

**Steam Heating:** Campus buildings are to be heated with steam from Abbott Power Plant via the central steam distribution system. Medium pressure “Campus Steam”, if available, is typically to be used for this purpose. If Campus Steam is not available (e.g. at remote locations such as the Veterinary Medicine Complex and the furthest north reaches of campus) high pressure steam is typically utilized to serve building heating systems. (Reference paragraph entitled Utility Program Statement below.)

**Hydronic Heating:** Steam is not to be used as a direct source of heating for a heating, ventilating, and air-conditioning (HVAC) system. It is to be used in conjunction with a heat exchanger (or hot water converter) to heat fluid within a hydronic heat transfer system. Thus, the use of steam heating coils, unit heaters, cabinet unit heaters, convectors, finned-tube elements, etc. is not allowed. Exception: In areas within existing buildings where only steam heat is available and it is impractical to provide a hydronic system, steam heating equipment is allowed if specifically approved by the University of Illinois at Urbana Champaign (U of I or UIUC) Facilities and Services group (F&S). However, this exception is application to unitary and terminal equipment only. It is not applicable to central air handling equipment.

**Natural Gas Heating:** Natural gas, as opposed to electricity, typically is used to provide heating for buildings that are not served with steam from Abbott Power Plant. (Reference paragraph entitled Utility Program Statement below.) When natural gas is used as a heating source for an office, classroom and/or laboratory building it should not be used to heat air directly, but be used to fire steam or hot water boiler(s). The use of gas fired air heating units may be allowed in less substantial building types (e.g. residential, light commercial, farm) but must be vented type. Direct gas-fired heating units are not to be used.

**Electric Heating:** Electric resistance heating is not allowed for applications except where integrated into a specialized packaged HVAC unit for the express purpose of providing humidity control. Such applications are rare.

**Boilers:** As stated above, when campus steam is not available as a heat source for a hydronic heating system, natural gas will be used to fire hot water generators (boilers). Boilers are to be of the sealed combustion high efficiency type. Boilers are to be configured and operated in a manner that takes full advantage of available efficiency. Achieving project specific heating system efficiencies that are maximized is desired.

Maximizing condensing, modulating boiler plant efficiency includes maximizing operation with flue gas temperatures below condensing temperature. Thus, boilers are to have enough turn-down capability to allow them to remain in operation at very low loads. Hot water systems may be configured and operated such that the return water temperature is kept as low as possible, preferably below 130 degrees Fahrenheit (deg-F). Hot water coils may be selected for appropriate supply water temperatures (minimum 140-deg-F) to achieve this. Heating coils size (e.g. two rows rather than single row), air and water pressure losses, and other factors are to be considered in the system design. Water temperature is to be resettable based upon actual load conditions. The control system, and the control valves in particular, are to be capable of maintaining maximum supply/return temperature differential (aka delta T) in order to maintain return water temperature. Pressure independent control valves and/or pressure regulators may be used as appropriate and feasible. The number and capacity of boilers should typically be selected to minimize boiler cycling in response to variations in load. In this vein, automatic isolation of non-operational boilers is to be provided to maximize flow through operating boilers, thus reducing boiler cycling.

**Pressurization:** As most HVAC designers are aware, building pressurization has substantial impact upon building envelope integrity and overall HVAC performance. Its negative impact upon HVAC is most apparent in areas near building entrances and other envelope openings. Occupants at reception areas, occupied lobbies, adjacent rooms, receiving areas, etc. are typically most affected. Such spaces require localized environmental control and in some cases, such as public entrances, dedicated heating units. Regardless, such areas are to be
served by dedicated HVAC zones. The effect of negative building pressure doesn’t stop there. Impact of envelope leakage upon occupants and processes within exterior spaces often goes overlooked. Spaces requiring pressure control are most affected. Thus, building pressure control is to be treated as a key component in building HVAC design.

**Perimeter Heating:** It has been the experience of the University that provision of hydronic perimeter heating consistently improves occupant comfort during cold weather conditions. Thus it is to be treated as non-optional. Each space with an exterior exposure is to incorporate hydronic perimeter heating unit(s) generously sized to offset associated building envelope loads. Sizing is to incorporate unanticipated envelope leakage due to inevitable non-optimal envelope construction and negative building pressurization. Perimeter heating is to be in the form of baseboard finned tube heating elements. With specific approval of F&S, ceiling radiant heating panels may be utilized in lieu of baseboard elements if such elements would otherwise be inaccessible for service and repair. Heating units are to be strategically located adjacent to areas of greatest heat loss (e.g. beneath windows). Considerations for provision of perimeter heating in the form of hydronic baseboard finned-tube:

1. Perimeter heating provides a heat source separate from and in addition to air source heating (e.g. reheat).
2. It facilitates heating outages without total loss of heat. Loss of one heat source during cold weather may actually go unnoticed by occupants.
3. It allows entire exterior heat source to be turned off throughout cooling season reducing undesirable heat gain.
4. It allows optimization of each heat source. It allows individual setpoint of supply water temperature for each system.
5. It supports energy reduction strategies. For examples it allows central air-handling units (AHUs) to be turned off and/or outdoor air conditioning to be reduced during periods of vacancy (e.g. nightly) with no loss of heating.
6. It allows supply air temperature to be reduced. Thus short-cycling of ceiling supply air back into return opening is reduced, improving room ventilation effectiveness.
7. Prevents building systems from freezing during loss of air source (e.g. AHU failure)
8. It is simpler and more reliable than air source heating.
9. Unlike reliance upon AHUs with sizable motors, operation of hydronic perimeter heating systems require relatively little electrical power and thus are more easily supported by emergency power generation.
10. Warms walls and windows bottom-up to prevent cold downdrafts.
11. Reduce radiant heat transfer. This comfort reduction at exposures is significant but often overlooked.

**Public Entrances:** At each public entrance one or more cabinet unit heaters are to be provided. At larger, high traffic entrances one heater is to be provided at each side of the entrance. These units may be floor or wall supported, recessed or surface mounted. They are not to be installed overhead. Given, as previously identified, buildings often operate with negative pressurization relative to outdoors. Thus, entrances can function as makeup air intakes and associated cabinet unit heaters end up serving as preheat coils for the building. Thus, these units are to be generously sized at a minimum of 25,000 BTUH per 3-foot x 7-foot door and include calculated heat loss. Each such unit is to be controlled via BAS with local temperature sensing.

**Non-Public Entrances:** The installation of cabinet unit heaters is not specifically required at low-traffic entrances. However, hydronic heating of some form (e.g. finned tube, convectors) will typically be needed to mitigate the effect of cold drafts in adjacent areas (e.g. corridors).

**Loading Docks:** High capacity unit heaters and/or heated air curtains are to be provided at loading docks and other high infiltration service areas.

**Backup Equipment:** A 100% backup or duplex unit is to be provided for each critical
piece of heating equipment vulnerable to failure. This includes equipment required for freeze protection of facilities or critical service to animal rooms. Critical equipment includes boilers, hot water pumps, steam condensate pumps, temperature control air compressors (as applicable) and associated equipment/systems dedicated to each.

**Insulation:** The hot surfaces of heating piping and related equipment, with the exception of steam traps, steam condensate receivers and condensate pump volutes must be insulated. The common practice of leaving unions, strainers, pressure regulating valves, control valves, and various specialties uninsulated is disallowed.

**Utility Program Statement:** Specific direction regarding which steam system(s) are to be used to serve a specific building/site and associated operating pressures and temperatures to be used for design purposes must be obtained from F&S Utility and Energy Services Division via a Utility Program Statement. As applicable, specific direction regarding the use of natural gas and associated design information is to be obtained in the same manner.