

SECTION 15670 - ROTARY-SCREW WATER CHILLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

Chiller package.
Charge of refrigerant and oil.
Controls and control connections.
Chilled water connections.
Condenser water connections.
Starters.
Electrical power connections.

1.2 REFERENCES

ANSI/ASHRAE STANDARD 15-1992 - Safety Code for Mechanical Refrigeration.
ANSI/ASHRAE 90.1 - Energy Efficient Design of New Buildings.
ANSI/ASME SEC VIII - Boiler and Pressure Vessel Code.
ANSI/ASME B31.S-1983 ASME Code for Pressure Piping and Refrigeration Piping.
ANSI/UL 1995 - Central Cooling Air Conditioners.
UL 984 - Safety Standards for Hermetic Motor Compressors.
ANSI/ARI 550/590-98 - Standard for Water Chilling Packages using the Vapor Compression Cycle.
ARI STANDARD 575-87 - Method of Measuring Machinery Sound Within Equipment Rooms.

1.3 SUBMITTALS

Submit drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

Submit manufacturer's installation instructions.

1.4 OPERATION AND MAINTENANCE DATA

Include start-up instructions, operation data, maintenance data, controls, and accessories. Include trouble-shooting guide.

1.5 VERIFICATION OF CAPACITY AND EFFICIENCY

A. All proposals for chiller performance must include an ARI approved selection method. Verification of date and version of computer program selection or catalog is available

through the Vice President, Engineering, ARI (703) 524-8800.

1.6 REGULATORY REQUIREMENTS

- A. Conform to ARI Standard 550/590-98 for rating and certified testing of Water Chilling Packages using the Vapor Compression Cycle.
- B. Conform to ANSI/UL 1995 - Standard for Heating and Cooling Equipment, Safety Standard .
- C. Conform to ASME SECTION VIII Boiler and Pressure Vessel Code for construction and testing of unfired pressure vessels.
- D. Conform to ANSI/ASHRAE STANDARD 15-1992 safety code for mechanical refrigeration.

1.7 HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Protect units from physical damage. Leave factory shipping covers in place until installation.

1.8 WARRANTY

- A. The unit manufacturer shall provide complete warranty of the chillers for a period of five (5) years from the date of substantial completion, including all parts and labor for the entire unit. Warranty shall include annual oil analysis throughout the warranty period.

PART 2 PRODUCTS

2.1 SUMMARY

- A. The contractor shall furnish and install rotary screw water chillers as shown and scheduled in the plans. The units shall be installed in accordance with this specification and produce the specified tonnage per the scheduled data in accordance with ARI Standard 550/590-98. The unit shall be ARI certified as applicable.
- B. Chiller shall be Trane Series RTHD.

2.2 COMPRESSOR AND MOTOR

- A. The compressor shall be rotary screw type. Compressor shall be semihermetic and utilize twin rotor design.
- B. Chiller should be able to unload to 25 percent of full load tonnage with constant

entering condenser water temperature.

C. The motor shall be semihermetic and suction gas cooled. Hot gas motor cooling is not acceptable. If an open motor design is used, the motor shall be a TEFC and the contractor shall provide and install a properly designed mechanical cooling system to remove motor heat. The size of the auxiliary equipment shall be based upon is 10% of the total compressor motor input kW. Manufacturer shall list, on its bid, additional kW requirement for the cooling system, additional maintenance requirements due to alignment, refrigerant seal, coupling and bearings.

D. Manufacturers with speed increasing transmissions that exceed 5000 RPM compressor speeds shall annually inspect the gears and bearings. A report shall be forwarded to the owner each year over the first five years to confirm completion.

2.3 EVAPORATOR AND CONDENSER

A. The evaporator and condenser shall be built in accordance with ANSI/ASHRAE 15-Safety Code for Mechanical Refrigeration. Water boxes shall be designed for 150 psig maximum working pressure and shall be flanged and gasketed for easy removal and access to the tubes. Condenser water box shall be of the marine type. The water boxes shall have grooved type water connections for easy field chilled water and condenser water connections.

B. Evaporator and Condenser tubes shall be internally enhanced and externally finned to achieve maximum efficiency. The nominal tube wall thickness shall be .028 inches for both evaporator and condenser tubes.

C. Adjustable or float type refrigerant metering devices and thermal expansion valves (TXV) shall be inspected and adjusted by the manufacturer annually for the first five years of operation to assure equivalent reliability to an electronic expansion valve (EXV) system. A written report shall be forwarded to the owner each year over the first five years to confirm completion of calibration.

D. Units with multi-stage compressors shall incorporate an interstage flash vessel economizer in the refrigerant cycle.

E. Factory insulation will be 3/4" foam insulation and cover all low temperature surfaces to include the evaporator and water boxes, suction line, and motor housing.

2.5 CONTROLS

A. The chillers shall be controlled by a stand-alone direct digital control (DDC) system. A dedicated chiller control panel with a clear language display is to be supplied with each chiller by the chiller manufacturer. The controller shall provide chiller capacity control in response to the leaving chilled water temperature.

B. The chiller control panel shall utilize the following components to automatically take action to prevent unit shutdown due to abnormal operating conditions which will

perform as follows:

1. High pressure switch that is set 20 PSIG lower than factory pressure switch that will automatically unload the compressor to help prevent a high pressure condenser control trip. One switch is required for each compressor and indicating light shall also be provided.
2. Motor surge protector that is set at 95% of compressor RLA that will automatically unload the compressor to help prevent an overcurrent trip. One protector is required for each compressor and indicating light shall also be provided.
3. Low pressure switch that is set at 5 PSIG above the factory low pressure switch that will automatically unload the compressor to help prevent a low evaporator temperature trip. One switch is required for each compressor and indicating light shall also be provided.

C. In all of the above cases, the chiller will continue to run, in an unloaded state, and will continue to produce some chilled water in an attempt to meet the cooling load. However, if the chiller reaches the trip-out limits, the chiller controls will take the chiller off line for protection, and a manual reset is required. Once the "near trip" condition is corrected, the chiller will return to normal operation and can then produce full load cooling.

D. The chiller control panel shall provide control of chiller operation and monitoring of chiller sensors, actuators, relays, and switches. The panel shall be a complete system for stand-alone chiller control and include controls to safely and efficiently operate the chiller.

E. The chiller control panel is to be provided with the following digital type pressure readouts:

1. Evaporator refrigerant pressure
2. Condenser refrigerant pressure

F. The front of the chiller control panel shall be capable of displaying the following in clear language as standard:

Entering and leaving evaporator water temperature
Entering and leaving condenser water temperature
Chilled water setpoint
Electrical 3 phase current limit and percent RLA setpoint
Electrical 3 phase amp draw
Chiller operating mode
Condenser refrigerant temperature
Elapsed time and number-of-starts counter
Chiller compressor run status relay
Diagnostics with time and date stamp

Last 20 diagnostics with time and date stamp
External chilled water setpoint input 2-10VDC/4-20mA
External current limit setpoint input 2-10VDC/4-20mA
Voltage readout
Percent RLA output 2-10VDC

G. The chiller control panel shall provide a relay output to start the condenser water pump and/or enable the cooling tower temperature controls.

H. The chiller control panel shall provide an alarm relay output that shall energize whenever a fault requiring manual reset is detected by the panel.

I. The chiller control panel shall provide a limit relay output that shall energize whenever the unit is operating in a limit mode (for extended time periods).

J. The chiller control panel shall provide a programmable soft load to prevent the chiller from achieving full capacity during the pulldown period by imposing a ramped current limit, or a temperature pulldown rate. Either can be adjusted to limit how fast the chiller can load after an initial startup.

K. The chiller control panel shall provide a chilled water pump output relay that closes when the chiller is given a signal to start.

L. The chiller control panel shall provide control of leaving chilled water setpoint with a minimum variation of chiller capacity.

N. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.

P. The chiller control panel shall be provided with communication capability required to communicate with the BAS/ATC control system. Chiller points list is attached for points to be monitored by control system.

2.6 STARTERS

A. The motor starter shall be a wye-delta closed transition. Motor starter shall have NEMA 1 gasketed enclosure. Enclosure shall be constructed of 12 gauge steel minimum with the exception of doors which shall be 14 gauge steel minimum.

B. Starter shall be unit mounted with ventilating louvers.

C. Motor starters shall include incoming line provisions for the number and size cables shown on the drawings. Incoming line lugs shall be aluminum mechanical type. Connection directly to the contactors is not permissible.

D. Contactors shall be sized properly to the chiller full load and locked rotor currents. Contactors shall have double break main contacts with weld resistant silver cadmium faces. Auxiliary interlocks that interface with the control panel shall be low resistance

having palladium silver contacts.

E. Each motor starter shall include a control power transformer with fused primary and secondary. Current transformers of the proper size, ratio and burden capacity shall be provided to provide a signal to the control panel and optional devices. Control relays shall be provided within the motor starter to interface with the control panel.

F. Power wiring within the starter shall be type MTW copper stranded 90 degree C. Power wire bends shall show no evidence of nicking or insulation degradation. Control wire shall be type MTW copper stranded 90 degree C 14 gauge minimum.

G. Starter shall include an advanced motor protection system incorporating electronic three phase overloads and current transformers. This electronic motor protection system shall monitor and protect against the following conditions:

Three phase overload protection

Overload protection during start-up

Phase imbalance

Phase loss

Phase reversal

Low voltage

Distribution fault protection consisting of three-phase, current sensing devices that monitor the status of the current. Distribution faults of 1-1/2 electrical cycle duration's shall be detected and the compressor motor shall be disconnected within six electrical cycles.

Under/over voltage protection (optional)

H. Alternately the advanced motor protection system can be furnished in the chiller control panel.

I. The starter/control shall be designed and able to operate in temperatures up to 122 F (50 C).

J. All field supplied wires, bus bars, and fittings shall be copper only.

K. The following optional starter options shall be provided:

1. Amperage shall be displayed at the control panel or ammeters and voltmeters provided. Three ammeters shall be provided, one per phase. Ammeters shall be calibrated to indicate the inrush current. Three voltmeters shall be provided, each reading a phase-to-phase voltage.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

- B. Provide for connection to electrical service. If oil pump is electric include the connection of the oil pump to emergency power.
- C. Provide Neoprene Isolation Pads to reduce vibration transmission and install unit on 6" reinforced concrete pad. Coordinate pad requirements with structural engineer.
- D. On units without unit mounted starters provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit.
- E. Furnish and install necessary auxiliary water piping for oil cooling units and purge condensers.
- F. Arrange piping for easy dismantling to permit tube cleaning.
- G. Provide piping from chiller relief valve to outdoors. Size as recommended by manufacturer.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer shall furnish a factory trained service engineer without additional charge to start the units. Representatives shall provide leak testing, evacuation, dehydration, and charging of the unit as required. Chiller manufacturers shall maintain service capabilities no more than two (2) hours driving time from the jobsite.
- B. A start-up log shall be furnished by the manufacturer to document the chiller's start-up date and shall be signed by the owner or his authorized representative prior to commissioning the chillers.
- C. The manufacturer shall furnish complete submittal wiring diagrams of the chiller starter and associated components like cooling towers, pumps, interlocks, etc. as applicable.

END OF SECTION