Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

MHP0270R Water Source Heat Pump Water Heater

c LC us

LEAD FREE
NSF/ANSI/CAN 61
IAPMO R&T ®

For R513A units produced from 11/1/24 to:

IM-MHP0270R-L251214

MADE IN USA
WITH U.S. & IMPORTED PARTS

Installation Manual

Lochinvar, LLC 300 Maddox Simpson Parkway, Lebanon, Tennessee 37090 ▪ (877) 737-2840 ▪ Lochinvar.com

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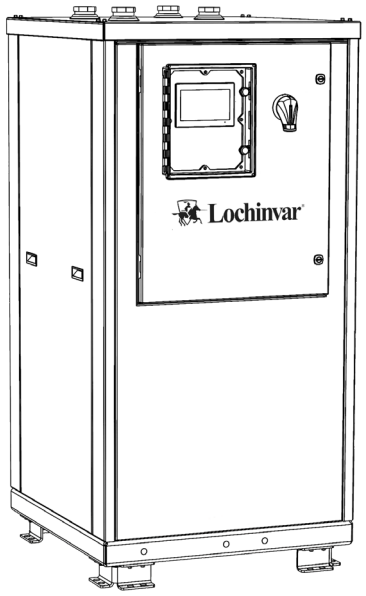
Contents

Introduction

Thank you for your purchase of a MHP0270R water source heat pump water heater! With this purchase, you now own one of the most efficient and reliable large-volume water heaters available in the world today. This unit will produce potable hot water from a highly efficient and capable heat pump, helping end users reach their carbon reduction, electrification, efficiency, and operating cost reduction goals.

The MHP0270R heat pumps use R513A refrigerant, is available in single-pass or multi-pass configurations, is capable of providing leaving water temperatures up to 175° F, and can perform at source water temperatures as low as 35° F with glycol antifreeze. Models are available for 230v, 460v, and 575v 3-phase power, includes internal power quality monitoring, and all units are ready to be integrated into BMS systems with the purchase of an additional BMS Gateway accessory.

MHP0270R heat pumps are not intended for primary space conditioning. When installed on condenser loops, they can provide supplemental cooling benefits.



MHP0270R Water Source Heat Pump Water Heater

Safety Information

The proper installation, use and servicing of this commercial heat pump water heater is extremely important to your safety and the safety of others.

Many safety-related messages and instructions have been provided in this manual and on your own heat pump water heater to warn you and others of a potential injury hazard. Read and obey all safety messages and instructions throughout this manual. It is very important that the meaning of each safety message is understood by you and others who install, use, or service this heat pump water heater

⚠	This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in injury or death.

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⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, could result in property damage.

All safety messages will generally tell you about the type of hazard, what can happen if you do not follow the safety message, and how to avoid the risk of injury.

The California Safe Drinking Water and Toxic Enforcement Act requires the Governor of California to publish a list of substances known to the State of California to cause cancer, birth defects, or other reproductive harm, and requires businesses to warn of potential exposure to such substances.

This product contains a chemical known to the State of California to cause cancer, birth defects, or other reproductive harm. This appliance can cause low level exposure to some substances listed in the Act.

Precautions

If the unit is exposed to the following, do not operate heater until all corrective steps have been made by a qualified service agency.

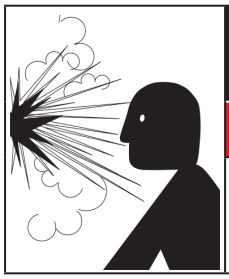
- Electrical surge
- Fire
- Freeze conditions in attached piping
- Physical Damage
- Rodent Infestation
- Running without water

IMPORTANT!

Before servicing this unit, verify that the power to the unit is turned off prior to opening the cabinet control door.

⚠ WARNING — **Contains Refrigerant!**

System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit rating label for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.
Failure to follow proper procedures or the use of non-approved refrigerants, refrigerant substitutes, or refrigerant additives could result in death or serious injury or equipment damage.



⚠ WARNING

Explosion Hazard!

- Do not use oxygen to purge or pressurize system for leak test
- Oxygen reacts violently with oil, which can cause an explosion resulting in severe personal injury or death

⚠ WARNING

Electrical Shock Hazard!

- Turn off power to the water heater before performing any service
- Label all wires prior to disconnecting when performing service. Wiring errors can cause improper and dangerous operation
- Failure to follow these instructions can result in personal injury or death

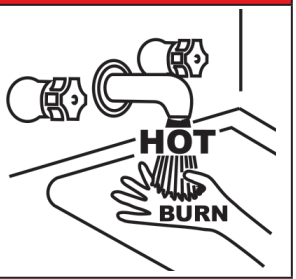
⚠ WARNING

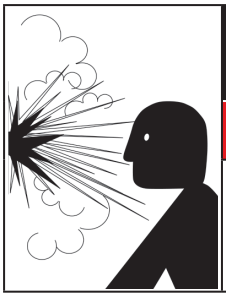
Read and understand this instruction manual and the safety messages herein before installing, operating or servicing this water heater.
Failure to follow these instructions and safety messages could result in personal injury or death
This manual must remain with the water heater.

⚠ DANGER

Burn Hazard!

- Water temperature over 125°F (52°C) can cause severe burns instantly resulting in severe injury or death.
- Children, the elderly and the physically or mentally disabled are of highest risk for scald injury.
- Feel water before bathing or showering.
- Temperature limiting devices such as mixing valves must be installed when required by orders to ensure safe temperatures at fixtures.





⚠ WARNING

Explosion Hazard!

- Overheated water can cause water tank explosion
- Properly sized temperature and pressure relief valve must be installed in the opening provided on connected storage tanks

Grounding Instructions

This heat pump must be grounded in accordance with the National Electrical Code and/or local codes.

This heat pump must be connected to a grounded metal, permanent wiring system; or an equipment grounding conductor must be run with the circuit conductors and connected to the equipment grounding terminal or lead on the water heater.

⚠ WARNING

Failure to properly ground equipment can result in equipment damage, erratic operation, fire, and death by electrical shock.

General Description

Purpose

This water source heat pump is a monobloc water-to-water Commercial Heat Pump Water Heater (CHPWHs) using R-513A refrigerant in a closed and factory charged circuit. CHPWHs are not intended for primary space heating or cooling applications, however, heat recovery applications and supplemental source loop cooling are potential benefits of water source heat pump water heating.

All monobloc CHPWHs are intended to be mounted remotely from a primary storage tank or tank array with appropriate safety devices, provided and piped separately, to provide water heating functions. These models of CHPWHs are constructed for either “single-pass” or “multi-pass” operation at the factory, and can only be deployed on domestic water heating systems of the appropriate type.

Usage

MHP0270R heat pumps are suitable for single-pass or multi-pass operation, determined at the time of order. Single-pass heat pumps contain an “SP” in the model number, and multi-pass heat pumps contain an “MP”.

Single-pass means that water is pulled from the bottom of a domestic hot water tank and delivered at full usable temperature to the top of a domestic hot water storage tank in one pass. This allows for faster recovery of usable water temperatures than in traditional multi-pass configurations, smaller tank sizes, and smaller heat pumps. This system is not an “on demand” heater and does require external and stratified storage to operate effectively. Building recirculation loops must be returned to a separate “swing tank” to preserve this stratification, and the swing tank must have its own heat source to meet the heat loss of the recirculation loop.

Multi-pass systems do not require swing tanks, and recirculate water to and from the bottom of primary storage tanks, raising the water several degrees with each pass. This requires larger primary storage tanks, but can be more appropriate in some retrofit applications, especially when recirculation loads are a major portion of total energy usage.

Flexible Installation

The enclosure is designed to minimize the MHP0270R footprint, and to simplify placement considerations for multiple-unit installations, including zero side clearance requirements for installation and service. As a “monobloc” style heat pump, the unit arrives ready to connect to electrical, source water loops, and domestic water infrastructure in the field.

The heat pump features an integral load side circulator, water temperature control valve, and a load side double wall heat exchanger for direct piping to domestic hot water storage tanks.

Controls and Electrical

The MHP0270R water source heat pump features a single point power connection in 208-230v, 440-480v, and 575v 3 phase variants, determined at the time of order.

MHP0270R heat pumps are certified to UL/CSA 60335-2-1 and -40, NSF-61, and feature an SCCR rating of 100 on the primary power connection.

The MHP0270R provides dry contact outputs for Alarm conditions, Run indication, and a source pump relay. The heat pump can receive an external dry contact enable/disable signal. Up to two tank sensors can be wired directly to the heat pump, or an external heat demand dry contact signal can be used to control heat demand logic.

The MHP0270R Is MODBUS and BACNET capable using a separate BMS Gateway accessory option, allowing the heat pump to be integrated into BMS systems by 3rd party integrators using Bacnet/IP and MSTP protocols.

The MHP0270R is compatible with the MCP, MCP-G, and MCP-LA main control panel optional accessories, to provide staging and additional control options to multiple heat pump and/or multiple primary storage tank systems.

For More Information

Please refer to the Performance Specifications for appropriate operating ranges and requirements. If more detailed information is required than is available in this manual, please contact your factory representative for additional assistance.

Performance Specifications and Requirements

Table 1: MHP0270R – Performance Specifications

Performance Specifications	Single-pass	Multi-pass
Nominal DOE Capacity [1]	278,800 BTUs/Hr.	
Nominal DOE Performance [1]	4.1 COP	
Recovery Rate [2]	664 Gal./Hr.	
Min. Ambient Exposure	33 Deg F	
DHW Loop		
Max Water Pressure	150 psig	
Outlet Operating Range [3]	100 - 175 Deg F	
Inlet Operating Range	40 - 115	40 - 140
Design Flow Rate	22.0 GPM	36.0 GPM
Water Circuit Pressure Drop [4]	16.9 Ft. Hd.	7.4 Ft. Hd.
Heat Pump Cv Value [4]	8	20
DHW External Head Allowance [5]	19.5 Ft. Hd.	18.7 Ft. Hd.
Min. Cold Cycle Volume [6]	119 Gal.	
Min. Warm Cycle Volume [7]	N/A	334 Gal.
Min. Tank Volume [8]	N/A	835 Gal.
Source Loop		
Max Water Pressure	300 psig	
Source Water Operating Range	35 - 120 Deg F	
Design Flow Rate	48 GPM	
Water Circuit Pressure Drop [4]	11.11 Ft. Hd.	
Heat Pump Cv Value [4]	22	
Misc.		
Sound Pressure (Front/Left/Right/Rear) [9]	72.1 / 71.9 / 70.9 / 73.6	
Certifications	UL60335-1, UL60335-2-40, CSA C22.2 60335-1, CSA 60335-2-40 (LC16116-1), NSF/ANSI/CAN 61-2023 (N-16151)	

Notes:

1. Nominal heating performance is 100% water source at 80.6 Deg F, DHW 120 Deg. F. LWT and 70 Deg. F. EWT.
2. Recovery Rate is at nominal heating performance condition producing 120 degree water.
3. Maximum LWT not available at all ambient conditions. See max LWT graph, Diagram 1, on page 9.
4. Heat Pump pressure drop and Cv value are for external pump applications at design flow rate.
5. Piping pressure drop allowed by integral circulator in the heat pump.
6. Cold Cycle volume is the volume below the cold trigger sensor. Cold in water over 70 Deg F will need more volume.
7. Warm Cycle volume is the volume of water below the warm/recirc trigger sensor.
8. Tank volume is based on individual project demands, but cannot be lower than this minimum value in any case.
9. Sound Pressure measured 3' away, 3' from ground.

IMPORTANT!

Water source R513A heat pumps will stop operation when source loop temperatures are above or below acceptable thresholds. If configured for "water" source loops, operation will stop below approximately 45 Deg F source inlet temperature. If configured for "glycol" source loops, operation will stop at the minimum source inlet temperature for the heat pump. See product specifications for source loop temperature operating envelope information.

For more information on configuring water source heat pumps, see the “Programming and Operation Manual” for the software version on your heat pump.

IMPORTANT!

Single-pass heat pumps may limit their leaving water temperature in lower source inlet temperature conditions. See the Maximum LWT diagram for details.

CAUTION

Water source heat pumps SHOULD NOT be installed in ambient conditions that may freeze. See the “Exterior Installation Considerations” section of this manual for a more detailed discussion of freeze protection requirements for your heat pump.

Expanded Performance Data

Table 2: MHP0270R Single-pass Performance Test Data: 50° EWT, 140° LWT, 100% Water Source Side

Entering Source Water	Supply Heating Capacity (Btu/hr)	Source Cooling Capacity (Btu/hr)	Power Input (kW)	Heating COP	Cooling COP	Combined COP
90°F	280,400	203,630	22.5	3.7	2.7	6.3
80°F	253,600	178,536	22.0	3.4	2.4	5.8
70°F	226,900	153,542	21.5	3.1	2.1	5.2
60°F	200,600	129,460	20.9	2.8	1.8	4.6
50°F	174,400	105,478	20.2	2.5	1.5	4.1
40°F	152,200	87,031	19.1	2.3	1.3	3.7

Table 3: MHP0270R Multi-pass Performance Test Data: 140 LWT, Design GPM, 100% Water Source Side

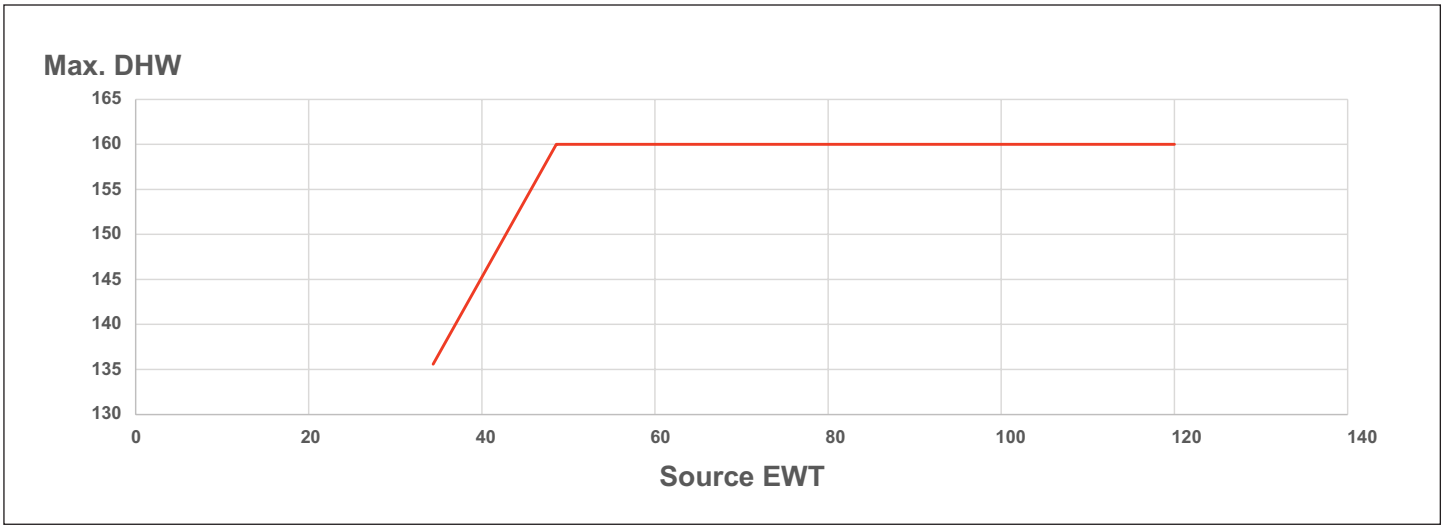
Entering Source Water	Supply Heating Capacity (Btu/hr)	Source Cooling Capacity (Btu/hr)	Power Input (KW)	Heating COP	Cooling COP	Combined COP
110°F	336,000	252,065	24.6	4.0	3.0	7.0
90°F	306,000	222,065	24.6	3.6	2.6	6.3
70°F	230,000	148,112	24.0	2.8	1.8	4.6
50°F	178,000	98,159	23.4	2.2	1.2	3.5
35°F	149,000	72,571	22.4	1.9	0.9	2.9

Table 4: MHP0270R High Temperature Performance Test Data: 160 EWT, 175 LWT, 100% Water Source Side

Unit Size	MHP0270R
Entering Source Water Range	90 – 100°F
Source Design GPM	60
Load Design GPM	39
Supply Heating Capacity (Btu/hr)	291,400
Source Cooing Capacity (Btu/hr)	178,122
Power Input (kW)	33.2
Heating COP	2.6
Cooling COP	1.6
Combined COP	4.1

Notes: Operation over 160 LWT requires the above adjustments to design flow rates, and restricts allowable source temperature ranges as shown. Requires Multi-pass HP. Source pressure drop increases to 17.2 Ft. Hd. Load side available head allowance drops to 17.4 Ft. Hd.

Diagram 1: MHP0270R Source EWT - Maximum DHW LWT for Single-Pass Operation



Note: Maximum source EWT: 120° F

Electrical Specifications

Table 5: MHP0270R – Electrical Specifications

Main Power Input	208-230/3/60	460/3/60	575/3/60
Minimum Circuit Ampacity (MCA)	108	55	38
Minimum Overcurrent Protection (MOCP)	175	100	60
Rated Load Amps (RLA)	88	45	30
Short Circuit Current Rating (SCCR)	100		
Internal Component Data			
Compressor Locked Rotor Amps (LRA)	605	272	238
Compressor Horsepower (HP)	25		

Sound Pressure Data

Table 6: MHP0270R Sound Pressure Data

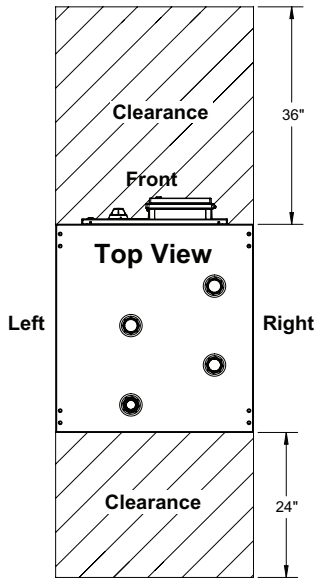
	Leq	1:1 Octave								
	LAeq (dBA)	31.5 Hz (dB)	63 Hz (dB)	125 Hz (dB)	250 Hz (dB)	500 Hz (dB)	1 kHz (dB)	2 kHz (dB)	4 kHz (dB)	8 kHz (dB)	16 kHz (dB)
Front	72.1	62.4	68.3	70.3	72	70	68.9	57.9	59.3	48	35.8
Left	71.9	61.1	73.7	69.9	73.3	72.1	65.8	59.1	59.1	48.7	36.2
Right	70.9	59	70.9	65.5	70.3	68.2	66.5	61	59.8	49.2	34
Rear	73.6	60.4	72.1	69.7	69.3	70.9	71.2	59.7	60.2	48.9	35.5

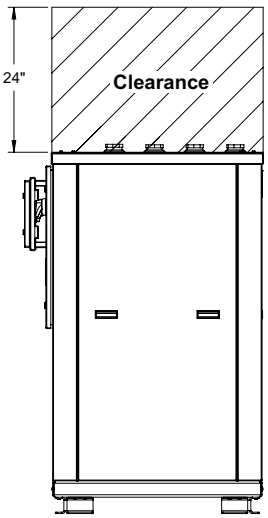
Physical Specifications and Clearances

Table 7: MHP0270R Physical Specifications

Physical Specifications	
Domestic Water Connections	2" FPT
Source Water Connections	2" FPT
Internal DHW Water Volume (Gal.)	4.7
Internal Source Water Volume (Gal.)	0.4
Dimensions (in.)	32-1/2" L x 39" D x 66-1/4" H
Weight (lbs.)	1074 Dry / 1113 Operating
Compressor Type	Scroll
Refrigerant	R513A
Factory Charge	38.5
Oil Charge (Initial/Recharge)	230/220
Salt Spray Resistance Cabinet/Evap	1000

Figure 1: MHP0270R Model Clearances

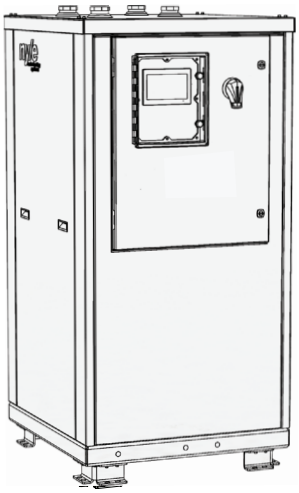


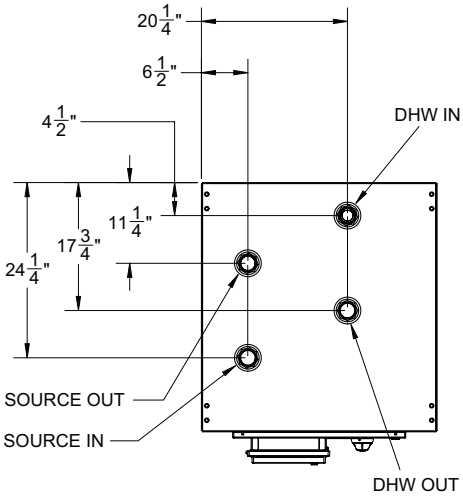


Left Side View

Note: *If vibration transmission and/or seismic activity is a concern for your installation, account for the additional height of vibration isolation or seismic measures as recommended by a qualified engineer.*

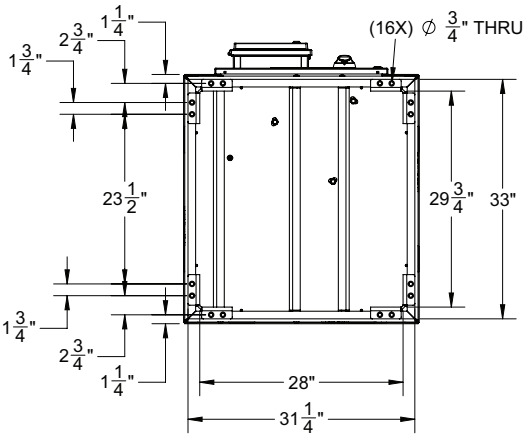
Dimensions



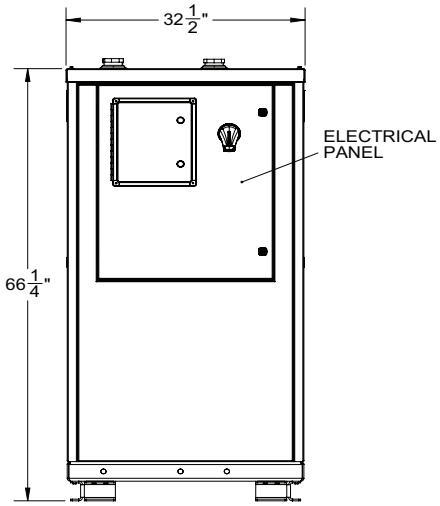


TOP

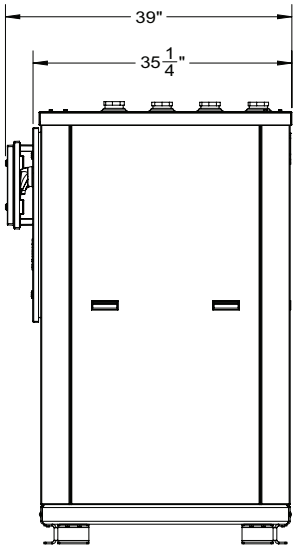
Anchor Locations



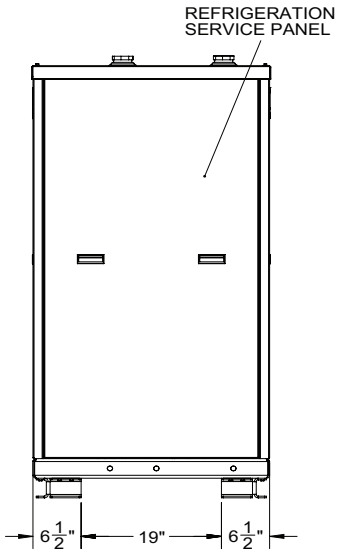
BOTTOM



FRONT



LEFT



BACK

Before Ordering Your Heat Pump

Lochinvar recommends following this pre-order checklist, to minimize the chances of costly mistakes and potentially lengthy project delays:

- ☐ Be sure to thoroughly review this manual and familiarize yourself with the equipment's installation requirements. The manual has been organized to follow the general sequence of most installations. **If any details are not clear or questions are not answered contact your Lochinvar representative to resolve them ahead of time.**
- ☐ **Review performance specifications** against your intended installed environment and water temperature requirements, and ensure the unit will perform appropriately for your conditions. **Ensure all options and accessories are correct and appropriate for your application!**
- ☐ **Review physical specifications** to ensure the unit will have adequate installation space, support, and clearances, familiarize yourself with piping and wiring connections to ensure all attached infrastructure will be able to access the unit.
- ☐ **Evaluate the need for backup heat production, especially in applications with colder source water.** Water source heat pumps without antifreeze additives in their source water should not be run below 45 deg F. inlet source water temperatures.
- ☐ Be clear on your plan to deliver, transport, mount, and secure the unit.
- ☐ **Double check the voltage requirements of the unit you intend to order,** to make sure it is compatible with the available voltage on site.
- ☐ **Double check the intended piping configuration for your project (Single-pass or Multi-pass)** and ensure you are ordering the correct model for your application.
- ☐ Water to Water heat pumps are multidisciplinary installations that may require any or all of the following trade specialties to support: **site prep/structural, electrical, plumbing, automation/controls, and refrigeration.** Be sure that various specialties involved in your project are well informed as to their role in the installation and are properly certified and qualified in their specialties in accordance with all governing codes and regulations.
- ☐ Be sure that qualified refrigeration technicians are available for installation troubleshooting support and ongoing system maintenance. If this is in question, contact your local Lochinvar representative to discuss support options.

Exterior Installation Considerations

Water source heat pumps are intended for indoor installation. While it is possible to install them outdoors in mild climates, onboard freeze protection is limited.

If the heat pump detects a freeze risk on its water lines, it will operate its internal DHW/load side circulator. This requires the heat pump to be powered up, to have free flow through the connecting pipes, and it may not be sufficient protection against deep cold exposure.

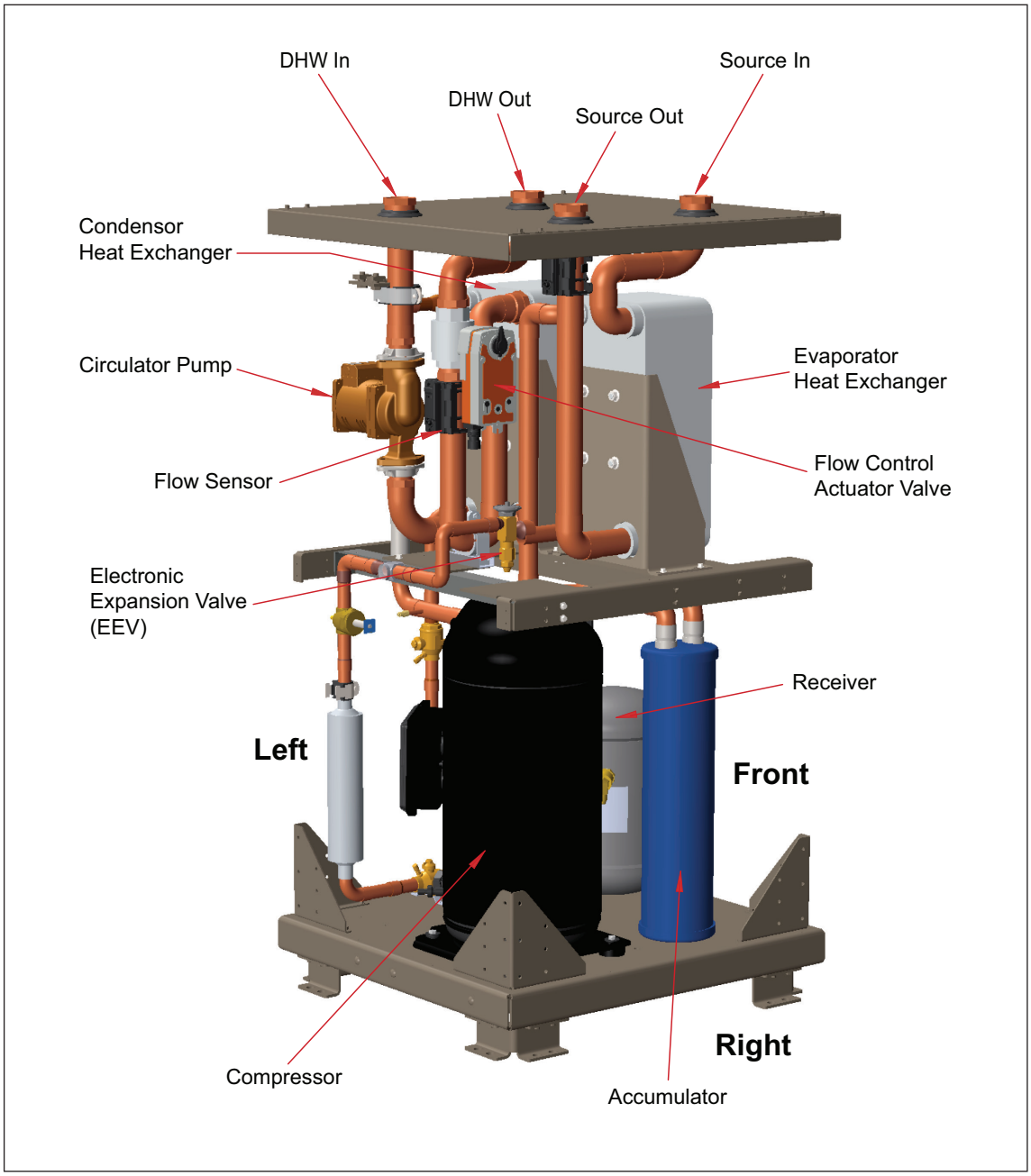
On the source loop side, the heat pump will trigger its pump contacts as a normal demand would to enable flow via external devices, however if external flow control devices are not operational, there is no other form of freeze protection on the source side of the unit. Glycol antifreeze for the source side is the best practice for exterior installations.

This heat pump must be shut down and drained prior to any exposure to temperatures significantly below freezing unless more robust measures, such as field applied heat tracing, are applied.

Since most climates can experience temperatures that deviate well below typical annual norms, It is not recommended to install water source units outside, and there is no warranty against freeze damage that may occur in outdoor installations.

Unit Diagrams and Key Components

Figure 2: MHP0270R Model



Heat Pump Installation

Required Tools and Materials

In addition to all standard tools and material required for any electrical or plumbing installation, some of the other specialty tools required to support this installation include:

1. Heat transfer compound such as Honeywell part number 107408 or equivalent.
2. Electrical switch lock out devices - used to secure disconnect switches/breaker panels while servicing.
3. Electronic thermometer with range of 10°F - 210°F (-12°C - 100°C) including:
   - Sensors capable of measuring surface temperatures on water or refrigerant piping
   - Sensors capable of measuring ambient air temperature
4. Volt-Ohm Multimeter - capable of measuring:
   - AC Voltage up to 600 VAC
   - DC Voltage up to 24 VDC
   - Ohms up to 2,000,000 ohms
   - Continuity
   - Amperage up to 200 amps

Transporting The Heat Pump

WARNING

Heat pumps are heavy objects and require planning to transport and mount safely. Always use appropriate safety gear and transportation equipment to move your heat pump.

IMPORTANT!

Do not remove, cover, or deface any permanent instructions, wiring diagrams, labels, or the rating labels present on the unit. These are important for installation and service.

1. Review the physical specifications of your heat pump to ensure equipment used and delivery route is appropriate for the size and weight of the unit.
2. Do not tilt the unit beyond 45 degrees at any time. Prior to fully hoisting the unit, perform a test lift to be certain the unit remains level and balanced at its center of gravity.
3. Do not hoist the unit with chains or straps unless spreader bars are furnished and used as depicted in Figure 3. The side panels and roof of the unit are not constructed to handle significant force from the sides or above. Follow all standards and best practices for hoisting and load stabilization.
4. When using a forklift to raise or move the heat pump, take care not to damage the feet on the unit. Follow all standards and best practices for lifting and load stabilization.
5. When transporting a heat pump by vehicle, the heat pump must be in its shipping crate, or the heat pump must be shrink-wrapped and properly strapped for safety. Heat pumps require air ride equipped vehicles for road transportation.

Figure 3: Rigging and Hoisting Unit

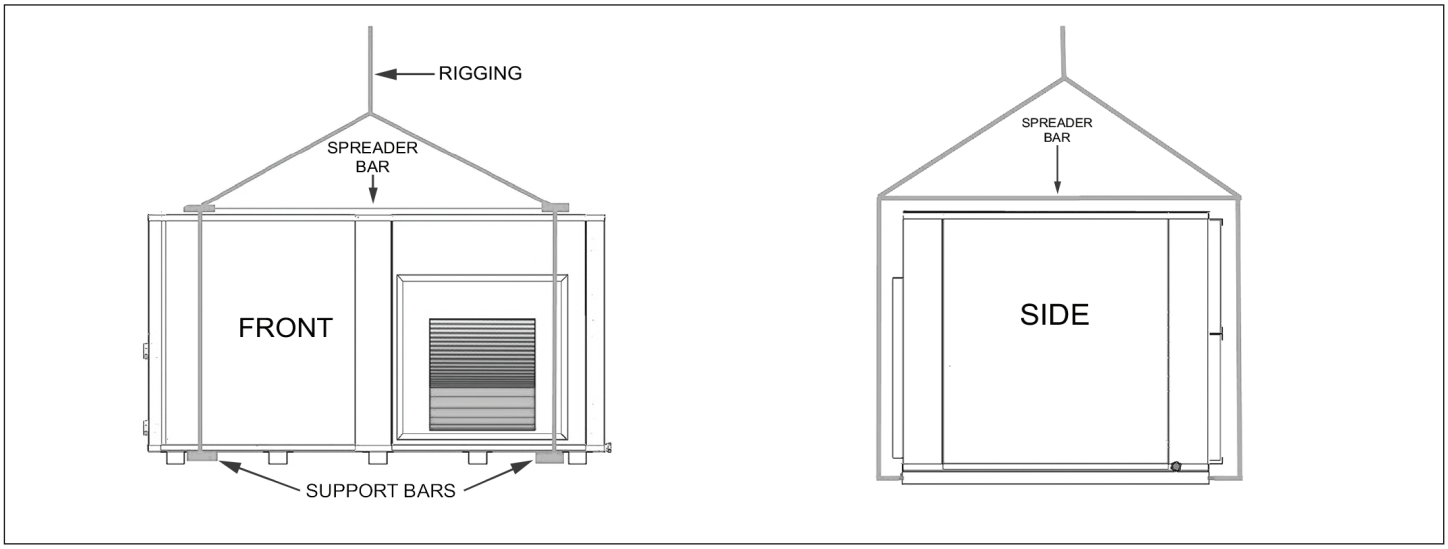
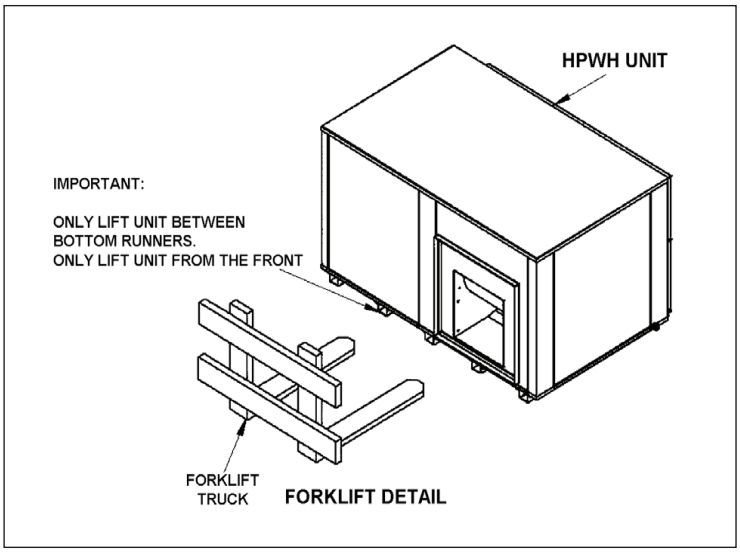


Figure 4: Lifting and Moving Unit with Forklift



Heat Pump Placement

- ☐ Ensure the location meets all requirements for ambient temperature, structural support, unit dimensions, operational and service clearances. Refer to “Performance Specifications and Requirements” on page 7.
- ☐ Mounting location must be level and stable.
- ☐ Heat pump location should be easily accessible for visual inspection and for regular service. Placement should allow for possible heat pump removal/replacement in the future.
- ☐ Water source heat pump placement should be in interior, protected space. Exterior locations are possible in very mild climates that do not experience freezing conditions, but they are not recommended. See “Exterior Installation Considerations” for additional notes on exterior installations.
- ☐ Heat pump location should minimize the risk of water damage in the event of leaks or drainage failure.
- ☐ Location of heat pump should be determined with consideration of operating sound and potential vibration on the surroundings and to avoid these impacts where possible.

Mounting the Heat Pump

The heat pump must be mounted on a solid, level base, typically a concrete pad. Unit should be bolted securely to the base using the supplied attachment points. If the base is not level, then the heat pump itself must be leveled to ensure proper condensate drainage and mounting stability.

Mounting the unit on elevated rails is also possible. Complete structural requirements for rails are beyond the scope of this manual: however, required rail positions and minimum rail widths are specified in Figure 5 on page 16, which will properly support the internal structure of the heat pump.

WARNING

Prior to fully hoisting the unit, perform a test lift to be certain the unit remains level and balanced at its center of gravity.

Seismic Mounting

Local area seismic or vibration considerations should be addressed with field supplied, additional equipment as per applicable codes, regulations, and best practice. Seismic mounts and vibration control measures should be evaluated and determined by a qualified engineer.

CAUTION

After placing the heat pump, ensure that the unit is level front to rear and side to side. Units that are not level may vibrate excessively.

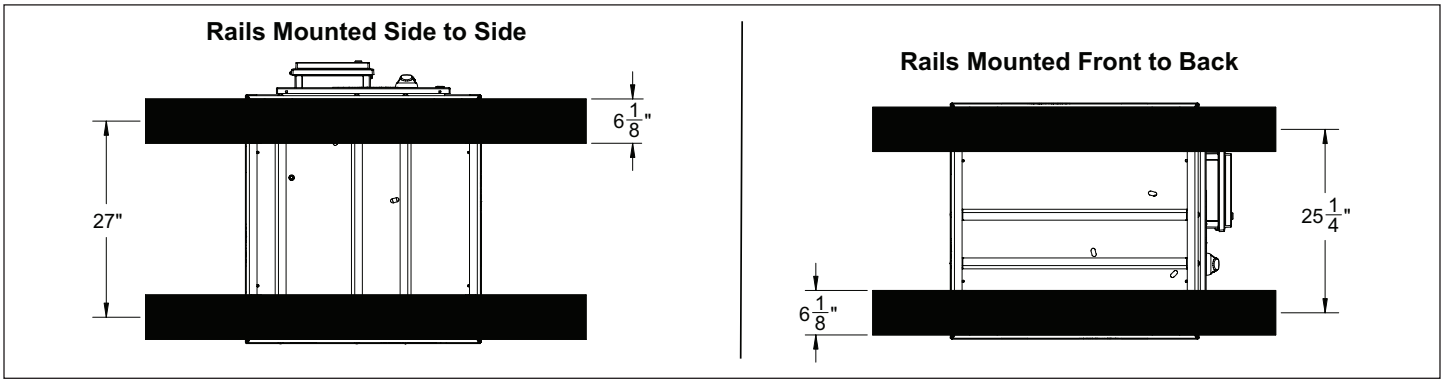
Rough-In Checklist

Infrastructure must sometimes be installed prior to the installation of the unit. Items to consider for “rough-In” installation include:

- ☐ Domestic water pipes to and from storage tanks, including pipe insulation.
- ☐ Source water pipes to and from the heat source loops, including pipe insulation.
- ☐ Primary power wiring.
- ☐ Control wiring for alarms, BMS interface, and external accessories. Best practice is to install a minimum of one 18/12 control wire and a CAT-5e/6 wire to ensure that all likely accessories and control functions could be utilized.
- ☐ Site prep for mounting the heat pump.

Please refer to the appropriate sections of this manual for the specific details associated with each item.

Figure 5: MHP0270R Mounting Rails Positions and Widths



IMPORTANT!

Prior to fully hoisting the unit, perform a test lift to be certain the unit remains level and balanced at its center of gravity.

Water Piping - DHW Loops

Heat pump water heaters in this model series are designed to be piped to tank water storage in either a “Single-pass” configuration or a “Multi-pass” configuration, which is set at the time of order and is not field-adjustable.. **These units significantly differ in their piping and operation and are not interchangeable!** Be sure of your operation method and intended piping configuration before ordering your heat pump, and ensure that proper single- or multi-pass piping practices are followed.

CAUTION

Deploying heat pumps with incorrect piping configurations can result in performance failure and dramatically shortened equipment lifespans. No Warranty coverage is extended to equipment installed in piping configurations inappropriate for the heat pump operational mode.

Heat pump water heaters ALWAYS require storage tanks, and are not instantaneous water heaters.

Domestic Water Quality

IMPORTANT!

All information in this manual is superseded by all applicable local codes and regulations. Where codes and guidance from Lochinvar are in conflict, advise Lochinvar or your local manufacturer’s representative of the conflict.

Water quality is an important concern for human health and well being. Ensure DHW supply water is clean and meets all applicable standards for potable water consumption. In addition, water quality can affect longevity and performance of the heat pump water heater on both DHW and source sides of the system. Ensure system water meets the specifications in the table of water quality guidelines in this manual.

Table 8: Water Quality Specifications

	MG/l or ppm
Alkalinity	70-300
Sulfate	<70
HCO3/SO4	>1
Conductivity	10-500 µS/cm
pH	7.5-10
Ammonium	<2
Chlorides	<100
Free Chlorine	<1
Hydrogen Sulfide	<0.05
Free CO2	<5
Total Hardness	60-120
Nitrate	<100
Iron	<0.2
Aluminum	<0.2
Manganese	<0.1

WARNING

Components and Water Circuit Additives:
Use only components and joining methods suitable for potable water usage and suitable for temperatures in excess of 160 degrees Fahrenheit on the DHW piping circuit. Only pure water or food grade additives should ever be used within the DHW circuit on the heat pump. Any other additives or contaminants in the water circuit can render it unusable for domestic water heating.

Domestic Piping Considerations

CAUTION

The following considerations are important to preserve the performance and integrity of the system components.

Check Valves:
The heat pump water heaters have internal control valves that can be configured to be open or closed when the unit is off. External check valves are not necessary on heat pump piping. Single-pass units, which can modulate flow to very low velocities, CAN NOT use check valves on the heat pump outlet or inlet piping.

Heat Tracing:
Potable water piping installed outdoors must be insulated and heat traced properly if any freeze risk is present. Failure to protect potable water from freezing can result in property damage and catastrophic heat pump failure.

Pipe Sizing and Care:
All connected piping must be sized for the design flow rates, appropriate velocity, and available head pressure for the heat pump in use. Refer to the performance specifications of your heat pump for this information. Ensure that pipes are clean and protected from intrusion of dirt or other contaminants during the installation.

Pressure Testing and Purging:
All connected pipes and components should be pressure tested with air before filling with water. A thorough fill and purge process is required to remove any air bubbles from the lines BEFORE starting up the unit. Failure to purge piping of air bubbles can damage the internal circulator. Install purge valves in the connected piping to facilitate this process.

Tank Selection:
Temperature stratification is necessary to the proper operation of Single-pass systems, and usable volume is very important for Multi-pass systems. To ensure optimal system operation, vertical tanks are preferred for commercial heat pump domestic water heating systems, as they typically maintain usable volumes and stratification better than horizontal tanks.

⚠ WARNING

The following considerations are important life/safety measures. Failure to properly accommodate these issues can result in damage, injury, or death.

Expansion:
All hot water systems require accommodation for fluid expansion. Ensure that expansion devices such as expansion tanks or compression tanks are specified and sized by a qualified engineer. T&P Valves are required on primary storage tanks and should be sized for the total maximum BTU capacity of all attached heat sources.

Water Temperature Control:
Commercial water heating is typically done at storage temperatures that are dangerous for human contact. All water heating systems should install mechanical temperature limiting devices, such as tempering valves, between storage volumes and the building's plumbing fixtures.

Typical DHW Water Piping Process

1. Rough-in any pipe/insulation/heat trace in areas that will not be accessible or traversable during the final installation.
2. Pressure test any rough-in sections that will not be accessible for repairs later in the process.
3. Final installation of remaining water piping and components.
4. Pressure testing the water side components with air to a pressure less than 150 PSI or the pressure rating on the storage tank pressure relief valves. Lochinvar recommends testing to 80-100 PSI or 1.25x the standing pressure of the system, whichever is higher, for a minimum of two continuous hours.
5. Find and rectify any leaks.
6. Install heat tracing and pipe insulation after the piping is determined airtight.
7. Isolate the building piping from the heat pumps and storage, then use purge valves to fill the heat pump and storage system.
8. Purge lines by continuing to fill through isolated flow paths until fill water exits a far point drain valve in a clean and continuous stream without stuttering or foaming.
9. After the system has operated for 24 hours, including several heat/cool cycles of the heat pump, a final check for water leaks should be performed.

Single-Pass with Swing in Series Piping

CAUTION

Heat pumps are typically suitable for either single- or multi-pass operation, but not both. Before installing any heat pump in a single-pass configuration, verify that your heat pump model is intended for installation in a single-pass configuration.

Single-pass heat pumps deliver water at a variable flow rate, at a fixed temperature, to the top of a stratified temperature storage tank. Water is pulled from the cold, bottom portion of the tank. Flow rates through the heat pump will vary depending on inlet water temperature, outlet target water temperature, and the current heat pump capacity. Single-pass heat pumps have a “design” flow rate, which is the highest flow rate they need to be able operate at, but most of their operation is at significantly lower flow rates than design.

Single-pass systems rely on stratification in the primary storage tank to operate properly, and are designed to operate with relatively cold incoming water. For these reasons, building recirculation loops must be returned to a separate “swing tank”, which is fed by the heat pump storage tank in series during domestic hot water demands. The swing tank then provides hot water to the mixing valve

CAUTION

It is important that recirculation loops are NOT returned to the primary storage in single-pass with swing systems! Failing to separate recirculation will result in under-performance and shorten the lifespan of the heat pump.

The swing tank is heated by a secondary heat source to handle recirculation losses when demands are not present, and can provide a convenient way to provide backup heat to the system as well. Swing tanks must be maintained at a lower temperature than the primary storage, to maximize the contribution of the heat pump to overall energy demand. The swing tank must have heating capacity installed or connected sufficient to cover at least the recirc system heat losses.

Single-pass systems feature the smallest storage and heat pump capacity requirements, and are typically the most efficient method as well, however, on systems where recirculation loads are a larger fraction of the total energy usage, such as office buildings, either heating the swing tank with a dedicated heat pump or using the multi-pass method is recommended

Diagram 2: Single-Pass with Swing in Series Piping Basic Concept

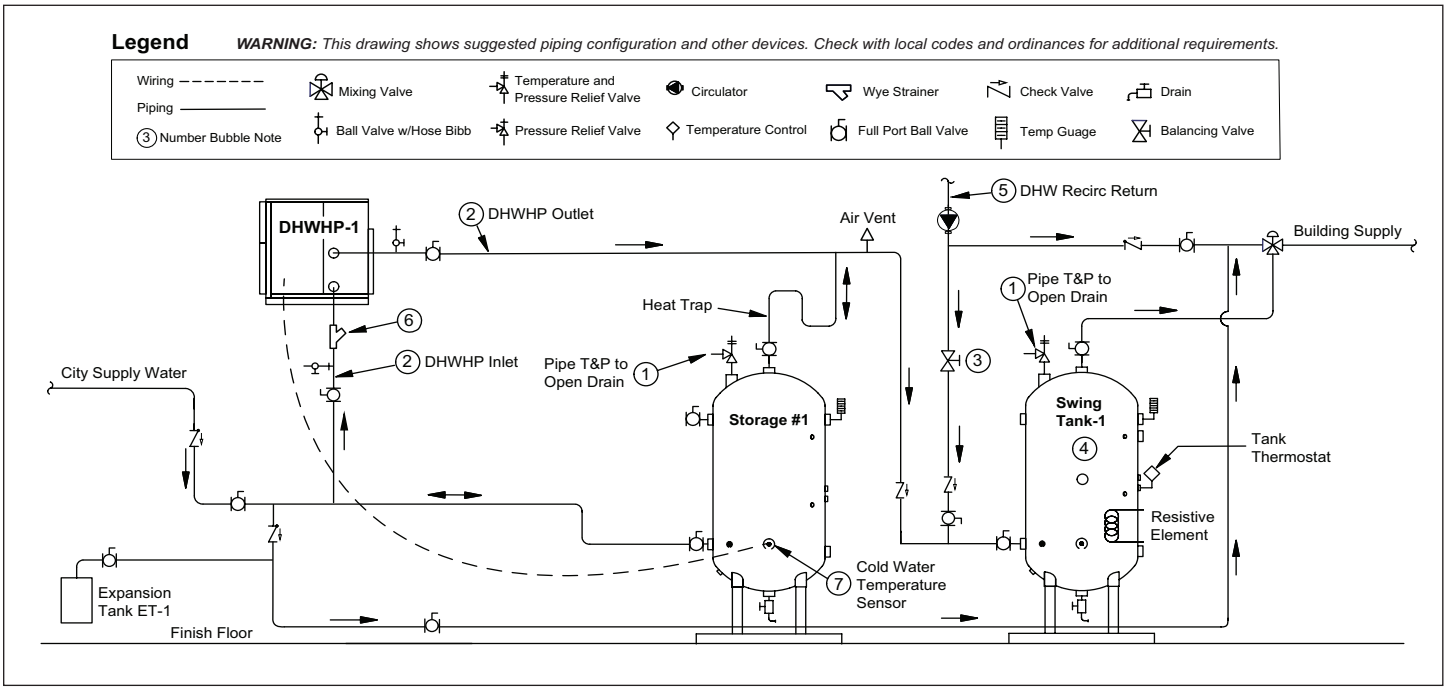


Diagram 2 Notes:

1. The temperature and pressure relief valve setting shall not exceed the pressure rating of any component in the system.
2. There shall be no check valve in the heat pumps supply and/or return circuit.
3. Calibrate the balancing valve after installing, by fully opening the valve, then gradually close the valve to the point where the mixing valve is unable to obtain steady mixture. Next, open the valve slowly to a point where the mixing valve is stable.
4. The swing tank temperature must be set 10°F below the storage tank temperature.
5. The recirculation pump must deliver the minimum flow rate of the mixing valve.
6. The wye strainer has a 20-mesh screen.
7. The sensor must have at least the minimum cold cycle volume of the heat pump, below the sensor position to the bottom of the tank, or the next lowest sensor.

Diagram 3: Single-Pass with Swing in Series Piping Multi-Unit Concept

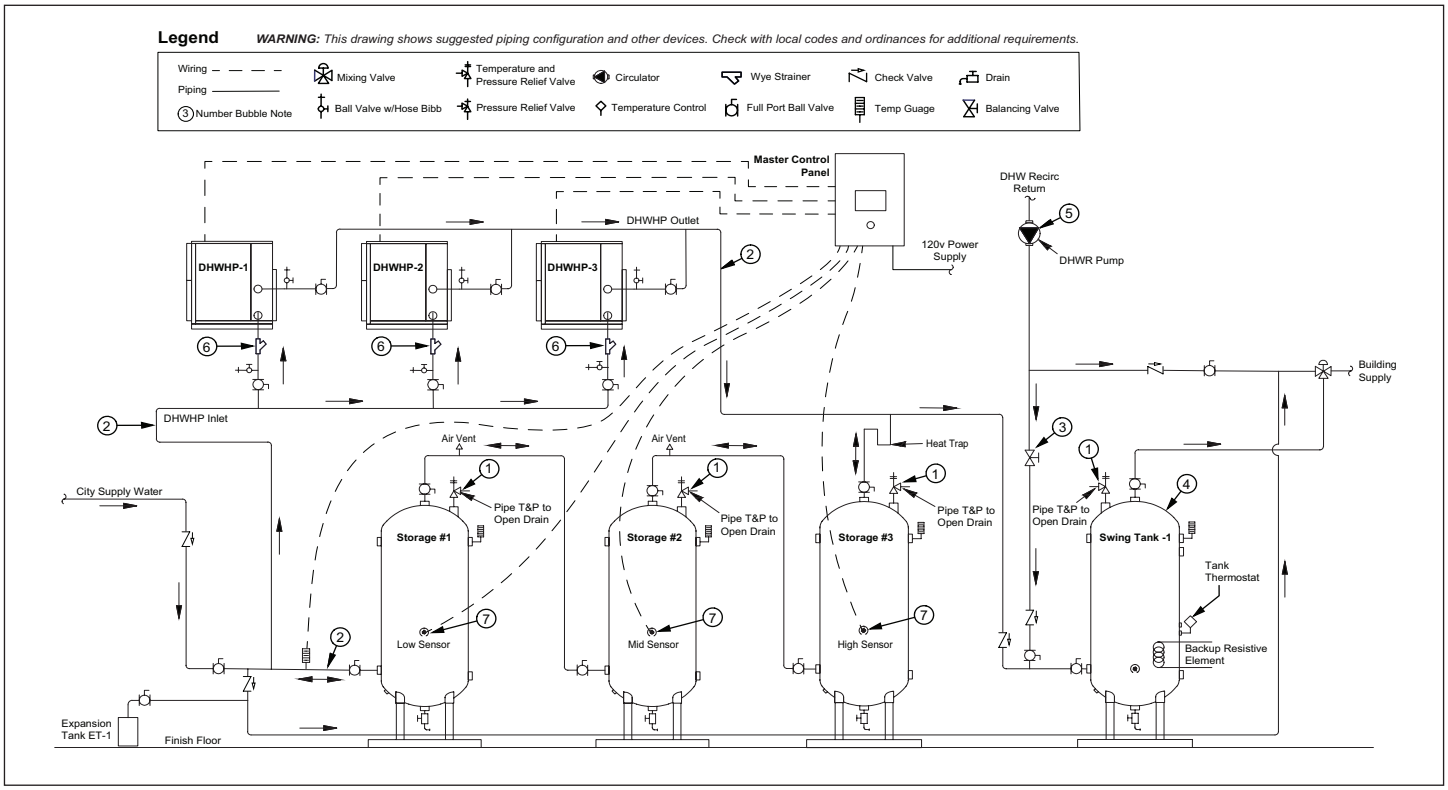


Diagram 3 Notes:

1. The temperature and pressure relief valve setting shall not exceed the pressure rating of any component in the system.
2. There shall be no check valve in the heat pumps supply and/or return circuit.
3. Calibrate the balancing valve after installing, by fully opening the valve, then gradually close the valve to the point where the mixing valve is unable to obtain steady mixture. Next, open the valve slowly to a point where the mixing valve is stable.
4. The swing tank temperature must be set 10°F below the storage tank temperature.
5. The recirculation pump must deliver the minimum flow rate of the mixing valve.
6. The wye strainer has a 20-mesh screen.
7. The sensor must have at least the minimum cold cycle volume of the heat pump, below the sensor position to the bottom of the tank, or the next lowest sensor.

Multi-pass Piping

CAUTION

Heat pumps are typically suitable for either single- or multi-pass operation, but not both. Before installing any heat pump in a multi-pass configuration, verify that your heat pump model is intended for installation in a multi-pass configuration.

Multi-pass units deliver water at a fixed flow rate, at a variable temperature, with leaving water temps several degrees higher than incoming water temp. These systems do not always stratify their tanks, and water is taken from the colder bottom portion and returned slightly higher in the tank, similar to traditional boiler-driven systems.

Multi-pass systems do not require swing tanks, and building recirculation loops will typically return directly to the primary storage tanks. They require significantly more storage and heat pump capacity than single pass systems, but can be more efficient for systems with large recirc loads that would otherwise be serviced by secondary boilers or electric resistance heating. Also, for projects optimizing heat pump contributions for “part load” conditions, this method allows the heat pump to run with an additional backup source at the same time quite easily.

Multi-pass heat pumps can also be used to heat swing tanks in single-pass systems, instead of electric resistance or fossil fuel backup.

Diagram 4: Multi-pass Piping Basic Concept

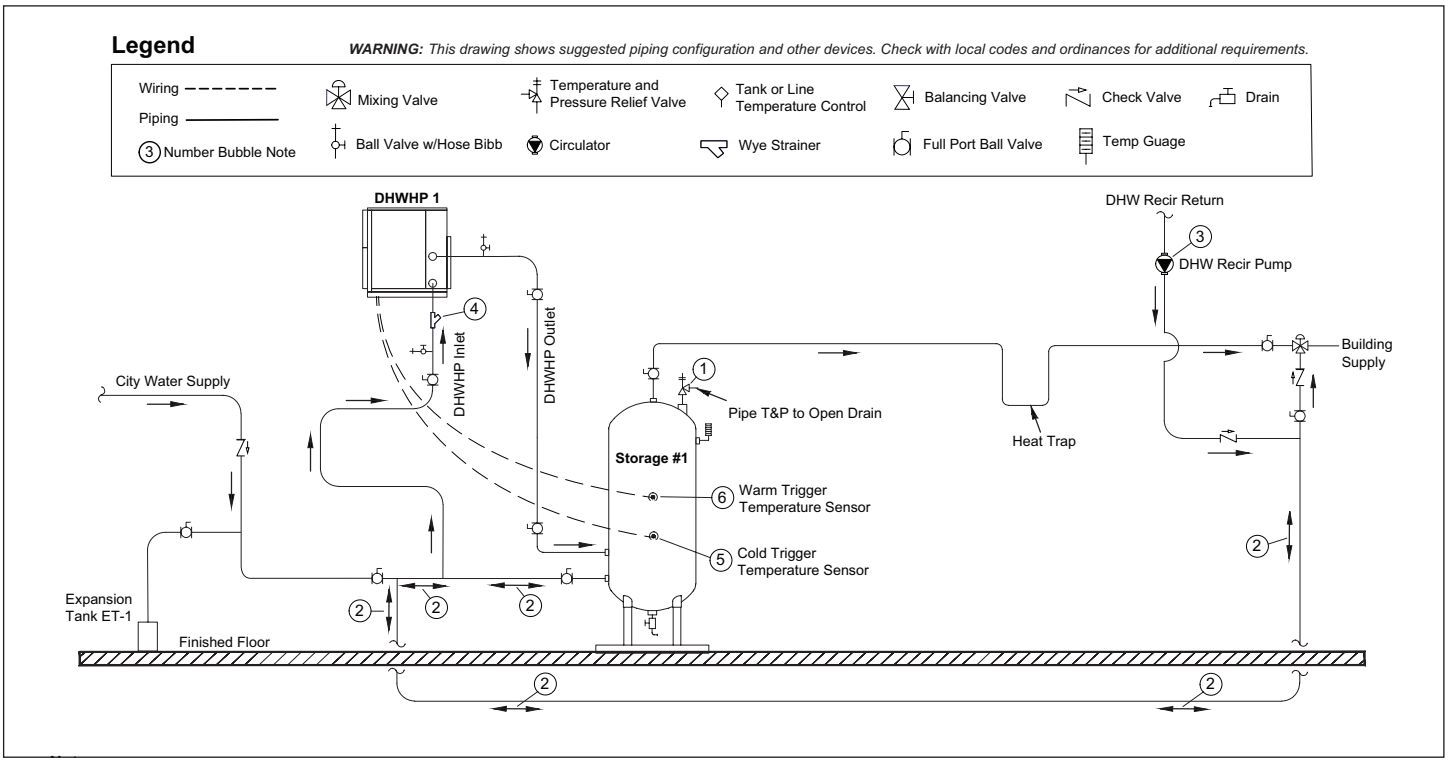


Diagram 4 Notes:

1 The temperature and pressure relief valve setting shall not exceed pressure rating of any component in the system.
2 There shall be no check valve on bi-directional lines.
3 Re-circulation pump shall deliver the minimum flow rate of the mixing valve.
4 Wye strainer has a 20-mesh screen.
5 Minimum cold cycle volume of heat pump shall be one-fifth of tank volume at maximum. Cold sensor shall be set to trigger at a temperature below the recirculation return temperature.
6 Minimum warm cycle volume of heat pump shall be two-fifths of tank volume at maximum. Warm sensor shall be set to trigger at a temperature above the recirculation return temperature.

Diagram 5: Multi-pass Piping Basic Concept

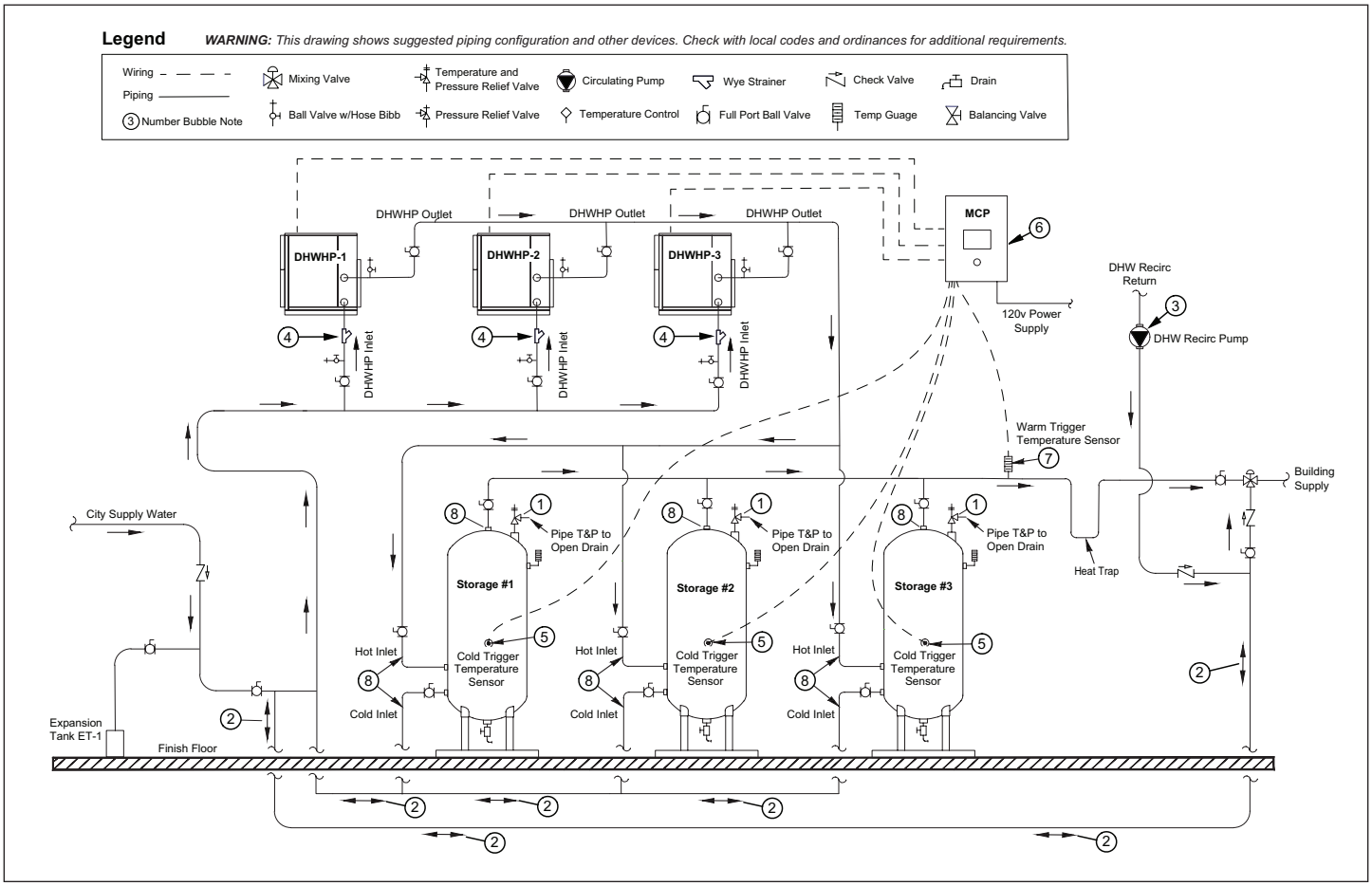


Diagram 5 Notes:

1. The temperature and pressure relief valve setting shall not exceed the pressure rating of any component in the system.
2. There shall be no check valve on bi-directional lines.
3. Re-circulation pump shall deliver the minimum flow rate of the mixing valve.
4. The wye strainer has a 20-mesh screen.
5. Cold trigger sensor height shall be one-fifth of individual tank volume at maximum, based on ‘n’ number of tanks, each tank shall have 1/n of heat pump minimum cold cycle volume below cold trigger sensor. Cold sensor shall be set to trigger at a temperature below the recirculation return temperature.
6. MCP is sold separately from heat pumps and storage tanks.
7. Tank piping shall be reverse return on all piping connections.
8. Tank piping shall be reverse return on all piping connections.

Additional Domestic Piping Notes

- **Exterior water piping** requires insulation in all cases. Heat Tracing is required on all pipes that could be exposed to freezing conditions. UV jacketing is recommended for pipes exposed to sunlight. Insulate as per applicable energy codes, ambient conditions, and heat trace mfg requirements.
- **All piping** between heat pump and storage should be sized for appropriate pressure drops and velocities. Refer to your heat pump's specifications for available pressure and flow rate requirements.
- **No external solenoids** or zone valves should be installed between the HPWH and primary storage. Circulation between heat pump and storage tanks is required as a part of freeze protection in some conditions.
- **Ensure all storage tanks are rated for potable usage**, have adequate volume for the design, have tappings and thermowells at required locations, and are able to handle system flow rates without fitting erosion.
- **Air venting** is recommended at any high points of the hot water outlet piping from the water heater and hot water outlets from the storage tanks. Use only air vents suitable for open, oxygenated systems. Ensure the air vents installed are appropriate for the ambient conditions.
- **Expansion tank** must have a direct pipe run to all heat sources. Expansion at each heat source must be able to travel to the expansion tank with no opposing check valves.

Water Piping - Source Loop

Source water piping is similar to DHW water piping, and requires all the same considerations for water quality, expansion, pipe sizing, pressure testing and purging. Please review the DHW water piping section of this manual regarding those topics.

Key differences from DHW water piping, and additional considerations for source side piping, are discussed in the following subsections.

Source Loop Freeze Protection

Evaporator discharge water can be significantly colder than the source water temperature. In any application that is likely to see source loop temperatures fall below 45 Deg F, an antifreeze additive such as inhibited propylene glycol must be used. Best practice dictates targeting a freeze protection rating at least 20 degrees below the coldest inlet temperature or exposure temperature expected for the source loop, whichever is lower.

Use only antifreeze products formulated for use in hydronic systems: automotive antifreeze or other such products are not appropriate

CAUTION

Allowing source loops to freeze can cause lockouts or damage to the heat pump, as well as to attached pumps and piping. Catastrophic heat pump failure is a possibility. DO NOT operate the heat pump on source loops that fall below 45 degrees F without appropriate freeze protection additives.

The source loop design flow rate includes a safety factor appropriate for up to 30% blends of ethylene or propylene glycol: no adjustment to design flow rates are required for glycol mixtures. However, pressure drops through the heat pump are affected in accordance with the following table: use these corrected values instead of the standard design pressure drop for the source loop, if glycol is used in the loop.

Greater than 30% concentration of glycol additives requires evaluation by qualified engineers.

Table 9: MHP0270R Source Pressure Drops for Glycol Antifreeze

	10% Mix	20% Mix	30% Mix
Propylene Glycol (Ft. Hd.)	11.7	13.0	15.4
Ethylene Glycol (Ft. Hd.)	12.4	14.2	16.5

Non-Potable Source Loops

Most source loops are not potable water. In non-potable applications, any piping or components capable of handling the temperature and pressure requirements of the source water loop can be used, without regard for its suitability in potable systems, in accordance with local codes.

Component selection should consider whether the piping system is susceptible to oxygen diffusion, either by changing over the volume of water in the piping regularly, or through the walls of plastic piping systems. Open systems should use only non-ferrous components to avoid premature component failure from oxidation.

Careful consideration should be given to plastic pipes that run outdoors that may be exposed to, and damaged by, UV light.

Source Loop Pumping and Flow Control

The source side of your water source heat pump DOES NOT have an integral circulator.

Therefore, circulators and control devices are field supplied and must be sized and controlled appropriately to provide design flow rates at the specified pressure drop for the heat pump and attached piping during operation.

CAUTION

Failure to reach design flow rates can result in lockouts, under-performance, and creates a potential freeze risk in non-glycol systems that can catastrophically damage the heat pump.

Water source heat pumps need individual source loop pumps, or control valves on centralized pumping systems. Pay attention to the response time of any pumps or control valves on the source loop: it may be necessary to modify the heat pumps' default evaporator flow delay timers to avoid nuisance flow alarms for particularly slow valve motors or pump control algorithms.

The "source pump" contacts on the heat pump can be used as a control signal to trigger source side flow control equipment. Do not use the "Run Signal" contacts to control source loop equipment.

Power Wiring

Commercial heat pumps are voltage-specific, and can only be installed on the intended voltage the heat pump was manufactured for. Voltage and electrical information is included in the model number and is located on the nameplate for your heat pump.

Please be sure to refer to the heat pump's electrical specifications in this manual, product submittals, project documentation, and the power requirements and the following installation instructions before attempting to connect the heat pump to the building's electrical infrastructure.

⚠ WARNING

Improper connection of unit electrical power can result in immediate equipment damage, fire, injury, and death. Ensure only qualified personnel interact with main power lines. Never work while power is live; use all possible safety precautions and perform all work in accordance with appropriate local codes, National Electric Code, and/or CSA regulations.

Power Requirements

1. Voltage is correct to within +/- 5% of ratings and within +/-2% between phases.
2. Power is clean, reliable, and well grounded.
3. Wire and breakers are appropriately sized for the load.
4. Wire and breakers are properly specified for the environment they are installed in.
5. Backup generators should include line conditioning suitable for running electronics.
6. Follow manufacturer's torque specifications for all power wire equipment by others.
7. Install service disconnects on incoming power feeds at the heat pump location.
8. All power wiring to the unit must be rated for 600v.

Power Wiring Installation

Electricians must create their own entry into the heat pump. A white "Electrical Connection-Knock Out Hole Here" sticker marks the suggested location for the power wire entry power on the heat pump exterior cabinet, and a second sticker inside the electrical enclosure marks the recommended entry point into the enclosure itself.

Yellow stickers are for control wires, and they are addressed elsewhere in this manual.

All holes should be weather-tight when installation is completed.

1. Ensure the heat pump is disconnected from live power, then open the electrical enclosure access door.
2. Identify the white "Electrical access - knockout hole location" stickers: one on the heat pump exterior cabinet, and one on the interior of the electrical enclosure.
3. Drill or knock out the sticker locations.
4. Run conduit to/through the knockouts with appropriate, weather tight connections, and pull wire into the enclosure. Do not obscure service panels with external power conduit.
5. Make the final power wire and ground wire connections in accordance with the power connection drawing. Use 375 inch-pounds of torque on the power wire terminals in the heat pump enclosure.
6. Close the electrical enclosure box. Power may be restored to the heat pump.

Figure 6: Wiring Knockout Locations

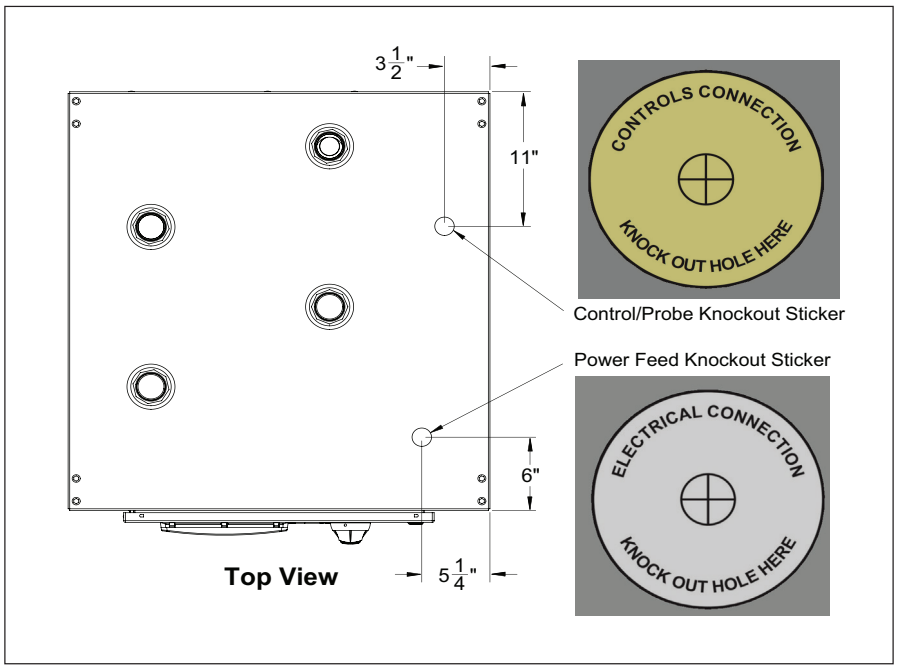
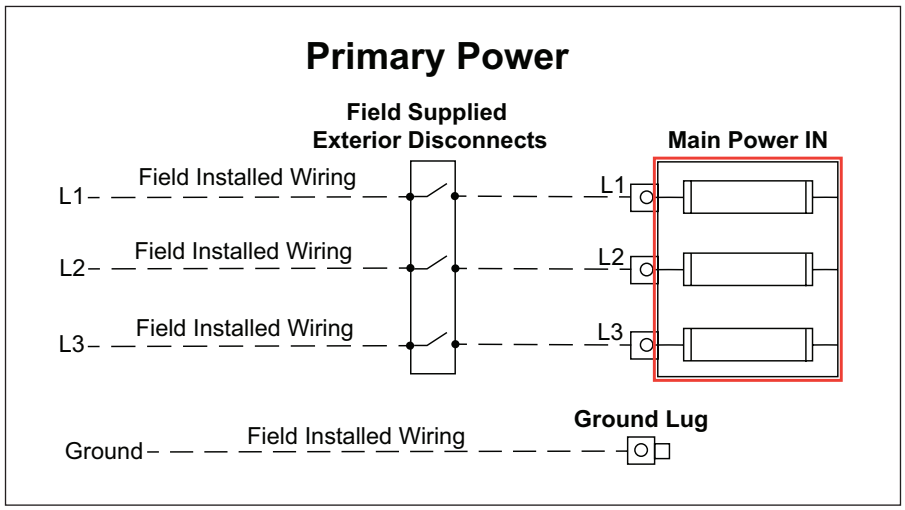


Diagram 6: Power Wire Connections



Backup Generator Interlocks

Backup generators are often project requirements, to continue normal heating operation at full capacity, or to operate freeze protection functions during power outages. However, such generators generally require periodic testing, which can often involve a power interruption to the building or the mechanicals during the generator test.

This power interruption can cause power faults and/or immediate shutdowns of the heat pump. If this occurs in the middle of a heating cycle, it will prevent a proper shutdown, and it will create extra strain on the heat pump on the next startup. Therefore, to help ensure the long term reliability of the heat pump, it is best to avoid any regular risk of mid cycle power interruptions.

Your heat pump has “enable” contacts, and these contacts can be used to allow/disallow operation. Best practice is to interrupt the “enable” contact at least 2 minutes before a generator test, whether by an output on the generator control system itself, or potentially by a standalone timer set to trigger before a generator test. The enable contact can be closed after the generator test is complete to resume normal operation.

Control Wiring

Commercial heat pumps have several contact points for field wiring of external controls. More contacts can become available with the installation of various field accessories, and details on those accessories are shown in their own installation manuals.

Best practice is to run enough conductors to use all available contacts if the installation site would make wire retrofits challenging, even if those contacts are not intended for use during the initial installation. This allows changes and reconfiguration to happen seamlessly in the future. Additional conductors to allow for wire breakage, and/or the addition of future accessories, is also recommended.

The following drawing and notes provide a quick reference of the available contacts on the base heat pump, and what they are used for. For more advanced configuration guidance, see the Programming and Operation Manual for the software version in use, and/or instructions for any relevant accessories.

All control wiring should follow best practices, local codes and regulations, and NEC/CSA guidelines.

⚠ CAUTION

Do not steal power from powered contacts for external devices. Follow all ratings and wire types for the contacts detailed below.

Control Wiring Installation

1. Ensure the heat pump is powered down when making electrical connections.
2. Identify a control wire access point on the heat pump's exterior cabinet: this is marked with a yellow control wire knockout sticker. Do not obscure service or removable panels with wire or conduit.
3. Run all external sensor wires and/or control wiring for field accessories through the access point.
4. Open the electrical enclosure. The inside of the enclosure has several cable glands and/or yellow knockout stickers indicating appropriate wire entry points. Control wires may use any available entry point into the enclosure that does not contain line voltage wiring. Once in the enclosure, wires can be entered into the electrical raceways to get to the appropriate destination. See "Control Wiring Connections" diagram for specific wire run termination points.
5. Wire and tug test the new connections, and then close the electrical enclosure. Power may be restored to the heat pump.

CAUTION

Contacts labeled "Dry" are intended to switch power from external sources. DO NOT APPLY EXTERNAL POWER to any contact that is not "Dry". Equipment damage and system failure can result from applying power to a powered contact. Follow all power specs for each contact.

Diagram 7: MHP0270R Field Wiring Control Points

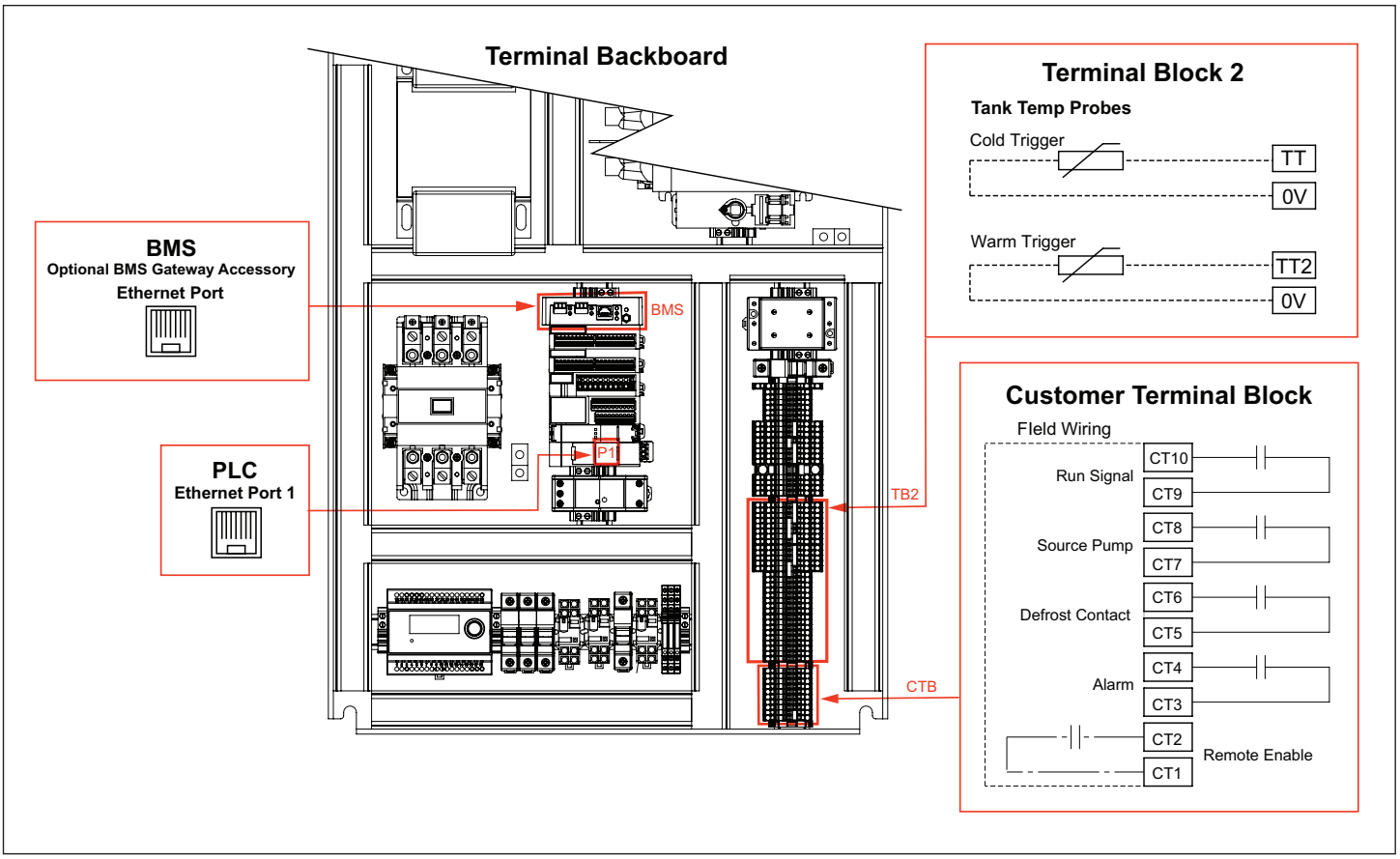


Table 10: Control Wiring Specifications

Contact	Location	Terminals			Wire Type	Power
Alarm Status	CTB	AC1	AC2	--	Any	Dry[4]
Defrost Status	CTB	DC1	DC2	--	Any	Dry[4]
Remote Enable	CTB	RE1	RE2	--	Any	Dry[4]
Run Signal	CTB	RC1	RC2	--	Any	Dry[4]
Source Pump Relay (N.O.)	--	5	9	--	Any	Dry[4]
Source Pump Relay (N.C.)	--	8	12	--	Any	Dry[4]
Service Mode[1]	TB2	i7	24v	--	Any	24Vdc
Tank Temp	TB2	TT	0v	--	Stranded/Shielded	24Vdc
Tank Temp[2]	TB2	TT2	0v	--	Stranded/Shielded	24Vdc
BMS[2]	COM	A1	B1	SC1	Stranded/Shielded	Variable
Ethernet	PLC	Note 3	--	--	CAT-5 or CAT-6	--

Notes:

1 Service Mode enables access to the Diagnose screen. Jump terminals for access.

2 Reserved terminals used by optional accessories and/or internal wiring. See accessory instructions.

3 Ethernet Port on internal PLC controller

4 All CTB Dry contacts are rated for 6A/250VAC, or 6A/30VDC maximum.

Field Wiring Control Points

Alarm Status Contacts: This dry set of contacts close whenever the compressor will not run because of lockout. Backup heat sources can use this as an enable trigger.

BMS: The Ethernet or Serial connection is used to connect to building automation systems. See appropriate accessory documentation for details on these contacts.

Defrost Contacts: This dry set of contacts close whenever defrost functions are active.

Ethernet: Ethernet cable is not necessary for standalone operation. Ethernet is used for connecting the optional Master Control Panel, various accessories, and service laptop connections, and will be necessary for future products and functionality. Roughing in a CAT-5 or CAT-6 cable at installation is recommended.

Remote Enable: When “Remote” mode is enabled during configuration, these terminals will place a heat demand on the heat pump when an external controller closes a set of dry contacts. No tank sensor is wired to the heat pump in this mode.

In “Tank Sensor” mode, these contacts can be jumped, or this can be used as a permission signal by external dry contact controls to allow/disallow compressor operation. Please note that a unit in “Tank Sensor” mode will not run without a jumper or closed contact between the remote enable terminals!

Remote enable contacts ship with a factory installed jumper.

Run Signal Contact: This dry set of contacts close whenever the internal circulator is engaged. External devices that need to run in response to the heat pump can use this as a trigger, such as louver motors and/or booster pump relays. Do not use these contacts to run Source Loop flow control devices.

Source Pump Relays: These contacts close in a similar manner to the Run Signal contacts, closing when flow is desired. However, they also close when water source units require freeze protection on the source loop side. Use these contacts to trigger any external flow control valves or pumps on the source loop feeding the heat pump.

Tank Temp: This sensor input allows the heat pump to monitor and control the tank temperature. Take care that the tank sensor is installed in accordance with the sensor diagrams appropriate to the type of heat pump in use, single- or multi-pass. The Tank Temp sensor will serve as the Cold trigger in multi-pass systems. See Tank Sensor detail sections in this manual.

Tank Temp 2: This is the Warm trigger sensor in multi-pass systems. See Tank Sensor detail sections following this section.

Single-pass Tank Sensors

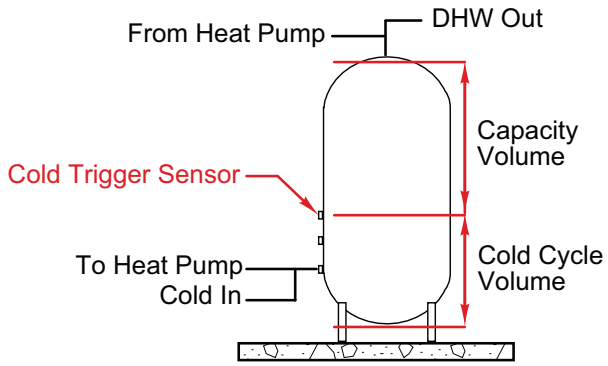
Single-pass systems require a trigger sensor or aquastat mounted low in the primary storage tank to initiate a demand when very cold incoming water is detected. This is typically mounted at or near the “Minimum Cold Cycle Volume” for the heat pump, as measured from the piping inlet on the tank from which the heat pump will draw its cold water, typically as close to the bottom of the tank as possible. Minimum cold cycle volumes are listed in the specifications for your heat pump.

Tank volume above the trigger sensor is called the “Capacity Volume”, which is the minimum amount of stored hot water needed to satisfy peak demand periods. This volume should be calculated during initial project sizing and, along with any minimum cycle volumes, is used to calculate the required size of the tank.

A separate termination sensor is used to end the demand. This can be an internal water temp sensor on the heat pump, or if a central controller is used, a dedicated sensor is installed on the common pipe to the heat pump inlets of all attached heat pumps.

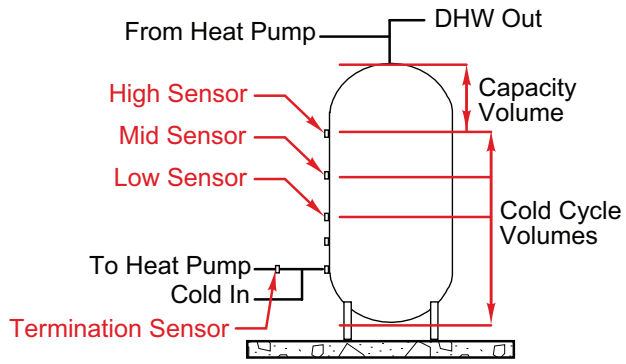
Staging multiple heat pumps is achieved with additional sensors in the storage tank to track the movement of the stratified hot water layer. Staging operation requires an additional external central controller to coordinate the heat pumps and to provide the additional required sensors. For more information on central controller systems, refer to the installation manuals for your specific controller.

Figure 7: Single-pass Tank Sensor Location



Note: Minimum CCV is listed in the heat pump specifications.

Figure 8: Single-pass, Multiple Heat Pumps with Central Controller



Notes:
1. Minimum CCV is listed in the heat pump specifications.
2. Multiply minimum CCV by the minimum number of heat pumps to operate simultaneously for each sensor position.
3. Ensure high sensor point allows for adequate capacity volume above the sensor.

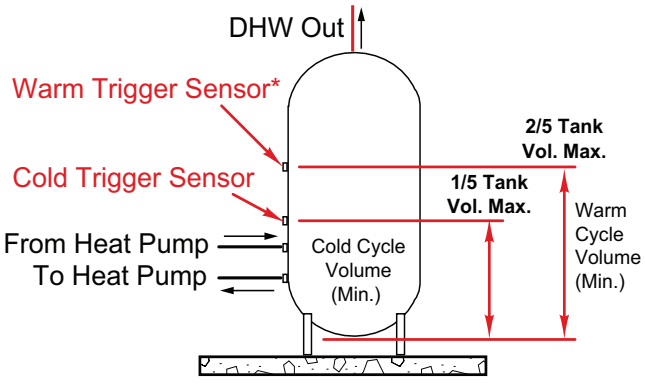
Multi-pass Tank Sensors

Multi-pass systems can experience demands either during cold water draws, or from the accumulated heat loss of recirculation loops. As the temperature of the water in these two demand conditions is very different, different sensors are used to trigger heat pump operation for these two conditions: a “Cold” trigger sensor to run when the bottom of the tank is very cold, and a “Warm” trigger sensor higher in the tank to trigger on higher temperatures associated with recirculation loop return water temperatures.

Cold Trigger Sensor

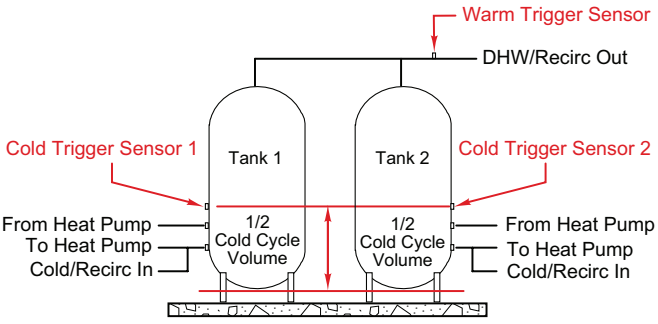
The cold trigger sensor is mounted low in the tank to activate on incoming cold water temperature, but not at recirc return temperatures. This allows the fastest response possible during demands without short cycling. This sensor also determines when heat demands are satisfied, when it reaches the tank target temperature

Figure 9: Multi-pass, Single Tank Sensor Locations



*Warm Trigger set above recirc return temp.

Figure 10: Multi-pass, Multiple Tanks with Central Controller



Notes:
1. CT sensors mounted at a maximum of 1/5 of total tank height.
2. Minimum CCV are in the heat pump specifications: ensure enough CCV is included for the minimum number of heat pumps to run simultaneously.

Cold Trigger Sensor Placement Rules

1. The cold trigger sensor must allow for a MINIMUM cold cycle volume for the heat pump below the sensor. This volume is specified in the heat pump specifications.
2. A MAXIMUM of one-fifth of the total tank volume can be below the cold trigger sensor.
3. Both volumes are the volume of water from the sensor position to the bottom of the tank.

Warm Trigger Sensor

A second warm trigger sensor is used higher in the tank. This sensor is used to activate at warmer, recirculation loop return temperatures, and provide for additional volume to avoid short cycling.

Warm Trigger Sensor Placement Rules

1. The warm trigger sensor must allow for a MINIMUM warm cycle volume for the heat pump below the sensor. This volume is specified in the heat pump specifications.
2. A MAXIMUM of two-fifths of the total tank volume can be below the warm trigger sensor.
3. Both volumes are the volume of water from the sensor position to the bottom of the tank.
4. In multiple-tank, multiple-heat pump applications, the warm trigger sensor may move to a common hot water outlet pipe, and it becomes a “minimum outlet temperature” sensor to signal a maximum stage event is necessary. A separate central controller accessory is needed for these systems: for more information on multiple heat pump control strategies, see the manuals for your Main Control Panel accessory.

Configuration

Configuring the heat pump will require active main power, and a copy of the Programming and Operation Manual for the specific software version installed on your heat pump.

CAUTION

Note that while activating the main power for programming is safe, turning compressor operation “on” at this stage is not. **Complete your heat pumps’ Pre-Startup Checklist before pressing the “on” button in the control interface on any attached heat pumps!** Operating the heat pump compressor before all checks have been performed can result in severe equipment damage or major component failure.

A Programming and Operation Manual is included with your heat pump for the software version installed in the factory. However, since the installed software on the heat pump can be updated during or after installation, and software is continually being improved, the POM originally included with the heat pump may not always match the current software version on the heat pump.

CAUTION

Always check the currently installed software version on your heat pump before attempting to configure or operate the heat pump, and ensure you are using the POM for the correct and specific software version.

If the currently installed software does not match the original POM shipped with your heat pump, it is best practice to throw away out of date paper copies of the POM.

Programming and Operation Manuals, and current recommended software updates, are both available through your manufacturer’s representative.

Pre-Startup Checklist

The following checklist is provided for reference, to assist in preparing for the eventual startup of the equipment. Please contact your manufacturer's representative MORE THAN ONE MONTH from your intended startup date. The following checklist items will be reviewed for compliance before a final startup is scheduled with a factory authorized commissioning agent.

CAUTION

Heat pump startups may only occur with a factory authorized commissioning agent. Do not start the heat pump before the authorized agent is on site and ready to assist, or you may void your warranty and cause equipment damage or failure.

Placement and Physical Checks

- ☐ Unit is level, stable, and securely mounted.
- ☐ Unit has all appropriate service clearances, and access panels are not obstructed by pipes, wires, or other obstacles.
- ☐ Unit is adequately protected from falling objects, vehicles, or other potential damage.
- ☐ Open the heat pump and inspect the cabinet around the refrigeration piping and compressor for any signs of leaks or oil. If any signs of refrigerant leak are present, DO NOT START THE UNIT. Leaks need to be identified and fixed, and refrigerant charge weighed, before startup can occur safely.
- ☐ Perform a tug test on all wires in the electrical enclosure, to ensure all wires remain firmly seated after shipping. Ensure all power feeds are powered down for this testing.

CAUTION

Damage to the compressor due to startup with visible leak indication is not covered by warranty.

Source Loop Checks

- ☐ Pumps and control valves are wired, powered, and active.
- ☐ Source piping is insulated and freeze protected as appropriate.
- ☐ Source piping is pressure tested, filled, and purged of air.
- ☐ Source water quality is acceptable for operation.

DHW Water and Piping Checks

- ☐ Exterior water piping is insulated, freeze protected, pitched toward drain points.
- ☐ All water piping has been pressure tested and verified leak free.
- ☐ All water piping has been filled with water and actively purged of air.
- ☐ Pressure relief valves are piped to the floor, drain, or reservoir as per local codes.
- ☐ Water quality has been determined to be acceptable for operation and potable use.
- ☐ Verify tank temperature probe or aquastat is installed as per the tank sensors shown in Figure 7 or Figure 9 on page 31 for single or multi-pass operation, as appropriate.

Electrical Checks

- ☐ Main power wires are securely attached to the heat pump and active.
- ☐ All control and communication wires are securely attached, and connected equipment is in place and ready to operate.
- ☐ Verify jumper or controller is installed on Remote Enable terminals if the heat pump is in tank mode. Verify jumper is NOT installed on Remote Enable terminals if the heat pump is in external control mode.

Final Checks

- ☐ All panels and enclosures are securely closed and affixed.
- ☐ All ball valves in the piping systems are open, including valves on expansion tanks, storage tanks, condensate drains and swing tanks.
- ☐ Turn on the main power to allow the heat pump to warm up. DO NOT engage any functions on the control interface.

CAUTION

Starting up the compressor without appropriate warming time will damage the compressor. Do not start up the heat pump water heater without a factory authorized technician present.

Startup Procedure

CAUTION

This heat pump must be started up by a factory authorized commissioning agent ONLY. Starting up the heat pump before a factory authorized technician is present will void your warranty.

Use the following procedure to schedule a start up:

1. Request a startup date through your manufacturer's representative. Dates are not guaranteed, and must be submitted more than one month before the intended startup.
2. Pre-Startup checklists must be completed and submitted to your rep more than 5 days before the startup in order for the startup date to remain scheduled. Cancellation of your startup date restarts the scheduling process, including the one month minimum delay.
3. At least 24 hours before startup, ensure that the power feed connection(s) to the heat pump being started up are live and activated, and that the heat pump is set to "Off" on the interface screen to prevent compressor operation.

CAUTION

This heat pump must be connected to active power for at least 6 hours before pressing the "On" button to enable operation. Failure to allow this warm up time can result in damage to the compressor and void warranty.

Note: *If the pre-startup checklist is found to misrepresent the startup readiness of the system once the technician is on site, the startup may be cancelled, requiring a rescheduled startup date, and you may be charged for additional travel expenses and time.*

Initial Troubleshooting

In the rare event that major components end up damaged or defective, you MUST obtain assistance and approval from your rep or from Lochinvar to authorize warranty replacement, BEFORE the components are removed from service.

For more in-depth troubleshooting information, see the **Programming and Operation Manual** for the software version installed on your heat pump. Some of the information in this manual include:

- Configuration and parameter guidance
- Sequences of operation
- Screen navigation guides
- Specific alarm tables

Also, refer to installation manuals for installed accessories for additional troubleshooting scenarios.

Detailed wiring schematics are shipped with your heat pump. If these are missing, or if you need a digital copy, you can obtain your wiring schematics through your manufacturer's rep. Detailed service part diagrams are also available. You may need the "production date" from the nameplate of your heat pump to get accurate wiring schematics and service part diagrams.

Use the following list of startup issues to assist with the diagnosis and troubleshooting of some common problems.

Table 11: Initial Troubleshooting

Problem	Check
Display Screen is Dark	Main power is active at breaker and input terminals.
	Transformer is providing 120V power.
	Control screen is receiving power.
Can't Access Diagnose Screens	Service jumper is installed and secure.
Heat Pump Won't Run	Primary power is active.
	No alarms or alerts present on control screen.
	System parameters would create a demand.
	System is turned "On" at control screen.
	System is "Enabled" by BMS.
Pump Runs, but Not Compressor	No Alarms are present.
	Heat pump is not in post purge.
	Compressor Time Delay (CTD) is zero.
	EWT is not too hot for selected mode.
Unit Runs, but Water Temperature is Insufficient	Tank and/or outlet temps are set correctly.
	Single-pass: Internal control valve is working properly.
	Outlet temp is allowed by current ambient temps.

Routine Maintenance

Like all modern equipment, commercial heat pump water heaters require routine maintenance to ensure efficient, safe, and reliable operation. Be sure that a maintenance schedule is created and adhered to, and that all personnel involved with maintenance are informed and educated on their role in supporting the system.-

Following are suggesting timelines and maintenance items typically associated with water source heat pump water heater installations. It is not possible to foresee all possible system configurations, accessories, or site conditions, so this list should be considered advisory only. Final maintenance schedules are the responsibility of the service/maintenance personnel on the project, and should be adjusted in accordance with best practices and observed conditions.

Weekly Checks

- ☐ Visually inspect heat pump for wear or damage to unit exterior or interior.
- ☐ Inspect for ice or water buildup around the heat pump.
- ☐ Check screens and/or BMS portals for alarms.
- ☐ Verify the system is within normal operating parameters for water temperatures.

Biannual Checks (Spring and Fall)

- ☐ Inspect and clean cabinet interior as necessary.
- ☐ Inspect and operate all source side flow control devices.
- ☐ Isolate, inspect, and clean any wye strainers on the heat pump DHW and source piping.
- ☐ Inspect all attached piping for water leaks and/or uncontrolled condensation.

Annual Checks

- ☐ Confirm flow rate using the “Max Purge” button on the control interface, and verify that flow is at or above maximum design flow for the unit.
    - ☐ Descale heat exchanger if necessary (low flow unsolved by purging/pipe/pump inspection).
- ☐ Operate all relief valves and inspect for signs of weepage or leaking.
- ☐ With the unit off, disconnect the main power leads on the compressor. With a dielectric tester (megger), test and record resistance on each set of windings. Store this information for future reference. Reconnect the main power leads to the compressor.
- ☐ For systems with glycol antifreeze, test antifreeze efficacy, and water pH levels for excessively corrosive conditions.

Service Log

Issue Description	Date	Servicer

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