

SECTION 23 64 00
PACKAGED WATER CHILLERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Deleted.
- B. Rotary-Screw air-cooled chillers complete with 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. Deleted.
- E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- F. Section 23 21 23, HYDRONIC PUMPS.
- G. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- H. Deleted.
- I. Section 23 21 13, HYDRONIC PIPING.
- J. Deleted.
- K. Deleted.
- L. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.
- M. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.
- N. Deleted.
- O. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS
- P. 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.
- E. Deleted.

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 AHRI requirements for testing and certification of the chillers.
- D. Refer to paragraph, WARRANTY, Section 00 72 00, GENERAL CONDITIONS, except as noted below:
 - 1. 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
- F. Deleted.
- G. Deleted.

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
- 575
- 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):
 - 2007ASME 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. Rotary-screw water chillers, including motor starters, control
panels, and vibration isolators 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.
- k. Deleted.

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.

F. Deleted.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL/ROTARY-SCREW/SCROLL/WATER-COOLED WATER CHILLERS: NOT USED

2.2 ABSORPTION WATER CHILLERS: NOT USED

2.3 ROTARY-SCREW AIR-COOLED WATER CHILLERS

- A. General: Factory-assembled and-tested rotary-screw or 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, mounted on a single welded steel base. 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 be less than 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 (I-P), and ANSI/AHRI Standard 550/590 (I-P), and shall be stamped in compliance with AHRI certification.
- E. Acoustics: Unit shall include compressor muffler and low noise condenser fan as standard. Unit shall also include insulating sound material on the suction and discharge lines of each refrigerant circuit, a flexible metallic connection at the suction and discharge of each compressor, a sound box enclosure for each compressor and fan speed control for sound reduction. Sound pressure levels shall be provided as part of submission. Testing shall be in accordance with AHRI requirements.
- F. Compressor (Rotary-Screw Type): Positive-displacement oil injected type, semi-hermetic, direct drive, cast-iron casing, precision-machined for minimum clearance about periphery of rotors. The motor shall be suction gas cooled, hermetically sealed, with a permanent magnet motor. Lubrication system shall provide oil at proper temperature to all moving parts. Provide an oil separator, separate from the compressor, and oil filtration internal to the compressor. Capacity control shall be by means of a variable speed drive to modulate the capacity from 100 to 30 percent of full unit rated capacity without unstable compressor

operation. Each refrigeration circuit shall have a compressor drive cooling circuit, including a wet rotor circulation pump that circulates a secondary heat transfer fluid in a closed system between the adaptive drive components in the control panel and a brazed plate heat exchanger.

G. Deleted.

H. Refrigerants Circuit: Each circuit shall include one rotary screw compressor, along with an electronic 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.

I. 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.

J. 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, internally finned seamless aluminum tubes mechanically bonded to aluminum fins. For corrosion protection, see Paragraph 2.7 below. Condenser coils shall be factory proof tested at 3105 kPa (525 psig), and leak tested at 150 psig. Condenser fans shall be propeller, low noise type, directly connected to motor shaft. Fans shall be statically and dynamically balanced, with wire safety guards. Condenser fan motors shall have permanently lubricated ball bearings, permanent magnet motors with integral drive to provide variable speed fan control for all fans. Provide internal temperature and current overload protection. Units shall have grilles factory mounted to prevent damage to coil surfaces. Provide additional protective ice breaking structure to protect from ice shed from roof above.

3. Deleted.

K. Evaporator: Shell and tube design with externally and internally finned seamless copper tubes roller expanded into tube sheets. Designed, tested, and stamped in accordance with applicable portions of ASME

Boiler and Pressure Vessel Code, Section VIII, for working pressure produced by the water system, but not less than 1035 kPa (150 psig). Refrigerant side working pressure shall comply with ASHRAE Standard 15. Shell shall be constructed of carbon steel. For the waterside of liquid cooler the performance shall be based on a water velocity not less than 1 m/s (3 fps) with a maximum water velocity of 3 m/s (10 fps) and a fouling factor 0.0000176 m² degrees C (0.0001 hr. sq. ft.) degrees F/Btu. 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.

- L. 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.
- M. 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.
- N. Controls: Chiller shall be furnished with unit mounted, stand-alone, microprocessor-based controls in IP56 rated 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 full color touch screen display.
 - 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. Deleted.
 - 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. Deleted.
 - 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.
- O. The chiller control panel shall provide leaving chilled water temperature reset based on return water temperature.
- P. Deleted.
- Q. Chiller control panel shall reside on the BACnet interworking using BACnet protocol for communication with building automation control system.
- R. Auxiliary hydronic system and the chiller(s) shall be interlocked to provide time delay and start sequencing as indicated on control drawings.
- S. 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.
- T. Motor Starter: Provide chiller compressors with adaptive frequency drives for capacity control and compressor motor protection from over

current, low or high line voltage, phase loss, incoming phase imbalance and over temperature.

2.4 CONDENSING UNITS FOR AIR CONDITIONING SERVICE: NOT USED

2.5 CONDENSERS: NOT USED

2.6 REFRIGERANT MONITORING AND SAFETY EQUIPMENT: NOT USED

2.7 CORROSION PROTECTION

- A. Deleted.
- B. Exposed Outdoor Cabinet: Unit panels, structural elements and control boxes shall be constructed of galvanized steel, and mounted on a galvanized steel base. Casing Surfaces (Exterior and Interior): All exposed and accessible metal surfaces shall be protected with a baked on powder paint. All paint shall meet the requirement of outdoor equipment of the US Navy and other federal government agencies.

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.
 - 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. Deleted.

- C. Deleted.
- 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, and other connections as necessary for proper operation and maintenance of the equipment.
 - 2. Deleted.
 - 3. Deleted.

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. Deleted.
 - 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.

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