SECTION 236426 – ROTARY SCREW WATER CHILLER

PART 1: GENERAL

A. Air-cooled rotary screw packaged chillers.

1.2 REFERENCES

A. Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ASHRAE 90.1 current version requirements, and ASME Section VIIII.

1.3 SUBMITTALS

A. Submit shop drawings and product data in accordance with specification requirements.

B. Submittals shall include the following:

1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections,

2. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.

3. Schematic diagram of control system indicating points for field connection and fully delineate field and factory wiring.

4. Installation manuals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the codes and standards specified.

B. Factory Tested: Packaged chiller shall be pressure tested, evacuated, and fully charged with refrigerant and oil, and be functionally run-tested at the factory.

C. Factory trained and authorized service personnel shall perform pre-startup checks and startup procedures.

1.5 WARRANTY

A. The chiller manufacturer’s warranty shall cover parts and labor costs for the repair or replacement of defects in material or workmanship for a period of one year from equipment startup or 18 months from shipment, whichever occurs first

B. Extended Compressor Warranty: 4 years extended compressor warranty, parts only.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. Daiken

B. Trane

C. Johnson Controls Inc.

D. Dunham Bush

2.2 UNIT DESCRIPTION

A. Provide and install as shown on the plans, factory assembled, factory charged with R-134a, air-cooled, rotary-screw compressor packaged chillers in the quantity and size specified. Each chiller shall consist of multiple semi-hermetic screw compressors, direct-expansion evaporator, air-cooled condenser section, control system and all components necessary for protected and controlled unit operation.

2.3 DESIGN REQUIREMENTS

A. General: Provide a complete rotary screw packaged chiller as specified and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.2.

B. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum of 15 percent of full load without hot gas bypass. The unit shall have factory mounted, low ambient head pressure control providing operation to 32ºF (0ºC).

C. Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per AHRI 370 must be provided in 8 octave band format at full load. In addition, A-weighted sound pressure at 30 feet should be provided at 100%, 75%, 50% and 25% load points to identify the full operational noise envelope. Sound power must be provided in 1/8 octave band format to highlight any tonal quality issues. If manufacturer cannot meet the noise levels (per the attached chart), sound attenuation devices and/or barrier walls must be installed to meet this performance level.

Sound Pressure (at 30 feet)											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	**Overall dBA**	75% Load dBA	50% Load dBA	25% Load dBA
Sound Power											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	**Overall dBA**	75% Load dBA	50% Load dBA	25% Load dBA

One-third Octave Band Sound Power																						
50 Hz	63 Hz	80 Hz	100 HZ	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1000 Hz	1250 Hz	1600 Hz	2000 Hz	2500 Hz	3150 Hz	4000 Hz	5000 Hz	6300 Hz	8000 Hz	10 KHz

2.4 CHILLER COMPONENTS

A. Compressor motors: Motors shall be high-torque, two-pole, semi-hermetic, squirrel-cage induction-type with inherent thermal protection on all three phases, and cooled by suction gas. The compressors shall be field serviceable, semi-hermetic, single-rotor screw type with one central helical rotor meshing with two opposing gate rotors. The gate rotor contact element shall be constructed of engineered composite material, dimensionally stable up to 1500°F and wear resistant for extended life. Compressors shall be vibration isolated from the frame by neoprene compression mounts and include an internal discharge compressor muffler. If a twin-screw design is used, the manufacturer shall provide an extended 5-year parts and labor warranty covering all additional moving parts. If compressor does not have an internal discharge compressor muffler, additional sound attenuation must be provided. Each compressor shall be equipped with a VFD providing compressor speed control as a function of the cooling load. Each VFD shall provide controlled motor acceleration and deceleration, and shall provide protection for the following conditions: electronic thermal overload, over/under current, stalled motor, input and output phase loss, high load current, and current unbalance. The VFD shall provide a minimum 95% compressor power factor at all load points. Compressors used in VFD controlled units must have electrically insulated, ceramic bearings to mitigate bearing and/or lubricant damage from stray electric current passage. Compressor shall be able to control compression ratio to optimize efficiency at all operating conditions. Units without this protection must have an extended 5-year compressor warranty.

B. Evaporator: The evaporator shall be of the direct expansion type with single pass on the refrigerant and water side for high efficiency counterflow heat transfer and low pressure drops, carbon steel shell, and high efficiency finned copper tubes rolled into steel tube sheets. The evaporator shall be designed, inspected, and stamped in accordance with ASME Section VIIII requirements. It shall be mounted and piped in the unit. The evaporator shall have ¾-inch thick closed-cell polyurethane insulation and an electric resistance immersion heater. This combination shall provide freeze protection down to -20ºF ambient air temperature.

1. Flow Switch: The evaporator shall be equipped with a factory-mounted and wired flow switch.

2. Evaporator shall have standard left-hand grooved connections when looking at the unit control panel.

C. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F with 0% fin loss and develop no leaks.

1. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct drive fan motors. Fan motors shall be weather protected, three-phase, direct-drive, TEAO, totally enclosed air-over motors with class F insulation or better. ODP motors are not acceptable. Each fan section shall be partitioned to avoid cross circulation. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Condenser fans must be constructed of a single piece, molded composite material to provide low noise levels and protection against corrosion.

D. Refrigerant Circuit: The unit must have refrigerant circuits completely independent of each other with one compressor per circuit; multiple per circuit shall not be acceptable. Each circuit shall include an electronic expansion valve, liquid line shut-off valve, replaceable core filter-drier, sight glass with moisture indicator, and combination discharge check and shutoff valve.

E. Unit casing, structural members and rails shall be fabricated of painted steel, and shall be able to pass a 1000-hour salt spray test per ASTM B117. The control enclosure and unit panels shall be corrosion resistant painted before assembly. Unit shall have condenser coil grilles and base frame grilles.

F. ELECTRICAL PANEL

1. Control Panel: Single-point power connection to disconnect switch with through-the-door handle and with individual circuit breakers. A UL-approved weatherproof electrical panel shall contain the unit control system, control interlock terminals and field-power connection points. Box shall be designed in accordance with NEMA 3R rating. Hinged control panel access doors shall be tool-lockable. Barrier panels shall be provided to protect against accidental contact with line voltage when accessing the control system. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection. Factory-supplied power components shall include:

   a. Individual contactors and circuit breakers for fan motors,

   b. Circuit breakers and factory-mounted transformers for each control-circuit,

   c. Unit power terminal blocks for connection to remote disconnect switch,

   d. Terminals for power supply to the evaporator heater circuit.

   e. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection.

2. The control logic shall be designed to maximize operating efficiency and equipment life with protections for operation under unusual conditions and to

provide a history of operating conditions. The system shall intelligently stage the unit to sustain leaving water temperature precision and stability while minimizing compressor cycling.

3. Equipment protection functions controlled by the microprocessor shall include high discharge pressure, loss of refrigerant, loss of water flow, freeze protection, and low refrigerant pressure. User controls shall include:

   a. auto/stop switch,

   b. chilled water set-point adjustment,

   c. anti-recycle timer,

   d. digital display with water temperature and setpoint,

   e. operating temperatures and pressures, and diagnostic messages.

4. The following features and functions shall be included:

   a. Durable liquid crystal display (LCD) screen type, having minimum four 20-character lines with 6 key input pad conveniently mounted on the unit controller. Default language and units of measure shall be English and I-P respectively. Messages shall be in plain English. Coded messages, LED indicators and LED displays are not acceptable.

   b. Separate control section and password protection for critical parameters.

   c. Remote reset of chilled water temperature using a 4-20mA signal

   d. Soft-load operation, protecting the compressor by preventing full-load operation during the initial chilled fluid pull-down period

   e. BAS communication flexibility through modular plug-in BACnet® with MSTP

   f. Non-volatile program memory allowing auto-restart after a power failure.

   g. Recording of safety shutdowns, including date-and-time stamp, system temperatures and pressures. A minimum of six previous occurrences shall be maintained in a revolving memory

   h. Start-to-start and stop-to-start cycle timers, providing minimum compressor off time while maximizing motor protection

   i. Lead-lag compressor staging for part-load operation by manual selection or automatically by circuit run hours

j. Discharge pressure control through intelligent cycling of condenser fans to maximize efficiency

k. Pro-active compressor unloading when selected operating parameters exceed design settings, such as high discharge pressure or low evaporator pressure

l. Diagnostic monitoring of unit operation, providing a pre-alarm signal in advance of a potential shutdown, allowing time for corrective action

PART 3: EXECUTION

3.1 INSTALLATION

A. Install in strict accordance with manufacturer's requirements, submittal drawings, and contract documents.

B. Measures must be taken to avoid accumulation of debris in the evaporator during initial system flushing. A strainer with perforation no larger than 0.125" diameter must be placed in the supply water line just prior to the inlet of the evaporator. Care shall be exercised when welding pipe or flanges to the evaporator to prevent any slag from entering the vessel. Any welds after the strainer must be mechanically cleaned to avoid slag entering the evaporator.

C. Adjust and level chiller in alignment on supports.

D. Coordinate electrical installation with electrical contractor.

E. Coordinate controls with control contractor.

F. Provide all required accessories or accompanying parts to insure a fully operational and functional chiller.

3.2 START-UP

A. Startup and training to be provided by a factory-trained service technician for a total of four (4) hours. These hours of training are to be "bankable hours" used within one full warranty year.

B. All training and start-up shall be videotaped with a professional videographer and present two (2) copies of the training on DVD format to the Construction Manager within one (1) week of the training session. This DVD will be provided to the owner.

END OF SECTION 236426