

SECTION 15626
AIR-COOLED ROTARY SCREW CHILLER

PART 1: GENERAL

1.01 PROVISIONS INCLUDED

- A. The general provisions of the Contract, including General and Supplementary Conditions, and Division 1 General Requirements, apply to work specified in this Section.
- B. Requirements of Section 15050, "Basic Mechanical Materials and Methods" apply to work specified in this Section.

1.02 REFERENCES

- A. Comply with applicable Standards/Codes of ARI 550/590, ANSI/ASHRAE 15, ASHRAE 90.1 and ASME Section VIII Div 1.

1.03 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. Summary of all auxiliary utility requirements such as electricity, water, compressed air, etc. Summary shall indicate quality and quantity of each required utility.
 - 3. Single line schematic drawing of the power field hookup requirements, indicating all items that are furnished.
 - 4. Schematic diagram of control system indicating points for field connection. Diagram shall fully delineate field and factory wiring.
 - 5. Certification of factory run test of chiller unit signed by company officer.
 - 6. Installation manuals.

1.04 QUALITY ASSURANCE

- A. Comply with USM IDAT per section 01810.
- B. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the equipment and refrigerant offered.
- C. Regulatory Requirements: Comply with the codes and standards specified.

1.05 DELIVERY AND HANDLING

- A. Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer
- B. Comply with the manufacturer instructions for rigging and handling equipment.

1.06 WARRANTY

- A. The refrigeration equipment manufacturer’s warranty shall be for a period of one year from date of equipment start up but not more than 18 months from shipment. It shall cover defects in material and workmanship that have proven defective within the above period, including refrigerant lost due to a warranty failure.
- B. Extend the compressor parts warranty for an additional 4 years.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. McQuay International – Model AGS
- B. Approved Equal

2.02 UNIT DESCRIPTION

- A. Provide and install as shown on the plans factory assembled, factory charged with HFC134a and factory run tested air-cooled rotary screw compressor packaged chillers in the quantity specified. Each chiller shall consist of multiple semi-hermetic rotary screw compressors, flooded evaporator, air-cooled condenser section, control system and all components necessary for safe and controlled unit operation.

2.03 DESIGN REQUIREMENTS

- A. General: Provide a complete rotary screw packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.
- B. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum of 12 percent of full load without hot gas bypass. Performance shall be in accordance with ARI Standard 550/590-98. The standard unit shall be capable of operating down to 35 F .
- C. Acoustics: Sound pressure levels for the unit shall not exceed the following specified levels. Manufacturers specified that cannot meet this sound requirement shall provide, at no additional cost, sound attenuation devices to include, but not limited to: compressor sound blankets, low sound fans, and discharge gas mufflers. Chiller performance reduction as a result of these devices shall meet the scheduled performance data. Measurements to be taken at full load at a distance of 30 feet (10 meters) from the side of the unit with no reflecting surfaces.

Sound pressure -- Octave Band at Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	Overall A-Weighting
dB	71	74	71	70	70	67	59	52	74

2.04 CHILLER COMPONENTS

- A. Compressors: The compressors shall be field serviceable, semi-hermetic, single-screw type with one main helical rotor meshing with two opposed gaterotors. The gaterotors' contact elements shall be constructed of engineered composite material designed for extended thermal range of 1500 F and long life. If a twin-screw compressor is used, the manufacturer shall provide an extended 5-year parts and labor warranty with annual oil inspection covering all moving parts, due to the large bearing loads inherent with this design.
- B. The compressor shall be provided with an internal economizer cycle to improve system efficiency by subcooling the refrigerant flowing to the evaporator. Units without an internal compressor economizer shall be equipped with an external economizer of the flash type to provide an equivalent degree of subcooling.
- C. Electric motors: shall be two pole, semi-hermetic, squirrel cage induction type and cooled by suction gas. Full load power factor shall be a minimum of 0.90. Specified manufacturers, which do not meet the minimum power factor, must correct the motor to 0.90 or better at no charge to the owner.
- D. Solid-State Motor Starters (each compressor): Starter shall be designed around the latest in solid state technology. At a minimum, each starter shall provide the following functions for the optimum in compressor reliability and long life: controlled acceleration and deceleration, phase rotation protection, electronic thermal overload, over/under current protection, stalled motor protection, single phase protection, high load current, and current unbalance protection. Use of across-the-line or wye-delta starters is not acceptable.
- E. Acceptable solid state starter manufacturers are GE, Cutler-Hammer, Benshaw or Reliance.
- F. The solid state starters shall be capable of self-diagnostics, metering, and have an LED display to include the following operating and fault messages:
 - 1. Operating Messages:
 - Line voltage not present
 - Voltage present, starter ready
 - Motor accelerating
 - Motor at full speed
 - Motor at full speed, ramp time expired
 - Stop command received, motor decelerating
 - Thermal overload has reached 90% to 99%
 - Thermal overload at 100%, motor stopped
 - Thermal overload reduced to 60%, motor can restart
 - Passcode enabled
 - Passcode disabled
 - Thermal overload content in percentage
 - 2. Fault Messages:
 - System power not three phase
 - Phase sequence incorrect
 - Line frequency less than 25 Hz

Line frequency more than 72 Hz
Excessive current unbalance
Operating parameters lost
No current after "Run" command
Undercurrent trip occurred
Overcurrent trip occurred
Control power too low
Motor stalled during acceleration
External fault

- G. Evaporator: The evaporator shall be flooded type with individual refrigerant circuits, carbon steel shell, polypropylene water baffles, and high efficiency internally finned copper tubes rolled into steel tubesheets. Refrigerant heads shall be removable. The evaporator shall be insulated with ¾ inch closed cell polyurethane insulation and heated with an electric heater to provide freeze protection to -20°F ambient temperature. The evaporator shall be designed, inspected, and stamped in accordance with ASME Section VIII requirements. Units without individual circuits must hold complete refrigerant charge or supply a pumpout unit at no charge to the owner.
- H. Condenser: The condenser coils shall have seamless copper tubes mechanically bonded into plate type fins. The fins shall have full drawn collars to completely cover the tubes. A subcooling coil shall be an integral part of the main condenser coil. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct drive fan motors. Each fan shall be in its own compartment to eliminate cross flow of condenser air during fan cycling and shall be equipped with a heavy-gauge fan guard.
1. Fan motors shall be weather protected, single-phase, direct-drive, 1140 rpm, totally enclosed air over motors with class F insulation or better. Industry standard ODP motors are not acceptable.
 2. Each external coil shall be protected by a vinyl coated, wire mesh guard.
- I. Refrigerant Circuit: The unit must have Two independent refrigerant circuits completely independent of each other with one compressor per circuit. Each circuit shall include an electronic expansion valve, compressor suction and discharge shutoff valves, a liquid line shutoff valve, replaceable core filter-drier, sight glass with moisture indicator, liquid line solenoid and insulated suction line. The use of fixed orifices or mechanical expansion valves is not acceptable.
- J. Unit casing and all structural members and rails shall be fabricated of continuous G90 galvanized steel and meet ASTM B117 500 hour salt spray test. The galvanized coating shall be applied to the base metal by the hot dip process and shall conform to ASTM A525. The control enclosure and unit panels shall be cleaned and phosphatized, then painted with a beige urethane finish.
- K. MicroTech II microprocessor based control system: A NEMA Type 3R weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Power and starting components shall include factory fusing of fan motors and control circuit; individual contactors for each fan motor, solid-state start timer, solid-state compressor

three-phase motor overload protection, inherent fan motor overload protection and unit power terminal blocks for connection to remote disconnect switch. Terminals shall also be provided for power supply to the evaporator heater circuit. Hinged access doors shall be lockable. Barrier panels are required to protect against accidental contact with line voltage when accessing the control system.

1. Control circuit transformers for each circuit shall be factory mounted as standard with every unit.

L. The system shall stage the unit based on the leaving water temperature. Safeties controlled by the microprocessor include motor protection, high discharge pressure, loss of refrigerant, loss of water flow, freeze protection, and low refrigerant pressure. Controls shall include auto/stop switch, chilled water setpoint adjustment, anti-recycle timer, and digital display with water temperature and setpoint, operating temperatures and pressures, and diagnostic messages. The following features and functions shall be included:

1. The LCD type display shall have a 4 line by 20 character/line liquid crystal display and 6 key keypad mounted on the unit controller with all messages in English. Units of measure will be I-P. Coded messages and LED displays are not acceptable.
2. Critical parameters shall have their own section of control and be password protected.
3. Resetting chilled water temperature by a remote 4-20mA signal.
4. A soft load function to prevent the system from operating at full load during the chilled fluid pulldown period.
5. Protocol selectability through the simple addition of an optional communications module that enables the controller to communicate using standard protocols such as LonTalk and BACnet.
6. Auto restart after a power failure without an external battery back-up or auxiliary power for maintaining program memory.
7. Safety shutdowns shall be date and time stamped with system temperatures and pressures recorded. A minimum of six previous occurrences shall be kept in a revolving memory.
8. Start-to-start and stop-to-start timers to provide minimum compressor off-time with maximum motor protection.
9. Lead-lag by manual selection or automatically by circuit run hours.
10. Discharge pressure control through intelligent cycling of condenser fans.
11. Pro-active compressor unloading in response to high discharge pressure or low evaporator pressure.
12. Continuous diagnostic checks of unit operation to provide a pre-alarm signal in advance of a shutdown allowing time for remedial action to be taken.

2.05 OPTIONS AND ACCESSORIES

A. The following options are to be included:

1. Controls:
 - a. low ambient head pressure control to 32°F (18°C), factory mounted, piped and wired
 - b. water flow switch for field installation
 - c. communication via standard BACnet protocol

2. Electrical:
 - a. non-fused service disconnect switch, factory mounted
 - b. ground fault protection, factory installed
 - c. single point power block
 - d. 115 volt, 15 amp ground fault convenience outlet

3. Unit:
 - a. copper fin condenser coils
 - b. spring vibration isolators for field installation
 - c. protective welded wire lower base guards on compressor section
 - d. 'low ambient noise' condenser fan blades
 - e. Sound isolation compressor blankets to reduce sound power levels by 2.7 dBA and sound pressure levels by 2.8 dBA.

PART 3: EXECUTION

3.01 AIR COOLED CHILLERS INSTALLATION

- A. Chillers will be installed under a separate contract by a qualified contractor in accordance with manufacturer's installation instructions, standards and codes specified in "Quality Assurance".
- B. Install in strict accordance with manufacturer's requirements, shop drawings, and contract documents.
- 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 appurtenances required allowing a fully operational and functional chiller.

3.02 START-UP, ADJUSTMENT, AND TESTING

- A. Coordination: Coordinating all equipment and specified personnel necessary for start-up, adjustment, and testing will be the responsibility of the installing contractor.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Chiller Manufacturer: Furnish services of factory authorized agent to provide unit and controls start-up, adjustment, and testing as specified in "Start-Up."

3.04 SYSTEM START UP

- A. Chiller authorized representative will provide startup and one year warranty service. This responsibility shall not be waived or assumed by another party. Coordinate start-up with phased construction. Extend start-up services to correspond to schedule of phased construction where required.
- B. Provide warranty service to one year from the date of project substantial completion.
- C. Make appropriate allowance, if required, for services required until date of substantial completion.

- D. Warranty service includes labor and materials to replace any parts or controls which might fail in service as the result of a defect in material or manufacture.

3.05 DEMONSTRATION AND TRAINING

- A. Owner's Instructions: Provide services of a factory-trained representative for full instruction on the care, operation, maintenance, and troubleshooting of the air cooled chiller. Training shall be a minimum of eight (8) hours. Schedule training with Owner.

END OF SECTION 15834