PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Factory-assembled packaged chiller

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Chilled water connections.

E. Electrical power connections.

1.02 REFERENCE STANDARDS

A. AHRI 550/590 - Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle; 2011.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

C. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Addenda.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

E. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2011.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

G. UL 984 - Hermetic Refrigerant Motor-Compressors; Current Edition, Including All Revisions.

H. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate physical size, weight and location of major pieces of equipment to be installed. Notify Architect of any major deviations from the equipment originally specified prior to ordering equipment.

1.04 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division I Specification Sections.

B. Product Data: Product data for each chiller, including chiller refrigerant, chiller capacity, minimum and maximum chilled water flows, weights (shipping, installed and operating), furnished accessories and electrical characteristics. Provide short circuit current rating of factory mounted starter or variable frequency drive.

C. Shop Drawings: Shop Drawings showing fabrication and installation of chillers, including plans, elevations, sections, details of components, attachments, and other construction elements. Include the following:

1. Dimensions.
2. Weight loadings and distribution.
3. Clearances for maintenance and operation.
4. Size and location of field connections.

D. Wiring Diagrams: Wiring diagrams detailing wiring for power and control systems and differentiating between manufacturer-installed and field-installed wiring.

E. Manufacturer's Certificate: Certify that components furnished but not produced by manufacturer meet or exceed manufacturer's requirements.

F. Manufacturer's Performance Data: Indicate energy input versus cooling load output from 0 to 100 percent of full load at specified and minimum condenser water temperature for water-cooled chillers and at specified and minimum outdoor air temperature for air-cooled chillers.

G. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

H. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

I. Operation & Maintenance Manuals: Operation and maintenance data to be included in Operation and Maintenance manuals. Include start-up instructions, maintenance data, parts lists, controls, and accessories; include trouble-shooting guide.

J. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Refrigerant: One container.
2. Extra Lubricating Oil: One container.

1.05 QUALITY ASSURANCE

A. AHRI Compliance: Rate chiller according to AHRI 550/590 “Standard for Water Chilling Packages using the Vapor Compression Cycle”.

B. ASHRAE Compliance: Conform to ASHRAE 15 “Safety Code for Mechanical Refrigeration” for chiller design, construction, leak testing and installation.

C. ASME Compliance: Fabricate and stamp chillers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

D. NEC Compliance: Comply with NFPA Standard 70 – National Electrical Code.

E. Chiller manufacturing plant must be ISO 9001:2000 registered.

F. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

G. Model furnished must have been in service for at least 2 years.

H. When required, provide certification of inspection for conformance to requirements of Authority Having Jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer’s written installation instructions for rigging, unloading, and transporting equipment.

B. Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer, except condenserless which shall be charged at site in accordance with manufacturers instructions. If refrigerant is shipped separately from chiller, chiller shall be charged with nitrogen.

1.07 WARRANTY

A. Manufacturer shall warrant all chiller equipment and material for a period of one year from equipment startup, or 18 months from date of shipment, whichever occurs first.

B. Manufacturer's Special Warranty on Compressor and Electric Motor: Written parts and labor warranty, signed by manufacturer agreeing to repair or replace compressor and/or compressor motor, including replacement of refrigerant for a period of 5 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. AERMEC

B. Arctic

C. Dunham Bush.

D. Multi-Stack

2.02 CHILLER APPLICATIONS

A. Chiller: Air-Cooled.

1. Packaged Air-Cooled Condenser.

2.03 CHILLERS

A. Chillers: Factory assemble and test chiller consisting of compressor(s), compressor motor(s), evaporator, condenser, enclosure, refrigeration circuits(s) and specialties, interconnecting piping, starters, and microprocessor-based controls.

1. Rating: AHRI 550/590.
2. Safety: UL 1995 and ASHRAE Std 15.
3. Construction & Testing: ASME BPVC-VIII-1 as applicable for construction type.
4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the Authority Having Jurisdiction.
5. Enclosures:

    a) Frame:

        1) Heavy-gauge steel.
        2) Factory apply hot-dipped galvanized or air-dried paint finish.

    b) Steel Chiller Cabinets:

        1) Factory apply baked on enamel, baked on powder paint, or _____ finish.
        2) Perform 500-hour minimum salt spray test in accordance with ASTM B117.

    c) Electrical Equipment:

        1) NEMA 250 or UL 1995 as applicable.
        2) Power panels shall be NEMA Type 1, except for air-cooled chillers which shall be NEMA Type 3 rain/dust tight.
        3) Painted steel cabinets with hinged, latched, lockable and gasketed outer doors. Provide main power connections, control power connections, compressor start contactors, current overloads and factory wiring.
        4) Power supply shall enter unit at a single location.
        5) Exposed wiring shall be routed through liquid tight conduit.
        6) For air-cooled chillers, evaporator heater shall have a separate power connection from the chiller power connection.

6. Motors: UL 984. See Section “Common Motor Requirements for HVAC Equipment” for additional requirements.
7. Chilled Water Flow Switch: Furnish field-mounted differential pressure sensor or thermal dispersion flow switch (paddle-type flow switch not allowed).

B. Chiller options

1. Air Cooled Chiller

a) Chiller shall be provided with the following options:

1) Low ambient control 0 F.
2) Copper fin condenser coils.
3) Factory mounted non-fused disconnect switch.
4) Double-thickness evaporator insulation.
5) Evaporator heater.

a) Evaporator heater shall be sized to maintain 40°F water temperature with ambient temperature of 0°F.
b) Heater shall have separate electrical connection.

2.04 COMPRESSORS AND EVAPORATOR

A. Compressors: Hermetic scroll type.

1. Unit: Fully hermetic type with single or multiple, direct drive compressors with service valves.
2. Vibration Control: Factory installed internal isolators or field installed external isolators.
3. Oil Lubrication System: Initial oil charge, oil sump, heater, oil level, and sight glass.
4. Capacity Reduction System: Compressor staging with control down to 12 percent of full load without the activation of hot gas by-bass.
5. Motor: 3600, 3500rpm, suction gas-cooled, with thermal or current overload protection on all three phases. open drip-proof, continuous duty, squirrel cage, induction-type motor. Motors operated by variable frequency drives shall be inverter-duty rated and shall have shaft grounding system as specified in Section "Common Motor Requirements for HVAC Equipment"

B. Evaporator: Provide shell and tube, or brazed plate.

1. Brazed plate type.

a) Plate Material:

1) Air-cooled chillers: 304 or 316 stainless steel

b) Refrigerant Working-Side Pressure Rating: 430 psig minimum.
c) Water Working-Side Pressure Rating: 150 psig minimum.
d) Provide with flanged, grooved, or threaded connections.
e) Insulation for all cold surfaces.

1) Insulation shall be factory or field installed.

2) 0.75 inches minimum thick, closed cell, expanded polyvinyl chloride, polyurethane, or flexible elastomeric insulation with a maximum k value of 0.28.

f) Provide factory or field installed vents and water drain connections on evaporator or piping.
g) Provide factory or field installed fittings for temperature control sensors on evaporator or piping.
h) Freeze Protection for Outdoor Locations: Provide thermostatically controlled electric heater to protect from freezing at ambient temperatures down to minus 10 degrees F.
i) Provide strainer at inlet to heat exchanger.

2.05 AIR-COOLED CONDENSER AND FANS

A. Provide finned-tube, brazed one-piece, or flat tube-plate-manifold type.

1. Brazed one-piece type.

a) Construct of same material to avoid galvanic corrosion.
b) Braze coils and headers as one assembly.
c) Clean, dehydrate and test.
d) Leak Test: 650 psig minimum.

B. Coil Guards: Provide corrosion proof, louvered panels, heavy gage wire panels, or grilles factory installed. Provide coil protection for shipping by enclosing entire condenser coil with heavy plastic to prevent coil damage during shipping or rigging.

C. Fans and Motors:

1. Fans: Dynamically balanced propeller, shrouded-axial, or airfoil type fans of reinforced polymer, glass fiber reinforced composite, or aluminum corrosion resistant construction equipped with sealed, permanently lubricated ball bearings.
2. Discharge Fan Guards: Corrosion resistant, heavy gage, steel wire.
3. Discharge Direction: Vertical.
4. Motors: Direct drive, totally enclosed for outdoor use with current overload protection.

2.06 REFRIGERATION CIRCUITS

A. Provide multiple independent refrigeration circuit(s) with one or multiple compressor(s) per circuit to match the required staging capacity.

B. Provide liquid line shut-off valve, filter-drier, expansion valve, refrigerant relief device, solenoid valve, sight glass with moisture indicator, closed cell foam insulated suction line, refrigerant charging connections and hot-gas muffler for each independent circuit.

2.07 INTEGRATED MICROPROCESSOR BASED DDC CONTROLS PACKAGE

A. Pre-wire, assemble, factory mount, and test operating and safety control system consisting of a digital display or gages, on-auto-off switch, motor starters, disconnect switches, power and control wiring. Provide controls, monitoring, programmable set-points, alarms, and BAS as defined below:

1. Automatic Adjustable Operating Controls:

    a) Temperature of chilled water leaving chiller.
    b) Chiller system capacity control based on set-points and system load.
    c) Compressor short-cycling prevention.
    d) Lead/lag for multiple compressors.
    e) Automatic reset on power source failure.
    f) Load limiting.
    g) Start/stop of Dedicated Chilled Water Pumps

2. Normal Operation Monitoring and Open Cover-less Displays:

    a) Hours of operation.
    b) Suction and discharge refrigerant pressures.
    c) Automatic diagnostics.
    d) Number of starts.
    e) On/off compressor status.
    f) Entering and leaving chilled water temperatures.
    g) Status of operation.
    h) Weekly purge cycle totalization if applicable.
    i) Oil pressure.

3. Set-Points:

    a) Leaving chilled water temperature.
    b) Date/time.

4. Automatic Chiller Shut-Down Safety Controls and Alarm:

    a) Automatic Reset:

        1) Chilled water flow interlock.
        2) Voltage protection (over/under).
        3) Phase reversal protection.

b) Manual Reset:

1) Evaporator low pressure.
2) High motor winding temperature.
3) Low chilled water temperature.
4) Low chilled water flow.
5) High condenser refrigerant discharge pressure.
6) Motor current overload and phase loss.
7) Low oil flow.

c) Remote Alarm: Activate remote, audible bell upon safety shutdown of chiller.

5. Building Automation System (BAS) Communications via Shielded Cable:

a) Minimum Data Transmission to BAS:

1) All system operating conditions.
2) Capacity control information.
3) Safety shutdown conditions.

b) Minimum Operating Commands from BAS:

1) Remote unit start/stop.
2) Remote condenser water reset.
3) Remote chilled water reset.

B. Controller shall have minimum 40-character liquid crystal display in English and numeric data in English units. Provide sealed keypad with password protection for operator interface.

2.08 SOUND

A. Outdoor Air Cooled Chiller

1. Sound pressure and/or power level ratings shall comply with AHRI Standard 370 “Sound Ratings for Large Outdoor Refrigeration and Air-Conditioning Equipment.”

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive chillers for compliance with installation tolerances and other conditions affecting performance and maintenance of chillers.

B. Examine proposed route of moving chillers into place and verify that it is free of interference's.

C. Verify piping roughing-in locations.

D. Verify branch circuit wiring suitability. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install chillers according to manufacturer's written instructions.

B. Install chillers plumb and level, and anchor. Support units as described below, using the vibration control devices indicated. Vibration control devices are specified in Division 23 Section "Vibration Isolation for HVAC Piping and Equipment."

1. Support ground-mounted air cooled chillers on concrete equipment bases using neoprene pads. Secure units to anchor bolts installed in concrete equipment base.

C. Install vibration isolators according to isolator manufacturer's written instructions.

D. Install chiller accessories which have been shipped loose or unassembled for shipment purposes.

E. Maintain manufacturers recommended clearances for service and maintenance.

F. Install piping connections maintaining clearances for service and maintenance of chillers.

G. Install flange or mechanical coupling connections at chillers.

H. Install flexible pipe connections for chillers mounted on vibration isolators.

I. Install shutoff valves, pressure gauges and temperature gauges at chiller inlet and outlet connections.

3.03 ELECTRICAL CONNECTIONS

A. Refer to Division 26 Sections for wiring devices, wires and cables, and electrical installation requirements.

B. Install and connect proof of flow device switches and remote chiller control panel.

C. Ground equipment.

1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer'' published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 MANUFACTURER'S FIELD SERVICES

A. Perform factory startup of the chiller by factory trained and authorized servicing technicians confirming equipment has been correctly installed prior to equipment becoming operational and covered under the manufacturer's warranty. Report results in writing.

B. Supply initial charge of refrigerant and oil if not completely factory charged.

C. Demonstrate system operations and verify specified performance.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.05 CLEANING

A. Clean finishes to remove dust and dirt.

B. Touch up scratches in unfinished surfaces to restore corrosion resistance.

C. Touch up scratches in finished surfaces to restore finish.

D. Comb fins of outdoor condenser coils.

3.06 CLOSEOUT ACTIVITIES

A. Refer to Division 01 for closeout activities in addition to what is specified herein.

B. Demonstrate proper operation of equipment to Owner's designated representative.

C. Demonstration:

1. Provide the services of a factory authorized service representative to provide start-up service and to demonstrate proper operation of equipment, accessories, and controls to Owner’s personnel

    a) Use operation and maintenance data as reference during demonstration.
    b) Conduct walking tour of project.
    c) Briefly describe function, operation, and maintenance of each component.

D. Training:

1. At a time mutually agreed upon between the Owner and Contractor, provide the services of a factory trained and authorized representative to train Owner's designated personnel for a minimum of four hours on the operation and maintenance of the equipment provided under this section.

2. Content: Training shall include but not be limited to:

    a) Overview of the system and/or equipment as it relates to the facility as a whole.
    b) Operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention.
    c) Review data included in the operation and maintenance manuals. Refer to Division 1 Section "Operating and Maintenance Data."

3. Certification: Contractor shall submit to the Engineer a certification letter stating that the Owner’s designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The certification letter shall be signed by the Contractor and the Owner’s representative indicating agreement that the training has been provided.

4. Schedule: Schedule training with Owner with at least 7 days' advance notice.
5. Location: At project site.

E. Start-up Service:

1. Evacuate, dehydrate, vacuum pump and charge with specified refrigerant, and leak test in accordance with manufacturer's instructions, if not factory charged. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
2. Perform lubrication service, including filling of reservoirs, and confirming that lubricant is of quantity and type recommended by manufacturer.
3. Verify the motor amperage conforms to manufacturer’s data.
4. Do not place chillers in sustained operation prior to initial balancing of mechanical systems for interface with chillers.

END OF SECTION

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