

**SECTION 23 64 00**  
**PACKAGED WATER CHILLERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Scroll air-cooled chillers complete with accessories.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- D. Section 23 21 23, HYDRONIC PUMPS.
- E. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- F. Section 23 21 13, HYDRONIC PIPING.
- G. Section 23 31 00, HVAC DUCTS and CASINGS
- H. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC.
- I. Section 26 29 11, MOTOR CONTROLLERS.
- J. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.
- K. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS
- L. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.

**1.3 DEFINITION**

- A. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.
- B. BACNET: Building Automation Control Network Protocol, ASHRAE Standard 135.
- C. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.
- D. FTT-10: Echelon Transmitter-Free Topology Transceiver.

**1.4 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC, and comply with the following.
- B. Refer to PART 3 herein after and Section 01 00 00, GENERAL REQUIREMENTS for test performance.
- C. Comply with AHRI requirements for testing and certification of the chillers.
- D. Provide a 5-year motor and compressor warranty to include materials, parts and labor.

- E. Refer to OSHA 29 CFR 1910.95(a) and (b) for Occupational Noise Exposure Standard

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning, Heating and Refrigeration Institute (AHRI):
- 370-01.....Sound Rating of Large Outdoor Refrigerating and  
Air-Conditioning Equipment
- 495-1999 (R2002).....Refrigerant Liquid Receivers
- 550/590-03.....Standard for Water Chilling Packages Using the  
Vapor Compression Cycle
- 560-00.....Absorption Water Chilling and Water Heating  
Packages
- 575-94.....Methods for Measuring Machinery Sound within  
Equipment Space
- C. American Society of Heating, Refrigerating, and Air-Conditioning  
Engineers (ASHRAE):
- ANSI/ASHRAE-15-2007....Safety Standard for Mechanical Refrigeration  
Systems
- GDL 3-1996.....Guidelines for Reducing Emission of Halogenated  
Refrigerants in Refrigeration and Air-  
Conditioning Equipment and Systems
- D. American Society of Mechanical Engineers (ASME):
- 2007 .....ASME Boiler and Pressure Vessel Code, Section  
VIII, "Pressure Vessels - Division 1"
- E. American Society of Testing Materials (ASTM):
- C 534/ C 534M-2008.....Preformed, Flexible Elastomeric Cellular Thermal  
Insulation in Sheet and Tubular Form
- C 612-04.....Mineral-fiber Block and Board Thermal Insulation
- F. National Electrical Manufacturing Association (NEMA):
- 250-2008.....Enclosures for Electrical Equipment (1000 Volts  
Maximum)
- G. National Fire Protection Association (NFPA):
- 70-2008.....National Electrical Code
- H. Underwriters Laboratories, Inc. (UL):
- 1995-2005..... Heating and Cooling Equipment

#### **1.6 SUBMITTALS**

- A. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's Literature and Data.

1. scroll water chillers, including motor starters, control panels, and vibration isolators, and remote condenser data shall include the following:
  - a. Rated capacity.
  - b. Pressure drop.
  - c. Efficiency at full load and part load WITHOUT applying any tolerance indicated in the AHRI 550/590/Standard.
  - d. Refrigerant
  - e. Fan performance (Air-Cooled Chillers only.)
  - f. Accessories.
  - g. Installation instructions.
  - h. Start up procedures.
  - i. Wiring diagrams, including factory-installed and field-installed wiring.
  - j. Sound/Noise data report. Manufacturer shall provide sound ratings. Noise warning labels shall be posted on equipment.

C. Maintenance and operating manuals for each piece of equipment in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

D. Run test report for all chillers.

E. Product Certificate: Signed by chiller manufacturer certifying that chillers furnished comply with AHRI requirements. The test report shall include calibrated curves, calibration records, and data sheets for the instrumentation used in factory tests.

**PART 2 - PRODUCTS**

**2.1 ROTARY-SCREW AND SCROLL AIR-COOLED WATER CHILLERS**

- A. General: Factory-assembled and-tested rotary-screw or scroll water chillers, complete with evaporator, compressors, motor, starters, integral condenser, and controls mounted on a welded steel base. The chiller unit shall consist of two compressors minimum, but not more than eight, mounted on a single welded steel base. Where compressors are paralleled, not more than two shall be so connected and not less than two independent refrigerant circuits shall be provided. Chiller shall be capable of operating one of the following refrigerants: HCFC-134a or HCFC-410a.
- B. Performance: Provide the capacity as shown on the drawings. Part load and full load efficiency ratings of the chiller shall not exceed those shown on the drawings.
- C. Capacity of a single air-cooled chiller shall not exceed 250 Tons (Standard AHRI Conditions).

- D. Applicable Standard: Chillers shall be rated and certified according to AHRI 550/590, and shall be stamped in compliance with AHRI certification.
- E. Acoustics: Sound pressure levels shall not exceed the following specified levels. The manufacturer shall provide sound treatment if required to comply with the specified maximum levels. Testing shall be in accordance with AHRI requirements.

OCTAVE BAND								Overall
<u>63</u>	<u>125</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2000</u>	<u>4000</u>	<u>8000</u>	<u>dB(A)</u>

- F. Compressor (Scroll Type): Three dimensional, positive-displacement, hermetically sealed design, with suction and discharge valves, crankcase oil heater and suction strainer. Compressor shall be mounted on vibration isolators. Rotating parts shall be factory balanced. Lubrication system shall consist of reversible, positive displacement pump, strainer, oil level sight glass, and oil charging valve. Capacity control shall be by on-off compressor cycling of single and multiple compressors.
- G. Refrigerants Circuit: Each circuit shall contain include an expansion valve, refrigerant charging connections, hot-gas muffler, compressor suction and discharge shutoff valves, replaceable-core filter drier, sight glass with moisture indicator, liquid-line solenoid valve and insulated suction line.
- H. Refrigerant and Oil: Sufficient volume of dehydrated refrigerant and lubricating oil shall be provided to permit maximum unit capacity operation before and during tests. Replace refrigerant charge lost during the warranty period, due to equipment failure, without cost to the Government.
- I. Condenser:
1. Air-cooled integral condenser as shown on the drawings and specified hereinafter.
  2. Integral Condenser: Condenser coils shall be extended surface fin and tube type, seamless copper tubes with aluminum fins. For corrosion protection, see Paragraph 2.5 below. Condenser coils shall be factory air tested at 3105 kPa (450 psig). Condenser fans shall be propeller type, directly connected to motor shaft. Fans shall be statically and dynamically balanced, with wire safety guards. Condenser fan motors with permanently lubricated ball bearings and three-phase thermal overload protection. Unit shall start -18°C

(0°F) with external damper assemblies. Units shall have grilles factory mounted to prevent damage to coil surfaces.

- J. Evaporator: Braze plate and frame type heat exchanger design. Braze plate evaporator shall be constructed of stainless steel with copper brazing material. The evaporator shall be designed for a minimum of 1.5 times the working pressure produced by the water system, but not less than 10,350 kPa (150 psig). Refrigerant side working pressure shall comply with ASHRAE Standard 15. Evaporator for packaged air-cooled chiller units designed for outdoor installation shall be protected against freeze-up in ambient temperature down to -30 degrees C (-20 degrees F) by a resistance heater cable under insulation with thermostat set to operate below 3 degrees C (37 degrees F) ambient. If electric resistance heater is required and the chiller is connected to emergency power, provide emergency power to the heater cable.
- K. Insulation: Evaporator, suction piping, compressor, and all other parts subject to condensation shall be insulated with 20 mm (0.75 inch) minimum thickness of flexible-elastomeric thermal insulation, complying with ASTM C534.
- L. Refrigerant Receiver: Provide a liquid receiver for chiller units when system refrigerant charge exceeds 80 percent of condenser refrigerant volume. Liquid receivers shall be horizontal-type, designed, fitted, and rated in conformance with AHRI 495. Receiver shall be constructed and tested in conformance with Section VIII D1 of the ASME Boiler and Pressure Vessel Code. Each receiver shall have a storage capacity not less than 20 percent in excess of that required for fully charged system. Each receiver shall be equipped with inlet, outlet drop pipes, drain plug, purging valve, and relief devices as required by ASHRAE Standard 15.
- M. Controls: Chiller shall be furnished with unit mounted, stand-alone, microprocessor-based controls in NEMA 4 enclosure, hinged and lockable, factory wired with a single point power connection and separate control circuit. The control panel provide chiller operation, including monitoring of sensors and actuators, and shall be furnished with light emitting diodes or liquid-crystal display keypad.
1. Following shall display as a minimum on the panel:
    - a. Date and time.
    - b. Outdoor air temperature.
    - c. Operating and alarm status.
    - d. Entering and leaving water temperature-chilled water.
    - e. Operating set points-temperature and pressure.
    - f. Refrigerant temperature and pressure.

- g. Operating hours.
  - h. Number of starts.
  - i. Current limit set point.
  - j. Maximum motor amperage (percent).
2. Control Functions:
- a. Manual or automatic startup and shutdown time schedule.
  - b. Entering and leaving chilled water temperature and control set points.
  - c. Automatic lead-lag switch.
3. Safety Functions: Following conditions shall shut down the chiller and require manual reset to start:
- a. Loss of chilled water flow.
  - b. Loss of condenser water flow (for water-cooled chillers only).
  - c. Low chilled water temperature.
  - d. Compressor motor current-overload protection.
  - e. Freeze protection (for air-cooled chillers).
  - f. Starter fault.
  - g. High or low oil pressure.
  - h. Recycling pumpdown.
- N. The chiller control panel shall provide leaving chilled water temperature reset based on return water temperature signal from Energy Control Center (ECC).
- O. Provide contacts for remote start/stop, alarm for abnormal operation or shutdown, and for Engineering Control Center (ECC).
- P. Chiller control panel shall reside on BACnet interworking using ARCNET or MS/TP physical data link layer protocol for communication with building automation control system.
- Q. Auxiliary hydronic system and the chiller(s) shall be interlocked to provide time delay and start sequencing as indicated on control drawings.
- R. Motor: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Compressor motor furnished with the chiller shall be in accordance with the chiller manufacturer and the electrical specification Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC. Starting torque of motors shall be suitable for driven machines.
- S. Motor Starter: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide a starter in NEMA I enclosure, designed for floor or unit mounted chiller using multiple compressors, with the lead compressor starting at its minimum capacity may be provided with across-the-line starter. See Section 26 29 11, MOTOR CONTROLLERS for additional requirements.

## **2.4 CONDENSING UNITS FOR AIR CONDITIONING SERVICE**

Refer to Section 23 81 00 DECENTRALIZED UNITARY HVAC EQUIPMENT.

## **2.5 CORROSION PROTECTION**

A. Remote Outdoor Condenser Coils: Epoxy Immersion Coating - Electrically Deposited: The multi-stage corrosion-resistant coating application comprises of cleaning (heated alkaline immersion bath) and reverse-osmosis immersion rinse prior to the start of the coating process. The coating thickness shall be maintained between 0.6-mil and 1.2-mil. Before the coils are subjected to high-temperature oven cure, they are treated to permeate immersion rinse and spray. Where the coils are subject to UV exposure, UV protection spray treatment comprising of UV-resistant urethane mastic topcoat shall be applied. Provide complete coating process traceability for each coil and minimum five years of limited warranty. The coating process shall be such that uniform coating thickness is maintained at the fin edges. The quality control shall be maintained by ensuring compliance to the applicable ASTM Standards for the following:

1. Salt Spray Resistance (Minimum 6,000 Hours)
2. Humidity Resistance (Minimum 1,000 Hours)
3. Water Immersion (Minimum 260 Hours)
4. Cross-Hatch Adhesion (Minimum 4B-5B Rating)
5. Impact Resistance (Up to 160 Inch/Pound)

B. Exposed Outdoor Cabinet: Casing Surfaces (Exterior and Interior): All exposed and accessible metal surfaces shall be protected with a water-reducible acrylic with stainless steel pigment spray-applied over the manufacturer's standard finish. The spray coating thickness shall be 2-4 mils and provide minimum salt-spray resistance of 1,000 hours (ASTM B117) AND 500 hours UV resistance (ASTM D4587)

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, piping and electrical to verify actual locations and sizes before chiller installation and other conditions that might affect chiller performance, maintenance, and operation. Equipment locations shown on drawings are approximate. Determine exact locations before proceeding with installation.

### **3.2 EQUIPMENT INSTALLATION**

A. Install chiller on concrete base with isolation pads or vibration isolators.

1. Concrete base is specified in Section 03 30 00, CAST-IN-PLACE CONCRETE
2. Vibration isolator types and installation requirements are specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT
3. Anchor chiller to concrete base according to manufacturer's written instructions.
4. Charge the chiller with refrigerant, if not factory charged.
5. Install accessories and any other equipment furnished loose by the manufacturer, including remote starter, remote control panel, and remote flow switches, according to the manufacturer written instructions and electrical requirements.
6. Chillers shall be installed in a manner as to provide easy access for tube pull and removal of compressor and motors etc.
- B. Install refrigerant monitoring and safety equipment in accordance with ASHRAE Standard 15.
- C. Install refrigerant piping as specified in Section 23 23 00, REFRIGERANT PIPING and ASHRAE Standard 15.
- D. Install thermometers and gages as recommended by the manufacturer and/or as shown on drawings.
- E. Piping Connections:
  1. Make piping connections to the chiller for chilled water, condenser water, and other connections as necessary for proper operation and maintenance of the equipment.
  2. Make equipment connections with flanges and couplings for easy removal and replacement of equipment from the equipment room.

### **3.3 STARTUP AND TESTING**

- A. Engage manufacturer's factory-trained representative to perform startup and testing service.
- B. Inspect, equipment installation, including field-assembled components, and piping and electrical connections.
- C. After complete installation startup checks, according to the manufacturers written instructions, do the following to demonstrate to the VA that the equipment operate and perform as intended.
  1. Check refrigerant charge is sufficient and chiller has been tested for refrigerant leak.
  2. Check bearing lubrication and oil levels.
  3. Verify proper motor rotation.
  4. Verify pumps associated with chillers are installed and operational.
  5. Verify thermometers and gages are installed.



6. Verify purge system, if installed, is functional and relief piping is routed outdoor.
  7. Operate chiller for run-in-period in accordance with the manufacturer's instruction and observe its performance.
  8. Check and record refrigerant pressure, water flow, water temperature, and power consumption of the chiller.
  9. Test and adjust all controls and safeties. Replace or correct all malfunctioning controls, safeties and equipment as soon as possible to avoid any delay in the use of the equipment.
  10. Prepare a written report outlining the results of tests and inspections, and submit it to the VA.
- D. Engage manufacturer's certified factory trained representative to provide training for 8 hours for the VA maintenance and operational personnel to adjust, operate and maintain equipment, including self-contained breathing apparatus.

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