

Central Chilled Water System: New buildings located within the “reach” of the campus central chilled water system shall use the central system as its source of cooling. This requirement applies to remodeled/renovated areas within existing buildings as well as new buildings. Thus, all building cooling systems that utilize central chilled water shall be designed such that they are compatible with this system. See section entitled *Chilled Water Distribution System within these General Guidelines*.

Interruptible Service: Although highly reliable, the central chilled water system shall be treated as “interruptible service”. Thus, backup cooling shall be provided for critical equipment served by this system.

Service Entrance: For specific requirements related to building chilled water service entrance, pressure control valve, metering station and related controls see the section entitled *Chilled Water Distribution System within these General Guidelines*.

Heat Exchanger: A water-to-water (or fluid-to-water) heat exchanger shall be provided for separation of central system piping from equipment and/or associated piping that place the system at risk of leakage or contamination. This includes equipment not fixed-in-place and/or “hard-piped”. Heat exchangers shall be provided for systems that incorporate flexible hoses, quick connectors and/or valved openings accessible to unauthorized personnel. Equipment deemed low risk such that a heat exchanger is not required typically includes the following: fan coil units, computer room cooling units, small water cooled condensing units and small process/lab equipment fixed in place and hard piped. Interpretation of level of risk, including potential for system contamination, shall be provided by *F&S Utilities and Energy Services*. Approval of exceptions shall be provided by same.

Independent Cooling: Each space requiring continual cooling independent of a building HVAC system shall be served by a dedicated cooling unit. If available, central chilled water shall be used as the cooling source. Unoccupied spaces of this type shall be served by a 100% recirculating unit

with little or no external ventilation. Examples of such spaces include electric transformer rooms, elevator equipment rooms, CITES telecom rooms, computer server rooms and mechanical equipment rooms with limited cooling requirements. Given the availability of year-round central chilled water the use of ventilation “free-cooling” is typically not required for such applications and shall be avoided. Compliance with this requirement yields uninterrupted cooling to such spaces when central air units are turned off for maintenance or energy conservation scheduling.

Central Air System: General space cooling for HVAC applications shall be provided by central air distribution systems that utilize chilled water as their source of cooling. The use of unitary or terminal cooling equipment that incorporate fans, filters and condensate drain pans for general space cooling shall be avoided. These tend to be low quality, high maintenance units.

AHU/Coil Design: As stated within the *Chilled Water Distribution* section within these *General Guidelines*, the design of each cooling coil connected to this system shall be based upon an entering water temperature of 43 degrees F and a minimum leaving water temperature of 59 degrees F. Each cooling unit shall maintain this 16 degree F minimum design temperature differential at all load/operating conditions. Each unit shall also be designed with all of the features that are needed for adequate freeze protection of its chilled water coil(s) without the use of antifreeze solution in the chilled water system or the necessity of isolating and draining coils. The University has embraced a specific freeze protection control sequence utilizing two separate freeze protection thermostats applied to each chilled water coil. These controls automatically open the control valve to cause flow through the coil as freezing conditions are approached. This system shall be provided for all coils that are potentially exposed to outdoor air. Only units that have 100% recirculated airflow are exempt.

Control Valves: Chilled water control valves serving building air handling equipment and various cooling units shall be

of the two-way type and shall have an appropriate static pressure rating, close-off pressure rating and dynamic pressure rating for this somewhat demanding application. Dynamic (operational) close-off rating, as opposed to static close-off pressure rating, shall be 50 PSID minimum. The use of pressure independent control valves is highly encouraged, particularly at larger chilled water coils. Their use results in higher and more consistent chilled water "delta T" which benefits the larger system in multiple ways. The Owner shall be consulted in determining if control valves should be pressure dependent or pressure independent for a given building or system.

Local Chilled Water System: Where central chilled water is not available, building cooling systems shall be served by a local chilled water system. Local chilled water systems that are within the future geographical reach of the campus-wide chilled water system shall be designed such that they are compatible with the central system to the greatest extent practical. (See compatibility requirements addressed above.) Ideally, this includes system configuration (i.e. variable flow design) as well as cooling coil and control valve selection and sizing. When new or replacement chilled water cooling coils are installed within a building that is served, or is eventually to be served, by the central system, two-way control valves shall be installed to serve these coils to the extent that the local system configuration allows. Typically, in such cases new control valves may be two-way even if the balance of the coils within the system are three-way.

Chiller Replacement/Relocation: When an existing chiller requires replacement or relocation, and central chilled water is available, the local system shall be "refed" with central chilled water. In such cases the chiller shall not be installed or relocated unless it is highly impractical to do otherwise. When the local system is re-fed from the central system it shall be properly converted as previously described.

Veterinary Medicine Complex: It is noted that some of the system description and requirements addressed above are not fully applicable to the central chilled water

system at the Veterinary Medicine complex. *F&S Utilities and Energy Service* shall be contacted to establish the limits of applicability for each cooling system/component to be served by this system.

Configuration: Throughout the HVAC industry there has been a movement toward the use of "variable primary" chilled water systems as a default configuration. This configuration typically yields wide swings in flow rates through individual chillers as cooling loads vary. While acknowledging that this approach has certain advantages, the U of I does not currently embrace it for standard applications on campus. The difficulty of controlling such systems stands as the primary reason for disallowing this approach. Thus, cooling shall be configured so as to provide a relatively constant flow of chilled water through each chiller. Systems that incorporate multiple chillers shall incorporate a primary/secondary (production/distribution) piping configuration.

Small Cooling Units: Neither window air conditioning units nor other small compressorized cooling units/systems are allowed.

An approved variance or project-specific approval from *F&S Engineering* is required prior to their installation. Such variance or approval will be considered only if it is determined to be highly impractical to provide cooling via a larger system.

If a window air conditioning unit is utilized, it shall be installed in the bottom sash of double-hung sash type windows if possible. See *Drawing 23 81 16-1, Window A/C Unit Installation in Lower Sash* and *Drawing 23 81 16-2, Window A/C Unit Installation in Upper Sash*. Window air conditioning units shall not exceed two tons nominal capacity. Maintenance of window air conditioning units and other non-central systems will not be provided by *F&S* but will be the responsibility of the using department / campus unit.

"Once-Through" Cooling: Water-cooled equipment of any size that incorporates a "once-through" cooling or condenser water configuration, other than for emergency backup usage, is not allowed. Operation of

COOLING SYSTEMS, BUILDING

this type of equipment results in unnecessary, excessive usage of water.

DX Equipment: A DX cooling system shall not be installed where a chilled water system is available, appropriate and expandable to serve a new load. A DX cooling system shall never be used in conjunction with a VAV air distribution system.

New Chilled Water System: If an existing chilled water system is not available, appropriate or expandable to serve the new load and the total new load is 10 tons or

greater, a new chilled water system shall be provided.

Exceptions:

1. Systems that serve special application areas such as central computer rooms that require specialized unitary HVAC equipment (e.g. CRAC unit). Where available, appropriate and expandable, an existing central chilled water system shall be used as the cooling source for even this type of equipment.
2. Back up cooling systems for critical applications.

Chiller Selection Criteria: Chillers shall be selected as follows:

Capacity:	Energy Source:	Means of Heat Rejection:
Less than 100 tons	Electric	Air cooled
100 to 200 tons	Electric	*Air or water cooled
Greater than 200 tons	**Electric or steam	Water cooled

* Based upon life cycle cost analysis

** Based upon availability of specific utilities and life cycle cost analysis

In each case, chiller efficiency shall satisfy the minimum requirements of *ASHRAE Standard 90.1* as well as the *Energy Conservation* section within these *Standards*. Beyond these minimal requirements, chiller efficiency shall be determined by life cycle cost analysis.

Refrigerants: Since HCFC refrigerants are being phased out they shall not be utilized in any air condition equipment.

Compliance: The design and construction of indoor refrigerant-containing mechanical cooling equipment, associated systems and equipment rooms shall be in complete compliance with *ASHRAE Standard 15*.

Cooling Tower Location: When local water-cooled equipment is utilized, the associated cooling tower(s) and/or other evaporative heat rejection devices shall generally be located at the top of the building being served. They shall be located and oriented relative to adjacent building

elements, to each other and to other equipment such that there is minimal restriction of intake and discharge airflow and minimum recirculation of discharge air back into the intake air stream. This equipment shall be located and installed so as to accommodate the discharge of large volumes of moisture-laden air without creating humidity related problems to surrounding areas. Adequate consideration shall be given to the potential for carryover and precipitation of water droplets that contain chemicals that can potentially damage finished surfaces such as the paint on automobiles.

Heat Rejection Equipment: Heat rejection equipment such as cooling towers, evaporative condensers, evaporative coolers, fluid coolers, condensing units and air-cooled condensers shall be located and installed such that neither the intake airflow is impeded nor the exhaust airflow recirculated. This type of equipment shall be located outdoors in its entirety. It shall not be installed within pits, areaways, or other tight enclosures or screened areas. Exception: Smaller evaporative heat rejection equipment dedicated to serving year-round process loads such as cold rooms and constant temperature rooms may be located indoors if outdoor installation is impractical. In such cases this equipment shall be located within an upper floor mechanical equipment room. It shall be installed such that it is supplied with outdoor air through connected ductwork and discharges heat and/or humidity directly back outdoors, also through connected ductwork. In these cases, heat rejection units shall be closed evaporative coolers rather than open cooling towers to prevent contamination of condenser water with acid fumes and other corrosive vapors that cause damage to system components. Non-evaporative (i.e. sensible) heat transfer units that serve relatively small year-round process loads may discharge heat directly into mechanical equipment rooms but only those rooms that have controlled ventilation to prevent heat build-up.

Roof/Upper Level Installation: When cooling equipment (e.g. a cooling tower, chiller or other compressorized unit) is located at the roof level or in an upper level equipment room, special consideration shall be given to minimizing transmission of vibration into the building structure such that occupants or sensitive equipment within the building are disturbed. Each piece of roof-mounted equipment shall be installed on an adequately supported box curb that is appropriately flashed into the roofing system. Otherwise, structural members above the roof surface shall support it. 3' minimum clearance is required between the roof surface and the bottom of any structural support to facilitate roof maintenance and replacement.

Ground Level Installation: Outdoor heat rejection equipment such as condensing units and air-cooled condensers shall be located far enough from adjacent trees, shrubs and/or structures such that intake airflow is not impeded and exhaust airflow is not recirculated. This equipment shall be located and oriented such that its operation does not damage trees and/or shrubs. It shall be protected from the intake of leaves, grass and other debris. It shall be elevated on a stand on a poured, reinforced concrete pad.

Impact on Surrounding Environment: When locating cooling equipment and associated piping, electrical conduit, etc. consideration shall be given to the aesthetic and acoustical impact that its installation will have on the surrounding environment, whether indoors or outdoors. See the section entitled *Impact on Surrounding Environment* within these *General Guidelines*.