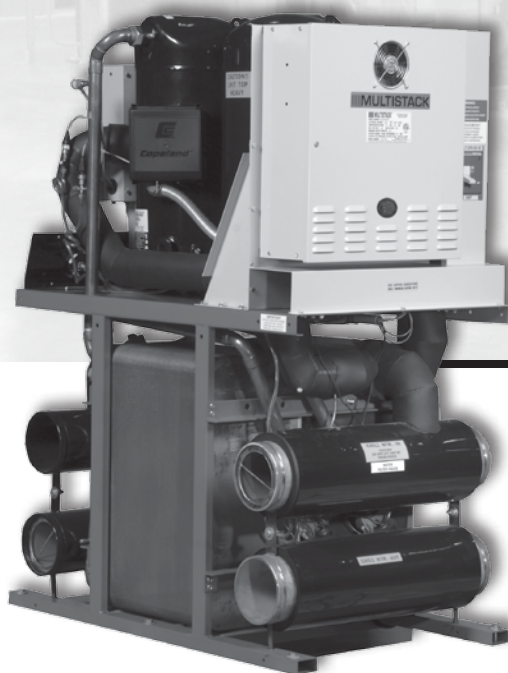


# **III<sup>®</sup> MULTISTACK<sup>®</sup>**

**Originators. Innovators. Never the Imitators.**



## **Water Cooled Chiller**

### **Operation Manual**

### **for R-410A Refrigerant**

**For Modules:**

**MS015XC-410A, MS020XC-410A, MS030XC-410A, MS050XC-410A, MS070XC-410A**

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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.

### Existing

MS 50 X 1 H 1 W 0 R410A

### New

MS	050	X	C or N	1	H	1	W	0	A	A	-410A
										Refrigerant	
										Condenser <sup>6</sup>	
										Evaporator <sup>5</sup>	
										AHRI Version - if applicable	
										Application <sup>4</sup>	
										Module Number ( 1 - single, 2 - multiple)	
										Voltage <sup>3</sup>	
										Configuration <sup>2</sup>	
										AHRI Certified (C - certified, N - Not certified)	
										Compressor Type <sup>1</sup>	
										Module Nominal Capacity (10 - 160 tons)	
Series											

<sup>1</sup> B: Bristol, C: Trane Cornerstone, R: Bitzer Screw, S: Trane Scroll, T: Danfoss Turbocor, Z: Copeland scroll (old elec), X: Copeland Scroll (ZP), A: Copeland Scroll (ZR)

<sup>2</sup> 1- Standard, 2- Total access, 3 - Evap extended headers, 4 - Cond extended headers, 5 - Both extended headers, V - others

<sup>3</sup> A - 208/3/60, L - 230/3/60, H - 460/3/60, C - 575/3/60, D - 200/3/50, E - 400/3/50, F - 380/3/60, S - 220/230/1/60, V - other

<sup>4</sup> 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

<sup>5</sup> A - Braze SS, B - Braze SMO, C - S&T copper, D - S&T cu-Ni, V - Other

<sup>6</sup> A - Braze SS, B - Braze SMO, C - S&T copper, D - S&T cu-Ni, E - Double wall brazed, 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 a signal to the Master Control that cooling is needed, compressors will begin to produce chilled water. A compressor's start is determined by the entering chilled water (ECHW) Upper set-point and the Variable set-point setting in the Master Control system variables menu. When the ECHW sensor senses that the chilled water temperature has dropped below the set-point, compressors will begin to cycle off.

Modules equipped with modulating butterfly valves on the chilled water side will be controlled from the leaving chilled water set-point (Lower set-point) in the System Variables. The module slave board(s) will send a 2-10 VDC output to each actuator to modulate the water valve to maintain Lower set-point. When a module is not running, valves will close to prevent bypassing of water with modules that are running. For Variable Flow applications you can keep one or more valves open at all times for minimum flow through the chiller. The valve that stays open will always be the lead compressor for that day, eliminating the need for an external bypass to be installed at the chiller. If modulating butterfly valves are used on the condenser side of each module, the valves will control to a discharge pressure setting (selected from) the Factory Setup menu. (This is also a 2-10 VDC output each module board sent to the valve actuator.) If the condenser pump cycles off while no modules are running, minimum flow doesn't need to be considered. If the condenser pump runs at minimum flow, the condenser bypass should be enabled in the factory set-up menu.

## 3.0 Water Treatment

Proper water treatment is essential to ensure the peak efficiency and performance of the chiller.

- To prevent any damage to the heat exchangers load-side water quality should be kept within the parameters shown below.
- DO NOT use of hydrochloric, sulfuric, and muriatic acids or household bleach as they can cause stress corrosion to the stainless steel in the heat exchangers. Use of these or other unapproved chemicals will void the Multistack warranty.

For installations where chlorides are high, please contact Multistack for optional molybdenum steel heat exchanger.

## Multistack Water Guidelines

- PH  $> 7 - < 9$
- TDS  $< 1000$  ppm (if glycol used this parameter will be exceeded)
- Hardness 30 - 500 ppm
- Alkalinity 30 - 500 ppm (if glycol used this parameter will be exceeded)
- Chlorides  $< 200$  ppm
- Sulphates  $< 200$  ppm

### 4.0 Flow Protection

Proof of chilled water and condenser water flow is required by the Master Control inputs. Paddle-type or Differential Pressure (DP) switches may be used. Switches can be supplied by Multistack as an option, otherwise they are to be field supplied and installed. Chillers purchased with chilled or condenser water pump modules have a DP switch installed across the pump to verify it is running. Multistack recommends a paddle-type switch be installed in the leaving water piping of the chiller using a differential pressure switch. Install it across the inlet and outlet water connections to the chilled and/or condenser water piping connections.

### 5.0 System Water Volume:

Chilled water systems remove the thermal gain from the process of cooling. A properly sized chilled water system will have enough time to properly control, respond to changes in load, and prevent short cycling of the chiller. To ensure the system water volume is adequate, a general rule of thumb is:

*7-10 gallons of water per ton*

*or*

*Acceptable Chilled Water Volume = Chilled Water Design GPM X 3*

In the event the system components can not hold the necessary chilled water volume, a properly sized chilled water storage tank should be added.

### 6.0 Condenser Water Temperature Control:

For installations where entering condenser water temperature could be lower than 65°F Multistack recommends the installation of a three-way tower bypass valve to maintain a minimum of 65°F entering condenser water temperature. This is based on a 10°F delta-T system.

### 7.0 Pressure Relief Piping and Refrigerant Monitoring:

Multistack modules utilize a small charge of refrigerant (typically .6 lbs per ton) so are often exempt from ASHRAE 15 Standard. Pressure relief valves are not standard on water-cooled modules, they must be special ordered if required by local codes.

### 8.0 Electrical Data

Field wiring should be done in accordance with all federal, state and local regulations. Breakers, fuses, wiring and wire size must be installed per the National Electric Code (NEC). Applied voltage to all Multistack chillers must be  $\pm 10\%$  of the stated unit nameplate voltage. The voltage imbalance between phases must not exceed 2%. According to NEMA Standard MG-1-1998, a 2% voltage imbalance will cause a current imbalance of 6 to 10 times the voltage imbalance. It is very important to keep the unbalance between electrical phases to a minimum.

Most Multistack chillers come with a single point of electrical connection (up to 500 Amps) that simplifies the installation. The main electrical conduit feeding the Power Junction Box needs to be fed from either the top, bottom, or left side of the panel when looking at the panel. Please note that there is a dedicated chiller ground in this panel that must reference a true earth ground.

Chillers requiring more than 500 Amps, will have multiple points of electrical connection (per 500 Amp requirement). See image 1.

#### 8.1 Optional Single Module Field Connection

For single module installations, the Power Junction Box can be deleted, but a PPM (Power Phase Monitor) must be installed. The main electrical feed can connect directly to the module circuit breaker. See image 2.

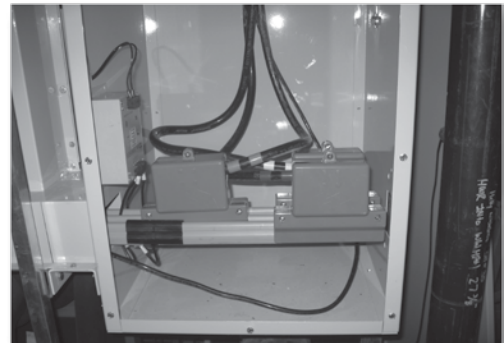


Image 1



Image 2



Image 3



## 9.0 Identification and Explanation of Components

### 9.1 Master Control Panel

Each chiller will have one (1) Master Control panel. The Master Control can be mounted on top of any of the module panels in the provided knockouts available. You can run the sensors, cables, and wiring into the point of connection at the bottom of the Master Control. The Master Control box can be tapped to wire flow sensors, interlock, and BAS connections. The master control box also has terminal strip inputs for flow switches, start/stop, alarm output, and power phase monitor built in. When shipped, the Master Control Panel will also contain the pLAN communication wire which is to be field installed by the start up technician.

There are four temperature sensors supplied by Multistack: enter chilled water, leaving chilled water, entering condenser water, leaving condenser water. These four sensors are intended to be installed in customer piping. See image 3, on page 4.

### 9.2 Module Control Boards and Low Voltage Panel

The module control boards communicate with the Master Control, sending individual module temperature and pressures to the master control. Each module has a switch labeled Auto/ Off/ Manual. Normal operation would be in the Auto mode. If there is a problem with the Master Control, the selector switch can be changed to Manual to control individual module leaving chilled water temperature which was pre-set through the Master Control. See image 4.

### 9.3 Module High Voltage Panel

The high voltage panel contains each compressor's contactor, circuit breaker, control relay and the module's transformer. External to the panel is the single-module isolation switch to isolate the entire module from the high voltage supply. See image 5.

### 9.4 Compressors, Sensors, Switches.

- Standard modules use two (2) scroll compressors with separate refrigeration circuits.
- Each compressor has a HP and LP transducer that send pressures to the module slave board as well as an HP switch with a manual reset button.
- Transducers are a 0-5V ratiometric type.
- Compressors have oil level sight glasses. Oil level should be at  $\frac{1}{8}$  -  $\frac{1}{4}$  full during operation.
- Each circuit will have its own Leaving Chilled Water Sensor as well as Refrigerant Suction Temperature Sensors.
- Compressor crankcase heaters are not standard on MS modules.

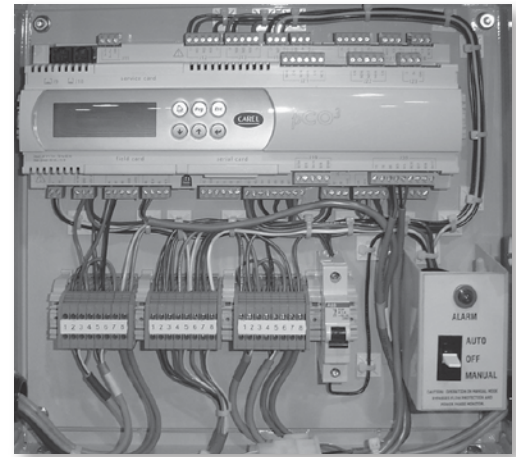


Image 4

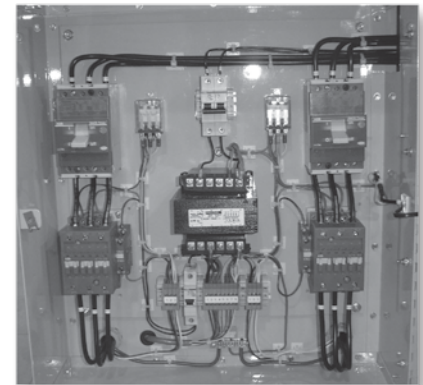


Image 5



Image 6

## 9.5 Chilled and Condenser Side Water Connections (Image 7)

- Water connections to the chilled and condenser side are standard 6" grooved pipes.
- The upper header on the Chilled Water side is Entering Water to the module.
- Bottom header is Leaving Chilled Water from the module.
- Entering water to the condenser is on the bottom.
- Leaving water from the condenser is on top.
- The Entering header on both sides contains a 30-mesh filter strainer to prevent debris from entering the brazed plate heat exchangers.
- This filter should be used as a final filter stage.
- Proper filtration before the module should be installed for easy access to cleaning, such as a 'Y' or a basket type of strainer. See image 7.

## 9.6 Expansion Valve, Subcooling, Liquid Line Sight Glass

- Each circuit on the module has a thermal expansion valve located between the water header pipes on the condenser side. During run testing at the factory valves are adjusted to maintain a 10-12 degree superheat. Superheat should be checked periodically to maintain this range.
- Subcooling should normally be within the 10-15 degree range. No external subcooler is used.
- Liquid Line Sight Glass show green on the indicator bulb if no moisture is present in the refrigerant circuit. A yellow indicator indicates potential moisture.
- Sight glasses should show full during normal operation.
- Flashing in the sight glass indicates possible under charge of the circuit.
- See Nameplate Data for refrigerant charge.

## 9.7 Variable Flow and Power Actuated Butterfly Valves

To accomplish variable flow on the chilled water or condenser water side, modules should be ordered with power actuated butterfly valves. See image 8.

### Note:

1. The footprint of an array of modules will increase as the valves add length.
2. Multistack recommends controlling the chiller pumps to maintain pressure differential across the chiller, not the system. Control based off of system pressure will provide erratic results.
3. The minimum flow bypass of the chiller for the system can be programmed in the master controller.

## 9.8 Optional Manual Isolation Valves

Manual isolation valves may be ordered with modules. Like the power actuated butterfly valves, the length footprint may increase with isolation valves. Isolation valves are intended to manually isolate water flow to heat exchangers. As valves can seize over time it is a good idea to exercise isolation valves as part of annual maintenance.

## 9.9 Optional Hot Gas Bypass

As an option hot gas bypass valves can be provided for each circuit. The pilot activated Sporlan HGBE-8 is used. The HGBE-8 is adjustable from 75 to 150 psi with a Multistack standard setting of 110 psig. A screw on the pilot valve handles the adjustment. Turning clockwise will increase the valve setting and counterclockwise rotation will decrease the valve setting. See image 9.

## 9.10 Nameplate

Module Nameplates are located on "B" side compressors electrical control box door. Nameplates include phone and address for Multistack, model and serial number (very important to supply when calling for service parts or technical support), refrigerant type and charge, and electrical data. See image 10.

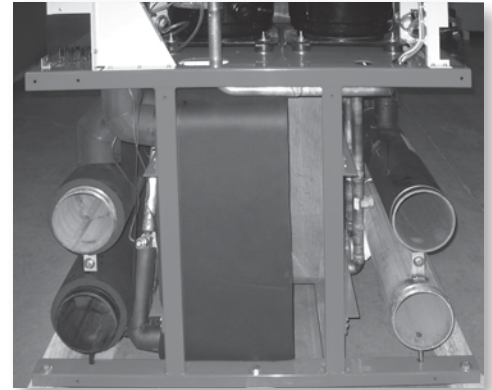


Image 7

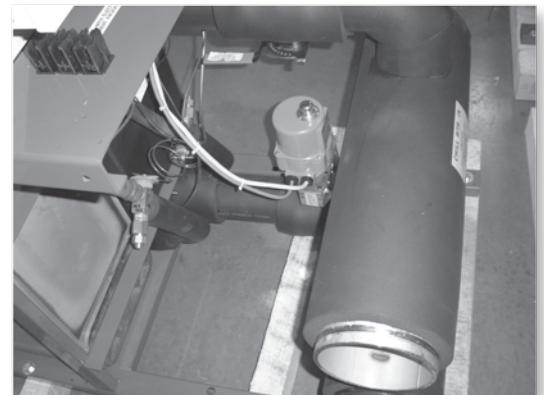


Image 8



Image 9

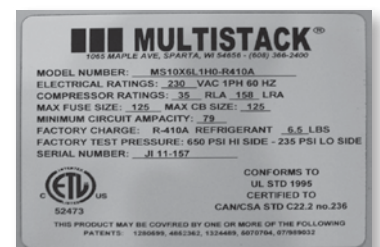


Image 10

## **10.0 Factory Setup / Commissioning Information:**

By going to the System Variables Menu and selecting Factory Settings you can access the program type and other setup information. This setup is to be done by the Authorized Startup Technician. When shipped the Setup parameters will be set to default. Actual site conditions need to be configured at startup. To change these settings you must enter a password when prompted. The password is available to Authorized Service Technicians by calling Tech Support at Multistack (608-366-2400).

The Standard program should be used on applications where no glycol is present in the chilled water side. In this mode the chilled water temp cutout is 34°F.

The Low Temp program should only be used in applications that have a minimum of 25% glycol in the chilled water loop. Cutout on low water temp in this mode is 20°F. Suction temperature cutout drops to 15°F.

Refrigerant Type: R410a.

Condenser Water Set-point: If Power Actuated Butterfly Valves are used on the condenser side, this value should be set for the desired discharge psig you want to maintain. Depending on the condenser water inlet temperature this will adjust the valve percent open to maintain psig.

Variable Flow: Select ENABLE if doing variable flow on the chilled or condenser side or DISABLE if not. To do variable flow, water control valves must be installed on each module between the water header pipe and heat exchanger.

Bypass: Select ENABLE to leave the valve on the lead module open for minimum flow bypass. Select CHILLED WATER or CONDENSER WATER bypass. If no valves are installed on the module keep this variable in the DISABLE MODE.

For information on basic control setup of the modules see the Comput 600 User manual.

## **11.0 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 help diagnose potential problems in the system.

## **12.0 Pressure Readings**

The operating suction and discharge pressures in the system are directly related to water flow, condenser temperature, chilled water set-point, and the cleanliness of the system. Standard operating conditions with 95°F LCW with 45°F LCHW are discharge pressure at 325 psig (102°F saturated) and suction pressure at 114 psig (38°F saturated).

All water-cooled modules have a high pressure cutout safety device and a backup HP cutout switch. The HP cutout is 475 psig for a standard water-cooled module with R-410A.

Each MS module also has a low pressure safety cutout. The LP cutout is controlled by a setting in the program of the module. The LP cutout for modules with R-410A is 50 psig.

If circuits are showing HP faults, first check to see that the cooling tower fan is operating. Next, verify proper water flow to the brazed plate heat exchanger and confirm the filters are clean and free flowing.

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.

## **13.0 Strainer Cleaning, Heat Exchanger Cleaning**

All Multistack modules have a 30-mesh filter strainer in the condenser and evaporator inlet headers. The purpose for the filter strainer 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 pre-determined time for cleaning the strainer 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 building up in the last modules to receive water. Multistack modules come with an auto blow down (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 strainers 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 create nuisance HP (high pressure) faults. By checking the pressure differential between the inlet and outlet of the condensers, it can be determined if the strainers are contaminated. Refer to the MS 15-70X Product Data Catalog for correct pressure drop of your model. For an MS70X module with a 10° F Delta T, the condenser side pressure drop should be 17' / 7.4 psi, for chilled water 16' / 7 psi. To keep HP faults from repeating, the strainers will need to be pulled and cleaned. If HP faults still occur after cleaning the strainer 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 the Heat Exchanger Cleaning Bulletin available from Multistack.

(Cont'd on next page...)

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 grooved fitting 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 the crossbar 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 a hose, power washer, or wire brush as needed and re-install. 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 grooved fitting clamps previously removed.
7. Open the ¼" petcock bleed valves on the pipe stubs.
8. Fill the system by opening the bottom butterfly / gate valve and filling from the bottom up. Close the ¼" petcock valves and open the top butterfly / gate valve after the air has been bled from the system.
9. Start the condenser pump. Bleed any remaining air in the system once the pump has started and 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 may be caused by a low flow condition or too low (the set-points may be too low) in the master control. If these possibilities are eliminated the evaporator heat exchangers may need cleaning.

#### **14.0 Compressor Oil Level**

All compressors on water-cooled modules have an oil level sight glass on each compressor. Each module is run tested and has the oil level set at the factory. Following are factory oil level settings and recommendations.

R-410A scroll compressors are single stage and oil level is set at ⅛ – ¼ full sight glass.

The compressor uses POE oil. Use Copeland type 998-E022 or Nu Calgon 32-3MA

Factory oil charge volume for each compressor can be found by calling Multistack service at (608)366-2400.

#### **15.0 Refrigerant Charge / Evacuation**

All water-cooled modules are factory charged to recommended refrigerant volumes. 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 proper charge on water-cooled machines the circuit should be charged until the sight glass clears.

<b>Model</b>	<b>Refrigerant lbs. per circuit</b>	<b>Oil Charge Per Circuit (in Pints)*</b>
MS015X	6.5	3.5
MS020X	6.5	6.9
MS030X	10	6.9
MS050X	16	14.4
MS070X	21	13.3

\* Based on Copeland compressors

#### **16.0 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 representative.

#### **17.0 Superheat / Subcooling**

Multistack uses a mechanical-type expansion valve on all modules. Clockwise adjustment of the valve increases superheat.

On water-cooled modules, superheat is set at 10°-12°F during the factory run test.

Subcooling is necessary in the system to prevent flash gas as the refrigerant enters the expansion valve. Multistack condensers are sized so that subcooling of the liquid refrigerant will take place without a separate subcooler. The general range of subcooling is 10°-20°F.



## **18.0 Annual Maintenance**

Annual maintenance requirements for Multistack Chillers involve proper shut-down of the machine and cleaning of the heat exchangers. The Preventative Maintenance bulletin and Heat Exchanger Cleaning Procedures bulletin 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 for more details.

Other annual checks that should be done are:

- A check of all electrical components (contactors, fuses, relays, etc...) should be performed yearly, in order to identify 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.

## **19.0 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. 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 problem. 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.
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 proper refrigerant charge on nameplate data of unit.
6. Run the system 2-3 weeks with burnout filter core. Replace with standard core drier

## **20.0 Heat Exchangers**

Multistack uses brazed plate stainless steel heat exchangers for all condensers and evaporators. Proper water treatment is essential to heat exchangers and, especially, condensers as they 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 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 grooved fitting connections and header pipes for the module with the suspected leak.
3. Place some type of expandable 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 expandable 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. Isolate the chiller and drain water from the side to be worked on.
3. Remove the 6" water header pipes by unbolting the Victaulic couplings.
4. Support the under side of the defective heat exchanger and the other circuits heat exchanger if applicable. A 2x4 and 1x4 should fit perfectly underneath.
5. 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 damaged exchanger.
7. Position the new heat exchanger and 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, retighten.
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 moisture from 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.

## 21.0 Troubleshooting Water-Cooled Modules

MS modules use the Carel PC03 master control. The user manual for the PC03 controller is supplied with the submittal package. 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	Solution	Fault	Solution
<b><u>No Display on Master Module</u></b>	<ul style="list-style-type: none"> <li>• Check main disconnect for power</li> <li>• Check circuit breakers in module</li> <li>• Check transformer in modules</li> <li>• Check for 24V at J1 on board</li> </ul>	<b><u>100% Demand, chiller won't load</u></b>	<ul style="list-style-type: none"> <li>• Turn chiller on</li> <li>• Check sensors</li> <li>• Check load limit setting in system variables</li> </ul>
<b><u>EX 1,2, Interlock</u></b>	<ul style="list-style-type: none"> <li>• Check appropriate interlock component</li> <li>• Check jumpers on TB11 in master control</li> </ul>	<b><u>Excessive Cycling</u></b>	<ul style="list-style-type: none"> <li>• Check VSP setting in system variables</li> <li>• Check entering CHW sensor location</li> <li>• Look for system problem (low water Volume, low load)</li> </ul>
<b><u>EX 4 Interlock</u></b>	<ul style="list-style-type: none"> <li>• Check for proper rotation, phasing</li> <li>• Check PPM device</li> </ul>	<b><u>High Discharge Pressure (HP)</u></b>	<ul style="list-style-type: none"> <li>• Check strainers in condenser headers</li> <li>• Check condenser water flow</li> </ul>
<b><u>Waiting For Chilled Water Flow</u></b>	<ul style="list-style-type: none"> <li>• Check CHW pump</li> <li>• Check flow switch operation</li> <li>• Check filter strainers</li> <li>• Check TB11 inputs #3 - #7</li> </ul>	<b><u>Low Suction Pressure (LP)</u></b>	<ul style="list-style-type: none"> <li>• Check refrigerant charge / leaks</li> <li>• Check expansion valve</li> </ul>
<b><u>Waiting For Condenser Water Flow</u></b>	<ul style="list-style-type: none"> <li>• Check CW pump</li> <li>• Check flow switch operation</li> <li>• Check filter strainers</li> <li>• Check TB11 inputs #3 - #8</li> </ul>	<b><u>Low Suction Temperature</u></b>	<ul style="list-style-type: none"> <li>• Check suction sensor</li> <li>• Check set-points in system variables</li> <li>• Check for flow restriction</li> </ul>
<b><u>Low Chilled Water Temp</u></b>	<ul style="list-style-type: none"> <li>• Check LCHW sensor</li> <li>• Check set-points in system variables</li> <li>• Check for flow restriction</li> </ul>	<b><u>Communication Error</u></b>	<ul style="list-style-type: none"> <li>• Check settings in system variables</li> <li>• Check cables at J11 comm ports</li> <li>• Check dip switch settings</li> </ul>
<b><u>No Demand</u></b>	<ul style="list-style-type: none"> <li>• Check entering CHW sensor</li> <li>• Check set-points in system variables</li> <li>• Check sensor location</li> </ul>	<b><u>Circuit Fault</u></b>	<ul style="list-style-type: none"> <li>• Check components in control circuit</li> <li>• Check wire crimps in control circuit</li> <li>• Check ratio of HP to LP</li> </ul>
<b><u>100% Demand all the time</u></b>	<ul style="list-style-type: none"> <li>• Check entering CHW sensor</li> <li>• Check set-points in system variables</li> </ul>	<b><u>P Lan Error</u></b>	<ul style="list-style-type: none"> <li>• Check cables at J11 comm ports</li> <li>• Check for possible power issues</li> </ul>

### III MULTISTACK Chiller Daily Log Sheet

<b>Job Name:</b>						
<b>Job Number:</b>						
<b>Module Serial Numbers:</b>						
<b>Date:</b>						
	<b>Status</b>	<b>Suct. Press</b>	<b>Head Press</b>	<b>Suct. Temp</b>	<b>LoChw Temp</b>	<b>Fault (if any)</b>
<b>Comp #1</b>						
<b>Comp #2</b>						
<b>Comp #3</b>						
<b>Comp #4</b>						
<b>Comp #5</b>						
<b>Comp #6</b>						
<b>Comp #7</b>						
<b>Comp #8</b>						
<b>Comp #9</b>						
<b>Comp #10</b>						
<b>Comp # 11</b>						
<b>Comp #12</b>						
<b>System</b>	<b>Ent. Chw</b>	<b>Lvg. Chw</b>	<b>Ent CW</b>	<b>Lvg. CW</b>	<b>Demand</b>	<b>Capacity</b>
<b>System</b>	<b>Upset</b>	<b>LoSet</b>	<b>VSP</b>	<b>Load Limit</b>	<b>Tdiff</b>	<b>Index</b>
<b>Comments:</b>						
<b>CHW P Drop</b>		<b>CW P Drop</b>				

## ***Environmentally Friendly Refrigerants***

### **R-410A and R-134a**

Refrigerant R-410A and R-134a are widely available, safe, and environmentally friendly refrigerants. R-410A is available in virtually all Multistack systems making hot water up to 140°F and R-134a is available in machines making hot water up to 180°F. Good environmental choices!

### **Environmental Focus**

In addition to providing products to deliver reliable comfort and low operating cost, Multistack's products can also reduce your environmental footprint. We are committed to developing and manufacturing cooling and heating products that can reduce fossil fuel consumption and operate on the refrigerants designed to protect the environment. Multistack Water-Cooled chillers and efficiency improvements across our product line are the result of this focus.

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## ***Originators...***

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

## ***Innovators...***

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

## ***Never the Imitators...***

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



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