160 Ton Modular Chiller Specifications

PART 1 GENERAL

1.01 SUMMARY

Section includes design, performance criteria, refrigerants, controls, and installation requirements for a 160-ton modular, water-cooled liquid chiller.

1.02 REFERENCES

Comply with all federal, state, and local codes and standards. Installation will follow the 2018 IBC, 2018 IPC, 2018 IMC, 2018 IFC, 2017 NEC with local amendments.

1.03 SUBMITTALS

Submittals shall include, but not be limited to the following:

A. Chiller dimensional drawings with elevation overview. Drawings to include required service clearances, location of all field installed piping and electrical connections.
B. A summary of all auxiliary utility requirements for normal system operation required. Auxiliary utility requirements include electrical, water, and air. Summary of auxiliary equipment shall include quantity and quality of each specific auxiliary utility required.
C. Chiller Control documentation to include Chiller control hardware layout, wiring diagrams depicting factory installed wiring, field installed wiring with points of connection, and points of connection for BAS control/interface points.
D. Installation and Operating Manuals.

1.04 QUALITY ASSURANCE

A. Chiller is required to be run tested at manufacturer's facility to job specific requirements, prior to shipment. Report available upon request.

1.05 DELIVERY and HANDLING

A. Chiller(s) shall be delivered to the job site completely assembled and charged with complete refrigerant charge.

B. Installing contractor to comply with the manufacturer's instructions for transporting, rigging, and assembly of chiller.

1.06 WARRANTY and START-UP

A. Manufacturer shall provide the following warranty coverage for the entire chiller for the time period defined below. All parts shall be warranted against defects in material and workmanship.

B. Manufacturer's Warranty: Manufacturer shall provide full parts-only warranty coverage for entire chiller for a period of one year. All parts shall be warranted against defects in material and workmanship. Similar parts-only coverage shall be provided for the chiller's compressors for a period of five years. The warranty period shall commence either on the equipment start-up date or six months after shipment, whichever is earlier.

C. Manufacturer shall provide the services of a Factory Authorized Service Engineer to provide complete start-up supervision. After start-up a Manufacturer's Representative shall provide a minimum of 8-hours of operator training to the owner's designated representative(s).

PART 2 PRODUCTS

2.01 OPERATING CONDITIONS

A. Provide a 160-ton modular, water-cooled liquid chiller, such as a MULTISTACK model 050X/V/W or approved equal.

B. Chiller shall be designed to operate using **R-410a** Refrigerant.

C. Chiller shall be designed for parallel evaporator water flow.

D. Chiller shall be designed to operate using **460 volts**, 3 phase, **60 Hz** electrical power supply.

2.02 WATER-COOLED PACKAGED CHILLER

A. Approved manufacturer is MULTISTACK or approved equal.

B. System Description: Chiller shall incorporate both Variable Speed Scroll compressors and Fixed Speed Scroll compressors. Each module has two compressors that can be combinations of two variable speed, one variable and one fixed or two fixed speed compressors and can consist of multiple **50-ton** modules. This chiller has a total of **4** Variable Speed compressors and **4** Fixed Speed compressors. Each refrigerant circuit shall consist of an individual compressor, common dual circuited condenser, dual circuited evaporator, electronic expansion valve (thermal expansion valves not acceptable), and control system. Each circuit shall be constructed to be independent of other circuits from a refrigeration and electrical standpoint. The multi-circuit chiller must be able to produce chilled water even in the event of a failure of one or more refrigerant circuits. Circuits shall not contain more than **20** lb. of **R-410a** refrigerant.

B. General

1. Chiller Modules shall be ETL listed in accordance with UL Standard 1995, CSA certified per Standard C22.2#236.

2. Chiller modules shall be AHRI certified.

3. Modules shall ship wired and charged with refrigerant. All modules shall be factory run tested prior to shipment.

4. Compressors, heat exchangers, piping and controls shall be mounted on a heavy gauge, powder coated steel frame. Electrical controls, contactors, and relays for each module shall be mounted within that module.

D. Chilled and Condenser Water Mains: Each module shall include supply and return mains for both chilled and condenser water. Module piping will be rated for 150psi working pressure. Cut grooved end connections are provided for interconnection to **six**-inch standard **6.625"**outside diameter piping with grooved type couplings. Rolled grooved shall be unacceptable. Chilled water mains shall be insulated with ¾" closed cell insulation. Water Mains shall be installed such that they are beneath any power or control wiring so as to insure for safe operation in the event of condensation or minor piping leaks.

E. Evaporators and condensers: Each evaporator and condenser shall be brazed plate heat exchangers constructed of 316 stainless steel; designed, tested, and stamped in accordance with UL 1995 code for 650 psig refrigerant side working pressure. Both the condenser and evaporator heat exchanger shall be mounted below the compressor, to eliminate the effect of migration of refrigerant to the cold evaporator with consequent liquid slugging on start-up.

F. Compressor: Each module shall contain two hermetic scroll compressors independently circuited and mounted to the module with rubber-in-shear isolators. When a variable speed compressor is used, it shall be a true variable speed pairing. Standard compressors with drives applied to them will not be acceptable. Each system also includes high discharge pressure and low suction pressure manual reset safety cut-outs.

G. Central Control System.

1. Scheduling of the various compressors shall be performed by a microprocessor-based control system (Master Controller). A new lead compressor is selected every 24 hours to assure even distribution of compressor run time.

2. The Master Controller shall monitor and report the following on each refrigeration system:

    a. Discharge Pressure Fault
    b. Suction Pressure Fault
    c. Compressor Winding Temperature
    d. Suction Temperature
    e. Evaporator Leaving Chilled Water Temp.

3. The Master Controller shall be powered by the chillers single point power connection and shall monitor and report the following system parameters:

    a. Chilled Water Entering and Leaving Temperature
    b. Condenser Water Entering and Leaving Temperature
    c. Chilled Water and Condenser Water Flow

4. An out of tolerance indication from these controls or sensors shall cause a "fault" indication at the Master Controller and shutdown of that compressor with the transfer of load requirements to the next available compressor. In the case of a System Fault the entire chiller will be shut down. When a fault occurs, the Master Controller shall record conditions at the time of the fault and store the data for recall.

    This information shall be capable of being recalled through the keypad of the Master Controller and displayed on the Master Controller's 2 line by 40 character back-lit LCD. A history of faults shall be maintained including date and time of day of each fault (up to the last 20 occurrences).

5. Individual monitoring of leaving chilled water temperatures from each refrigeration system shall be programmed to protect against freeze-up.

6. The control system shall monitor entering and leaving chilled water temperatures to determine system load and select the number of compressor circuits required to operate. Response times and set points shall be adjustable. The system shall provide for variable time between compressor sequencing and temperature sensing, so as to fine tune the chiller to different existing building conditions.

7. The Chiller shall be capable of interfacing to a building Automation system. Interface shall be accomplished using an Interoperability Web Portal and shall be capable of communication over **BACnet, MS/TP**

H. Chiller shall have a single point power connection and external inputs and outputs to be compatible with the building management system. Inputs/Outputs will include, but not be limited to:

1. Remote Start/Stop
2. Customer Alarm Relay
3. Customer Chilled/Load Limit Reset Signal
4. ECW to Mechanical Cooling Module
5. LCW from Mechanical Cooling Module
6. ECHW to Mechanical Cooling Module
7. LCHW from Mechanical Cooling Module
8. Power Phase Monitor

9. Chilled Water Flow Switch Input
10. Condenser Water Flow Switch Input
11. Full Load Indicator Relay
12. Condenser Pump Relay
13. DDRS Condenser Multiflush Relay
14. Chilled Water Pump Relay

I. Each inlet water header shall incorporate a built in 30-mesh (maximum) in-line strainer system to prevent heat exchanger fouling and accommodate 100% flow filtration with a minimum surface area of 475 sq inches per module. Condenser-side strainer system shall incorporate an automatic debris blow-down system for self-cleaning of the strainer system that is controlled and powered by the chiller.

J. **Single Point Power:** Chiller shall be equipped with a pre-engineered genuine buss bar electrical system for single point power at a **5,000-amp SCCR**. Where the equipment size exceeds the amp rating of the electrical system, multiple power connections may be applied. Pre-engineered system shall also incorporate individual module isolation circuit breakers for full redundancy and ability of a module to be taken off-line for repair while the rest of the modules continue to operate. Individual power feeds to each module shall be unacceptable.
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2.03 SAFETIES, CONTROLS AND OPERATION

A. Chiller safety controls system shall be provided with the unit (minimum) as follows:

1. Low evaporator refrigerant pressure
2. Loss of flow through the evaporator
3. Loss of flow through the condenser
4. High condenser refrigerant pressure
5. High compressor motor temperature
6. Low suction gas temperature
7. Low leaving evaporator water temperature

B. Failure of chiller to start or chiller shutdown due to any of the above safety cutouts shall be annunciated by display of the appropriate diagnostic description at the unit control panel. This annunciation will be in plain English. Alphanumeric codes shall be unacceptable.

C. The chiller shall be furnished with a Master Controller as an integral portion of the chiller control circuitry to provide the following functions:

1. Provide automatic chiller shutdown during periods when the load level decreases below the normal operating requirements of the chiller. Upon an increase in load, the chiller shall automatically restart.

2. Provisions for connection to automatically enable the chiller from a remote energy management system.

3. The control panel shall provide alphanumeric display showing all system parameters in the English language with numeric data in English units.

4. Each module shall contain a slave controller that will allow any module to run in the event of a master controller failure or loss of communication with the master controller via an on/off/manual toggle switch.

D. Normal Chiller Operation

1. When chiller is enabled, the factory supplied Master Controller stages the chiller capacity from minimum to maximum as required by building load.

2. The Chiller control system shall respond to Entering Water Temperature and will have an integral reset based on entering water temperature to provide for efficient operation at part-load conditions.

E. Power Phase Monitor **(PPM)**

1. Provide a Power Phase Monitor on the incoming power supply to the chiller. This device shall prevent the chiller from operating during periods when the incoming power is unsuitable for proper operation.

2. The Power Phase Monitor shall provide protection against the following conditions:
   a. Low Voltage (Brown-Out)
   b. Phase Rotation
   c. Loss of Phase
   d. Phase Imbalance

PART 3 INSTALLATION

3.01 CODES, ORDINANCES, RULES AND REGULATIONS

A. Installation shall conform to all applicable local, state, and federal codes in effect.
1. **2018 International Building Code with local amendments**
2. **2018 International Plumbing Code with local amendments**
3. **2018 International Mechanical Code with local amendments**
4. **2018 International Fire Code with local amendments**
5. **2017 International Electrical Code with local amendments**

3.02 WARRANTY and START-UP

A. Manufacturer's Warranty: Manufacturer shall provide full parts-only warranty coverage for entire chiller for a period of one year. All parts shall be warranted against defects in material and workmanship. Similar parts-only coverage shall be provided for the chiller's compressors for a period of five years. The warranty period shall commence either on the equipment start-up date or six months after shipment, whichever is earlier.

B. Manufacturer shall provide the services of a Factory Authorized Service Engineer to provide complete start-up supervision. Factory Authorized Service Engineer shall also be responsible for assembly of the chillers cabinetry package and electrical bus bar system. After start-up a Manufacturer's Representative shall provide a minimum of 8-hours of operator training to the owner's designated representative(s).