CENTRIFUGAL WATER CHILLERS

1. GENERAL

1.1 Related Sections

.1 Section 01 33 00 - Submittal Procedures.

1.2 References

.1 Air-Conditioning, Heating and Refrigeration Institute (AHRI)

.1 AHRI 550/590, Performance Rating of Water-Chilling Packages Using the Vapor Compression Cycle.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 15 (2010), Safety Standard for Refrigeration Systems.

.3 American Society of Mechanical Engineers (ASME).

.1 ASME, Boiler and Pressure Vessel Code.

.4 Canadian Standards Association (CSA)

.1 CSA B52-09, Mechanical Refrigeration Code.

.5 Environment Canada/Environmental Protection Services (EPS)

.1 EPS 1/RA/2, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

.1 Dimensioned plan and elevation view, including required clearances, and location of all field piping and electrical connections.

.2 Summaries of all auxiliary utility requirements such as: electricity, water, air, etc. Summary shall indicate quality and quantity of each required utility.

.3 Diagram of control system indicating points for field interface and field connection. Diagram shall fully depict field and factory wiring.

.4 Manufacturer’s certified performance data at full load plus IPLV or NPLV.

.5 Installation and Operating Manuals.

1.4 Closeout Submittals

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 33 00 - Submittal Procedures.

.2 Data to include:

.1 Dimensioned plan and elevation view, including required clearances, and location of all field piping and electrical connections.

.2 Summaries of all auxiliary utility requirements such as: electricity, water, air, etc. Summary shall indicate quality and quantity of each required utility.

.3 Diagram of control system indicating points for field interface and field connection. Diagram shall fully depict field and factory wiring.

.4 Manufacturer's certified performance data at full load plus IPLV or NPLV.

.5 Installation and Operating Manuals.

1.5 Delivery And Handling

.1 Chillers shall be delivered to the job site completely assembled and charged with refrigerant.

.2 Comply with the manufacturer's instructions for rigging and transporting units. Leave protective covers in place until installation.

1.6 Warranty

.1 The refrigeration equipment manufacturer's warranty shall be for a period of five years from date of Total Performance. The warranty shall include parts and labour costs for the repair or replacement of defects in material or workmanship. The refrigerant warranty shall match the parts and labour warranty.

1.7 Equipment Service Agreement

.1 The equipment shall include a 2 year service agreement which will include the seasonal start-up and shut-down.

2. PRODUCTS

2.1 Acceptable Manufacturers

.1 McQuay International

2.2 Unit Description

.1 Provide and install as shown on the plans a factory assembled, charged, and run-tested water-cooled packaged chiller. Each unit shall be complete with two multi-stage, oil-free, magnetic bearing, hermetic centrifugal compressors. Each compressor shall have variable frequency drive operating in concert with inlet guide vanes for optimized unit part load efficiency. The evaporator, condenser, and expansion valve shall be common to both of the

compressors. The chiller unit shall be capable of running on one compressor with the other compressor or any of its auxiliaries inoperable or removed.

2.3 Design Requirements

.1 General:

.1 Provide a complete water-cooled, dual hermetic compressor centrifugal water chiller as specified herein. Machine shall be provided according to standards, Section 1.2. In general, unit shall consist of two magnetic bearing, completely oil-free, compressors, refrigerant condenser and evaporator, and control systems including variable frequency drive, operating controls and equipment protection controls. Note: Chillers shall be charged with a refrigerant such as HFC-134a, not subject to phase-out by the Montreal Protocol and the U. S. Clean Air Act.

.2 Performance:

.1 Refer to Section 23 06 00 – Schedules for HVAC

.2 The chiller shall be capable of stable operation to ten percent of full load with standard AHRI entering condensing water relief without hot gas bypass.

.3 Acoustics:

.1 Sound pressure for the unit shall not exceed the specified levels in Section 23 06 00 – Schedules for HVAC.

.2 Provide the necessary acoustic treatment to chiller as required.

.3 Sound data shall be measured according to ANSI/AHRI Standard 575 and shall be in dB. Data shall be the highest levels recorded at all load points.

2.4 Chiller Components

.1 A. Compressors:

.1 The unit shall have two two-stage, magnetic bearing, oil-free, hermetic centrifugal compressors. The compressor drive train shall be capable of coming to a controlled, safe stop in the event of a power failure.

.2 Movable inlet guide vanes, acting together with variable speed, shall provide unloading. A microprocessor controller, dedicated to each compressor shall coordinate the vane and speed control to provide optimum unit efficiency.

.2 Refrigerant Evaporator and Condenser:

.1 Evaporator and condenser shall be of the shell-and-tube type, designed, constructed, tested and stamped according to the requirements of the ASME Code, Section VIII. Regardless of the operating pressure, the refrigerant side of each vessel will bear the ASME stamp indicating compliance with the code and indicating a test pressure of 1.1 times the working pressure but not less than 100 psig. Provide intermediate tube supports at a maximum of 18 inch spacing.

.2 Tubes shall be enhanced for maximum heat transfer, rolled into steel tube sheets and sealed with Locktite® or equal sealer. The tubes shall be individually replaceable and secured to the intermediate supports without rolling.

.3 Provide sufficient isolation valves and condenser volume to hold full refrigerant charge in the condenser during servicing or provide a separate pumpout system and storage tank sufficient to hold the charge of the largest unit being furnished.

.4 The water sides shall be designed for a minimum of 150 psig or as specified elsewhere. Vents and drains shall be provided.

.5 Evaporator minimum refrigerant temperature shall be 33°F.

.6 An electronic expansion valve shall control refrigerant flow to the evaporator. Fixed orifice devices or float controls with hot gas bypass are not acceptable because of inefficient control at low load conditions. The liquid line shall have a moisture indicating sight glass.

.7 The evaporator and condenser shall be separate shells. A single shell containing both vessel functions is not acceptable because of the possibility of internal leaks.

.8 Reseating type spring loaded pressure relief valves according to ASHRAE-15 safety code shall be furnished. The evaporator shall be provided with single or multiple valves. The condenser shall be provided with dual relief valves equipped with a transfer valve so one valve can be removed for testing or replacement without loss of refrigerant or removal of refrigerant from the vessel. Rupture disks are not acceptable.

.9 The evaporator, including water heads, suction line, and any other component or part of a component subject to condensing moisture shall be insulated with UL recognized 3/4 inch closed cell insulation. All joints and seams shall be carefully sealed to form a vapour barrier.

.10 Provide factory-mounted and wired water flow switches on each vessel to prevent unit operation with no water flow.

.3 Prime Mover:

.1 Permanent-magnet, synchronous motor of the hermetic type, of sufficient size to efficiently fulfill compressor horsepower requirements.

.2 Motor shall be liquid refrigerant cooled with internal thermal overload protection devices embedded in the winding of each phase.

.3 Motor shall be compatible with variable frequency drive operation.

.4 Variable Frequency Drive (VFD)

.1 The chiller shall be equipped with a Variable Frequency Drive (VFD) to automatically regulate each compressor speed in response to cooling load and compressor pressure lift. The chiller control shall coordinate compressor speed and guide vane position to optimize chiller efficiency.

.2 The unit shall be equipped with a line reactor.

.5 Chiller Control

.1 The unit shall have distributed microprocessor-based control architecture consisting of a VGA touchscreen operator interface, a controller for each compressor and a unit controller.

.2 The touchscreen shall display the unit operating parameters, accept setpoint changes (password protected) and be capable of resetting faults and alarms. The following trended parameters shall be displayed:

.1 Entering and leaving chilled water temps

.2 Entering and leaving condenser water temps

.3 Evaporator saturated refrigerant pressure

.4 Condenser saturated refrigerant pressure

.5 Percent of 100% speed (per compressor)

.6 % rated load amps for entire unit

.3 In addition to the trended items above, other real-time operating parameters are also shown on the touchscreen. These items can be displayed in two ways: by chiller graphic showing each component or from a color-coded, bar chart format. At a minimum, the following critical areas must be monitored:

.4 Complete fault history shall be displayed using an easy to decipher, color coded set of messages that are date and time stamped. The last 25 faults shall be downloadable from the USB port drive.

.5 Automatic corrective action to reduce unnecessary cycling shall be accomplished through pre-emptive control of low evaporator or high discharge pressure conditions to keep the unit operating through abnormal transient conditions.

.6 System specific, chiller plant architecture software shall be employed to display the chiller, piping, pumps and cooling tower. Chiller plant optimization software for up to 3 chillers shall also be available to provide automatic control of: evaporator and condenser pumps (primary and standby), up to 4 stages of cooling tower fans and a cooling tower modulating bypass valve or cooling tower variable frequency drives.

.7 The unit controller shall support operation on a BACnet, Modbus or LONWORKS network via a factory-installed communication module.

.8 Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® or LONMARKS ® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.

.1 BACnet MS/TP master (Clause 9)

.2 BACnet IP, (Annex J)

.3 BACnet ISO 8802-3, (Ethernet)

.4 LONMARKS FTT-10A. The unit controller shall be LONMARKS® certified.

.9 The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.

.10 For chillers communicating over a LONMARK network, the corresponding LONMARK eXternal Interface File (XIF) shall be provided with the chiller submittal data.

.11 All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

2.5 OPTIONAL ITEMS

.1 The following optional items shall be furnished:

.1 BAS interface module for the applicable protocol being used.

.2 Extended warranties: See Point 1.7 of this Section.

.3 Additional Service Agreement: See Point 1.8 of this Section.

3. EXECUTION

3.1 Installation

.1 Install per manufacturer's requirements, Shop Drawings, and Contract.

.2 Adjust chiller alignment on foundations, or subbases as called for on drawings.

.3 Arrange piping to allow for dismantling to permit head removal and tube cleaning.

.4 Coordinate electrical installation with electrical contractor.

.5 Coordinate controls with control contractor.

.6 Install vent pipe in schedule 40 steel with all necessary fitting. Refer to section 23 21 13.02 Hydronic Systems – Steel

.7 Provide all material required for a fully operational and functional chiller.

3.2 Start-Up

.1 Units shall be factory charged with the proper refrigerant.

.2 Factory Start-Up Services: Provide for as long a time as is necessary to ensure proper operation of the unit, but in no case for less than two full working days. During the period of start-up, The Start-up Technician shall provide training to the City in proper care and operation of the unit.

3.3 Performance

.1 Refer to Section 23 06 00 – Schedules for HVAC.

END OF SECTION