MULTISTACK®



Water Cooled MagLev™ Compact Centrifugal Modular Chiller

Product Data Catalog
MS-080F, MS-100F

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AHRI CERTIFIED™ www.ahridirectory.org
Water-Cooled Chillers
AHRI Standard 550/590

Multistack Modular Flexibility with MagLev™ Centrifugal Compressor Performance

80 & 100-Ton Modules for Up to 1000-Ton Chiller Arrays

High-Efficiency Chiller Performance in a Compact, Modular Footprint

- Breakthrough compact flooded evaporator technology
- Modular design for installation ease, expandability, and redundancy. Assemble modules for up to 800 tons capacity
- Small refrigerant charge qualifies for LEED® EA credit
- Ideal for new construction or retrofit/renovation projects
- Multiple compressor redundancy ideal for mission-critical applications including data centers
- Multistack Total Access™ stacked header design allows heat exchanger cleaning or replacement with chiller running—ideal for mission critical jobs
- Field-proven MagLev® chiller controls. Low sound, ultra-quiet operation

Superior Dependability

- Multiple independent systems for redundancy
- Comprehensive computer monitoring
- Automatic lead-lag
- Automatic fault recording

Easy Installation

- Compact modules fit through most double doorways and into freight elevators - ideal for retrofit/renovation projects
- Modules connect quickly and easily
- Factory charged and run-tested

High Flexibility

- Install only the capacity needed, when needed
- Operates only the capacity required by the load
- Integrates fully with BMS systems through BACnet®, ModBus®, or LON

Serviceability

- Service can be performed on a convenient, non-emergency basis
- Optional Total Access™ configuration makes service even easier by placing heat exchangers at outside of frame



High Performance in a Small Footprint

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Cutting Edge Compressor Technology

- MagLev™ compressor with magnetic levitation bearings
- Oil-free design
- Quieter than typical background noise
- Soft start—only 2 amps at 460V
- Superior part load efficiency
- Integrated VFD control
- Environmentally friendly R-134A refrigerant

Master Controller

- Stages and monitors status of up to eight 80- and/or 100-ton modules.
- Provides interface with all system variables and set points.

LCD Display

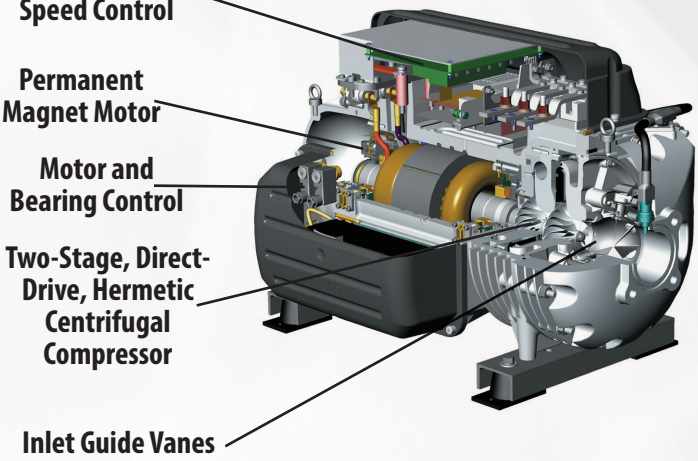
- 4X20 character backlit LCD displays system and chiller variables and status of both compressor and chiller system performance
- Displays (but not limited to) refrigerant temperatures and pressures, water temperatures, compressor speeds (actual and desired), detailed fault information, compressor run hours, and system capacity.

System Interface Portal

- Integrates chiller with building management system through BacNet®, ModBus®, or LON.

Module Controller and Hand-Off/ Auto Control

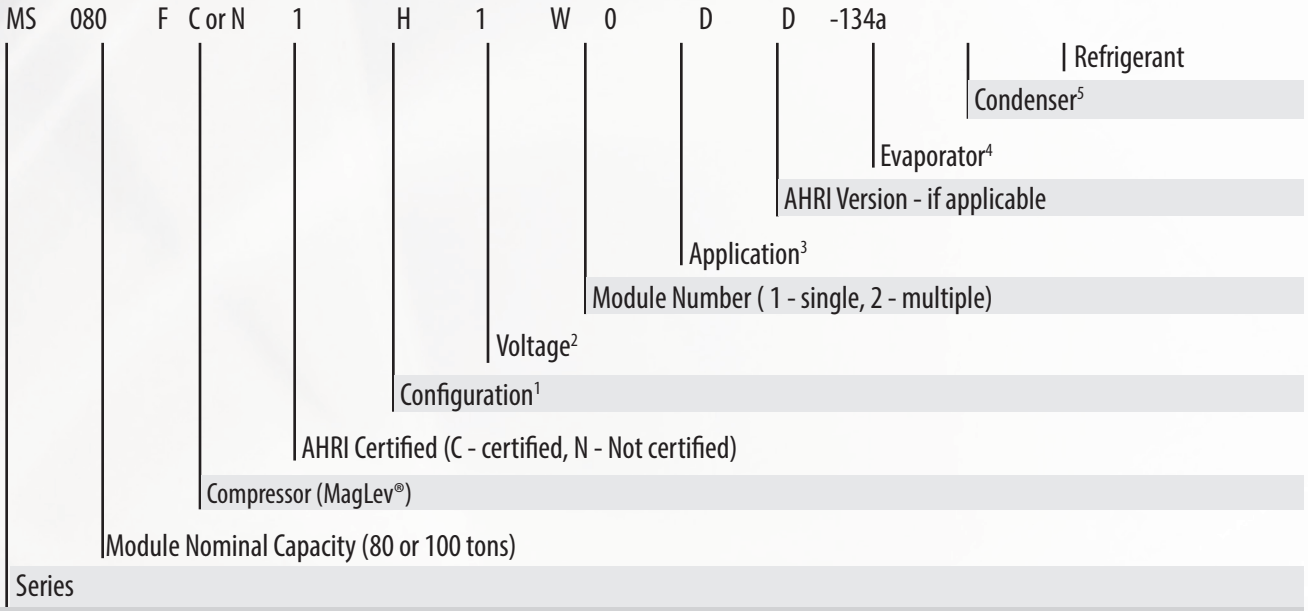
- Receives direction from the master controller and provides for stand-alone operation if the master controller fails or if master controller communication is lost.
- Each module controller communicates directly with its module's MagLev™ compressor through ModBus® providing redundant multiple compressor control.



10-Year Limited Powertrain Warranty Available



Model Number Information & General Data



[1] 1- Standard, 2- Total access, 3 - Evap extended headers, 4 - Cond extended headers, 5 - Both extended headers, V - others
[2] H - 460/3/60, C - 575/3/60, E - 400/3/50, F - 380/3/60, V - other
[3] A - Air Cooled split, D - Cond unit, F - Fluid cooler (high temp), W - Water cooled
[4] C- S&T copper, D - S&T cu-Ni, V - Other
[5] C- S&T copper, D - S&T cu-Ni, E - Double wall brazed, V - Other

General Data	MS080F	MS100F
Compressor Type	**MagLev™ Centrifugal**	**MagLev™ Centrifugal**
Dry weight (lbs. each)	265	290
Normal Capacity (Tons Each)	80	100
Quantity	1	1
Evaporator		
Weight (lbs. each)	1,543	1,543
Water Storage (gallons)	22.5	22.5
Quantity	1	1
Header System (gallons)	15.1	15.1
Condenser		
Weight (lbs. each)	1,488	1,488
Water storage (gallons)	26.5	26.5
Quantity	1	1
Header System (gallons)	15.1	15.1
Refrigerant Type/Charge (lbs./circuit)	R-134a/110	R-134a/110
Number of Circuits	1	1
Operating Weights (lbs.)	7,179	7,204
Shipping Weight (lbs.)	5,923	5,948
Enclosure Panel Weight Addition- Lbs. Per Module	177	177

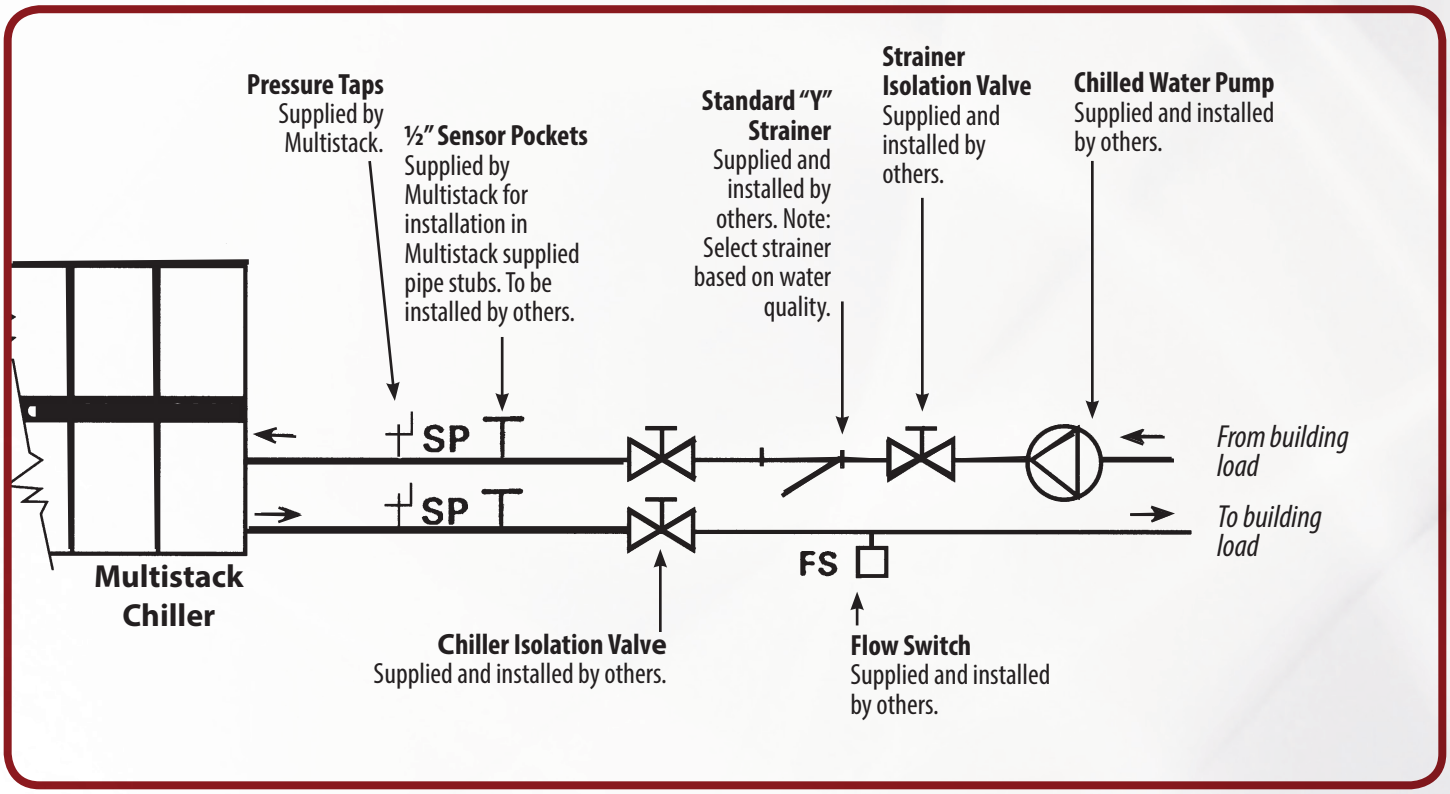
Dimensions

Typical MS080-100F Chiller Modules
No Enclosure Panels
Refer to Submittal Drawings for As-Built Dimensions

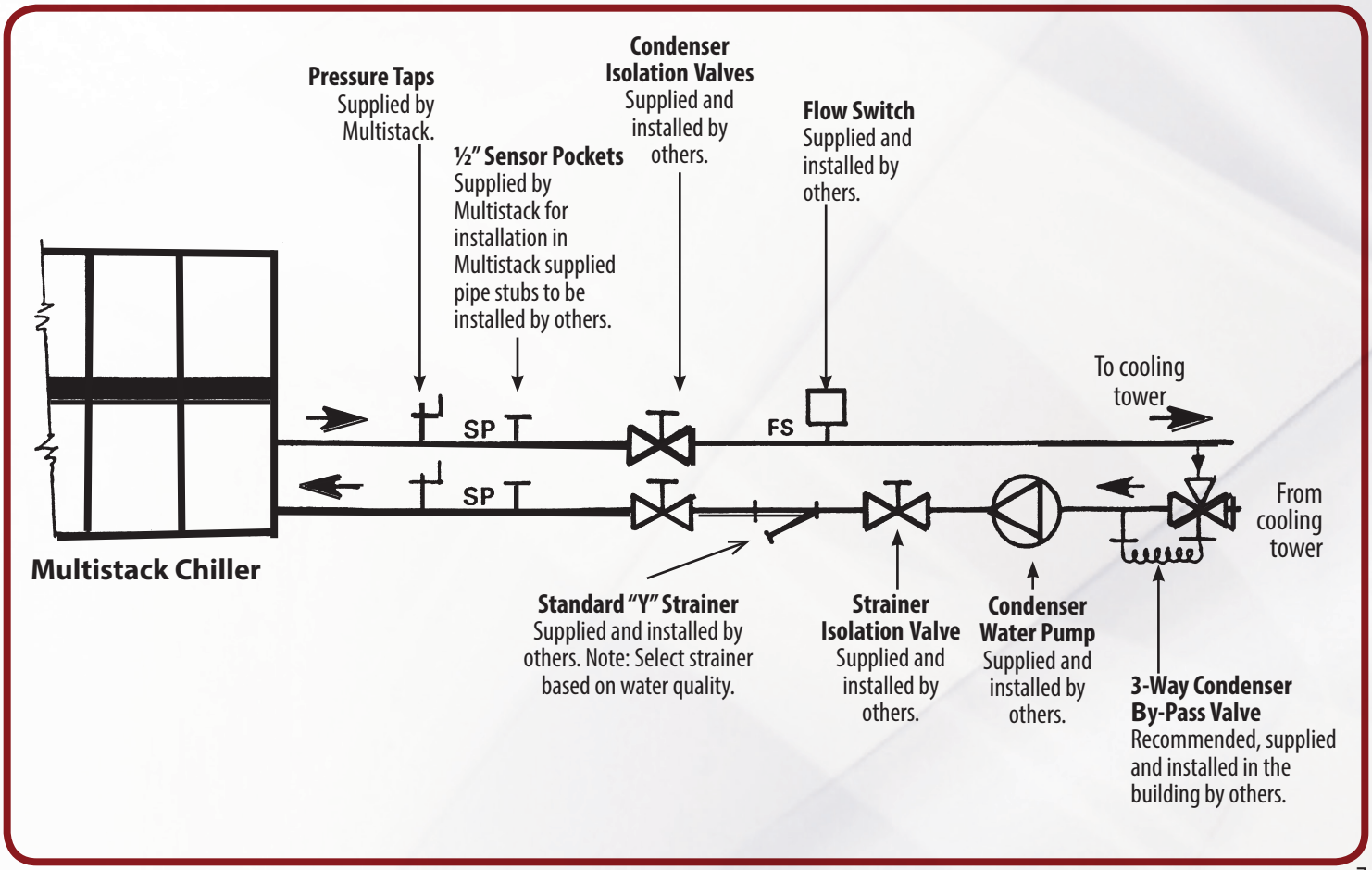
Dimensions

Typical MS080-100F Chiller Modules With Enclosure Panels Refer to Submittal Drawings for As-Built Dimensions

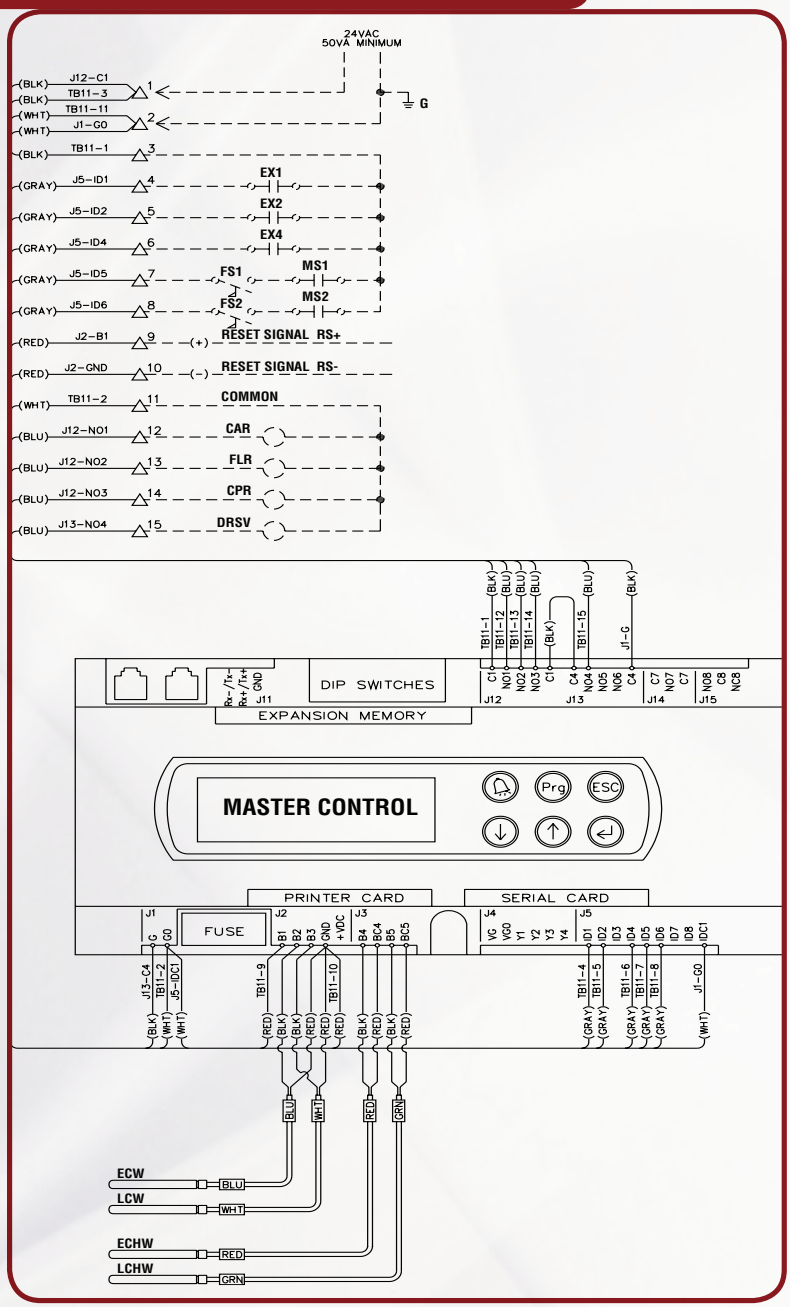
Required Chilled Water Piping



Condenser Piping with Head Pressure Control



Electrical Data



Legend

1. Components and wiring by others. (18 AWG Min. wire).
2. Inputs to terminals 4 through 8 of TB11 must be wired closed if not used.
3. External inputs (Closed to operate).
   EX1 Manual reset required to resume operation.
   EX2 Auto reset (Remote start/stop).
   EX4 Auto reset (Power phase monitor input).
   FS1 Flow switch (Chilled water).
   FS2 Flow switch (Condenser water).
   MS1 Aux. interlock (Chilled water pump starter).
   MS2 Aux. interlock (Condenser water pump starter).
   RS+ Reset signal (Software selectable 0-10VDC, 4-20mA).
   RS- Reset signal (Software selectable 0-10VDC, 4-20mA).
4. External outputs.
   CAR Customer alarm relay (24 VAC, 5 VA max).
   CPR Condenser pump relay (24 VAC, 5 VA max).
   FLR Full load relay (24 VAC, 5 VA max).
   DRSV Debris removal solenoid valve (24 VAC, 6 W, 16VA)
   Max of (2) DRSV in this circuit.
5. Sensor Inputs
   ECW Entering condenser water.
   LCW Leaving condenser water.
   ECHW Entering chilled water.
   LCHW Leaving chilled water.

For additional information, see installation manual and master control user manual.

System Wire and Fuse Sizing

Rated Load Amps (RLA) for each module compressor for this product line will range between 77 and 108 amps depending on jobsite conditions. For project-specific information refer to the as-built submittal.

Wiring Sizing

(MCA=minimum circuit ampacity)
MCA = (1.25 x RLA1*) + RLA2+RLA3

Fuse Sizing

(MF = maximum fuse size)
MF = (2.25 x RLA1*) + RLA2 + RLA3

Notes:

*1. *RLA1 = RLA of the largest motor in the system. RLA2 & RLA3 = RLA of other motors in the system.*
2. Wire sizing is based on National Electrical Code (NEC) rating for 75°C wire, with 3 wires per conduit.
3. Wiring distance from branch circuit shall not exceed 100 feet.

MCA	3 Conductor *1 Conduit*	6 Conductor *2 Conduit*
50	8	–
65	6	–
85	4	–
100	3	–
115	2	–
130	1	–
150	1/0	–
175	2/0	–
200	3/0	–
230	4/0	–
255	250 MCM	–
285	300 MCM	1/0
300	–	2/0
350	–	3/0
400	–	4/0
460	–	4/0
500	–	250 MCM

Multistack Water-Cooled Chillers, MS-080F and MS-100F, Guide Specifications

PART 1 GENERAL
1.01 SUMMARY
A. Section Includes:
1. Design
2. Performance Criteria
3. Refrigerants
4. Controls
5. Installation Requirements

1.02 REFERENCES
A. ARI 550/590-2003
B. ANSI/ASHRAE 15
C. ASME Section VIII
D. NEC
E. UL
F. CSA
G. OSHA as adopted by each individual State

1.03 SUBMITTALS
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. Sequence of operation depicting overview of control logic used.
E. Installation and Operation Manuals.
F. Manufacturer-certified performance data at full load in addition to either IPLV or NPLV.

1.04 QUALITY ASSURANCE
A. Regulatory Requirements: Comply with the codes and standards as defined in Section 1.02 titled REFERENCES
B. Chiller is required to be run tested at manufacturer's facility prior to shipment. Report available upon request.

1.05 DELIVERY and HANDLING
A. Chiller modules 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 modular chiller.

1.06 WARRANTY
A. The manufacturer's equipment warranty shall be for a period of one (1) year from date of equipment start up, or 18 months from date of shipment, whichever occurs first.
B. The compressor(s) shall be provided with a limited powertrain warranty for a period of ten (10) years from date of equipment shipment. Powertrain shall be defined as the compressor shaft, motor, magnetic bearings, and touchdown bearings.
C. Extended warranty on parts and labor available by request. The warranty shall include parts and labor costs for the repair and or replacement of defects in components or workmanship.

1.07 MAINTENANCE
A. Chiller maintenance shall be the sole responsibility of the owner.

PART 2 PRODUCTS
2.01 Operating Conditions
A. Provide water-cooled liquid chiller with the capacity as scheduled on drawings at job site elevation listed in Section 15050.
B. Chiller shall be designed to operate using R-134A Refrigerant.
C. Chiller shall be designed for parallel evaporator water flow.
D. The liquid to be chilled will be water containing corrosion inhibitors.
E. Chiller shall be designed to operate using 460 volt, 3 phase, 60 Hz electrical power supply.

2.02 Water-Cooled Packaged Chiller
A. Approved manufacturer is MULTISTACK.
B. System Description: Chiller shall incorporate a two-stage centrifugal compressor with magnetic bearings and consist of a single 80- or 100- ton refrigerant circuit. The compressor shall use its integrated variable speed drive and inlet guide vanes to optimize the chiller's part load efficiency. Each refrigerant circuit shall consist of a compressor, condenser, evaporator, electronic expansion valve, and control system. Each circuit shall be constructed to be independent of other circuits from a refrigeration and electrical stand-point. The chiller system must be able to produce chilled water even in the event of a failure of one or more refrigerant circuits.
C. General
1. Chiller modules shall be ETL listed in accordance with UL Standard 1995, CSA certified per Standard C22.2#236.
2. Modules shall ship wired and charged with refrigerant. All modules shall be factory run tested on an AHRI certified or 3rd party verified test stand before shipment.
3. Compressors, heat exchangers, piping and controls shall be mounted on a heavy gauge, powder coated steel frame. Electrical controls and associated components 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. Cut grooved type end connections are provided for connection to eight-inch standard (8.625 inch outside diameter) piping with grooved type couplings. Water mains shall be installed such that they are not above any power or control wiring so as to ensure safe operation in the event of condensation or minor piping leaks. Water boxes shall be hinged for maintenance access.
E. Evaporators and condensers: Each evaporator and condenser shall be tube in shell heat exchangers constructed with copper tubes in a carbon steel shell; built in accordance with Section VIII of the ASME code and carry a manufacturer's name plate certifying ASME compliance for 200 psig working pressure on the evaporator and 200 psig working pressure on the condenser. 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. Total Access Design: Isolation valves shall be installed between the heat exchangers and water supply mains for heat exchanger isolation and removal without the requirement to remove a module or shut down the entire chiller allowing for total access to all serviceable components.
G. OPTIONAL: Variable Flow Operation - Chilled and/or Condenser Water
Chiller shall incorporate integral condenser and/or evaporator motorized butterfly valves.
H. OPTIONAL: Integral Filtration
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.

Continued on next page.

I. Compressor:
1. Unit shall have a direct drive oil-free two-stage semi-hermetic centrifugal compressor complete with an active / passive magnetic bearing system. Casing shall be constructed from aluminum and shall not weigh more than 300 lbs. each. The electronic soft starters, compressor controls, inverter power electronics, bearing and motor control shall be fully integrated into the compressor and shall be digitally controlled. The magnetic bearing system must be fully protected in the case of a power outage with its own built-in power generation system.
2. The impeller shall be statically and dynamically balanced. The compressor shall be vibration tested and not exceed a level of 0.14 IPS.
3. The capacity control should primarily be achieved by varying the compressors operating speed and a movable inlet guide vane shall only be used in the case of a surge or choke condition arising during normal operation. The moveable inlet guide vane shall be of the electro-mechanical type.
4. Bearing System: The compressor shall use an oil-free bearing system of the digitally controlled homo-polo magnetic bearing type. The bearings shall have a fully integrated back up bearing system and shall have a self generating power system so that the bearings shall be able to stay levitated in the case of a power failure. No sump heater is to be required. The bearing system shall use no more than 500 watts of energy during its normal operation and it must also have an auto balance capability in the case of any external vibration or out of balance event occurring.
5. Prime Mover: A direct drive synchronous permanent magnet brushless DC motor of the hermetic type of sufficient size to efficiently fulfill compressor horsepower requirements. Motor shall be liquid refrigerant cooled with internal thermal overload protection devices embedded in the winding of each phase
6. Motor Starter: The main motor starter is to be fully integrated into the compressor and shall be of the soft-start type with a maximum starting current of 20% of the full load current of the compressor. It must be fully integrated with the motors variable speed control system and it must be factory tested during the run test of the unit.
7. Variable Frequency Drive: The chiller shall be equipped with a fully integrated Variable Frequency Drive (VFD) to automatically regulate 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.
   a. A digital regulator shall provide V/Hz control.
   b. The VFD shall have 110% continuous overload of continuous amp rating with no time limit, PWM (Pulse Width Modulated) output, IGBT (Insulated Gate Bipolar Transistors) power technology, full power rating at 2kHz, DC bus inductor (choke), and wireless construction. The inverter unit shall be refrigerant cooled and shall be fully integrated into the compressor package.

J. OPTIONAL: Sound Reduction Panel Package
Each module shall be supplied with sound reduction panels covering the compressor section of the module. Panels are powder coated 20 gauge steel with 1" of fiberglass insulation to reduce sound levels. Sound package will reduce sound pressure levels measured at 1 meter at a minimum of 12 dBA.

K. 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 Temperature
3. The Master Controller shall be powered by the chiller 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 optimize the chiller performance to different existing building loads.
7. OPTIONAL: INTEROPERABILITY WEB PORTAL
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, Modbus or LON.
8. OPTIONAL: Fail To Run Mode (FRM)
Chiller shall be capable of operation in the event that the Master Controller has lost communication. FRM provides the ability to switch the chiller into manual mode automatically keeping the chiller online until a replacement Master Controller can be provided. FRM requires a power phase monitor per module.
   a. OPTIONAL: IFM flow switch per module. Integral to each module and powered by the module for individual module proof of flow and flow safety. Modules without independent IFM switches per module are not acceptable alternates.

L. Chiller shall have a single point power connection and external inputs and outputs to be compatible with the building management system. Inputs/ Outputs include:
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

M. Single Point Power: Chiller shall be equipped with a pre-engineered genuine buss bar electrical system for single point power rated at a 5,000 amp SCCR. Where the equipment size exceeds the amp rating of the buss bar, 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.
   a. OPTIONAL—SCCR greater than 5,000 amps: Contact factory. Depending on voltage and module size SCCR up to 85,000 may be available. Some higher SCCR will require fused protection as opposed to the standard isolation circuit breakers.

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

Continued on next page.

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. 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 modulates 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
1. Provide a Power Phase Monitor on the incoming power supply to each compressor. 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 from:
a. Low Voltage (Brown-Out)
b. Phase Rotation
c. Loss of Phase
d. Phase Imbalance

PART 3 INSTALLATION
3.01 PIPING SYSTEM FLUSHING PROCEDURE
A. Prior to connecting the chiller to the condenser and chilled water loop, the piping loops shall be flushed with a detergent and hot water (110-130° F) mixture to remove previously accumulated dirt and other organics. In old piping systems with heavy encrustation of inorganic materials, consult a water treatment specialist for proper passivation and/or removal of these contaminants.
B. During the flushing, a 30 mesh (max.) Y-strainers (or acceptable equivalent) shall be in place in the system piping and examined periodically as necessary to remove collected residue. The flushing process shall take no less than 6 hours or until the strainers when examined after each flushing are clean. Old systems with heavy encrustation shall be flushed for a minimum of 24 hours and may take as long as 48 hours before the filters run clean. Detergent and acid concentrations shall be used in strict accordance with the respective chemical manufacturer's instructions. After flushing with the detergent and/or dilute acid concentrations the system loop shall be purged with clean water for at least one hour to ensure that all residual cleaning chemicals have been flushed out.
C. Prior to supplying water to the chiller the Water Treatment Specification shall be consulted for requirements regarding the water quality during chiller operation. The appropriate chiller manufacturer's service literature shall be available to the operator and/or service contractor and consulted for guidelines concerning preventative maintenance and off-season shutdown procedures.

3.02 Water Treatment Requirements
A. Supply water for both the chilled water and condenser water circuits shall be analyzed and treated by a professional water treatment specialist who is familiar with the operating conditions and materials of construction specified for the chiller's heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for modular chillers using 316 stainless steel brazed plate heat exchangers and carbon steel headers is maintained within the following parameters:

1. pH	Greater than 7 and less than 9
2. Total Dissolved Solids (TDS)	Less than 1000 ppm
3. Hardness as $CaCO_3$	30 to 500 ppm
4. Alkalinity as Ca CO_3	30 to 500 ppm
5. Chlorides	Less than 200 ppm
6. Sulfates	Less than 200 ppm

3.03 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 chillers 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).

Multistack has a policy of continual improvement and reserves the right to change product design, literature and specifications without notice. For more information on this and other Multistack products, contact your nearest Multistack dealer.

Originators. Innovators. Never the Imitators.SM

Originators…

Multistack invented the modular water chiller. It started with a radically simple idea: chiller modules that could be brought into the equipment room one at a time, through standard doorways and down elevators, to form a fully integrated chiller system. The idea launched a revolution and transformed Multistack into a leader in the commercial water-chiller industry.

Innovators…

Multistack perfected the modular chiller and leads the industry in innovative and environmentally friendly modular solutions. Since founding in the late 1980s, Multistack has engineered, manufactured, and distributed an impressive array of modular air conditioning firsts: the first on-board strainer, the first modular automatic blow-down device, the first modular chiller for variable flow, the first modular chiller-heater (heat pump), the first modular heat-recovery chiller, the first modular air-to-water heat pump, the first modular chiller to utilize MagLev™ compressor technology, and the first modular chiller to utilize R-410A.

Never the Imitators…

Multistack sets the standard in the industry for superior customer service, fast and on time shipment, superior product quality, and new product development. Our pioneering leadership in environmental issues is well documented. If you want the best, be sure to specify the original – Multistack®.

MULTISTACK®

Originators. Innovators. Never the Imitators.

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