Vertical Water-to-Water Heat Pumps With R-410A

Installation, Operation and Maintenance Manual

Sizes: 064 to 480
Model: K Vintage

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K Vintage Water-to-Water
Sizes 064 to 480

Model Nomenclature

F	-170-	W-	H-	K
Voltage	**BTU/hr Cooling**	**Unit Type**	**Temperature Range**	**Vintage**
F = 208-230/60/3	064 = 58,437	W = Water-to-Water	H = Standard Range	
G = 460/60/3	120 = 127,792		L = Low Temp Operation	
J = 380-415/50/3	170 = 172,906			
K = 575/60/3	270 = 257,319			
S = 380/60/3	360 = 350,047			
	480 = 459,580			

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 its side. In the event that elevator transfer makes horizontal 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. But 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 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 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 and electrical wiring. The locations of these items are clearly marked on the submittal drawings.
7. Mammoth recommends the unit be covered during construction to protect components from dust and other harmful materials. This is critical while spraying fireproofing material on bar joists, sandblasting, spray painting and plastering.

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.

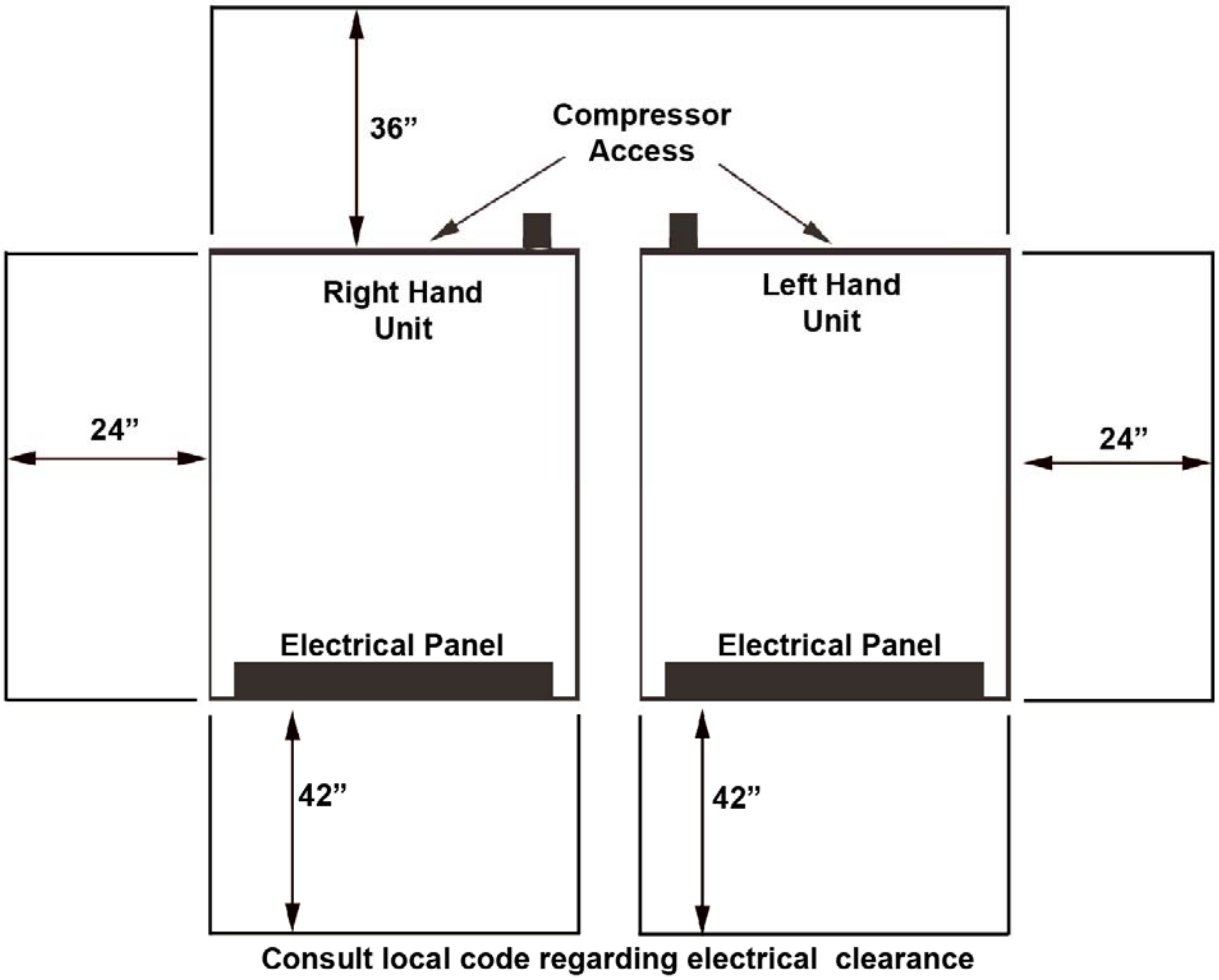
Unit Location

Locate the unit in an area that allows for easy removal of the compressor and control box access panels. The diagram below shows minimum suggested clearances. Any additional clearances would be beneficial, but not always necessary.

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.

The electrical connections are accessible from the front. The compressor can be accessed from either side. There are no air filter, ductwork or ventilation air requirements for K-Vintage water-to-water units.

Service Clearances



Unit Piping

1. All K-Vintage 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 verify proper water flow, the differential temperature should be between 7°F to 10°F for heat pumps in the cooling mode or heating 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. We recommend a 30 mesh strainer (supplied by others) be mounted prior to the water inlet to the unit.
3. Supply and return run-outs usually join the heat pump via short lengths of flexible hose which that can be sound attenuators for hydraulic pumping noise. Make sure hoses and pipes are suitable for system water pressure and sized for proper flow rate. Never use flexible hoses that are smaller (inside diameter) than that of the water connection on the unit. 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. The supply and the discharge pipes should be insulated to prevent condensation damage caused by low water temperature in the pipes.
5. Make sure that threaded fittings are sealed. Teflon tape can be used to provide a tight seal.
6. Supply and return shutoff valves are required at each heat pump. All flow valves should be ball type. 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. To avoid water hammer during start-up or shut down, solenoid vales of the slow closing diaphragm type should be used. Placing the solenoid valve on the outlet side of the system helps relieve this situation. Due to high pressure drop or poor throttling characteristics, globe and gate valves should not be used.
7. 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.

Cleaning and Flushing

IMPORTANT:
Prior to first operation of K-Vintage units, the water circulation system must be cleaned and flushed of all construction dirt and debris. After the cleaning and flushing has taken place, the initial connection should have all valves wide open in preparation for the water system flushing.

1. If the K-Vintage units are equipped with optional water shutoff valves, either electric or pressure operated, the supply and return run-outs must be connected at each heat pump location. This will prevent the introduction of dirt into the heat pump.
2. Fill the system at the city water makeup connection with all air vents open. After filling, close all air vents.
3. 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.
4. 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.
5. Shut off the 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.
6. 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.
7. 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.
8. 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.

Start-up

Before powering up any K-Vintage unit, check the following:

1. The high voltage supply matches the nameplate.
2. Field wire size, breakers and fuses are the correct size.
3. Water piping is complete and correct.
4. The closed loop system is flushed and purged.
5. Loop pumps are correctly wired.
6. Access panels on the unit are in place and secured.
7. Temperature controller is in the “Off” position.

IMPORTANT NOTE:

Avoid starting any electrical equipment for the first time alone. Always have another person located away from the unit that can turn off main power immediately.

Once the above items have been verified, you are now ready to begin start-up.

1. Set temperature controller to highest position.
2. Set temperature controller to “cool”. Compressor should not operate. The source water pump should energize.
3. Slowly lower the temperature controller setting until the compressor is energized. Measure the water flow using pressure and temperature (P/T) ports until the temperature difference is 7 to 10°F between the entering and leaving water temperature.
4. Check the cooling high and low refrigerant pressures.
5. Turn temperature controller to the “off” position. The unit will stop running and the reversing valve should de-energize.
6. Leave unit “off” for approximately five minutes to allow pressure to equalize.
7. Adjust temperature controller to lowest setting.
8. Set temperature controller to “heat”.
9. Slowly adjust temperature controller to higher temperature until the compressor energizes.
10. Check the heating high and low refrigerant pressures.
11. Check for vibrations, noise, water leaks, etc.
12. Adjust temperature controller to correct mode and set to maintain desired temperature.
13. If the unit does not operate, check the following points:
    a) Is supply voltage to the unit compatible?
    b) If the unit operates but stops after a brief period:
        i) Is there proper water flow rate within temperature limits? Check water balancing; backflush unit if dirt clogged.
        ii) See troubleshooting guide on page 15 for more tips.

Once the unit is up and running, instruct the equipment owner/operator of correct temperature controller and system operation.

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 extremes 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˚	40˚	25˚**	25˚**
MAXIMUM ENTERING WATER TEMPERATURE	110˚	110˚	110˚	110˚

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

** Requires glycol in the system

Additional Information For Initial Start-up Only

Operating voltages

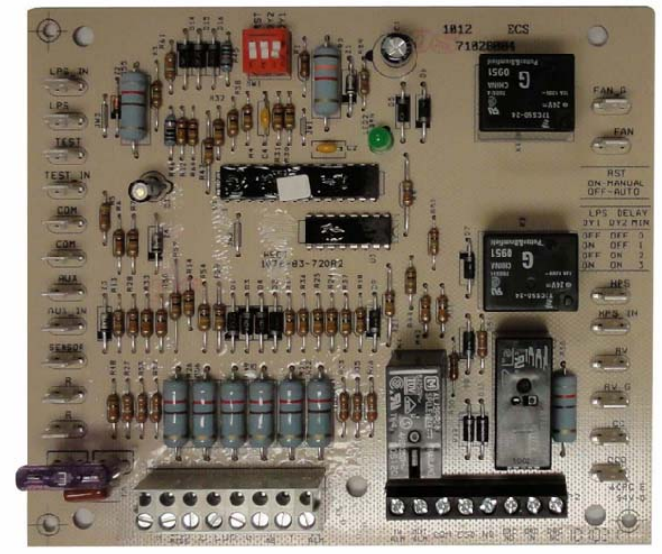
208-230/60/3. . . . . 187 volts min.; 253 volts max.
460/60/3 . . . . . 414 volts min.; 506 volts max.
380-415/50/3. . . . . 342 volts min.; 456 volts max.
575/60/3 . . . . . 518 volts min.; 632 volts max.
380/60/3 . . . . . 342 volts min.; 418 volts max.

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 CONTROLS

HP 5 Microprocessor Control Board



The standard HP 5 microprocessor control board provides complete control of a compressor, reversing valve and offers numerous safety features and troubleshooting fault indicators. The HP 5 unit is designed to operate with Mammoth's existing series of wall thermostats and arrives factory-installed and wired.

Operation and maintenance (OM) instructions for the HP 5 control board are contained in a separate document (MAMM-WSHP-IOM-1HP5). This document is available on the Mammoth website at www.mammoth-inc.com under Literature.

Key Features and Benefits

- Low and high voltage protection
- Check microprocessor at startup – self-diagnostic
- Random start time delay from 5 to 35 seconds
- Compressor anti-short cycle protection for 300 seconds (5 minutes)
- Compressor and reversing valve control
- Compressor lockout with selectable intelligent/manual reset
- LED status on the board
- Lockout alarm signal to the temperature controller in the event of a safety circuit fault
- Operable on 50 and 60 cycle power
- Emergency shutdown from a field-supplied signal
- Unoccupied (night setback and night setup) mode from a field-supplied signal
- Dry contact alarm signal for connection of a fault signal to a DDC controller.
- Auxiliary dry contact for tie-in of a motorized valve when the compressor is on (or optional compressor status)
- Night heating or cooling operation from temperature controller
- Override of the unoccupied mode from the temperature controller
- Low and high pressure compressor protection
- Low pressure bypass with 0, 1, 2 and 3 minute selections

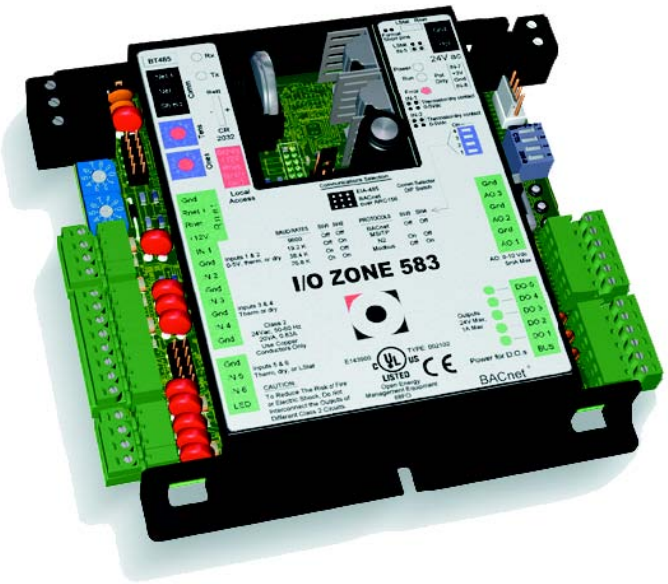
I/O 560 Controller

Mammoth I/O Zone 560 controller delivers powerful control and communications features all in a compact, economical package. Fully capable of operating in a 100% stand-alone control mode, the I/O Zone 560 can connect to a Building Automation System (BAS) using any of today's most popular protocols, such as BACnet, Modbus, N2, LonTalk. The I/O Zone 560 also supports communication to the Mammoth line of intelligent space sensors and keypad/display units.

Key Features and Benefits

- I/O point count: 5 digital outputs (relayed), and 6 universal imputs.
- Built-in protocol support: BACnet (ARCNET and MS/TP), Modbus RTU, and N2. Optional plug-in communications boards: LonTalk
- On-board battery-backed real-time clock is standard, thus enabling full stand-alone scheduling capabilities as well as historical trend data storage and alarm event time-stamping.•
- Powerful, high-speed 16-bit processor with 1MB Flash memory and 512KB of battery-backed RAM - plenty of room for even demanding and complex applications.

I/O 583 Controller



Mammoth I/O Zone 583 controller delivers powerful control and communications features all in a compact, economical package. Fully capable of operating in a 100% stand-alone control mode, the I/O Zone 583 can connect to a Building Automation System (BAS) using any of today's most popular protocols, such as BACnet, Modbus, N2, and LonTalk,. The I/O Zone 583 also supports communication to Mammoth's line of intelligent space sensors and keypad/display units.

Key Features and Benefits

- I/O point count: 5 digital outputs (relayed), 8 inputs and 3 analog outputs.
- Built-in protocol support: BACnet (ARCNET and MS/TP), Modbus RTU, and N2. Optional plug-in communications boards: LonTalk
- On-board battery-backed real-time clock is standard, thus enabling full stand-alone scheduling capabilities as well as historical trend data storage and alarm event time-stamping.•
- Powerful, high-speed 16-bit processor with 1MB Flash memory and 512KB of battery-backed RAM - plenty of room for even demanding and complex applications.

I/O 560 & 583—Example of I/Os

INPUTS				
Point	**Description**			
UI #1	Thermistor/ Dry Contact	Load Supply Water Temperature (Outlet)		
UI #2		Load Return Water Temperature (Inlet)		
UI #3	Thermistor/ Dry Contact	Source Leaving Water Temperature (Outlet)		
UI #4		Source Entering Water Temperature (Inlet)		
UI #5		Compr Lockout (Waterflow)	Compr #1 HP4 Alarm	Compr #2 HP4 Alarm
UI #6		Emergency Shut Down	Remote Start (External Clock)	Htg/Clg Changeover ****
OUTPUTS				
Point	**Description**			
DO #1	Dry Contact for 24VAC	Pump Start*		
DO #2		Compressor Call #1		
DO #3		Compressor Call #2		
DO #4		Reversing Valve*		
DO #5		Common Alarm		

Notes:
1. Multiplexed inputs 5, 6 use 10K/4.99K/2.49K resistors for contact inputs. 1.24K resistor not used.
* Could do more stages if cooling call and pump started externally.
** A minimum of one keypad display must be ordered per project to set required set-points (Part #71027956).
*** A protocol will be a cost add option.
**** Load Shed will be a cost add option.

General Maintenance

Proper maintenance is important to provide the most efficient operation and longest life for your equipment. The following points are to serve as a general guide. Always consult with your maintenance contractor with regard to the specific requirements of your own installation.

DANGER!

Electric shock hazard. Turn of all power before servicing. Failure to do so may result in severe personal injury or death.

The following should be checked only by a competent contractor.

Contactor Points: Check contactor points twice a year to see that they are not burned or pitted as a result of low voltage, lightning strikes, or other electrical difficulties.

Water System: The water circulating pump should be checked and cleaned so that it is operating normally. The 30 mesh strainer should also be cleaned at this time. Clogged coils lead to high head pressures and inefficient operation. If coil is limed, a cleaning treatment may be necessary. Water coils should be checked yearly for liming or clogging.

Brazed Plate Heat Exchanger Cleaning: When the likelihood of fouling is high (for instance, when hard water is used), clean the exchanger by circulating a cleaning liquid through it. Use a tank with a weak acid

NOTE:

DO NOT place refrigeration gauges on system for Check, Test and Start procedure. They should be used for major service only.

for this clean-in-place (CIP) process. A five-percent solution of phosphoric acid is an effective choice for most units. If the exchanger is cleaned frequently, use a five-percent solution of oxalic acid.

For best results, the cleaning solution flow rate should be at least 1.5 times the normal flow rate, preferably in backflush mode. Before restarting, flush the unit with plenty of fresh water to purge any remaining acid. Clean at regular intervals.

Improper Unit Functioning: If unit is not performing properly, several readings of temperature, pressure and electrical characteristics need to be taken. The normal required troubleshooting information is listed on the Check, Test and Start Form on page 16.

Performance Measurements: 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 water problems. The lockout (shutdown) of the heat pump is a normal protective result. Check for dirt in the water system, water flow rates, and water temperatures.

Parts and Service Support

Mammoth brand products are serviced by Authorized Service Providers. For service support, contact Mammoth at 952-358-6618 or info@mammoth-inc.com.

Parts for Mammoth brand products are available by contacting your local representative. For assistance locating your Mammoth representative, call 952-358-6600 or e-mail info@mammoth-inc.com.

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

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Troubleshooting Refrigeration Circuit

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

Performance Troubleshooting

Performance Troubleshooting	Heating	Cooling	Possible Cause	Solution
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	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 too hot or cold	Check load, loop sizing, loop backfill, ground moisture
High head pressure		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	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	X	Insufficient charge	Check for refrigerant leaks

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.) _____
Maximum Fuse Size (Amps) _____ _____ Minimum Circuit Ampacity (Amps) _____

Operating Conditions

Unit Conditions	**Cooling Mode**	**Heating Mode**
Entering Fluid Temperature	_____	_____
Leaving Fluid Temperature	_____	_____
Fluid Flow (gpm)	_____	_____
Fluid Side Pressure Drop	_____	_____

Compressor	**# 1**		**# 2**	
Mode	**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		**# 1**			**# 2**	
Phase	**L1**	**L2**	**L3**	**L1**	**L2**	**L3**
Compressor Volts	_____	_____	_____	_____	_____	_____
Compressor Amps	_____	_____	_____	_____	_____	_____

Notes

Notes

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