



SERVICE MANUAL

for

Lebanon VA Medical Center
178-N003

(4) MR030XN2H2R0AAC-410A & (3) VME1H6L2
460 Volt



1065 Maple Avenue
PO Box 510
Sparta, WI 54656
Phone: (608)366-2400
Fax: (608)366-2450
www.multistack.com

Building Automation Protocol Site Survey

Provide the information requested below by typing in the highlighted fields.

To return or forward, please save as the Multistack Job Name and attach to an email.

Rep Office: Harrisburg Trane
 Multistack Job Name: Lebanon VA Medical Center
 Multistack Job #: 178-N003

Chiller ID: _____
 Controls Contactor: _____
 Phone & Email: _____

PROTOCOL SELECTION (Select One) - Find the type of chiller and then select the desired protocol.

| MS-X Modules (COMPUT600) | ASP Modules (Airstack Controls) | MagLev Modules (COMPUT300) | Flooded Evap (FlexSys Controls) |
|--|--|--|--|
| <input type="checkbox"/> BACnet MS/TP | <input type="checkbox"/> BACnet MS/TP | <input type="checkbox"/> BACnet MS/TP | <input type="checkbox"/> BACnet MS/TP |
| <input type="checkbox"/> BACnet TCP/IP | <input type="checkbox"/> BACnet TCP/IP | <input type="checkbox"/> BACnet TCP/IP | <input type="checkbox"/> BACnet TCP/IP |
| <input type="checkbox"/> BACnet Ethernet | <input type="checkbox"/> BACnet Ethernet | <input type="checkbox"/> BACnet Ethernet | <input type="checkbox"/> Modbus RTU |
| <input type="checkbox"/> Modbus RTU | <input type="checkbox"/> Modbus RTU | <input type="checkbox"/> Modbus RTU | <input type="checkbox"/> Modbus TCP/IP |
| <input type="checkbox"/> Modbus TCP/IP | <input type="checkbox"/> Modbus TCP/IP | <input type="checkbox"/> Modbus TCP/IP | <input type="checkbox"/> LonWorks |
| <input type="checkbox"/> LonWorks | <input type="checkbox"/> LonWorks | <input type="checkbox"/> LonWorks | |

PORTAL CONFIGURATION Please supply the information below for the protocol selected above. The following information is required to configure the portal. Please use a different form for each portal.

1. BACnet over Ethernet: (Field Configurable if necessary)

a. Device Instance: _____ Default - 610001: Range – 1 to 4194303

2. BACnet over MS/TP: (RS-485 2 wire)

a. Device Instance: _____ Default - 610001: Range – 1 to 4194303

b. Master Station ID*: _____ Default – 1: Range – 1 to 127

c. Max Masters: _____ Default – 127: Range – 1 to 127

d. Max Info Frames: _____ Default – 10: Range – 1 to 255

e. Baud Rate (check one): ☐ 9600 ☐ 19200 ☐ 38400 ☐ 76800 Default – 38400

*Master Station ID = MAC ADDRESS

3. BACnet over TCP/IP: (Field Configurable if necessary)

a. Device Instance: _____ Default - 610001: Range – 1 to 4194303

b. IP Address: _____ Default – 192.168.30.20

c. Subnet Mask: _____ Default – 255.255.255.0

d. Gateway Address: _____ Default – 0.0.0.0

e. UDP: _____ Default – 47808

4. Modbus RTU: (RS-485 2 wire) – No Additional information needed

5. Modbus TCP/IP: – No Additional information needed

6. LonWorks: (via FieldServer Bridge) – No Additional information needed

Please complete the required information and return to Dan dhagen@multistack.com or Dawn dwright@multistack.com. Please “Save as” the name of the Multistack job and return as an email attachment. If there are any questions, please call or email Dan or Dawn.

IF YOU ARE UNABLE TO PROVIDE THE INFORMATION ON THIS SHEET,

PLEASE PASS THIS ON TO THE PROJECT MANAGER.

III MULTISTACK

JOB NAME: Lebanon VA Medical Center
LOCATION: Lebanon, PA
CUSTOMER:

Submittal Information Wednesday, October 23, 2013
ENGINEER:
ARCHITECT:
CONTRACTOR:

Multistack Order Number: 178-N003
Customer P.O. Number:
Sales Representative: Mike Schultz

Submitted by: Mike Schultz / SG
Quote #: QSG091320123
Approved by: Date:

GENERAL INFORMATION

Chiller I.D. (4) MR030XN2H2R0AAC-410A
Other (3) VME1H6L2
Dimensions (inches): (dimensions do not include junction boxes)
Length: 172
Width: see drawing
Height: 64

Load Flow - 0% Glycol:
Source Flow - 15% Propylene Glycol:

Cooling Mode Performance - EER = 14.8

Load water: 151.3 GPM @ 8.2 Feet Pressure Drop
Entering Temp. 55.0 °F Leaving Temp. 45.0 °F
Source water: 202 GPM @ 5.9 Feet Pressure Drop
Entering Temp. 80.0 °F Leaving Temp. 99.0 °F
Cooling Capacity: 63.1 Tons THR: 931.3 MBH

Heating Mode Performance - COP = 2.5

Load water: 101.6 GPM @ 3 Feet Pressure Drop
Entering Temp. 115.0 °F Leaving Temp. 135.0 °F
Source water: 202 GPM @ 5.9 Feet Pressure Drop
Entering Temp. 40.0 °F Leaving Temp. 32.0 °F
Heating Capacity: 84.7 Tons Heat Extracted: 602.8 MBH

SOUND PRESSURE:

Yields: 77 dB @ 1 meter

WATER-COOLED HEAT-PUMP FEATURES

- Stainless steel evaporator and condenser
- Lead compressor sequencing every 24 hours
- Automatic internal rescheduling if fault occurs
- Multiple, independent refrigeration systems
- Automatic logging of any fault conditions
- Electronic chilled water control
- Modules fit through single width doors and into passenger elevators
- Filters in condenser and evaporator supply headers
- Stainless steel evaporator & condenser inlet headers
- Quick interconnect modular design
- R-410A Refrigerant
- Warranty: Compressor (5 Year)
- Virtual Moveable Endcap Design w/ Controls
- Interoperability Web Portal (BACnet or Modbus)
- Total Access Design w/ Var. Flow (Load) (2" C-Steel Valves)
- Low Temp. Chip
- Motorized Valves on Source

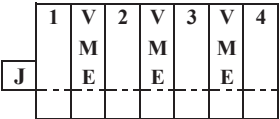
Design Note: Performance shown is based on a maximum of (2) modules operating in cooling mode or a maximum of (3) modules operating in heating mode

ELECTRICAL DATA

MAIN POWER SUPPLY 460 / 60 / 3

ELECTRICAL CIRCUIT(S) CAPACITY HEAT PUMP CIRCUIT*
Minimum Circuit Ampacity (amps) 256
Maximum Over Current Protection (MOP) 300


CHILLER BUSBAR SCHEMATIC
- LOCATION OF JUNCTION BOX(S) =
- ROUTING OF BUSBARS: ---

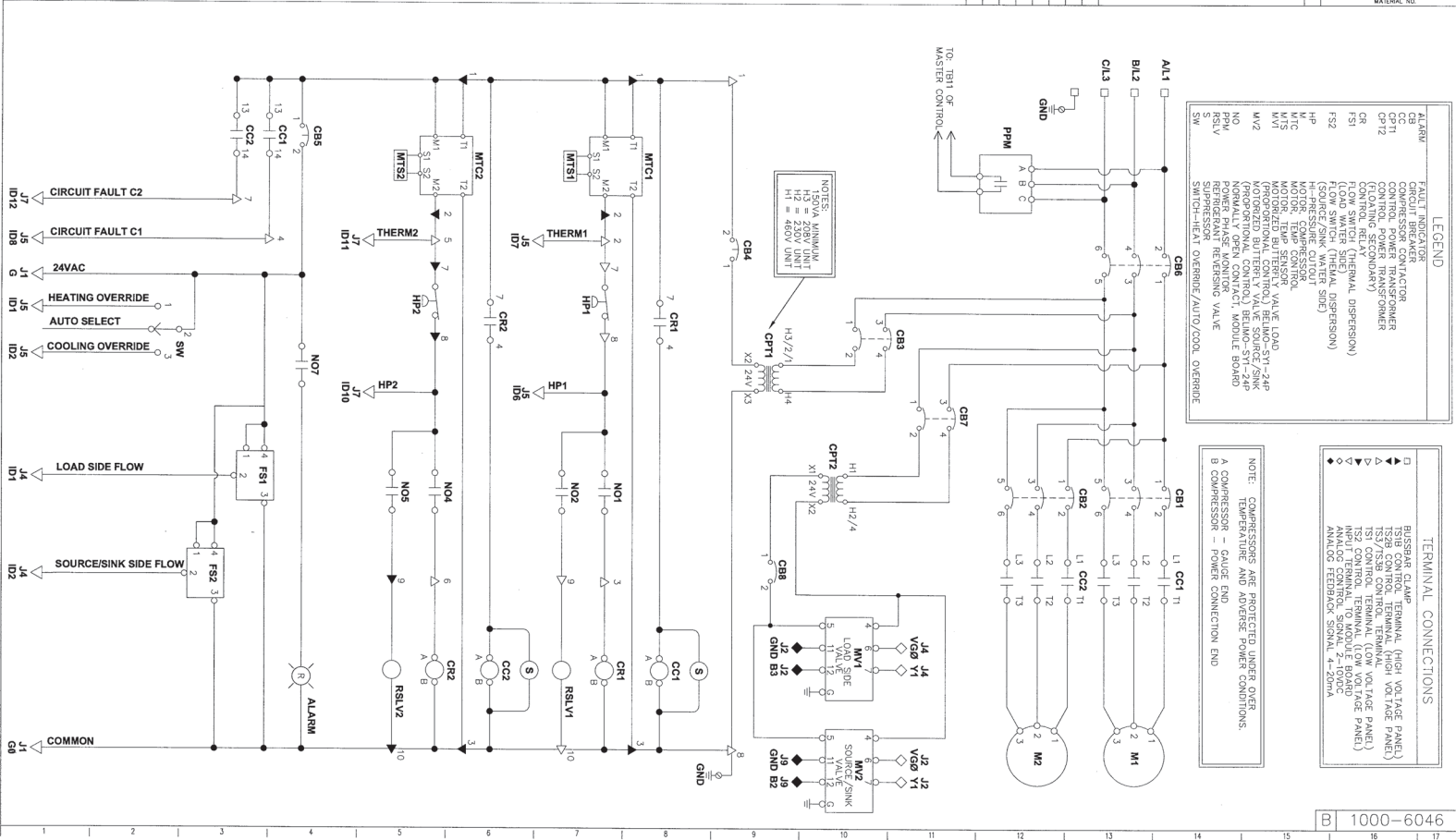


PLAN VIEW

*All chillers require completion of at least one of these columns.

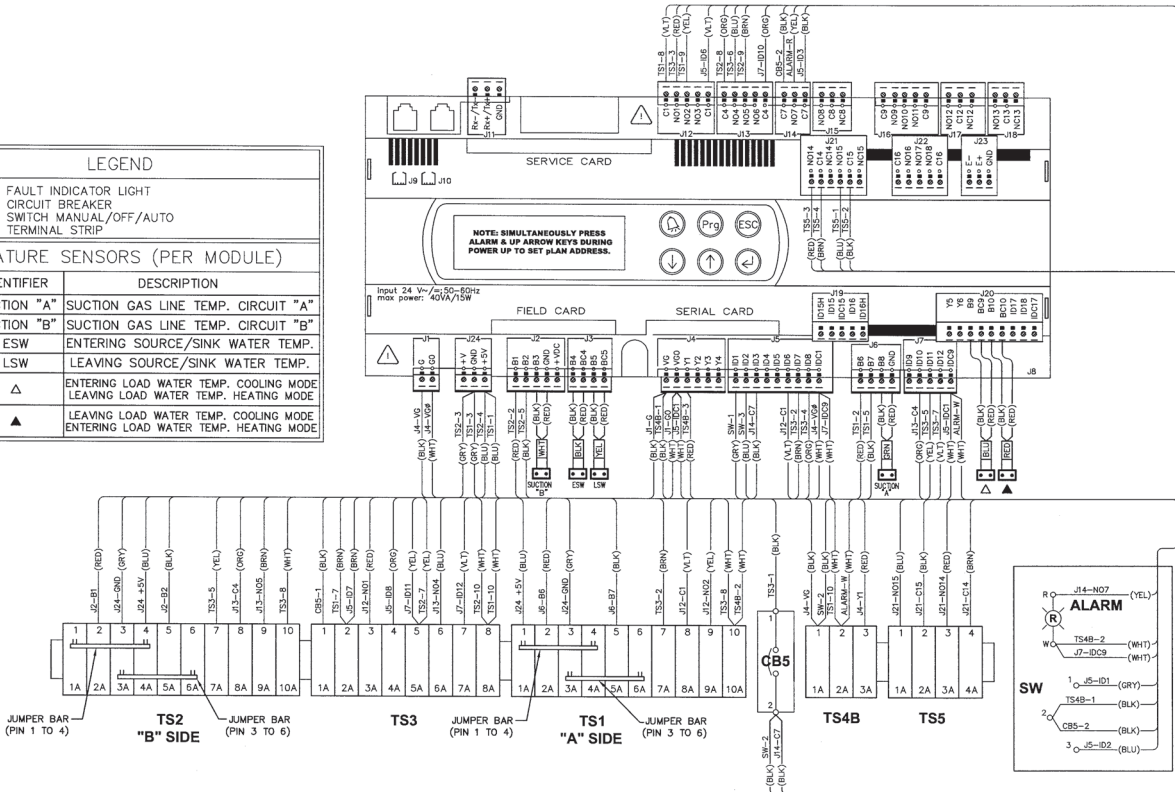
IMPORTANT: To assure full equipment design performance, life and reliability, the MULTISTACK chiller must be piped in accordance with Installation Manual unless specifically authorized otherwise by MULTISTACK in writing.


| | | | | |
|---|-------------|--|--------|-------|
|  MULTISTACK | | D | LAYOUT | A |
| Sports, Wisconsin 54656 ALL DIMENSIONS IN INCHES / DO NOT SCALE DRAWINGS FIRST USED OR FIRST INC. | | LEBANON VA MEDICAL CENTER (4) NRC30X (3) VME1 | | |
| SIMILAR TO: | CHECKED BY: | DATE: | SCALE: | NONE |
| DRAWN BY: MLG DATE: 10/14/13 | DATE: | DATE: | DATE: | DATE: |

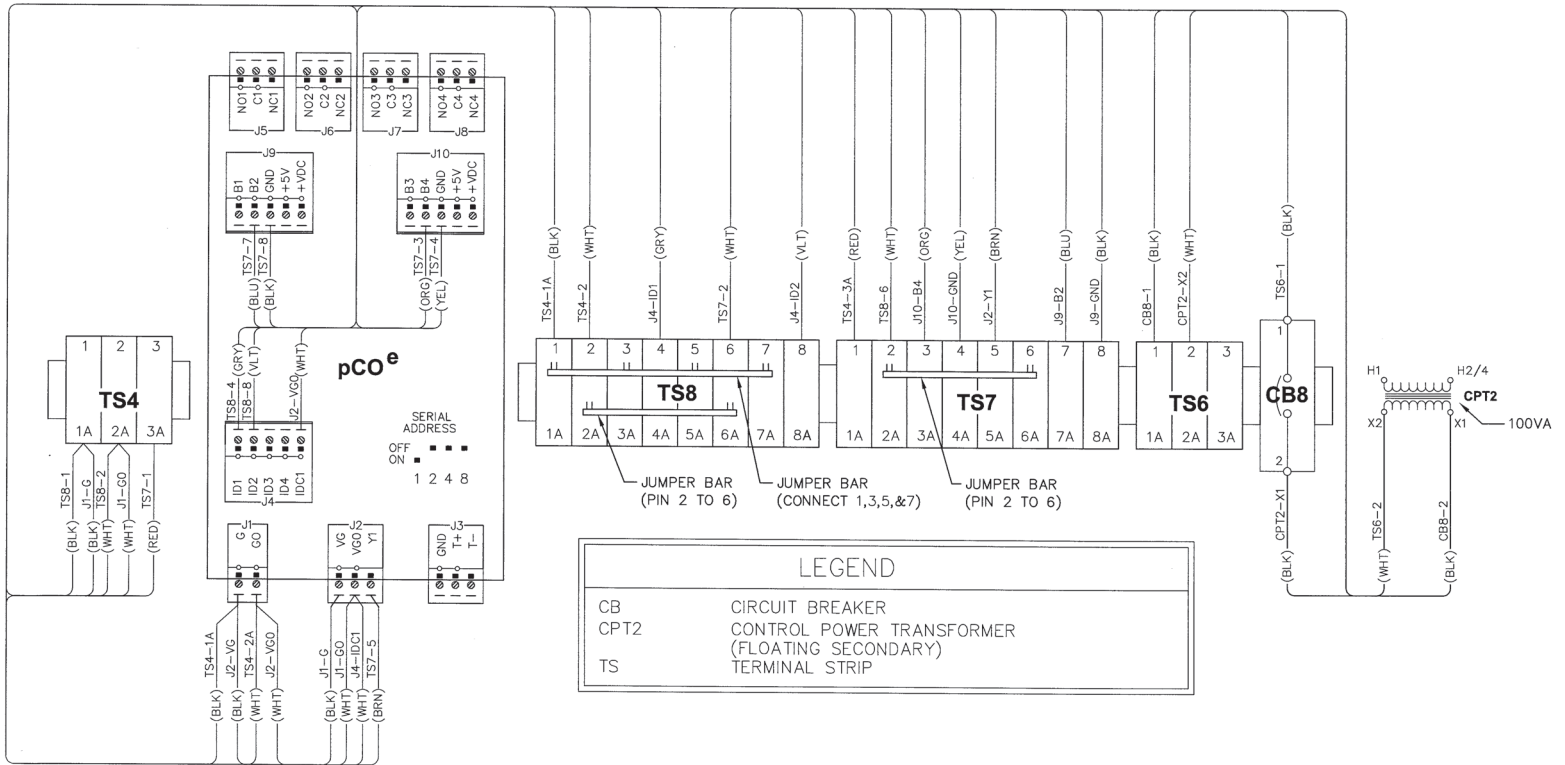


| | | | | | | |
|------|--|-----------------|---|-------|---------------------------|-----------|
| REV. | | REFERENCE DWGS: | MULTISTACK | | B | 1000-6047 |
| BY | | | Sparta, Wisconsin 54656 | | LOW VOLTAGE CONTROL PANEL | |
| DATE | | SIMILAR TO: | 2-10VDC MOTORIZED BUTTERFLY VALVE LOAD SIDE (BELIMO SY1-24P) | | WIRING DIAGRAM | |
| | | | 2-10VDC MOTORIZED BUTTERFLY VALVE SOURCE/SINK SIDE (BELIMO SY1-24P) | | MULTIPLE MODULE | |
| | | DRAWN BY: KJP | CHECKED BY: | ENGR: | MS30X COPELAND SCROLL | |
| | | DATE: 3/31/11 | DATE: | DATE: | VME HEAT PUMP APPLICATION | |
| | | | | | SCALE: | NONE |

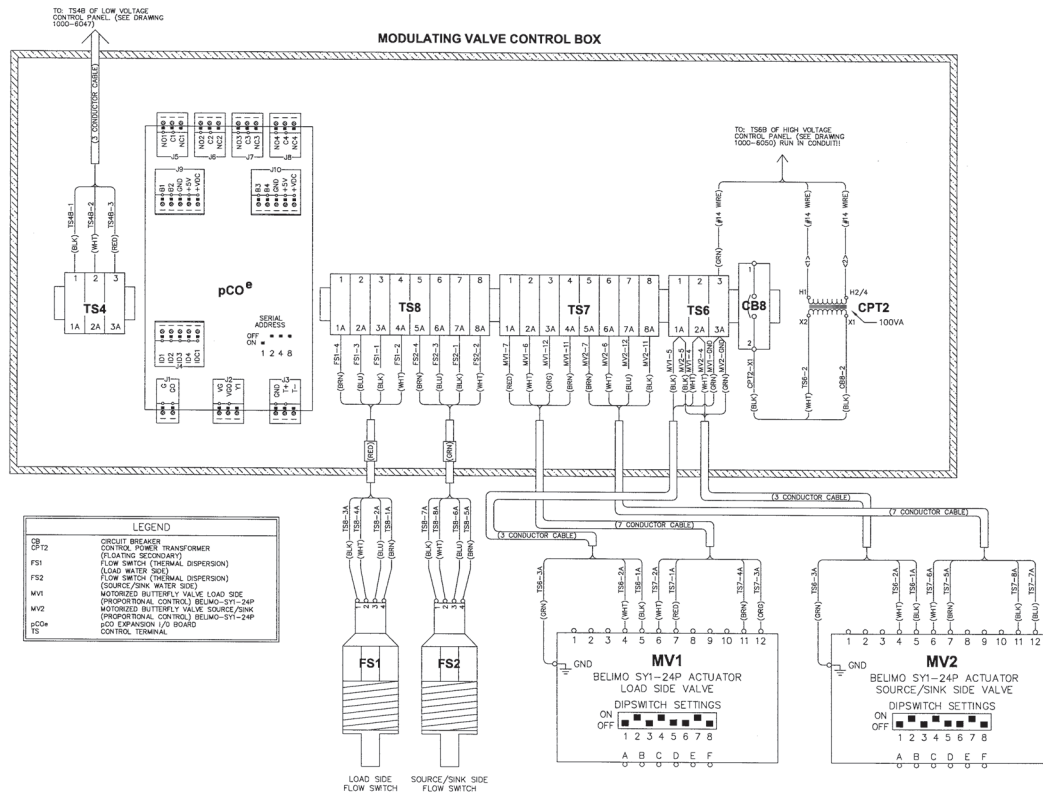
| LEGEND | | |
|----------------------------------|------------------------|---|
| ALARM | FAULT INDICATOR LIGHT | |
| CB | CIRCUIT BREAKER | |
| SW | SWITCH MANUAL/OFF/AUTO | |
| TS | TERMINAL STRIP | |
| TEMPERATURE SENSORS (PER MODULE) | | |
| COLOR | IDENTIFIER | DESCRIPTION |
| GRN | SUCTION "A" | SUCTION GAS LINE TEMP. CIRCUIT "A" |
| WHT | SUCTION "B" | SUCTION GAS LINE TEMP. CIRCUIT "B" |
| BLK | ESW | ENTERING SOURCE/SINK WATER TEMP. |
| YEL | LSW | LEAVING SOURCE/SINK WATER TEMP. |
| BLU | Δ | ENTERING LOAD WATER TEMP. COOLING MODE LEAVING LOAD WATER TEMP. HEATING MODE |
| RED | ▲ | LEAVING LOAD WATER TEMP. COOLING MODE ENTERING LOAD WATER TEMP. HEATING MODE |

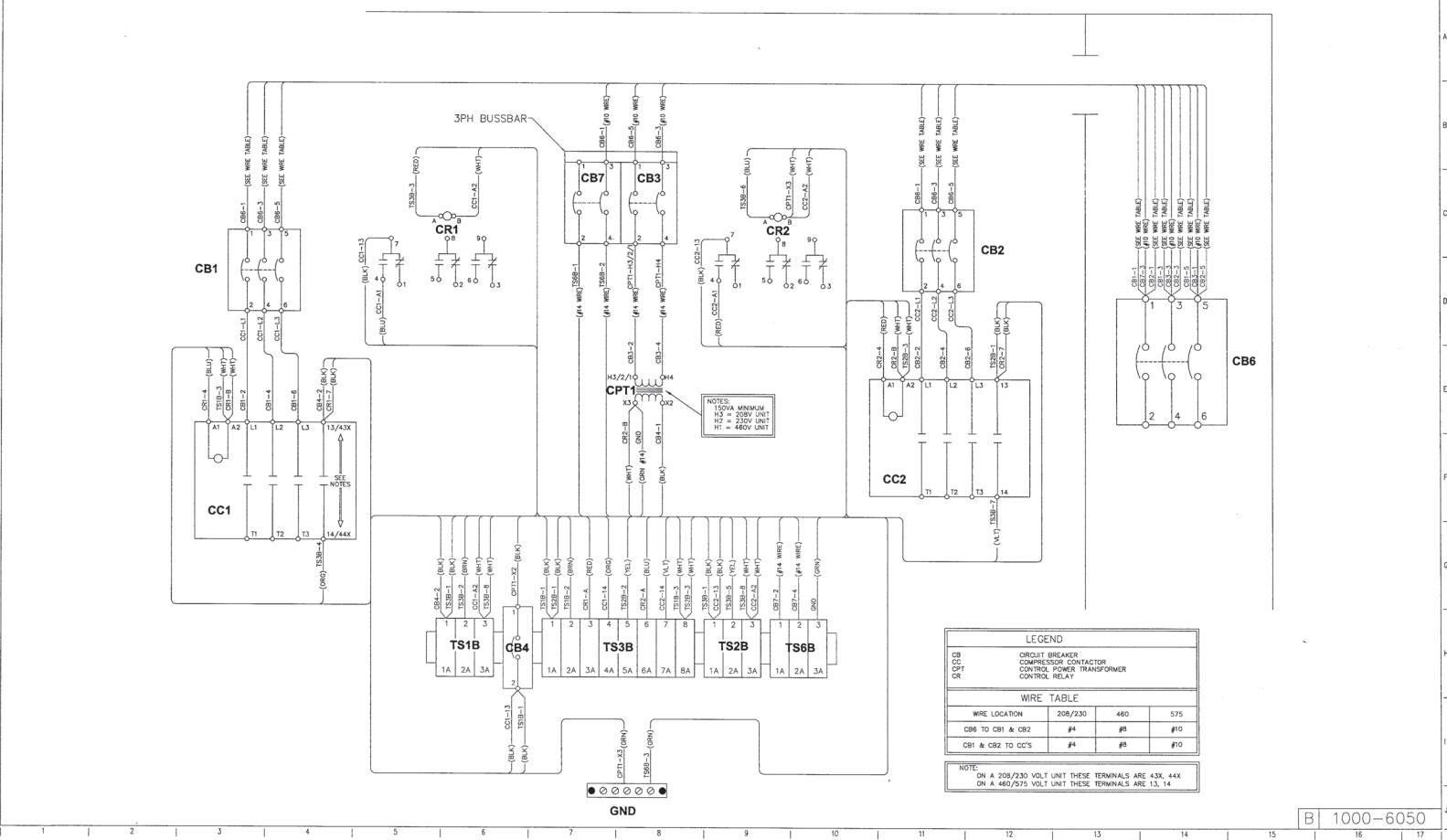


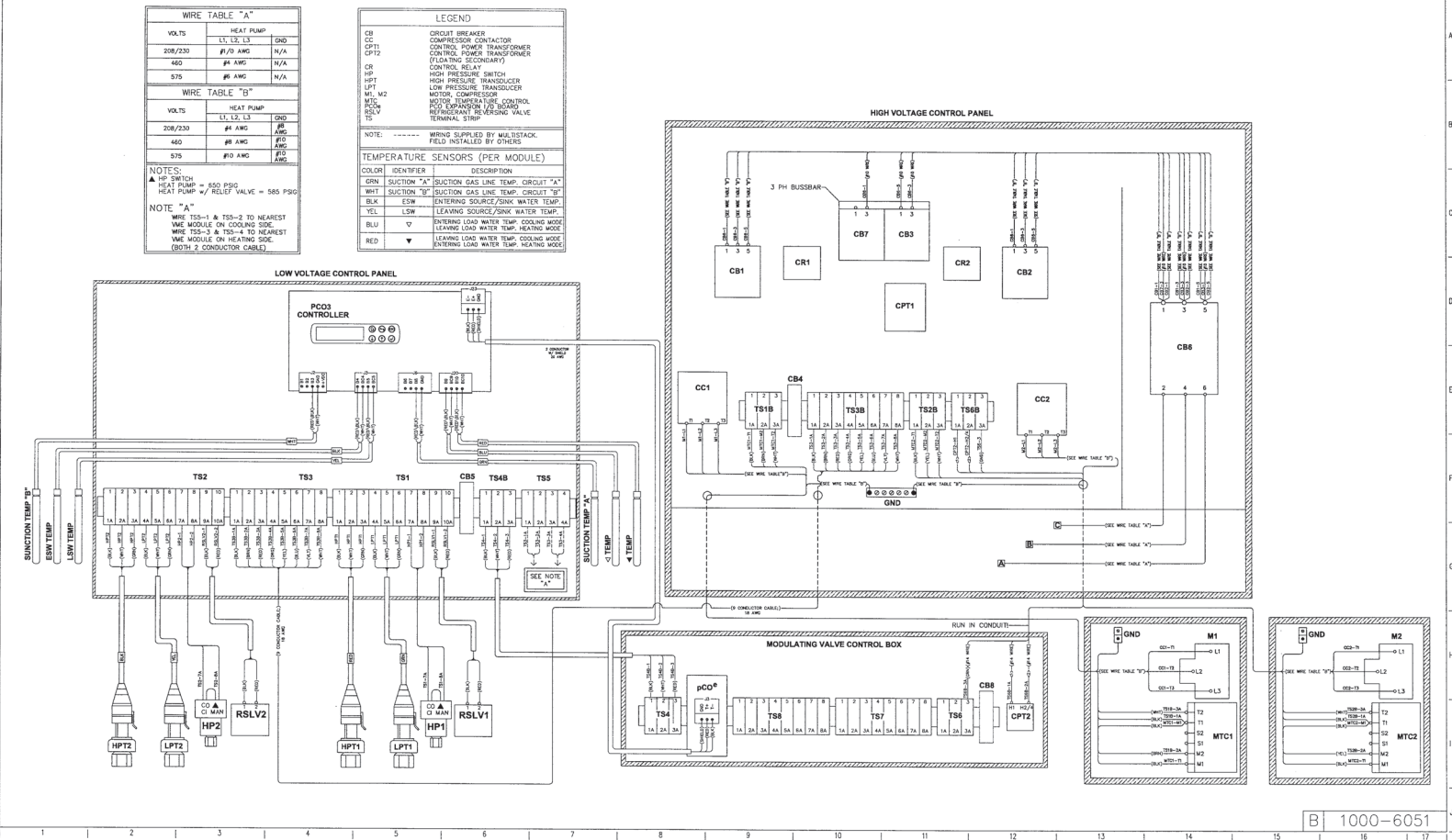
| | | | | | | | |
|----------|--|--------------------------------|---|-------------------------|---|-----------|--|
| REV. | | REFERENCE DWGS: |  MULTISTACK | | B | 1000-6048 | |
| BY | | | Sparta, Wisconsin 54656 ALL DIMENSIONS IN INCHES / DO NOT SCALE DRAWINGS | | MODULATING VALVE CONTROL BOX | | |
| REVISION | | SIMILAR TO: | 2-10VDC MOTORIZED BUTTERFLY VALVE LOAD SIDE (BELIMO SY1-24P) 2-10VDC MOTORIZED BUTTERFLY VALVE SOURCE/SINK SIDE (BELIMO SY1-24P) | | WIRING DIAGRAM MULTIPLE MODULE MS30X COPELAND SCROLL VME HEAT PUMP APPLICATION | | |
| DATE | | DRAWN BY: KJP DATE: 3/31/11 | CHECKED BY: DATE: | ENGR: APPR: DATE: | SCALE: | NONE | |



| | | | | | |
|----------|----|--------------------------------|---|---|-------------|
| REV. | | REFERENCE DWGS: | MULTISTACK Sparta, Wisconsin 54656 ALL DIMENSIONS IN INCHES / DO NOT SCALE DRAWINGS | B | 1000-6049 |
| REVISION | BY | SIMILAR TO: | 2-10VDC MOTORIZED BUTTERFLY VALVE SOURCE/SINK SIDE (BELIMO SY1-24P) 2-10VDC MOTORIZED BUTTERFLY VALVE LOAD SIDE (BELIMO SY1-24P) | MODULATING VALVE CONTROL BOX INTERCONNECT DIAGRAM MULTIPLE MODULE MS30X COPELAND SCROLL VME HEAT PUMP APPLICATION | |
| DATE | | DRAWN BY: KJP DATE: 3/31/11 | CHECKED BY: DATE: | ENGR: APPR: DATE: | SCALE: NONE |







| REVISION | BY | DATE | REV. | REFERENCE DWGS: | III MULTISTACK | B | 1000-4877 |
|----------|----|------|------|-------------------------------|---------------------------|-------------------------|-------------|
| | | | | | Sparta, Wisconsin 54656 | | |
| | | | | SIMILAR TO: | FIRST USED ON ASSY NO: | STD ENGR SPEC | |
| | | | | DRAWN BY: KRO DATE: 5/7/09 | CHECKED BY: | ENGR: APPR: DATE: | |
| | | | | | | | SCALE: NONE |

NETWORK ADDRESSING

EACH CONTROL BOARD IN THE NETWORK MUST HAVE AN UNIQUE pLAN ADDRESS. TO SET THE ADDRESS OF EACH CONTROLLER PRESS AND HOLD THE ALARM AND UP ARROW KEYS SIMULTANEOUSLY DURING THE POWER UP OF EACH BOARD. USE THE UP AND DOWN ARROW KEYS TO SELECT THE pLAN ADDRESS.

VALID MODULE NUMBERS ARE 1 THRU 15
MASTER CONTROL ADDRESS = 30
REMOTE DISPLAY (OPTIONAL) = 32

SCREEN DISPLAY

pLAN ADDRESS: 30

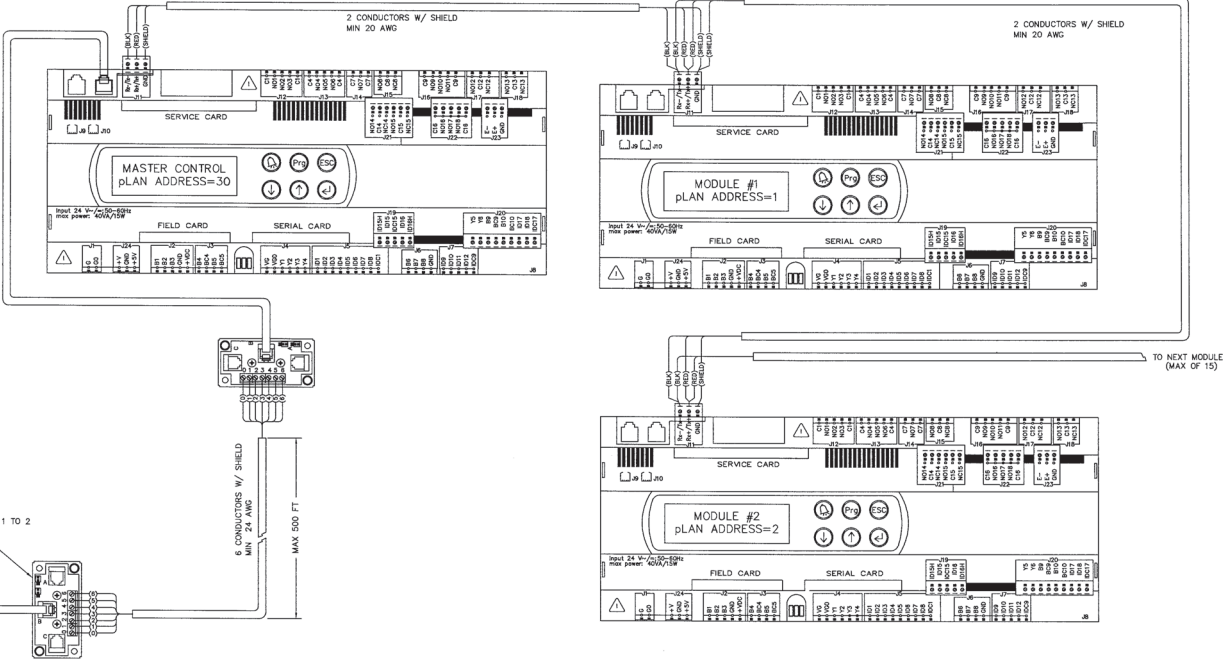
UP: INCREASE

DOWN: DECREASE

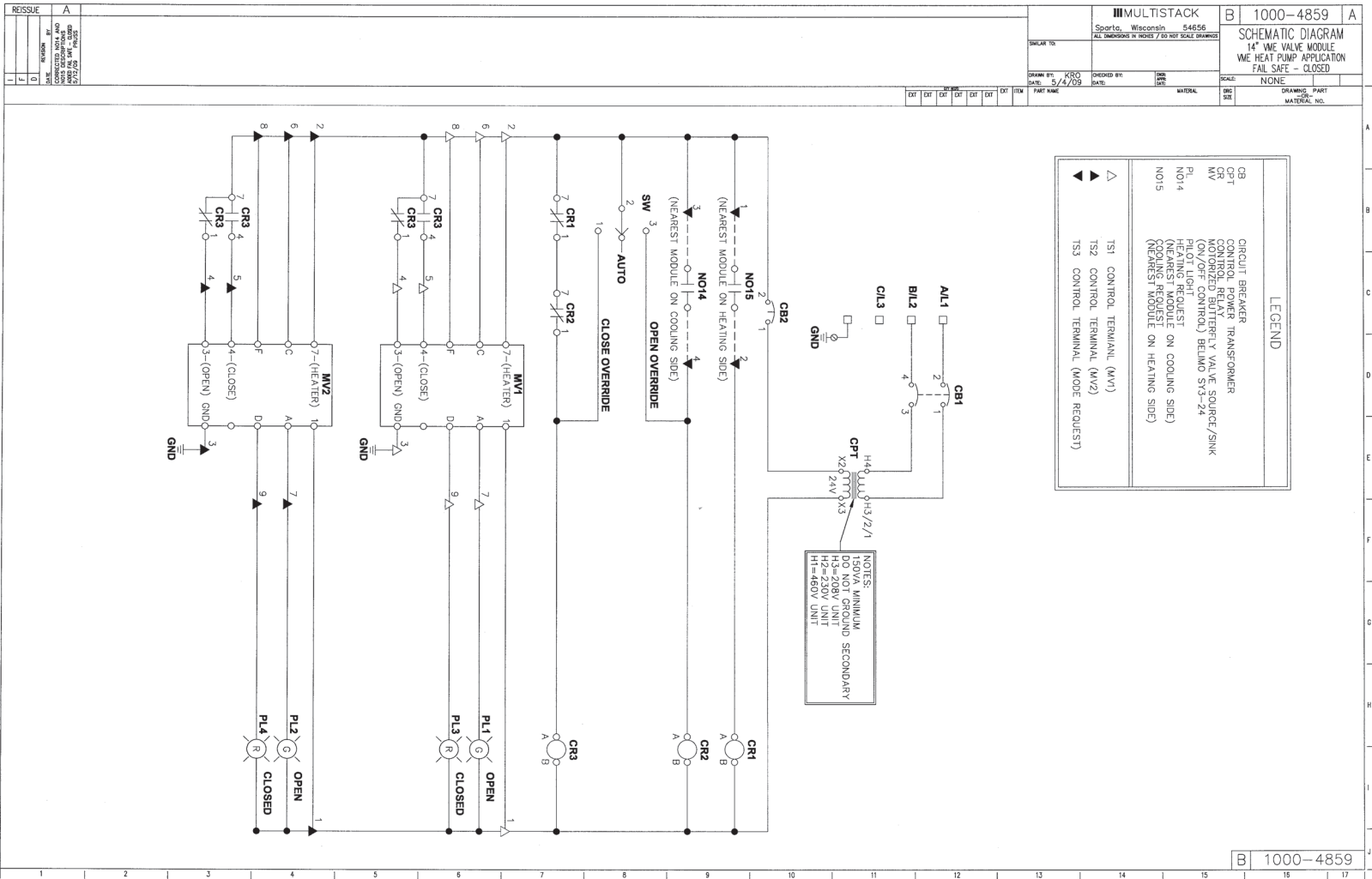
ENTER: SAVE AND EXIT

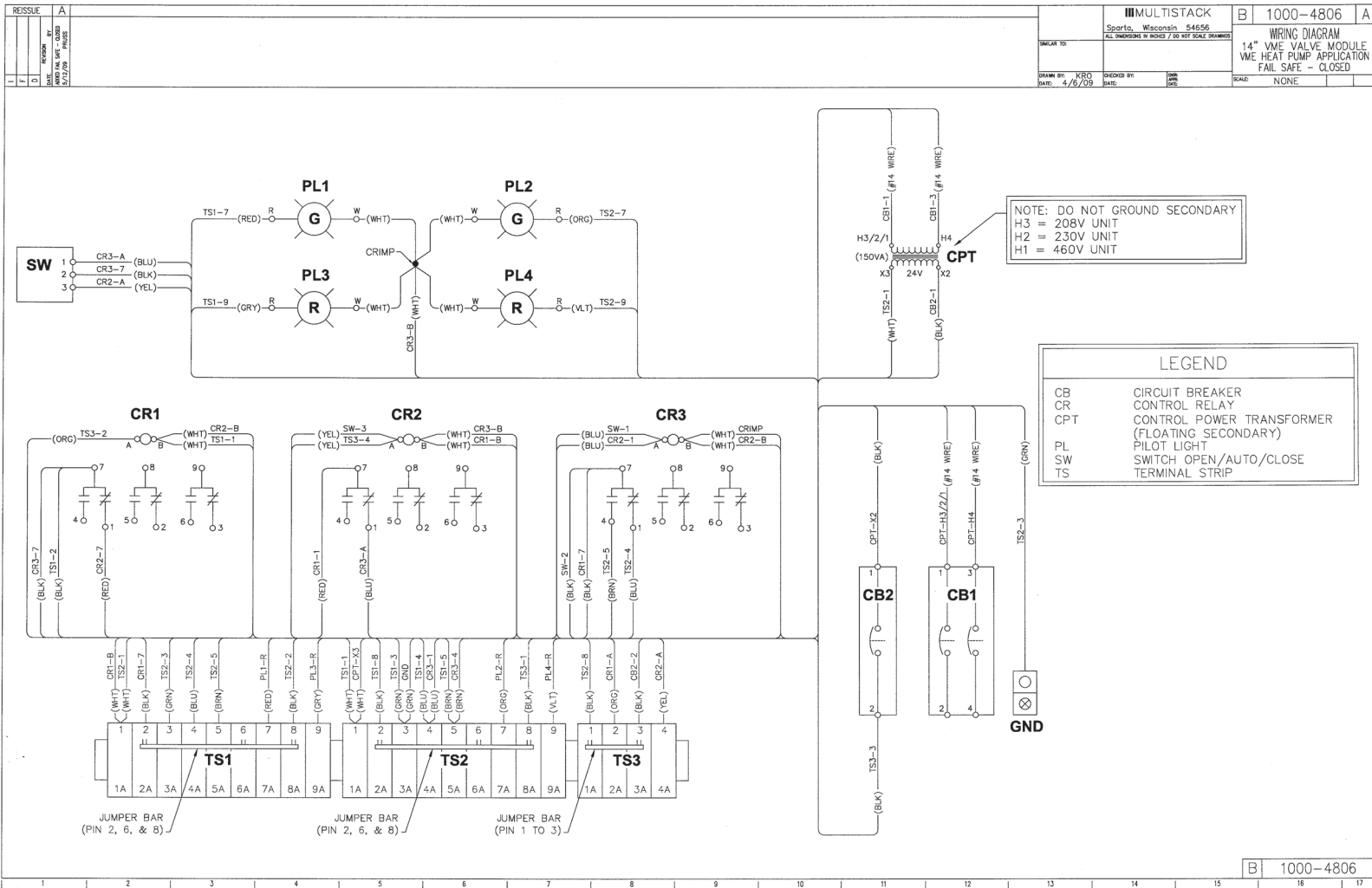
A SOLID YELLOW AND GREEN LIGHT IN THE WINDOW BETWEEN J3 AND J4 OF EACH CONTROLLER INDICATES COMMUNICATION ON THE pLAN NETWORK.

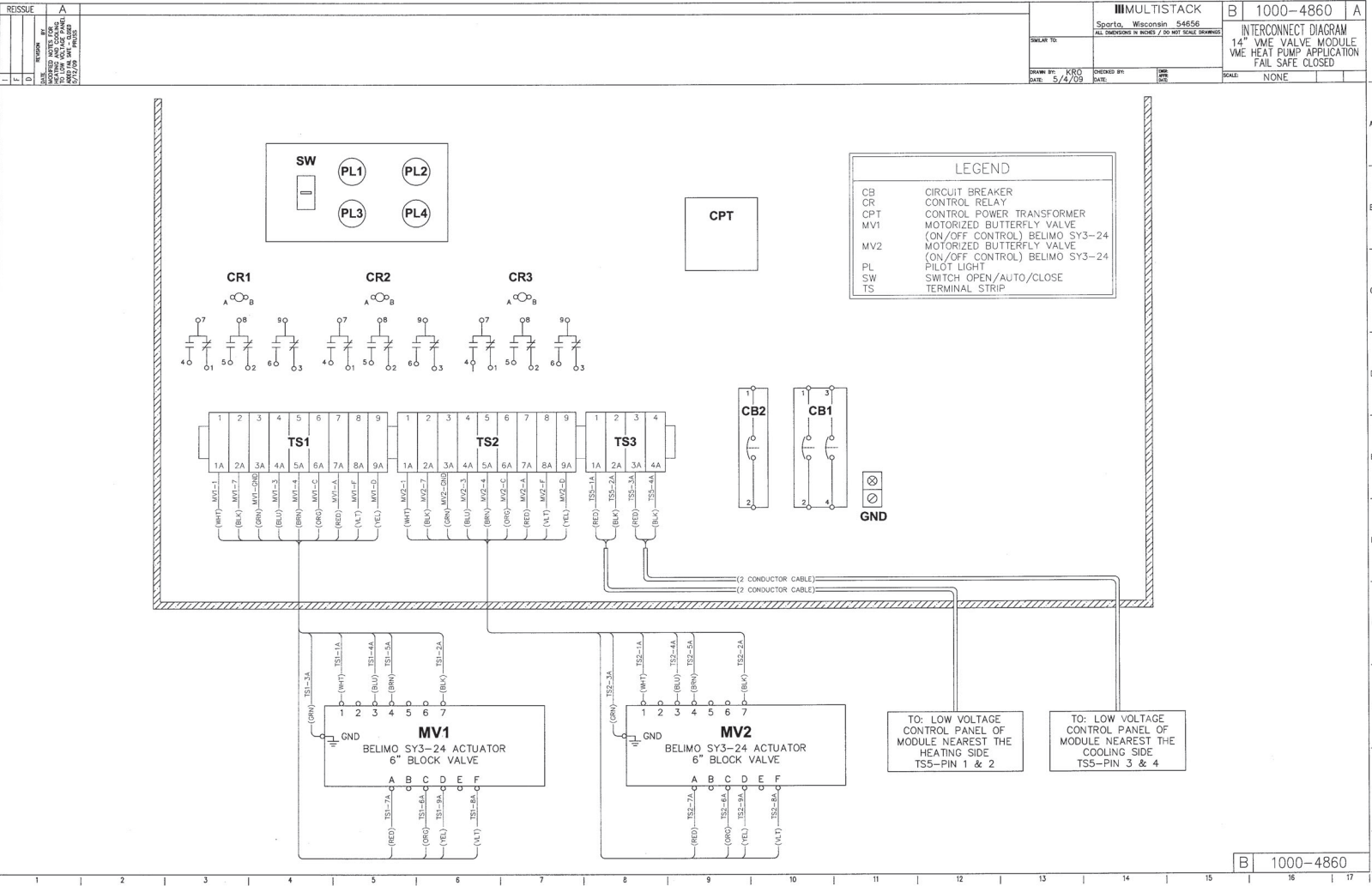
NOTE: REMOTE DISPLAY HAS A BUILT IN AUDIBLE ALARM. PRESS THE [B] BUTTON TO SILENCE.



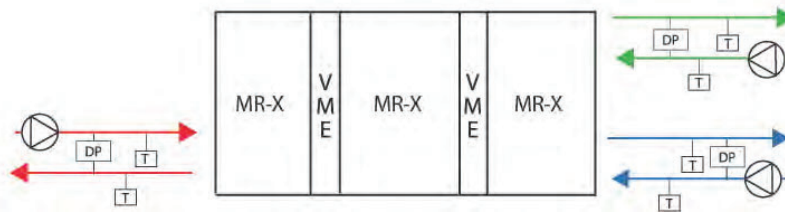
[illegible]







Multistack Heat Pump with End Cap VME I Modules



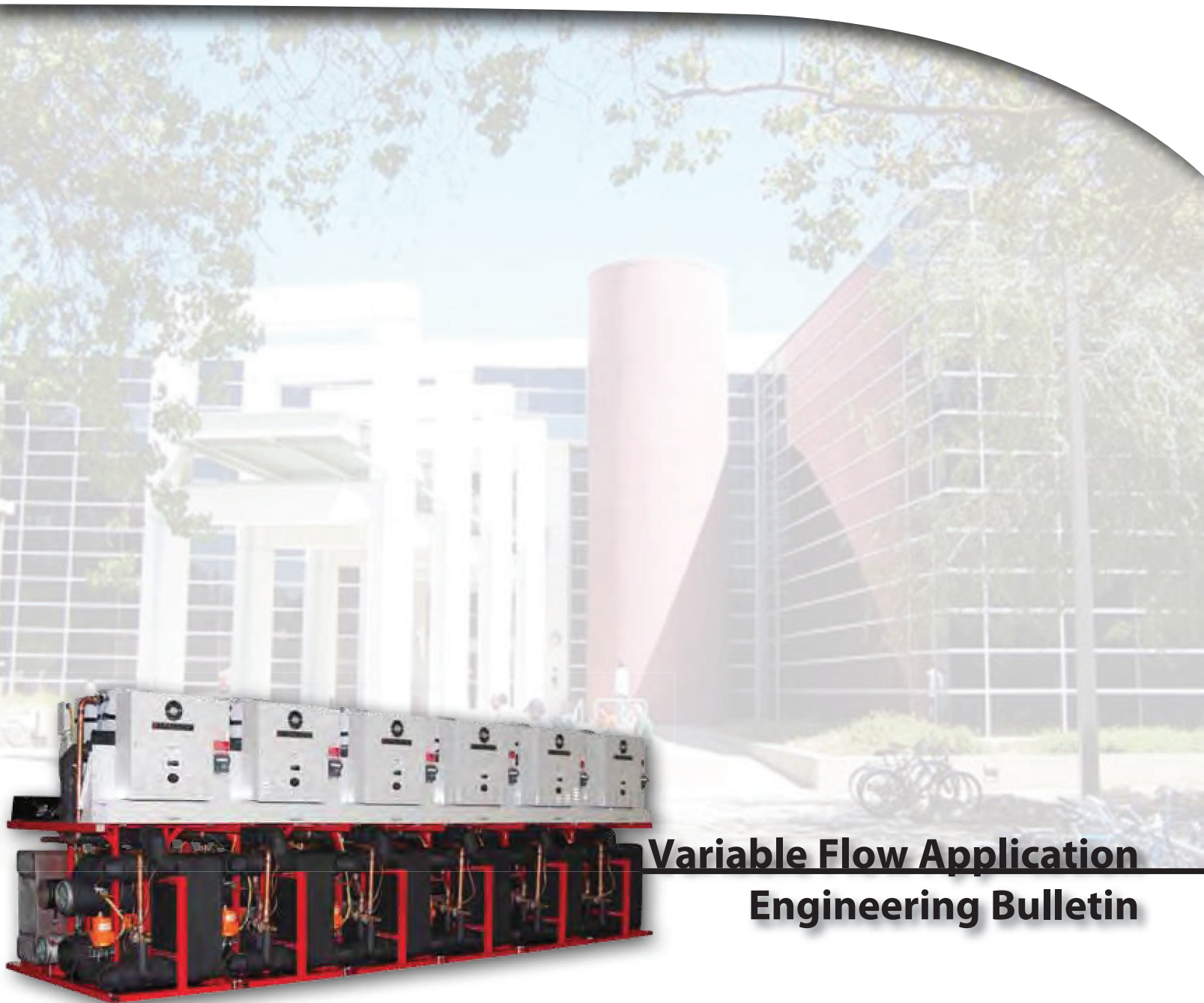
- Heating/Cooling priority determines which mode can use all modules. In heating priority all modules will be utilized in heating if the load exists to run all modules.
- Heating or cooling can be disabled. If heating is disabled no modules will run in the heating mode. If cooling is disabled no modules will run in the cooling mode.
- When heating and cooling are both enabled the master control will stage on compressors to maintain both cooling and heating set points simultaneously. Heating/cooling priority will determine which mode will take priority if the load requires more capacity than is available. For example, if the master controller is in cooling priority, and 2 modules are making chilled water and one module is running to make hot water, and the building load requires more chilled water capacity, the master controller will shut down the module that is running in heating and then operate it in the cooling mode.
- When all modules go into heating or cooling the end VME module will be driven closed. To avoid dead heading the pumps when all modules are in heating or cooling a field supplied load bypass at the chiller is required. The master controller will continue to monitor temps if flow is maintained, and when the end module is available, simultaneous cooling and heating will resume if both loads exist. The bypass can be field wired to operate opposite the end vme or it can be a pressure dependent valve.
- All pumps require VFD's that should operate to maintain heat pump DP while maintaining heat pumps minimum flow requirements at all load conditions. A system bypass will also need to be field provided to accommodate minimum chiller flow at all load conditions.

* Temperature sensors are supplied by Multistack for field installation

* DP transmitters for VFD control are supplied and installed by others

MULTISTACK[®]

Originators. Innovators. Never the Imitators.sm



Variable Flow Application Engineering Bulletin

For:
Multistack Modular Scroll Only Applications



Variable Flow Application Engineering Bulletin

Product Information

MULTISTACK MODULAR CHILLERS OR HEAT PUMPS AND VARIABLE PRIMARY FLOW PUMPING SYSTEMS

The Multistack Modular Chiller and Heat Pump design offers some unique advantages when used in a variable primary flow system. These advantages include precise temperature control while providing infinite flow modulation with minimum flows significantly lower than traditional chillers. The Multistack Modular Chiller, however, has some subtle differences from a conventional system. These differences must be understood to properly design a variable primary flow system. This document will outline the basic requirements for a variable primary flow application utilizing the Multistack Modular System. The following three factors must be considered:

1. Pump VFD Control
2. System Bypass Sizing and Control (Minimum flow requirement at full load)
3. Minimum Chiller Flow – (Minimum flow requirement at low load)

PUMP VFD CONTROL

The application of the Multistack Chiller or Heat Pump in a variable flow system requires a different control approach when compared to conventional systems. In place of a single machine with one heat exchanger, the Multistack system incorporates multiple heat exchangers, each with its own motorized, fully modulating isolation valve. The internal header system of a Multistack Modular Chiller manifolds all modules' evaporators and condensers in a parallel flow arrangement and provides proper flow distribution to each active heat exchanger. As a result the differential pressure across the MULTISTACK MODULAR CHILLER or HEAT PUMP can be directly correlated to the flow across all active heat exchangers.

Proper water flow to each operating heat exchanger must be maintained at all load conditions. This can be accomplished one of two ways:

1. The variable speed drive of the pump is controlled directly by a differential pressure transmitter installed at the inlet and outlet of the Multistack Modular System. The pump will modulate to maintain the required pressure differential across the Multistack Modular System. (Drawing 1).
2. The variable speed drive of the pump is controlled directly to a pressure transmitter installed in the building piping. The pump will modulate to control system pressure at the point of measurement (Drawing 2).

Design Note: To maintain acceptable temperature variance and avoid nuisance faults Multistack incorporates fast acting modulating valves with a stroke times less than 30 seconds. As a result it is critical that there is no delay associated with the Pump VFD control or the System bypass valve. The system bypass valve must be a pressure dependent valve with a similar stroke time to the Multistack onboard valve.

MINIMUM FLOW REQUIREMENT AT FULL LOAD and SYSTEM BYPASS SIZING and CONTROL

One reality of a variable primary flow system, regardless of which of the above pump control methods is utilized (based on the chiller ΔP or the system pressure), is that there will be some control lag between the load seen by the chilled water distribution system and the Multistack chiller or heat pump. Because of this, it is possible for the chiller to temporarily have a different flow requirement than the air handler (or other terminal device). To avoid potential operational issues due to this phenomenon the system must incorporate a bypass valve. One example of how this operational issue could occur is:

The chiller is operating at full load (perhaps in a pull down situation). The air handlers gain control of their load and all simultaneously drive their chilled water control valves closed (this can happen quite abruptly in some variable primary flow systems). At this point the system has a very low water flow requirement to the air handlers. Simultaneously, the chiller (whose capacity is being controlled by chilled water temperature) has not yet seen a drop in required capacity at its system sensors due to the system water volume (which creates a time lag between a change in leaving temperature at the air handlers and a change in entering temperature at the Multistack Chiller). As a result of this lag, the MULTISTACK MODULAR CHILLER or HEAT PUMP would require more flow than the rest of the system until the chiller controls can unload the chiller/heater to match the system load condition. Without a system bypass valve in place the result of this condition would be to either provide too much flow to the air handlers or not enough flow to the MULTISTACK MODULAR CHILLER or HEAT PUMP.

When controlled properly the system bypass valve ensures each system component receives the proper flow at all times (including the potential lag period). There are two control methods for the system bypass valve (which directly correlate to the control of the pump as described above):

1. When using the first pump control method (differential pressure drop across the chiller controlling the pump speed) the system bypass valve is controlled directly to a differential pressure transmitter installed in the building piping. The system bypass valve will modulate to control pressure differential as shown in (Drawing 1).
2. When using the second pump control method (system pressure controlling the pump speed) the system bypass valve is controlled directly to a differential pressure transmitter installed at the inlet and outlet of the Multistack Modular System. The system bypass will modulate to maintain the required differential pressure across the MULTISTACK MODULAR CHILLER or HEAT PUMP. (Drawing 2)

When sizing the system bypass all load conditions must be taken into account. For this reason the system bypass is not sized to the minimum system flow, rather it is sized to provide minimum flow at full load of the chiller. Contact your local Multistack sales representative for proper bypass sizing.

Design Note: The minimum flow bypass should be located on the load side of the piping system and is typically accomplished by installing the valve as an end-of-loop bypass. Some systems may not allow for an end-of-loop bypass. In these situations the valve may be installed closer to the chiller, however, a minimum system volume equaling a minimum of a 2-minute loop time must be maintained to ensure proper operation.

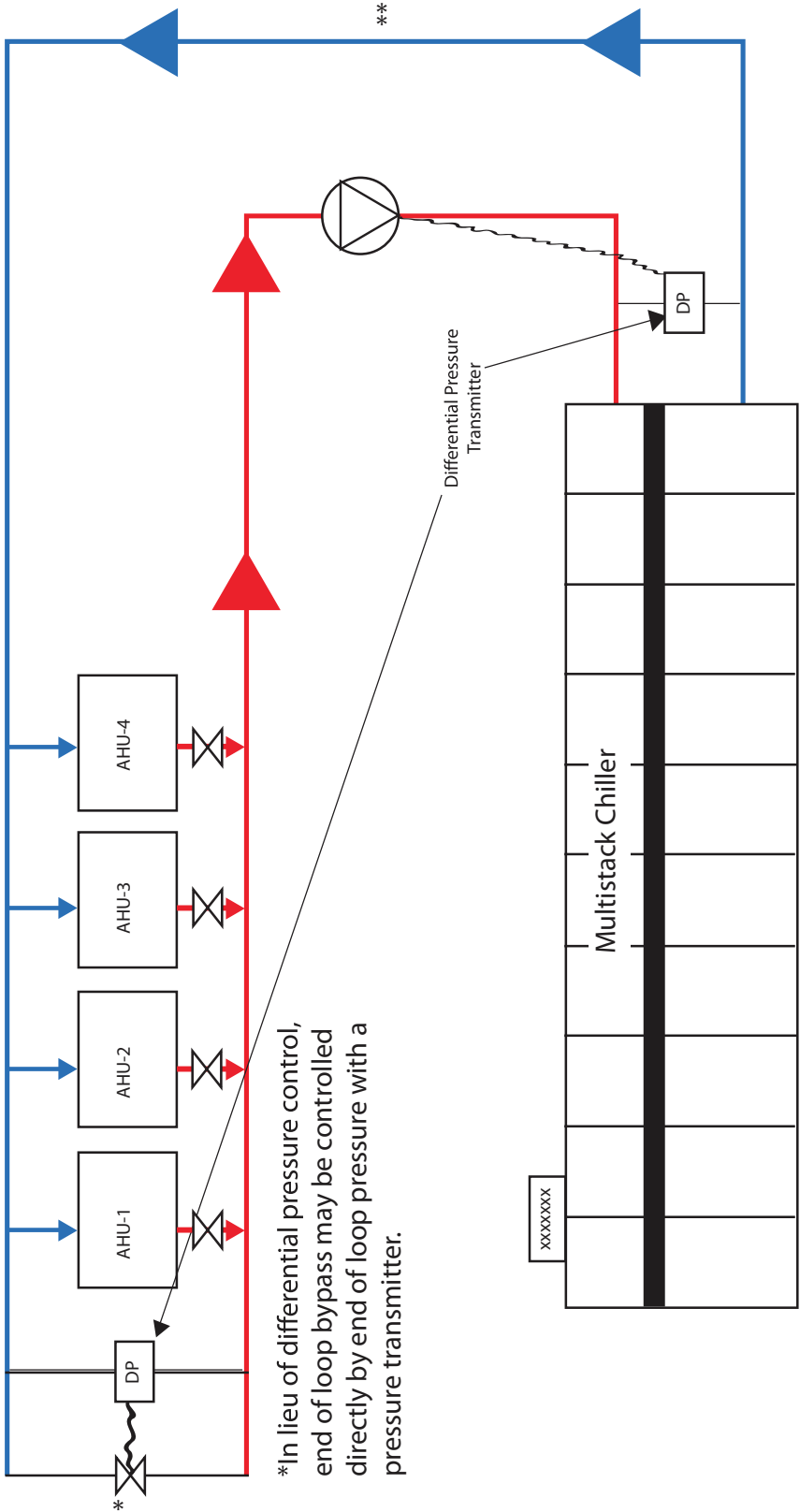
MINIMUM CHILLER FLOW (MINIMUM FLOW REQUIREMENT AT LIGHT LOAD)

The Multistack control system together with the modulating valves at each evaporator and or condenser allows for maximum flow turndown. The MULTISTACK MODULAR CHILLER or HEAT PUMP can have a minimum flow at light load equivalent to the flow required for one circuit. Often the pumping system has a higher flow requirement than the Multistack Chiller. Additionally, by keeping the lead circuit's modulating valve open (which is rotated each day to follow the lead circuit) the pumping system will not be "dead-headed" by the chiller under a no-load condition. If the pumps minimum turndown is more than one circuit of flow, the MULTISTACK MODULAR CHILLER or HEAT PUMP can be programmed to set the number of open valves to satisfy the minimum flow of the pump, eliminating the need for an external chiller bypass.

Design Note: This is the minimum operating point for MULTISTACK MODULAR CHILLER or HEAT PUMP only. It does not determine the system's minimum flow requirement or the system bypass valve sizing.

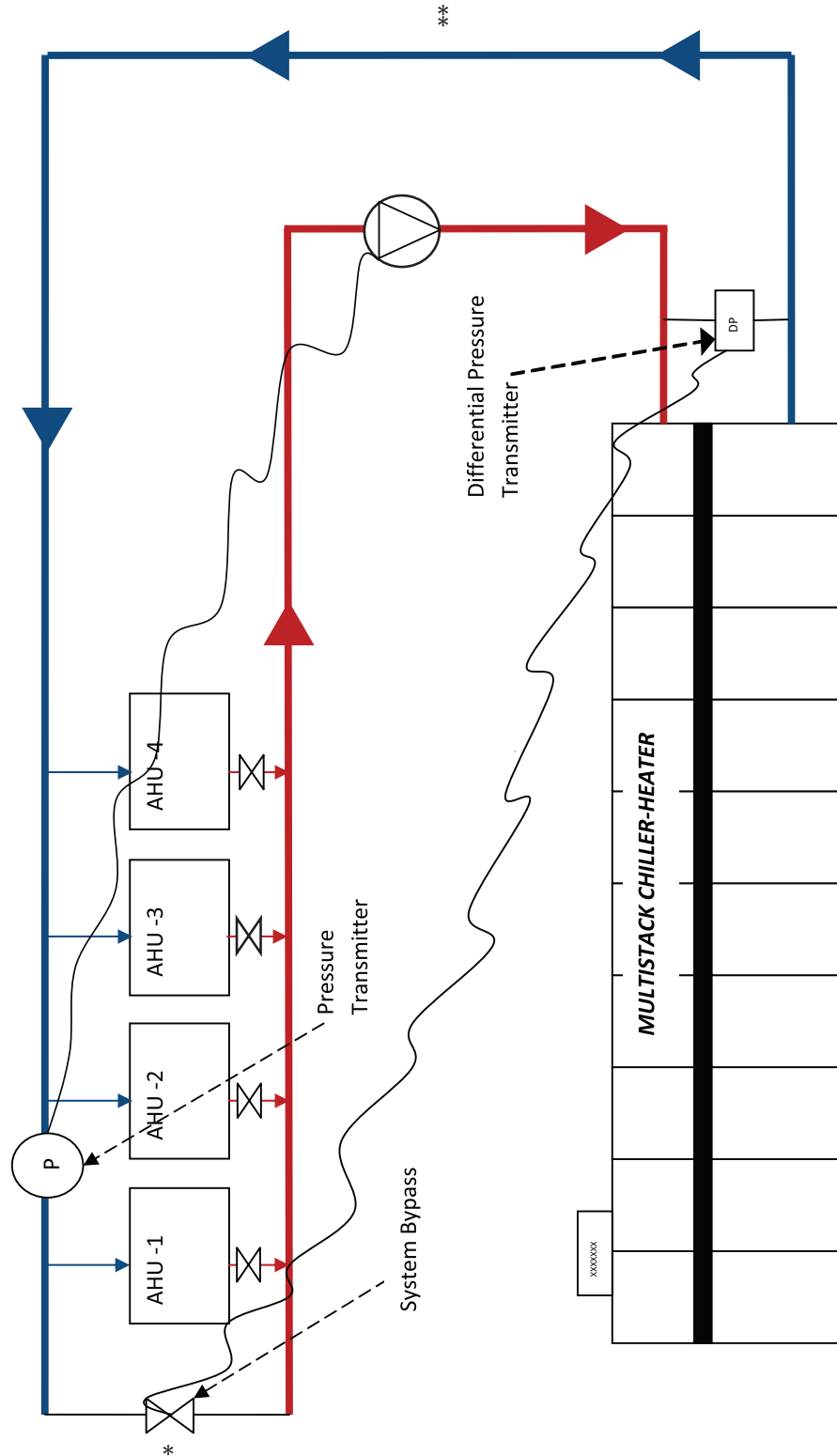
In summary, the Multistack Variable Flow Chiller or Heat Pump can offer significant control and turn-down advantages in variable primary flow pumping systems that will improve the energy profile of the system. Please contact us with any questions or concerns that you may have. We will listen, and do our best to support you in making your system the best it can be.

Multistack Recommended Variable Flow Chiller Schematic
End of Loop System Bypass with Chiller Differential Pressure Control



*Less than 30 second stroke time required.
**Maintain 2 minute loop time at all load conditions.

Multistack Variable Flow Chiller Schematic



*Less than 30 second stroke time required.
 **Maintain 2 minute loop time at all load conditions.

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-134a.

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®.



III® MULTISTACK®

1065 Maple Avenue P.O. Box 510 Sparta, WI 54656

Phone 608-366-2400 • Fax 608-366-2450

www.multistack.com



F168_0812

VME



pCO³ CONTROLLER USER MANUAL

CONTROLLER FOR “MR20-70X VME HEAT PUMP”
WATER-COOLED HEAT PUMP
for Version – MSVME_100.08



Introduction

The Multistack Chiller- Heat Pump is a modular water-cooled chiller system, composed of one or more modules and is controlled by a *master controller*, to provide chilled liquid to an external circuit. The modules interconnect to a Virtual Moveable Endcap module with power actuated butterfly valves to open and close modules for simultaneous heating and cooling. Each module contains a scroll compressor, stainless steel-brazed plate heat exchangers, and other related control components. Each chiller system is operated by a microprocessor based controller that monitors the status of each refrigerant circuit and provides a signal to operate the compressors as required. The system monitors the leaving load water temperature (LLWT) to determine the need for cooling to the external circuit.

Module Board

Each module has a *module board*, which sends information to the *master controller* regarding the temperatures, pressures, and activity of the module and is equipped with a semi graphical LCD with backlight and six button keypad. The feedback from the *module board* reports the status of each module back to the Master Controller. The *module board* performs safety checks and alerts the *master controller* when something is wrong. Loss of communication with the *master controller* results in the shutting down of the module when in *Auto* mode. The screen at the *module board* will display information regarding that module and the compressor installed on that module. The *module board* communicates this information and it is also passed to the Master Controller over the pLAN connection. Information like Mode, ELW, LLW, ESW, LSW, Suction Temp, High Pressure, Low Pressure, etc. from the compressor is available through this connection.

Master Controller

The *master controller* is equipped with a semi-graphical LCD with backlight and a six button keypad. These buttons aid the operator in setting *SYSTEM VARIABLES*, checking fault conditions, monitoring the status of the chiller system, and monitoring the status of individual modules. The *master controller* is also the interface to field supplied hardwire remote connections such as Remote Start/Stop, flow switch inputs, customer alarm outputs, LOAD WATER RESET or LOAD LIMIT RESET signals. There is also an optional communication link for connecting to a Building Automation System (BAS). This connection will allow the BAS to remote monitor and control the chiller system. See *BAS Interface* on page 18.







MODULE BOARD



MASTER CONTROLLER

Controller Keys

-  The **UP** arrow button is used to go back to the previous category on the screen or to increase the value of a digit in a numeric variable field.
-  The **DOWN** arrow button is used to advance to the next category on the screen or to decrease the value of a digit in a numeric variable field.
-  The **ENTER** button is used to make a selection from any of the menu screens in the program. It is also used to enter and exit *edit mode* while in the *SYSTEM VARIABLES* screens.
-  The **ALARM** button is the menu for current system or module faults. When the backlight is red, it indicates that a fault has occurred.

Prg The **PROGRAM** button goes to the *MAIN MENU* from any screen in the program.




Esc The **ESCAPE** button goes to the previous screen or the *status screen*, if you are at the top of the *MAIN MENU*.



Controller Setup

The Master Control and Module Boards' address are set electronically by simultaneously pressing and holding the ALARM and UP buttons while cycling power on. After a few seconds a screen configuration will appear, to modify the address use the UP and DOWN buttons, and then press ENTER to confirm.

The following are the addressing parameters for setting up a Multistack Chiller network:

-  Modules – 1 thru 8 (MODULE 1 SHOULD ALWAYS BE 1ST HEAT MODULE)
-  Master Controller – 30
-  Remote LCD Display – 32

In setting up the network, the *master controller* must have an address of 30. The Chiller modules would start with module 1 and proceed numerically through module 8.



Manual/Off/Auto Switch

Each Chillert module has a *Manual/Off/Auto* switch. In *manual mode*, the loading of the compressor is done by the *module board*. The control is independent of the other modules and is based on the LLW of that module. When *auto mode* is selected, the staging of the compressors is handled by the *master controller*. The *master controller* will determine how many compressors need to be on in order to satisfy the load requirements. Control of the compressors is based on the system LLW when in *auto mode*. *Disabled mode* (off) selection disables the module and the compressor is not allowed to run.

Main Menu

The *MAIN MENU* displays the options the user can access in the program. Press the **Prg** button to get to the *MAIN MENU* and then use the **UP** and **DOWN** arrow buttons to scroll through the menu. The **ENTER** button allows displaying of the sub-menu that the greater than sign (>) is located beside. The *MAIN MENU* contains *ON/OFF CONTROL*, *STATUS*, *SYSTEM VARIABLES*, *FAULT REVIEW*, *LOAD PROFILE*, and *SECURITY*.

On/Off Control Screen

Upon power up, the initial screen will go through a 12 second delay before giving control to the user. The *ON/OFF CONTROL* screen will be the next screen displayed when the timer expires. This screen allows the user to command the chiller *on* or *off*. The display will read 'CHILLER OFF, PUSH ENTER TO START'. Pushing the **ENTER** button, will display a message of '30 SECONDS TO START!' and will change to 'CHILLER ON, PUSH ENTER TO STOP'. After the 30 second delay, the first compressor will turn on, if needed, and the display will change to the *status screen*. The last line of the ON/OFF control screen shows critical system faults such as WAITING FOR LW FLOW, REMOTE SRART/STOP, and POWER PHASE MONITOR.

System Variables

Once power is connected to the *master controller*, the *SYSTEM VARIABLES* can be accessed. These variables determine how the chiller system will run and are assigned default values. For most installations, these values will provide optimum performance. However, special operating conditions may require different settings.

Use the **UP** or **DOWN** arrow buttons to locate the *SYSTEM VARIABLES* in the *MAIN MENU*. The greater than sign (>) is the cursor indicator. Press the **ENTER** button to enter the *SYSTEM VARIABLES MENU*. *Chiller Setup*, *Customer Resets*, *Temp Readings*, *Time and Date*, *BAS Interface*, and *Factory Setup* are located in the *SYSTEM VARIABLES MENU*. Press the **ENTER** button again to enter one of the sub-menus. To change the value of a variable, press the **ENTER** button. A blinking block cursor will appear in that system variables' value field indicating that the program is in *edit mode*. Use the **UP** or **DOWN** arrow buttons to change the value of the variable. To save the new setting, press the **ENTER** button, pressing the **Esc** button will not save the change. The cursor will move back to the upper left corner of the screen indicating that the program is no longer in *edit mode*. An asterisk (*) next to the variables indicates that the *SYSTEM VARIABLES* are **locked** and cannot be adjusted. For assistance on unlocking the *SYSTEM VARIABLES*, see *SECURITY* on page 16.

Chiller Setup (System Variables)

The following is a list of *SYSTEM VARIABLES* for the modules in Heating Mode.

HEATING MODE SETUP

1. **UPPER SETPOINT:** The designed entering load water temperature (ELW – System sensor) at full load. The temperature drop across this chiller is based on flow rate. If the design temperature drop (ΔT) is 10°F across the chiller, then the UPPER SETPOINT should be 10°F above the LOWER SETPOINT.
2. **LOWER SETPOINT:** The desired leaving load water temperature (LLW – System sensor). The LOWER SETPOINT would be the setpoint the chiller is controlling to if the VSP is set to 0%.
3. **VSP SETPOINT:** A percentage used to determine the *control setpoint*. Leaving the VSP at 0% would keep the *control setpoint* at the value of the LOWER SETPOINT. Raising the VSP would incorporate a chilled water reset scheme allowing the *control setpoint* to change depending on the ELW Temperature. As the ELW Temperature approaches the LOWER SETPOINT value the *control setpoint* will reset according to the VSP percentage. See Graph on page 7 for explanation.
4. **T-DIFF (Time Difference):** The minimum time in seconds between increases in demand to a compressor on initial ramp up. This time should be set to the loop time of the chiller. The loop time is the time it takes for the water to make one pass through the entire LW loop of the building
5. **HEAT DELAY:** A time in seconds where on initial start of a compressor in the Heating Mode the 4 way reversing valve will energize and operate in the cooling mode before switching to Heating. This has been found to help prevent the reversing valve from sticking and the compressor from tripping on HP on a call for Heating due to liquid present at the reversing valve.
6. **HIGH ESW TEMP:** The maximum entering source water temperature before the compressor trips on a fault.
7. **MAXIMUM NUMBER HEAT MODULES:** The maximum number of modules that can operate at one time in the heating mode. This is based on how many modules can be isolated to the Heating loop by the VME modules.

COOLING MODE SETUP

8. **UPPER SETPOINT:** The designed entering load water temperature (ELW – System sensor) at full load. The temperature drop across this chiller is based on flow rate. If the design temperature drop (ΔT) is 10°F across the chiller, then the UPPER SETPOINT should be 10°F above the LOWER SETPOINT.
9. **LOWER SETPOINT:** The desired leaving load water temperature (LLW – System sensor). The LOWER SETPOINT would be the setpoint the chiller is controlling to if the VSP is set to 0%.
10. **VSP SETPOINT:** A percentage used to determine the *control setpoint*. Leaving the VSP at 0% would keep the *control setpoint* at the value of the LOWER SETPOINT. Raising the VSP would incorporate a chilled water reset scheme allowing the *control setpoint* to change depending on the ELW Temperature. As the ELW Temperature approaches the LOWER SETPOINT value the *control setpoint* will reset according to the VSP percentage. See Graph on page 7 for explanation
11. **T-DIFF (Time Difference):** The minimum time in seconds between increases in demand to a compressor on initial ramp up. This time should be set to the loop time of the chiller. The loop time is the time it takes for the water to make one pass through the entire LW loop of the building.
12. **MAXIMUM NUMBER COOLING MODULE:** The maximum number of modules that can operate at one time in the Cooling Mode. This is based on how many modules can be isolated to the Cooling loop by the VME modules.
13. **MODE PRIORITY:** Which Mode (Heating or Cooling) takes priority for maximum allowable modules if demand calls for the maximum number of modules in both Heating & Cooling.

14. **MODE SELECT:** The point of contact used to select starting the Heat Pump in either Heating or Cooling.
- EX2-EX3:** Mode selection by hard wired inputs into the master control
 - EX2 CLOSED IS HEATING**
 - EX3 CLOSED IS COOLING**
 - BOTH CLOSED FOR AUTO OPERATION**
 - BAS:** Mode selection by the Building Automation System via an interoperable web portal
15. **FAIL INDIC** (Failure Indicator): A percentage value which provides for an output signal to the Customer Alarm Relay whenever compressors of the indicated value have failed. A 0% setting will give an output signal after any failure within the system.
16. **NUM OF MODULES:** This is the number of Heat Pump modules that are in the system.
17. **HP CUTOUT:** The point where a high pressure fault occurs based on the high pressure reading returned from the compressor. This value is measured in psig. Note: Each module also has a mechanical high pressure switch with a manual reset.

Standard Application

Program Version Format

MRVME_100.08

System Variable Ranges & Default Settings

The following table defines all of the *SYSTEM VARIABLE* ranges and default values for the standard program.

| System Variable | Range | Default Value |
|---------------------|-----------------------------|---------------|
| HEAT UPPER SETPOINT | 80°F to 135°F | 120°F |
| HEAT LOWER SET | 70°F to 130°F | 110°F |
| HEAT VSP VALUE | 20% to 100% | 50% |
| HEAT T-DIFF | 15 to 360 sec | 15 sec |
| HEAT DELAY | 0 to 120 sec | 30 sec |
| HIGH ESW TEMP | 65°F to 95°F | 85°F |
| MAX # HEAT MODS | 1 to 15 | 1 |
| COOL UPPER SETPOINT | 45°F to 80°F | 55 |
| COOL LOWER SET | 35°F to 70°F | 45 |
| COOL VSP VALUE | 0% to 80% | 50% |
| COOL T-DIFF | 15 to 360 sec | 15 sec |
| MAX # COOL MODS | 1 to 15 | 1 |
| MODE PRIORITY | Cooling or Heating | Heating |
| MODE SELECT | Hard Wired or BAS Interface | Hard Wired |
| FAIL INDIC | 0 to 100% | 100% |
| NUM OF MODULES | 1 to 15 | 1 |
| HP CUTOUT | 400 to psig 650 | 650 |

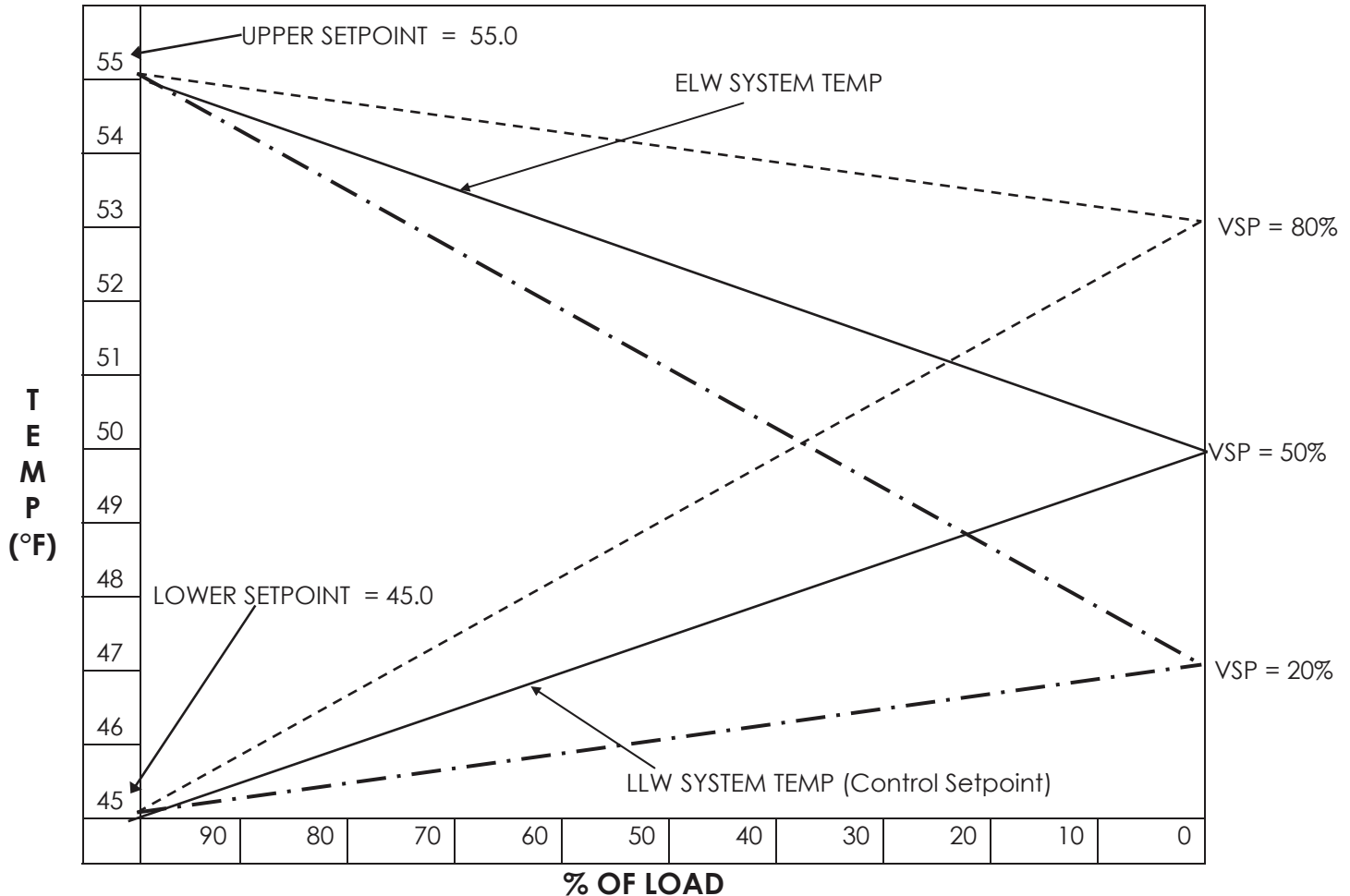
Standard Module Cutouts and Reset Points

| | | |
|------------------|-------------------|----------------------|
| Low Suction Temp | Cutout → 25°F | Reset @ 30°F |
| Low Leaving CHW | Cutout → 34°F | Reset @ 38°F |
| Low Pressure | Cutout → 40 psig | Reset @ 60 psig |
| High Pressure | Cutout → 650 PSIG | Reset below 600 psig |

Auto Mode

Chilled Water Reset for Temperature Control

The following chart defines how the chilled water reset scheme operates when utilizing UPPER SETPOINT, LOWER SETPOINT, and VSP in the *SYSTEM VARIABLES*.



Example:

If the UPPER SETPOINT = 55°F; LOWER SETPOINT = 45°F; VSP = 50%; then the *no load* point would be 50°F. $([upper - lower] * vsp \div 100 + lower = no\ load)$ In this example, if the ELWT is at or above 55°F (upper setpoint) then the *control setpoint* would be 45°F. If the ELWT is at or below 50°F (no load) then the *control setpoint* would be 50°F.

Note: The lower the VSP value selected will result in the most constant Leaving Chilled Water Temperature from the chiller

Master Controller Status Screens

System Screens

The main status screen displays information about the chiller system.

A. SYSTEM STATUS

1. HEATING

DEMAND: A percentage of current load needed compared to the maximum design load. This value is determined by the system Heating ELW temperature and the settings of the *SYSTEM VARIABLES*.

CAPACITY: A percentage of the chiller that is operating. It is calculated by adding the *demand* of each compressor (0-100%) This value is then divided by the product of the total number of compressors times 100. This value will be displayed in the range of 0-100%. An asterisk (*) displayed next to capacity indicates that it is being controlled by an external source, either LOAD LIMIT or LOAD WATER RESET.

2. COOLING

DEMAND: A percentage of current load needed compared to the maximum design load. This value is determined by the system Heating ELW temperature and the settings of the *SYSTEM VARIABLES*.

CAPACITY: A percentage of the chiller that is operating. It is calculated by adding the *demand* of each compressor (0-100%) This value is then divided by the product of the total number of compressors times 100. This value will be displayed in the range of 0-100%. An asterisk (*) displayed next to capacity indicates that it is being controlled by an external source, either LOAD LIMIT or LOAD WATER RESET.

3. **HEATING LLW:** The common Heating Leaving Load Water temperature from the chiller.

4. **COOLING LLW:** The common Cooling Leaving Load Water temperature from the chiller.

Press the **DOWN** arrow button once to display the next main status screen with system information.

HEATING MODE

1. **DEMAND:** See above

2. **CAPACITY:** See above

3. **DELAY:** A time in seconds between demand increases or compressor starts. A compressor should only turn on or ramp to a new demand if the delay time counter is at zero. This is determined by the system variable T-DIFF.

4. **FAULTS:** A value showing how many current faults are in the chiller system.

5. **ELW:** The common Heating Entering Load Water temperature to the chiller.

6. **LLW:** The common Heating Load Water temperature from the chiller.

7. **ESW:** The common Entering Source Water temperature to the chiller.

8. **LSW:** The common Leaving Source Water temperature from the chiller.

Press the **DOWN** arrow button once to display the next main status screen with system information.

COOLING MODE

1. **DEMAND:** See above
2. **CAPACITY:** See above
3. **DELAY:** A time in seconds between demand increases or compressor starts. A compressor should only turn on or ramp to a new demand if the delay time counter is at zero. This is determined by the system variable T-DIFF.
4. **FAULTS:** A value showing how many current faults are in the chiller system.
5. **ELW:** The common Entering Cooling Load Water temperature to the chiller.
6. **LLW:** The common Leaving Cooling Load Water temperature from the chiller.
7. **ESW:** The common Entering Source Water temperature to the chiller.
8. **LSW:** The common Leaving Source Water temperature from the chiller.

Press the **DOWN** arrow button once to display the next main status screen with system information.

SYSTEM STATUS

1. **HEAT OFFSET:** Shows the value of the customer HLW RESET signal from 0 to 10°F. This value is added to the UPPER and LOWER SETPOINTS. An asterisk (*) indicates the external HLW RESET signal is enabled.
2. **COOL OFFSET:** Shows the value of the customer CLW RESET signal from 0 to 10°F. This value is added to the UPPER and LOWER SETPOINTS. An asterisk (*) indicates the external CLW RESET signal is enabled.
3. **HEAT LOAD WATER PUMP STATUS:** On or Off
4. **COOL LOAD WATER PUMP STATUS:** On or Off
5. **SOURCE / SINK PUMP:** On or Off

Module Information Screens *(at the master controller)*

Press the **DOWN** arrow button while on the second main status screen will display information for the first Heat Pump module. The following information is available for each module in the chiller

MODULE 1A STATUS

1. **STATUS:** On or Off
2. **HP:** The High Pressure reading in psig based on the transducer in the compressor for that module.
3. **LP:** The Low Pressure reading in psig based on the transducer in the compressor for that module.
4. **SUCT:** The Suction temperature in the module, located on the compressor suction line.
5. **SUPERHEAT:** Calculated refrigerant suction superheat to the compressor.
6. **ELW:** The Entering Load Water temperature in the module, measured at the entering of the heating or cooling system.
7. **LLW:** The Leaving Load Water temperature in the module, measured at the leaving of each heat exchanger coil.
8. **ESW:** The Entering Source Water temperature in the module, measured at the entering of the heating or cooling system.

9. **LSW:** The Leaving Source Water temperature in the module, measured at the leaving of the heating or cooling system.
10. **RUN TIME HOURS:** This displays the total number of hours that the compressor has run. To reset the run hours, press and hold the **ALARM** and **DOWN** arrow buttons simultaneously on the screen of the module whose hours need to be reset. The SYSTEM VARIABLES must be unlocked to clear compressor run hours.

Press the **DOWN** arrow button again to display screen #2 for the first module. Information on this screen is as follows:

MODULE 1A STATUS

- | | |
|--------------------------------|------------------|
| 1. LOAD SIDE FLOW: | On or Off |
| 2. SOURCE / SINK FLOW: | On or Off |
| 3. VARIABLE FLOW VALVES | On or Off |
| 4. SOURCE WATER OUTPUT | given in percent |
| 5. SOURCE WATER ACTUAL | given in percent |
| 6. LOAD WATER OUTPUT | given in percent |
| 7. LOAD WATER ACTUAL: | given in percent |

Press the **DOWN** arrow button again. The same information for Module 1B will be displayed.

Module Information Screens at the Module Boards

1. **STATUS:** Compressor 1 & 2: On or Off
2. **ELW:** The Entering Load Water temperature in the module, measured at the entering of the heating or cooling system.
3. **LLW:** The Leaving Load Water temperature in the module, measured at the leaving of the heating or cooling system.
4. **ESW:** The Entering Source Water temperature in the module, measured at the entering of the heating or cooling system.
5. **LSW:** The Leaving Source Water temperature in the module, measured at the leaving of the heating or cooling system.
6. **Mode:** Heating or Cooling

Press the **DOWN** arrow button once to display the next main status screen with system information.

7. **HP:** The High Pressure reading in psig based on the transducer in the compressor for that module.
8. **LP:** The Low Pressure reading in psig based on the transducer in the compressor for that module.

Press the **DOWN** arrow button once to display the next main status screen with system information.

9. **SUCT:** The Suction temperature in the module, located on the compressor suction line.
10. **SUPERHEAT:** Calculated refrigerant suction superheat to the compressor.

Press the **DOWN** arrow button once to display the next main status screen with system information.

11. **RUN TIME HOURS:** This displays the total number of hours that the compressor has run.

PUSH THE PROGRAM KEY: The following Manual Mode setpoints will be displayed.

SYSTEM VARIABLES

- | | |
|------------------|-----|
| 1. HEAT SETPOINT | 100 |
| 2. HEAT RANGE | 5 |
| 3. HEAT OFFSET | 2 |
| 4. COOL SETPOINT | 45 |

- | | |
|----------------|---|
| 5. COOL RANGE | 5 |
| 6. COOL OFFSET | 2 |

Manual Mode Module Screens

NOTE: These screens are only accessible when the module is in manual Mode of operation!

Press the **PRG** button when in *Manual Mode* to change the manual mode variables.

1. **MAN. SETPOINT:** The LCHW temperature that the compressor will control to.
2. **MAN. OFFSET:** A value, when added to the MAN. RANGE, where the compressor will turn *on*; and, when subtracted from the MAN. RANGE, the point where the compressor will turn *off*.

Press the **ALARM** button when in *Manual Mode* to view and reset alarms in that module. The screen below is a sample of what the screen will look like.

***** MODULE #01 *****

****** ALARM ******

(ALARM HERE)

PRESS ENTER TO RESET

Inputs and Outputs

Master Controller Inputs

1. **Customer Chilled Water Reset Signal or Customer Load Limit Reset Signal:** A 0-10Volt, 0-20 mA, or 4-20 mA, customer supplied, **external** signal that shifts the UPPER and LOWER SETPOINTS from 0 to 10°F or allows the customer to change the LOAD LIMIT from 0 to 100%.
2. **Entering Heat Load Water Sensor:** A NTC type sensor that measures the temperature of the Heating ELW going into the chiller.
3. **Leaving Heat Load Water Sensor:** A NTC type sensor that measures the temperature of the Heating LLW coming out of the chiller.
4. **Entering Cool Load Water Sensor:** A NTC type sensor that measures the temperature of the Cooling ELW going into the chiller.
5. **Leaving Cool Load Water Sensor:** A NTC type sensor that measures the temperature of the Cooling LLW coming out of the chiller.
6. **Entering Source / Sink Water Sensor:** A NTC type sensor that measures the temperature of the system ESW going into the chiller.
7. **Leaving Source / Sink Water Sensor:** A NTC type sensor that measures the temperature of the system LCHW coming out of the chiller.
8. **EX1:** A customer supplied “Dry Contact” input that is required to be closed circuit to operate; open to stop operation. Requires manual reset to resume operation. This input will create a fault.
9. **Remote Start/Stop:** An input that is a closed circuit to operate; open to stop operation. Automatic restart of the chiller. This input does NOT create a fault.
10. **Power Phase Monitor:** An input that is a closed circuit to operate; open to stop operation. Automatic restart returns the chiller to the previous on/off state of the chiller. This input will create a fault.

11. **Heat LW Flow Switch:** An input that is a closed circuit to operate; open to stop operation. This circuit has a 4 second delay between the time it opens and when the system shuts down. Requires a reset and a restart to resume operation.
12. **Cooling LW Flow Switch:** An input that is a closed circuit to operate; open to stop operation. This circuit has a 4 second delay between the time it opens and when the system shuts down. Requires a reset and a restart to resume operation.
13. **Source / Sink Flow Switch:** An input that is a closed circuit to operate; open to stop operation. This circuit will allow the system to start when open. There is a 10 second delay on start-up before this circuit will shut the system down. This is to allow time for the condenser water pump to start with the first compressor and provide water flow stabilization. After the initial 10 second delay expires, then the fault only requires a 4 second delay between the time it opens and the time the system shuts down during normal operation. Requires a reset and a restart to resume operation.

Master Controller Outputs

1. **Customer Alarm Relay:** This is a 24V AC, 5VA max signal that can power a relay to trigger an alarm. The output is controlled by the failure indicator setting in the [SYSTEM VARIABLES](#).
2. **Full Load Indicator Relay:** This is a 24V AC, 5VA max signal that can power a relay to show when the chiller system is at *full load*.
3. **Run Status Relay or Source / Sink Pump Relay:** This is a 24V AC, 5VA max signal that can power a small relay to control the condenser water pump. This output is energized anytime at least one compressor is running in the chiller.

Module Board Inputs

1. **Leaving Heating Load Water Sensor:** A NTC type sensor that measures the temperature of the LCHW in the module.
2. **Leaving Cooling Load Water Sensor:** A NTC type sensor that measures the temperature of the LCHW in the module.

Module Board Outputs

Faults

If a fault condition has occurred, the **ALARM** button will illuminate. To view the current fault(s), press the **ALARM** button. Use the **UP** and **DOWN** arrow and **ENTER** buttons to view and clear the fault(s). If the fault does not clear, then the fault is still current.

System Faults

If any of the following fault conditions occur, all compressors in the system will be turned off.

1. **EX1:** Customer Input – EX1 requires a reset and restart command at the *master controller*.
2. **Remote Start/Stop:** Customer Input – This condition does not log as a fault. This circuit operates like an on/off switch. If closed, the chiller is enabled. If open, the chiller is disabled and the compressors will not run.
3. **Power Phase Monitor:** When the Power Phase Monitor Input opens, the chiller is disabled until the input is closed again. There is no reset required at the *master controller* to resume operation, only to clear the alarm from the current fault log. Automatic restart returns the chiller to the previous on/off state of the chiller.

4. **Source / Sink Flow:** Signal from the condenser water flow switch that alerts the *master controller* of NO FLOW on the condenser side of the chiller and disables all modules. This fault requires a manual reset and a restart at the *master controller*.
5. **Heating Load Water Flow:** Signal from the Heating Load water flow switch that alerts the *master controller* of NO FLOW on the heating side of the chiller and disables all modules in the chiller. If the flow switch opens and the chiller has not been commanded ON, a warning will appear at the bottom of the *start/stop screen*, however, no fault will occur. This fault requires a manual reset and restart at the *master controller*.
6. **Cooling Load Water Flow:** Signal from the Cooling Load water flow switch that alerts the *master controller* of NO FLOW on the cooling side of the chiller and disables all modules in the chiller. If the flow switch opens and the chiller has not been commanded ON, a warning will appear at the bottom of the *start/stop screen*, however, no fault will occur. This fault requires a manual reset and restart at the *master controller*.
7. **Cooling LOLW Temp:** Low Leaving Load Water temperature. If the system LLW falls below 34°F, all compressors will turn off. The water temperature must rise to 38°F before the fault can change from current to reset. This requires a manual reset and restart at the *master controller*.
8. **Heating ELW Sensor Failure:** The sensor for the system Heating ELW has either opened or shorted to the *master controller*. This fault requires resetting at the *master controller*.
9. **Heating LLW Sensor Failure:** The sensor for the system Heating LLW has either opened or shorted to the *master controller*. This fault requires resetting at the *master controller*.
10. **Cooling ELW Sensor Failure:** The sensor for the system Cooling ELW has either opened or shorted to the *master controller*. This fault requires resetting at the *master controller*.
11. **Cooling LLW Sensor Failure:** The sensor for the system Cooling LLW has either opened or shorted to the *master controller*. This fault requires resetting at the *master controller*.
12. **ESW Sensor Failure:** The sensor for the system ESW has either opened or shorted to the *master controller*. This fault does not affect the operation of the chiller.
13. **LSW Sensor Failure:** The sensor for the system LSW has either opened or shorted to the *master controller*. This fault does not affect the operation of the chiller.

Mechanical Cooling Module Faults

The following faults will only affect the module that they are associated with.

1. **High Pressure:** High Pressure Cutout. This high pressure fault can come from the transducer reading of the compressor or the HP switch being tripped. When the HP transducer reading reaches the value of the HP CUTOFF the alarm goes off, shutting down that module. The fault can be reset at the *master controller* after the high side pressure drops below xxx psig. If the High Pressure switch trips then, it requires resetting at the module HP switch and the *master controller* to resume operation. The fault will remain current until the HP switch is manually reset and the pressure is below xxx psig.
2. **LOSUCT:** Low Suction Temperature: This is measured by the module suction sensor. If during operation this temperature should drop below 25°F, the module's compressor will shut down. This requires resetting at the *master controller*, but only after the temperature has risen above 30°F. The system has to be *on* for this fault to occur.
3. **SUCT SENSOR FAILURE:** Suction Sensor Failure. This would occur if the suction line sensor reading is outside the range of the sensor. This fault requires resetting at the *master controller*.

4. **COOLING LOLW TEMP:** Low Leaving Cooling Load Water Temperature: This is measured by the module Cooling LLW temperature sensor. If the temperature falls below 34°F, the module's compressor will turn *off*. The temperature must rise to 38°F before the fault can be reset at the *master controller*.
5. **HEATING LLW SENSOR FAILURE:** Heating Leaving Load Water Sensor Failure: This would occur if the sensor opened or shorted to the *module board*. This fault requires resetting at the *master controller*.
6. **COOLING LLW SENSOR FAILURE:** Cooling Leaving Load Water Sensor Failure: This would occur if the sensor opened or shorted to the *module board*. This fault requires resetting at the *master controller*.
7. **COMMUNICATIONS ERROR:** Communication errors can occur when the *master controller* is not properly communicating with the module boards in the chiller. This fault is an automatic reset. The alarm will still need to be cleared in the alarm screens; however, this will not hold back the operation of the module if the *master controller* begins communicating again.
8. **VALVE FAIL:**

Fault Review

The FAULT REVIEW is a history of the faults that have occurred in the chiller system. The review holds up to 25 faults. The review can be found in the *MAIN MENU*. The faults are in order by the most recent to the oldest. Pushing the **UP** and **DOWN** arrow buttons allows scrolling through the faults. Pushing the **ENTER** button on a particular fault allows for viewing of a second screen of information. Pushing **ENTER** again returns to the first screen of the fault. The following is a sample of what the three screens contain.

| | |
|----------------------------|-------------------|
| FAULT 01 | CURRENT |
| COMMUNICATION ERROR | |
| MOD1 | 9/17 12:35 |
| PRESS ENTER | FOR MORE |

Screen #1

| | |
|-------------------|------------------|
| *SYS INFO* | |
| HEATING | COOLING |
| ELW 00.0 | ELW 000.0 |
| LLW 00.0 | LLW 00.0 |
| ESW 00.0 | ESW 00.0 |
| LSW 00.0 | LSW 00.0 |

Screen #2

| | |
|-------------------|-------------------|
| *MOD INFO* | |
| ELW 00.0 | HP "A" 000 |
| LLW 00.0 | HP "B" 000 |
| ESW 00.0 | LP "A" 000 |
| LSW 00.0 | LP "B" 000 |

Screen #3

| | | |
|-----------------------|------------------|---------------|
| *MOD INFO* | | |
| SUCT "A" = 000 | "B" = 000 | |
| S/H "A" = | "B" = 000 | |
| VALVE | OUTPUT | ACTUAL |
| LLW | 00% | 00% |
| LSW | 00% | 00% |

Screen 4

Screen one displays information about the fault. The status of the fault will be displayed as **CURRENT**, **RESET**, or **RECORD**. **CURRENT** means that the fault is still present, **RESET** means that the fault can be reset at the *master controller*, and **RECORD** means that the fault is part of the history for future reference. The date and time of the fault, the fault that occurred and where the fault occurred are also displayed on the first screen. On screen two, the system temperatures at the time the fault occurred will be displayed. On screen 3 the module information that was current at the time of the fault will be displayed. If the fault is a system fault the module information will display all zeros. Screen 4 will display more module information including the valve output plus actual positions.

Clearing the faults from the FAULT REVIEW removes all the faults at once. Hold down the **Prg** and **UP** arrow buttons simultaneously for all faults to be removed from the FAULT REVIEW. When a message of **NO MORE ALARMS** appears on the screen, release the buttons.

Time and Date

The TIME AND DATE option is located in the *SYSTEM VARIABLES' MENU*. Press **ENTER** on the TIME AND DATE option. The time appears first and is displayed in 24 hour time. To change the time, press the **ENTER** button, putting the program into *edit mode*. The cursor is now in the *hour* field, use the **UP** and **DOWN** arrow buttons to change the *hour* to the correct time. Press the **ENTER** button again to move the cursor to the *minute* field to change it. Press the **ENTER** button one more time to set the TIME. Press the **Esc** button, at anytime, to abort the time change.

After setting the TIME, use the **DOWN** arrow button to move to the DATE screen. Press **ENTER** to move the cursor into the *month* field. Using the **UP** and **DOWN** arrow buttons, change the value to the current *month*. Press **ENTER** again to move the cursor to the *day* field, adjust the *day* accordingly. Press **ENTER** again to move to the *year* field, adjust the *year* accordingly. Press **ENTER** one more time to accept the DATE. Press the **Esc** button, at anytime, to abort the date change.

Customer Resets

HEATING OR COOLING LOAD WATER RESET (LW) and LOAD LIMIT RESET are external inputs that are program selectable as 0-10Volt, 0-20 mA, or 4-20 mA. The customer can send a signal to change these values remotely. The LW RESET will increase the UPPER and LOWER SETPOINTS in the chiller from 0 to 10 °F. The LOAD LIMIT RESET will allow the LOAD LIMIT of the chiller to be changed from 0 to 100%. There will be an asterisk (*) by the LW OFFSET or the LOAD LIMIT values on the second system status screen, if they are enabled. The *CUSTOMER RESET* options are located in the *SYSTEM VARIABLES' MENU*. An asterisk (*) also appears next to CAPACITY on the *main status screen* when either reset is enabled. Press **ENTER** and use the **UP** and **DOWN** arrow buttons to enable the feature to be used. Both default to OFF, but when enabling the user must select the type of input being used. (0-10 Volt, 0-20 mA, or 4-20 mA)

Temperature Readings

The temperature readings default to Fahrenheit (°F). The readings may be set to display in Celsius (°C), by going to the *SYSTEM VARIABLES' MENU*. Press **ENTER** on TEMP. READINGS option. Press **ENTER** again to move the cursor into the field. Use the **UP** or **DOWN** arrow button to change the field from Fahrenheit to Celsius. Press **ENTER** again to accept the change.

Security

The security option in the *MAIN MENU* is used to lock the *SYSTEM VARIABLES*. The first screen tells whether the variables are **locked** or **unlocked**. Initially the screen will say 'SYSTEM VARIABLES UNLOCKED'. Press **ENTER** to change the status of the security. The cursor will be on the first letter of the password code. Enter a five letter password, using the **UP** and **DOWN** arrow buttons to change the letter and press **ENTER** to move to the next letter. After entering the last letter, the next screen is to accept the password or clear the password. Press **ENTER** again to set the password or **Esc** to clear the password. The screen will then display the status of the *SYSTEM VARIABLES* as LOCKED. An asterisk (*) is displayed within the *SYSTEM VARIABLES' MENU* in place of the greater than sign (>) as a cursor for the menu. If the asterisk is seen, the *SYSTEM VARIABLES* need to be **unlocked** before trying to make any changes to them.

If the password is forgotten, please call your Multistack Service Representative at 608-366-2400.

Board LED's

Five LED's are present on the *master controller* board. Two LED's are located at the bottom of the board, one yellow and one red. The yellow one indicates that the board is receiving power. The red one is an alarm LED that would indicate that something is wrong with the board internally. Three more LED's are located at the top of the board next to the DIP switches. These LED's indicate that the connection, address definition and pLan

(network of the modules) are working correctly. The green and yellow LED's should be lit for the network to be working properly.

Four LED's are present on each *module board*. They are all located at the top of the board. One single yellow LED indicates that the board is receiving power. The other three LED's indicate that the connection, address definition and pLan (network of the modules) are working correctly. The green and yellow LED's should be lit for the network to be working properly.

Program Version

The program version is found by going to the *Main Menu* and pressing the **PRG** and **UP** arrow buttons simultaneously. A screen will appear that displays the version of the program in the controllers and the month and year the program was developed. The version will appear in a format similar to MCTS_A00-SE. When looking at the version, the forth position could vary between S, L, and B. The S stands for a Standard application, the L for a Low Ambient application, and the B for a Brine or Low Temperature application. Each of these programs may have different cutouts or temperature ranges available to the customer. The standard application *system variables* and cutouts are located on [page 6](#).

BAS Interface

The *master controller* is capable of tying into a building automation system. Modbus and BACnet are the two protocols that are currently available. First the *BAS INTERFACE* needs to be enabled. This is accomplished by going to the *SYSTEM VARIABLES Menu* and changing the enable point, under *BAS INTERFACE*, to *yes*. The enable defaults to *no*. This menu also has a variable to select which *Protocol* will be used. Select the appropriate *Protocol* for the job. BACnet is the default for this variable.

Modbus

Modbus requires that a RS485 card is installed into the pCO2 *Master Controller*. This card plugs into the serial port and communicates Modicon Modbus Protocol Rev. D. The Modbus protocol used is RTU type. The configuration is multipoint for RS-485. The data communication is asynchronous serial, 8 data bits, 2 stop bits, and no parity across an EIA-485 two-wire half-duplex connection. The minimum cable size recommended is an AWG20/22 two-wire twisted shielded cable. The pin wiring is GND, RX+/TX+, RX-/TX- and is stamped on the terminal connector. The customer can adjust the *Baud Rate* and the *Network Number*. These settings are found in the *SYSTEM VARIABLES Menu* under *BAS INTERFACE*. The *Baud Rate* defaults to 9600 bps and can be adjusted to 1200, 2400, 4800, 9600, or 19200 bps. The *Network Number* is the same as a slave address and defaults to 1. This number must be unique to the Modbus network. The range for the *Network Number* is from 1-200. See the Turbocor Modbus Technical Manual for a table of Modbus registers.

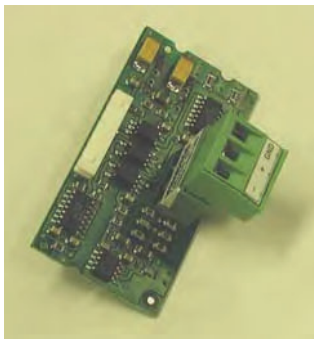


Figure 1 - RS485 Card

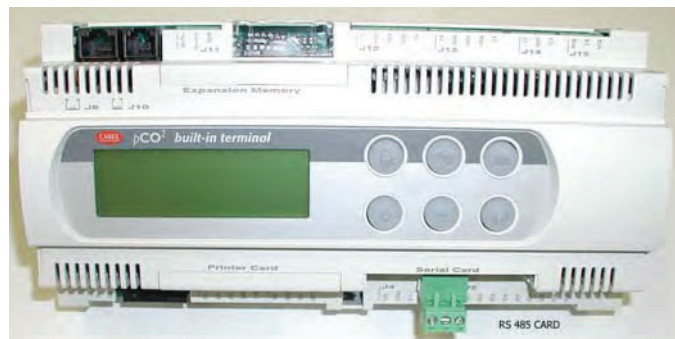


Figure 2 - pCO2 with RS485 Card

BACnet

BACnet requires that a pCO Web card is installed in to the pCO2 *Master Controller*. This card plugs into the serial port and communicates BACnet over Ethernet (ISO8802-2 or 8802-3) or BACnet over TCP/IP (Addenda A/Annex J). The recommended cable is shielded class 5, max 100mt. The *Baud Rate* is selectable and defaults to 19200. See the Turbocor BACnet Technical Manual for a table of points and instructions on changing the IP



Figure 3 – pCO Web Card

Addressing scheme.

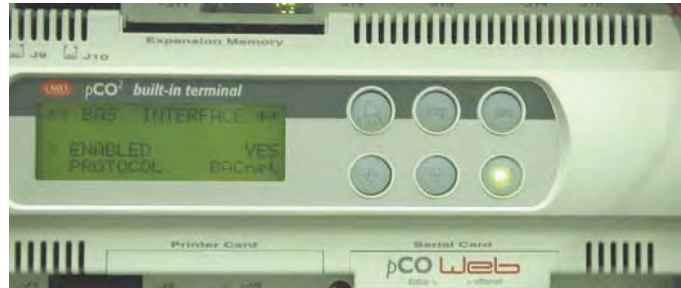


Figure 4 - pCO2 with pCO Web Card

Factory Setup for MR20-70X Heat Pump VME

(If in doubt use bold face values)

Go to SYSTEM VARIABLES / Factory Setup Menu:

Password: -----

WATER SAFETIES

Load: **Standard** Low Temp *(low temp requires minimum of 20% glycol)*
 Source: **Standard** Low temp *(low temp requires minimum of 20% glycol)*

CHILLER TYPE **Water Cooled** Air Cooled

REFRIGERANT TYPE: **410A** 134a R22 R407C

FLOW FAULT RESET: Load Side Flow

Source Auto or **Manual** *(Auto requires glycol in loop)*
 Side Flow
 Auto or **Manual** *(Auto requires glycol in loop)*

FACTORY RESET: Push enter to reset to default *(resets to default values)*

CIRCUIT TYPE: **Dual** Single *(type of heat exchanger used on module)*

COMM DATE: 00/00/2000 *(start up date)*

SINK PUMP DELAY: Delay on start of first compressor (30 second) turns off pump output 1 minute when chiller is satisfied
 Range: 0 – 180 seconds. 30 default

VARIABLE FLOW: **ON** OFF

Valve Delay: **15 sec (10-99)**

Load Water Output: Disabled 4-20 Ma 4-20mA ®
(type of signal used for valve output feedback)

LW Flow Bypass: **1** (0-5) *(number of modules that will have valve 100% open when chiller is off for minimum flow bypass)*

LW Min Output: **25%** (0-50) *(lowest percent open the valve will be when module starts)*

Source Water Output: Disabled **2-10V** 0-10V 2-10VR 0-10V®
(type of signal used for valve output feedback)

SW Flow Bypass: **1** (0-5) *(number of modules that will have valve 100% open when chiller is off for minimum flow bypass)*

SW Setpoint: **340 psig at 105 deg** (240-370) *(Head Pressure setting for Source water in cooling mode)*

SW Min Output: **20%** (0-50%) *(lowest percent open the valve will be when module starts)*

PID Setup:

Load

Valve PID

K= **400** *(how far off of setpoint before it starts to Move) (0 -32767)*

TI= **250** *(amount of error from setpoint)*

TD = **0** *(don't adjust)*

Source/

ink Valve

K= **400**

TI= **250**

TD = **0**

SOURCE SINK VME: **NO** YES (*does chiller have VME module on Source Side?*)

REVERSING VALVE PULSE: **1 SECOND (0-5)** (*In cooling mode the reversing valve will run in heating mode on initial start for this duration*)

APPENDIX A

DEFINITION OF INPUTS AND OUTPUTS

MASTER CONTROL

ANALOG INPUTS

| | |
|------------|--|
| B1 | HEATING RESET OR LOAD LIMIT RESET (selectable) |
| B2 | COOLING RESET OR LOAD LIMIT RESET (selectable) |
| B3 | ENTERING SOURCE WATER SENSOR (LCW) |
| B4 | HEATING ENTERING LOAD WATER SENSOR (ELW-H) |
| B5 | HEATING LEAVING LOAD WATER SENSOR (LLW-H) |
| B8 | LEAVING SOURCE WATER SENSOR (LSW) |
| B9 | COOLING ENTERING LOAD WATER SENSOR (ELW-C) |
| B10 | COOLING LEAVING LOAD WATER SENSOR (LLW-C) |

DIGITAL INPUTS

| | |
|------------|---------------------------------|
| ID1 | EX 1 INPUT |
| ID2 | REMOTE START / STOP |
| ID3 | EX 3 INPUT |
| ID4 | POWER PHASE MONITOR |
| ID5 | HEATING LOAD WATER FLOW SWITCH |
| ID6 | COOLING LOAD WATER FLOW SWITCH |
| ID7 | SOURCE / SINK WATER FLOW SWITCH |
| ID8 | 24V |

ANALOG OUTPUTS

Y1
Y2
Y3
Y4

DIGITAL OUTPUTS (RELAY TYPE)

| | |
|-------------|---------------------------------------|
| NO1 | CUSTOMER ALARM RELAY |
| NO2 | HEATING FULL LOAD RELAY |
| NO3 | COOLING FULL LOAD RELAY |
| NO4 | SOURCE / SINK WATER PUMP RELAY OUTPUT |
| NO5 | HEATING LOAD WATER PUMP RELAY OUTPUT |
| NO6 | COOLING LOAD WATER PUMP RELAY OUTPUT |
| NO7 | RUN STATUS OUTPUT |
| NO12 | HEATING LOAD WATER BYPASS |
| NO13 | COOLING LOAD WATER BYPASS |

MODULE BOARDS

ANALOG INPUTS

| | |
|------------|----------------------------|
| B1 | HP TRANSDUCER COMPRESSOR 2 |
| B2 | LP TRANSDUCER COMPRESSOR 2 |
| B3 | SUCTION TEMP COMPRESSOR 2 |
| B4 | ENTERING SOURCE WATER TEMP |
| B5 | LEAVING SOURCE WATER TEMP |
| B6 | HP TRANSDUCER COMPRESSOR 1 |
| B7 | LP TRANSDUCER COMPRESSOR 1 |
| B8 | SUCTION TEMP COMPRESSOR 1 |
| B9 | LOAD WATER SENSOR |
| B10 | LOAD WATER SENSOR |

DIGITAL INPUTS

| | |
|-------------|---------------------|
| ID1 | HEATING OVERRIDE |
| ID2 | COOLING OVERRRIDE |
| ID3 | 24V |
| ID4 | |
| ID5 | |
| ID6 | HP FAULT COMP 1 |
| ID7 | THERM FAULT COMP1 |
| ID8 | CIRCUIT FAULT COMP1 |
| ID10 | HP FAULT COMP 2 |
| ID11 | THERM FAULT COMP2 |
| ID12 | CIRCUIT FAULT COMP2 |

ANALOG OUTPUTS

Y1
Y2
Y3

DIGITAL OUTPUTS (RELAY TYPE)

| | |
|-------------|---------------------------------|
| NO1 | COMPRESSOR 1 START |
| NO2 | COMPRESSOR 1 REVERSING VALVE |
| NO3 | |
| NO4 | COMPRESSOR 2 START |
| NO5 | COMPRESSOR 2 REVERSING VALVE |
| NO7 | ALARM |
| N014 | NEAREST VME MODULE HEATING SIDE |
| N015 | NEAREST VME MODULE COOLING SIDE |

MODULE BOARDS

SMALL PCOE2

ANALOG INPUTS

B1

B2 4-20 MA FEEDBACK INPUT FROM BELIMO VALVE

B3

B4

DIGITAL INPUTS

ID1 LOAD SIDE FLOW

ID2 SOURCE SINK SIDE FLOW

ID3

ID4

ID5

ID6

ID8

ID12

ANALOG OUTPUTS

Y1 2-10VDC OUTPUT TO BELIMO ACTUATOR

Y2

Y3

III[®] MULTISTACK[®]

Originators. Innovators. Never the Imitators.



Water Cooled Chiller

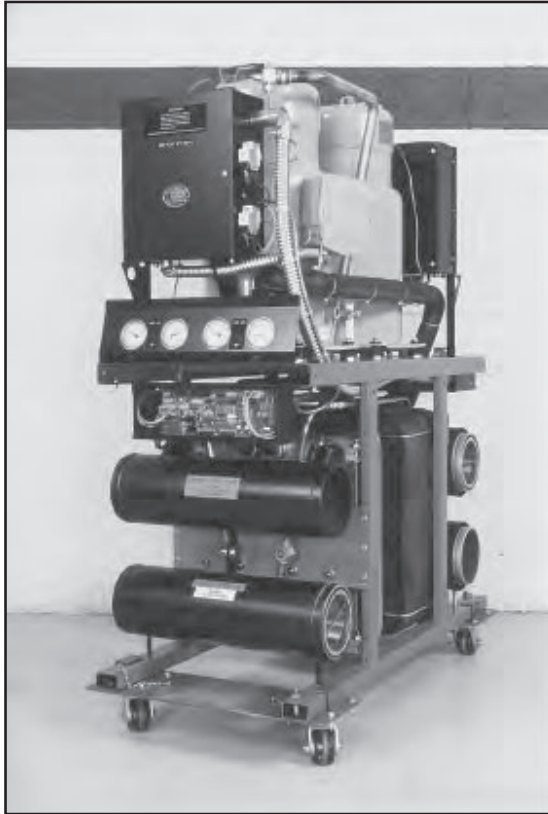
Installation Manual

Introduction

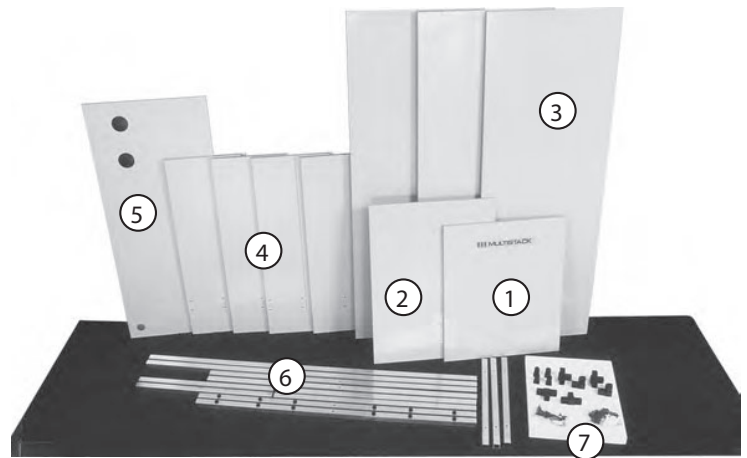


- This MULTISTACK Inc. INSTALLATION MANUAL has been prepared to serve as a guide to assist in the proper installation of the MULTISTACK Modular Chiller. This is an installation guide ONLY. Separate documents and instructions are available for Operation and Maintenance.
- Review this manual carefully before beginning the installation.
- The information and illustrations contained in this manual are generalized. Your installation may be customized to an extent that consultation with a MULTISTACK representative may be necessary in order to provide specific details not covered in this manual.
- Good electrical and piping practices must be followed and the MULTISTACK Inc. INSTALLATION MANUAL must be strictly adhered to as it pertains to this installation and all applicable local codes.
- Manufacture and use of this equipment meets all existing legislated rules which pertain.
- This equipment should not be installed near an open flame per local codes and ASHRAE specifications.
- Personnel servicing MULTISTACK equipment must have a minimum Class II EPA certification.
- Any questions regarding the content of this Installation Manual, the handling or installation of the MULTISTACK Chiller components should be directed immediately to your authorized MULTISTACK representative or to the MULTISTACK Service Department at (608) 366-2400 or FAX (608) 366-2450.

Module Shipment Package

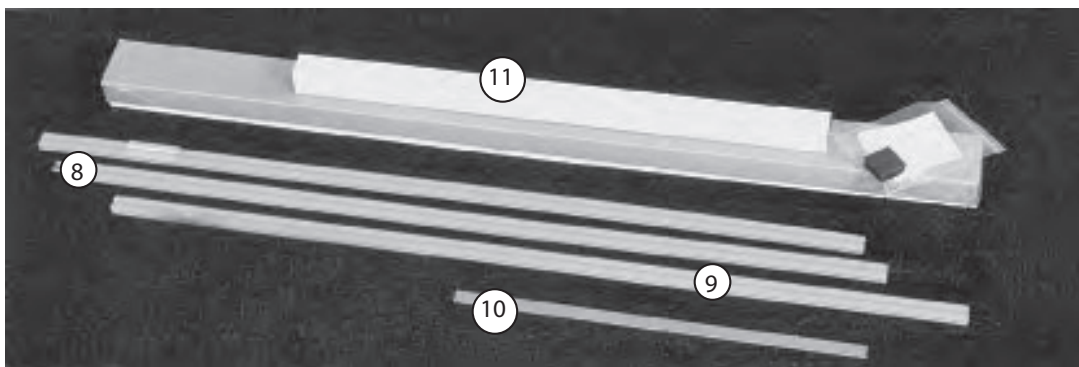


MULTISTACK Module (shown with optional removable wheels and standard filter strainers installed)



Pallet #1 (Cabinetry)

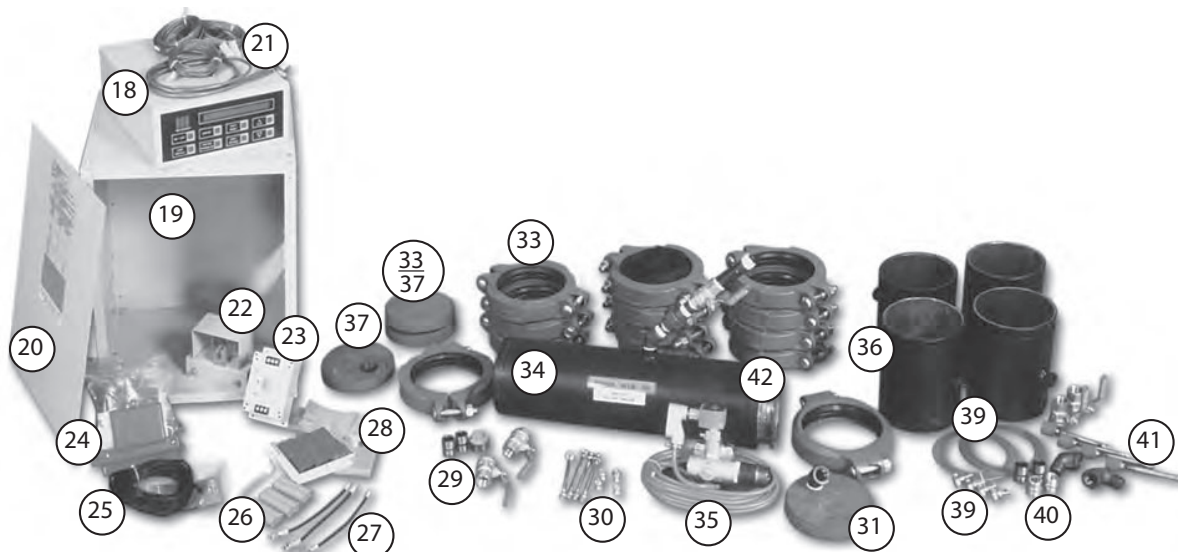
1. Top Front Panel
2. Bottom Front Panel
3. Rear Panel/End Panel
4. Side End Panel
5. Master Controller Top Panel
6. Frame Pieces
7. Frame Connectors, Fasteners, Clips & Magnetic Tape



Pallet #2 (Buss Connections)

8. Bussbar
9. Bussbar insulation
10. Ground strap
11. Junction Box leg

Module Shipment Package, Cont'd



Pallet #3 (Piping & Electrical)

- | | |
|-------------------------------------|-----------------------------------|
| 18. Master Control (*a) | 31. End Cap for DDRS-210A (upper) |
| 19. Junction Box | 32. End Caps (evap) |
| 20. Junction Box Cover | 33. Couplings |
| 21. Sensors / Cables | 34. DDRS-210A |
| 22. Junction Box Connector (Throat) | 35. Auto Solenoid for DDRS |
| 23. Power Phase Monitor | 36. Pipe Stubs |
| 24. Bussbar Connector | 37. End Cap DDRS (lower) |
| 25. Power Phase Monitor Wire | 38. Filter Stops |
| 26. Bussbar Insulation Overlap | 39. Pet Cock Valves |
| 27. Phase Monitor Wire | 40. Drain Valves & Fittings |
| 28. Bussbar End Caps | 41. Sensor Wells |
| 29. Drain Valves & Fittings | 42. 30 Mesh Filter Strainer |
| 30. Module Joining Bolts | |

*a. Maybe shipped separately to sales office or job site.

*b. Shipped inside #19 - Junction Box

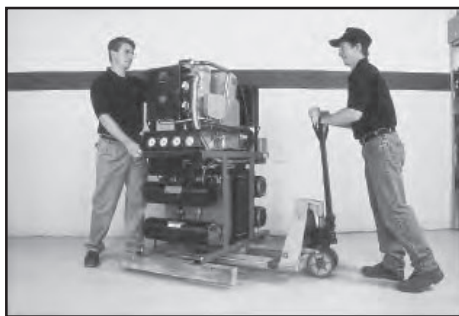
NOTE: Before accepting delivery of the MULTISTACK Chiller, check the overall condition of the equipment for any visible damage. Items to be looked for may include broken copper lines, oil leaks, damaged controls and/or electrical component housing, or any major component torn loose from its mounting.

If the MULTISTACK Modular Chiller is damaged during transportation or handling by the transportation company or its agent, the installing contractor **MUST** promptly file a claim with the transportation company and advise MULTISTACK Inc. Any discrepancy must be noted on the bill of lading.

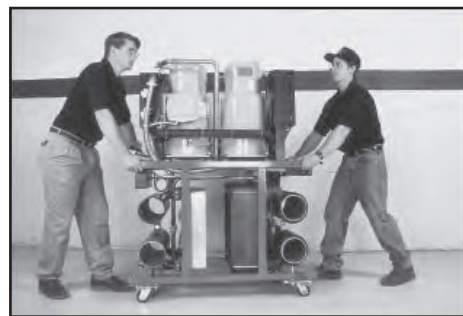
Caution: Unit Top Heavy



Module on Fork Lift

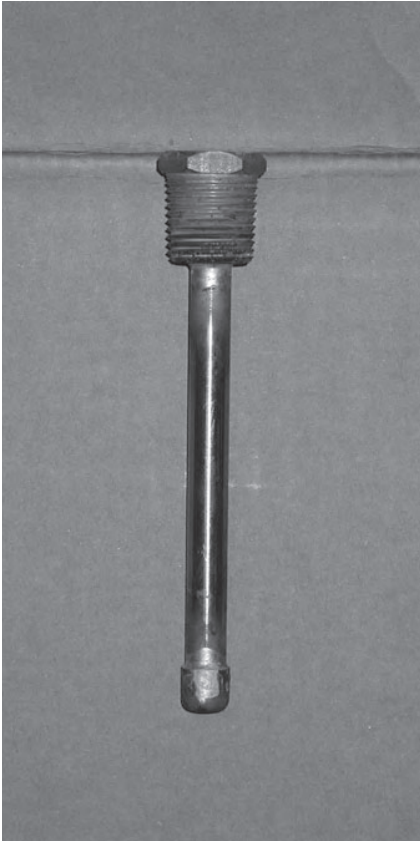


Module on Pallet Jack



Module on Removable Wheels

Note: Sling lift and spreader bar available.



Sensor well

!!! Important !!!

Be sure to install the supplied sensor wells in the system piping. The wells should be installed a few feet after the chiller in the CHW entering and leaving (water-cooled and air-cooled chillers) and CW entering and leaving (water-cooled).

!!! Caution !!!

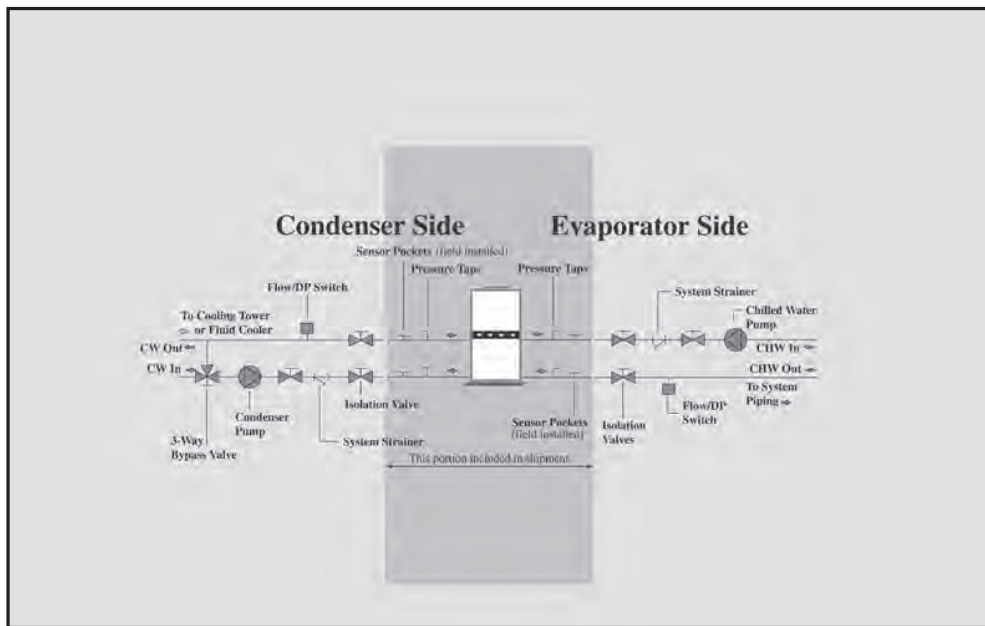
The introduction of unapproved chemicals to the chilled or condenser water supplies may be damaging to the metals of the heat exchangers. This includes, but is not limited to, hydrochloric acid, sulfuric acid, muriatic acid, and household bleach. Damage caused by the use of these and other unapproved chemicals is not covered by warranty. The only approved chemicals for heat exchanger cleaning are phosphoric or sulfamic acids in concentrations of 10 percent or less by volume. If you have questions about chemicals you intend to use, please call the Multistack Servicing Engineering Group.

!!! Planning Ahead !!!

To ensure all warranties and a successful installation, a Factory Authorized Technician is required to perform start-up of the Multistack Chiller. If start-up is to be performed directly by Multistack, a minimum of 2 weeks notice is required. Please call the Multistack Service Department at (608) 366-2400 to schedule.

Site Preparation

1. Piping - recommended



NOTE: Air Cooled (A/C) and/or Direct Expansion (DX) Modules, see Supplement.

All piping must be properly and adequately supported at coupling connections and other suitable intervals along the piping runs. Hanger design must provide for the weight of fluids in the piping system when the chiller is in operation.

MULTISTACK modules are equipped with brazed plate heat exchangers made of 316 stainless steel. MULTISTACK recommends a 1/8" basket "Y" type or other similar system strainer. MULTISTACK supplies a serviceable 30 mesh filter cartridge in each condenser and evaporator inlet header.

It is the responsibility of the contractor to make sure the water systems have been flushed, strainers are clean and clear of debris before any startup of the chiller will take place. This should not be done through the chiller.

2. Piping System Flushing Procedure

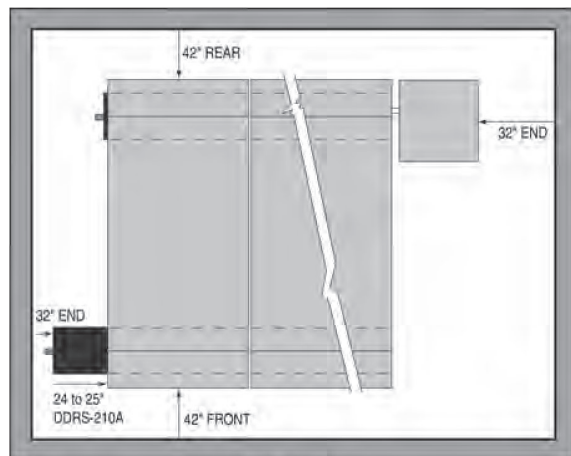
Prior to connecting the chiller to the condenser and chilled water loop, the piping loops shall be flushed with a detergent and hot water (110-130° F) mixture to remove previously accumulated dirt and other organic residue. After removal of organic residue, flushing shall continue with a dilute phosphoric acid, sulfamic acid or citric acid and water mixture to remove inorganic scale in the pipe. Cleaning chemicals such as Nu-Calgon "Imperial Grade" Scale Remover part number 4360-84 or equivalent suitable for both organic residue and scale removal may be substituted. Otherwise detergents and acids shall not be combined unless approved by the chemical manufacturers.) Only chemicals compatible with 316 stainless steel, copper and carbon steel shall be used. (Any concentrations of hydrochloric or sulfuric acid or chloride containing chemicals shall not be allowed to come in contact with copper brazed 316 stainless steel heat exchangers).

During the flushing, 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 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.

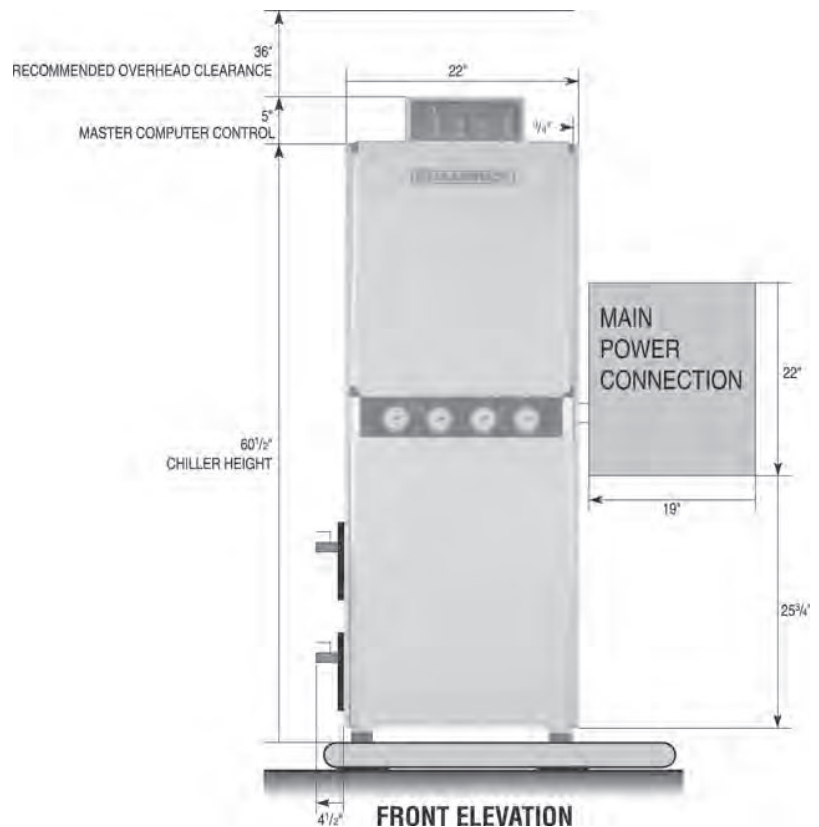
Prior to supplying water to the chiller, the Water Treatment Specification shall be consulted for requirements regarding the water quality during chiller operation. The appropriate chiller manufacturer's service literature shall be available to the operator and/or service contractor and consulted for guidelines concerning preventative maintenance and off-season shutdown procedures.

3. Clearances

Recommended clearance values for the modular chiller. Please note: there must be a minimum of 6" clearance from top of chiller (this includes the top of master controller when placed on top of chiller).



TOP VIEW



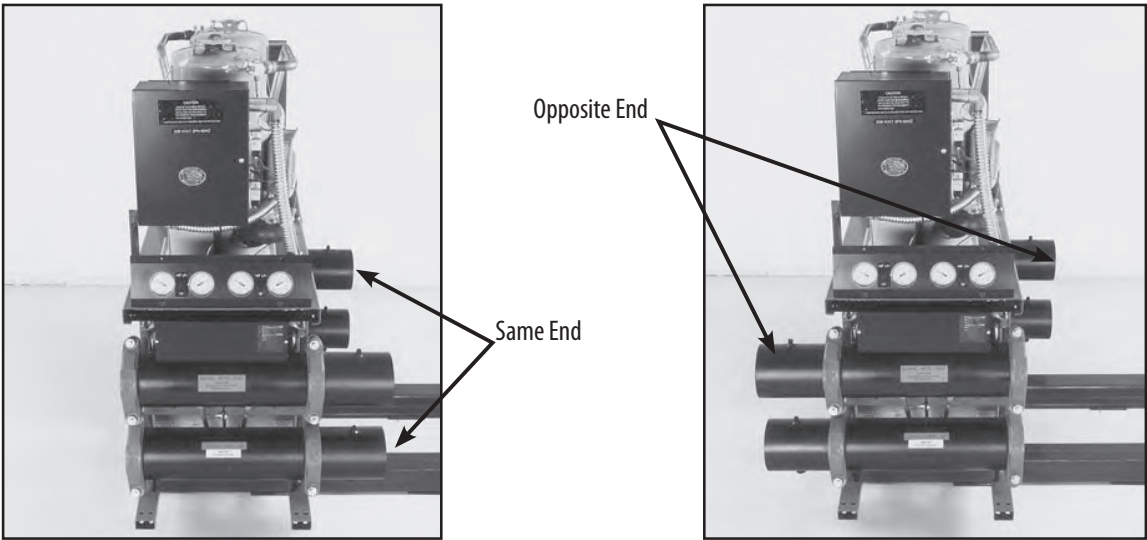
4. Water Treatment / Specification

Supply water for both the chilled water and condenser water circuits must be analyzed and treated by a professional water treatment specialist who is familiar with the operating conditions and materials of construction specified for the chillers 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:

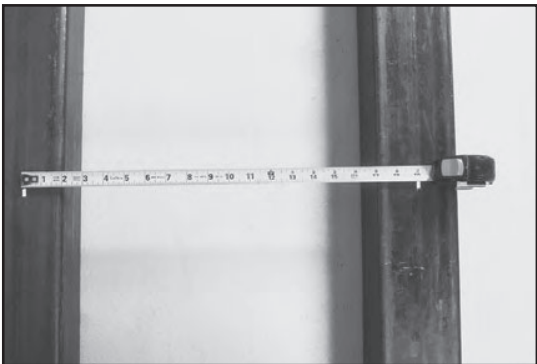
| | |
|---------------------------------|--------------------|
| * ph | >7 and <9 |
| * Total Dissolved Solids (TDS) | Less than 1000 ppm |
| * Hardness as CaCO ₃ | 30 to 500 ppm |
| * Alkalinity as CaCO | 30 to 500 ppm |
| * Chlorides | Less than 200 ppm |
| * Sulfates | Less than 200 ppm |

Site Preparation, Cont'd

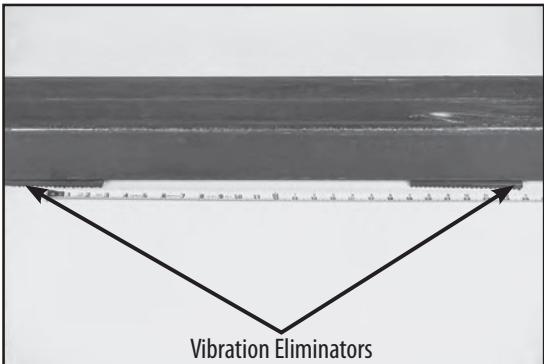
Rail Location / Position



1. You must determine piping location before modules are set in place (see below).



2. Chiller to be mounted on 4" x 4" x 4" steel rails or suitable equivalent (21" center to center).



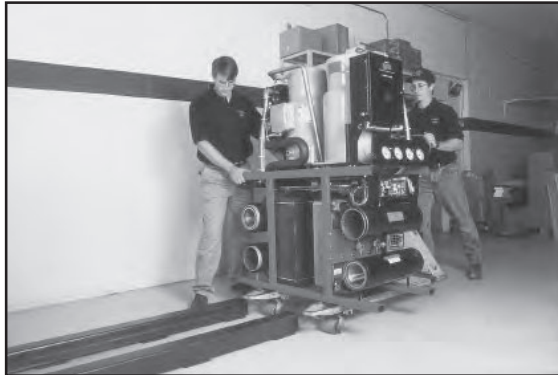
3. Place waffle type vibration eliminators 4" x 4" x 3/8" every 22" under rail (maximum load 50 psi).



4. Rails may be lubricated with solid vegetable shortening or other non-petroleum lubricant to facilitate installation.

Note: Seismic restraint information available from MULTISTACK Headquarters.

Assembly of Modules



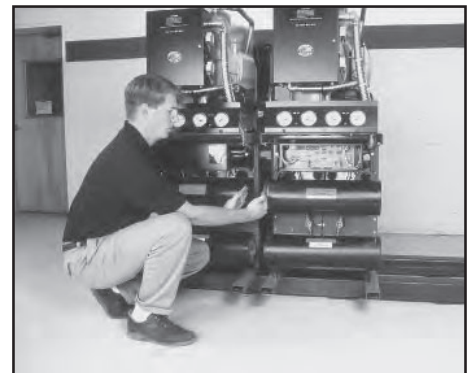
1. Place first module on the rails.



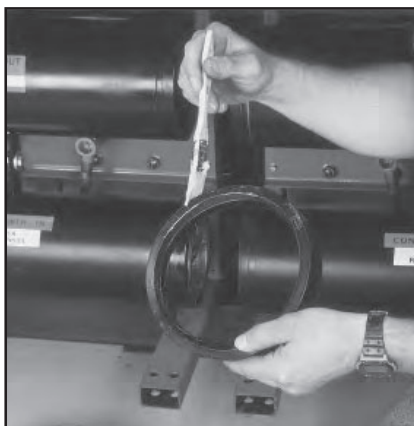
2. Slide module into position.



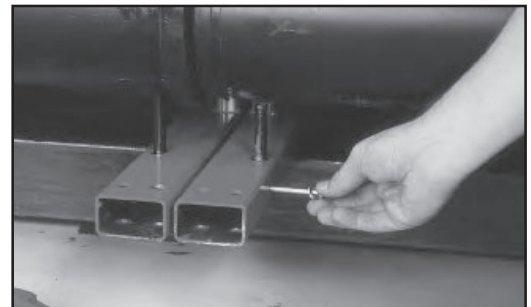
3. Place subsequent modules onto rails.



4. Make sure you leave enough space between to install coupling gaskets.



5. Lubricate gaskets with a solid vegetable shortening or other non-petroleum based lubricant.



6. Slide modules together lining up footing holes. Install bottom joining bolts.

NOTE: A/C & DX modules, see supplement.

Assembly of Modules, cont'd

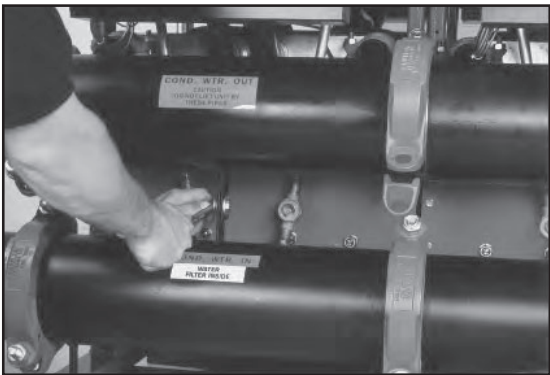


7. Install top joining bolts.

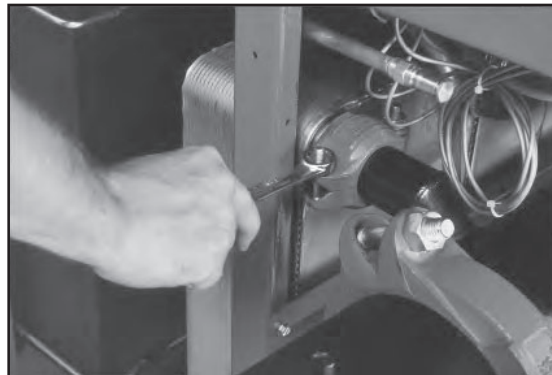


8. Starting with the lower header, install the couplings. Position coupling bolts as shown in order for proper installation of frame. (Bolts @ 1:00 and 7:00)

Note: Assure proper strainer placement.



9. If adjustment is needed when tightening bolts, loosen center header bolt.



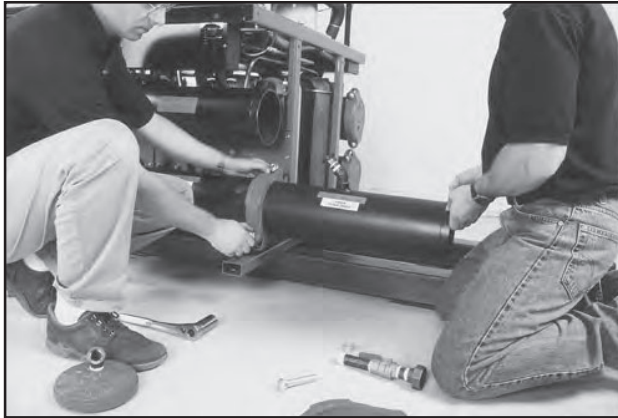
10. You may also loosen the 1½" victaulic heat exchanger couplings if adjustment is required.



11. Install the header blank ends, start with the bottom blank B, then move to the top blank A which includes the drain valves (evaporator shown).

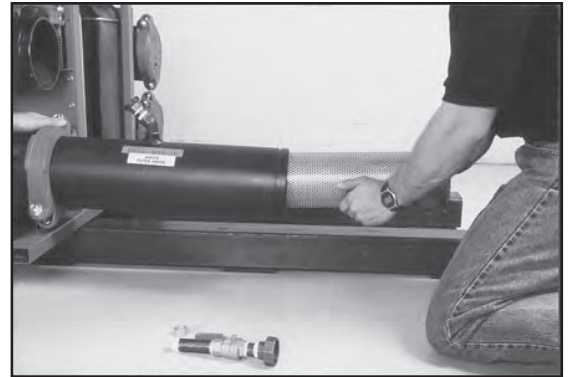
Assembly

Assembly Of Multiflush DDRS-210A

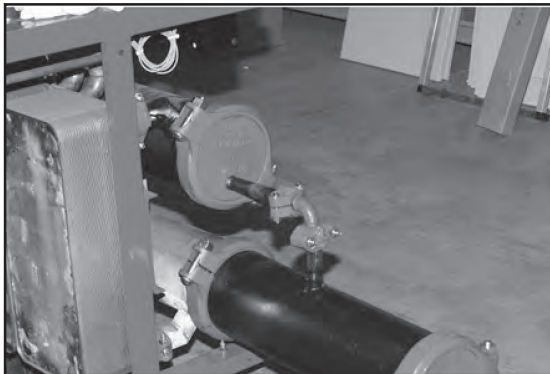


1. Install Multiflush DDRS-210A header pipe.

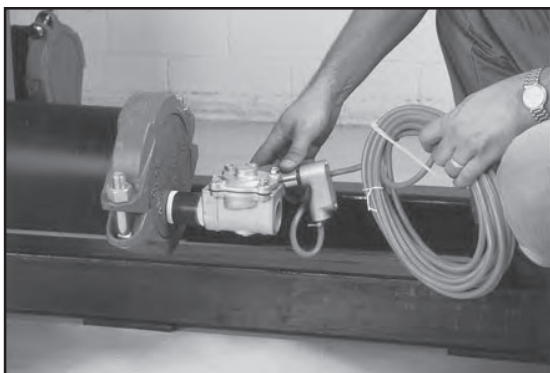
NOTE: See pallet #3 (piping & electrical), items 33, 35, 36 & 38 on page 3.



2. Insert 30 mesh filter into header.

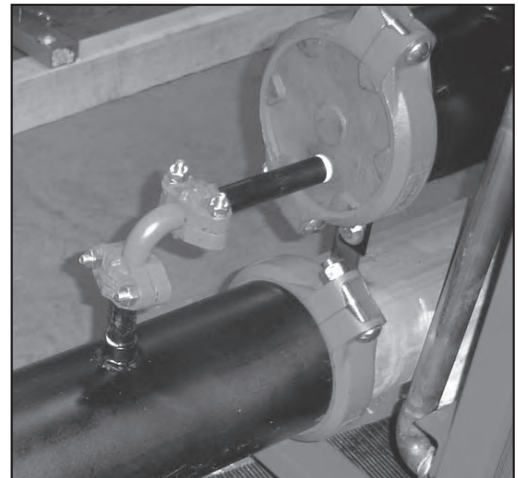


3. Install couplings. (leave loose - do not tighten)



5. Install manual or solenoid valve at end of Multiflush DDRS-210A header.

NOTE: Electrical connections to be completed by startup technician.

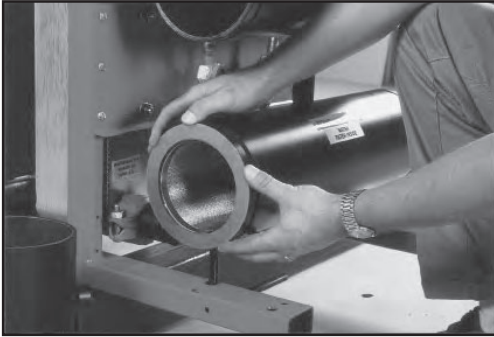


4. Attach pipe fittings with Victaulic's as shown in picture.

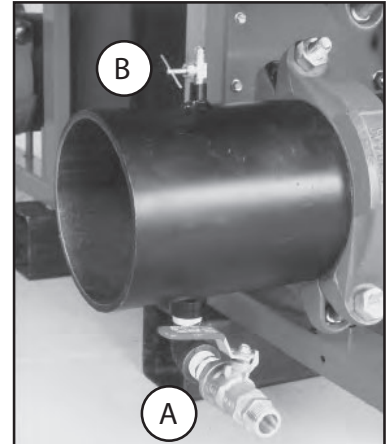
NOTE: Ball valve and union is no longer used.

Assembly

System Connections



1. Install filter stop rings on module closest to piping take-off.
2. The 9" long pipe stubs supplied by MULTISTACK should be installed at the take-off ends of the chiller.
3. The 3/4" drain valve A, should be located on bottom header, and pet cock valve B, installed in each contractor pipe stub.



Leak Testing

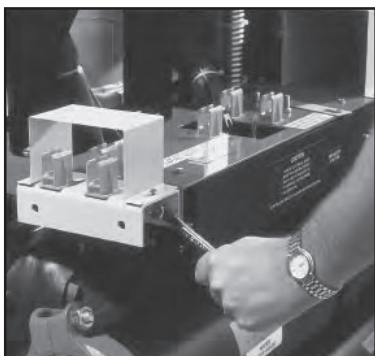
Following all fluid connections, an initial static leak pressure test should be performed and any leaks must be properly sealed.

When the initial leak test has proved satisfactory, start the system fluid pumps and purge any remaining air from the system. Any remaining leaks now need to be sealed before proceeding further.

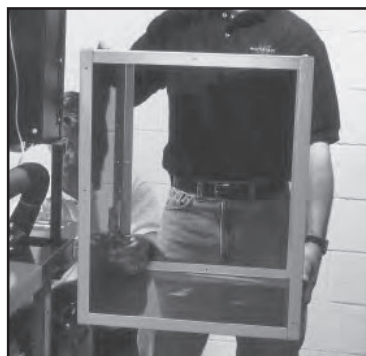
NOTE: Prior to leak testing, make sure the four sensor wells have been installed.

Electrical

1. Attach the Junction Box support. Line up orange posts to ensure support is not backwards. Threaded plate slides in between frame to secure.
2. Electrical Junction Box can be installed either end of the module.
3. Remove cover plate on proper end of Junction Box and bolt to support.
4. Cut Junction Box support leg to size and fasten to bottom of box and to the floor if required.
5. Three phase wire, and ground should be run through the Junction Box in accordance with nameplate sizing.



Junction Box Support



Electrical Junction Box

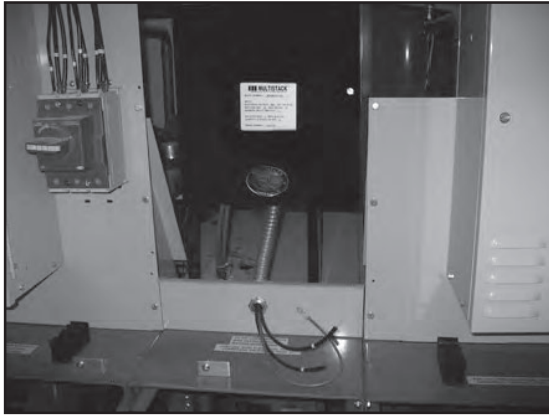


Junction Box Support Leg

Bussbar Installation

NOTE: Prior to installation contact your local representative.

NOTE: Depending on the start-up representative's policy, the attachment of the bussbar system, and power phase monitor to the electrician's wire and lugs may be the responsibility of the electrician or the Multistack Authorized Start-up technician. The following procedures should be used.



1. Remove the buss duct covers on the heat pump.



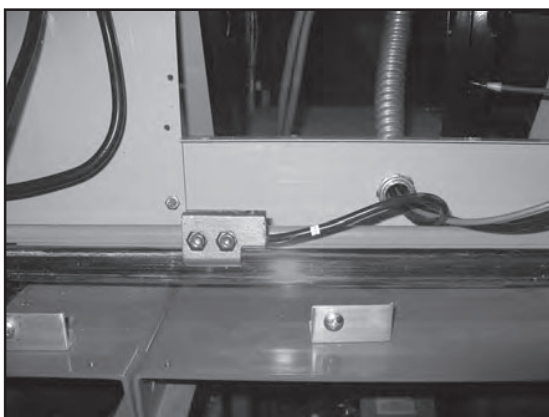
2. Remove the isolation switch cover



3. Install the three bussbar connector wires to the isolation switch to each Heat Pump. The wires are shipped with each module.



4. Remove the orange insulation and install the bussbar for line 3 (back). Connect lug for line three on each module.



5. Single-phase power for the modules should be taken off two lines of the bussbar. Multistack recommends lines one and three.



6. After connecting the lugs for line three of all the modules, cut the orange insulation to fit between the lugs. Now install the lug cover and snap the bussbar into place on the plastic holders.

Bussbar Installation, Cont'd



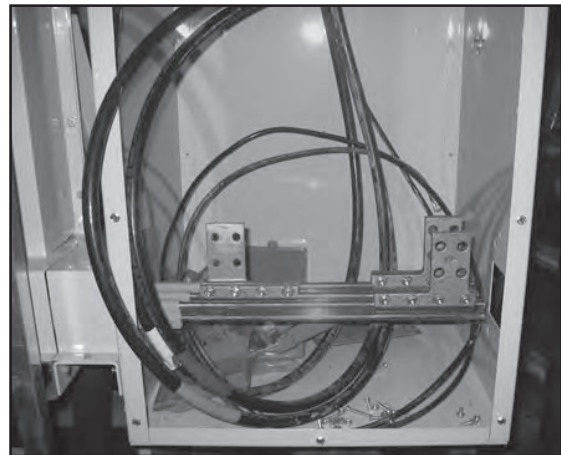
1. Follow the procedure in step four to complete the installation of lines one and two.



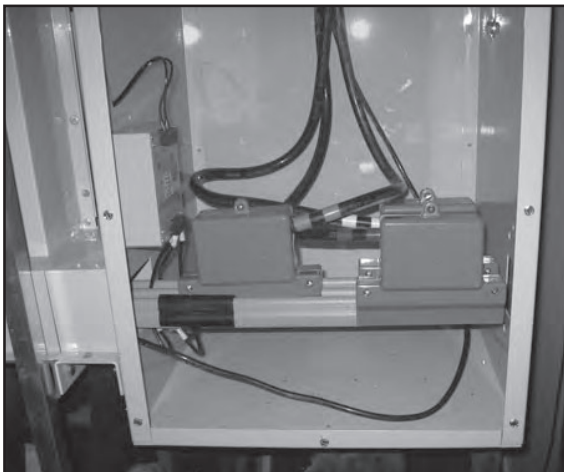
2. Once all three lines are completed, use the provided overlap pieces to cover any open bussbar areas.



3. The ground bar will need to be drilled, then attached to the module ground lug.



4. Reinstall the buss duct and isolation switch covers
5. Install the main power connectors as shown.
NOTE: IT IS THE ELECTRICIAN'S RESPONSIBILITY TO CONNECT THE MAIN POWER TO THIS CONNECTOR.

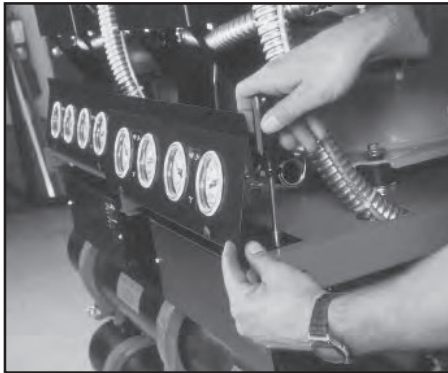


6. Finally, install the power phase monitor as shown. When installed the lettering on the power phase monitor will be upside down. Wires will need to run to the N.O. contact of the power phase monitor and connect to the master control.

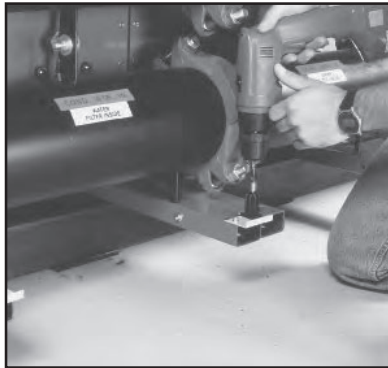
Frame & Panel Install

NOTE: Attachment of the frame and panels is the responsibility of the MULTISTACK Authorized Start-up Technician. The following procedure should be used.

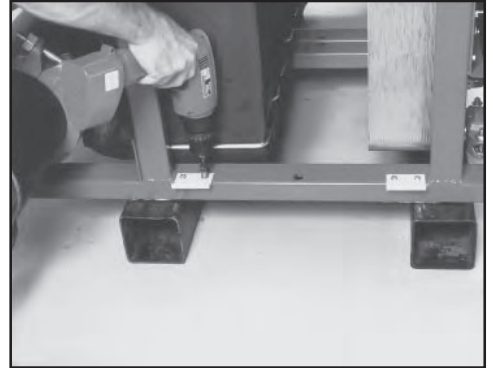
NOTE: See supplements for Shell & Tube and Extended Header cabinetry.



1. Remove screws from gauge panel and pull assembly forward 1" from shipping position. Secure panel to new location.



2. Install panel clips and spindle posts on the outside four corners of module frame.



3. Panel supports also go on the outside of end modules.



4. Attach front frame section onto module (33-1/8" pieces go on bottom) Use "T" connectors in front middle. Four corner connectors go on top (front & rear).



5. Install 2 long frames over spindle posts vertically in rear (bussbar side). Attach top frames to corner joints (use special frames with 7 holes forend modules only). Attach 20" horizontal frames (2 in front, 1 in rear).



6. Once the frame has been assembled you can attach the black fasteners and magnetic tape (or Velcro™ strips) to front of support panels.



Now, you have the first module frame together, continue procedure with subsequent modules.

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Start-Up Data Log

START-UP DATA LOG

START-UP DATE: _____ SHIP DATE: _____
JOB NAME: _____ JOB NUMBER: _____
ADDRESS: _____
MULTISTACK REPRESENTATIVE: _____
MODEL NUMBER: _____

MODULE SERIAL NUMBERS

| | |
|----------|-----------|
| 1. _____ | 7. _____ |
| 2. _____ | 8. _____ |
| 3. _____ | 9. _____ |
| 4. _____ | 10. _____ |
| 5. _____ | 11. _____ |
| 6. _____ | 12. _____ |

DESIGN PARAMETERS

| | |
|---------------|-------|
| 1. ECHW | _____ |
| 2. LCHW | _____ |
| 3. CHW GPM | _____ |
| 4. CHW P DROP | _____ |
| 5. ECW | _____ |
| 6. LCW | _____ |
| 7. CW GPM | _____ |
| 8. CW P DROP | _____ |

WATER SIDE AND INSTALLATION CHECKLIST CIRCLE CORRECT RESPONSE

| | | |
|--|--------------------|----|
| 1. Chiller mounted on rails and isolators? | YES | NO |
| 2. Any visible damage, oil or refrigerant leaks? | YES | NO |
| If yes, detail: _____ | | |
| 3. All pipe work independently supported from chiller? | YES | NO |
| 4. System sensor wells installed: CHILLED: IN OUT CONDENSER: IN OUT | | |
| 5. Flow or differential switches installed: CHILLED: _____ CONDENSER: _____ | | |
| 6. Operation of flow or differential switches with reduction of 50%. P _____ | | |
| 8. Condenser 3-way by-pass valve? | YES | NO |
| If yes, Temperature set point: _____ °F | | |
| 9. System strainers installed? | CONDENSER: YES NO | |
| | EVAPORATOR: YES NO | |
| 10. Install System sensors and apply thermal paste? | YES | NO |

ELECTRICAL AND CONTROLS CHECKLIST

| | | |
|--|-----|----|
| 1. All electrical connections tight and correct? | YES | NO |
| 2. Power wiring sufficient to carry F.L.A.? | YES | NO |
| 3. Voltage levels: PHASES: 1 + 2 _____ 2 + 3 _____ 1 + G _____ 2 + G _____ 3 + G _____ | | |
| 4. Set module board addresses, run communication wire, do factory reset on Master Control? | YES | NO |
| 5. Program system variable to site connections, date and time? | YES | NO |
| 6. Verify demand for cooling? | YES | NO |
| 7. Check temperature and pressure sensors through microprocessor display? | YES | NO |
| 8. Check interlock operation: Stop chilled water pump? YES NO | | |
| Stop condenser water pump? YES NO | | |
| 9. Provide training to contractor or owner? | YES | NO |
| 9. Leave system in full operation? | YES | NO |
| 10. Notify contractor of any problems? | YES | NO |

Start-up Service Technician

Owner or Contractor Acceptance

Start-Up Data Log, Cont'd

Actual Setpoints

1. ECHW (Upset) _____
2. LCHW (LoSet) _____
3. VSP _____
4. Control _____
5. TDIFF _____
6. Flush Dur. _____
- *PC0 Program Version _____
- (Go to main menu screens then push PRG & UP buttons)

Factory Setup

1. Program Type _____
2. Chiller Type _____
3. Refrigerant _____
4. Flow Faults: CHW _____
CW _____
5. Circuit Type _____
6. Variable Flow _____
 - A. Valve Display _____
 - B. CHW Output _____

- C. CHW Bypass _____
- D. CHW Min Output _____
- E. CW Output _____
- F. CW Bypass _____
- G. CW Setpoint _____
- H. CW Min Output _____
- I. CW PID _____
- J. CHW PID _____

Measured Readings

1. CHW P Drop _____
2. CW P Drop _____

| MODULE | CURRENT | | | TEMPERATURE | | | | HP | LP |
|--------|---------|---|---|-------------|-------|----------|------|----|----|
| | A | B | C | Suct | LoChw | SYS LCHW | ECHW | | |
| 1 | A | | | | | | | | |
| | B | | | | | | | | |
| 2 | A | | | | | | | | |
| | B | | | | | | | | |
| 3 | A | | | | | | | | |
| | B | | | | | | | | |
| 4 | A | | | | | | | | |
| | B | | | | | | | | |
| 5 | A | | | | | | | | |
| | B | | | | | | | | |
| 6 | A | | | | | | | | |
| | B | | | | | | | | |
| 7 | A | | | | | | | | |
| | B | | | | | | | | |
| 8 | A | | | | | | | | |
| | B | | | | | | | | |
| 9 | A | | | | | | | | |
| | B | | | | | | | | |
| 10 | A | | | | | | | | |
| | B | | | | | | | | |
| 11 | A | | | | | | | | |
| | B | | | | | | | | |
| 12 | A | | | | | | | | |
| | B | | | | | | | | |

INSTALLATION CHECKLIST & REQUEST FOR AUTHORIZED START-UP ENGINEER

CUSTOMER: _____

JOB NAME: _____

JOB LOCATION: _____

CUSTOMER ORDER NO.: _____

| CHILLED WATER | Yes | No | N/A |
|--|--------------------------|--------------------------|--------------------------|
| Piping complete and connected to Multistack Units. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Water system filled and vented. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Pumps installed (Rotation checked). | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Recommended strainers installed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Controls (3-way valves & by-pass valves, etc.) operable. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Water system operated and flow balanced to meet unit design requirements. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Strainers checked for unusual debris. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Flow or differential pressure switch installed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| CONDENSER WATER | Yes | No | N/A |
| Piping complete and connected to Multistack Units. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower flushed, filled and vented. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Pumps installed (Rotation checked). | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Recommended strainers installed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Controls (3-way valves and by-pass valves, etc.) operable. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooling tower fans wired and operable. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Condenser water system operated. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Condenser & evaporator strainers must be checked, cleaned and free of debris. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Flow or differential pressure switch installed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ELECTRICAL | Yes | No | N/A |
| Power wiring complete and in accordance with nameplate rating on Multistack unit and prepared for connection in accordance with installation manual. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| NOTE: No power is to be applied to unit prior to inspection by Multistack engineer. | | | |
| All interlock wiring complete between control panel and complies with Multistack specifications and with applicable codes. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| MISCELLANEOUS | Yes | No | N/A |
| Thermometer wells, thermometer gauges, control, etc. installed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A minimum system load of 50% of total building load is available for testing and adjusting controls. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

We understand that authorized representatives of the installing electrical and piping contractor must be available during the start-up period and that coordination is our responsibility.

We further understand that the services of Multistack Authorized Start-up Engineer will be furnished for a period of not more than sixteen (16) consecutive normal working hours and we agree that a charge for time and expenses will be made by Multistack if services are required for longer than sixteen (16) consecutive normal working hours or if repeat calls are required through no fault of Multistack.

Signed

Title

Company Name, Company Location and Company Telephone

Job Location Telephone



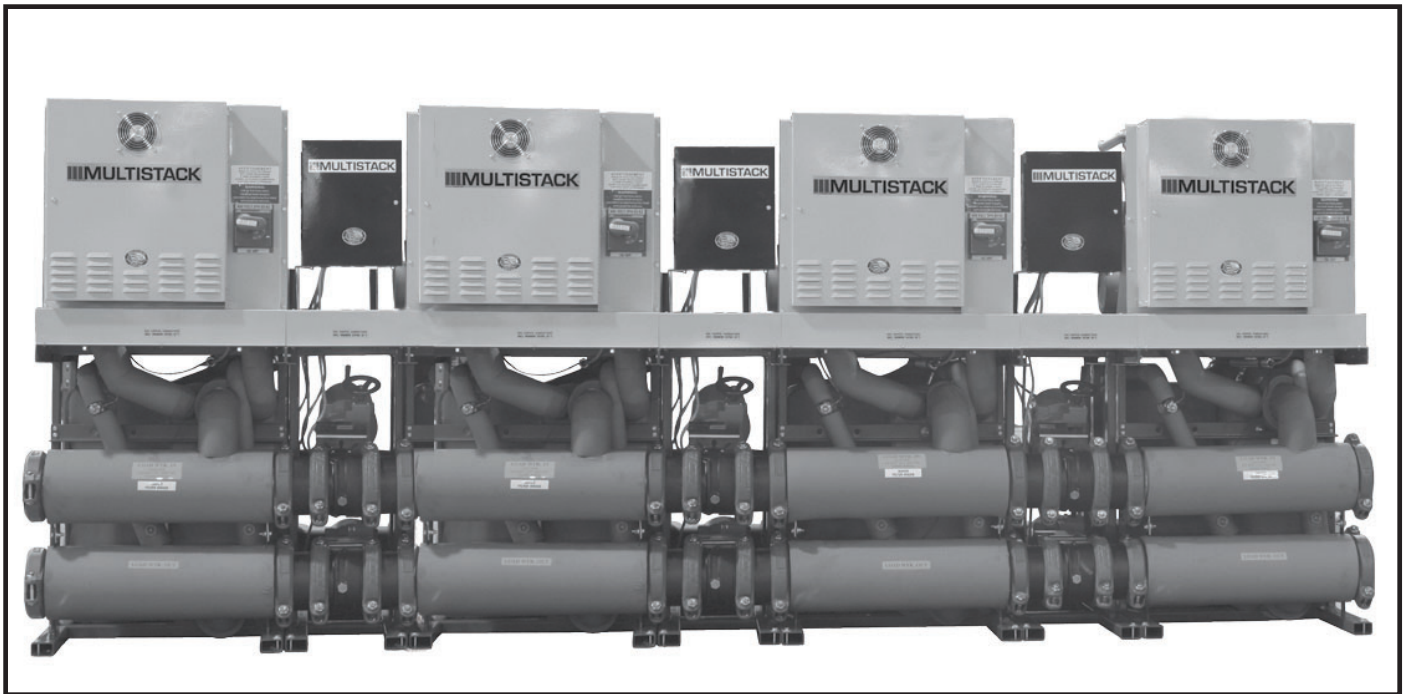
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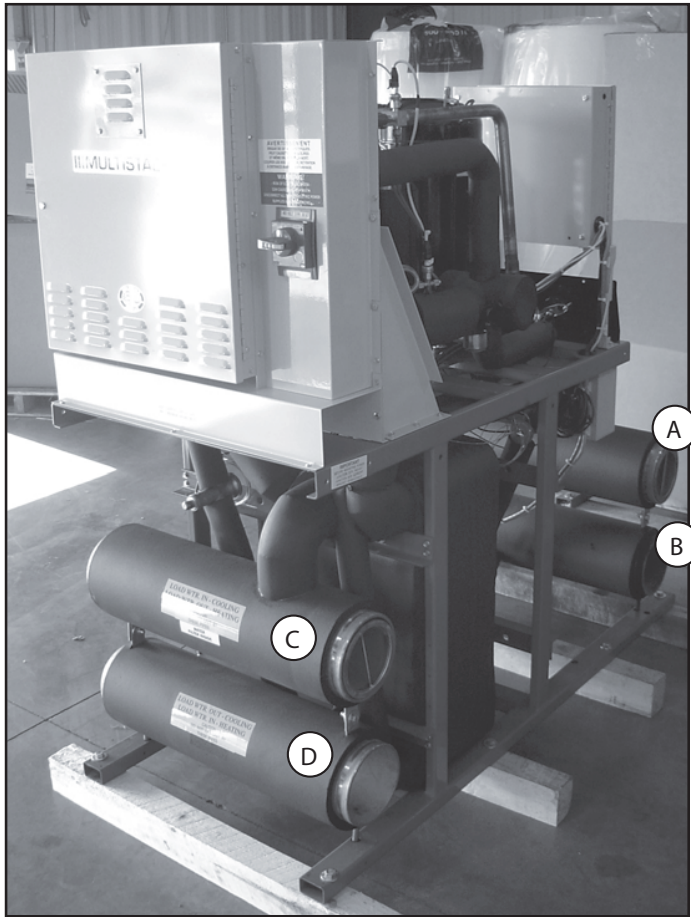
III[®] MULTISTACK[®]

Originators. Innovators. Never the Imitators.



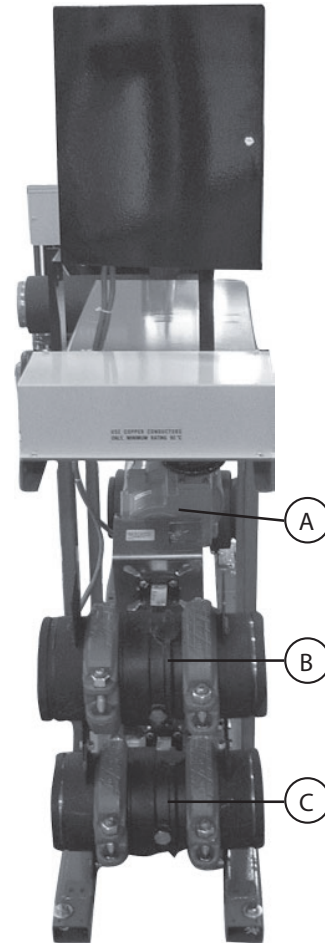
Virtual Moveable End Cap for Heat Pumps
Installation Supplement

MR15X - MR70X Heat Pump Module



MR15X-MR70X Heat Pump

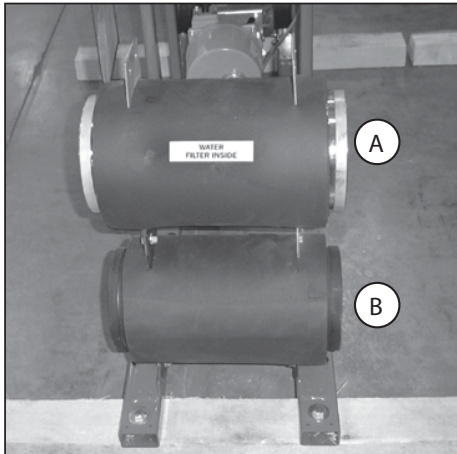
- A. Source/Sink In (strainer inside)
- B. Source/Sink Out
- C. Load Water In (Cooling)/ Load Water Out (Heating) with strainer inside
- D. Load Water Out (Cooling)/Load Water In (Heating) with strainer inside



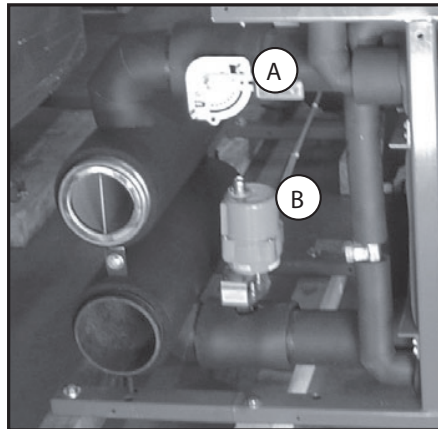
VME Load Side

- A. Motorized Valve Actuators with Manual Hand Valves
- B. Upper Butterfly Valve
- C. Lower Butterfly Valve

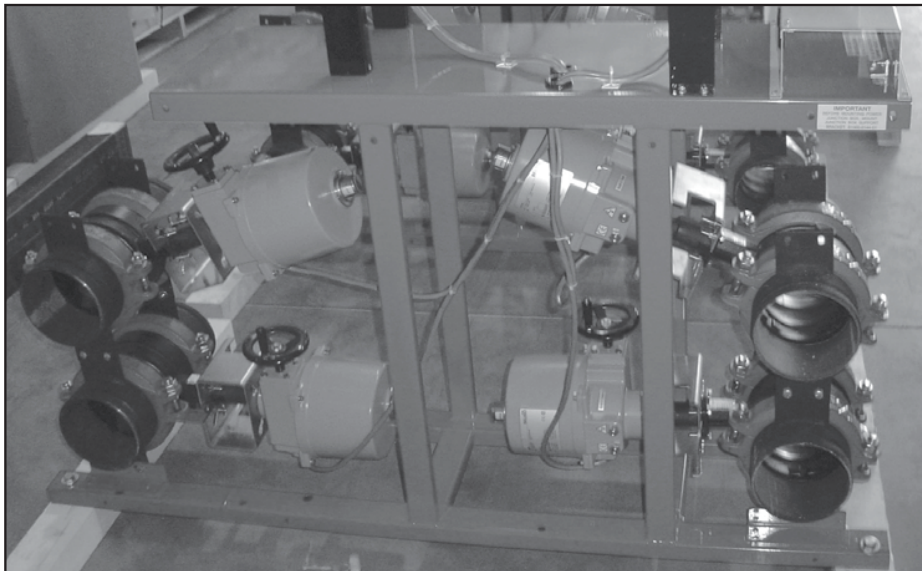
MR15X - MR70X Heat Pump Module, Cont'd



Multistack VME, Source/Sink Side
(Option 1: Without Motorized Valves for Source/Sink side)
A. Entering Source/Sink (Strainer Inside)
B. Leaving Source/Sink



Multistack Heat Pump, Source/Sink Side
A. Manual Isolation Valve Source/Sink Inlet
B. Power Actuated Butterfly Valve Source/Sink Outlet

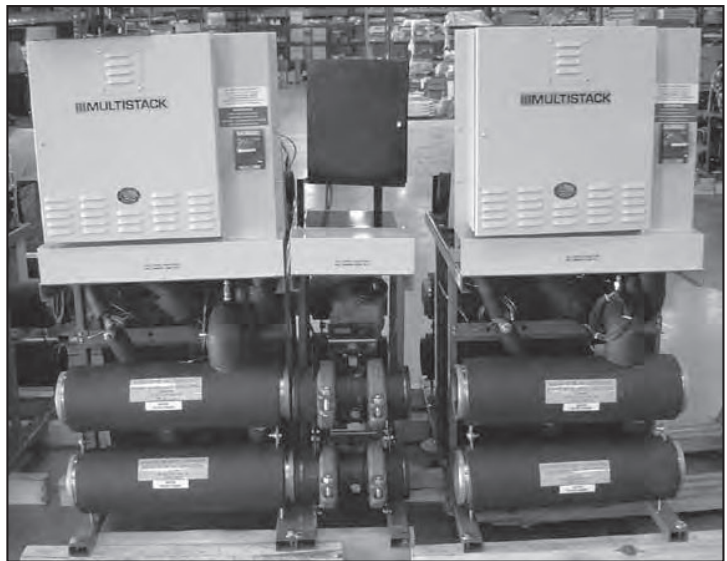


Multistack VME, Source/Sink Side
(Option 2: With Motorized Valves for Source/Sink side)

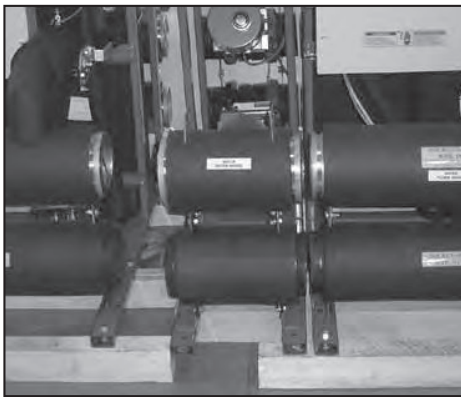
Unit Assembly



1. Install the first VME module next to the heat pump.
(Source/Sink side shown) The end heat pump will connect to system connections or the blank end on the source side.



2. Position second heat pump on opposite side of VME module. (Load side shown)
Note: VME module will always go between heat pumps. Never on system piping end.



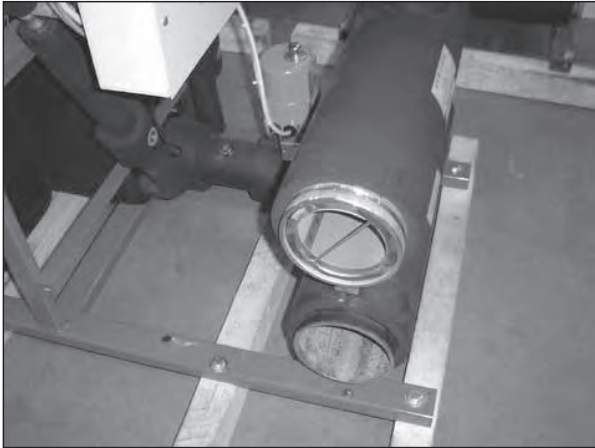
3. e. Always start with bottom headers when installing couplings.
f. Be sure to loosely install Victaulic gaskets before connecting modules together.
g. You must align the couplings at 1:00 and 7:00 to allow clearance for the chiller frame and panel installation.



4. Frame installation view. Frames connect by attaching the black plastic corner joints to the aluminum frames. Panels will hang on the black pins that push into the aluminum frame.

Multistack VME Load Side

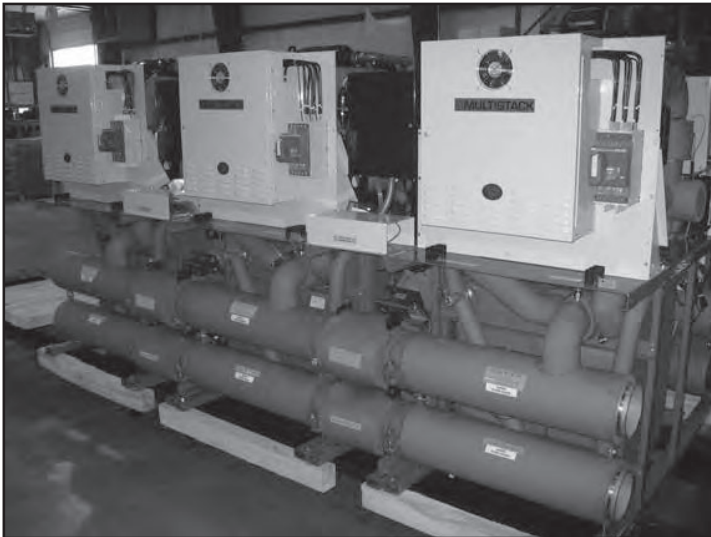
A filter stop ring must be installed between every Heat Pump and VME module on the load side. This will ensure that the filter does not “float” or shift and interfere with the butterfly valve operation. To make service and cleaning easy, Multistack recommends a 30-mesh filter with isolation valves be installed before the inlet to the load side of the array. Remember the filters in the heat pump are a last line of defense, not a primary filtering system. Cleaning of these filters will require removal of the header pipes from each module.



1A. If the modules have filters in both the top and bottom header pipes, stop rings will be required in each.



1B. Filter stop ring can slide between module header pipes after modules have slid together.



2. A three-module VME Heat Pump requires 12 Filter Stop Rings for the headers. Additionally, it will require a Filter Stop Ring for the entering Source/Sink side take-off.

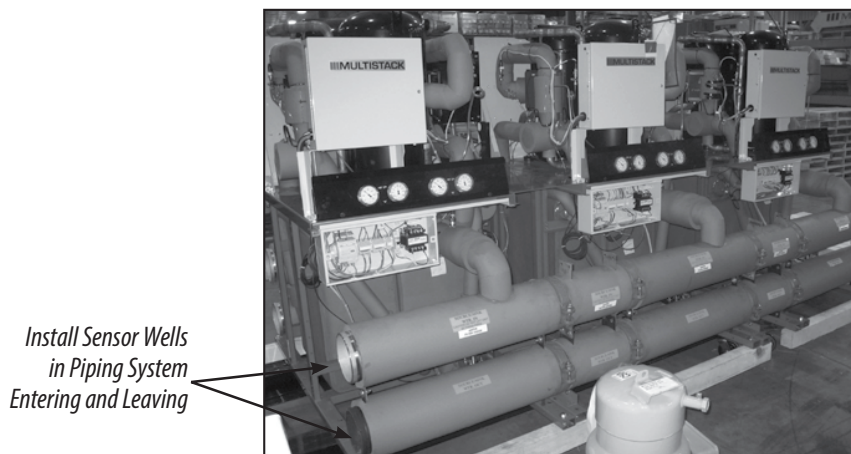
System Sensor Wells

Multistack supplies System Sensor Wells. The wells are ½" NPT and should be installed between 2' and 10' after the take-off on both ends.



Load Side VME

1A. Install Sensor Wells in system piping for entering and leaving water at both ends.



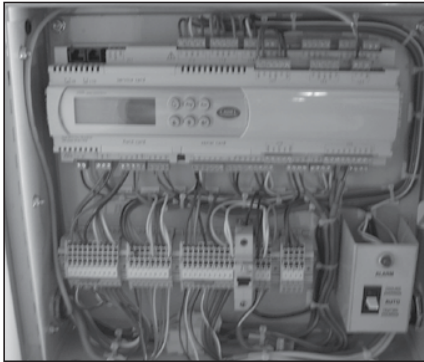
Source/Sink Side VME

1B. Install Sensor Wells in entering and leaving water system piping. Source side connections can be from either side. The opposite side should have blank endcaps.

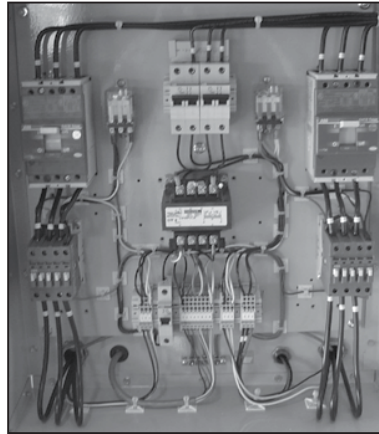


Sensor Well supplied by Multistack.
Install thermal paste in sensor well.

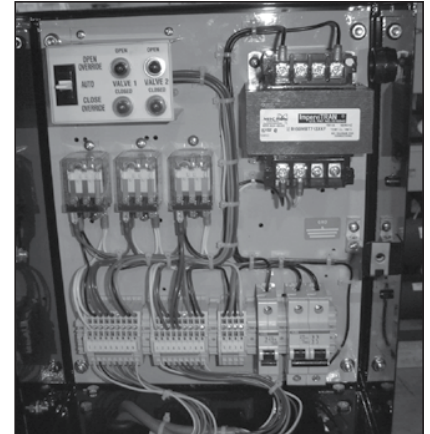
Component Identification



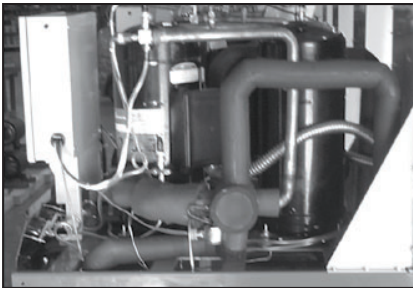
1. Heat Pump Module Board and Low Voltage Panel
 - Communicates with Master Control
 - Selector switch for independent module control



2. Heat Pump High-Voltage Panel
 - Separate circuit breaker for each circuit
 - Module isolation switch is outside of box

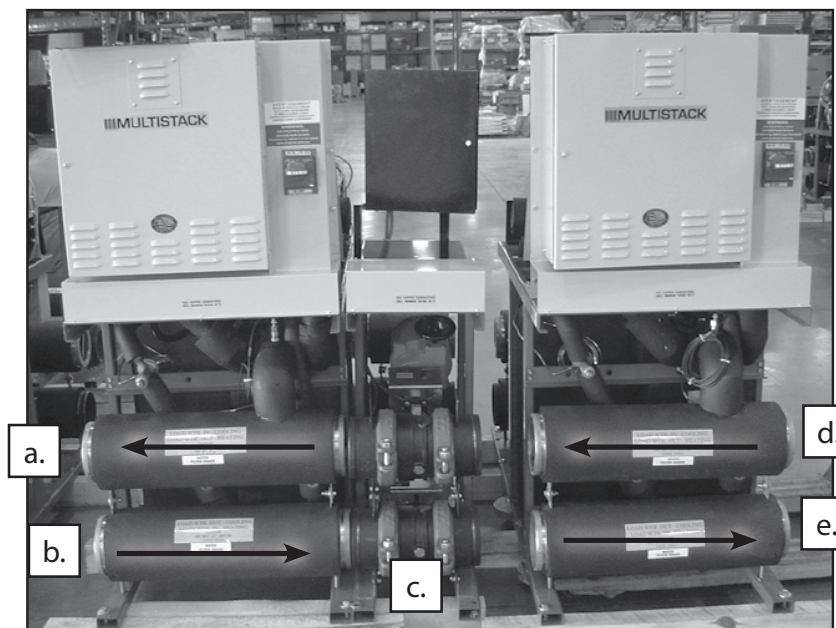


3. VME Module Control Panel
 - Open / close override switch
 - Open / close indicator lights



4. Heat Pump Four-Way Refrigerant Reversing Valve
 - Default position is heating. When energized it switches to cooling

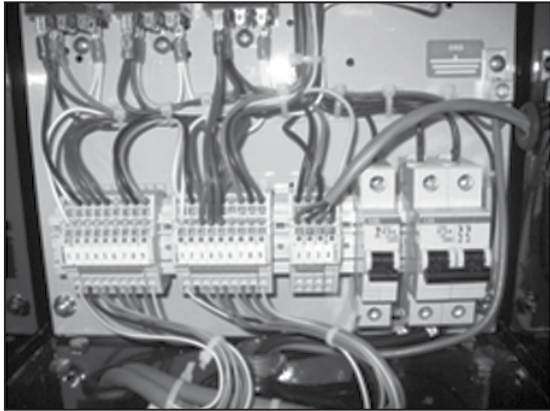
Component Identification



- a. Leaving Hot Water
- b. Entering Hot Water
- c. Motorized Isolation Valves
- d. Entering Chilled Water
- e. Leaving Chilled Water

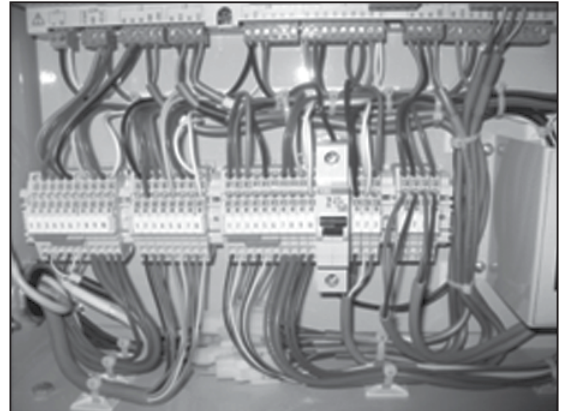
Note: Heating and cooling sides may be reversed as shown in photo.

Module Low Voltage Connect to VME Module



1. VME Module Control Panel

- At the VME control panel, run wires from TS3 #1 and #2 to the nearest Heating Module Control Panel TS5 #1 and #2.
- At the VME Control Panel run wires from TS3 #3 and #4 to the nearest Cooling Module Control Panel TS5 #3 and #4.
- To override Auto Control, the VME valves can be manually set to position by using the switches in the VME Control Panel.



2. Heat Pump Module Low Voltage Panel

- The Module Board output tells the VME Module what position the valve should be in when in the Auto Mode.
- The end Heat Pump Module on the Cooling Side will have wires connected to TS5 #3 and #4 only. The end Heat Pump Module on the Heating Side will have connections on TS5 #1 and #2 only.

VME Master Control

A VME Master Control uses a larger board than a standard Multistack Heat Pump or Chiller.

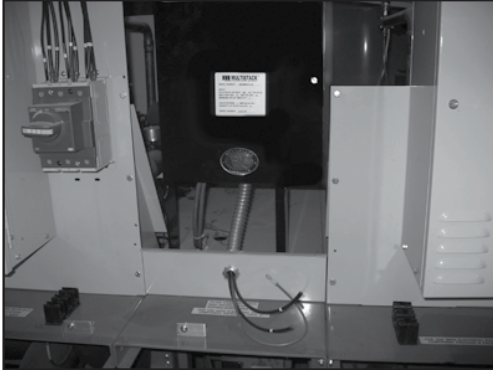


The master control module can be mounted on the top panel of any heat pump module in the array. The BAS interface, system sensors, start/stop, phase monitor and other input connections go to the Master Control panel. The Master Control is powered by 24 VAC (24 V can be pulled from the low voltage side of any modules). **Note: damage to the controller may occur if 24 V polarity is reversed.**

Bussbar Assembly

Tools needed:

- Cordless drill
- 5/16" bit and extension
- Allen T-handle
- PVC Cutter
- Allen wrench
- Rubber Mallet
- PVC Cutter



1. Remove the buss duct covers on the heat pump and VME modules



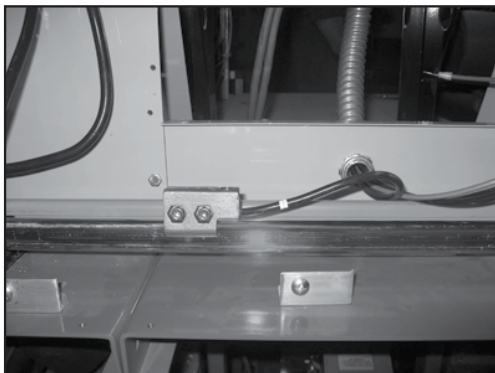
2. Remove the isolation switch cover



3. Install the three bussbar connector wires to the isolation switch to each Heat Pump. The wires are shipped with each module and are tied to the compressor feet on each module.



4. Remove the orange insulation and install the bussbar for line 3 (back). Connect lug for line three on each module.



5. Single-phase power for the VME modules should be taken off two lines of the bussbar. Multistack recommends lines one and three.



6. After connecting the lugs for line three of all the modules, cut the orange insulation to fit between the lugs. Now install the lug cover and snap the bussbar into place on the plastic holders.

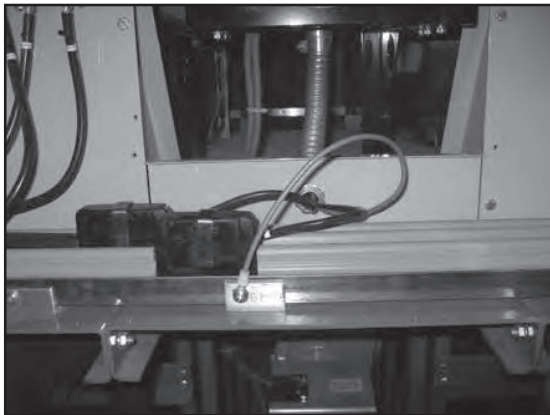
Bussbar Installation



7. Follow the procedure in step four to complete the installation of lines one and two.



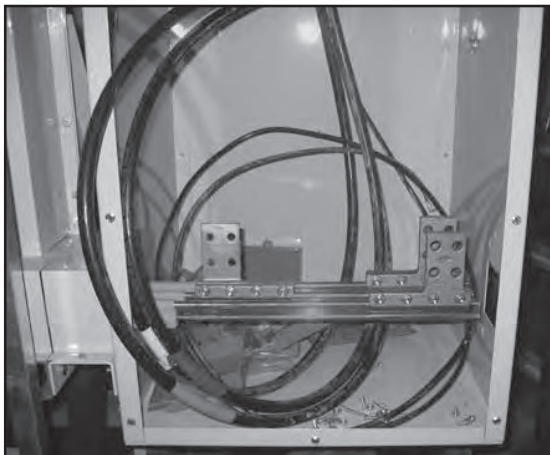
8. Once all three lines are completed, use the provided overlap pieces to cover any open bussbar areas.



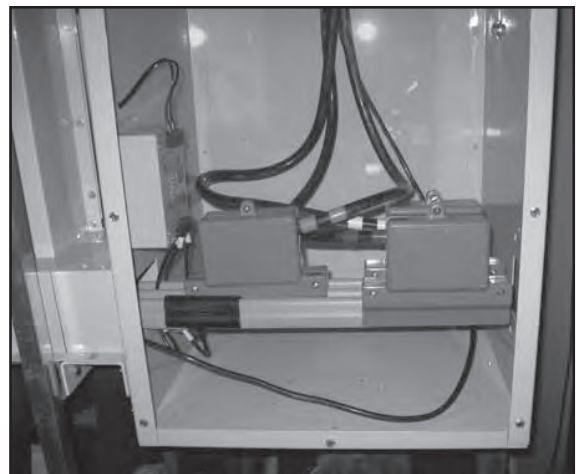
9. The ground bar will need to be drilled, then attached to the module ground lug.



10. Reinstall the buss duct and isolation switch covers



11. Install the main power connectors as shown.
NOTE: IT IS THE ELECTRICIAN'S RESPONSIBILITY TO SUPPLY LUGS AND BOLTS TO CONNECT THE MAIN POWER TO THE CONNECTORS.



12. Finally, install the power phase monitor as shown. When installed the lettering on the power phase monitor will be upside down. Wires will need to run to the N.O. contact of the power phase monitor and connect to the master control.

Installation Checklist & Request for Authorized Start-up Engineer

CUSTOMER: _____

JOB NAME: _____

JOB LOCATION: _____

JOB NUMBER: _____

The work checked below is in process and will be completed by: (Date) _____. The service of a Multistack Authorized Start-up Engineer is requested on this date and it is understood that if the work checked below is not completed, the engineer's time and expenses will be billed to us by Multistack. Terms Net 30 days. Multistack to be notified at least ten (10) working days in advance of the start-up date.

| Water Side | Cool Load | Heat Load | Source/Sink |
|--|------------------|------------------|--------------------|
| Piping complete and connected to Multistack units. | Y N N/A | Y N N/A | Y N N/A |
| Water system filled and vented. | Y N N/A | Y N N/A | Y N N/A |
| Pumps installed (Rotation checked). | Y N N/A | Y N N/A | Y N N/A |
| Recommended strainers installed. | Y N N/A | Y N N/A | Y N N/A |
| Controls operable. (3-way valves & by-pass valves, etc.) | Y N N/A | Y N N/A | Y N N/A |
| Water system operated and flow balanced to meet unit design recommended. | Y N N/A | Y N N/A | Y N N/A |
| Strainers checked for debris. | Y N N/A | Y N N/A | Y N N/A |
| Flow or differential pressure switch installed. | Y N N/A | Y N N/A | Y N N/A |

| Electrical | Cool Load | Heat Load | Source/Sink |
|--|------------------|------------------|--------------------|
| Power wiring complete and in accordance with nameplate rating on Multistack unit and prepared for connection in accordance with installation manual. | Y N N/A | Y N N/A | Y N N/A |

Note: No power is to be applied to unit prior to inspection by Multistack engineer.

| | | | |
|--|---------|---------|---------|
| All interlock wiring complete between control panel and complies with Multistack specifications and with applicable codes. | Y N N/A | Y N N/A | Y N N/A |
|--|---------|---------|---------|

| Miscellaneous | Cool Load | Heat Load | Source/Sink |
|--|------------------|------------------|--------------------|
| Chiller sensor wells, thermometer gauges, control, etc. installed. | Y N N/A | Y N N/A | Y N N/A |
| A minimum system load of 50% of total building load is available for testing and adjusting controls. | Y N N/A | Y N N/A | Y N N/A |

We understand that authorized representatives of the installing electrical and piping contractor must be available during the start-up period and that coordination is our responsibility.

We further understand that the services of Multistack Authorized Start-Up Engineer will be furnished for a period of not more than sixteen (16) consecutive normal working hours and we agree that a charge for time and expenses will be made by Multistack if services are required for longer than sixteen (16) consecutive normal working hours or if repeat calls are required through no fault of Multistack.

Signed

Title

Company Name

Company Location

Company Telephone

Job Location Telephone

VME Heat Pump Start-Up Data Log

START-UP DATE: _____ SHIP DATE: _____ JOB NUMBER: _____

JOB NAME: _____

ADDRESS: _____

MULTISTACK REPRESENTATIVE: _____

MODEL NUMBER: _____

MODULE SERIAL NUMBERS

- | | |
|----------|----------|
| 1. _____ | 2. _____ |
| 3. _____ | 4. _____ |
| 5. _____ | 6. _____ |
| 7. _____ | 8. _____ |

PCO3 Program Version _____

WATER SIDE AND INSTALLATION CHECKLIST

CIRCLE CORRECT RESPONSE

- | | | |
|---|---|---|
| 1. Chiller mounted on rails and isolators? | YES | NO |
| 2. Any visible damage? | YES | NO |
| If yes, detail: _____ | | |
| 3. Any obvious oil and/or refrigerant leaks? | YES | NO |
| If yes, detail: _____ | | |
| 4. All pipe work independently supported from chiller? | YES | NO |
| 5. Sensor pockets installed: | HEAT LOAD: IN ____ OUT ____ SOURCE SINK: IN ____ OUT ____ COOL LOAD: IN ____ OUT ____ | |
| 6. FLOW or differential switches installed: | HEAT LOAD: ____ COOL LOAD: ____ SOURCE /SINK ____ | |
| 7. Operation of flow or differential switches with reduction of 50% P _____ | | |
| 8. SOURCE/SINK 3-way by-pass valve? | YES | NO |
| If yes - Temperature set point: ____ °F | | |
| 9. System strainers installed? | SOURCE/SINK YES NO HEAT LOAD YES NO | TYPE (Y, Basket, etc.): _____ COOL LOAD YES NO |

ELECTRICAL AND CONTROLS CHECKLIST

CIRCLE CORRECT RESPONSE

- | 1. All electrical connections tight and correct? | YES | NO | | | | | | | | | | | | |
|---|--|-------|-------|-------|-------|-------|---------|--|--|--|--|--|--|--|
| 2. Power wiring sufficient to carry F.L.A? | YES | NO | | | | | | | | | | | | |
| 3. Voltage levels: | | | | | | | | | | | | | | |
| <table border="1"> <tr> <th>Phases</th> <td>1 + 2</td> <td>2 + 3</td> <td>1 + G</td> <td>2 + G</td> <td>3 + G</td> </tr> <tr> <th>Voltage</th> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> | Phases | 1 + 2 | 2 + 3 | 1 + G | 2 + G | 3 + G | Voltage | | | | | | | |
| Phases | 1 + 2 | 2 + 3 | 1 + G | 2 + G | 3 + G | | | | | | | | | |
| Voltage | | | | | | | | | | | | | | |
| 4. Total AMP draw at 100% capacity: ____ AMPS | YES | NO | | | | | | | | | | | | |
| 5. Program system variable to site connections, program date & time? | YES | NO | | | | | | | | | | | | |
| 6. Verify demand for cooling? Heat? | YES | NO | | | | | | | | | | | | |
| 7. Check sensors through microprocessor display? | YES | NO | | | | | | | | | | | | |
| 8. Check interlock operation: | Stop HEAT LOAD water pump? YES NO Stop COOL LOAD water pump? YES NO Stop SOURCE/SINK water pump? YES NO | | | | | | | | | | | | | |
| 9. Leave system in full operation? | YES | NO | | | | | | | | | | | | |
| 10. Notify contractor of any problems? | YES | NO | | | | | | | | | | | | |

Start-up Service Technician

Owner or Contractor Acceptance

Cooling Mode Readings

| Cooling Setpoints | | | | | | |
|-------------------|--------|-----|------------|---------|-------------|------------|
| UP SET | LO SET | VSP | LOAD LIMIT | T. DIFF | LOAD P DROP | S/S P DROP |
| | | | | | | |

Max number of cooling modules: _____

| Cooling Mode Readings | | | | | | | | | | | | |
|-----------------------|---|---------|---|---|-------------|-----|-----|-----|----|-------|---------------|------------------|
| Module Circuit | | Current | | | Temperature | | | | | | Head Pressure | Suction Pressure |
| | | A | B | C | ELW | LLW | ESW | LSW | SH | Suct. | | |
| 1 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 2 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 3 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 4 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 5 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 6 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |

Heating Mode Readings

| Heating Setpoints | | | | | | | |
|-------------------|--------|-----|------------|---------|------------|---------------|-----------|
| UP SET | LO SET | VSP | LOAD LIMIT | T. DIFF | HEAT DELAY | HIGH ESW TEMP | # MODULES |
| | | | | | | | |

Max number of heat modules:_____

| Heating Mode Readings | | | | | | | | | | | | |
|-----------------------|---|---------|---|---|-------------|-----|-----|-----|----|-------|---------------|------------------|
| Module Circuit | | Current | | | Temperature | | | | | | Head Pressure | Suction Pressure |
| | | A | B | C | ELW | LLW | ESW | LSW | SH | Suct. | | |
| 1 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 2 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 3 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 4 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 5 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |
| 6 | A | | | | | | | | | | | |
| | B | | | | | | | | | | | |



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MULTISTACK[®]

Originators. Innovators. Never the Imitators.SM



Virtual Moveable End (VME) Cap

Operation Manual

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1.0 Chiller Identification

The module data plate which contains the model and serial number for all MS modules is located on the “B” side electrical box door of each module.

1.1 Model Number Nomenclature

VME (Virtual Moveable Endcap) Module

| | | | | | | |
|-----|---|---|---|---|--|--|
| VME | 1 | H | 4 | A | 1 | |
| | | | | | Configuration ¹ | |
| | | | | | Valve Location (A - Both Sides, E - Evaporator side only, C - Condenser side only, S - Source, L - load) | |
| | | | | | Valve Size (inches) | |
| | | | | | Voltage (See Voltage Codes) | |
| | | | | | VME Version Number (1 or 2) | |
| | | | | | Series (VME - Virtual Moveable Endcap) | |

¹ 1- standard, 2- total access, 3 - evap ext headers, 4 - cond ext headers, 5 - both ext headers, A - 31.5 x 24, B - 36 x 24, C - 72 x 24, V - others

Water Cooled Module

| | | | | | | | | | | | | |
|----|-----|---|--------|---|---|---|---|---|---|---|---|---|
| MR | 050 | X | C or N | 1 | H | 1 | W | 0 | A | A | C | -410A |
| | | | | | | | | | | | | Ref. (410A, 134a, 407c) |
| | | | | | | | | | | | | Controller Option ⁷ |
| | | | | | | | | | | | | Condenser ⁶ |
| | | | | | | | | | | | | Evaporator ⁵ |
| | | | | | | | | | | | | AHRI Version - if applicable |
| | | | | | | | | | | | | Application ⁴ |
| | | | | | | | | | | | | Module Number (1 - single, 2 - multiple) |
| | | | | | | | | | | | | Voltage ³ |
| | | | | | | | | | | | | Configuration ² |
| | | | | | | | | | | | | AHRI Certified (C - certified, N - Not certified) |
| | | | | | | | | | | | | Compressor Type ¹ |
| | | | | | | | | | | | | Module Nominal Capacity (10 - 165 tons) |
| | | | | | | | | | | | | Series (MS - Multistack (non - reversing valve), MR - Multistack Heat pump (w/ reversing valve) |

¹ B - Bristol, C - Trane Cornerstone, D-Copeland Digital Scroll, G - Bitzer Scroll, H - Hanbell screw, N - none, R - Bitzer Screw, S - Trane Scroll, T - Danfoss Turbocor, Z - Copeland scroll (old elec), X - Copeland Scroll (ZP)

² 1- Standard, 2- Total access, 3 - Evap extended headers, 4 - Cond extended headers, 5 - Both extended headers, 6-Outdoor, V - others

³ See Voltage Codes

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

2.0 Theory of Operation

The Multistack chiller provides chilled water to an external load based off of the return water temperature to the Multistack master control. When the Entering Chilled Water sensor sends the signal to the master control that cooling is needed, compressors will begin to start and produce chilled water. The point at which the ECHW temperature calls for compressors to start is determined by the Upsetpoint and the Variable Set-point setting in the system variables menu of the master control.

When the ECHW sensor senses that the chilled water temperature has dropped below the set-point, compressors will begin to cycle off.

3.0 Daily Log Sheet

On the back page of this manual is a chiller information log sheet. The log sheet can be used daily, weekly or as desired to record operation characteristics of the chiller. The information recorded on the log sheet can also be very helpful for diagnosing potential problems in the system.

4.0 Pressure Readings

The operating suction and discharge pressures in the system are directly related to water flow, condenser temperatures, chilled water set-points, and the cleanliness of the system.

For a R410A chiller at standard water-cooled conditions of 55° ECHW, 45° LCHW, 85° ECW, 95° LCW the suction pressure should be approximately 109 psig and 342 psig discharge pressure.

All Multistack modules have a high pressure cut out safety device. The HP cut out for water-cooled MS modules is 465 psig. Each Multistack module also has a low pressure safety device. The LP cut out is 50 psig. .

If circuits are faulting on HP the first action to be taken should be checking the condenser water inlet filter cartridge for debris. *See filter strainer cleaning procedure in section 5.0.*

A LP fault is an indication of low refrigerant charge in the system. If a circuit is going out on a LP fault check the static pressure of the system while the circuit is in the off mode. If pressures are low check the circuit for possible leaks. The circuit can be pressurized to 15 psig with refrigerant and topped to 160 psig with dry Nitrogen.

5.0 Water Treatment

Proper Water treatment is essential to ensure the peak efficiency and performance of the chiller. The condenser and chilled water quality should be kept within the

following parameters to prevent any damage to the heat exchangers. The use of hydrochloric, sulfuric, and muriatic acids as well as household bleach can cause stress corrosion to the stainless steel in the heat exchangers. Use of these or any other unapproved chemicals is not covered under the Multistack warranty.

Multistack Water Guidelines

| | |
|------------|--------------|
| PH | > 7 - < 9 |
| TDS | < 1000 ppm |
| Hardness | 30 - 500 ppm |
| Alkalinity | 30 - 500 ppm |
| Chlorides | < 200 ppm |
| Sulphates | < 200 ppm |

6.0 Strainer Cleaning

All Multistack modules have a 30 mesh filter cartridge in the condenser and evaporator inlet header. The purpose for the filter cartridge is to keep debris from entering the heat exchanger. An external "Y" or basket type system strainer should also be installed as a pre-filter to the Multistack strainers.

There is no set time for cleaning the filter cartridges. The frequency of this process is dependant on the water quality in the condenser and / or evaporator loop.

Normally, debris in a water loop is going to take the path of least resistance and build up on the last modules to receive water. Multistack modules come with an auto blow down (the Multiflush) installed on the condenser side of the last module to receive water flow. The Multiflush is controlled by a timer in the master control; it opens once a day to remove debris from the loop. The Multiflush does not eliminate the need to pull the filters for cleaning. It is meant however to decrease the frequency.

The effect of debris being built up in the condenser water inlet filter cartridge will be nuisance HP (high pressure) faults. By checking the pressure differential between the inlet and outlet of the condensers, an indication can be determined if the filters are contaminated. Refer to the Product Data Catalog for correct pressure drop of your model. For a MS70Z module with a 10° F delta T, the condenser side pressure drop should be 17' / 7.4 psi. For the chilled water 16' / 7 psi. To keep HP faults from repeating, the filters will need to be pulled. If HP faults still occur after cleaning the filter cartridges the condenser pump should be checked for proper flow. If flow is not a problem the heat exchangers may need to be cleaned. Refer to section 11.0 on Heat Exchanger Cleaning. Following is the procedure for removing and cleaning the filter cartridges on the condenser side.

1. Turn off the chiller, shut down the condenser pump, and close the butterfly / gate valves to the condenser.
2. Drain the water remaining in the condensers and header pipes. You can do this by opening the drain valve in the supplied pipe stubs or removing the end Victaulic cap on the Multiflush.
3. Remove the first filter in the Multiflush and remove all remaining filters in the bottom condenser header pipes. You may need to fabricate a tool to hook onto and pull the strainers out through the Multiflush end.
4. Slowly open the top butterfly / gate valve and allow water to flow through the condensers and onto the floor for approximately 30 seconds. This will push out any debris that was trapped in the bottom of the heat exchanger as the filters were removed.
5. Clean the filters with hose, power washer, or wire brush as needed and reinstall. Slide filters in until you hit the filter stop ring on the first module. Some people like to keep an extra set of strainers for quick re-installation. These filters are available for purchase through your local Multistack Representative.
6. Close the system by installing any Victaulic clamps previously removed.
7. Open the 1/4" petcock bleed valves on the pipe stubs.
8. Re-fill the system by opening the bottom butterfly / gate valve and filling from the bottom up. Close the 1/4" petcock valves and open the top butterfly / gate valve after the air has been bled from the system.
9. Restart the condenser pump. Bleed any remaining air in the system once the pump has started and re-start the chiller. If circuits are faulting on Low Suction Temperature, or Low Chilled Water Temperature the chilled water inlet filter cartridge should be checked. The strainers are located in the top header on the CHW side so the previous instructions on condenser strainer removal do not have to be exactly followed. If the strainers are clean the fault is most likely being caused by a low flow condition or to low of set-points in the master control. If these possibilities are eliminated the evaporator heat exchangers may need cleaning.

7.0 Compressor Oil Level

All compressors used on MS modules have an oil level sight glass on each compressor. Each module is run tested and has the oil level set at the factory. The compressor crankcase heaters should always be on 24 hrs before a compressor is started to ensure no liquid is present in the oil. Following are factory oil level settings and recommendations. Scroll Compressors with R-410A are all 1 stage and oil level is set at 1/8 – 1/4 full sight glass. The compressor uses a POE oil. Factory oil charge volume for each compressor can be found in the Product Data Catalog.

8.0 Refrigerant Charge / Evacuation

All MS modules come factory charged with the recommended refrigerant volume. Prior to charging, each circuit is evacuated to a maximum of 150 microns and held 15 minutes. The proper refrigerant charge for each module can be found on the module data plate. For a MS70ZX module each circuit is charged with 16 lb. of R-410A.

For proper charge on water-cooled machines the circuit should be charged until the sight glass just clears.

9.0 Filter Driers

Multistack modules contain very short piping runs to the major components. Only a micro refrigerant charge (.6 of a lb. per ton) is used, and all circuits are evacuated to 150 microns. For this reason a liquid line filter drier is not factory installed in the unit.

When changing a major component in the system, a replaceable core suction line filter kit can be added to reduce contamination. The suction filter kit can be purchased from Multistack through your local Multistack Representative. Installation instructions and drawings are also available from Multistack.

10.0 Superheat / Subcooling

Multistack uses a mechanical type expansion valve on all modules. By turning the valve adjustment clockwise superheat is increased.

On MS modules, superheat is set at the factory during the run test. Superheat is set for 10 – 12 degrees during the test run.

Sub cooling is necessary in the system to prevent flash gas as the refrigerant enters the expansion valve. Multistack condensers are sized so that sub cooling of the liquid refrigerant will take place with no separate sub cooler being needed. The general range of sub cooling seen is 10- 20 degrees.

11.0 Pressure Relief Valve

MS modules do not have pressure relief valves as a standard component. If desired or required by local code, pressure relief can be added as an option.

12.0 Annual Maintenance

Most of the annual maintenance requirements for Multistack Chillers involve proper shut-down of the machine, and cleaning of the heat exchangers. *Preventative Maintenance bulletin #021594PM* and *Heat Exchanger Cleaning Procedures bulletin #091594CP* describe the recommended procedures for both processes. Multistack has available the 151A Cleaning Kit to assist with this process. Please see the *151A Cleaning Kit bulletin # 090195CK* for more details. All

of these bulletins are part of the standard O&M manual package.

Other annual checks that should be done:

A check of all electrical components (contactors, fuses, relays, etc...) should be performed once a year for any signs of excessive wear. Checking for tight connections should also be performed at this time.

Superheat, pressure gauges, oil levels, master control condition, and sensor accuracy should also be checked.

13.0 Compressors

With any chiller system there is always the chance of a compressor failure. In the event of a failure, proper steps should be taken to determine the cause of the failure.

A motor burn due to a fault in the motor insulation is quite rare. Most burnouts are actually caused by a mechanical condition or lubrication problems. In the event of a burnout, proper clean up procedures should be followed.

1. Check all electrical components of the circuit (contactors, fuses, wires, etc.)
2. If necessary do a system clean up. Nu-Calgon RX-11 flush, or Sporlan System Cleaner work well.
3. Install a suction filter drier with burnout core. See section 7 on filter driers.
4. Evacuate the system to a minimum of 500 microns and hold for 20 minutes.
5. Charge the circuit with virgin refrigerant. Charge with liquid into the discharge side. See refrigerant charge on nameplate data of unit.
6. Run the system 2-3 weeks with burnout filter core. Replace with standard core drier.

14.0 Heat Exchangers

Multistack uses brazed plate stainless steel heat exchangers for all condensers and evaporators.

Without proper water treatment or due to abuse, heat exchangers, especially condensers can corrode over time and eventually develop an internal leak. In such an event it would become necessary to replace the heat exchanger.

Following are the steps for to test for a failed condenser or evaporator heat exchanger.

1. Shut down the chiller, valve off, and drain water out of the side to be tested.
2. Remove the Victaulic connections and header pipes for the module with the suspected leak.
3. Place some type of seal over the water connections such as balloons or plastic gloves.
4. Pressurize the refrigerant side with Nitrogen up to 160 psig. If there is a water to refrigerant leak the seals on the water side should expand.

Following are the steps for field replacement of a failed condenser or evaporator heat exchanger.

1. If the refrigerant has not been lost on the failed circuit, you should first do a standard refrigerant recovery.
2. Begin by isolating the chiller and draining water from the side to be worked on.
3. Remove the 6" water header pipes by unbolting the victaulic couplings.
4. Support the underneath of the defective heat exchanger and the other circuit heat exchanger if applicable. A 2x4 and 1x4 should fit perfectly underneath.
5. Using a saws all you can now cut the refrigerant piping to remove the heat exchanger. Cut on the bottom side of the elbow and sweat off remaining portion of old elbow.
6. Remove the red support brace that holds both heat exchangers in place. Once this is removed you can remove the defective exchanger.
7. Set the new heat exchanger in place and re-install the support brace.
8. Fit the couplings and refrigerant piping into the heat exchanger. You may need to loosen the rotolock at the compressor at this time.
9. Braze in the new exchanger while purging with a low pressure of nitrogen.
10. After brazing leak check and evacuate to a maximum of 500 microns. Charge the circuit according to the name plate charge.

If the heat exchanger failure has caused water to enter into the refrigerant side, the compressor and opposite side heat exchanger should also be checked for possible contamination. If water has entered into the compressor it is recommended the compressor be replaced, as removing all the moisture from the oil is very difficult. Replacement of the other contaminated heat exchanger, the expansion valve, and installation of a suction drier with a water core cartridge is also recommended. Evacuate the circuit to a maximum of 500 microns and let stand for 20 minutes. Charge the circuit and run 2-3 weeks with the high water core cartridge and then replace with a standard core.

15.0 Troubleshooting MS70X Modules

MS70X modules use the Carel PC03 master control. The user manual for the PC03 controller is located in section 6 of the Service Manual. The user manual details the different status screens and explanations of system or module faults. The following guide is for troubleshooting the modules and the PC03 controller.

FAULT

No Display on Master Module

EX 1,2, Interlock

EX 4 Interlock

Waiting For Chilled Water Flow

Waiting For Condenser Water Flow

Low Chilled Water Temp

No Demand

100% Demand all the time

100% Demand, chiller won't load

Excessive Cycling

High Discharge Pressure (HP)

Low Suction Pressure (LP)

Low Suction Temperature

Communication Error

Circuit Fault

P Lan Error

SOLUTION

Check main disconnect for power

Check circuit breakers in module

Check transformer in modules

Check for 24V at J1 on board

Check appropriate interlock component

Check jumpers on TB11 in master control

Check for proper rotation, phasing

Check PPM device

Check CHW pump

Check flow switch operation

Check filter strainers

Check TB11 inputs #3 - #7

Check CW pump

Check flow switch operation

Check filter strainers

Check TB11 inputs #3 - #8

Check LCHW sensor

Check setpoints in system variables

Check for flow restriction

Check entering CHW sensor

Check setpoints in system variables

Check sensor location

Check entering CHW sensor

Check setpoints in system variables

Turn chiller on

Check sensors

Check load limit setting in system variables

Check VSP setting in system variables

Check entering CHW sensor location

Look for system problem (low water Volume, low load)

Check strainers in condenser headers

Check condenser water flow

Check refrigerant charge / leaks

Check expansion valve

Check suction sensor

Check setpoints in system variables

Check for flow restriction

Check settings in system variables

Check cables at J11 comm ports

Check dip switch settings

Check components in control circuit

Check wire crimps in control circuit

Check ratio of HP to LP

Check cables at J11 comm ports

Check for possible power issues

Factory Set-Up

Go to System Variables, Factory Setup Menu, Password: Call Multistack

Water Safety

Load Side: Standard/Low Temp

Source Side: Standard/ Low Temp

Chiller Type: Can't enter

Refrigerant Type:

Water Flow Faults:

Load Side: Manual/Auto

Source Side: Manual/Auto

Factory Reset: Don't not repeat

Circuit Type: Cannot enter

Commission Date: (when chiller was started)

Sink Pump Delay: (delays madule start to prove source water flow)

Variable Flow: On/Off

Valve Delay: sec (10-99)

Load Water output: Disabled 4-10ma 2-10V 0-10V ext...

LW Flow Bypass: (0-5)

LW Min Output: (0-50)

Source Water Output: Disabled 4-20ma 2-10V 0-10V ext...

SW Flow Bypass: (0-5)

SW Set point: 340 psig at 105° F (240-370)

SW Min Output: (15%-50%)

PID Setup:

Load Valve PID: K=

TI=

Td=0

Source/sink Valve PID: (controls the head pressure in cooling)

KI=

TI=

Td=0

Source/Sink VME: Yes/No

Rev Valve Pulse: sec (0-5) in cooling

Operating Settings

See user manual for descriptions of the terms used below.

Under SYSTEM VARIABLES go to CHILLER SETUP MENU:

(If you change set points, keep the upper and lower set points spanned for the water delta T across the heat exchanger on one module running both compressors, so that the chiller can stage up and down properly.)

Heat Mode Set Points:

Up Setpt:
Low Setpt:
VSP:
T-diff:
Heat Delay:
High ESW temp:
Max number of heat modules:

Cool Mode Set Points:

Up Setpt:
Low Setpt:
VSP:
T-diff:
Max number of heat modules:

Also under Chiller Setup Menu:

Mode Priority: heat/cool
Mode Select: EX2= heat enable/ EX3= cool enable/ Hard wire or BAS Interface
Fail indicator:
Number of Modules:
High Pressure Cutout:

Also Under System Variables:

Time and Date: Check current time and date.
Interface option: BAS Enabled : Yes/No
Protocol:
Baud Rate:
Network Number:

Slave Modules: *(Press program button to get into the settings, escape to get out)*

| | | |
|-------------|--------------|--------------|
| Heat setpt: | Heat Range: | Heat Offset: |
| Cool setpt: | Coole Range: | Cool Offset: |

 **MULTISTACK®**

III® MULTISTACK®

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Filter Strainers: Increase Energy Efficiency, Reduce Maintenance Cost

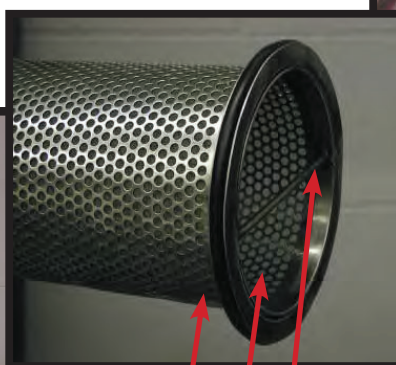
MULTISTACK Chiller Supply Header Filter Strainers*:

The 316 Stainless Steel Strainer with a Teflon coated 30 mesh screen is designed to provide protection to the brazed plate heat exchanger. This lining prevents harmful debris contamination that leads to higher energy costs.

- MULTISTACK chillers with filter strainers provide 7 - 13 times more surface area than the alternative "Y Basket" strainers.
- Teon coated filter strainers are now standard equipment in all MULTISTACK modules.
- The pressure drop increases by only 7% on a five module chiller.

Possible debris contaminants that drive up your energy costs include:

- Metal Chips
- Insects
- Slag
- Plastic Particles
- Dirt
- Rust
- Plant Seeds



Filter Strainer

Teflon Coated 30
Mesh Screen

Filter Pull Rod



Cleaning Procedure

1. Remove the filter strainers from the header and spray it with a normal hose. With a mild household detergent, simply wash the mesh screen until the debris is removed.
2. MULTISTACK recommends cleaning at the end of each cooling season or whenever the refrigerant discharge pressure gauge exceeds 40 - 50lbs above normal operating conditions. We also recommend cleaning the chilled water filter strainers when the evaporator is operating at 52 psig or 10-12 psig below normal.

Note: Refer to the MULTISTACK Installation Manual for instructions on cleaning the system prior to installing the Multistack Chiller.

3. For normal air conditioning application 55 - 45°F entering and 105°F condensing, the optimal operating conditions are:
60 - 62 psig suction, and 200 - 212 discharge pressure.

Note: Operating conditions vary depending on the application, temperatures and flow rates.

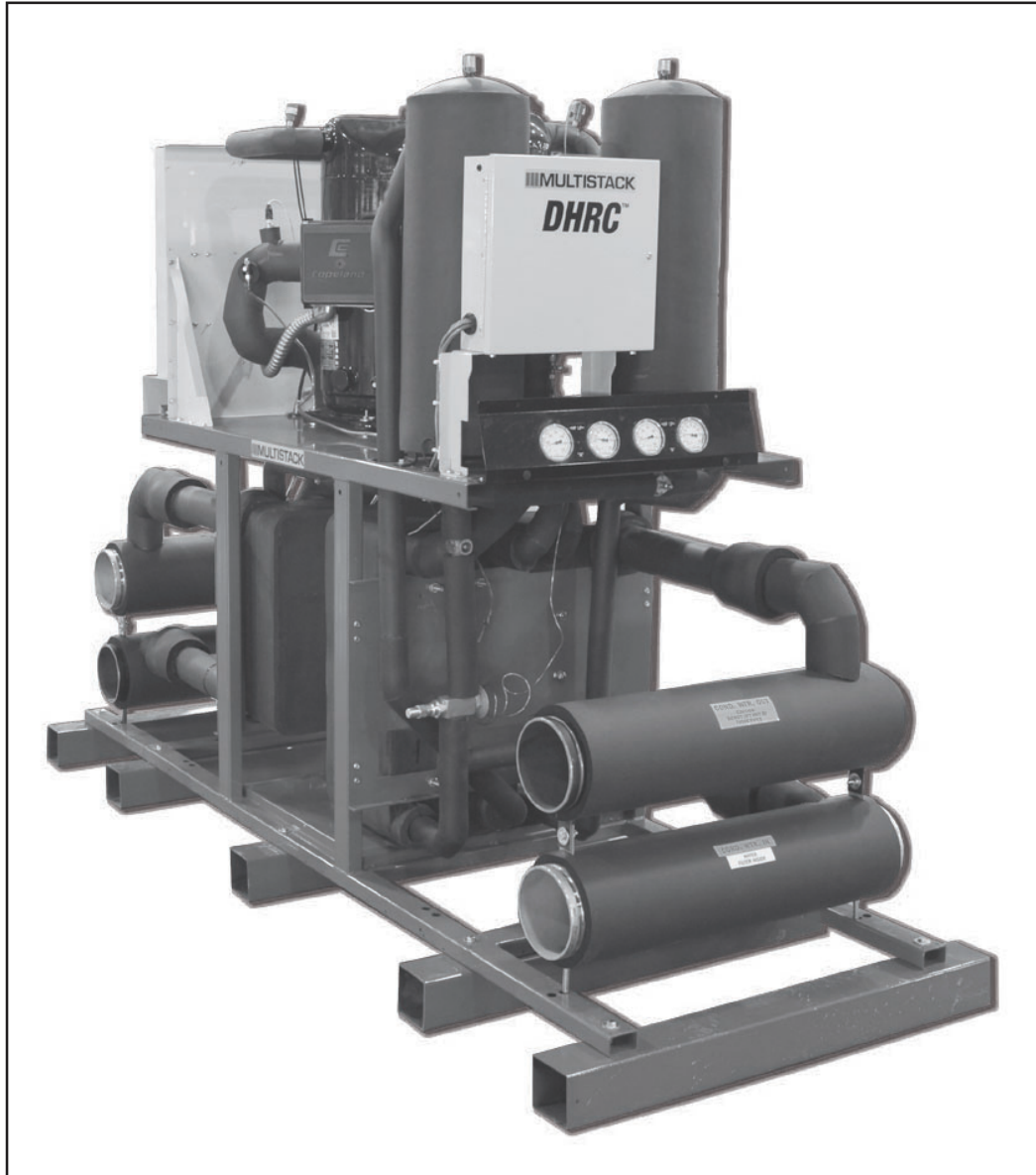
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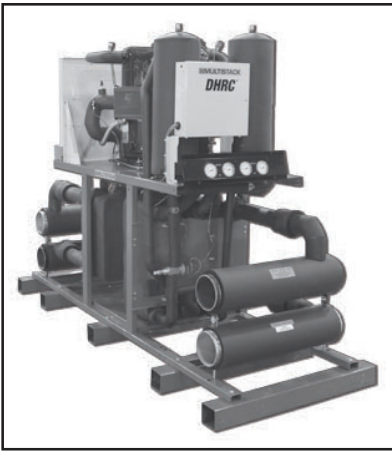
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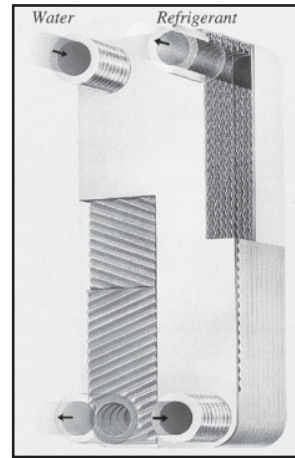


Preventative Maintenance



←
Braze plate heat exchangers make each MULTISTACK module highly efficient. This side view of module, without cabinetry, shows the location of the heat exchangers.

→
The evaporator system is shown in this illustration. A complex series of channels within each heat exchanger gives rise to vigorous turbulence, ensuring maximum heat transfer.



ANNUAL CLEANING PROCEDURE FOR SHUT-DOWN OF MULTISTACK CHILLERS

MULTISTACK Chillers utilize Heat Exchangers that differ greatly in design, construction and performance from other types of heat exchangers (e.g., shell and tube design), and have completely different fouling characteristics. For best performance, MULTISTACK recommends taking the first step in fighting fouling: PREVENTION.

FACTORS AFFECTING FOULING

- Temperature
- Velocity
- Surface Finish
- Turbulence
- Flow Distribution
- Water Quality

TYPES OF FOULING: Scaling and Particulate

Scaling

Scaling is caused by substances dissolved in the heat transfer medium which deposit on the heat transfer surface. To prevent or minimize scaling, a proper water treatment program designed by a competent water treatment professional is recommended.

Particulate

Particulate fouling is caused by solids in the heat transfer medium such as mud, silt, sand or other particles. Particulate fouling is affected by velocity, distribution of the medium, roughness of the heat transfer surface and the size of the particles. Particles can enter the heat exchanger through old rusty pipes or through the cooling tower.

To reduce particulate fouling, MULTISTACK recommends a good filtration system (i.e., strainers, sand filters, mechanical/centrifugal separators).

Note: A Teflon Coated Stainless Steel cartridge filter for the evaporator and condenser header is supplied with all MULTISTACK modules to remove particles. If required, other types of filtration systems can be added to meet specific filtration parameters.

LAMINAR VS. TURBULENT FLOW

Laminar

When a fluid passes through a tube the greatest velocity is at the center of the tube. The tube wall has no turbulence to keep particles in the fluid in suspension. These particles are allowed to precipitate out and collect on the tube wall which causes fouling of the heat transfer surface. Conventional types of heat exchangers are very sensitive to low velocities and easily get into the laminar region.

TURBULENT FLOW

The opposite of laminar is turbulent flow. Operating with turbulent flow is the best way to avoid fouling in the heat exchangers.

MULTISTACK Chillers dispense a high degree of turbulence to the fluid which keeps particles in the fluid in suspension, and actually performs a scouring action to help keep the heat transfer surface clean. This is accomplished by the unique design of the MULTISTACK Heat Exchanger. As the water passes through the channels it is constantly changing direction and velocity, disturbing the boundary layer and creating turbulent flow even at low velocities. Therefore, the MULTISTACK Modular Water Chiller will always operate with fully developed turbulence.

PREVENTIVE MAINTENANCE

Annual cleaning of the heat exchangers is recommended. If the chiller is shut down for non-cooling season, the following cleaning procedure should be performed at time of shut down:

1. Isolate chiller (both condenser and chilled water circuits).
2. Drain chiller.
3. Backflush chiller with water to remove foreign material.
4. Fill chiller with clean water.

WARNING: Do not use hydrochloric or sulfuric acid for cleaning any MULTISTACK Heat Exchangers. Make sure any chemical used are compatible with copper and stainless steel.

NOTE: Operating conditions may indicate more frequent cleaning is required. A rise in discharge pressure to above 420 psi (at normal condenser water temperature) or a reduction in evaporator heat transfer, low suction pressure, and low chilled water temperatures are examples of such indicators.

If the above procedure does not restore normal operating conditions, consult the MULTISTACK Heat Exchanger Cleaning Procedures.

CORROSION RESISTANCE

Corrosion is a complex process influenced by many different factors. Although stainless steels are considered corrosive resistance, AISI 316 and 316L stainless steel are not resistant to chloride concentrations above 300 parts per million (ppm). MULTISTACK Heat Exchangers are made of stainless steel plates brazed together with copper (99.9%).

CAUTION: Knowing the chloride content of your supply water is essential. A qualified water treatment professional should test your water for chloride levels and treat the water accordingly.

CAUTION: Chloride concentrations above 300 ppm will damage stainless steel heat exchangers.

CAUTION: Do not add any chemical to the water without consulting with a water treatment professional to make sure that treatment is compatible with all materials in the system including copper and stainless steel. Do not use sulfuric or hydrochloric acid.

| MULTISTACK TROUBLESHOOTING GUIDE | |
|---|--|
| SOURCE OF CONTAMINANTS | POSSIBLE SOLUTION |
| Water Impurities <ul style="list-style-type: none"> • Oil • Oil film build-up in the condenser or evaporator will reduce the transfer. • Chlorides • Chlorides entering the condenser or evaporator will corrode the brazed plate heat exchangers. • pH-Level • High acid levels entering the condenser or evaporator will cause corrosion. • Calcium • Calcium build-up in the condenser will reduce the heat transfer, as well as water flow through the system. | <ol style="list-style-type: none"> 1. Organic materials can be removed with detergent cleaning. 2. Maintain chloride levels below 300 ppm. 3. pH levels should be maintained between 7 and 9. 4. Inorganic contaminants can be removed by mild cleaning with phosphoric or sulfamic acid (e.g. Nu-Calgon Imperial Scale Remover Part Number 4360-84). DO NOT USE HYDROCHLORIC OR SULFURIC ACID 5. Have a water treatment contractor test your water and recommend a proper treatment plan. 6. Make sure the contractor is familiar with the components of the system (e.g., 316 stainless steel heat exchanger, and copper brazing material). |
| System Impurities <ul style="list-style-type: none"> • Rust • Pipe Scale • Welding Slag and Other Debris • Internal contaminant present in the water pipes can enter the MULTISTACK condenser or evaporator, plugging up the filters and ultimately the heat exchangers. | <ol style="list-style-type: none"> 1. When installing a new chiller, acid wash the condenser and evaporator water loop system before connecting the water pipes to the MULTISTACK unit. 2. During normal system operation, observe the discharge pressure and clean filters if head pressures approach 450 psi (high pressure cut out trips at 475 psi). |
| Cooling Tower Impurities <ul style="list-style-type: none"> • Grass • Algae • Tower Fill • Air-born Soot and Dirt • Insects • Cottonwood Seeds • Construction Debris • External contaminants enter the condenser of the MULTISTACK module through the cooling tower. | <ol style="list-style-type: none"> 1. A filter (polyester or wire mesh) over the air inlet to the cooling tower will help prevent external contaminants from entering the cooling tower. 2. Drain and clean cooling towers as required. 3. Whenever possible, avoid placing cooling towers in close proximity to trees, smoke stacks or outside lights. |



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MULTISTACK has designed the 151A Heat Exchanger Cleaning Kit. This cleaning kit allows the customer to quickly and efficiently clean both the condenser and evaporator (approximately 50 minutes per heat exchanger).

Heat Exchanger

Cleaning Procedures

Cleaning the MULTISTACK stainless steel brazed plate heat exchanger can be done using FlushGun™ with and Acid Flush or Detergent Soak. Each solvent offers an advantage for removing specific types of debris.

Acid Flush

- Carbonates
- Sludge
- Rust

Detergent Soak

- Dirt and Sand Particles
- Fibrous Materials
- Grease
- Plastics

WARNING: Do not use hydrochloric or sulfuric acid for cleaning any MULTISTACK Heat Exchangers. Make sure any chemicals used are compatible with copper and stainless steel.

The MULTISTACK Heat Exchangers should always be cleaned from the outlet to inlet, by backflushing the particles from the corrugated passages.

1. Victaulic Coupling
2. Remove Condenser Headers
3. Remove Evaporator Headers

PREPARING CHILLER FOR CLEANING

1. Disconnect power to chiller.
2. Isolate Chilled Water Loop by closing the condenser and evaporator isolation valves.
3. Remove end caps and drain the water from the condenser or evaporator (Figure 1).

CAUTION: Be careful not to let the electrical connections get wet. Remove the VICTAULIC COUPLINGS and HEADERS (Figure 1).



Figure 1, Removing header from heat exchanger.

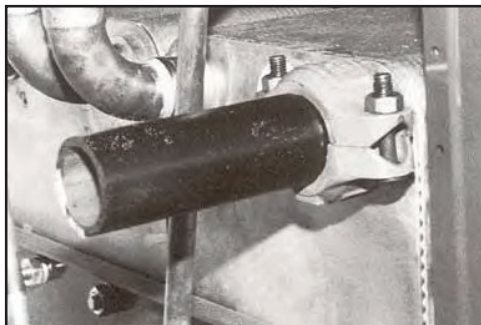


Figure 2, 6" Pipe connection.

NOTE: Install 6" long pipe to condenser or evaporator inlet, using one victaulic coupling and gasket that you removed from unit (Figure 2).

PREPARE SOLVENT

Detergent

Dish soap and hot water (140° F)

CAUTION: When cleaning difficult types of debris (i.e., grease), allow heat exchanger to soak in detergent 1 ½ hours.

Acid

Phosphoric or sulfamic acid such as Nu-Calgon Imperial Grade Scale Remover part number 4360-84. Prepare acid solvent according to the chemical manufacturers' directions. If further assistance is required, call Multistack, Inc.

CAUTION: When circulating solutions heated to temperatures above 128° F, the module high pressure switches will open. They will need to reset before starting.

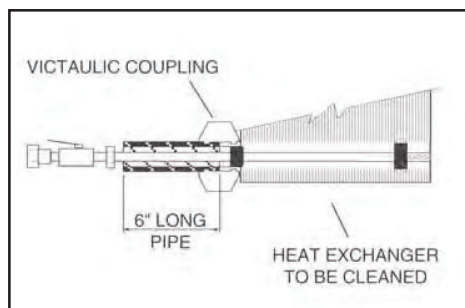
WARNING: Do not use hydrochloric or sulfuric acid for cleaning any MULTISTACK Heat Exchangers. Make sure any chemicals used are compatible with copper and stainless steel.

USING FLUSHGUN TO CLEAN INDIVIDUAL HEAT EXCHANGERS

FlushGun kits are available in different styles, depending on the heat exchanger model. To obtain the correct FlushGun kit, simply provide MULTISTACK with the initial purchase order for your modular chiller. The correct kit will be sent to you.

FlushGun A

1. Connect hose to FlushGun A.



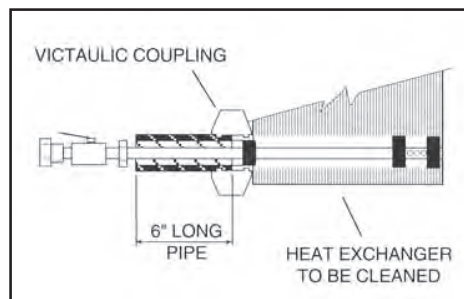
FlushGun A, position mock up.



Figure 3, Inserting FlushGun into heat exchanger.

2. Insert FlushGun A into the top outlet side opening of the condenser (bottom outlet of the evaporator) until it is against the back plate.
 - A. Tightening the compression nut clockwise until the tool cannot be removed. Open the hand valve slowly.
 - B. Apply a minimum of 60 psig water pressure for ten full minutes or until all foreign particles have been flushed.

Note: If 60 psig is not available, connect a separate pump to compensate.



FlushGun B, position mock up.

FlushGun B

1. Loosen the compression nut and remove FlushGun A.
2. Change hose connection to FlushGun B.
3. Insert FlushGun B until it is at the back of the heat exchanger (Figure 3).
4. Repeat Steps A & B.

FlushGun B

1. Loosen the compression nut and pull the tool out 1 ¼", measured at the back of the compression nut.
2. Repeat 1 ¼" increments until the entire heat exchanger has been cleaned. The 1 ¼" increments are marked on the FlushGun as 1, 2, 3, and 4.
3. Repeat Steps A & B.

FINAL CLEANING

1. Repeat each of the steps for every heat exchanger until the entire chiller has been flushed.
2. Once the chiller heat exchangers have been cleaned, take a standard garden hose sprayer and insert it into the inlet (condenser bottom/evaporator top) of the heat exchangers and apply full water pressure until all the debris has been dispersed from the plates.
3. Remove CARTRIDGE FILTERS from headers and clean with soap and wire brush.
4. Rinse CARTRIDGE FILTERS thoroughly with clean water.
5. Remove scale from the headers with a wire brush and replace them. Attach VICTAULICS and reinstall CARTRIDGE FILTER.
6. Backflush the entire chiller with clean water to ensure particles do not break free and enter the heat exchangers.

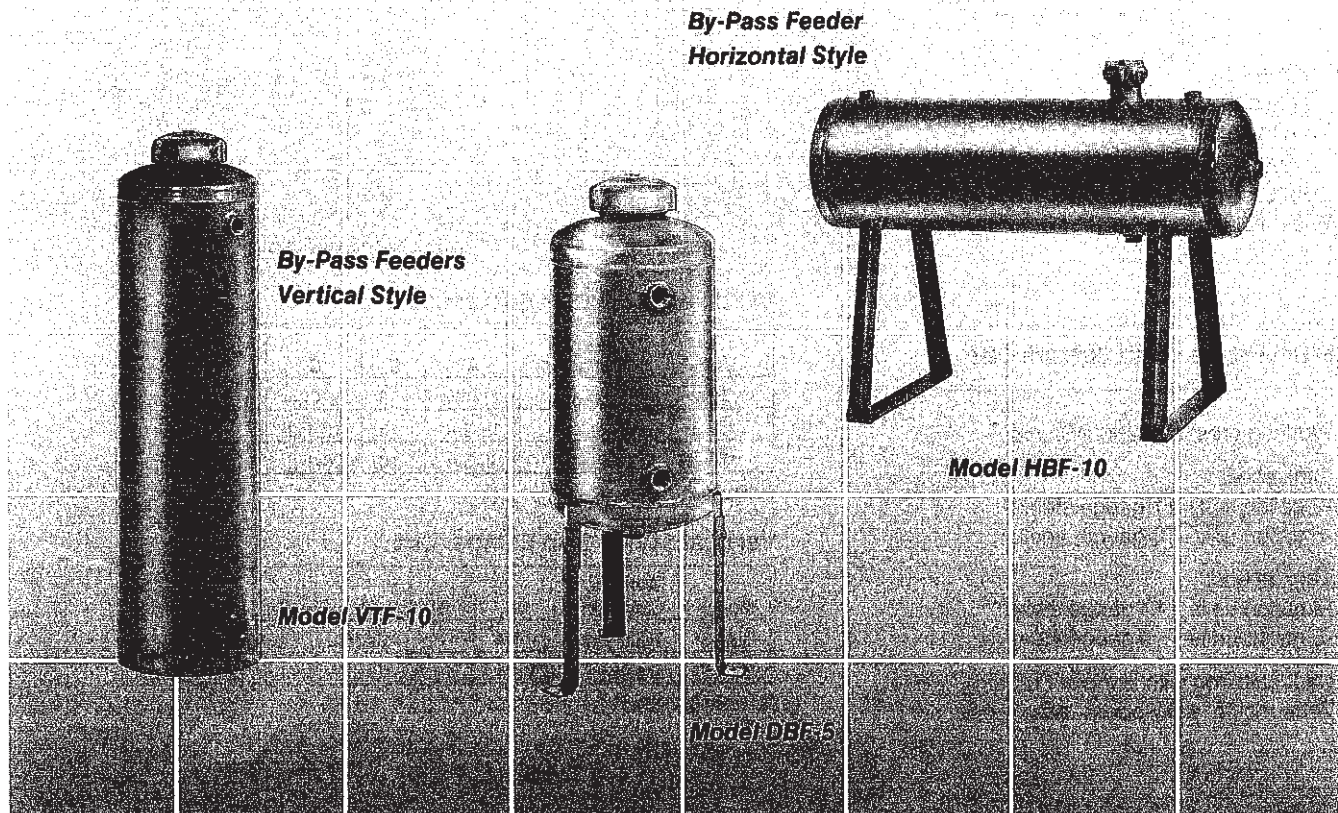
NOTE: See MULTISTACK Maintenance Instructions for information on fouling characteristics.



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BY-PASS FEEDERS

Neptune
CHEMICAL PUMP COMPANY



Neptune By-Pass Feeders are a convenient method of introducing treatment chemicals into closed circulating water systems.

Neptune By-Pass Feeders are ideal for use with chilled water treatment such as air conditioning systems or hot water treatment in heating systems or large engine water jackets.

Neptune offers 3 styles of By-Pass Feeders: A vertical style with dish bottom in, and a vertical style with dish bottom out or a high pressure horizontal style.

Vertical Style - Dish Bottom In

The 'VTF' series is the most popular and economical of the bypass feeders available from Neptune. This series features a wide mouth cap

manufactured by Neptune. This cap utilizes a square section 'O' ring seal and will **close easily by hand**.

Vertical Style - Dish Bottom Out

The 'DBF' series uses the same **easy close** cap described above. Advantages of this series are demountable leg extensions and a full bottom drain.

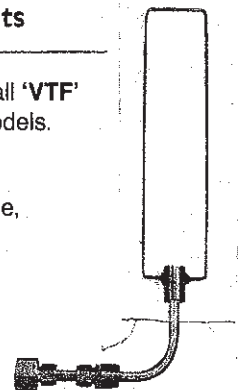
Horizontal Style - High Pressure

The 'HBF' series is a redesign of the old standard 'BF' series, a popular standard for over 2 decades. This series offers a 2" fill with threaded cap and four pipe connections for maximum piping flexibility.

Filter Bag Kits

Available for all 'VTF' and 'DBF' models.

Kit includes bag, bag frame, tubing and connectors.



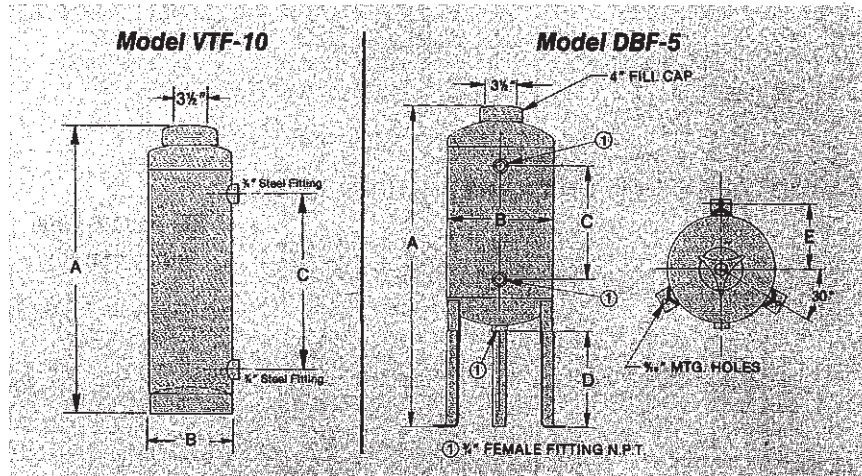
| Model | For Use On |
|--------|----------------|
| FBK-2 | VTF-2 or DBF-2 |
| FBK-5 | VTF-5 or DBF-5 |
| FBK-10 | VTF-10 only |

Addition of a filter bag allows By-Pass Feeder to function simultaneously as a side stream filter.

Specifications

Vertical Style - Dish Bottom In

- Working pressure: 200 PSI max.*
- Tank shell: 2 gallon unit - 11 gauge steel;
10 gallon unit - 10 gauge steel
- Tank heads:
- 2 gallon units - 11 gauge steel;
- 5 and 10 gallon units - 9 gauge steel
- Cap: cast iron with Buna N "□" ring
Wide mouth, easy open - easy close.



Vertical Style - Dish Bottom In

| Model | Approx. Capacity | A | B | C | Ship. Wt. |
|--------|------------------|--------|----|--------|-----------|
| VTF-2 | 2 Gallons | 21-1/4 | 6 | 12-3/4 | 23 lbs. |
| VTF-5 | 5 Gallons | 19-3/4 | 10 | 10-1/2 | 37 lbs. |
| VTF-10 | 10 Gallons | 35-3/4 | 10 | 26-1/2 | 60 lbs. |

(All sizes in inches)

Vertical Style - Dish Bottom Out

- Working pressure: 200 PSI max.*
- Tank shell:
- 2 gallon unit - 11 gauge steel;
- 5 gallon unit - 10 gauge steel
- Tank heads:
- 2 gallon units - 11 gauge steel;
- 5 gallon units - 9 gauge steel
- Cap: cast iron with Buna N "□" ring
Wide mouth, easy open - easy close.

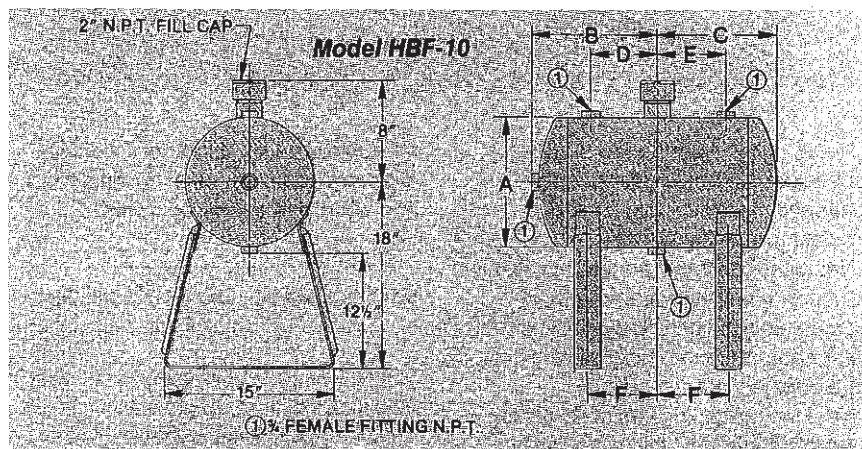
Vertical Style - Dish Bottom Out

| Model | Approx. Capacity | A | B | C | D | E | Ship. Wt. |
|-------|------------------|--------|----|--------|-------|-------|-----------|
| DBF-2 | 2 Gallons | 31-1/4 | 6 | 12-3/4 | 8-5/8 | 4-1/8 | 23 lbs. |
| DBF-5 | 5 Gallons | 29-3/4 | 10 | 10-1/2 | 8 | 6-1/8 | 38 lbs. |

(All sizes in inches)

Horizontal Style - High Pressure

- Working pressure: 250 PSI max.*
- Tank shell:
- 5 gallon unit - 10 gauge steel;
- 10 gallon unit - 10 gauge steel
- Tank heads:
- 5 gallon units - 9 gauge steel;
- 10 gallon units - 9 gauge steel
- Cap: cast iron floating disc seal



Horizontal Style - High Pressure

| Model | Approx. Capacity | A | B | C | D | E | F | K | Ship. Wt. |
|--------|------------------|----|--------|--------|-------|--------|--------|--------|-----------|
| HBF-5 | 5 Gallons | 10 | 10-1/4 | 9-1/4 | 5-1/4 | 5-1/4 | 5-1/2 | 12-1/2 | 41 lbs. |
| HBF-10 | 10 Gallons | 10 | 10-1/4 | 25-1/4 | 5-1/4 | 21-1/4 | 11-1/2 | 12-1/2 | 62 lbs. |

*At 200 °F.

Sold by:

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CHEMICAL PUMP COMPANY
Division of R.A. Industries, Inc.
Lansdale, PA 19446 • 215-699-8701
FAX: 215-699-0370



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For the Treatment of Water - Steam - Fuel Oil

515 Pennsylvania Avenue
Linden, New Jersey 07036

(908) 486-2000
Fax: (908) 486-0844

MATERIAL SAFETY DATA SHEET

Identity: Formula 600

Section I - Product Information

Manufacturer's Name: Scientific Boiler Water Conditioning Co. Inc.
Address: 515 Pennsylvania Ave., Linden, NJ 07036
Telephone Number for Information: (908) 486-2000
Date Prepared: 1/08
Product Class: Boiler Water Compound
Trade Name & Synonyms: Formula 600
C.A.S. Number: Mixture
D.O.T. Hazard Class: Corrosive
Proper Shipping Name: Cleaning Compound
UN: 'NA1760'
Hazard Rating: (none --> extreme) (0 --> 4)
Health - 2 Fire - 1 Reactivity - 1 Personal Protection - B

Section II - Hazardous Ingredients/Identity Information

| Component | C.A.S. # | ----- Exposure Limits ----- | | | VP mm HG |
|---------------------|------------|-----------------------------|---------------------|------|-------------|
| | | OSHA/PEL | ACGIH/LV | STEL | |
| Sodium Nitrite | 7632-00-0 | N.A. | N.E. | N.E. | 13 |
| Sodium Hydroxide | 1310-73-2 | N.A. | N.E. | N.E. | 0 |
| Borax | 1330-43-4 | N.E. | 1 mg/M ³ | N.E. | 0 |
| Sodium Tolytriazole | 64665-57-2 | N.E. | N.E. | N.E. | 0 |

All other ingredients are considered to be non-hazardous.

ALL Ingredients in this product are listed in the T.S.C.A. Inventory.

N.A. : Not Applicable, N.E. : No exposure limits established by OSHA or ACGIH

Section III - Physical/Chemical Characteristics

| | |
|-------------------------------|-----------------------------|
| Boiling Point: (Degrees F) | 212 |
| Specific Gravity: (Water = 1) | 1.33 |
| Weight per Gallon: | 11.07 pounds |
| Percent Volatile by Volume: | 52 |
| Vapor Density: (Air = 1) | Heavier Than Air |
| Evaporation Rate: | Faster Than n-Butyl Acetate |
| Appearance: | Clear White Liquid |

Section IV - Fire and Explosive Hazard Data

| | |
|-----------------------------------|-----------------|
| Flash Point (Method Used): | None |
| Flammability Class: | NA |
| Extinguishing Media: | No fire hazard. |
| Special Fire Fighting Procedures: | NA |
| Unusual Fire & Explosive Hazards: | NA |

Section V - Health Hazard Data

Permissible Exposure Level: No Limits for Sodium Nitrite Given By Major Manufacturers.

Effects of Overexposure: May Cause Skin And Eye Irritation. If Ingested, Flushed Face (Bluish), Uneven Heart Action, Tremors, Dizziness and Nausea.

Emergency & First Aid Procedures: In Case Of Contact With Skin Or Eyes, Flush With Water.

Ingestion: If Swallowed, Give Milk And Induce Vomiting. Give Oxygen. Call physician.

Eyes: Flush Eyes With Water For 15 Minutes.

Skin: Wash Thoroughly With Water.

Section VI - Reactivity Data

| | |
|-----------------------------------|--|
| Stability: | Stable |
| Conditions to Avoid: | Freezing |
| Incompatibility: | Incompatible With Acids And Strong Oxidizing Agents. |
| Hazardous Decomposition Products: | Will Form Nitrogen Oxides If Reacted With Above. |
| Hazardous Polymerization: | Will Not Occur |
| Conditions To Avoid: | NA |

Section VII - Spill or Leak Procedures**Steps To Be Taken In Case Material Is Released Or Spilled:**

Wash With Water .

Waste Disposal Method:

Flush With Water.

Section VIII - Special Protection Information**Respiratory Protection (Specify type):**

None

Ventilation :

None

Protective Gloves:

Rubber or plastic.

Eye Protection:

Goggles

Other Protective Equipment:

None

Section IX - Special Precautions**Precautions To Be Taken In Handling & Storage:** Do Not Store Near Acids,
Oxidizing Agents, Reducing Agents Or Unknown Materials.**Other Precautions:** Do Not Take Internally. Avoid Contact With Skin And Eyes.

Section X - Additional Regulatory Information**SARA Title III Section 313:**

This product does not contain toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right To Know Act of 1986 and of 40 CFR 372:

All information, recommended and suggestions appearing herein concerning our product are based upon tests and data believed to be reliable. However, it is the user's responsibility to determine the safety, toxicity, and suitability for his own use of the product described herein. Since the actual use by others is beyond our control, no guarantee, expressed or implied, is made by Scientific Boiler Water Conditioning Co. Inc. as to the effects of such use, the results to be obtained, or the safety and toxicity of the product, nor does Scientific Boiler Water Conditioning Co. Inc. assume any liability arising out of use, by others, of the product referred to herein. The information herein is not to be construed as absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations.
