

Basis of Design

This section applies to refrigeration equipment.

Design Criteria

- Design air-cooled condensing units using an ambient temperature of 95 ° F. Design to operate at a low ambient temperature of 0° F.
- Do not use city water-cooled condensing units without prior approval from Campus Engineering.
- To avoid short-cycling, incorporate a compressor capacity-control scheme (i.e. hot gas bypass) whenever the range of the minimum and maximum refrigeration load differs by 25% or less.
- With the exception of refrigeration systems that incorporate heat recovery, use outside air as the heat sink for air-cooled condensing systems.
- Regulate condensing unit fan speed to control the condensing system operating pressure. For multiple fan units, the speed of at least one fan shall be regulated and operated on a "first on/last off" basis.
- Provide compressors located remotely from evaporators with oil separators. Design oil circulation piping to ensure adequate oil circulation.
- Install refrigeration compressors, condensers, and condensing units in a mechanical room or in a weather-protected enclosure. Provide a minimum of 24 inches horizontal clearance between units to allow future maintenance.
- Incorporate refrigeration equipment with vibration isolation to reduce sound transmission and prevent piping or tubing damage.
- Provide evaporator condensation drains from evaporators with a trap and route to funnel or floor drains. Provide condensate pan and piping with insulation, and equip with electric heater cable/tape where temperatures are expected to be below 32°F.
- Implement the "pump down" method to control compressors. Provide compressor controls with a low-pressure switch (primary control and a high-pressure limit with manual reset.) Provide compressors designed with pressurized oil lubrication which have an oil pressure safety switch with timer and manual reset.
- Provide a refrigerant sensing/measuring device and adequate ventilation for refrigerant Machinery rooms. Vent the refrigerant safety valve outside the building.
- Provide a minimum of 400 cfm per ton.
- Fluorocarbon refrigerant R-22 is not acceptable. Reduce and aim to eliminate all CFCs from existing facilities. Provide EPA approved HFC refrigerant for new equipment (if not available, discuss with Campus Engineering). CFC and HCFC are not acceptable.
- For refrigeration leak detection system requirements see Mechanical – Process and Environmental Chilled Water section.

Design Evaluation

The following information is required to evaluate the design:

- Schematic Design Phase: Provide equipment locations; system definition and design criteria developed by the users, names of responsible Mechanical Design Engineer, Refrigeration Shop Supervisor, and Campus Engineering representative.
- Design Development Phase: Provide design calculations, equipment sizing criteria, equipment lists, operation sequence, control diagram and piping plans.
- Construction Document Phase: Provide one-line diagrams, pipe sizing, descriptive literature with capacities for each piece of equipment and appropriate selections marked. Capacity balance curves shall be included to show operating balance conditions for matching components.

Construction Submittals

- Provide control schematics, sequence of operation, and location of controls.
- Provide standard industry submittal requirements.

Related Sections

- Facilities Services Design Guide – Mechanical - General Requirements
- Facilities Services Design Guide – Mechanical - Heating, Ventilating and Air Conditioning
 - Process and Environmental Chilled Water
 - Refrigeration
 - Air Handlers and Ventilation Fans
 - Coils
 - HVAC and HVAC Piping Pressure Testing
- Facilities Services Design Guide – Mechanical - Piping, Valves & Accessories
- Facilities Services Design Guide – Mechanical - Hangers and Supports
- Facilities Services Design Guide – Mechanical - Motors and VFDs
- Facilities Services Design Guide – Mechanical - Metering and Gauges
- Facilities Services Design Guide – Mechanical - Nonstructural Component Seismic Design
- Facilities Services Design Guide – Mechanical - Identification
- Facilities Services Design Guide – Mechanical - Insulation
- Facilities Services Design Guide – Mechanical - Water Treatment and Flushing
- Facilities Services Design Guide – Mechanical - Noise and Vibration Control
- Facilities Services Design Guide – Mechanical - Cold/Environmental Rooms
- Facilities Services Design Guide – Mechanical - Computer Server Rooms

- Facilities Services Design Guide – Mechanical - Environmental Control Systems
- Facilities Services Design Guide – Mechanical - Testing, Adjusting and Balancing
- Facilities Services Design Guide – Mechanical - Commissioning

Products, Material and Equipment

- Provide scroll-type hermetic compressors.
- Provide maximum warranty option for compressors.

Installation, Fabrication and Construction

- Braze all pipe joints under a nitrogen purge. No mechanical couplings allowed. No Flare connections.
- All work shall be performed by a contractor with a valid City of Seattle Refrigeration Mechanics license. The contractor shall also have an A & B Refrigeration Handlers Certificate with a Universal Rating as required by 40CFR part 82-F of EPA Regulations.
- Subject completed systems to the field test as stipulated in the latest edition of the Seattle Mechanical Code. The University's Representative shall witness this test.
- Complete Refrigeration Compliance Forms. The University can provide these forms or download from www.washington.edu/admin/facserv/fstech/formWH.htm.

END OF DESIGN GUIDE SECTION