

Multiple Circuit Horizontal and Vertical Water Source Heat Pumps With R-410A

Installation, Operation and Maintenance Manual

 Mammoth®

Sizes: 084 to 144 — Horizontal
084 to 288 — Vertical
Model: M Vintage



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M Vintage Vertical
Size 084 to 288



M Vintage Horizontal
Size 084 to 144

Model Nomenclature

<u>F</u>	<u>-084-</u>	<u>V-</u>	<u>H-</u>	<u>M</u>
<u>Voltage</u>	<u>BTU/hr Cooling</u>	<u>Unit Type</u>	<u>Temperature Range</u>	<u>Vintage</u>
F = 208-230/60/3	084 = 84,000	V = Vertical	H = Standard Range	
G = 460/60/3	096 = 96,000	H= Horizontal	L = Low Temp Operation	
J = 380-415/50/3	120 = 120,000			
K = 575/60/3	144 = 144,000			
	168 = 168,000			
	192 = 192,000			
	240 = 240,000			
	288 = 288,000			



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Transportation and Storage

Upon receipt of the equipment, check for visible damage. Make a notation on the shipper’s delivery ticket before signing. If there is any evidence of rough handling, immediately check for concealed damage. If any damage is found, notify the carrier within 48 hours to establish your claim and request their inspection and a report. Then contact the Mammoth Service department at (952) 358-6618 or info@mammoth-inc.com for a warranty claim number.

Do not stand or transport the unit on end. In the event that elevator transfer makes up-ended positioning unavoidable, absolutely ensure that the unit is in the normal upright position for at least 24 hours before operating.

Temporary storage at the job site must be indoors, completely sheltered from rain, snow, etc. High or low temperatures naturally associated with weather patterns will not harm units. Excessively high temperatures, 140°F (60°C) and higher, may deteriorate certain plastic materials and cause permanent damage.

Installation

General

IMPORTANT:

Mammoth water source heat pumps should be installed only by qualified personnel, experienced in the installation of this equipment and related systems. Read these instructions carefully before unpacking, installing and operating this unit

1. To prevent damage, this equipment should not be operated for supplementary heating and cooling during the construction period.
2. Inspect the unit for any specific tagging numbers indicated by the factory per a request from the installing contractor.
3. Check the unit nameplate for the size and voltage rating and confirm against the plans that the unit is being installed in the correct location.
4. Verify the installation location with the piping, sheet metal and electrical contractors prior to installation

5. Verify all clearances are available for the unit prior to installation.
6. Note the location and routing of water piping, condensate drain piping, and electrical wiring. The locations of these items are clearly marked on submittal drawings.
7. Mammoth recommends the unit be covered during construction to protect components from dust and other harmful material. This is critical while spraying fireproofing material on bar joists, sandblasting,

NOTE:

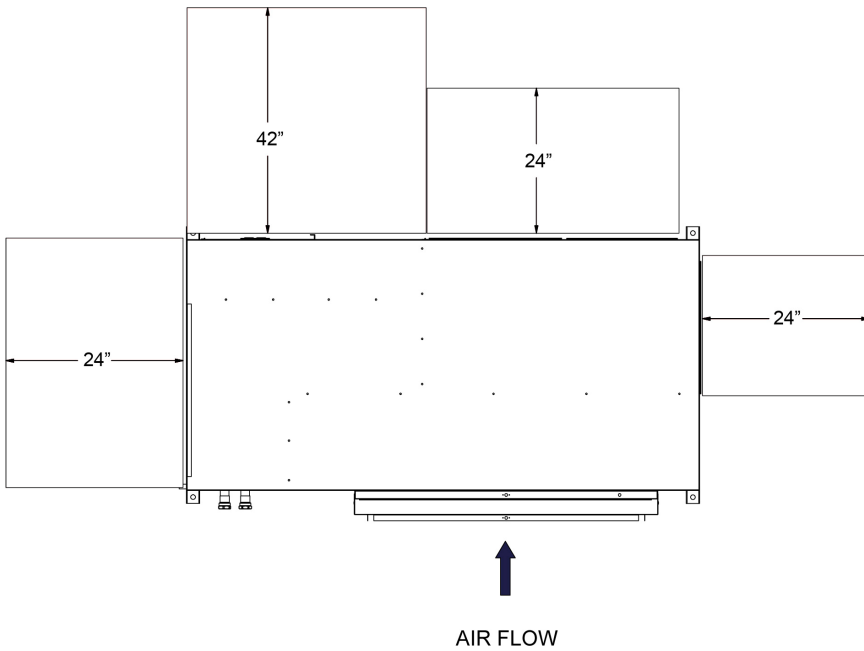
Check the unit name plate for correct voltage with the plans before installing the equipment. Make sure all electrical ground connections are made in accordance with local code.

Unit Location

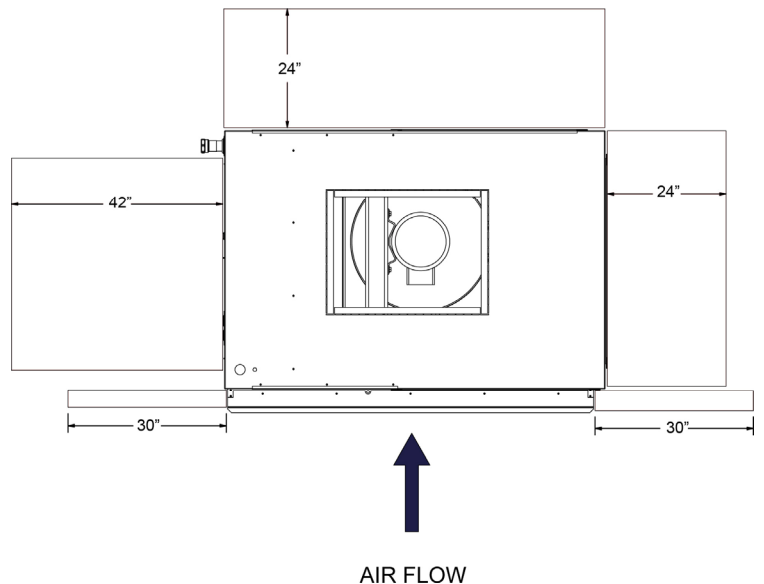
Locate the unit in an area that allows for easy removal of the filter and access panels. The diagrams to the right show minimum suggested clearances. Any additional clearances would be beneficial, but not always necessary. Units need to be accessed from three sides: two panels for the blower, two electrical access doors and one for the compressor compartment.

The requirements on any specific unit may increase or be reduced depending on several factors such as maintenance requirements and mechanical or electrical installation codes. Horizontal unit filters are removed from the bottom with an option for side removal. Vertical unit filters slide out of the left or right side (quad-circuit units must be removed from each side). If return air is not ducted, enough clearance will be required to provide for adequate airflow.

Horizontal Service Clearances



Vertical Service Clearances



Ductwork and Attenuation

Discharge ductwork is normally used with the M-vintage horizontal and vertical multiple circuit units. Return air ductwork may also be required.

All ductwork should conform to industry standards of good practice as described in the ASHRAE Systems Guide.

The discharge duct system will normally consist of a flexible connector at the unit connection, a transition piece to the full duct size, a short run of duct, and elbow with vanes, and a trunk duct teeing into a branch duct with discharge diffusers. The transition piece must not have angles totaling more than 30° or severe reduction in airflow performance can result.

Do not connect the full duct size to the unit. Use a transition piece sized according to the discharge collar on the unit to get to the full duct size. With metal duct material, the sides of only the elbow and entire branch duct should be internally lined with acoustic fibrous insulation for sound attenuation. Glass fiber duct board material is more absorbing and may permit omission of the canvas connector.

The ductwork should be laid out so that there is no line of sight between the unit discharge and the distribution diffusers.

Do not use sheet metal screws directly into the unit cabinet for connection of supply or return air ductwork, especially return ductwork which can hit the drain pan or the air coil.

Ventilation Air

Outside air may be required for ventilation. The temperature of the ventilation air must be controlled so that the mixture of outside air and return air entering the unit is within application limits. It is typical to close off the ventilation air system during unoccupied periods (i.e. night setback).

The ventilation air system is typically a separate building subsystem with distribution ductwork. Simple introduction of the outside air into each return air plenum chamber reasonably close to the unit air inlet is recommended. Do not duct outside air directly to the unit inlet. Provide sufficient distance for the thorough mixing of outside and return air.

Supply Piping

1. All heat pumps should be connected to supply and return piping in a two-pipe reverse return configuration. A reverse return system is inherently self-balancing and requires only trim balancing where multiple quantities of heat pumps with different flow and pressure drop characteristics exist in the same loop. Check for proper water balance by measuring differential temperature reading across the water connections. To insure proper water flow, the differential temperature should be between 10°F to 14°F for heat pumps in the cooling mode.
2. The piping may be steel, copper, or PVC. Avoid dissimilar metal fittings as they may corrode. If the use of dissimilar metals is unavoidable, use dielectric isolation at that connection point.
3. Supply and return run-outs usually join the heat pump via short lengths of high pressure flexible hose which are sound attenuators for both heat pump operating noise and hydraulic pumping noise. One end of the hose should have a swivel fitting to facilitate removal for service. Hard piping can also be brought directly to the heat pump. This option is not recommended since no vibration or noise attenuation can be accomplished. The hard piping must have a union to facilitate heat pump removal.
4. Make sure that threaded fittings are sealed. Teflon tape can be used to provide a tight seal.
5. Supply and return shutoff valves are required at each heat pump. The return valve is used for balancing and should have a “memory stop” so that it can always be closed off but can only be reopened to the proper position for the flow required.
6. No heat pump should be connected to the supply and return piping until the water system has been cleaned and flushed completely. After the cleaning and flushing has taken place, the initial connection should have all valves wide open in preparation for the water system flushing.

Condensate Piping

1. Condensate piping can be steel, copper, or PVC. Each unit includes a condensate connection.
2. The condensate disposal piping must be trapped. Vertical and horizontal units must be externally trapped. The piping must be pitched away from the heat pump not less than ¼” per foot. The unit is supplied with a 1-1/4” male pipe fitting to accommodate the condensate drain connection.
3. Do not locate any point in the drain system above the drain connection of any unit.
4. The condensate piping system must be vented at its highest point.

Cleaning and Flushing

1. Prior to first operation of the M-Vintage horizontal and vertical units, the water circulation system must be cleaned and flushed of all construction dirt and debris
2. If the M-Vintage horizontal and vertical units are equipped with water shutoff valves, either electric or pressure operated, the supply and return runouts must be connected at each heat pump location. This will prevent the introduction of dirt into the heat pump.
3. Fill the system at the city water makeup connection with all air vents open. After filling, close all air vents.
4. The contractor should start the main circulator with the pressure reducing valve open. Check vents in sequence to bleed off any trapped air, providing circulation through all components of the system.
5. While circulating water, the contractor should check and repair any leaks in the piping. Drains at the lowest point(s) in the system should be opened for the initial flush and blow down, making sure city water fill valves are set to make up water at the same rate. Check the pressure gauge at the pump suction and manually adjust the makeup to hold the same positive steady pressure both before and after opening the drain valves. Flush should continue for at least two hours, or longer if required, until the drain water is clear and clean.
6. Shut off supplemental heater (if applicable) and circulator pump and open all drains and vents to completely drain down the system. Short circuited supply and return runouts should now be connected to the heat pump supply and return connections. Do not use sealers at the swivel flare connections of the hoses.
7. Refill the system with clean water. Test the water using litmus paper for acidity and treat as required to leave the water slightly alkaline (pH 7.5 to 8.5). The specified percentage of antifreeze may also be added at this time. Use commercial grade antifreeze designed for HVAC systems only. Do not use automotive grade antifreeze.
8. Once the system has been filled with clean water and antifreeze (if used), precaution should be taken to protect the system from dirty water conditions. Dirty water will result in system wide performance degradation and solids may clog valves, strainers, flow regulators, etc. Additionally, the heat exchangers may become clogged which reduces compressor service life or causes premature failure.
9. Set the loop water controller heat add setpoint to 70°F and the heat rejection setpoint to 85°F. Supply power to all motors and start the circulation pumps. After full flow has been established through all components including the heat rejecter (regardless of season) and air has been vented and loop temperatures have been stabilized, each of the heat pumps will be ready for check, test and start-up, and water balancing.

FANWALL TECHNOLOGY® Assembly

Fan / Cone Alignment

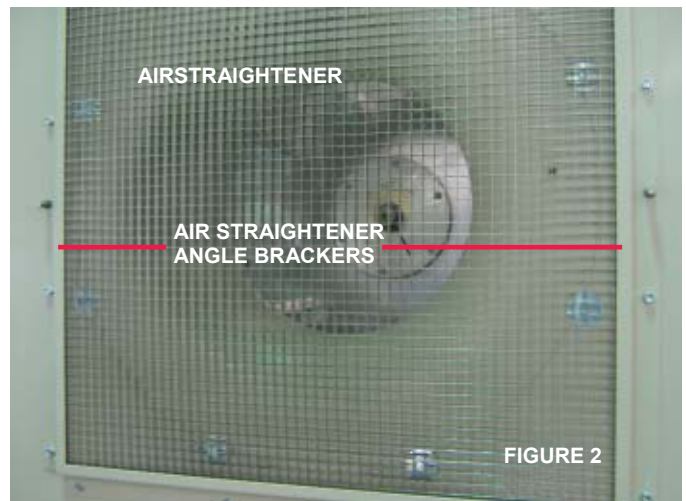
1. Temporarily attach the cone to the cell inlet using the screws and washers provided, or slightly loosen the screws holding the cone if already installed. Use a minimum of four screws for this step.
 - a. Refer to the fan wheel overlap drawings provided to determine where to set the wheel with respect to the cone.
 - b. Adjust the amount of overlap by moving the motor pedestal forward or backward to line up the cone with the wheel (wheel/cone overlap is designed to insert the cone 50% of the distance of the rolled shroud lip on the wheel). Once you have the wheel approximately located, tighten the ½" pedestal bolts to 90ftlbs.
2. Center the cone in the wheel shroud.
 - a. The cone alignment can be a tedious process as there are no tools that effectively work to align the cone. It is a hands on process to align the cone. Mammoth cones have a running clearance of about 1/16" (see Figure 1).
 - b. Start by loosening the four screws that were used to hold the cone for the depth alignment. Hold the cone with one hand and with the other use a drill to attach a screw to hold the cone in place. Feel between the wheel inlet shroud and the cone and set the gap to approximately 1/16" and tighten the screw in that location (top of the cone is usually the best place to start). At this point you should be able to move the cone about that screw location, adjusting the cone on the left or right until there is approximately a 1/16" gap.
 - c. Spin the wheel by hand at this point to check for any clearance issues. If the wheel spins clear, tighten the remaining screws on the cone. Check that the wheel spins clear after tightening each screw.

3. Attach the inlet airflow straightener using the formed angle brackets (see Figure 2).
 - a. Start by loosely installing (don't tighten screws all the way) the bottom angle bracket. Set the air-flow grid on the angle bracket. Align the side of the grid with the end of the bracket.
 - b. Install either vertical angle bracket loosely and check fit up.
 - c. Install the two remaining brackets and tighten (see Figure 2).

Figure 1—FANWALL® cone alignment



Figure 2—Inlet airflow straightener



Start-up

1. Open all valves to full open position and turn on power to the heat pump.
2. Set room temperature sensor for “Fan Only” operation by selecting “Off” at the system switch and “On” at the fan switch. If “Auto” fan operation is selected, the fan will cycle with the compressor. Check for proper air delivery.
3. M-Vintage horizontal and vertical units have time delays which help protect the compressor(s) against short cycling. In the cooling mode, after a few minutes of operation, check the discharge grilles for cool air delivery. Measure the temperature difference between entering and leaving water. It should be approximately 1 ½ times greater than the heating mode temperature difference.
4. In the heating mode, measure the temperature difference between entering and leaving air and entering and leaving water. With entering water of 60° F to 80°F, leaving water should be 6°F to 12°F cooler, and the air temperature rise through the M-Vintage horizontal and vertical units should not exceed 35°F. If the leaving air temperature falls below 35°F, adjust water flow to the unit to >3 gpm/ton to avoid freeze damage to the unit.
5. Fill the p-trap with water to ensure that negative pressure does not pull drain gases into the unit.
6. Check the elevation and cleanliness of the condensate line. If the air is too dry for sufficient dehumidification, slowly pour enough water into the condensate pan to ensure proper drainage.
7. If the unit does not operate, check the following points:
 - a) Is supply voltage to the M-Vintage horizontal and vertical units compatible?
 - b) If the M-Vintage horizontal and vertical units operates but stops after a brief period:
 - i) Is there proper airflow? Check for dirty filter, incorrect fan rotation or incorrect ductwork.
 - ii) Is there proper water flow rate within temperature limits? Check water balancing; back-flush unit if dirt clogged.
 - iii) See troubleshooting guide on page 16 for more tips.

Operating Limits

Environment

This equipment is designed for indoor installation only. Sheltered locations such as attics, garages, etc., generally will not provide sufficient protection against ex-

tremes in temperature and/or humidity, and equipment performance, reliability, and service life may be adversely affected.

Application Limits				
WATER TEMPERATURES / Degrees F *	Standard range		Low Temp Geothermal	
	COOLING	HEATING	COOLING	HEATING
MINIMUM ENTERING WATER TEMPERATURE	50°	50°	40°	25°
MAXIMUM ENTERING WATER TEMPERATURE	110°	90°	110°	90°

* Application limits apply at or above standard flow rates specified for size of unit.

Application Limits				
AIR TEMPERATURES / Degrees F *	Standard range		Low Temp Geothermal	
	COOLING	HEATING	COOLING	HEATING
MINIMUM AMBIENT AIR TEMPERATURE **	50°	50°	50°	50°
MAXIMUM AMBIENT AIR TEMPERATURE **	110°	110°	110°	110°
MINIMUM ENTERING AIR TEMPERATURE	65°	50°	65°	40°
MAXIMUM ENTERING AIR TEMPERATURE	100°	80°	100°	80°

* Application limits apply at or above standard flow rates specified for size of unit.

** Minimum and maximum ambient conditions apply to ducted supply and return units only.

Additional Information For Initial Start-up Only

Standard Range Units

Units are designed to start-up in an ambient temperature of 50°F (10°C), with entering air at 50°F (10°C), with entering water at 70°F (21°C), with both air and water flow rates used in the ISO13256-1 rating test, for initial start-up in winter.

Note: This is not a normal or continuous operating condition. It is assumed that such a start-up is for the purpose of bringing the building space up to occupancy temperature.

Geothermal Range Units

Geothermal heat pump units are designed to start-up in an ambient temperature of 50°F (10°C), with entering air at 40°F (5°C), with entering fluid at 25°F (-4°C), with both air and water at flow rates used in the ISO 13256-1 rating test, for initial start-up in winter.

Note: This is not a normal or continuous operating condition. It is assumed that such a start-up is for the purpose of bringing the building space up to occupancy temperature.

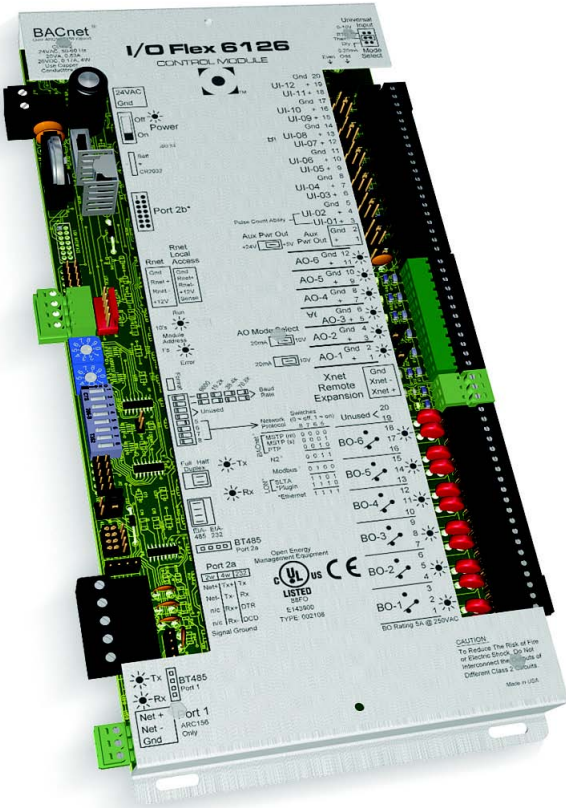
Operating voltages

208-230/60/3 197 volts min.; 253 volts max.
 460/60/3 342 volts min.; 418 volts max.
 380-415/50/3 342 volts min.; 418 volts max.
 575/60/3 342 volts min.; 418 volts max.

Note:
 Voltages listed are to show voltage range. However, units operating with over- or under-voltage conditions for extended periods of time will experience premature component failure. Three phase system imbalance should not exceed 2%.

MAMMOTH DDC CONTROLS

I/O Flex 6126



The standard factory-integrated DDC controller provides control flexibility that can be easily customized to meet any sequence of operation needs. It is fully capable of operating in a 100% stand-alone mode or can connect to a Building Automation System (BAS) using any of today's four leading protocols: BACnet, Modbus, N2, and Lontalk. The base controller provides ample input/output capacity, plus support for an expander board if additional I/O capacity is required.

Key Features and Benefits

- 6160 I/O points: 6 digital outputs, 12 universal inputs, and 6 analog outputs.
- 8160 I/O points: 16 universal inputs, 8 digital outputs.
- Optional built-in protocol support: BACnet® (ARCNET, MS/TP, and PTP modes), Modbus® (RTU and ASCII modes supported), N2, or Lontalk®.
- Powerful, high-speed 16-bit microprocessor with 1 MB Flash memory and 1 MB of battery-backed RAM
- Built-in support through an Rnet port for control's custom configurable keypad/display unit, BACview6 (4-line by 40 character per line display) for intelligent sensors.
- For variable air volume (VAV), constant volume (CAV), and make-up air (MAU) applications.

Examples of I/O's

INPUTS				
Point	Description			
UD #1	+Pulse	BMS Supply Air, Duct Static Reset or Room Air Temperature Setpoint		
UD #2		Room Air Temperature		
UD #3	RTD/Therm/Dry Contact, 0-10VDC, 0-20MA	System Switch	Emergency Shut Down	Remote Start
UD #4		High Static	Low Static	VFD in Bypass
UD #5		Economizer Lockout	Cooling Lockout	Heating Lockout
UD #6		Supply Fan Status	Compressor Fault	Condensate Overflow
UD #7		Duct Static Pressure or Airflow Switch		
UD #8		Filter Static Pressure or Dirty Filter Switch #1		
UD #9		Outside Air Temperature (AiSE Only)		
UD #10		Condenser Water Temperature		
UD #11		Entering Air Temperature or Return Air Temperature (AiSE)		
UD #12		Supply Air Temperature		
OUTPUTS				
Point		Description		
UO #1	4-20mA, 0-10Vdc	Spare		
UO #2		Heating Source Control Signal		
UO #3	0-10 Vdc	Economizer Valve (WiSE)/Damper Control Signal (AiSE)		
UO #4		WiSE Bypass Valve Signal		
UO #5		Spare		
UO #6		Supply Fan VFD Control Signal		
DO				
Point	Description			
DO #1	120 VAC FORM C	Start Supply Fan		
DO #2		Start Condenser Pump or Switch Reversing Valve		
DO #3		Field-Lin (MWU or Open Min OA)		
DO #4		Common Alarm		
DO #5		Compressor Call #2		
DO #6		Compressor Call #1		

MAMMOTH DDC CONTROLS

Keypad



Locally access controllers and operational properties with the easy-to-use BACview6 keypad/display. It plugs into an Rnet connection on a 6126 controller and allows you to display and modify properties. The BACview6 features a numeric keypad, directional keys, and four programmable function keys. A large 4-line by 40-character backlit LCD display is provided for easy reading even in poor lighting conditions. The device also includes an alarm indicator light.

Key Features and Benefits

- Compatible with all EPiC system controllers.
- Flexible design allows panel or wall mounting; can be located up to 500 feet from the controller.
- Hand-held version can be plugged into RS room temperature sensors.
- Backlit LCD display enhances reading even in poor lighting conditions.
- Customized menus for each product.
- Password protection provides security.
- One keypad can be used on different units/programs since the menus are part of the control program.

General Maintenance

Normal maintenance on M-Vintage horizontal and vertical units is generally limited to filter changes.

Air filter changes are required at regular intervals. The time period between changes will depend upon the project requirements. Some applications such as motels produce a lot of lint from carpeting and linen changes, and will require more frequent filter changes. It is suggested that the filter be checked at 60-day intervals for the first year until experience is acquired. If light cannot be seen through the filter when held up to sunlight or a bright light, it should be changed. A more critical standard may be desirable.

The condensate drain pan should be checked annually and cleaned and flushed as required.

Recording of performance measurements of volts, amps, and water temperature differences (both heating and cooling) is recommended. A comparison of logged data with start-up and other annual data is useful as an indicator of general equipment condition.

Periodic lockouts almost always are caused by air or water problems. The lockout (shutdown) of the heat pump is a normal protective result. Check for dirt in the water system, water flow rates, water temperatures, airflow rates (may be dirty filter), and air temperatures. If the lockout occurs in the morning following a return from night setback, entering air below machine limits may be the cause.

VFD GENERAL PURPOSE APPLICATION PARAMETERS

Parameter	Default Value	Description	Comments
b1-01	1	Reference Source	0 = Digital Operator (Adjust Motor Speed from keypad)
		Speed Control Method	1 = Terminals (Speed Pot. / 0 – 10V / 4—20mA)
b1-02	1	Run Source /	0 = Digital Operator (Start/Stop motor from keypad)
		Start/Stop Control Method	1 = Terminals (Start/Stop using external contact / switch)
b1-03	1	Stop Method Selection	0 = Ramp to stop (Motor ramps down at stop command)
			1 = Coast to stop (Motor freewheels at stop command)
b1-04	0	Reverse Operation	0 = Allow motor to run in reverse direction
			1 = Reverse direction prohibited
C1-01	10.0 sec.	Acceleration Time	The time it takes to ramp up from 0 to maximum motor speed.
C1-02	10.0 sec.	Deceleration Time	The time it takes to ramp down from maximum motor speed to 0.
C6-01	1	Normal / Heavy Duty	0 = Normal Duty (Use for fan and pump applications)
			0 = Normal Duty (Use for fan and pump applications)
d1-01	0.00 Hz	Frequency Reference	Frequency setting when speed is set from the keypad.
d2-01	100.0 %	Frequency Upper Limit	Maximum motor speed allowed (e.g. 100 % = Max rpm)
d2-02	0.0 %	Frequency Lower Limit	Minimum motor speed allowed (e.g. 100 % = Max rpm)
E2-01	*	Motor Rated Current	Motor nameplate current
L1-01	1	Motor Overload Selection	0 = Disabled
			1 = Standard Fan Cooled Motor
			2 = Standard Blower Cooled Motor
			3 = Vector Duty Motor
L1-02	1.0 min	Motor Overload Time	Sets the motor thermal overload protection time.

Troubleshooting

R-410A

The In's and Out's of R-410A

R-410A is a non-ozone depleting blend of two Refrigerants — HFC-125 and HFC-32 in a fifty percent mixture. Refrigerant 410A exhibits higher operating pressure and refrigeration capacity than R-22.

Although R-410A is non-flammable at ambient temperature and atmosphere pressure, it can become combustible under pressure when mixed with air. (NOTE: R-410A should not be mixed with air under pressure for leak testing. Pressure mixtures of dry nitrogen and R-410A can be used for leak testing.)

Lubrication

R410A should be used only with polyolester (POE) oil. The HFC refrigerant components in R-410A will not be compatible with mineral oil or alkylbenzene lubricants. R-410A systems will be charged with the OEM recommended lubricant, ready for use with R-410A.

Charging

Due to the zeotropic nature of R-410A, it should be charged as a liquid. In situations where vapor is normally charged into a system, a valve should be installed in the charging line to flash the liquid to vapor while charging.

WARNING!

It is very important to make certain that the recycle or recovery equipment used is designed for R-410A. The pressure of R-410A refrigerant is approximately 60 percent greater than that of R-22. Pressure gauges require a range up to 800 PSIG high side and 250 PSIG low side. Recovery cylinders require a 400 PSIG rating.

All Mammoth M-Vintage units are designed for commercial use. Units are designed for the cooling mode of operation and fail safe to heating.

Troubleshooting Refrigeration Circuit

Symptom	Head Pressure	Suction Pressure	Compressor Amp Draw	Super Heat	Subcooling	Air Temp Differential	Water (Loops) Temp Differential	Safety Lock Out
Charge Undercharge System (Possible Leak)	Low	Low	Low	High	Low	Low	Low	Low Pressure
Overcharge System Pressure	High	High	High	Normal	Low	Normal Low	Normal	High Pressure
Low Air Flow Heating	High	High	High	High Normal	Low	High	Low	High Pressure
Low Air Flow Cooling	Low	Low	Low	Low Normal	Low	Low	Low	Low Temp
Low Water Flow Heating	Low Normal	Low Normal	Low	Low	High	Low	High	Low Temp
Low Water Flow Cooling	High	High	High	High	Low	Low	High	High Pressure
High Air Flow Heating	Low	Low	Low	Low	High	Low	Low	Low Temp
High Air Flow Cooling	Low	High	Normal	High	Low	Low	Normal	High Pressure
High Water Flow Heating	Normal	Low	Low	Low	Normal	Normal	Low	High Pressure
High Water Flow Cooling	Low	Low	Low	Low	High	Normal	Low	Low Temp
TXV Restricted	High	Low	Normal Low	High	High	Low	Low	

Performance Troubleshooting

Performance Troubleshooting	Heating	Cooling	Possible Cause	Solution
Insufficient Capacity	X	X	Dirty Filter	Replace or clean
Not cooling or heating properly	X	X	Reduced or no air flow	Check for dirty air filter and clean or replace, Check fan motor operation and airflow restriction. External static too high? Check static vs. blower table
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers: If significantly different, duct leaks are present
Unit doesn't operate in cooling	X	X	Low refrigerant charge	Check superheat and subcooling
	X	X	Restricted metering device	Check superheat and subcooling– replace
		X	Defective reversing valve	Perform RV touch test
	X	X	Thermostat improperly located	Check location and for air drafts behind stat
	X	X	Unit undersized	Recheck loads & sizing. Check sensible, cooling load and heat pump capacity
	X	X	Scaling in waterside heat exchanger	Perform scaling check and clean if necessary
	X	X	Inlet water to hot or cold	Check load, loop sizing, loop backfill, ground moisture
High head pressure	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high? Check static vs. blower table
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting. Check water flow; adjust to proper flow rate
		X	Inlet water to hot	Check load, loop sizing, loop backfill, ground moisture
	X		Air temperature out of range in heating	Bring return air temp within design parameters
		X	Scaling in waterside heat exchanger	Perform scaling check and clean if necessary
	X	X	Unit overcharged	Check superheat and subcooling
	X	X	Non-condensable in system	Vacuum system, reweigh in charge
Low suction pressure	X		Reduced water flow in heating	Check pump operation or valve operation/setting. Check water flow adjust to proper flow rate
	X		Water temperature out of range	Bring water temp within design parameters
		X	Reduced air flow in cooling	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high? Check static vs. blower table
		X	Air temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks
Low discharge air temperature in heating	X		To high of air flow	Check fan motor speed selection and airflow
	X		Poor performance	See insufficient capacity

UNIT CHECK-OUT SHEET

Customer Data

Customer Name _____ Date _____
 Address _____
 Phone _____ Unit Number _____

Unit Nameplate Data

Make _____ Model Number _____ Serial Number _____
 Compressor(s):
 # 1: RLA _____ LRA _____ Refrig. Charge (oz.) _____ # 2: RLA _____ LRA _____ Refrig. Charge (oz.) _____
 # 3: RLA _____ LRA _____ Refrig. Charge (oz.) _____ # 4: RLA _____ LRA _____ Refrig. Charge (oz.) _____
 Blower Motor(s):
 # 1: FLA (or NPA) _____ HP _____ # 2: FLA (or NPA) _____ HP _____
 # 3: FLA (or NPA) _____ HP _____ # 4: FLA (or NPA) _____ HP _____
 Maximum Fuse Size (Amps) _____ Minimum Circuit Ampacity (Amps) _____

Operating Conditions

Unit Conditions	Cooling Mode	Heating Mode	Measured At:
Entering Air Temperature	_____	_____	_____
Leaving Air Temperature	_____	_____	_____
Entering Fluid Temperature	_____	_____	n/a
Leaving Fluid Temperature	_____	_____	n/a
Fluid Flow (gpm)	_____	_____	n/a
Fluid Side Pressure Drop	_____	_____	n/a

Compressor Mode	# 1		# 2		# 3		# 4	
	Cooling	Heating	Cooling	Heating	Cooling	Heating	Cooling	Heating
Suction Pressure (psig)	_____	_____	_____	_____	_____	_____	_____	_____
Discharge Pressure (psig)	_____	_____	_____	_____	_____	_____	_____	_____
Suction Temp (at compressor)	_____	_____	_____	_____	_____	_____	_____	_____
Discharge Temp (at compressor)	_____	_____	_____	_____	_____	_____	_____	_____
Suction Superheat (at compressor)	_____	_____	_____	_____	_____	_____	_____	_____
Liquid Line Leaving Condenser Temp	_____	_____	_____	_____	_____	_____	_____	_____
Liquid Subcooling	_____	_____	_____	_____	_____	_____	_____	_____

Volts/Amps Phase	# 1			# 2			# 3			# 4		
	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Compressor Volts	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Compressor Amps	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Blower Volts	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Blower Amps	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____



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