Guide Specifications for Magnetic Bearing Centrifugal Water-cooled chiller

1.1 General Specifications

Manufacturer of oil free magnetic chiller must have at least 10 years' experience in manufacturing magnetic chiller. Chillers shall have single or multiple oil-free, magnetic bearing, semi-hermetic centrifugal compressors (no exceptions), coupled with a flash tank economizer. E IPlant manager use machine learning algorithm for smart sequencing for air cool chillers. Smart sequencing is a staging and sequencing based on optimal efficiency of the combination of air cool chiller operationach compressor shall have an integrated variable-frequency drive operating in concert with inlet guide vanes for optimized full and part load efficiency. On multiple-compressor units, the evaporator and condenser refrigerant sides and the expansion valve shall be common, and the chiller shall be capable of running on one compressor with the other compressor or any of its auxiliaries inoperable or removed.

1.2 Component Specifications

A. Compressors:

i. The unit shall utilize magnetic bearing, oil-free, only semi-hermetic centrifugal compressors, coupled with a flash tank economizer. The compressor drive train shall be capable of coming to a controlled, safe stop in the event of a power failure.

ii. The motor shall be of the semi-hermetic type, of sufficient size to efficiently fulfill compressor horsepower requirements. It shall be liquid refrigerant cooled with internal thermal sensing devices in the stator windings. The motor shall be designed for variable frequency drive operation.

iii. The chiller shall be equipped with an integrated Variable Frequency Drive (VFD) to automatically regulate compressor speed in response to cooling load and the compressor pressure lift requirement. Movable inlet guide vanes and variable compressor speed shall provide unloading. The chiller controls shall coordinate compressor speed and guide vane position to optimize chiller efficiency.

iv. Each compressor circuit shall be equipped with a line reactor to help protect against incoming power surges and help reduce harmonic distortion.

B. Evaporator and Condenser:

i. The evaporator and condenser shall be separate vessels of the shell-and-tube type, designed, constructed, tested and stamped according to the requirements of the ASME Code, Section

VIII. The tubes shall be individually replaceable and secured to the intermediate supports without rolling.

ii. The evaporator shall be flooded type with [0.025 in.] wall copper tubes rolled into carbon steel tubesheets. The water side shall be designed for a minimum of [150 psig]. The heads shall be [carbon steel]. Water connections shall be grooved suitable for [Victaulic couplings]. The evaporator shall have [dished heads with valved drain and vent connections].

iii. The condenser shall have [0.025 in.] wall [copper] tubes rolled into carbon steel. Water connections shall be [grooved suitable for Victaulic couplings]. The water side shall be designed for a minimum of [150 psig]. The condenser shall have [dished heads with valved drain and vent connections].

iv. Provide sufficient isolation valves and condenser volume to hold the full unit 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.

v. 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 moisture indicating sight glass.

vi. Re-seating 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 relief valve can be removed for testing or replacement without loss of refrigerant or removal of refrigerant from the condenser. Rupture disks are not acceptable.

vii. 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 OR 1 ½ inch closed cell insulation. All joints and seams shall be carefully sealed to form a vapor barrier.

viii. Provide factory-mounted and wired, thermal-dispersion water flow switches on each vessel to prevent unit operation with no or low water flow.

C. Vibrations

Provide neoprene waffle-type vibration isolators for each corner of the unit.

D. Power Connections

Power connection shall be single point to a factory-mounted disconnect switch OR shall be multipoint to each compressor power panel on two-compressor units.

1.3 Control Specifications

i. The unit shall have a microprocessor-based control system consisting of a 15-inch VGA touch-screen operator interface and a unit controller.

ii. The touch-screen shall display the unit operating parameters, accept setpoint changes (multi-level password protected) and be capable of resetting faults and alarms. The following parameters shall be displayed on the home screen and also as trend curves on the trend screen:

- Entering and leaving chilled and condenser water temperatures
- Evaporator and condenser saturated refrigerant pressures
- Percent of 100% speed (per compressor)
- % of rated load amps for entire unit

iii. In addition to the trended items above, all other important real-time operating parameters shall also be shown on the touch-screen. These items shall be displayed on a chiller graphic showing each component. At a minimum, the following critical areas must be monitored:

- Compressor actual speed, maximum speed, percent speed
- Evaporator water in and out temperatures, refrigerant pressure and temperature
- Condenser water in and out temperatures, refrigerant pressure and temperature
- Liquid line temperature
- Chilled water setpoint
- Compressor and unit state and input and output digital and analog values

iv. A fault history shall be displayed using an easy to decipher, color coded set of messages that are date and time stamped. The alarm history shall be downloadable from the unit's USB port. An operating and maintenance manual specific for the unit shall be viewable on the screen and downloadable.

v. All setpoints shall be viewable and changeable (multi-level password protected) on the touch screen and include setpoint description and range of set values.

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

vii. The chiller shall be capable of sequencing up to two other similar chillers and automatic control of: evaporator and condenser pumps (primary and standby), up to 3 stages of cooling tower fan cycling control and a tower modulating bypass valve or cooling tower fan variable frequency drives.

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

- Modbus
- BACnet MS/TP master (Clause 9)
- BACnet IP, (Annex J)
- BACnet ISO 8802-3, (Ethernet)
- LonTalk® FTT-10A. The unit controller shall be LONMARK ® certified.

ix. 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.

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

xi. 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.

xii. The chiller shall be able to maintain operation during a momentary power loss event lasting up to 5 seconds when operated at standard AHRI load and lift conditions. The chiller shall be able to ride through this momentary power loss event without shutting down. Chillers not able to

maintain operation during momentary power loss events lasting up to 5 seconds shall include a properly sized thermal storage tank to maintain temperature stability in the system

xiii. The chiller shall be equipped with the capability to restart and reach full load quickly in the event of a power interruption without UPS. The first compressor shall be capable of restarting in less than 60 seconds after power is restored and shall reach 80% load within 77 seconds. Chillers not able to restart or load within this time frame shall include a properly sized thermal storage tank to maintain temperature stability in the system.

Mech Fit

Smart Valve

iPM Controls

10 Point Part Load