

**SECTION 23 6426**  
**ROTARY-SCREW WATER CHILLERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Factory-assembled packaged chiller.
- B. Charge of refrigerant and oil.
- C. Controls and control connections.
- D. Chilled water connections.
- E. Electrical power connections.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete housekeeping pads.
- B. Section 23 0513 - Common Motor Requirements for HVAC Equipment.
- C. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- D. Section 23 0553 - Identification for HVAC Piping and Equipment.
- E. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.
- F. Section 23 0800 - Commissioning of HVAC.
- G. Section 23 0923 - Direct-Digital Control System for HVAC.
- H. Section 23 0993 - Sequence of Operations for HVAC Controls.
- I. Section 23 2113 - Hydronic Piping.
- J. Section 23 2114 - Hydronic Specialties.
- K. Section 26 2717 - Equipment Wiring.

**1.03 REFERENCE STANDARDS**

- A. AHRI 550/590 - Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle; 2011.
- B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.
- C. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Addenda.
- D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- F. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate physical size, weight and location of major pieces of equipment to be installed. Notify Architect of any major deviations from the equipment originally specified prior to ordering equipment.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.
- C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.
- D. Manufacturer's Certificate: Certify that components furnished but not produced by manufacturer meet or exceed manufacturer's requirements.

- E. Manufacturer's Performance Data: Indicate energy input versus cooling load output from 0 to 100 percent of full load at specified and minimum condenser water temperature for water-cooled chillers and at specified and minimum outdoor air temperature for air-cooled chillers.
- F. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
- G. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- H. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories; include trouble-shooting guide.
- I. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. When required, provide certification of inspection for conformance to requirements of Authority Having Jurisdiction.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Conform to manufacturer's written installation instructions for rigging, unloading, and transporting units.
- B. Deliver units to the job site completely assembled and charged with refrigerant and oil by manufacturer.

#### **1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Warranty: Provide minimum five year warranty to include coverage for materials only for compressor.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp; \_\_\_\_\_: [www.carrier.com](http://www.carrier.com).
- B. Trane, a brand of Ingersoll Rand; \_\_\_\_\_: [www.trane.com](http://www.trane.com).
- C. York International Corporation/Johnson Controls, Inc; \_\_\_\_\_: [www.york.com](http://www.york.com).
- D. Substitutions: See Section 01 6000 - Product Requirements.
  - 1. The chilled water system has been designed based on specific capacities and characteristics of equipment specified in this section and other sections.

#### **2.02 CHILLERS**

- A. Chillers: Factory assemble and test chiller consisting of compressor(s), compressor motor(s), motor starter(s) or variable frequency drives as indicated, evaporator, condenser, enclosure, refrigeration circuits(s) and specialties, interconnecting piping, microprocessor-based controls, readouts, and diagnostics.
  - 1. Rating: AHRI 550/590.
  - 2. Safety: ASHRAE Std 15 and UL 1995.
  - 3. Construction & Testing: ASME BPVC-VIII-1.
  - 4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
  - 5. Energy Efficiency: ASHRAE Std 90.1.
  - 6. Enclosures:
    - a. Chiller Structural Framing:
      - 1) Mount structural steel on welded steel base.

- 2) Factory apply hot-dip galvanized finish.
- b. Steel Chiller Cabinets:
  - 1) Factory apply baked on enamel finish.
- c. Steel Control Panels:
  - 1) Factory apply baked on powder paint or applied corrosion resistant paint prior to assembly.
  - 2) Provide gasketing and weather-proofing to panels with fully opening doors containing starters or variable frequency drives, terminal blocks, through-the-door type disconnects and circuit breaker with lockable handles indicating "power-on" or "power-off".
  - 3) Provide door stays.
- d. Electrical Equipment: NEMA 250.

### **2.03 COMPRESSORS AND EVAPORATOR**

- A. Compressors: Rotary-screw type.
  - 1. Unit: Semi-hermetic type with two, direct drive compressors with multiple independent refrigeration circuit(s), internal muffler, discharge, check, suction, and \_\_\_\_\_ service valves.
  - 2. Oil Lubrication System: Positive pressure system, oil heater, oil separator, check valves, solenoid valves, and filtration devices.
  - 3. Valves: Check valves in compressor discharge.
  - 4. Capacity Reduction System: Load/unload valve control down to 20 percent of full load without the activation of hot gas by-pass.
  - 5. Motor: 3600 rpm, suction gas-cooled, hermetically sealed, squirrel cage induction with starter.
- B. Evaporator: Shell and tube type.
  - 1. Three pass type, with three independent refrigeration circuits.
  - 2. Shell, Removable Heads and Tube Support Sheets: Carbon steel.
  - 3. Tubes: Mechanically expand and fasten, seamless, externally or internally enhanced, copper tubes into intermediate tube support sheets along the length of shell to avoid contact and relative motion between tubes with the capability of being cleanable.
  - 4. Tube Size: 1.0 inches diameter.
  - 5. Conform with ASME BPVC-VIII-1 as applicable.
  - 6. Refrigerant Working-Side Pressure Rating: 200 psig.
  - 7. Water Working-Side Pressure Rating: 150 psig.
  - 8. Connections: Flanged and designed for 150 psig waterside working pressure.
- C. Insulation for All Cold Surfaces:
  - 1. Factory install on shell and all other cold surfaces.
  - 2. 0.75 inches minimum thick, closed cell, expanded polyvinyl chloride flexible foam insulation with a maximum K value of 0.28.
- D. Provide vents and water drain connections.
- E. Provide fittings for temperature control sensors.
- F. Freeze Protection: Provide evaporator heater with thermostat to protect from freezing at ambient temperatures down to minus 20 degrees F.

### **2.04 AIR-COOLED CONDENSER AND FANS**

- A. Heat Exchanger:
  - 1. Tubes: Round.
  - 2. Arrangement: Two pass.
  - 3. Mechanically bond aluminum fins to internally enhanced, seamless copper tubing and protect with corrosion resistant materials or coatings.
  - 4. Clean, dehydrate and test.
  - 5. Leak Test: 506 psig.
  - 6. Seal: Nitrogen holding charge.

- B. Coil Guards: Provide expanded metal with lint screens. Provide coil protection for shipping by enclosing entire condenser coil with heavy plastic to prevent inadvertent damage to coil during shipping or rigging.
- C. Fans and Motors:
  1. Fans: Dynamically balance propeller type, direct drive fans of reinforced polymer corrosion resistant construction and equip with sealed, permanently lubricated ball bearings.
  2. Discharge Fan Guards: Coated steel wire.
  3. Discharge Direction: Vertical.
  4. Motors: Totally enclosed, high efficiency, suitable for outdoor use, three phase, permanent split capacitor, single speed with internal overload protection.

## **2.05 REFRIGERATION CIRCUITS**

- A. Provide two independent refrigeration circuit(s) with two compressor(s) per circuit.
- B. Minimum Refrigerant Specialties per Circuit:
  1. Isolation and service valves for refrigerant removal and charging.
  2. Removable-core filter driers.
  3. ASHRAE Std 15 compliant relief valves.
  4. Liquid line sight glass with moisture indicator.
  5. Refrigerant expansion valves or metering devices.
  6. Complete operating charge of both refrigerant and oil.

## **2.06 STARTERS AND DRIVES**

- A. Starters: Design unit mounted, across-the-line starter to operate in temperatures up to 104 degrees F.
  1. Provide incoming line provisions for aluminum, mechanical type incoming line lugs based on the number and cable sizes shown on drawings.
  2. Provide properly sized, double break main contacts with weld resistant silver cadmium faces and low resistance auxiliary interlocks with palladium silver contacts for interlocks that interface with control panel.
  3. Provide control power transformer with fused primary, secondary, and current transformers of the proper size, ratio and burden capacity.
  4. Provide control relays to interface with control panel.
  5. Wiring:
    - a. Type MTW copper stranded 90 degree C for power and control wiring.
    - b. 14 gage, 0.0641 inch, minimum, for control wiring.
  6. Motor Protection System Attributes:
    - a. Three phase overload protection.
    - b. Startup overload protection.
    - c. Phase imbalance, loss and reversal.
    - d. Low voltage.
    - e. Distribution fault protection.

## **2.07 MICROPROCESSOR-BASED, PROPORTIONAL AND INTEGRAL CONTROLLER**

- A. Control Components for Preventing Shutdown:
  1. Provide high pressure limit with indicating light for each compressor, set lower than factory pressure switch to automatically unload compressor and prevent nuisance high pressure condenser control trip.
  2. Provide one protector with indicating light for each compressor, with current limit set point of 120 percent of compressor running load amperage to automatically unload compressor preventing over-current trip.
  3. Provide low refrigerant limit to automatically unload each compressor preventing a low evaporator temperature trip.
- B. Chiller Operation in Abnormal Operating Conditions:
  1. Unloaded Running: Adequate chilled water production.

2. Trip-out Limit Reached: Chiller goes off-line and manual reset is required for continued operation.
- C. Control Panel Display:
1. Evaporator pressure.
  2. Condenser refrigerant pressure.
  3. Entering and leaving evaporator water temperature.
  4. Chilled water set-point.
  5. Electrical 3 phase current limit and percent RLA setpoint.
  6. Electrical 3 phase amp draw.
  7. Chiller operating mode.
  8. Condenser refrigerant temperature.
  9. Elapsed time and number of starts counter.
  10. Chiller compressor run status relay.
  11. Minimum of 20 diagnostics with time and date stamp.
  12. Identification of the fault, date, time and operating mode at time of occurrence, type of reset required, and help message.
- D. Points for BAS Control and Monitoring:
1. Relay output energized upon detecting a fault requiring manual reset.
  2. Relay output energized whenever unit is operating in a limit mode for an extended period of time.
  3. Analog input to control leaving chilled water temperature set-point based upon a 4-20ma or 0-10 VDC signal from the building automation system.
  4. Programmable soft during pull-down period via ramped current limit or fully adjustable, temperature pull-down rate.
  5. Leaving chilled water reset based upon return water temperature.
  6. Provide RS-232 for printer interface.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Align chiller package on steel or concrete foundations.
- C. Install units on vibration isolators.
- D. Connect to electrical service.
- E. Connect to chilled water piping.
- F. Arrange piping for easy dismantling to permit tube cleaning and removal.

### **3.02 MANUFACTURER'S FIELD SERVICES**

- A. Perform factory startup of the chiller by factory trained and authorized servicing technicians confirming equipment has been correctly installed prior to equipment becoming operational and covered under the manufacturer's warranty.
- B. Supply initial charge of refrigerant and oil if not completely factory charged.
- C. Demonstrate system operations and verify specified performance.

### **3.03 CLOSEOUT ACTIVITIES**

- A. See Section 01 7900 - Demonstration and Training, for additional requirements.
- B. Demonstrate proper operation of equipment to Owner's designated representative.
- C. Demonstration: Demonstrate operation of system to Owner's personnel.
  1. Use operation and maintenance data as reference during demonstration.
  2. Briefly describe function, operation, and maintenance of each component.

**END OF SECTION 23 6426**

