

MULTISTACK[®]

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Virtual Moveable Endcap II (VME II[™])

Product Catalog For Heat Recovery Applications



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Why VME II?

In addition to simultaneous, variable heating and cooling, Multistack VME II™ chillers offer numerous advantages in efficiency, simplicity, ease of installation, reliability, redundancy and cost.

30 Percent More Efficient

Multistack VME II modular chillers provide superior full- and part-load efficiency—and free cooling during cold weather. VME II is up to 30 percent more efficient during simultaneous heating and cooling, and eliminates multiple reversing valves (for an additional three-percent efficiency gain) and associated control complexity. The VME II control algorithm automatically matches chiller module capacity to the building heating and cooling load requirements by closing and/or opening VME valves for best operation, maximum efficiency, lower energy costs and a smaller carbon footprint. DHRC™ modules in VME II applications can provide up to 122 degrees of water temperature lift with a single compression cycle compared to only 86 degrees of lift with heat pumps, in heating mode.

Multistack VME II vs. Six-Pipe

- VME II Uses Standard AHRI Certified Modules
- VME II Only Uses High Quality, Quick Response Valves
- VME II Uses Fewer Valves vs. 6 Pipe Design
- VME II Has Better Service Access vs. 6 Pipe Design
- VME II Allows Smaller Modules For Simultaneous Loads
- VME II Offers Single Point Power For Entire Machine
- VME II Has A Lower First Cost When The Design Is Optimized
- VME II Can Use Dual and Quad Scroll Compressor Modules

Pre-Engineered

Multistack makes the consulting engineer's job easier. Multistack designs and builds VME II modular chillers to meet the customer's jobsite requirements. Controlling the chiller is easy — the consulting engineer simply provides a start-stop signal from the building automation system to enable the chiller. The VME II Master Controller does the rest to control the chiller modules to provide simultaneous, variable heating and cooling. Multistack VME II chillers are compact and require minimal equipment room space. With VME II's single-point power and water connections, equipment room design and construction is simplified and costs less.

All Multistack chiller and VME II modules are factory assembled and wired. In addition, Multistack's modular concept allows units to be moved into a building equipment room via standard doors and elevators. The expense of cranes or demolition is eliminated.

Reliable, Redundant

VME II increases HVAC system longevity while maximizing reliability by eliminating the numerous reversing valves found in traditional heat pump systems. Centralized maintenance significantly reduces service and repair costs. Multistack's Total Access option makes maintenance and serviceability even easier.

With two refrigeration circuits per chiller module, Multistack VME II chillers provide unsurpassed redundancy. For mission-critical applications, Multistack VME II modular chillers with multiple compressors and refrigeration circuits provide N+1 redundancy.

Multistack VME II modules use only high-quality, high-speed NEMA-4X actuators with position indicators. Each module requires only four actuators: two condenser water valves and two chilled water valves. Very importantly, Multistack's standard chiller modules with VME II are AHRI certified. Typical competitors' six-pipe variable flow systems are not AHRI certified and use as many as eight actuators per chiller module, significantly increasing complexity and reducing reliability. For example, a Multistack VME II 180-ton chiller with four chiller modules (three 50-ton and one 30-ton) and three VME II modules needs only eight variable flow valves and 12 VME valves—20 valves total—compared to a competitor's six-pipe system requiring 32 variable flow valves.

A 510-ton VME II modular chiller with three VME II modules and four chiller modules also requires only 20 valves total while competition's six-pipe 510-ton chiller would need 64 variable flow valves—more than three times the number of valves!

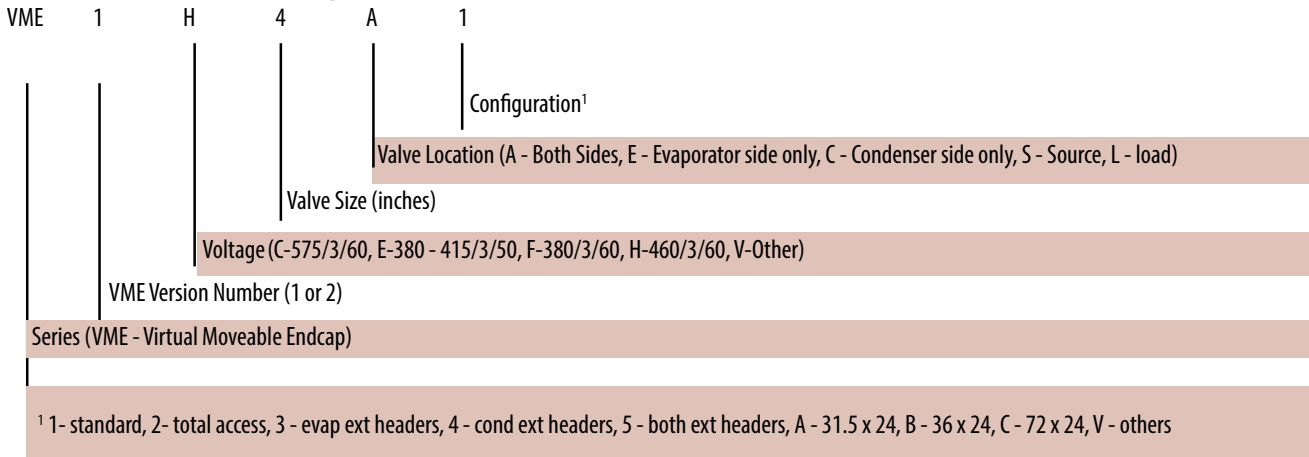
VME II: A Great Solution for Virtually Any Application

Multistack chillers with VME II are ideal for virtually any building application requiring simultaneous chilled and hot water needs: hospitals, schools and universities, data centers, office buildings and manufacturing facilities. VME II chillers are available from 30 tons capacity to as much as 1320 tons capacity. On the airside Multistack compressors can be used with VAV, fan-coil and chilled beam system designs. VME II is especially well-suited for geothermal applications.

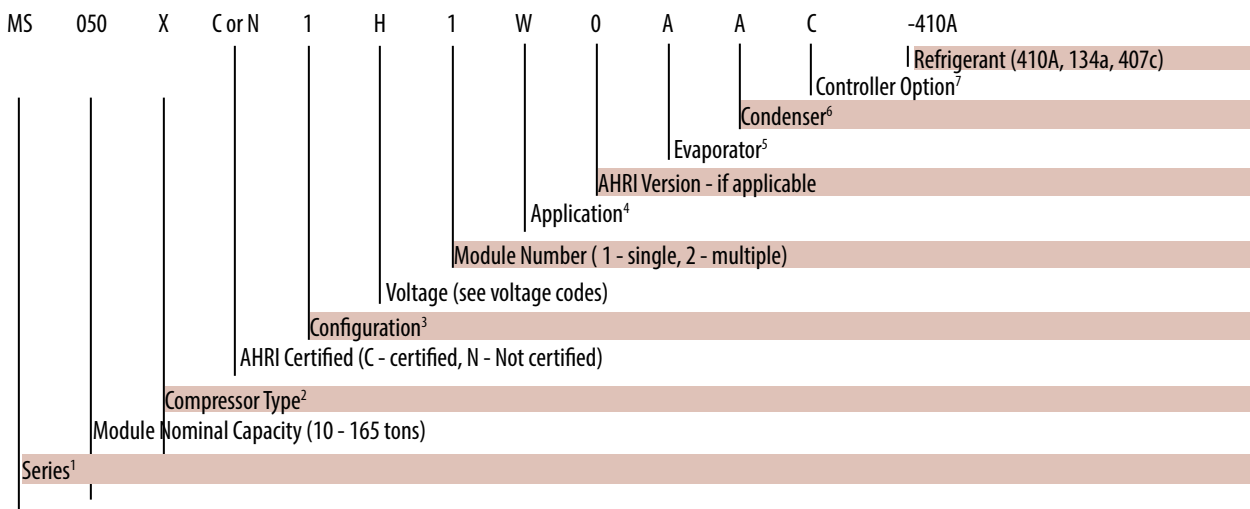


Model Number Nomenclature

VME (Virtual Moveable Endcap) Module



Model Number Nomenclature

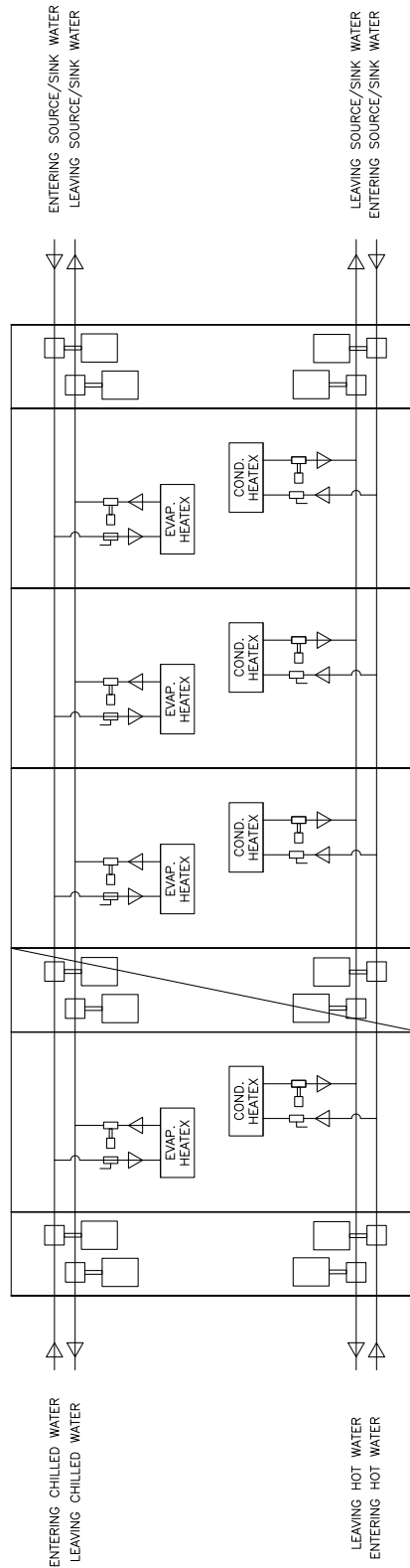
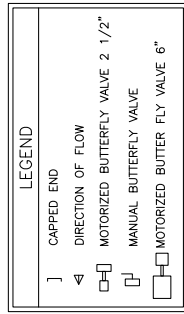


¹ MS - Multistack (non - reversing valve), MR - Multistack Heat pump (w/ reversing valve)
² A - Copeland Scroll (ZR), B - Bristol, C: Trane Cornerstone, D-Copeland Digital Scroll, H - Hanbell screw, N - none, R - Bitzer Screw, S - Trane Scroll, T - Danfoss Turbocor, Z - Copeland scroll (old elec), X - Copeland Scroll (ZP)
³ 1- Standard, 2- Total access, 3 - Evap extended headers, 4 - Cond extended headers, 5 - Both extended headers, 6-Outdoor, V - others
⁴ A - Air Cooled split, C - Single module temp controller, D - Cond unit, F - Fluid cooler (high temp),H - Heat recovery, R - Heat pump, W - Water cooled
⁵ A - Brazed SS, B - Brazed SMO, C - S&T copper, D - S&T cu-Ni, O - remote by others, R - remote by MS, V - Other
⁶ A - Brazed SS, B - Brazed SMO, C - S&T copper, D - S&T cu-Ni, E - Double wall brazed, O - remote by others, R - remote by MS, V - Other
⁷ F - FlexSys base, G - FlexSys with options, C - Carel, V - Other

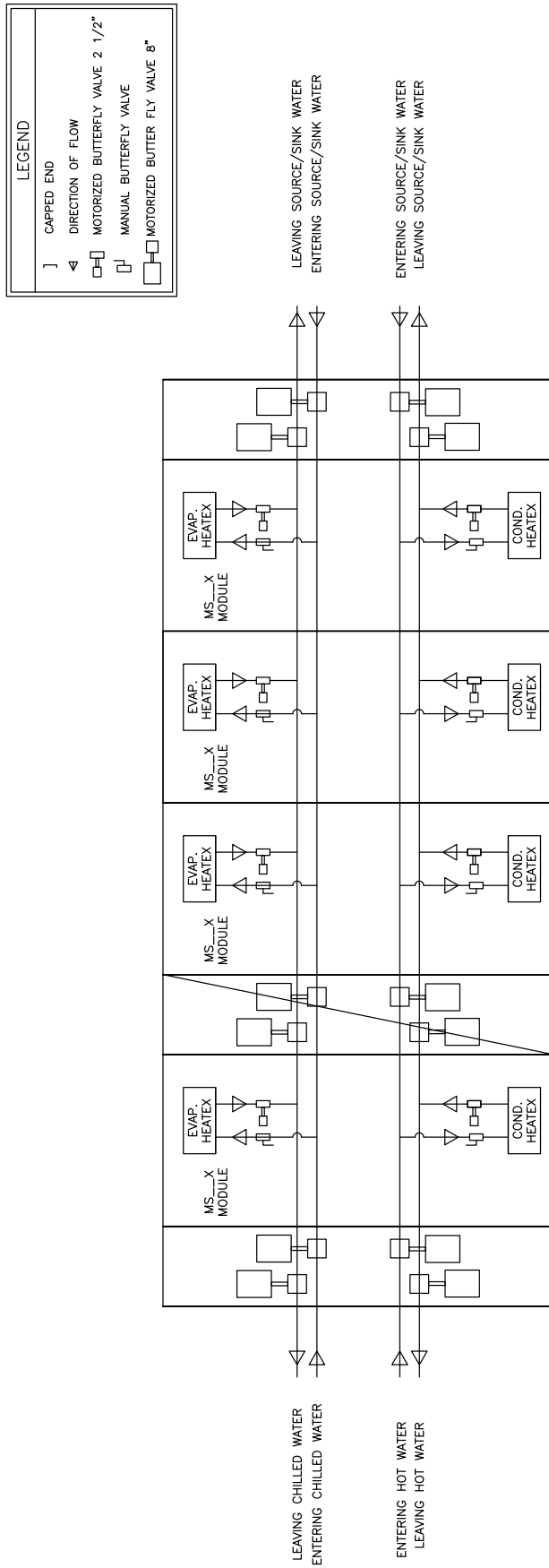
VME II: The Next Generation of Multistack Innovation

VME II is the latest generation of Multistack’s innovative VME (Virtual Movable Endcap™ Pat. Pend.) technology. VME II takes advantage of digital control technology advances and heat recovery capabilities to create HVAC systems that provide simultaneous and variable heating and cooling more efficiently and reliably than ever before. VME II eliminates the need for separate cooling and heating systems, distributed water source heat pump systems, and the need for geothermal water as an energy transfer buffer.



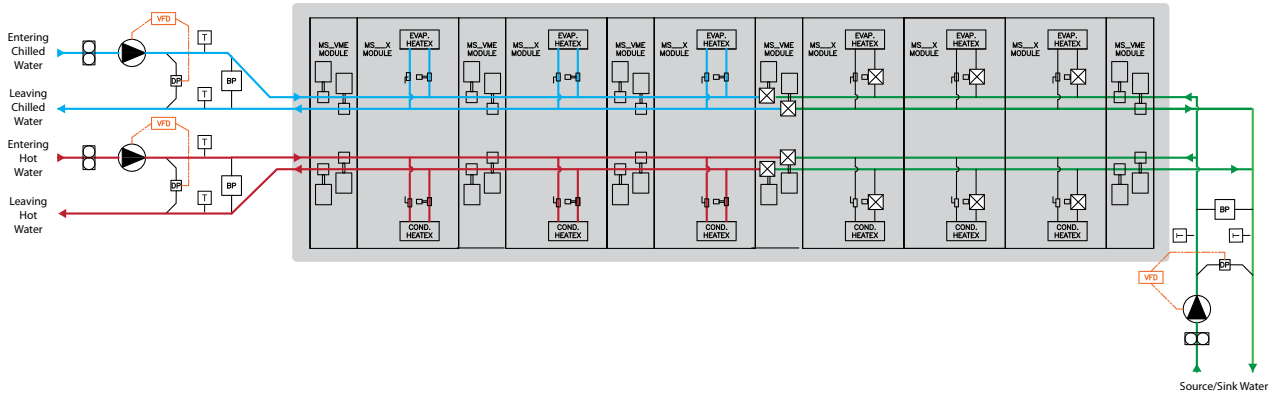


Flow Diagram for reference only, see Piping Diagrams on page 7 for mode schematic.

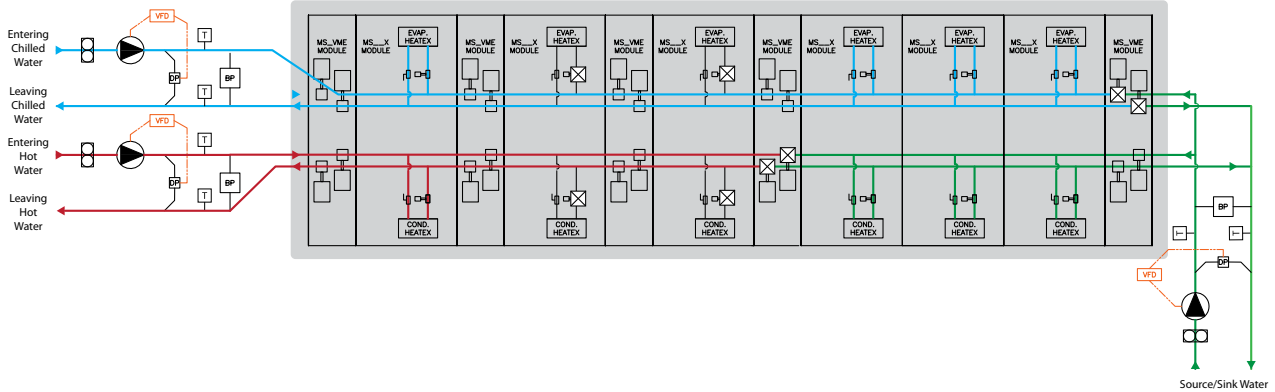


Flow Diagram for reference only, see Piping Diagrams on page 7 for mode schematic.

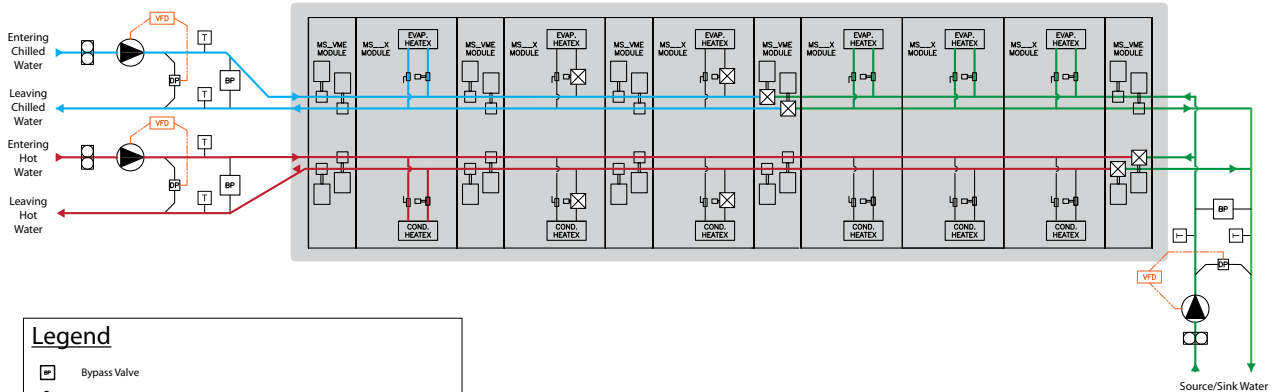
Simultaneous Mode 3 Cooling, 3 Heating



Cooling Dominant Mode 4 Cooling, 1 Heating



Heating Dominant Mode 1 Cooling, 4 Heating



Legend

- Bypass Valve
- Capped End
- Differential Pressure
- Direction of Flow
- Motorized Butterfly Valve
- Manual Butterfly Valve
- Motorized Butterfly Valve - VME
- Pump
- Strainer
- Variable Frequency Drive
- Temperature Sensor

Note:
Area highlighted in grey is supplied by Multistack. All other components can be optionally provided or field provided, except for temperature sensors, which are supplied by Multistack and field installed.

SECTION 15400
Multistack Heat Recovery Chiller/Heater Model (MS-X H) With Variable Source/Sink Valving & Variable Load Flow Valving
(Virtual Moveable Endcap™ Technology)

PART 2 PRODUCTS

2.01 General

- A. Chiller/Heater shall be a Multistack VME II™ (patent pending) heat recovery, Chiller/Heater. Chiller/Heater shall be equipped with integral valves that allows the assembly to serve the following functions:
- Simultaneous Heating and Cooling Mode – Chiller/Heater assembly must be capable of varying the flow rate on the evaporator and condenser sides of the modules to maintain heating and cooling water set points simultaneously. Simultaneous loads must be satisfied with a single compression cycle and cannot use the source/sink solution as the means of energy transfer. Systems that require double compression to satisfy simultaneous loads are not acceptable.
 - Cooling Dominant Mode – Chiller/Heater must be able to reject cooling dominant load to the source/sink. Cooling dominant modules must be capable of running at a lower head pressure than simultaneous modules to minimize power consumption.
 - Heating Dominant Mode – Chiller/Heater must be able to satisfy heating dominant load by extracting heat from the source/sink. Heating dominant modules must be capable of running at optimal suction pressure to minimize power consumption.
 - Packaged System Shall Be Reversing Valve Free Design – Chiller/Heater must be reversing valve free and optimize heat transfer in all control modes.
 - Source/Sink Water Connections – Chiller/Heater must allow geothermal loop water to enter both the evaporator and condenser side of the machine.
- B. System shall be configured to allow modules to run in simultaneous DHRC™ mode, dominant cooling mode, and dominant heating mode. The Chiller/Heater must be capable of allowing modules to run in multiple modes at the same time to optimize efficiency.
- C. Chiller/Heater shall be designed to operate using R-410a (or R-134A) Refrigerant.
- D. The liquid to be heated and cooled will be water containing corrosion inhibitors or other Multistack approved heat transfer fluid.
- E. System Description: Chiller/Heater shall incorporate Scroll-type compressors and consist of multiple refrigerant circuits. Each refrigerant circuit shall consist of an individual compressor (two compressors per circuit on Quad Scroll modules), condenser, evaporator circuit, expansion valve, and control system. Each circuit shall be constructed to be independent of other circuits from a refrigeration and electrical stand-point. The multi-circuit Chiller/Heater must be able to produce chilled or heated water even in the event of a failure of one or more refrigerant circuits. Each circuit shall contain the following refrigerant charge:

8 lbs.	MS020X
12 lbs.	MS030X
18 lbs.	MS050X
24 lbs.	MS070X
28 lbs.	MS085X
40 lbs	MS1050X
45 lbs	MS135X
50 lbs	MS145X
51 lbs	MS165X

2.02 Chiller/Heater

- A. Chiller/Heater shall be MULTISTACK (patent pending) VME II.
- B. Virtual Moveable Endcap II™ (patent pending): The Chiller/Heater shall be designed for simultaneous variable heating and cooling capacity. VME II valve module shall contain fast-acting motorized butterfly valves that open/close on a command from the central control system. The motorized actuators shall be modulating NEMA 4X rated with easily visible position indicators and internal thermal motor overload protection. Valves shall be fast acting type with a maximum stroke time (full closed to full open) of 35 seconds. Valve modules shall be built into pre-engineered headers and powered by the Chiller/Heaters buss bar (wire whips required for high SCCR applications). VME II valves shall be grooved connection type.
- C. Heat Exchanger Variable Flow Valves: Condenser and Evaporator heat exchangers shall be equipped with motorized modulating butterfly type valves driven independently by signals from the module controller and powered from the main power feed. The motorized actuators shall be modulating NEMA 2, IP-54 with a stroke time of no more than 35 seconds.
- Optional: NEMA 4X rated valves with easily visible position indicators and internal thermal motor overload protection. Valves shall be fast acting type with a maximum stroke time (full closed to full open) of 15 seconds.

Load side valves shall modulate to maintain modular leaving load temperatures. When heat exchangers are using sink/source due to unequal heating/cooling duty, master controller shall modulate valve to provide minimum required head pressure control in order to maximize efficiency of those Chiller/Heater modules and to provide equipment protection. All valves must be installed such that proper piping practices are observed, including proper distances before and after elbows.

D. General

1. All Modules shall be ETL listed in accordance with UL Standard 1995, CSA certified per Standard C22.2#236.
 2. All modules shall be AHRI certified according to the AHRI 550 certification program.
 3. Modules shall ship wired and charged with refrigerant. All modules shall be factory run tested prior to shipment on an AHRI certified test stand.
 4. Compressors, heat exchangers, piping and controls shall be mounted on a heavy gauge steel frame. Electrical controls, contactors, and relays for each module shall be mounted within that module.
- E. Water Mains: Each module shall include supply and return mains for both load and source-sink water. Cut grooved end connections are provided for interconnection with grooved type couplings. 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.
- F. Heat Exchangers: Each load and source-sink heat exchanger shall be brazed plate heat exchangers constructed of 316 stainless steel; designed, tested, and stamped in accordance with UL 1995 code for 650 psig working pressure on the load side and 650 psig working pressure on the source-sink. Both the load side and source-sink side heat exchangers shall be mounted below the compressor, to eliminate the effect of migration of refrigerant to the cold heat exchanger with consequent liquid slugging on start-up.
1. All inlet connections require minimum 30 mesh external filtration.

OPTIONAL: Total Access Design

- G. 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.
- H. Each module shall contain two (four for quad modules) hermetic scroll compressors independently circuited and with internal spring isolation mounted to the module with rubber-in-shear isolators. Each system also includes high discharge pressure and low suction pressure manual reset safety cut-outs.
- I. Master Controller
1. Sequencing and operation of the of the various compressors, VME Isolating Valves, and Heat Exchanger Variable Flow Valves shall be performed and coordinated by a microprocessor based controller to maximize efficiency and minimize system energy usage.
 2. The Master Controller shall monitor and report the following on each refrigeration system:
 - a. Discharge Pressure Fault
 - b. Suction Pressure Fault
 - c. Suction Temperature
 - d. Load Leaving Water Temperature
 - e. Source-Sink Leaving Water Temperature
 3. The Master Controller shall be powered by the chillers single point power connection and shall monitor and report the following system parameters:
 - a. Cooling Load Water Entering and Leaving Temperature
 - b. Heating Load Water Entering and Leaving Temperature
 - c. Source-Sink Water Entering and Leaving Temperature
 - d. Load Water (both heating and cooling) and Source-Sink 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/Heater 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 LCD display. 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 water temperatures from each refrigeration system shall be programmed to protect against heat exchanger freeze-up.
 6. The control system shall evaluate the water temperatures of the heating and cooling systems to assess the required capacity of each and cycle compressors of the Chiller/Heater Modules, open/close VME Isolation Valves, and modulate Heat Exchanger Variable Flow Valves to meet load requirements, optimize efficiency, minimize system energy usage and equalize compressor run times.

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

- a. Remote Start/Stop
- b. General Alarm

Two of the following are available at the same time:

- a. Cooling Load Limit
- b. Heating Load Limit
- c. Cooling Load Reset
- d. Heating Load Reset

The Chiller/Heater shall be capable of communicating the above points with the Building Automation System via an Interoperability Web Portal. BACnet, LONWORKS, or Modbus available. Additional points shall include:

- a. Chiller leaving chilled water temperature
 - b. Heater leaving hot water temperature
 - c. Chiller/Heater percent cooling capacity
 - d. Chiller/Heater percent heating capacity
 - e. Module level leaving condenser temperature
 - f. Module level leaving evaporator temperature
 - g. Individual Compressor Status On/Off
 - h. Condenser VME valves Open/Close status
 - i. Evaporator VME valve Open/Close status
- J. Single Point Power: Chiller shall be equipped with a pre-engineered genuine buss bar (wire whips optional) electrical system for single point power. 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.
- K. Thermal dispersion type 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 Modules without independent thermal dispersion type flow switches per module are not acceptable alternates.

2.03 SAFETIES, CONTROLS AND OPERATION

- A. Chiller/Heater safety controls system shall be provided with the unit (minimum) as follows:
1. Low refrigerant pressure
 2. Loss of flow through the condenser heat exchanger
 3. Loss of flow through the load evaporator heat exchanger
 4. High refrigerant pressure
 5. High compressor motor temperature
 6. Low suction gas temperature
 7. Low leaving water temperature
- B. Failure of DHRC Chiller/Heater/Heater to start or Chiller/Heater shutdown due to any of the above safety cutouts shall be enunciated 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 DHRC Chiller/Heater/Heater shall be furnished with a Master Controller as an integral portion of the Chiller/Heater control circuitry to provide the following functions:
1. Provide automatic Chiller/Heater shutdown during periods when the load level decreases below the normal operating requirements of the Chiller/Heater. Upon an increase in load, the Chiller/Heater shall automatically restart.
 2. Provisions for connection to automatically enable the Chiller/Heater from a remote energy management system.
 3. The control panel shall provide alphanumeric display showing all system parameters in plain English language with numeric data in English units.

D. Normal Chiller/Heater Operation

1. When DHRC Chiller/Heater is enabled, the factory supplied Master Controller modulates the Chiller/Heater heating and cooling capacity from minimum to maximum as required by building load.
2. The DHRC Chiller/Heater control system shall respond to Entering or Leaving 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 the Chiller/Heater. This device shall prevent the Chiller/Heater 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 PIPING SYSTEM FLUSHING PROCEDURE**

- A. Prior to connecting the Chiller/Heater 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 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 manufacturers 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/Heater the Water Treatment Specification shall be consulted for requirements regarding the water quality during Chiller/Heater operation. The appropriate Chiller/Heater 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/Heater's heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for modular Chiller/Heaters 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 CaCO₃ 30 to 500 ppm
 4. Alkalinity as Ca CO₃ 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).

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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**®

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