

SECTION 23 64 10
AIR COOLED WATER CHILLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Chiller package
- B. Charge of refrigerant and oil
- C. Controls and control connections
- D. Chilled water connections
- E. Starters
- F. Electrical power connections

1.2 REFERENCES

- A. ARI 550/590 – Standard for Performance Rating of Water Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle
- B. ASHRAE 15 - Safety Standard for Refrigeration Systems
- C. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings
- D. ASME BPVC SEC 8 - Boiler and Pressure Vessel Code
- E. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus
- F. NEMA MG 1 - Motors and Generators
- G. UL 1995 – Heating and Cooling Equipment

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections.
 - 1. Indicate valves, strainers, and thermostatic valves required for complete system.
- C. Submit product data indicating rated capacities, weights, acoustical properties, specialties, and accessories, electrical requirements and wiring diagrams.
- D. Submit written certification that components of package not furnished by manufacturer are in accordance with manufacturer requirements.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit operations and maintenance data under provisions of Section 01 77 00.
- B. Include startup instructions, maintenance data, parts lists, controls, accessories, and trouble-shooting guide.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ARI 550/590 - code for testing and rating of water chillers.
- B. Conform to UL 1995 - code for construction of water chillers.
- C. Conform to ASME BPVC SEC 8 Boiler and Pressure Vessel Code for construction and testing of water chillers.
- D. Conform to ASHRAE 15 code for construction and operation of water chillers.
- E. Chiller shall have sound properties enabling conformance to Land Development Code of Palm Beach County, "Prohibited Sound Levels", using basic noise reduction techniques including unit location, orientation, distance factor, and attenuation through use of barrier walls.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00.
- B. Store and protect products under provisions of Section 01 60 00.
- C. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- D. Protect units on site from physical damage.

1.7 WARRANTY

- A. Provide 10-year warranty under provisions of Section 01 77 00.
- B. Include 10-year parts and labor coverage for complete chiller package as manufactured and delivered to the site including but not limited to compressor, compressor motor, condenser coils, evaporator bundle, fan motors, controls, and refrigerant piping.

1.8 COMMISSIONING

- A. Commissioning of a system or systems specified in this section is part of the construction process.
- B. Factory performance test in accordance with AHRI 550/590 with certified test report showing full load efficiency and capacity.
- C. Training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Authority.
- D. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure.
- E. Refer to Section 01 77 00 - Contract Closeout, for substantial completion details.
- F. Refer to Section 01 91 00 - Commissioning, for detailed commissioning requirements

1.9 MAINTENANCE SERVICE

- A. Furnish service and maintenance of complete assembly for 1-year from Date of Substantial Completion in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. York
- B. Trane
- C. Daikin

2.2 MANUFACTURED UNITS

- A. Provide factory assembled and tested outdoor air-cooled liquid chillers consisting of compressors, condenser, evaporator, thermal expansion valve, refrigeration accessories, and control panel.
 - 1. Construction and ratings shall be in accordance with ARI 550/590.
 - 2. All components and surfaces subject to sweating or corrosion shall be factory painted and insulated with a minimum of 1.25" thick closed cell insulation.
 - 3. Any optional insulation kits shall be included and factory installed.
 - 4. Upon loss of power the units shall have the ability restart within 120 seconds of power restoration.
- B. The Engineer shall refer to FPL Commercial/Industrial HVAC Trade Ally Program Standards and select chillers with EER ratings that qualify for incentive rebate payments from FPL.
 - 1. The Contractor shall supply and install units meeting the minimum EER ratings.
- C. Provide two air-cooled chillers with total capacity equal 110% of the total design-cooling load.
 - 1. Size the chillers equally at 55% each, or unequally between 44% and 66% of the total design-cooling load.
 - 2. Design chiller plant to deliver chilled water at temperature not exceeding 44°F.
 - 3. Use a value of 0.00025 for fouling factor.
 - 4. For 50% vented enclosure or 3-sided (or less) solid wall enclosure use 95°F air entering condenser.
 - 5. For 4-sided solid wall enclosure, use 105° F air entering condenser.
- D. Use the approved manufacturer's formula to determine minimum chilled water GPM requirements.
- E. The proposed bid shall list noise reduction options and prices available from the equipment manufacturer.

1. Provide with factory sound reduction baffle hoods and/or noise reduction blankets on the compressors and low noise condenser fans with discharge extension hoods or equivalent to meet local noise code requirements of less than 50 dbA measured at the property lines.

2.3 COMPRESSORS

- A. Screw: Semi-hermetic helical rotary with heat-treated forged steel or ductile iron shafts, and sealing surface immersed in oil with the following features.
 1. Statically and dynamically balanced rotating parts with vibration isolators.
 2. Oil lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping, and normal operation.
 3. Automatic compressor capacity reduction consisting of capacity control slide valve or other means of capacity modulation.
 4. Compressor motor shall have suction gas or liquid refrigerant cooling with electronic winding overheating protection, designed for across the line or wye delta starting for 3-phase 480 volt electrical service.
- B. Scroll: Fully hermetic and dynamically, balance rotating parts and with vibration isolators with the following features.
 1. Direct drive suction gas cooled motor.
 2. Completely enclosed compression chamber to maximize efficiency.
 3. Internal overload protection for each compressor.
 4. Centrifugal oil pump, oil level sight glass and oil charging valve for each compressor.
 5. Crankcase heater for each compressor to minimize the amount of liquid refrigerant present in the oil sump during off cycles.
 6. Rated for 3-phase 480 volt electrical service.

2.4 EVAPORATOR

- A. Provide shell and tube type evaporator, seamless or welded steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral fins, rolled or silver brazed into tube sheets.
 1. Provide multiple refrigerant circuits on multiple compressor units.
 2. Stainless steel brazed plate heat exchangers are acceptable for scroll compressors.
 3. Heat exchangers shall be designed to withstand a refrigerant side working pressure of 400 psig and a waterside working pressure of 100 psig.
- B. Design, test, and stamp refrigerant side for 225-psig working pressure and waterside for 150-psig working pressure, in accordance with ASME BPVC SEC 8.
- C. Provide flexible insulation with maximum K value of 0.28 at 75° F.
- D. Provide water drain connection and thermometer wells for temperature controller and low temperature cutout.

2.5 CONDENSERS

- A. Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing.
 1. Provide sub-cooling circuits with liquid accumulators.
 2. Air test the unit under water to a minimum pressure of 425-psig.
- B. ALL condenser coils shall have corrosion protective coating covering all copper tubes, u-bends, and aluminum fins. Provide condenser coil coating as specified in the design documents. Approved coil coating materials shall include one of the following:
 1. Blygold PoluA1 XT by Blygold of Florida HVAC Corrosion Protection
 2. Coating process by Eisenheiss
 3. Field applied Oxiguard.
 4. HVAC Armor by ECM Group South Florida

- C. All coating materials and methods must pass a minimum of 10000 hours of salt spray exposure in a testing performed by an independent laboratory in accordance with ASTM B117
 - 1. The company providing coating process shall be acceptable to the equipment manufacturer and shall provide a 10-year coil limited warranty.
 - D. Provide vertical discharge direct driven low speed propeller type condenser fans with high volume blades, and extended discharge air stacks and fan guards.
 - 1. Equip with roller or ball bearings with grease fittings extended to outside of casing.
 - E. Provide fan motors with permanently lubricated ball bearings and built-in current and overload protection refer to section 23 05 13.
 - F. Straighten or replace all damaged coil fins.
 - G. Condenser coil shall not have more than 15 fins per inch.
- 2.6 ENCLOSURES
- A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.
 - B. Provide unit mounted starters and disconnects in weatherproof panel provided with full opening access doors.
 - 1. Provide mechanical interlock to disconnect power when door is open.
 - C. Tight all screws and bolts to minimize noise.
- 2.7 HEAT RECOVERY CONDENSERS (Requires written permission from the District)
- A. Provide factory installed or approved heat recovery condensers of shell and tube type, seamless or welded stainless steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral fins, rolled, or silver brazed into tube sheets.
 - 1. Factory approved third party heat recovery equipment shall not void the manufacturer's warranty.
 - B. Design, test, and stamp refrigerant side for 450-psig working pressure in accordance with ANSI/ASME SEC. 8.
 - C. Provide 450-psig safety relief valves on condenser shell.
 - D. Design, test, and stamp water side for 150-psig working pressure in accordance with ASME BPVC SEC. 8.
- 2.8 REFRIGERANT CIRCUIT
- A. Provide refrigerant circuits, factory installed and piped refer to Section 23 23 00.
 - B. Provide for each refrigerant circuit:
 - 1. Liquid line solenoid valve
 - 2. Filter dryer (replaceable core type)
 - 3. Liquid line brass-body sight glass and moisture indicator
 - 4. Expansion valve sized for maximum operating pressure
 - 5. Charging valve
 - 6. Insulated suction line
 - 7. Discharge line check valve
 - 8. Compressor discharge and suction service valve
 - 9. Condenser pressure relief valve
- 2.9 CONTROLS: Provided by the chiller manufacturer and to include a translator/interface module compatible with the Owner's Energy Management Control System (EMCS) hardware and software, see design drawings with controls schematics and sequence of operations for details.
- A. On chiller, mount weatherproof, galvanized steel control panel to include single main disconnect for single point power feeder and factory wiring to internally powered starters and controls.
 - B. For each compressor, provide across-the-line starter, non-recycling compressor overload, starter relay, and control power transformer. Provide manual reset current overload protection.

- C. Provide the following safety controls arranged so that operating any one will shut down machine and require manual reset:
 - 1. Low chilled water temperature switch.
 - 2. High-discharge pressure switches for each compressor circuit.
 - 3. Low-suction pressure switches for each compressor circuit.
 - 4. Oil pressure switch
 - 5. Flow switch in chilled water line.
 - 6. Relay for remote mounted emergency shutdown switch.
- D. Provide the following operating controls:
 - 1. Multi-step or variable unloading chilled water temperature controller that cycles compressors (scroll) or variably unloads compressors (helical rotary/screw).
 - 2. Five minute off timer prevents compressor from short cycling.
 - 3. Periodic pump-out timer to pump down on chilled water flow and high evaporator refrigerant pressure.
 - 4. Solenoid valve between the heat recovery condenser and the receiver, limits refrigerant level in condenser.
 - 5. Load limit thermostat to limit compressor loading on high return water temperature.
 - 6. Provide a self-diagnostic digital display module with microprocessor for each chiller located in control panel.
 - 7. When control voltage from EMS system is greater than 24 volts, provide a separate disconnect.
 - 8. Low ambient control is not required.
 - 9. Terminals for the external start-stop control
- E. Provide pre-piped gage board with pressure gages for suction and discharge refrigerant pressures, and oil pressures for each compressor circuit.
- F. For multiple chiller units use EMCS hardware and software lead-lag switching.
- G. Provide soft loading capabilities for compressors.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Align chiller on 8" high concrete foundation.
 - 1. Coordinate foundation size with manufacturer's dimensions to extend minimum 8" beyond unit, on each side.
 - 2. Foundation shall support chiller at ends and other key locations.
 - 3. It shall not extend under any compressor.
- C. Install units in vibration isolation; refer to Section 23 05 48.
- D. Connect to electrical service underground; refer to Section 26 05 19.
- E. Connect to chilled water piping; refer to Section 23 21 13.
 - 1. On inlet, provide thermometer well(s) for thermometer and temperature controller, flow switch, flexible pipe connector, and shutoff valve.
 - 2. On outlet, provide flexible pipe connector and shutoff valve, and thermometer well with thermometer.
- F. If applicable, connect to heat-recovery condenser water piping; refer to Section 23 21 13.
 - 1. On inlet, provide flexible pipe connector and shutoff valve.
 - 2. On outlet, provide flexible pipe connector, shutoff, and balancing valve.
- G. Arrange chillers and piping to include all required maintenance service clearances and easy dismantling to permit tube cleaning, coil cleaning, removal of tubes, removal of compressors, etc.

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- H. Provide flanged connections with shut-off valves and blank flanges for connections of future emergency chiller.
 - I. When using multiple chillers, make provisions to simulate flow (GPM) and pressure drop (ΔP) of any chiller.
 - 1. Achievable with permanent by-pass lines and valves, or the connections for future emergency chiller can be used with auxiliary by-pass system.
- 3.2 MANUFACTURER'S FIELD SERVICES
- A. Prepare and start systems under provisions of Section 01 60 00 and 23 08 00.
 - B. Supply service of factory-trained representative to install heat recovery system, perform testing, dehydration and charging of machine, start-up, and instruction on operation and maintenance to Owner's satisfaction.
 - C. Supply initial charge of refrigerant and oil.
 - D. Contractors' startup shall be scheduled and documented in accordance with the commissioning requirements.
 - 1. Refer to Section 01 91 00, Commissioning, for further details.
- 3.3 DEMONSTRATION
- A. Provide systems demonstration under provisions of Section 01 75 00.
 - B. Demonstrate system operation and verify specified performance, refer to Section 23 08 00.
- 3.4 SCHEDULE
- A. Provide a schedule on the drawings to include the following data:
 - 1. Manufacturer
 - 2. Model Number
 - 3. Cooling Capacity
 - 4. Evaporator
 - a. Water Flow
 - b. Entering Water Temperature
 - c. Leaving Water Temperature
 - d. Pressure Drop
 - e. Fouling Factor
 - 5. Condenser
 - a. Entering Air Temperature
 - b. Condensing Temperature
 - 6. Heating Recovery Condenser (if applicable)
 - a. Type
 - b. Water Flow
 - c. Entering Water Temperature
 - d. Leaving Water Temperature
 - e. Pressure Drop
 - f. Fouling Factor
 - 7. Compressor
 - a. Number
 - b. Steps Unloading
 - c. RPM
 - d. Starter Type
- 3.5 FUNCTIONAL PERFORMANCE TESTING
- A. System Functional Performance Testing is part of the Commissioning Process.
 - 1. The Contractor shall perform the Functional Performance Testing and the Commissioning Authority shall witness and document the test.

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2. Refer to Section 01 91 00, Commissioning, for functional performance tests and commissioning requirements.
 - B. Systems Readiness Checklists shall be completed and submitted for each piece of equipment included in this section.
 - C. Include the functional performance testing of HVAC pumps as part of the Chilled Water System Functional Performance testing.
- 3.6 DEMONSTRATION AND TRAINING
- A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative.
 1. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.
 2. Schedule the instruction in coordination with the Owner's Representative after submission and approval of formal training plans.
 3. Refer to Section 01 91 00, Commissioning, for further contractor training requirements
 - B. Provide demonstration and training for all installed equipment on this project covered by this section.

END OF SECTION