

SECTION 23 64 00
PACKAGED WATER CHILLERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scroll air-cooled chillers with complete accessories.

1.2 RELATED WORK

- A. Section 00 72 00, GENERAL CONDITIONS.
- B. Section 01 00 00, GENERAL REQUIREMENTS.
- C. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- E. Section 23 21 23, HYDRONIC PUMPS.
- F. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- G. Section 23 23 00, REFRIGERANT PIPING.
- H. Section 23 21 13, HYDRONIC PIPING.
- I. Section 23 31 00, HVAC DUCTS AND CASINGS
- J. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
- K. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

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.
- E. LonMark: An association comprising of suppliers and installers of LonTalk products. The Association provides guidelines for the implementation of the LonTalk protocol to ensure interoperability through Standard implementation.
- F. LonTalk: An open standard protocol developed by the Echelon Corporation that uses a "Neuron Chip" for communication.
- G. LonWorks: Network technology developed by the Echelon Corporation.

1.4 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, 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 ARI requirements for testing and certification of the chillers.
- D. Refer to paragraph, WARRANTY, Section 00 72 00, GENERAL CONDITIONS, except as noted below:
1. A 5-year motor/transmission/compressor warranty shall be provided based upon the RPM of the compressor as follows:

Compressor RPM	Warranty Term
0-5000	1 year from start up
5001-10,000	5 years from start up
10,001 and above	5 years plus annual oil analysis
 2. A 5-year parts and labor warranty shall be provided on any reciprocating compressor.
- E. Refer to OSHA 29 CFR 1910.95(a) and (b) for Occupational Noise Exposure Standard.
- F. Refer to ASHRAE Standard 15, Safety Standard for Refrigeration System, for refrigerant vapor detectors and monitor.

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. American Refrigeration Institute (ARI):
- 210/ 240-03.....Unitary Air Conditioning and Air-Source Heat Pump Equipment
 - 370-01.....Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment
 - 495-99.....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):
- 15-02.....Safety Standard for Mechanical Refrigeration Systems
 - 3-96.....Guidelines for Reducing Emission of Halogenated Refrigerants in Refrigeration and Air-Conditioning Equipment and Systems

- D. American Society of Mechanical Engineers (ASME):
1998ASME Boiler and Pressure Vessel Code, Section
VIII, "Rules for Constructive Pressure Vessels"
- E. American Society of Testing Materials (ASTM):
C 534-03.....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):
250-03.....Enclosures for Electrical Equipment (1000 Volts
Maximum)
- G. National Fire Protection Association (NFPA):
70-05.....National Electrical Code
- H. Underwriters Laboratories, Inc. (UL):
1995-99..... 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 ARI 550/590/Standard.
 - d. Refrigerant
 - e. Fan performance
 - f. Accessories.
 - g. Installation instructions.
 - h. Start up procedures.
 - i. Wiring diagrams, including factor-installed and field-installed wiring.
 - j. Noise data report. Manufacturer shall provide noise 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 ARI 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 RECIPROCATING, ROTARY-SCREW, AND SCROLL WATER CHILLERS**

- A. General: Factory- assembled and-tested scroll water chillers, complete with evaporator, compressors, motor, starters, integral or remote 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 with any of the refrigerants, HCFC-22, HCFC-134a, HCFC-407c, or HCFC-410a.
- B. Applicable Standard: Chillers shall be rated and certified according to ARI 550/590, and shall be stamped in compliance with ARI certification.
- C. Compressor (Rotary-Screw Type): Positive-displacement oil injected type, direct drive, cast-iron casing, precision-machined for minimum clearance about periphery of rotors. Lubrication system shall provide oil at proper temperature to all moving parts. Capacity control shall be by means of single slide valve to modulate the capacity from 100 to 25 percent of full unit rated capacity without unstable compressor operation. The slide valve shall be hydraulically operated upon the actuation of temperature or pressure sensor.
- D. 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.
- E. Refrigerants Circuit: Each circuit shall contain include an expansion valve and discharge shutoff valves, replaceable-core filter drier, sight glass with moisture indicator, liquid-line solenoid valve and insulated suction line.
- F. 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.
- G. Condenser: Water-cooled as shown on the drawings and specified hereinafter.
- H. Evaporator: Evaporator shall be factory insulated.

- I. Controls: Chiller shall be furnished with unit mounted, stand-alone, microprocessor-based controls in NEMA 3R enclosure, hinged and lockable, factory wired with a single point power connection and separate control circuit. The control panel provides 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 and condenser 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. Condenser water temperature.
 - c. Entering and leaving chilled water temperature and control set points.
 - d. 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.
- J. The chiller control panel shall provide leaving chilled water temperature reset based on 4-20 ma or 0-10 VDC signal from Energy Control Center (ECC).
- K. Provide contacts for remote start/stop, alarm for abnormal operation or shutdown, and for Engineering Control Center (ECC).
- L. Chiller control panel shall either reside on the "LonTalk FTT-10a network", and provide data using LonMark standard network variable types and configuration properties, or BACnet interworking using ARCNET or MS/TP physical data link layer protocol for communication with building automation control system.
- M. Auxiliary hydronic system and the chiller(s) shall be interlocked to provide time delay and start sequencing.

- N. Motor: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION. 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 AND STEAM GENERATION EQUIPMENT. Starting torque of motors shall be suitable for driven machines.
- O. Motor Starter: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION. 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, LOW-VOLTAGE MOTOR STARTERS for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

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. Extend vent piping from the relief valve or rupture disk and purge system to the outside.

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 2 hours for the VA maintenance and operational personnel to adjust, operate and maintain equipment, including self-contained breathing apparatus.

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