooms or other easily accessible mechanical spaces. PRV stations shall be sized for the calculated peak demand. For process equipment load, the PRV shall be sized, as a minimum, for 100% steam consumption of the largest single user plus 25% steam consumption of all other users.

Part 2 – PRODUCTS

2.1 Use expansion loops, and not expansion joints, whenever possible. JHFRE approval required for the use of expansion joints.

2.2 Use Spirax-Sarco, "DIVA" saturated steam flow meters.

2.3 Use Spirax-Sarco UTD 52 traps with strainers on main lines and the Float &Thermostatic style trap on equipment.

2.4 Use Spirax-Sarco "APT" type steam-powered pump traps to prevent condensate flooding for all heat exchangers and steam heating/pre-heating coils that are controlled by modulating valves.

2.5 Heat Exchangers: The piping connections shall be flanged. Install shutoff valves at heat exchanger inlets and outlet connections. Pressure drop shall be typically in the range of 10 to 15 psi, with up to 20 psi allowed for 2° F approach selections.

A. For steam to water conversion, a shell and tube heat exchanger shall be used. All heat exchanger performance ratings shall be per AHRI 400. Provide two-pass, U-Tube for water. Provide steel shell and cast-iron head. For steam, the shell shall have flanged entry and threaded (or flanged for 2.5 inches and larger connection) exit. Provide seamless copper tubes with steel tube sheets.

B. Where applicable (where space permits) a heat transfer packaged system shall be used in lieu of a standard shell and tube exchanger for steam to hot water conversion. Heat exchanger shall be of shell and tube type and comply with requirements for shell and tube heat exchangers above.

1. The package heat transfer system shall be skid-mounted and include the following components at a minimum: controls, heat exchanger, air separation apparatus, expansion tank(s), pump(s), motor(s), triple duty valve(s), suction diffuser(s) with strainer, relief valve(s), reducing valve(s), temperature and pressure gauges, frame, interconnecting piping and motor starter(s). The frame of the heat transfer package shall be supported by a housekeeping pad. Provide vibration isolation of pumps, frame and piping connections within three pipe hangers from unit.

2. A single point of power connection is required. Air separation apparatus shall consist of an air separator, air vent and diaphragm tank. Specify the HTP shall be hydrostatically tested at the factory that includes a full flow and head test of which a test report shall be provided as part of the project record as part of the submittal. The University shall have the option of witnessing the factory test. In addition to the factory test, specify a field test shall be performed to confirm correct system operation.

3. Provide two pumps (one duty and one standby), each with VFDs, which shall be base-mounted, single- stage, end suction design with an integrally cast, foot mounted volute, capable of allowing the impeller and bearing assembly being serviced without disturbing piping connections, pump volute or motor. Each pump shall have full flow and head capabilities. Discharge side of each pump shall be fitted with an angle pattern combination calibrated balancing valve, center guided non-slam check valve and shut- off valve. Packages shall use triple duty valves where applicable.

4. The Pressure Reducing Valve shall be diaphragm operated and have a brass body, low inlet pressure check valve and inlet strainer. The strainer shall be easily removed without system shutdown. The valve seat, strainer and stem shall be removable and of non-corrosive material. Provide all devices, such as pressure and temperature gages, isolation valves and connections, per details associated with shell and tube heat exchanger and with pumps.

Part 3 – EXECUTION

3.1 Where design dictates a steam control valve larger than 2”, two valves shall be used in parallel. Valves shall be sized for one-third, two-thirds capacity and be sequenced with positioners.

3.2 Provide double valve isolation with bleed capability on steam lines 2” diameter and larger.

3.3 Valves

A. Steam control valves shall be fully proportional with a modulating equal-percentage plug (Exception: steam control valves serving integrated face and bypass damper steam coil shall be non-modulating). A steam control valve shall have stainless steel trim and be suitable for the pressure condition, additionally it shall operate with the differential pressure required. Steam control valves shall be provided with a one-third/two-third control valve arrangement to provide better controllability.

B. Steam valves and specialties shall be of the industrial high-performance type. Positive shut-off and isolation of mains are critical to the safety of maintenance personnel. Stainless-steel seats and disks are required. A shut-off gate valve shall be used in all steam and condensate lines; gate valves shall be OS&Y 300# ANSI for high, medium and low-pressure systems. Bronze stemmed gate valves are recommended for use throughout the JHU campus. All insulated stems shall be extended as required to permit sufficient clearance for proper operation without damaging the insulation.

C. Steam safety-relief valves shall be piped individually and discharged to less than 7’ above the building roof. Care shall be taken not to locate discharge close to outdoor air intake or where they could be a hazard to maintenance personnel. Relief valves shall not be connected to other steam vents. All valves, drip pan elbows and relief lines shall meet ASME requirements.

D. A warmup valve shall be provided to bypass shut-off valves on each building main shut-off valve larger than 3”.

E. A steam strainer shall be positioned horizontally (flat) to prevent condensate from collecting in the bottom of the strainer and reducing its life.

F. Steam vacuum breakers, not check valves, shall be used on coil and heat exchangers to eliminate any vacuum. Vacuum breakers shall be located external to AHU casings.

G. Steam pressure gauges shall be liquid filled with a range consistent with operating pressure. Stainless Steel ball valves shall be used for gauge cock.

3.4 PRVs

A. Where a PRV would exceed 3” in size or the turndown (maximum load/minimum load) is greater than 10:1, two PRVs shall be provided in parallel, on for approximately 0-33% for low-load conditions and one for 33-100% for high-load conditions, with a single full pipe size bypass. In no case shall high pressure steam be reduced in a single stage to 40 psi or less.

B. For a large PRV, where the valve size would exceed 6” in size, three PRVs shall be provided in parallel. Each PRV shall be designed for a third of the load with a single fill pipe size bypass.

C. Bypass globe valves shall be provided around the PRV station and modulate pressure if the PRV is out of service. Ball valves are not appropriate for steam service. Isolation gate valves will be provided for isolation. Each branch of the PRV station shall have a single shut-off valve capable of securing steam without approaching the station.

D. Where the steam service includes capacity for future expansion, all PRV station piping and components except the PRVs shall be sized for the future load. The PRV shall be sized for the present load. An eccentric reducer before the PRC and a concentric reducer after the valve shall be installed to prevent condensate from collecting in the station. Each PRV shall be fitted with a removable custom fabric insulation jacket to further reduce noise and heat gain to the space. The insulation jacket shall be equipped with straps and buckles to allow frequent removal and reinstallation without damaging the insulation.