PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes packaged, water cooled or air cooled as scheduled, electric-motor-driven, rotary-screw water chillers with the following features:
   1. Motor controller.
   2. Microprocessor-based controls.

1.2 SUBMITTALS

A. Product Data: For each model indicated, provide the following:
   B. 1. Dimensioned prints of water chiller assemblies, including control panels, sections, and elevations, and unit isolation.
      2. Structural support requirements.
      3. Piping roughing-in requirements.
      4. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
      5. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.
   C. Operation and maintenance data.
   D. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. ARI Certification: Signed by manufacturer certifying compliance with requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
B. ASHRAE Certification: Signed by manufacturer certifying compliance with ASHRAE 15 for safety code for mechanical refrigeration. Comply with ASHRAE Guideline 3 for refrigerant leaks, recovery, and handling and storage requirements.
C. ASME Compliance: Fabricate and label water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
D. Comply with NFPA 70.
E. Comply with UL 1995.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to provide parts, labor and refrigerant to repair or replace components of water chillers that fail in materials or
workmanship within manufacturer’s standard warranty period, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Trane Company
   2. YORK International Corporation.
   3. Daikin

2.2 PACKAGED WATER CHILLERS

A. Description: Factory-assembled and -tested water-cooled, water chiller complete with compressor, evaporator, condenser, controls, interconnecting unit piping and wiring, indicated accessories, and mounting frame.
   –OR–

B. Description: Factory-assembled and -tested air-cooled, water chiller complete with casing, compressor, heat exchanger, condenser coils and fans, and controls integrated with compressor operation. Controls shall permit operation down to 25 degrees F.
   2. Fans: Propeller type, statically and dynamically balanced, with vertical air discharge for high efficiency and low sound; located in its own compartment to eliminate cross flow of condenser air during fan cycling; and equipped with heavy-gage, weather-protected fan guard.
   3. Fan Motor: Direct drive, weatherproof, with bearings permanently lubricated, and having built-in current- and thermal-overload protection.

2.3 COMPRESSORS

A. Description: Positive displacement, oil injected with direct-drive, semi-hermetically sealed motor/compressor assembly operating at 3,600 rpm and 60 Hz.
   1. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
   2. Rotors: Twin screw.
   3. The motor is a suction gas cooled, hermetically sealed, squirrel cage induction motor.

B. Capacity Control: Modulating or stepped sliding valve to maintain chilled-water temperature set point without hunting within throttling range. Throttling range shall be from 100 to 20 percent of full load at the scheduled entering condenser water temperature.

C. Oil Lubrication System: Positive-displacement submersible pump with heater, oil filter, and sight glass.

D. Refrigerant and Oil: HFC-134a.
E. Refrigerant Compatibility: Seals, O-rings, motor windings on semi-hermetic compressors, and internal water chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.

F. Refrigerant Circuit: Provide quantity of independent circuits, as indicated on Drawings. Each circuit shall include an electronic expansion valve, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter drier, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.

2.4 HEAT EXCHANGERS

A. Evaporator:
   1. Description: Shell-and-tube design, ASME labeled.
   3. Tube Construction: Individually replaceable, expanded into tube sheets.
      a. Material: Copper.
      b. Minimum Size: 3/4-inch OD; 0.028-inch wall thickness.
      c. Internal Finish: Enhanced.
   4. Water Box: Standard, with design working pressure of 150 psig, and having flanged or grooved mechanical-joint coupling water-nozzle connections with a thermistor-type temperature sensor factory installed in each nozzle. Provide vent and drain connections with plugs.

B. Condenser:
   1. Description: Shell-and-tube design, ASME labeled.
   3. Tube Construction: Externally enhanced and individually replaceable, expanded into tube sheets.
      a. Material: Copper.
      b. Minimum Size: 3/4-inch OD; 0.028-inch wall thickness.
      c. Internal Finish: Enhanced.
   4. Water Box: Standard, with design working pressure of 150 psig, and having flanged or grooved mechanical-joint coupling water-nozzle connections with a thermistor-type temperature sensor factory installed in each nozzle. Provide vent and drain connections with plugs.

C. Air-Cooled Condenser: Copper tubes with mechanically bonded aluminum fins with corrosion-resistant coating, integral sub-cooling circuit, leak-tested at 400 psig.
   1. Safety and Operating Options: Low-ambient controls for operation down to 25 degrees F.

2.5 INSULATION

A. Cold Surfaces: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type II, for sheet materials.

2.6 ACCESSORIES

A. Pressure Relief Valve: Single- or multiple, spring-loaded relief valve.

B. Base rails suitable for forklifting the chiller assembly.
C. Flanged water connections.

2.7 CONTROLS

A. Control Panel: Stand-alone, microprocessor based, factory-wired to control transformer in starter.

B. Enclosure: Unit-mounted, NEMA 250, Type 12 enclosure, hinged and lockable.

C. Status Display: Multiple-character liquid-crystal display or light-emitting diodes and keypad. Display the following conditions:
   1. Date and time.
   2. Operating or alarm status.
   3. Operating hours.
   4. Temperature and pressure of operating set points.
   5. Entering and leaving temperatures of chilled water.
   6. Refrigerant pressures in evaporator and condenser.
   7. Saturation temperature in evaporator and condenser.
   8. Oil temperature and pressure.
  11. Number of compressor starts.

D. Control Functions:
   1. Manual or automatic startup and shutdown time schedule.
   2. Leaving chilled-water temperature and motor load limit.
   3. Current limit and demand limit.
   4. External water chiller emergency stop.

E. Manually Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
   1. Low evaporator pressure or temperature.
   2. High condenser pressure.
   3. Low chilled-water temperature.
   4. Low oil differential pressure.
   5. High or low oil pressure.
   6. High oil temperature.
   7. High compressor-discharge temperature.
   8. Electrical overload.
   9. Sensor- or detection-circuit fault.
  11. Starter fault.

F. Building Automation System Interface: Provide a BACnet BCI-C interface for communication with the existing Building Automation System.

2.8 MOTORS

A. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment".
2.9 MAGNETIC ENCLOSED STARTERS

A. Enclosure: Unit mounted, NEMA 250, Type 12, with hinged access door with lock and key or padlock and key.

B. Control Circuit: 120 V; obtained from integral control power transformer of enough capacity to operate connected pilot and indicating and control devices.

C. Overload Relay: Shall be sized according to UL 1995 or shall be an integral component of water chiller control microprocessor.

D. Wye-Delta Starter: NEMA ICS 2, closed transition.

E. Solid-State, Reduced-Voltage Starter: NEMA ICS 2.
   1. Surge suppressor in solid-state power circuits providing 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
   2. Light-emitting-diode indicators showing motor and control status, including the following conditions:
      a. Controller on.
      b. Overload trip.
      c. Loss of phase.
      d. Starter fault.

F. Circuit Breaker: High interrupting circuit breaker with ground fault protection meeting all local short circuit withstand ratings. Short circuit withstand rating shall be factory-stamped on breaker. Circuit breaker to be interlocked to disconnect line power from the starter when the starter door is opened.

2.10 SOURCE QUALITY CONTROL

A. Factory test and rate water chillers, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle." Stamp with ARI label.

B. Factory test heat exchangers hydrostatically at 1.50 times the design pressure.

C. Factory test and inspect evaporator and water-cooled condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.

D. Factory test and inspect water boxes at 150 percent of working pressure.

E. Rate sound power level according to ARI 575 procedure.

F. Rate sound power level according to ARI 370 procedure.

PART 3 - EXECUTION

3.1 WATER CHILLER INSTALLATION

A. Install water chillers on concrete base. Concrete base is specified in Section 230515 "Common Work Results for HVAC".
B. Concrete Bases: Anchor chiller mounting frame to concrete base.
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.
   5. Cast-in-place concrete materials and placement requirements are specified in Division 3.

C. Install water chiller on steel support structure.
   1. Refer to Structural Drawings for steel support structure.
   2. Coordinate exact location of structural support members with General Contractor.
   3. Steel support structure shall be leveled prior to setting water chiller in place.
   4. Bolt water chiller to structural members or vibration isolators in strict conformance with manufacturer's recommendations.

D. Vibration Isolation: Neoprene pads with a minimum deflection of 0.25 inch. Vibration isolation devices and installation requirements are specified in Section 230548 "Vibration Controls for HVAC Piping and Equipment."

E. Vibration Isolation: Mount water chiller on vibration isolation equipment base as specified in Section 230540 "Vibration Controls for HVAC Piping and Equipment."

F. Installation shall comply with the manufacturer's installation instructions and applicable codes. Maintain manufacturer's recommended clearances for service and maintenance.

G. Charge water chiller with refrigerant if not factory charged.

H. Install separate devices furnished by manufacturer.

3.2 CONNECTIONS

A. Chilled and condenser water piping installation requirements are specified in Section 232113 "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Connections: Connect inlet to evaporator with controller-bulb well, shutoff valve, thermometer and pressure gage. Connect outlet to evaporator with throttling valve, flow switch, thermometer, pressure gage, and drain line with shutoff valve.

D. Condenser Connections: Connect inlet to condenser with shutoff valve, thermometer, and pressure gage. Connect outlet to condenser with throttling valve, thermometer, pressure gauge, flow switch and drain line with shutoff valve.

E. Refrigerant Pressure Relief Valve Connections: Extend vent piping to the outside without valves or restrictions (for water chillers mounted indoors) in accordance with ASHRAE Standard 15.

F. Ground water chillers according to Division 26.

G. Connect wiring according to Division 26.
3.3  STARTUP SERVICE

A. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

B. Engage a factory-authorized service representative to complete the installation and startup checks according to the manufacturer's written instructions and perform the following:

1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period according to manufacturer's written instructions.
5. Check bearing lubrication and oil levels.
6. Verify that refrigerant pressure relief is vented outside (for water chillers mounted indoors).
7. Verify proper motor rotation.
8. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
11. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

C. Prepare a written startup report that records results of tests and inspections.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

3.4  DEMONSTRATION

Engage a factory-authorized service representative to train the Owner's maintenance personnel adjust, operate and maintain the chiller. Provide not less than 4 hours of training.

END OF SECTION