SECTION 15686
WATER COOLED ROTARY 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. Condenser water connections.
F. Auxiliary water connections.
G. Starters.
H. Electrical power connections.

1.2 REFERENCES

A. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
B. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.
C. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code.
D. ANSI/UL 465 - Central Cooling Air Conditioners.
E. ARI 550 - Centrifugal or Rotary Water - Chilling Packages.

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 equipment, piping and connections, 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, 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's requirements.
F. Submit manufacturer's installation instructions under provisions of Section 01300.
G. Submit performance data indicating energy input versus cooling load output from 0% to 100% of full load at specified and minimum condenser water temperature.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit operation data under provisions of Section 01700.
B. Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide and installation manual. Provide expanded breakdown of machine including parts list and number, factory generated service repair manuals and complete as-built wiring diagram of machine and controls.
C. Submit maintenance data under provisions of Section 01700.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture of the products specified in this Section with minimum five years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to ARI 550 code for testing and rating of centrifugal or rotary chillers.
B. Conform to ANSI/UL 465 code for construction of centrifugal or rotary chillers.
C. Conform to ANSI/ASME SEC 8 Boiler and Pressure Vessel Code for construction and testing of centrifugal or rotary chillers.
D. Conform to ANSI/ASHRAE 15 code for construction and operation of centrifugal or rotary chillers.
E. Provide certification of inspection for conforming authority having jurisdiction approval.
F. Mechanical equipment rooms where chiller components containing refrigerant are located shall meet all requirements of the FBC-M, Chapter 11, including but not limited to design, installation, construction, ventilation, refrigerant detection with alarms, safety equipment, system pressure testing and refrigerant leak testing.

1.7 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 from physical damage. Leave factory-shipping covers in place until installation.

1.8 WARRANTY

A. Provide five-year warranty under provisions of Section 01700.
B. Include warranty coverage for complete chiller package as manufactured and delivered to site including materials and labor.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of chillers for period of one year from Date of Substantial Completion in accordance with manufacturer's instructions.
B. Provide factory generated start-up reports to Owner upon commissioning air conditioning system, along with manufacturer's recommended periodic service reports.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Trane (Rotary Screw)
B. Carrier (Rotary Screw)
C. York (Rotary Screw)
D. Engineer and Owner approved equal.

2.2 MANUFACTURED UNITS

A. Provide factory assembled and tested, packaged, water cooled, liquid chillers consisting of rotary compressors, compressor motor, condenser, evaporator, refrigeration accessories, instrument and

control panel including gages and indicating lights, all optional auxiliary components and accessories, and motor starters. Construction and ratings shall be in accordance with ARI 550.

B. Units shall have Energy Efficiency Rating (EER) not less than prescribed by ANSI/ASHRAE 90A.

C. The Engineer should refer to FPL Commercial/Industrial HVAC Trade Ally Program Standards and select chillers with KW/ton or EER ratings that qualify for incentive rebate payments from FPL.

1. For cooling loads exceeding 600 tons of refrigeration the engineer shall design the central chiller plant to facilitate stable 1 to 3 hour operation at partial loads ranging from 3.6% to 18% of the total design cooling load. The alternatives may include two or three water-cooled centrifugal and/or screw compressor chillers. The use of one air-cooled chiller in the three-chiller alternative is allowed. For air-cooled chillers refer to Section 15680 and for centrifugal chillers refer to Section 15684.

D. Provide screw type rotary water chiller, having minimum capacity of 360 tons. Use chilled water-fouling factor of not less than 0.001 when supplied with 3 GPM/ton of condenser water at 85°F EWT with condenser fouling factor of not less than 0.001.

E. Design chiller plant to deliver chilled water at temperature not exceeding 44°F.

2.3 COMPRESSORS

A. Compressor shall be semi-hermetic, direct drive, 3600 RPM, rotary screw type with: capacity control system loading and unloading the chiller through adjustment of the compressor slide valve, integral single stage economizer, oil sump heater and differential pressure refrigerant oil flow system. Four pressure lubricated rolling element bearing groups shall support the rotating assembly.

B. Motor shall be a liquid refrigerant cooled, hermetically sealed, two-pole, squirrel cage induction type.

C. Compressor motor shall be 3-phase 480 Volt rated.

2.4 EVAPORATOR AND CONDENSER

A. Shells shall be carbon steel plate. Evaporator and condenser shall be designed, tested and stamped in accordance with ASME Code for refrigerant side working pressure of 300 psig.

B. All tube sheets shall be carbon steel. Evaporator and condenser tubes shall be individually replaceable. Standard tubes shall be externally finned, internally enhanced seamless copper with lands at the tube sheets. Tubes shall be mechanically expanded into tube sheets. Condenser tubes shall be mechanically fastened to tube supports. Condenser baffle shall prevent direct impingement of compressor discharge gas upon the tubes.

C. All water pass arrangements shall be available in either flat-faced flange 150 psig waterside. All connections shall be as detailed on drawings. Waterside shall be hydrostatically tested at 1-1/2 times design pressure, but not less than 225 psig.

D. Epoxy coat tube sheets and end bells in evaporator and condenser.

2.5 REFRIGERANT CIRQUIT

A. A multiple orifice system shall consist of an electronically controlled expansion valve and a fixed orifice, to maintain proper refrigerant flow.

B. The unit shall be factory pre-charged and all chillers in the chiller plant shall use the same EPA approved refrigerant.

2.6 PURGE SYSTEM

A. Purge system, where applicable shall consist of motor driven compressor, electrically heated oil separator, and baffled drum, to automatically remove non-condensibles and water vapor.
B. System shall automatically discharge non-condensable. Provide for manual blow-off of water vapor. Provide sight glass for monitoring purge condenser drum.

2.7 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 or near chiller, mount steel control panel containing solid state, fully automatic operating and safety controls.
B. Provide the minimum shown but not limited to safety controls arranged so that operating any one will shut down machine and require manual reset:
   1. High refrigerant (condenser) pressure.
   2. Low refrigerant (evaporator) temperature.
   3. Low refrigerant (evaporator) pressure.
   4. High bearing temperature.
   5. Motor winding temperature.
   6. Motor overload.
   7. Low chilled water temperature.
   8. Low oil pressure (differential pressure switch).
C. Provide the following safety controls arranged so that operating any one will shut down machine and automatically reset:
   1. Chilled water flow switch.
   2. Condenser water flow switch.
   3. Phase protection and delay start.
D. Provide the following devices on control panel face, each chiller.
   1. Machine off-auto switch.
   2. Machine selector switch to allow load, unload, hold or automatic operation.
   3. Sequential start pilot light.
   4. Operating pilot light.
   5. Condenser pressure gage.
   6. Evaporator pressure gage.
   7. Oil pressure gage.
   8. Oil pump pilot light.
   9. Oil pump switch (manual or automatic).
   10. Purge drum pressure gage.
   11. Purge pump pilot light.
   12. Purge pump switch (manual-off-auto).
   13. Purge oil separator heater pilot light.
   14. Purge oil separator heater switch.
   15. Evaporator low temperature cutout pilot light.
   16. Evaporator low-pressure cutout pilot light.
   17. Condenser high-pressure cutout pilot light.
   18. Demand limit switch.
   19. Motor driven elapsed run time meter.
   20. Start counter.
E. Provide the following operating controls:

1. Solid state, chilled water temperature controller which controls temperature within setting of 0.8°F and features adjustable load rate. Locate temperature sensor in leaving chilled water.
2. Adjustable thirty minute off timer prevents compressor from short cycling.
3. Demand limit device to manually set maximum current infinitely between 40% and 100% of full load amperes.
4. Provide condenser water temperature sensor. Installation shall include condenser water temperature control system to enable starting and stable operation of the rotary chiller.

F. Provide self-diagnostic digital display module with microprocessor to indicate faults.

2.8 STARTER

A. On or near chiller, mount steel NEMA 1 type enclosure, containing solid state closed transition starter, manufactured in accordance with chiller manufacturer's specifications and factory tested.
B. Enclosure shall be designed for bottom cable entry with front access. Door, interlocked with circuit breaker, shall accommodate padlock.
C. Mount the following devices within enclosure:
   1. Disconnect switch on line side with fuses.
   2. High interrupting capacity circuit breaker with ground fault protection.
   3. Pilot relays to start and stop compressor on signal from chiller control panel.
   4. Electronic overload provides overload protection, protects compressor motor from distribution system irregularities, phase protection with manual or automatic reset, and provides motor current signal to chiller capacity control module.
   5. Control power transformer.
   6. Fused control circuits for control circuit, oil pump motor, oil heater, and purge control unit.
   7. Contactor interlocks for communication between starter and control panel.
   8. Capacitors, one per phase, to correct power factor to minimum 95%.
   9. Fused disconnect and starter for oil pump.
D. Provide the following devices on starter door:
   1. Starter fault trip indicator and reset.
   2. Overload trip indicator and reset.
   3. Distribution fault trip indicator and reset.
   4. Ground fault trip indicator and reset.
E. Provide chiller sequencing panel
   1. For optimizing multiple chiller operation.
   2. Panel shall be made by chiller manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide for connection to electrical service. Include for connection of oil pump to separately fused circuit.
C. Provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit.
D. Align chiller on concrete foundations, sole plates, and sub-bases. Level, grout, and bolt in place.
E. Install units in vibration isolation.
F. Provide evaporator connections to chilled water piping. Refer to Section 15510. On inlet, provide thermometer well for temperature controller, thermometer well and thermometer, strainer, 1½" threaded weld-o-let for flow switch, flexible stainless steel corrugated pipe connector, pressure

gage, and shut-off valve. On outlet, provide thermometer well and thermometer, corrugated stainless steel flexible pipe connector, pressure gage, and shut-off valve.

G. Furnish and install necessary auxiliary water piping for oil cooling units and purge condensers with strainers and cut-off valves.
H. Insulate Evaporator and any other cold surfaces in accordance with manufacturer's instructions. Insulation materials shall meet Quality Assurance requirements of Section 15260.
I. Provide condenser connection to condenser water piping. Refer to Section 15510. On inlet, provide thermometer well and temperature limit controller, thermometer well and thermometer, strainer, 1¼" (minimum) weld-o-let and flow switch, flexible pipe connector, pressure gage, and shut-off valve. On outlet, provide thermometer well and thermometer, flexible pipe connector, pressure gage, and shut-off valve.
J. Arrange piping for easy dismantling and clearance to permit tube cleaning and removal.
K. Provide piping from chiller rupture disc to outdoors. Size as recommended by manufacturer, with removable flexible connection at disc.
L. Locate chillers to align with exterior doors for tube pull.
M. A minimum clearance of 3' must be maintained between chiller and nearest external system component and 6' between any two chillers or manufacturer's commendations which ever is greater.
N. Provide 5' clearance above top of chiller highest component.
O. Provide a trolley I-beam lifting structure built over chillers. Chiller supplier shall specify the recommended trolley lifting capacity to allow service and removal of heaviest chiller components.
P. Locate control panels facing each other for dual chillers. Three or more chiller panels will face same direction.

3.2 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under provisions of Section 01600.
B. Provide services of factory trained representative to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, calibrate controls, and instruct Owner on operation and maintenance to Owner's satisfaction.
C. Supply initial charge of refrigerant and oil.

3.3 DEMONSTRATION

A. Provide systems demonstration under provisions of Section 01670.
B. Start-up and demonstrate system operation and verify specified performance. Refer to Section 15990.
C. Provide equipment schedule on the drawings to include the following data:
    1. Manufacturer
    2. Model Number
    3. Cooling Capacity
    4. Refrigerant
    5. Unit EER
    6. Evaporator
        a. Water Flow
        b. Entering Water Temperature
        c. Leaving Water Temperature
        d. Pressure Drop
        e. Fouling Factor
    7. Condenser
        a. Water Flow

b. Entering Air Temperature
c. Leaving Water Temperature
d. Pressure Drop
e. Fouling Factor

8. Heating Recovery Condenser (if applicable)
   a. Water Flow
   b. Entering Water Temperature
   c. Leaving Water Temperature
   d. Pressure Drop
   e. Fouling Factor
9. Compressor
   a. Maximum Power Input
   b. Starter Type

END OF SECTION