

ROSEWOOD MIDDLE DEMOLITION

SECTION 236426 – AIR-COOLED CHILLERS

PART 1 - GENERAL

1.1. SUMMARY

- A. Section includes packaged, air-cooled, electric motor driven chillers.

1.2. SUBMITTALS

A. Product Submittals:

1. Product Data: For each type of product indicated include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
 - a. Performance at ARI standard conditions and at conditions indicated.
 - b. Performance at ARI standard unloading conditions.
 - c. Minimum evaporator flow rate.
 - d. Refrigerant capacity of chiller.
 - e. Oil capacity of chiller.
 - f. Fluid capacity of evaporator.
 - g. Characteristics of safety relief valves.
 - h. Minimum entering condenser-air temperature.
 - i. Maximum entering condenser-air temperature.
 - j. Performance at varying capacities with constant-design entering condenser-air temperature. Repeat performance at varying capacities for different entering condenser-air temperatures from design to minimum in 5 deg F increments.
 - k. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - l. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
 - m. Wiring Diagrams: For power, signal, and control wiring.
2. Warranty: Sample of special warranty.

B. Close-Out Submittals:

1. Operation and Maintenance Data: For each chiller to include in emergency, operation, and maintenance manuals.

1.3. EXTRA MATERIALS

A. Extra Stock: Provide owner with the following extra materials:

1. Quart container of paint used in application of topcoat to use in touchup applications.

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1.4. QUALITY ASSURANCE

- A. ARI Certification: Certify chiller according to AHRI 590 certification program(s).
- B. ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.
- C. Efficiencies shall comply with the State Energy Conservation Code.
- D. Electrical Components, Devices and Accessories: UL listed and labeled as defined by NFPA 70, the National Electric Code, or equivalent by a qualified testing agency marked for the intended location and application and accepted by the Authority Having Jurisdiction and Engineer.
- E. Mechanical Equipment and Materials: UL listed and labeled as defined by State Building Codes or equivalent by a qualified testing agency marked for the intended location and application and accepted by the Authority Having Jurisdiction and Engineer.
- F. Testing and listing laboratories of mechanical and electrical equipment shall be accredited by the North Carolina Building Code Council (NCBCC).

1.5. DELIVERY, STORAGE, AND HANDLING

- A. Ship each chiller with a full charge of refrigerant. Charge each chiller with nitrogen if refrigerant is shipped in containers separate from chiller.
- B. Ship each oil-lubricated chiller with a full charge of oil.

1.6. COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
- B. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7. WARRANTY

- A. Special Warranty: Manufacturer's complete machine parts, labor and refrigerant warranty for 5-years from the date of Owner Acceptance.

PART 2 - PRODUCTS

2.1. GENERAL REQUIREMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following for scroll-type compressor chillers:
 - 1. Carrier (30R Series)
 - 2. Daikin-McQuay (AGZ Series)
 - 3. Trane (CGAM Series)

2.2. PACKAGED, AIR-COOLED CHILLERS

- A. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
- B. Cabinet: Chiller cabinet shall be manufacturer's standard galvanized steel construction with corrosion protection coating and exterior finish.
 - 1. Architectural Louvered Panels: Provide unit with louvered panels that completely cover the condenser coils and service areas beneath the condenser coils.
- C. Enhanced Sound-Reduction: Factory provided and field installed package designed to reduce sound level without affecting performance, including an added acoustic enclosure around compressors, reducing fan speeds and acoustically treating fans.

2.3. CHILLERS WITH SCROLL COMPRESSORS

- A. Compressors: Positive displacement, direct-drive, semi-hermetic compressors with precision-machined cast-iron casing and manufacturer's standard scroll design. Each compressor shall be equipped with suction and discharge shut-off valves, crankcase oil heater and suction strainer.
 - 1. Capacity Control: On-off compressor cycling with hot-gas bypass or digital compressor unloading.
 - 2. Oil Lubrication System: Consisting of automatic pump with strainer, sight-glass, filling connection, filter with magnetic plug, and initial oil charge.
 - 3. Compressor Motors: High-torque, two-pole induction type motors with inherent thermal-overload protection on each phase and hermetically sealed and cooled by refrigerant suction gas.
 - 4. Compressor Motor Controllers: Across-the-Line NEMA ICS 2, Class A, full-voltage, non-reversing.”
- B. Refrigerant Circuits:
 - 1. Refrigerant: R-454B or R-32
 - 2. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - 3. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - 4. Pressure Relief Valves: ASME-rated, spring-loaded, multi-reseating type pressure relief valves shall be provided for each heat exchanger. Comply with ASHRAE 15, ASHRAE 147 and applicable portions of ASME Boiler and Pressure Vessel Code.
- C. Evaporator: Brazed-plate or shell-and-tube design, as indicated.
 - 1. Shell and Tube Type: Direct-expansion, shell-and-tube design, tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - a. Shell Material: Carbon steel.
 - b. Shell Heads: Removable carbon-steel heads with multi-pass baffles designed to ensure positive oil return and located at each end of the tube bundle.

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- c. Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - d. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 2. Brazed Plate Type: Direct-expansion, single-pass, brazed-plate design, tested according to ASME Boiler and Pressure Vessel Code.
 - a. Plate Material: Type 304 or 316 stainless-steel construction.
 - b. Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
 - c. Inlet Strainer: Factory-furnished, 40-mesh strainer for field installation in supply piping to evaporator.
 3. Flow Switch: Factory furnished and field installed, thermal-type flow switch wired to chiller operating controls.
 4. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F.
- D. Air-Cooled Condenser:
 1. Coil(s) with integral sub-cooling on each circuit.
 2. Copper Tube with Plate Fin Coils: Coils constructed of copper tubes mechanically bonded to aluminum fins.
 3. Aluminum Microchannel Coils: Coils constructed of a series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds. Fins, tubes, and header manifolds shall be constructed of aluminum alloy treated with a corrosion-resistant coating.
 4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
 5. Fans and Fan Motors: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge. Refer to Sections 230513 and 233416.
 6. Fan Guards: Removable steel safety guards with corrosion-resistant coating.
- E. Electrical Power: Factory installed and wired switches, motor controllers, transformers, and other electrical devices necessary to provide a single-point field power connection. Wiring shall be numbered and color-coded to match wiring diagram. Electrical equipment shall be mounted in a NEMA 250, Type 3R enclosure with hinged access door, lock and key. Factory installed wiring located outside the enclosure shall be routed in metallic raceway with no more than 24-inch length of liquid-tight or flexible metallic conduit at connections.
 1. Field power interface shall be to NEMA 1, heavy-duty, non-fused disconnect switch. Minimum SCCR according to UL 508 shall be as required by electrical power distribution system, but not less than 65,000A.
 2. Each motor shall have branch power circuit and controls with fused disconnect switch or circuit breaker disconnecting means with SCCR to match main disconnecting means: Each motor shall have overcurrent protection. Overload relay shall be sized according to UL 1995 or be an integral component of water chiller control microprocessor.
 3. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.

4. Power Factor Correction: Capacitors to correct power factor to 0.95 at full load.
 5. Controls Power: Provide unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity and auxiliary and adjustable time-delay relays or an integral to water chiller microprocessor.
 6. User Interface: Indicate the following for water chiller electrical power supply:
 - a. Current, phase to phase, for all three phases.
 - b. Voltage, phase to phase and phase to neutral for all three phases.
 - c. Three-phase real power (kilowatts).
 - d. Three-phase reactive power (kilovolt amperes reactive).
 - e. Power factor.
 - f. Running log of total power versus time (kilowatt hours).
 - g. Fault log, with time and date of each.
- F. Controls: Factory installed, wired, and functionally tested standalone, microprocessor based controls with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power. Controls shall share enclosure with electrical power devices or provide a separate enclosure of matching construction.
1. Operator Interface: Keypad or pressure-sensitive touch screen with multiple-character digital display. Display the following:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.
 - d. Outside-air temperature if required for chilled-water reset.
 - e. Temperature and pressure of operating set points.
 - f. Chilled-water entering and leaving temperatures.
 - g. Refrigerant pressures in evaporator and condenser.
 - h. Saturation temperature in evaporator and condenser.
 - i. No cooling load condition.
 - j. Elapsed time meter (compressor run status).
 - k. Pump status.
 - l. Anti-recycling timer status.
 - m. Percent of maximum motor amperage.
 - n. Current-limit set point.
 - o. Number of compressor starts.
 - p. Alarm history with retention of operational data before unit shutdown.

- q. Superheat.
- 2. Control Functions:
 - a. Manual or automatic startup and shutdown time schedule.
 - b. Capacity control based on evaporator leaving-fluid temperature.
 - c. Capacity control compensated by rate of change of evaporator entering-fluid temperature.
 - d. Chilled-water entering and leaving temperatures, control set points, and motor load limit.
 - e. Current limit and demand limit.
 - f. External water chiller emergency stop.
 - g. Anti-recycling timer.
 - h. Automatic lead-lag switching.
- 3. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - a. Low evaporator pressure or high condenser pressure.
 - b. Low chilled-water temperature.
 - c. Refrigerant high pressure.
 - d. High or low oil pressure.
 - e. High oil temperature.
 - f. Loss of chilled-water flow.
 - g. Control device failure.
- 4. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - a. BACnet per ASHRAE 135 communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. All control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.
 - b. Hardwired I/O Points:
 - 1) Monitoring: On/off status, common trouble alarm, electrical power demand, and electrical power consumption.
 - 2) Control: On/off operation, chilled-water discharge temperature set-point adjustment, and electrical power demand limit.
- 5. Factory-installed wiring outside of enclosures shall be in NFPA 70-complaint raceway. Make terminal connections with liquid-tight or flexible metallic conduit.
- G. Insulation: Closed-cell, flexible, elastomeric thermal insulation complying with ASTM C 534/C 534M, Type I for tubular materials and Type II for sheet materials. Factory-apply insulation over all cold surfaces of chiller capable of forming condensation. Components shall include evaporator, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, refrigerant-cooled motor, and auxiliary piping.

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1. Thickness: 3/4-inch, minimum.
2. Paint: After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.

2.4. SOUND REDUCTION FEATURES

- A. Sound Reduction Features: Provide factory installed or factory-fabricated and field installed accessories from the chiller manufacturer designed to reduce noise from the standard product.
 1. Compressor Muffler
 2. Low Noise Condenser Fans
 3. Refrigerant Piping Sound Absorption Insulation
 4. Refrigerant Piping Metallic Flexible Connections
 5. Condenser Fan Speed Control

2.5. SOURCE QUALITY CONTROL

- A. Perform functional tests of chillers before shipping.
- B. Factory run test each air-cooled chiller with water flowing through evaporator.
- C. Factory test and inspect evaporator and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. For chillers located outdoors, rate sound power level according to ARI 370.

PART 3 - EXECUTION

3.1. EXAMINATION

- A. Examine chillers before installation. Reject chillers that are damaged.
- B. Examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting chiller performance, maintenance, and operations before equipment installation.
 1. Final chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. CHILLER INSTALLATION

- A. Equipment Mounting:
 1. Install chillers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations.
 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548.
- B. Maintain manufacturer's recommended clearances for service and maintenance.

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- C. Charge chiller with refrigerant and fill with oil if not factory installed.
- D. Install separate devices furnished by manufacturer and not factory installed.

3.3. CONNECTIONS

- A. Comply with requirements for piping specified in Section 232113 and 232116. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, and drain connection with valve. Make connections to chiller with a flange.

3.4. STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
 - 3. Verify that pumps are installed and functional.
 - 4. Verify that thermometers and gages are installed.
 - 5. Operate chiller for run-in period.
 - 6. Check bearing lubrication and oil levels.
 - 7. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
 - 8. Verify proper motor rotation.
 - 9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 - 10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator.
 - 11. Verify and record performance of chiller protection devices.
 - 12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
- C. Prepare test and inspection startup reports.

3.5. DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers.

END OF SECTION 236426