SECTION 15650
REFRIGERATION, WATER CHILLING

A. REFRIGERATION - GENERAL

1. General

   a. Install floor mounted refrigeration equipment on a 4" high concrete pad.

   b. On Bloomington Campus use chilled water from the central chilled water loop where available.

   c. At IUPUI, use chilled water from district chilled water system provided by CTE.

2. Condensers

   a. Install air cooled condensing units up to 100 ton capacity. Install water cooled condensing units with cooling towers if greater than 100 ton capacity. Water cooled refrigeration equipment using domestic water can only be used where emergency backup is required. At IUPUI: Do not use domestic water for cooling purposes.

   b. Roof mounted condensers should be selected to operate in 120 degree F ambient temperature.

3. Refrigerants and Compressors

a. Up to 100 ton	Reciprocating, screw or scroll compressors, refrigerant R22 or R-410a. Small low temperature systems, non-CFC blend.
b. 100 ton to 400 ton	Screw or centrifugal compressors, refrigerant R22 or R134a.
c. 400 ton upwards	Centrifugal compressors, R22, or R134a.

   d. Two units, capacity 50% of peak load, are preferred rather than a single machine when load exceeds 300 ton. Provide reseatable relief valve in lieu of rupture disk to prevent total refrigerant loss.

4. Equipment Rooms

   a. Equipment rooms shall contain refrigerant detectors with both audible and

visual alarms. Provide detection for all refrigerants used in the equipment room(s). Alarms shall be activated at levels not exceeding the corresponding TLV-TWA values shown in the Indiana Mechanical Code for the refrigerant classification.

b. Install alarms outside of equipment rooms to alert operators to potentially hazardous situations due to refrigerant leak.

c. Install code-compliant mechanical ventilation to remove escaped refrigerants from equipment rooms.

d. Make respirators available adjacent to equipment rooms in accordance with ASHRAE Standards.

e. Pipe purge and relief valves to the outside.

5. Controls

a. The controls and chiller design shall allow start up and operation with a condenser water entering temperature as low as 55^{o}F.
b. Consider demand limiting control for chillers from energy management system.

6. Refrigerant Reclaim

a. Supply receiver and pump-down system so that the machine can be emptied of refrigerant for maintenance and repair. Contact IU Engineering Services for the applicability of this guideline.

7. Noise Levels

a. The operating noise of package water chillers shall not exceed 85 dBA as measured under ARI Standard 575.

8. Air Cooled Condensing Units

a. Equipment energy efficiency ratings shall comply with the latest applicable state and federal laws in addition to the requirements of ASHRAE 90.1-1989.

b. Provide low ambient controls if operation during periods of low outdoor temperatures is required.

B. WATER CHILLERS

1. Reciprocating Compressor Water Chillers

a. Compressor shall be semi-hermetic type with electric drive. Electrical energy

use shall not exceed 0.85 kW/ton if the condenser is water cooled. Provide maximum of two compressors with independent refrigerant circuits when redundancy is required.

2. Screw Compressor Water Chillers

   a. Compressors shall be horizontal helical rotary screw type. IPLV shall not exceed 0.62 kW/ton.

   b. Compressor capacity control shall be accomplished by either a variable frequency drive or a valve in the rotor section. Capacity control shall allow continuous unloading down to 10 % of capacity of each chiller without causing noise or vibration.

   c. Sound power level shall not exceed 89 dBA when tested according to ARI 530.

3. Centrifugal Compressor Water Chillers

   a. Compressor shall be electric drive, centrifugal type. IPLV shall not exceed 0.60 kW/ton.

   b. Compressors shall be capable of capacity modulation by the use of inlet guide vanes from 100 % to 25 % of full load.

   c. Sound power level shall not exceed 85 dBA when tested according to ARI 530.

C. COOLING TOWERS

1. Towers to be induced draft, counterflow or crossflow. Fans to be of propeller type with cast aluminum blades. Mount fan motors outside the airstream. Drive fans through drive shafts and right angle gear reducers. Provide vibration switch, handrail, ladder, and lube line extension.

2. Construct framework, casing, cold water basin, louvers, fan cylinder, and fan guard from heavy galvanized steel (minimum of 2-1/2 oz zinc per ft^2). Fill and drift eliminator to be PVC.

3. Power use shall not exceed 0.030 kW/ton of cooling based on 1 ton equivalent to 3 gpm of water cooled from 95^oF to 85^oF with a 78^oF entering wet bulb temperature.

4. Provide hot-dipped galvanized steel structure to support the tower.

5. Pipe overflow and drain connections to sanitary sewer.