SECTION 236410

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.

1.2 RELATED SECTIONS

A. Section 23 05 13 - Motors.

B. Section 23 05 48 - Vibration Isolation.

C. Section 23 05 93 - Testing, Adjusting, and Balancing.

D. Section 23 09 13 - Instruments and Control Elements.

E. Section 23 21 13 - Hydronic Piping.

F. Section 23 21 23 - HVAC Pumps.

G. Section 23 23 00 - Refrigeration Piping and Specialties.

H. Section 26 05 05 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. ARI 590 - Reciprocating Water - Chilling Packages.

B. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. ASHRAE 90A - Energy Conservation in New Building Design.

D. ASME SEC 8 - Boiler and Pressure Vessel Code.

E. NEMA MG 1 - Motors and Generators.

F. UL 465 - Central Cooling Air Conditioners.

1.4 SUBMITTALS

A. Submit under the provisions of Division 01.

B. Shop Drawings: Indicate 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. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements, and wiring diagrams.

D. Submit manufacturer's installation instructions.

E. Manufacturer's Certificate: Certify that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Submit under the provisions of Division 01.

B. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with a minimum of three (3) years' experience.

1.7 REGULATORY REQUIREMENTS

A. Provide certification of inspection for conforming authority having jurisdiction approval.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Section 23 05 00 - Material and Equipment: Transport, handle, store, and protect products.

B. Comply with the manufacturer's installation instructions for rigging, unloading, and transporting units.

C. Protect units from physical damage.

1.9 WARRANTY

A. Provide a five-year warranty under the provisions of Division 01.

B. Warranty: Include coverage for complete assembly including materials only.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Trane.

B. York.

C. Carrier.

D. Substitutions: Refer to Division 01.

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, testing, and ratings shall be in accordance with ARI 590.

B. Conform to UL 465 code for construction of reciprocating water chillers and provide UL label.

C. Conform to ASME SEC 8 Boiler and Pressure Vessel Code for construction and testing of reciprocating water chillers.

D. Conform to ASHRAE 15 code for construction and operation of water chillers.

2.3 HERMETIC COMPRESSORS

A. Scroll Compressors:
1. Unit: Direct drive, hermetic, 3600 RPM, fixed compression, scroll motor-compressor with control panel.
2. Features: Centrifugal oil pump, sump oil heater, oil level sight glass, oil charging valve, two-point lubrication for each motor bearing, flooded lubrication for the journal and thrust bearings, check valve on scroll discharge port.
3. Motor: Suction gas cooled, hermetically sealed, squirrel cage induction.
4. Controls:
    a) Starter section:
        1. Non-fused molded case disconnect switch.
        2. Single point power connection and grounding lug.
        3. Control power transformer with fuse.
        4. Solid state overload relay for each compressor.
        5. Phase loss/reversal monitor.
        6. Cycle counter and hour meter per compressor.
    b) Refrigeration section:
        1. Anti-recycle timer.
        2. Reset relay.
        3. Reset switch.
        4. Low- and high-pressure control.
        5. Motor winding temperature protection.
    c) Manual reset for compressor overload, high motor temperature, and low and high refrigerant pressure.
5. Automatic Capacity Reduction: Wire steps to terminal strip, refer to Section 23 09 93.

2.4 SEMI-HERMETIC COMPRESSORS

A. Screw Compressors:
1. Unit: Direct drive, semi-hermetic 3600 RPM, fixed compression, rotary screw compressor with control panel.
2. Features: Differential refrigerant pressure oil pump, oil heater, oil separator and filter, oil charging valve.
3. Motor: Suction gas cooled, hermetically sealed, squirrel cage induction.
4. Controls:
    a) Non-fused molded case disconnect switch.
    b) Single point power connection and grounding lug.
    c) Anti-recycle timer.
    d) Solid state overload relay for each compressor.
    e) Phase loss/reversal monitor.

f) Cycle counter and hour meter per compressor.
g) Low- and high-pressure control.
h) Automatic shutdown compressor overload and low and high refrigerant pressure.

5. Automatic Capacity Reduction: Continuously variable slide valve with infinitely variable control to 25 percent of full load.

2.5 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 ASME SEC 8.

C. Insulate with 0.75-inch minimum thick flexible expanded polyvinyl chloride insulation with maximum K value of 0.28. Provide heat tape to protect evaporator to -20 degrees F.

D. Provide water drain connection and thermometer wells for temperature controller and low temperature cutout.

2.6 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. Provide vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Provide factory mounted, louvered, galvanized steel coil guard panels.

C. Provide fan motors with permanently lubricated ball bearings and built-in current and overload protection. Refer to Section 23 05 13.

2.7 ENCLOSURES

A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.

B. Mount starters and disconnects in NEMA ICS 6 weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

2.8 REFRIGERANT CIRCUIT

A. Provide refrigerant circuits, factory supplied 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 sight glass and moisture indicator.
4. Thermal expansion valve sized for maximum operating pressure.
5. Charging valve.
6. Insulated suction line.
7. Discharge line check valve.
8. Compressor discharge service valve.
9. Condenser pressure relief valve.
10. Suction line accumulator.

2.9 CONTROLS

A. On chiller, mount NEMA ICS 6 weatherproof steel control panel, containing starters power and control wiring, molded case disconnect switch, factory wired with single point power connection.

B. For each compressor, provide an across-the-line starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection.

C. Provide safety controls with indicating lights arranged so anyone will shut down machine and require manual reset:
   1. Low chilled water temperature switch.
   2. High discharge pressure switch.
   3. Low suction pressure switch.
   4. Oil pressure switch.
   5. Flow switch in chilled water line.
   6. Relay for remote mounted emergency shut-down switch.

D. Provide operating controls:
   1. Multi-step chilled water temperature controller which cycles compressors and activates cylinder unloaders.
   2. Termination for connection to controls system to cycle compressors; refer to Section 23 09 13.
   3. Five minute off-timer prevents compressor from short cycling.
   4. Periodic pump-out timer to pump down on chilled water flow and high evaporator refrigerant pressure.
   5. Solenoid valve between heat recovery condenser and receiver to limit refrigerant level in condenser.
   6. Load limit thermostat to limit compressor loading on high return water temperature.
   7. Low ambient control consisting of external damper assembly, controls head pressure for operation down to 0 degrees F.
   8. Hot gas bypass sized for minimum compressor loading on one compressor only, bypasses hot refrigerant gas to evaporator.

E. For multiple units, provide remote mounted sequence panel to allow operation in parallel with lead-lag switching.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with the manufacturer's instructions.

B. Align chiller package on steel or concrete foundations.

C. Install units on vibration isolation. Refer to Section 23 05 48.

D. Connect to electrical service. Refer to Section 26 05 05.

E. Connect to chilled water piping. Refer to Section 23 21 13.
   1. On inlet, provide:
      a) Thermometer well for temperature controller.
      b) Thermometer well for temperature limit controller.
      c) Flexible pipe connector.
      d) Shut-off valve.

2. On outlet, provide:
    a) Flexible pipe connector.
    b) Balancing valve.

F. Arrange piping for easy dismantling to permit tube cleaning.

3.2 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Starting of Systems: Prepare and start systems.

B. Supply service of factory trained representative for a period of 2 days to supervise testing, dehydration and charging of machine, start-up, and instruction on operation and maintenance to Owner.

C. Supply initial charge of refrigerant and oil.

3.3 DEMONSTRATION AND INSTRUCTIONS

A. Division 01 - Contract Closeout: Demonstrating installed work.

B. Demonstrate system operation and verify specified performance. Refer to Section 23 05 93.

END OF SECTION