SECTION 23 6423 – SCREW WATER CHILLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Packaged, air-cooled, electric-motor-driven, screw water chillers.

1.3 DEFINITIONS

A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

B. DDC: Direct digital control.

C. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

D. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 506/110 and referenced to ARI standard rating conditions.

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8. Minimum entering condenser-air temperature
9. Performance at varying capacity with constant design entering condenser-air temperature. Repeat performance at varying capacity for different entering condenser-air temperatures from design to minimum in 10 deg F (6 deg C) increments.

B. Shop Drawings: Complete set of manufacturer's prints of water chiller assemblies, control panels, sections and elevations, and unit isolation. Include the following:

1. Assembled unit dimensions.
2. Weight and load distribution.
3. Required clearances for maintenance and operation.
4. Size and location of piping and wiring connections.
5. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of (h e)-12(h e)-12(h ns)-8(,)-1d

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2. A free-standing refrigerant storage tank and pumpout unit shall be provided. The storage vessels shall be designed per ASME (American Society of Mechanical Engineers) Section VIII Division 1 code with 300 psig (2068 kPa) design pressure. Double relief valves per ANSI/ ASHRAE 15, latest edition, shall be provided. The tank shall include a liquid level gage and pressure gage. The pumpout unit shall use a semi-hermetic reciprocating compressor with water-cooled condenser. Condenser water piping, 3-phase motor power, and 115-volt control power shall be installed at the jobsite by the iovsunit actor.

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3. Waterboxes and nozzle connections shall be designed for 150 psig (1034 kPa) minimum working pressure unless otherwise noted. Nozzles should have grooves to allow use of Victaulic couplings.
4. The tube sheets of the cooler and condenser shall be bolted together to allow for field disassembly and reassembly.
5. The vessel shall display an ASME nameplate that shows the pressure and temperature data and the “U” stamp for ASME Section VIII, Division 1. A re-seating pressure relief valve(s) shall be installed on each heat exchanger. If a non-reseating type is used, a backup reseating type shall be installed in series.
6. Waterboxes shall have vents, drains, and covers to permit tube cleaning within the space shown on the drawings. A thermistor type temperature sensor with quick connects shall be factory-installed in each water nozzle.
7. Cooler shall be designed to prevent liquid refrigerant from entering the compressor. Devices that introduce pressure losses (such as mist eliminators) shall not be acceptable because they are subject to structural failures that can result in extensive compressor damage.
8. Tubes shall be individually replaceable from either end of the heat exchanger without affecting the strength and durability of the tube sheet and without causing leakage in adjacent tubes.
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10) Condenser refrigerant temperature
11) Oil supply pressure
12) Oil sump temperature

j. Pump Control:

1) Upon reque

7) High condenser pressure
8) High motor temperature
9) High compressor discharge temperature
10) Low oil pressure
11) Prolonged stall
12) Loss of cooler water flow
13) Loss of condenser water flow
14) Variable frequency drive fault
15) High variable frequency drive temperature

a) * Shall not require manual reset or cause an alarm if auto-restart after power failure is enabled.

b. The control system shall detect conditions that approach protective limits and take self-corrective action prior to an alarm occurring. The system shall automatically reduce chiller capacity when any of the following parameters are outside their normal operating range:

1) High condenser pressure
2) High motor temperature
3) Low evaporator refrigerant temperature
4) High motor amps
5) High VFD inverter temperature

c. During the capacity override period, a pre-alarm (alert) message shall be displayed informing the operator which condition is causing the capacity override. Once the condition is again within acceptable limits, the override condition shall be terminated and the chiller shall revert to normal chilled water control. If during either condition the protective limit is reached, the chiller shall shut down and a message shall be displayed informing the operator which condition caused the shutdown and alarm.

d. Internal built-in safeties shall protect the chiller from loss of water flow. Differential pressure switches shall not be allowed to be the only form of freeze protection.

3. Diagnostics and Service:

a. A self-diagnostic controls test shall be an integral part of the control system to allow quick identification of malfunctioning components.

b. Once the controls test has been initiated, all pressure and temperature sensors shall be checked to ensure they are within normal operating range. A pump test shall automatically energi htation iff4fi.8(m)-24.4((g)-12(pr)-6.4()-8(ur6)9.2(.)-TJ 12.434 0 Td)2.4(

a. The chiller controls shall be supplied as standard with a two-chiller lead/lag and a third chiller standby system. The control system shall automatically start and stop a lag or second chiller on a two-chiller system. If one of the two chillers on line goes into a fault mode, the third standby chiller shall be automatically started. The two-chiller lead/lag system shall allow manual rotation of the lead chiller and a staggered restart of the chillers after a power failure. The lead/lag system shall include load balancing if configured to do so.

G. Electrical Requirements:

1. Electrical contractor shall supply and install main electrical power line, disconnect switches, circuit breakers, and electrical protection devices per local code requirements and as indicated necessary by the chiller manufacturer.
2. Electrical contractor shall wire the chilled water pump and flow, condenser water pump and flow, and tower fan control circuit to the chiller control circuit.
3. Electrical contractor shall supply and install electrical wiring and devices required to interface the chiller controls with the building control system if applicable.
4. Electrical power shall be supplied to the unit at the voltage, phase, and frequency listed in the equipment schedule.

H. Piping Requirements — Instrumentation and Safeties:

1. Mechanical contractor shall supply and install pressure gages in readily accessible locations in piping adjacent to the chiller such that they can be easily read from a standing position on the floor. Scale range shall be such that design values shall be indicated at approximately midscale.
2. Gages shall be installed in the entering and leaving water lines of the cooler and condenser.

I. Vibration Isolation:

1. Chiller manufacturer shall furnish neoprene isolator pads for mounting equipment on a level concrete surface.

J. Start-Up:

1. The chiller manufacturer shall provide a factory-trained representative, employed by the chiller manufacturer, to perform the start-up procedures as outlined in the Start-Up, Operation and Maintenance manual provided by the chiller manufacturer.
2. Manufacturer shall supply the following literature:

a. Start-up, operation and maintenance instructions.
b. Installation instructions.
c. Field wiring diagrams.
d. One complete set of certified drawings.

K. Special Features:

1. Soleplate Package:

a. Unit manufacturer shall furnish a soleplate package consisting of soleplates, jacking screws, leveling pads, and neoprene pads.

2. Spring Isolators:

a. Spring isolators shall be field furnished and selected for the desired degree of isolation.

3. Spare Sensors with Leads:

a. Unit manufacturer shall furnish additional temperature sensors and leads.

4. Stand-Alone Pumpout Unit:

a. A free-standing pumpout unit shall be provided. The pumpout unit shall use a semi-hermetic reciprocating compressor with -29.51T1(s)-8.1(hal)-8.9provir33ro40.002 T8nis s3el

a. Hot gas bypass valve and piping shall be factory-furnished to permit chiller operation for extended periods of time.

11. Cooler and Condenser Tubes:

a. Contact your local Carrier Representative for other tube offerings.

12. Cooler and Condenser Passes:

a. Unit manufacturer shall provide the cooler and/ or condenser with 1, 2 or 3 pass configuration on the water side.

13. Nozzle-In-Head, 300 psig (2068 kPa):

a. Unit manufacturer shall furnish nozzle-in-head style waterboxes on the cooler and/or condenser rated at 300 psig (2068 kPa).

14. Marine Waterboxes, 150 psig (1034 kPa):

a. Unit manufacturer shall furnish marine style

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Qualification by Shake-Table Testing of Nonstructural Components and Systems. Manufacturer shall provide seismic certificate from OSHPD (California only).

21. Unit-Mounted Variable Frequency Drive (VFD) with Built-In Harmonic LiquiFlo™ II Filter (Q and R compressor only):

    a. Design:

        1) The VFD shall be refrigerant cooled, microprocessor based, pulse width modulated design. Water-cooled designs are not acceptable.
        2) Input and output power devices shall be Insulated Gate Bipolar Transistors (IGBTs).
        3) Rectifier shall convert incoming fixed voltage/frequency to fixed DC voltage.
        4) Transistorized inverter and control regulator shall convert fixed DC voltage to a sinusoidal PWM waveform.
        5) Low voltage control sections and main power sections shall be physically isolated.
        6) Integrated controls shall coordinate motor speed to optimize chiller performance over a wide variety of operating

j. Protection (the following shall be supplied):

1) Under-voltage
2) Over voltage
3) Phase loss
4) Phase reversal
5) Ground fault
6) Phase unbalance protection
7) Single cycle voltage loss protection (LF-2 VFD only)
8) Programmable auto re-start after loss of power
9) Motor overload protection (NEMA Class 10)
10) Motor over temperature protection

k. VFD Testing:

1) The VFD shall be factory-mounted, factory-wired and factory-tested on the chiller prior to shipment.

22. Unit-Mounted Variable Frequency Drive (VFD) without Built-In Harmonic Filter:

a. Design:

1) VFD shall be air or refrigerant cooled, microprocessor based, pulse width modulated design. Water-cooled designs are not acceptable.
2) Output power devices shall be insulated gate bipolar transistors (IGBTs).
3) Converter section with full-wave fixed diode bridge rectifier shall convert incoming fixed voltage/frequency to fixed DC voltage.
4) DC link shall filter and smooth the converted DC voltage.
5) Transistorized inverter and control regulator shall convert fixed DC voltage to a sinusoidal PWM waveform.
6) Integrated controls shall coordinate the motor speed to optimize chiller performance over a wide variety of operating conditions.

b. Enclosure:

1) Pre-painted unit mounted, NEMA 1 cabinet shall include hinged, lockable doors and removable lifting lugs.
2) VFD shall have a short circuit current rating of at least 100,000 amps.
3) Provisions to padlock main disconnect handle in the “Off” positions shall be provided. Mechanical interlock to prevent opening cabinet door with

1) Drive shall be suitable for nameplate voltage ±10%.
2) Drive shall be suitable for continuous operation at 100% of nameplate amps and 150% of nameplate amps for 3 seconds.
3) Drive shall comply with applicable UL, CE, and NEMA standards.
4) Drive shall be suitable for operation in ambient temperatures between 40 and 104 F (4.4 and 40 C), 95% humidity (non-condensing) for altitudes up to 3300 feet (1006 m) above sea level. Specific drive performance at jobsite ambient temperature and elevation shall be provided by the manufacturer in the bid.

e. User Interface:

1) Displays shall provide interface for programming and display of VFD and chiller parameter361 Td -0.002 Tc 074jn60:44(am)-2424S.0485.5(D)-2-8(dr)-6.4(i)-d3.2(i)3._c

3) Drive shall comply with applicable UL and NEMA standards.
4) Drive shall be suitable for operation in ambient temperatures between 40 and 104 F (4.4 and 40 C), 95% humidity (non-condensing) for altitudes up to 3300 feet (1006 m) above sea level. Specific drive performance at jobsite ambient temperature and elevation shall be provided by the manufacturer in the bid.

e. User Interface:

1) Displays shall provide interface for programming and display of VFD and chiller parameters. Viewable parameters include:

a) Operating, configuration and fault messages
b) Frequency in hertz
c) Load side voltage and current (at the VFD)
d) kW (on the VFD interface)

f. VFD Performance:

1) VFD full load efficiency shall meet or exceed 97% at 100% VFD Rated Ampacity.
2) Base motor frequency shall be 60 hertz.

g. VFD Electrical Service: (single point power):

1) VFD shall have input circuit breaker with minimum 35,000 amp interrupt capacity.
2) VFD shall have standard 15 amp branch oil pump circuit breaker to prov W1 Td (1e)-12.2( )

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shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, flow meter, and drain connection with valve. Make connections to water chiller with a flange.

D. Refrigerant Pressure Relief Valve Connections: For water chillers installed indoors, extend vent piping to the outside without valves or restrictions. Comply with ASHRAE 15**.**

E. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Verify that refrigerant charge is sufficient and water chiller has been leak tested. Verify that eld-