Note: Shading in the body of the specification is to identify work that will be given to the installing contractor in the subsequent “Request for Chiller Installation” documents to be issued by the Owner.

SECTION 15670 – AIR COOLED WATER CHILLER

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:
A. This section of the specifications is subject to the provisions of Division 1, Division 15 in general and specifically, Section 15000 - General Mechanical Requirements. Work described in this section shall comprise an integral part of the work of Division 15 and shall be referenced by all mechanical trades for purposes of coordination so that a complete mechanical installation will result without additional cost to the Owner.

1.02 SCOPE OF THE WORK:
A. “Provide,” meaning “Furnish and Install,” as described in these specifications and as shown on the drawings, a complete replacement air cooled chiller system.

B. Existing Chiller: Contractor shall take ownership of the existing chiller. Under Division 16 disconnect the existing chiller from power and control and under Division 15, disconnect the existing chiller from piping and mounting. Remove the existing chiller from its installed location and make the location ready for the new chiller described in the following. Make legal and lawful disposal of the chiller, which may include a reuse of the machine by another owner, or may involve recycling of the unit beginning with refrigerant recovery and dismantling of the assembly for recycling or other appropriate disposition.

C. New Chiller: Provide Microprocessor controlled, multiple-scroll compressor, air-cooled, liquid chillers of the scheduled capacities as shown and indicated on the Drawings, including but not limited to:
   Chiller package
   Electrical power and control connections
   Chilled water connections
   Charge of refrigerant and oil installed at the factory for factory mounted evaporator, or provided on site if the evaporator is shipped separately for field installation and piping by contractor

D. This installation, sized for 40 tons cooling, requires a dual circuited unit configuration with control to effect a seamless operation of the overall unit, but with either circuit able to run independently of the other as in the case of the loss of one circuit compressor or its related evaporator, including devices and controls. Owner will consider, and invites, presentation of two separate 20 ton units, the pair to be provided with controls to make the function equivalent to a “twinned” pair capable of “either one, or both” operation. This is thought to be equivalent to the dual compressor, independent circuit function of a single machine.

1.03 QUALITY ASSURANCE
A. Manufacturer's Qualifications:
   1. A manufacturer of the packaged system for environment control with a minimum of five years of experience in the production of these systems. Manufacturer shall have a
permanent, local (Salt Lake City +/- 20 miles) sales representation and a local maintenance and repair facility (fixed base, with skilled factory trained technicians) capable of 4 hour, day or night, response to a trouble call.

B. Installer’s Qualifications:

1. A firm with at least three years of successful installation experience and not less than 5 similar installations on projects with chilled water installations similar to that required for this project.

C. Codes and Standards:

Products shall be Designed, Tested, Rated and Certified in accordance with, and installed in compliance with applicable sections of the following Standards and Codes:

2. ASHRAE 90.1– Energy Efficiency compliance.
4. ASME Boiler & Pressure Vessel Code, Section VIII, Division 1.
5. ARI Standard 550/590 and 551/591 – Air Cooled Water-Chilling Packages.
6. Conform to Intertek Testing Services, formerly ETL, for construction of chillers and provide ETL/cETL Listing label.
7. Manufactured in facility registered to ISO9002.
8. OSHA - Occupational Safety and Health Act

D. Factory Test: Chiller shall be pressure-tested, evacuated and fully charged with refrigerant and oil, and shall be factory operational run tested with water flowing through the vessel.

E. Guaranty/Warranty

Manufacturer shall Warrant all equipment and material of its manufacture against defects in workmanship and material for a period of one year from date of initial start-up or eighteen (18) months from date of shipment, whichever occurs first. Warranty to include all involved and required “parts and labor”. Parts shall be genuine factory parts equivalent to the original. Labor shall be provided by a factory trained and manufacturer authorized service agency. Parts replaced during the warranty period shall be warranted in and of themselves for a full year from the date of any required replacement/repair

In response to this RFQ, include an additive price for an extension of the full parts and labor warranty for years two through five.

The installing Contractor shall provide full warranty of the chiller installation and related for one year from the date of proven (function conveyed to Owner with reliable operation assured) beneficial use by Owner.

1.04 DELIVERY AND HANDLING

A. Unit shall be delivered to job site fully assembled, and charged with refrigerant and oil by the Manufacturer.

B. Unit shall be stored and handled at the site per Manufacturer’s instructions, at the factory, in transit and at the installation site by the installing contractor

C. Installing contractor shall comply with manufacturer's rigging and installation instructions for unloading the unit and moving it to the final location.
1.05 SUBMITTALS:

A. Product Data: (Manufacturer)
   1. Submit overall dimension drawings, factory and field wiring diagrams, and product data including glycol solution flow, pressure drops, total power consumption, water entering and leaving temperature conditions under all operating modes.
   2. Basis of unit selection and performance with supporting documentation shall be furnished with bid. Guaranteed maximum annual operating cost based on scheduled ambient temperature patterns shall be supplied with the bid.

B. Shop Drawings: (Installing contractor utilizing Manufacturer’s information related to equipment configuration.)
   1. In tight areas, submit scaled layout drawings of proposed equipment installation.

C. Record Drawings:
   1. At project closeout, submit record drawings of installed equipment, in accordance with requirements of Division 1 and Section 15000.

D. Maintenance Data: (Manufacturer)
   1. Provide electrical wiring diagrams, installation and maintenance instructions and an Owner's Operating and Maintenance manual with each unit.

1.06 INSTRUCTION OF OWNER'S PERSONNEL: (Joint effort – Chiller manufacturer and installing Contractor.)

A. Provide factory trained and manufacturer authorized service agent(s) to place units in full operation.

B. Provide mechanical and electrical support personnel to assist with chiller startup in provision of the piping, electrical and related aspects.

PART 2 - PRODUCTS

2.01 AIR COOLED CHILLER:

A. Acceptable Manufacturers: Subject to compliance with requirements, provide an air cooled chiller of one of the following:
   1. Aaon
   2. Trane Co., The.
   3. Carrier A/C Group; Carrier Corp.
   4. York International, a Division of Johnson Control, Inc.
   5. Other manufacturers with local representation which are given written invitation to propose prior to the date of bidding.

2.02 CHILLER MATERIALS AND COMPONENTS

A. General: Install and commission, as shown on the schedules and plans, factory assembled, charged, and tested air cooled scroll compressor chiller(s) as specified herein. Chiller shall be designed, selected, and constructed using a refrigerant with Flammability rating of “1”, as defined by ANSI/ASHRAE STANDARD - 34 Number Designation and Safety Classification of Refrigerants. Chiller shall include, but is not limited to a complete system with not less than two refrigerant circuits above 35 tons (123kW), scroll compressors, direct expansion type
evaporator, air-cooled condenser, refrigerant, lubrication system, interconnecting wiring, safety and operating controls including capacity controller, control center, motor starting components, and special features as specified herein or required for safe, automatic operation.

B. Cabinet: External structural members shall be constructed of heavy gauge, galvanized steel coated with baked on powder paint which, when subject to ASTM B117, 1000 hour, 5% salt spray test, yields minimum ASTM 1654 rating of “6”. Add Wire Panels of heavy gauge, welded wire-mesh, coated to resist corrosion, to protect condenser coils from incidental damage and restrict unauthorized access to internal components. Factory installed.

2.02 COMPRESSORS

A. Compressors: Shall be by Copeland, of the hermetic, scroll-type, including:

1. Compliant design with axial and radial sealing.
2. Refrigerant flow through the compressor with 100% suction gas cooled motor. Motors shall be two-pole (3600 rpm,) squirrel-cage induction type, with capacity control slide valve, rolling element bearings, and differential refrigerant pressure oil pump.
3. Demonstrably adequate suction side liquid separation chamber and oil sump to provide refrigerant and oil handling capability.
4. Micro-processor controlled compressor crankcase heaters to provide/prevent liquid migration.
5. Annular discharge check valve and reverse vent assembly to provide low pressure drop, silent shutdown and reverse rotation protection.
6. In-line filter drier with moisture indication device.
7. Oil Level sight glass.
8. High side/Low side fittings with gasketed caps for introduction of refrigerant and monitoring of pressures.
10. Provide initial refrigerant and oil charge and any refrigerant and/or oil required during the period of the warranty.

2.03 REFRIGERANT CIRCUIT COMPONENTS

A. Each refrigerant circuit shall include liquid line shutoff valve with charging port, low side pressure relief device, filter-drier, solenoid valve, sight glass with moisture indicator, expansion valves, and flexible, closed-cell foam insulated suction line. Include service isolation valves as a minimum standard.

B. Provide unit with 304 or 316 stainless steel tubing as common tubing material. Indicate a price deduct to go with ACR copper tubing with brazed joints.

2.04 HEAT EXCHANGERS

A. Evaporator: One for each refrigeration circuit, either of Brazed Plate or Shell and Tube construction.

Brazed Plate: Evaporator shall be brazed-plate stainless steel construction, single or dual circuit heat exchangers capable of refrigerant working pressure of 650 psig (3103 kPa) and liquid side pressure of 150 psig (1034 kPa).
Evaporator shall be covered in 1-1/2” (19mm) flexible, closed cell insulation, thermal conductivity of 0.26k (BTU/HR-FT2-°F/in.) maximum.

Brazed plate heat exchangers shall have exposed brazing edges coated with a corrosion resistant coating at the factory and shall be UL listed.

Shell and Tube: The evaporator shall be a tube-in-shell heat exchanger design with internally finned 0.035 copper tubes roller expanded into the tube sheet. The evaporator shall be designed, tested and stamped in accordance with ASME for a refrigerant side working pressure of 450 psig. The evaporator shall be designed for a water side working pressure of 150 psig. Water connections shall have one water pass with a series of internal baffles. Each shell to have a vent, a drain and fittings for temperature control sensors and insulated with 3/4” Armaflex II or equal insulation (K = 0.26). Provide heat tape with thermostat to protect the evaporator from freezing at ambient temperatures down to -20°F.

Installing contractor must include accommodations in the chilled water piping to allow proper drainage and venting of the heat exchanger. A strainer with a mesh size between 0.5 and 1.5mm (40 mesh) is required upstream of the heat exchanger to prevent clogging.

Either type of cooler shall have thermostatically controlled heaters to protect to -20°F (29°C) ambient in off-cycle. Also, either type of cooler shall have 3”, 150 PSIG, raised face flanges for field installation on cooler nozzles and field piping.

B. Air Cooled Condenser:

Coils: Internally enhanced, seamless stainless steel tubes mechanically expanded into aluminum alloy fins with full height collars. Sub-cooling coil shall be an integral part of condenser. Design working pressure shall be 650 PSIG (45 bar gauge).

Vendor may offer an alternate price for a unit with aluminum tubes to compare with the stainless steel tube price.

Low Noise Fans: Shall be dynamically and statically balanced, direct drive, propeller type fan, providing vertical air discharge and low sound characteristics. Each fan shall sit in its own compartment to prevent crossflow during fan cycling. Fan guards of heavy gauge coated or galvanized steel. Fan Blades shall be of heavy gauge or cast aluminum.

Fan Motors: Provide high efficiency, direct drive, 6 pole, (1150 rpm +/-) 3 phase, insulation class “F”, current protected, Totally Enclosed Air-Over/Fan Cooled (TEFC), rigid mounted, with double sealed, permanently lubricated, ball bearings.

2.05 CONTROLS

A. General: Provide functions for automatic start, stop, operating, and protection sequences across the range of scheduled conditions and transients. All controls, including sensors, shall be factory mounted and tested prior to shipment. Units shall be UL listed.

B. Microprocessor Enclosure: NEMA 4X powder painted steel cabinet with a gasket sealed protective cover.

C. Microprocessor Control Center:

With a choice of local independent control or a remote “Run/Stop” signal from the Owner’s SCADA System, provide for subsequent automatic control of compressor start/stop, anti-coincidence and anti-recycle timers, automatic pump-down on shutdown, condenser fan staging, evaporator pump, evaporator heater, unit alarm contacts, and chiller operation from...
0°F to 125°F (-18°C to 52°C) ambient. Automatic reset to normal chiller operation after power failure.

Provide for digital communications to Owner’s SCADA system via MODBUS TCP or MODBUS485. Software stored in non-volatile memory, with programmed setpoints retained in lithium battery backed real time clock (RTC) memory for minimum 5 years.

Forty character liquid crystal display, descriptions in English, numeric data in English (or Metric) units. Sealed keypad with sections for Setpoints, Display/Print, Entry, Unit Options & Clock, and On/Off Switch.

Programmable Setpoints (within Manufacturer limits): display language; chilled liquid temperature setpoint and range, remote reset temperature range, set daily schedule/holiday for start/ stop, manual override for servicing, low and high AMBIENT °Cutouts, number of compressors, low liquid temperature cutout, low suction pressure cutout, high discharge pressure cutout, anti-recycle timer (compressor start cycle time), and anti-coincident timer (delay compressor starts).

Display Data: Return and leaving liquid temperatures, low leaving liquid temperature cut out setting, low ambient temperature cutout setting, outdoor air temperature, English or metric data, suction pressure cutout setting, each system suction pressure, discharge pressure, liquid temperature reset, anti-recycle timer status for each compressor, anti-coincident system start timer condition, compressor run status, no cooling load condition, day, date and time, daily start/ stop times, holiday status, automatic or manual system lead/lag control, lead system definition, compressor starts/operating hours (each), status of hot gas valves, evaporator heater and fan operation, run permissive status, number of compressors running, liquid solenoid valve status, load & unload timer status, water pump status.

System Safeties: Shall cause individual compressor systems to perform auto shut down; manual reset required after the third trip in 90 minutes. Includes: high discharge pressure, low suction pressure, high pressure switch, and motor protector. Compressor motor protector shall protect against damage due to high input current or thermal overload of windings.

Unit Safeties: Shall be automatic reset and cause compressors to shut down if low ambient, low leaving chilled liquid temperature, under voltage, and flow switch operation. Contractor shall provide flow switch and wiring per chiller manufacturer requirements. Alarm Contacts: Low ambient, low leaving chilled liquid temperature, low voltage, low battery, and (per compressor circuit): high discharge pressure, and low suction pressure.

Analog Signals: 4-20ma chilled water supply and return temperatures.

Discrete Signals: 24VDC or 120VAC run status, local LOR switch status.

D. Manufacturer shall provide any controls not listed above, necessary for automatic chiller operation. Contractor shall provide field control wiring necessary to interface chiller control system with Owner SCADA system.

2.06 POWER CONNECTION AND DISTRIBUTION

A. Power Panels:

NEMA 3R, powder painted steel cabinets with a gasketed protective cover. Provide main power connection(s), control power connections, compressor and fan motor start contactors, current overloads, and factory wiring.
B. Compressor, control and fan motor power wiring shall be fully contained within the unit enclosure, or shall be routed through liquid tight conduit.

2.07 ACCESSORIES AND OPTIONS

A. Assume microprocessor controlled, factory installed Across-the-Line type compressor motor starters as standard. Indicate with the pricing document the additive cost of Wye/Delta and/or variable speed drive motor starting and control devices.

B. Outdoor Ambient Temperature Control

Low Ambient Control: Support unit operation to -10°F ambient. Provide operable dampers, fan speed control, hot gas bypass, etc. as needed to support chiller operation at partial to full load in cold weather.

High Ambient Control: Support stable unit operation up to 115°F ambient. Construct unit for reliable and stable operation in warm ambient conditions with defensive and protective control features to shut the unit down if adverse conditions are encountered.

C. Power Supply Connections:

Single Point Circuit Breaker:

Provide unit with a single point landing Terminal Block with Circuit Breaker and lockable external handle (in compliance with Article 44014 of N.E.C.) as part of the unit power and control panel to isolate power voltage for servicing. Incoming power wiring is required to comply with the National Electric Code and/or local codes. Indicate need, or not, for low voltage power supply for crankcase heaters or other ancillary requirements. Effect a complete system.

D. Pressure Transducers and Readout Capability

Discharge Pressure Transducers: Permits unit to sense and display discharge pressure.

E. Control Power Transformer: Provide integral voltage reduction transformer(s) to convert 480VAC-3-60 unit power voltage to 120VAC, single phase, 60 hertz, 500 VA capacity. Factory-mounting to include primary and secondary wiring between the transformer and the control panel.

F. Motor Current Module: Capable of monitoring compressor motor current. Provide inherent protection against compressor reverse rotation, phase-loss and phase imbalance. Provide option of one factory-mounted module per electrical system.

G. Power Factor Correction Capacitors: Provided to correct unit compressor factors to a 0.90-0.95.

H. Condenser Coil & Tubing Environmental Protection:

Post-Coated Dipped (required if not constructed of aluminum or stainless steel): Dipped-cured coating on condenser coils for seashore and other corrosive applications (with the exception of strong alkalis, oxidizers, and wet bromine, chlorine and fluorine in concentrations greater than 100ppm).

Provide a corrosion protective coating in the factory to all copper tubing and copper/brass devices in the refrigeration system.

I. Coated, Factory Mounted, Protective Chiller Panels.

Louvered Panels (full unit): Painted steel as per remainder of unit cabinet, to protect condenser coils from hail and incidental damage, visually screen internal components, and deter unauthorized access to internal components.

J. Flow Switch (Field-mounted): Vapor proof SPDT, NEMA 4X switch, 150 PSIG, -20°F to 250°F.
K. Differential Pressure Switch:
   Alternative to an above mentioned flow switch. Pretempco model DPS300A-P40PF-82582-5
   (300 psi max. working pressure) SPDT 5 amp 125/250VAC switch, Range 3-45 PSIG (0.2-3 bar
gauge), deadband 0.5 - 0.8 psi, with 1/4” NPTE Pressure Connections.

L. Evaporator Options:
   Provide DX (direct expansion) Cooler with 150 PSIG water-side, 650 PSIG refrigerant-side design
   working pressure.

M. Service Isolation valves: Provide service suction and discharge (ball type) isolation valves per
   system. Include a factory mounted system high pressure relief valve in compliance with ASHRAE
   15.

O. Hot Gas By-Pass: Include this feature to support continuous, stable operation at capacities
   below the minimum step of unloading to as low as 5% capacity (depending on both the unit &
   operating conditions) by introducing an artificial load on the cooler. Install hot gas by-pass on
   both refrigerant circuits.

P. Building Automation System (EMS) Reset Interface: Chiller to accept 4 to 20mA, 0 to 10 VDC, or
   discrete contact closure input (24VDC or 120VAC) to reset the leaving chilled liquid temperature.

Q. Sound Reduction (Factory-mounted):
   1. Provide unit with “Ultra quiet,” low speed, reduced noise fans.
   2. Provide compressor acoustic sound blankets.

R. Vibration Isolation (Field-Mounted):
   1. Neoprene Pad Isolators. Raise the unit above direct contact with the concrete pad and let
      the isolators serve to accept any unevenness of the pad.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Rig and install in full accordance with Manufacturers requirements, Project Drawings,
   and Contract Documents.

B. Location: Locate chiller as indicated on drawings, including cleaning and service maintenance
   clearance per Manufacturer instructions. Adjust and level chiller on support structure. If
   equipment provided exceeds height of scheduled chiller, installing contractor is responsible for
   any additional costs associated with extending the height of parapet or screening
   walls/enclosures

C. Components: Installing Contractor shall provide and install all auxiliary devices and accessories
   for fully operational chiller.

D. Electrical: Coordinate electrical requirements and connections for all power feeds with
   Electrical Contractor (Division 16) and Owner’s maintenance electrician.

E. Controls: Coordinate all control requirements and connections with Owner’s IT Department
   (John Hunter, P.E.).

F. Finish: Installing Contractor shall paint damaged and abraded factory finish with touch-up paint
   matching factory finish.

G. Startup: Provide a complete Startup and Commissioning service for the machine as part of the
   Purchase Contract for the machine.
Air Cooled Chiller Performance Criteria

Nominal Air Cooled Chiller Cooling Capacity  40 Tons Cooling 480,000 Btu/hr
Glycol Solution  40% Propylene Glycol by volume
Glycol Solution Flow Rate  85 – 110 gpm
Fouling factor  ARI + 0.00025
Entering Glycol Solution Temperature  57.5 - 55 deg F
Leaving Glycol Solution Temperature  45 deg F
Maximum allowable Pressure Drop (PD) at 100 gpm  15 feet w.c.
Maximum KW demand at full load, 105 deg F  45KW
Voltage  480V – 60 Hz – 3 ph