

## SECTION 23 64 00 – CHILLERS

### PART 1 – GENERAL:

#### 1.1 SUMMARY:

- A. This section includes design and performance requirements for various types of chiller systems.
- B. Related Sections:
  - 1. Section 01 13 01 – Design Guidelines for Energy and Environment
  - 2. Section 23 00 10 – HVAC Design Criteria
  - 3. Section 23 09 00 – Building Automation Systems Design Criteria
  - 4. Section 26 00 10 - Electrical Design Criteria
  - 5. Section 28 35 00 - Refrigerant Detection and Alarm Systems

#### 1.2 WARRANTY:

- A. Chillers shall be provided with a minimum 5-year extended warranty, including parts and labor.

#### 1.3 SUBMITTALS:

- A. Product Data: Submit product literature detailing ratings, dimensions, materials of construction, applicable wiring diagrams, controls interfaces, BACNET communications address mapping and chiller accessories.

#### 1.4 GENERAL CHILLER DESIGN REQUIREMENTS:

- A. Brown utilizes various types of cooling systems, including package and split-system air-cooled chillers, and water-cooled scroll, screw and centrifugal chillers. Reciprocating compressor chillers are not a preferred chiller type.
- B. Unless specified otherwise in the Basis of Design, analyze all options for providing cooling to determine the option with the lowest life cycle cost. Options include direct expansion (DX) vs. local chilled water vs. campus chilled water systems.
- C. Chiller systems shall be designed with consideration for maintenance ergonomics. Avoid locating equipment in confined spaces, such as crawl spaces. Install and locate equipment to facilitate ready maintenance efforts.
- D. Show Manufacturer's recommended service clearances and pull clearances as shaded areas on mechanical plans.
- E. Chillers shall have IPLV ratings 25% more efficient than current Rhode Island Energy Code minimum requirements.
- F. Fully consider project impacts to chiller system operation. Concerns include full load operation, need for winter season operation, part load operation, and occupied vs. unoccupied modes of operation.
- G. Where possible, utilize the existing campus district chilled water system, instead of providing a dedicated chiller; this is the preferred method for providing cooling if

- system capacity is available and the distance to run chilled water does not make the life cycle cost unfavorable.
- H. Before connecting to a campus district chilled water system, consult with Brown Engineering staff to determine if capacity is available, the type of system connections to use, the expected supply water temperature, the temperature difference to design for, and system pumping pressures.
  - I. Water-cooled chillers are preferred for new installations. If air-cooled chillers are proposed, perform a life cycle cost analysis vs. water-cooled to confirm selection.
  - J. Avoid the use of small local DX equipment within a building wherever possible due to their high maintenance requirements.
  - K. For limited-access locations, “modular” chillers may be approved. Chiller modules shall be sized to prevent excessive on-off cycling under varying building load.
  - L. Variable-flow primary chilled water systems are preferred over constant-volume and primary-secondary designs.
  - M. Larger chillers incorporating the use of variable speed drives (VFDs) shall require a building Harmonic Study to establish the level of harmonic filtration required for the chiller VFDs; See Section 26 00 10 – Electrical Design Criteria, for details.
  - N. Redundancy, or N + 1 capacity, shall be provided in buildings considered to be critical to the University.
  - O. Systems with a single chilled-water chiller may require provision of piping and temporary electrical interfaces for the ready connection of a portable chiller. Piping connections to include flanged connections, with end caps and isolation valves; electrical to include a local disconnect switch sized for the portable chiller load.

#### 1.5 DETAILED CHILLER DESIGN REQUIREMENTS:

- A. Chiller turn-down ratio shall provide stable operation at minimum building cooling load, or 30% of maximum chiller capacity at maximum design condenser water temperature, whichever is lower.
- B. Provide multiple chillers or compressors if required to achieve minimum turndown. Use of hot-gas bypass for turndown shall be the last option considered.
- C. Preference is for variable-speed driven compressors, where applicable.
- D. For centrifugal chillers, provide marine-style water boxes with hinged end access flanges on both ends of evaporator and condenser barrels. Where marine-style boxes are not available, provide swinging davit arms to facilitate removal of evaporator and condenser barrels for cleaning and tube access.
- E. Chiller VFD cooling is preferred to be by chilled water or refrigerant. If manufacturer only offers cooling by condenser water, provide dual y-type strainers for water filtration. Strainer bank shall have DP sensor across it tied into the BAS.
- F. Chillers using HCFC-123 and HCFC-22 refrigerants are not allowed.
- G. Air-cooled units shall be provided with low-ambient controls if located outdoors.

1.6 CONTROLS:

- A. Water-cooled chillers shall be provided with microprocessor-based controls, and shall interface with the campus BAS through BACNET; refer to section 23 09 00 – Building Automation Systems Design Criteria for details. All variables displayed on the Campus BAS through BACNET shall conform to the Brown standards for BAS and BAS Naming and Alarming.
- B. Air –cooled chiller and split-system DX units shall have start/stop, status and alarm interface with the campus BAS.
- C. Provide chillers with individual manufacturer-furnished chilled water (and condenser water as required by the manufacturer) flow-proving switches.

1.7 FILTRATION AND WATER TREATMENT:

- A. Evaluate the need for sidestream filters on chilled water systems.
- B. Provide side stream filters, with 5 micron filtration, on condenser water systems.
- C. All “modular” chiller installations shall include a manufacturer-furnished strainer assembly or dual basket strainers, with manual flow transfer capability and DP gauge, on the chilled water return line to the chillers.

PART 2 – PRODUCTS

2.1. MANUFACTURERS:

- A. All equipment and components shall be new, and the manufacturer’s current model.
- B. Acceptable Manufacturers:
  - 1. Carrier, McQuay, York (water cooled)
  - 2. Carrier, McQuay, York, Trane (air –cooled )
  - 3. Multistack (modular)

PART 3 – EXECUTION

3.1. STARTUP AND TRAINING:

- A. Prior to project completion, manufacturer’s factory trained representative shall program, start up, thoroughly test and calibrate chiller system and controls, and verify that system is in compliance with operational sequence.
- B. Furnish written report certifying that work has been accomplished in accordance with the project Design criteria.
- C. Coordinate with project BAS vendor to ensure and test that all chiller system monitored points and alarms are properly reporting into the BAS and that all system interlocks are functional. Remove all unused BACNET points from BAS.
- D. Provide Training for University staff in the operation, use and maintenance of the chiller system.

END OF SECTION