

SECTION 15680
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. ANSI/ARI 550/590-98 - Water Chilling Packages.
- B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.
- D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code
- E. ANSI/NEMA MG 1 - Motors and Generators.
- F. ANSI/UL 465 - Central Cooling Air Conditioners.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01300.
- B. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate valves, strainers, and thermostatic valves required for complete system.
- C. Submit product data under provisions of Section 01300.
- D. Submit product data indicating rated capacities, weights, acoustical properties, specialties and accessories, electrical requirements and wiring diagrams.
- E. Submit written certification that components of package not furnished by manufacturer have been selected in accordance with manufacturer requirements.
- F. Submit manufacturer's installation instructions under provisions of Section 01300.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit operations data under provisions of Section 01700.
- B. Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.
- C. Submit maintenance data under provisions of Section 01700.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ANSI/ARI 590 code for testing and rating of water chillers.
- B. Conform to ANSI/UL 465 code for construction of water chillers.
- C. Conform to ANSI/ASME SEC 8 Boiler and Pressure Vessel Code for construction and testing of water chillers.
- D. Conform to ANSI/ASHRAE 15 code for construction and operation of water chillers.

- E. Chiller shall have sound properties to that conform to local jurisdiction “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 01600.
- B. Store and protect products under provisions of Section 01600.
- 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 five-year warranty under provisions of Section 01700.
- B. Warranty: Include five-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 MAINTENANCE SERVICE

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Carrier
- B. York
- C. Trane
- D. Engineer and Owner approved equal.

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. Construction and ratings shall be in accordance with ANSI/ARI 590. All components and surfaces subject to sweating and/or corrosion shall be factory painted and insulated. Any optional insulation kits shall be included and factory installed.
- B. The Engineer shall refer to FPL Commercial/Industrial HVAC Trade Ally Program Standards and make effort to select chillers with EER ratings that qualify for incentive rebate payments from FPL.
- C. Provide two air-cooled chillers with total capacity equal 110% of the total design-cooling load. The chillers can be sized equally at 55% each, or unequally between 44% and 66% of the total design-cooling load. Design chiller plant to deliver chilled water at temperature not exceeding 44°F. Value of 0.00025 shall be used for fouling factor. For 50% vented enclosure or 3-sided (or less) solid wall enclosure use 95°F air entering condenser. 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. 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. Construct semi-hermetic or hermetic reciprocating compressors with heat treated forged steel or ductile iron shafts, aluminum alloy connecting rods, automotive type pistons, rings to prevent gas leakage, suction and discharge valves, and sealing surface immersed in oil. Screw or scroll compressors with limited oil migration, noise control and acceptable EER are also allowed.
- B. Statically and dynamically balance rotating parts and mount on vibration isolators. Refer to Section 15252.
- C. Provide reversible, positive displacement, oil pump lubrication system with oil charging valve, oil level sight glass, oil filter, and magnetic plug on strainer, arranged to ensure adequate lubrication during starting, stopping, and normal operation.
- D. Provide compressor with automatic capacity reduction unloaders. Suction unloaders are not acceptable because they cannot be controlled with Energy Management Control System. Provide for unloaded compressor start.
- E. Compressor motor shall have suction gas or liquid refrigerant cooling system with solid-state sensor and electronic winding overheating protection, designed for across-the-line starting. Furnish with starter.
- F. Provide crankcase heater to evaporate refrigerant returning to crankcase during shut down.
- G. Compressor motor shall be rated 3-phase 480 Volt

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. Provide multiple refrigerant circuits on multiple compressor units.
- B. Design, test, and stamp refrigerant side for 225 psig working pressure and water side for 150 psig working pressure, in accordance with ANSI/ASME 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. Provide sub-cooling circuits with liquid accumulators. Air test under water to 425 psig.
- B. ALL condenser coils shall have corrosion protective coating covering copper tubes and aluminum fins. Provide condenser coil coating as specified in design documents. Approved coil coating materials and methods shall include one of the following:
 - 1. Process equal to the Bronz-Glow as patented and manufactured by Bronz-Glow Southeast Corp. (Jacksonville, FL).
 - 2. Coating process by Eisenheiss and Heresite
 - 3. Field applied Oxiguard.
 - 4. Black-Fin is NOT acceptable
- C. All coating materials and methods must pass a minimum of 3000 hours of salt spray exposure in a testing performed by an independent laboratory in accordance with ASTM B117.85. The company providing coating process shall also provide a five-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. 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.
- F. All damaged coil fins shall be straightened or replaced.
- 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. Provide mechanical interlock to disconnect power when door is opened.
- C. All screws and bolts shall be tightened to minimize noise.

2.7 HEAT RECOVERY CONDENSERS (Requires written permission from Florida Tech)

- 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. 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 ANSI/ASME SEC. 8.

2.8 REFRIGERANT CIRCUIT

- A. Provide refrigerant circuits, factory installed and piped. 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 – by chiller manufacturer including translator/interface module compatible with Owner's Energy Management Control System (EMCS) hardware and software. For details refer to design drawings with controls schematics and sequence of operations.

- 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 switch for each compressor circuit.
 3. Low suction pressure switch for each compressor circuit.
 4. Oil pressure switch.
 5. Flow switch in chilled water line.
 6. Relay for remote mounted emergency shut-down switch.
- D. Provide the following operating controls:
1. Multi-step chilled water temperature controller that cycles compressors and activates cylinder unloaders.
 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 heat recovery condenser and receiver to limit refrigerant level in condenser.
 5. Load limit thermostat to limit compressor loading on high return water temperature.
 6. Hot gas bypass sized for minimum compressor loading on one compressor only, bypasses hot refrigerant gas to evaporator.
 7. Provide a self-diagnostic digital display module with microprocessor for each chiller located in control panel.
 8. When control voltage from EMS system is greater than 24 volts, provide a separate disconnect.
 9. Low ambient control is not required.
 10. Terminals for 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 lead-lag switching will be controlled by EMCS hardware and software.
- 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. Coordinate foundation size with manufacturer's dimensions to extend minimum 8" beyond unit, on each side. Foundation shall support chiller at ends and other key locations. It shall not extend under any compressor.
- C. Install units in vibration isolation. Refer to Section 15252.
- D. Connect to electrical service underground. Refer to Section 16180.
- E. Connect to chilled water piping. Refer to Section 15510. On inlet, provide thermometer well(s) for thermometer and temperature controller, flow switch, flexible pipe connector, and shut-off valve. On outlet, provide flexible pipe connector and shut-off valve, and thermometer well with thermometer.
- F. If applicable, connect to heat recovery condenser water piping. Refer to Section 15510. On inlet, provide flexible pipe connector and shut-off valve. On outlet, provide flexible pipe connector and shut-off 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.
- 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. This could be achieved 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 01600 and 15990.
- 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.

3.3 DEMONSTRATION

- A. Provide systems demonstration.
- B. Demonstrate system operation and verify specified performance. Refer to Section 15990.

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

END OF SECTION