

**Service Entrance:** See the *Steam Distribution Systems* section within these *General Guidelines* for requirements regarding steam and condensate service entrances for buildings served by the central steam distribution system.

**Building System:** By definition, the building steam system consists of all steam piping and components on the “building side” of the steam supply and pumped condensate “stop valves”. As stated in the *Steam Distribution Systems* section within these *General Guidelines*, the stop valves themselves shall be considered a part of the steam/condensate distribution system just as if they were located within the tunnel system and shall be specified/selected accordingly (e.g. steam valves shall be higher quality with welded connections rather than lower quality flanged valves that would typically be utilized in a building steam system).

**Pressure Regulating Station:** Within each building, a separate pressure regulating (PRV) station shall be installed to serve each distinct steam operating pressure requirement. Air heating coils, heat exchangers for hot water heating, heat exchangers for domestic hot water service and reboilers for humidification are typically served by a common pressure regulating station that provides steam at 10-15 PSIG. Although no longer installed in new construction, perimeter heating systems that utilize steam directly shall be served by a dedicated pressure regulating station that provides steam at 2-4 PSIG. Both of these regulating stations shall be fed with steam from the medium pressure central distribution system (a.k.a. “Campus Steam” system). Each process steam system that requires higher pressure steam shall be served by a dedicated regulator fed from the high pressure central distribution system (a.k.a. “Utility Steam” system).

**PRV Exception:** Although uncommon, the installation of a building pressure regulating station may be deemed non-essential. This determination is based upon two factors: the constancy of the steam pressure supplied to the building and the ability of the control system(s) to function adequately with variable inlet pressures. Typically, deletion

of PRVs is only appropriate for buildings located remotely from the power plant. Pressures tend to be lower and more consistent at such locations. If the pressure regulating station is to be deleted it is essential that the optimal number, type and size of control valve(s) be used. Valves with high rangeability (typically rotary type) are required. Special consideration shall be given to any equipment that is not designed for unregulated steam pressure (e.g. pressures exceeding 10-15 PSIG). Humidifiers and domestic water heaters often fall into this category. Dedicated regulators may be required in such cases.

Overall, a system design that incorporates a building pressure regulating station is the default design. Deletion of a regulating station is allowed only when specifically approved by F&S Engineering Services.

**Relief Valve:** As is typically required, an appropriately sized and selected relief valve shall be provided immediately downstream of each PRV station. The pressure setting for each relief valve shall be low enough to provide required protection for system components but shall be adequate to prevent nuisance discharges of steam throughout the full range of normal operating conditions. For example, a relief valve serving a 10-15 PSIG system shall typically have a set point of 20-25 PSIG. Equipment that requires a dedicated PRV will likely require a dedicated relief valve. Again, humidifiers and domestic water heaters may fall into this category. The vent line serving each relief valve shall be adequately sized and shall be extended to the top of the building and configured to discharge vertically at an elevation that is, at a minimum, 7 ft. above the adjacent roof line. This vent stack shall be terminated in a manner that prevents the entrance of birds and debris.

**Relief Valve Exception:** If the building steam system, including all steam traps, is designed to safely handle exposure to “worst case” steam distribution pressure, the relief valve and vent are not necessarily required. As stated in the *Steam Distribution Systems* section within these *General Guidelines*, the design pressure for the medium pressure system with all its components is 137 PSIG. This represents the highest pressure to

which the building steam system can potentially be exposed. (Note: Class 125 cast iron components are rated for 150 PSIG at 350 degrees F.) Special consideration shall be given to equipment that requires additional protection. Dedicated relief valves may be required in such cases. Again, humidifiers and domestic water heaters may fall into this category. If this approach is taken (i.e. deletion of relief valve and vent), it is essential that a pressure sensor be installed downstream of the PRV station such that the pressure can be monitored remotely and an alarm can be generated. A system design that incorporates a relief valve is the default design. The deletion of relief valves at PRVs is allowed only when specifically approved by F&S Engineering Services.

**Steam Supply Systems:** A dedicated steam supply piping system shall be installed in conjunction with each pressure regulating station to serve equipment that operates at a given supply pressure as addressed above.

**Automatic Isolation:** An automatic isolation feature shall be provided for each direct steam perimeter heating system to allow the steam service to be completely shut off during periods when heating is not required. This applies to older buildings with direct steam perimeter heating systems. These systems typically use cast iron radiators.

**Condensate Return Systems:** Each steam supply system with a distinct operating pressure shall be served by a dedicated gravity condensate return piping system. Each perimeter heating system that utilizes steam directly at individual heating units shall be served by a vacuum return system if possible. All condensate return piping, including vacuum return piping, shall be continually pitched in the direction of flow with no rises in elevation (with few exceptions, such as drip trap discharge lines). The condensate from all gravity return systems within a building shall be returned to one or more vented receivers. An adequately sized vent line shall be provided for each receiver. It shall be extended to the top of the building and configured to vent flash steam to atmosphere in a safe manner.

It shall be terminated in a manner that prevents the entrance of birds and debris. It should be noted that condensate receiver vent lines are often undersized, resulting in elevated pressures/temperatures within receivers. This contributes to cavitation at pump impellers. Vent lines shall typically be sized larger than the receiver vent opening. Condensate from high-pressure (i.e. greater than 15 PSIG) steam systems/equipment shall pass through a vented flash tank prior to entering the receiver and mixing with condensate from low pressure system(s).

**Condensate Pumping Unit:** All condensate from building steam systems that are served by the central steam distribution system shall be collected and pumped back into the central (tunnel) condensate return system. Typically, condensate pumps shall be electric motor driven in order to minimize cost of operation. However, it may be more appropriate to use steam-powered condensate pumps for applications that involve especially high condensate temperatures, a hot/humid environment, unavailability of electricity and/or physical space limitations. These conditions are most often found within the steam tunnel system.

**Condensate Metering:** Condensate shall be metered within each building prior to entering the central (tunnel) condensate return system. It is typically preferred that only one metering station be installed per building. It is not necessary to meter low, medium and high pressure condensate separately. In order to maintain accurate metering, it is essential that there be no backflow of condensate through building condensate pumps. This is prevented by use of a check valve in the discharge line at each pump. Given that this is a severe duty application, it is essential that this valve be a high quality device per specifications within these *UIUC Facilities Standards*.

**Steam Metering:** As of the time of this writing, steam is typically not metered at campus buildings. Rather, steam metering is accomplished indirectly via use of steam condensate meters. The use of direct steam metering has been avoided in the past for three reasons: cost, difficulty in achieving an installation with adequate straight run of

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pipng and unavailability of meters with adequate turn-down capability.

**Insulation:** Steam and condensate piping including all hot surfaces on related equipment and devices shall be insulated. The common practice of leaving unions, strainers, valves, valve bonnets, pressure regulating valves, control valves, condensate receivers and various specialties uninsulated is not allowed. Due to limited clearances and need for access condensate pumps (not receivers) may be excluded from this requirement.