Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

Modular Water Source Heat Pump Water Heater

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Conforms to: UL 60335-1; CAN/CSA C22.2 No. 60335-1
UL 60335-2-40; CAN/CSA C22.2 No.60335-2-40

LEAD FREE
NSF/ANSI/CAN 61
IAPMO R&T ®

For R513A units produced from 7/20/25 to:

IM-Modular-L260429

Installation Manual

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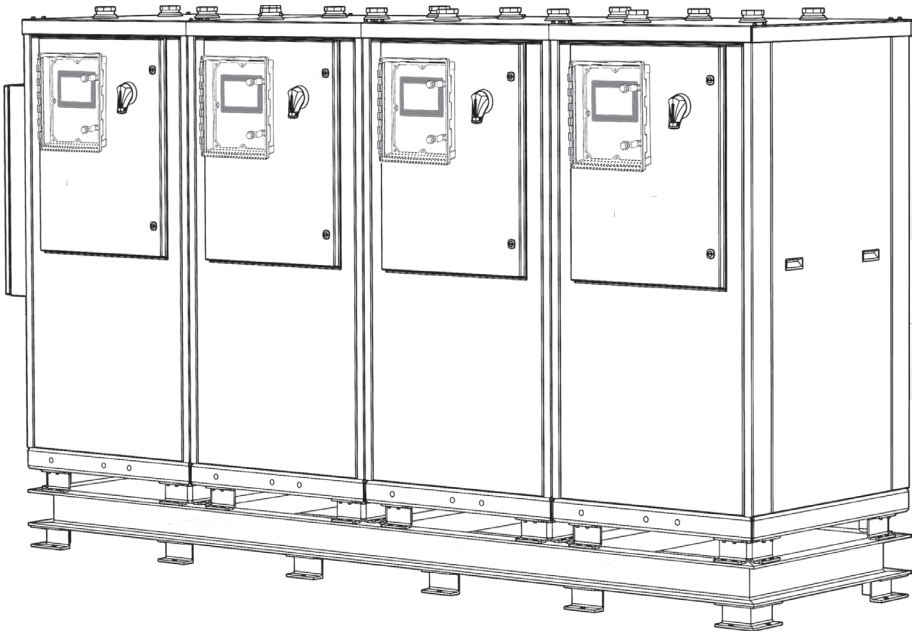
Contents

Introduction

Thank you for your purchase of a modular 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 domestic hot water from a highly efficient and capable heat pump, helping end users reach their carbon reduction, electrification, efficiency, and operating cost reduction goals.

Modular water-source heat pumps use R-513A refrigerant, are available in single-pass or multi-pass configurations, are capable of providing single-pass water heating to appropriate external storage vessels with up to 160°F water, can run in multi-pass or other applications with up to 175° water, 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.

Modular water source heat pumps are not intended for primary space conditioning. When installed on condenser loops, they can provide supplemental cooling and heat recovery benefits.



Modular Water Source Heat Pump Water Heater
Size MHP1080R Shown

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.

⚠ 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 the heat pump 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

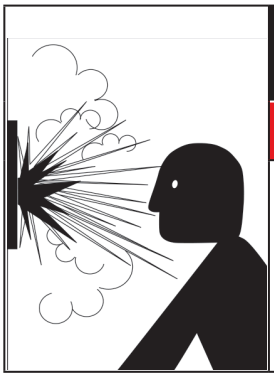
IMPORTANT!

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

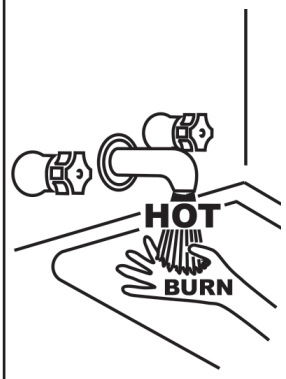
Read and understand this instruction manual and the safety messages herein before installing, operating or servicing this water heater.

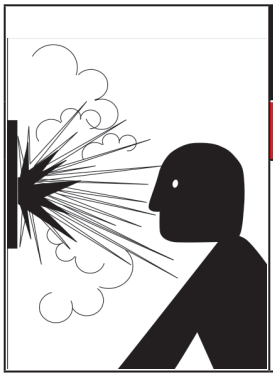
Failure to follow these instructions and safety messages could result in personal injury or death

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.

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General Description

Purpose

This water source heat pump is an array of individual monobloc water-to-water Commercial Heat Pump Water Heater (CHPWH) modules 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 cooling are a potential benefit of 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

Modular 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 its footprint, and to simplify placement considerations for multiple-unit installations. 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 and a water temperature control valve in each module, and load side double wall heat exchangers for direct piping to domestic hot water storage tanks. Left or Right side mounting options are available for primary power and/or onboard control panel locations, depending on control options selected at order.

Controls and Electrical

The modular water source line features a single point power connection in 208-230v, 440-480v, and 575v 3 phase variants, determined at the time of order. The power connection point is specified at time of order as “left” or “right” side mounted.

Modular heat pumps consist of individual modules that are certified to UL/CSA 60335-2-1 and -40, NSF-61, and feature an SCCR rating of 100 on their primary power connection. They are provided single point power via a UL508A Power Distribution Center (PDC) or Main Power and Control Panel (MPCP or MPCP–G), specified at time of order.

Individual modules provide dry contact outputs for Alarm conditions, Run indication, and a source pump relay for each module.

Modular heat pumps with the PDC option have no onboard staging controls, and require an external staging controller. External MCP, MCP-G, and MCP-LA control panels are all compatible with modular heat pumps using the PDC option. An ethernet port is provided to connect the modular heat pump to the external controller.

Modular heat pumps with the MPCP option have onboard staging controls which provide additional contacts and provide the control necessary to coordinate the individual modules.

Modular heat pumps with the MPCP-G option are also MODBUS and BACNET capable, allowing the modular heat pump to be integrated into BMS systems by 3rd party integrators using Bacnet/IP and MSTP protocols.

For More Information

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

Performance Specifications and Requirements

Performance Specifications	MHP0540R		MHP0810R		MHP1080R		MHP1350R	
	Single-pass	Multi-pass	Single-pass	Multi-pass	Single-pass	Multi-pass	Single-pass	Multi-pass
Nominal DOE Capacity [1]	557,600 BTUs/hr.		836,400 BTUs/hr.		1,115,200 BTUs/hr.		1,394,000 BTUs/hr.	
Nominal DOE Performance [1]	4.1 COP		4.1 COP		4.1 COP		4.1 COP	
Recovery Rate [2]	1328 Gal./hr.		1991 Gal./hr.		2655 Gal./hr.		3319 Gal./hr.	
Min. Ambient Exposure	33 Deg F		33 Deg F		33 Deg F		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	40 - 115	40 - 140	40 - 115	40 - 140	40 - 115	40 - 140
Design Flow Rate	44.0 GPM	72.0 GPM	66.0 GPM	108.0 GPM	88.0 GPM	144.0 GPM	110.0 GPM	180.0 GPM
Water Circuit Pressure Drop [4]	16.9 Ft. Hd.	7.4 Ft. Hd.	16.9 Ft. Hd.	7.4 Ft. Hd.	16.9 Ft. Hd.	7.4 Ft. Hd.	16.9 Ft. Hd.	7.4 Ft. Hd.
Heat Pump Cv Value [4]	8	20	8	20	8	20	8	20
DHW External Head Allowance [5]	19.5 Ft. Hd.	18.7 Ft. Hd.	19.5 Ft. Hd.	18.7 Ft. Hd.	19.5 Ft. Hd.	18.7 Ft. Hd.	19.5 Ft. Hd.	18.7 Ft. Hd.
Min. Cold Cycle Volume [6]	119 Gal.							
Min. Warm Cycle Volume [7]	N/A	334 Gal.	N/A	334 Gal.	N/A	334 Gal.	N/A	334 Gal.
Min. Tank Volume [8]	N/A	835 Gal.	N/A	835 Gal.	N/A	835 Gal.	N/A	835 Gal.
Source Loop								
Max Water Pressure	300 psig							
Source Water Operating Range	35 - 120 Deg F							
Design Flow Rate	96 GPM		144 GPM		192 GPM		240 GPM	
Water Circuit Pressure Drop [4]	11.11 Ft. Hd.							
Heat Pump Cv Value [4]	22							
Miscellaneous								
Sound Pressure [9]	74.5 dB (Front), 73.4 dB (Left), 75.7 dB (Right), 73 dB (Rear)		74.2 dB (Front), 73.0 dB (Left), 72.2 dB (Right), 75.8 dB (Rear)		76.6 dB (Front), 73.3 dB (Left), 75.7 dB (Right), 77.8 dB (Rear)		–	
Certifications	Modules: Certified to UL60335-1, UL60335-2-40, CSA C22.2 60335-1, CSA 60335-2-40 (LC16116-1), NSF/ANSI/CAN 61-2023 (N-16151) Control Panel: UL508A.							

Notes:

1 Nominal heating performance is 100% water source at 80 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 source conditions. See max LWT graph.

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.

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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

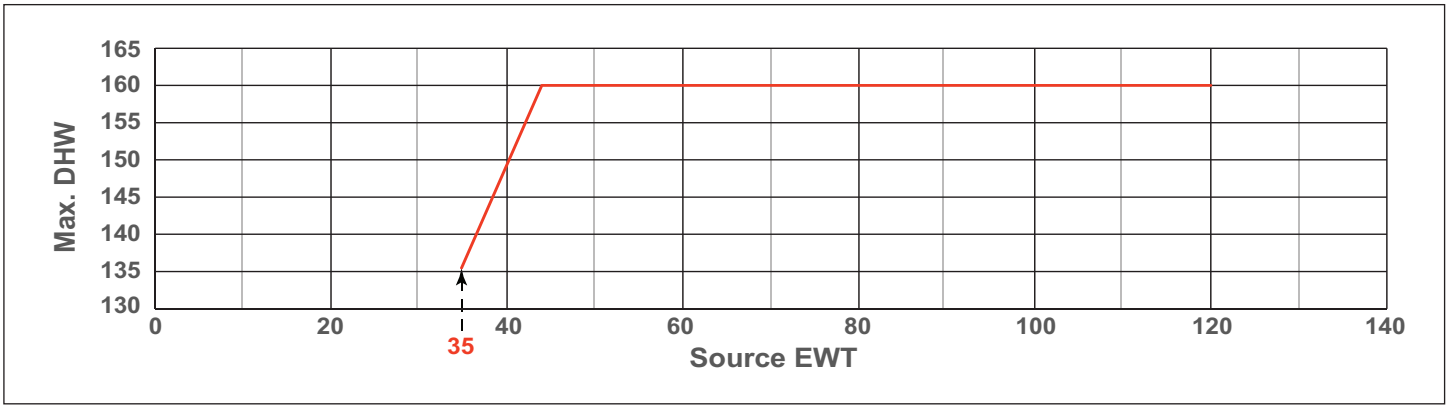
Water source heat pumps SHOULD NOT be installed in ambient conditions that may freeze. See the “Exterior Installation Considerations” section of this manual for a more detailed discussion of freeze protection requirements for your heat pump.

Expanded Performance Data

Table 1: Modulars Single-pass Performance: (50° EWT, 140° LWT, 100% Water Source Side)

Unit Size	Entering Source Water	Supply Heating Capacity (Btu/hr)	Source Cooling Capacity (Btu/hr)	Power Input (kW)	Heating COP	Cooling COP	Combined COP
MHP 0540R	90°F	560,800	407,260	45	3.7	2.7	6.3
	80°F	507,300	357,172	44.0	3.4	2.4	5.8
	70°F	453,800	307,084	43	3.1	2.1	5.2
	60°F	401,300	259,020	41.7	2.8	1.8	4.6
	50°F	348,800	210,955	40.4	2.5	1.5	4.1
	40°F	304,400	174,062	38.2	2.3	1.3	3.7
MHP 0810R	90°F	841,200	610,890	67.5	3.7	2.7	6.3
	80°F	760,900	535,708	66.0	3.4	2.4	5.8
	70°F	680,700	460,626	64.5	3.1	2.1	5.2
	60°F	601,900	388,479	62.6	2.8	1.8	4.6
	50°F	523,200	316,433	60.6	2.5	1.5	4.1
	40°F	456,600	261,092	57.3	2.3	1.3	3.7
MHP 1080R	90°F	1,121,600	814,520	90	3.7	2.7	6.3
	80°F	1,014,600	714,344	88.0	3.4	2.4	5.8
	70°F	907,600	614,168	86	3.1	2.1	5.2
	60°F	802,600	518,039	83.4	2.8	1.8	4.6
	50°F	697,600	421,910	80.8	2.5	1.5	4.1
	40°F	608,800	348,123	76.4	2.3	1.3	3.7
MHP 1350R	90°F	1,402,000	1,018,150	112.5	3.7	2.7	6.3
	80°F	1,268,200	892,880	110.0	3.4	2.4	5.8
	70°F	1,134,500	767,710	107.5	3.1	2.1	5.2
	60°F	1,003,200	647,499	104.3	2.8	1.8	4.6
	50°F	872,000	527,388	101	2.5	1.5	4.1
	40°F	761,000	435,154	95.5	2.3	1.3	3.7

Diagram 1: Modular Heat Pump Source EWT - Maximum DHW, LWT



Note: Maximum source EWT: 120° F

Table 2: Modulars Multi-pass Performance: (140° LWT, Design GPM, 100% Water Source Side)

Unit Size	Entering Source Water	Supply Heating Capacity (Btu/hr)	Source Cooling Capacity (Btu/hr)	Power Input (kW)	Heating COP	Cooling COP	Combined COP
MHP 0540R	**110°F**	672,000	504,130	49.2	4.0	3.0	7.0
	90°F	612,000	444,130	49.2	3.6	2.6	6.3
	70°F	460,000	296,224	48.0	2.8	1.8	4.6
	50°F	356,000	196,318	46.8	2.2	1.2	3.5
	35°F	298,000	145,142	44.8	1.9	0.9	2.9
MHP 0810R	**110°F**	1,008,000	756,194	73.8	4.0	3.0	7.0
	90°F	918,000	666,194	73.8	3.6	2.6	6.3
	70°F	690,000	444,336	72.0	2.8	1.8	4.6
	50°F	534,000	294,478	70.2	2.2	1.2	3.5
	35°F	447,000	217,714	67.2	1.9	0.9	2.9
MHP 1080R	**110°F**	1,344,000	1,008,259	98.4	4.0	3.0	7.0
	90°F	1,224,000	888,259	98.4	3.6	2.6	6.3
	70°F	920,000	592,448	96.0	2.8	1.8	4.6
	50°F	712,000	392,637	93.6	2.2	1.2	3.5
	35°F	596,000	290,285	89.6	1.9	0.9	2.9
MHP 1350R	**110°F**	1,680,000	1,260,324	123.0	4.0	3.0	7.0
	90°F	1,530,000	1,110,324	123.0	3.6	2.6	6.3
	70°F	1,150,000	740,560	120.0	2.8	1.8	4.6
	50°F	890,000	490,796	117.0	2.2	1.2	3.5
	35°F	745,000	362,856	112.0	1.9	0.9	2.9

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Table 3: Modulars High Temperature Performance Data: (160° EWT, 175 LWT, 100% Water Source Side)

Unit Size	MHP0540R	MHP0810R	MHP1080R	MHP1350R
Entering Source Water Range	90 – 100°F			
Source Design GPM	120	180	240	300
Load Design GPM	78	117	156	195
Supply Heating Capacity (Btu/hr)	582,800	874,200	1,165,600	1,457,000
Source Cooing Capacity (Btu/hr)	356,243	534,365	712,486	890,608
Power Input (kW)	66.4	99.6	132.8	166
Heating COP	2.6			
Cooling COP	1.6			
Combined COP	4.1			

Note: 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.

Electrical Specifications

Table 4: Modulars – Electrical Specifications

Unit Size	Main Power Input	208-230/3/60	460/3/60	575/3/60
MHP0540R	Minimum Circuit Ampacity (MCA)	189	96	66
	Minimum Overcurrent Protection (MOCP)	250	125	90
	Rated Load Amps (RLA)	168	86	61
	Short Circuit Current Rating (SCCR)	100		
	Internal Component Data			
	Compressor Locked Rotor Amps (LRA)	605	272	238
	Compressor Horsepower (HP)	25		
MHP0810R	Minimum Circuit Ampacity (MCA)	276	140	96
	Minimum Overcurrent Protection (MOCP)	350	175	125
	Rated Load Amps (RLA)	263	133	91
	Short Circuit Current Rating (SCCR)	100		
	Internal Component Data			
	Compressor Locked Rotor Amps (LRA)	605	272	238
	Compressor Horsepower (HP)	25		
MHP1080R	Minimum Circuit Ampacity (MCA)	263	184	126
	Minimum Overcurrent Protection (MOCP)	400	225	150
	Rated Load Amps (RLA)	350	177	121
	Short Circuit Current Rating (SCCR)	100		
	Internal Component Data			
	Compressor Locked Rotor Amps (LRA)	605	272	238
	Compressor Horsepower (HP)	25		
MHP1350R	Minimum Circuit Ampacity (MCA)	N/A	228	156
	Minimum Overcurrent Protection (MOCP)	N/A	250	175
	Rated Load Amps (RLA)	N/A	221	151
	Short Circuit Current Rating (SCCR)	N/A	100	
	Internal Component Data			
	Compressor Locked Rotor Amps (LRA)	N/A	272	238
	Compressor Horsepower (HP)	N/A	25	

Sound Pressure Data

Table 5: Sound Pressure Data

MHP 540R	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	74.5	63.3	82.7	70.6	73.5	70.6	72.1	63.4	56.8	49.2	36.3
Left	73.4	62.7	78.3	74.1	70.2	71.2	70.2	63.1	57.3	49	36.9
Right	75.7	65.6	82.1	74.1	71	72.7	72.9	66	60.6	53.3	42.1
Rear	73	64.5	81.2	75.1	71.9	69.4	69.8	62.6	58.1	52.5	38

MHP 0810R	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	74.2	67.6	74.9	74.5	70.3	71.7	71.3	64.6	55.9	48.2	33.5
Left	73	63.1	69.1	70.7	72	70.2	69	64.9	56.3	51.1	38.1
Right	72.2	63	70.2	69	70.3	70.3	67.9	63.9	55.4	52.4	41.9
Rear	75.8	69.9	71.7	72.4	74.6	74.9	70.3	68.4	58.2	54.3	41.3

MHP 1080R	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	76.6	59.7	82.9	79.8	76	74	72.8	66.6	59	50	37.7
Left	73.3	60.2	72.8	78.7	77.6	70.9	66.8	62.1	57.2	50.6	36.5
Right	75.7	61.8	72.6	79.9	79	72.7	70.6	64.9	61.4	53.9	37.6
Rear	77.8	61	81.9	79	79.1	76.1	73.4	66.8	63	55.4	43.1

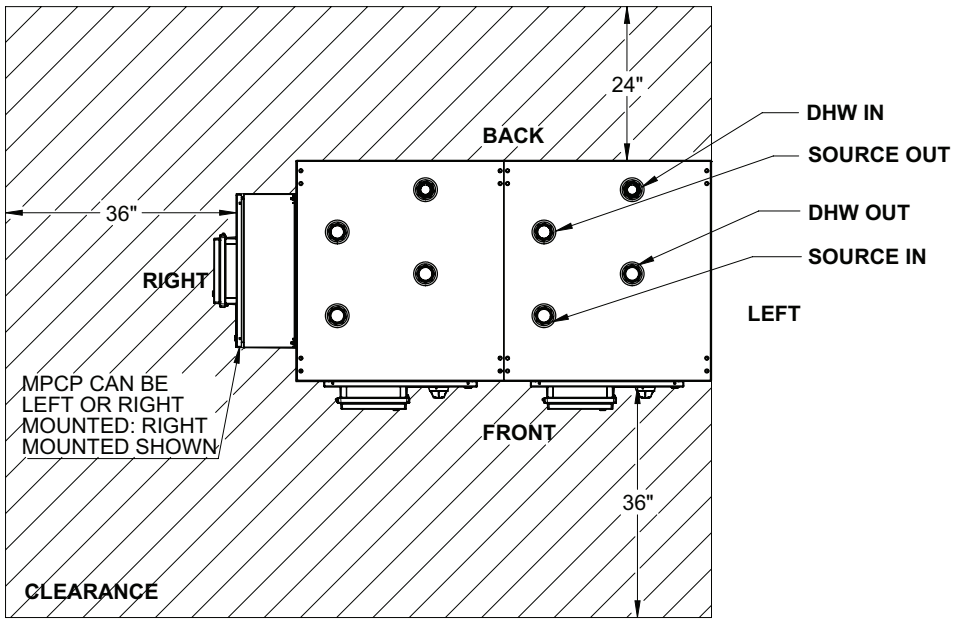
MHP 1350R	No Data Available

Physical Specifications and Clearances

Table 6: Modulars Physical Specifications

Unit Size	Physical Specification	
MHP540R	Domestic Water Connections	2" FPT x 4
	Source Water Connections	2" FPT x 4
	Internal DHW Water Volume (Gal.)	9.5
	Internal Source Water Volume (Gal.)	0.8
	Dimensions (in.)	77-3/24 L x 39" D x 74-1/4" H
	Weight (lbs.)	2342 Dry / 2421 Operating
	Compressor Type	Scroll
	Refrigerant	R513A
	Factory Charge	38.5 x 2
	Oil Charge (Initial/Recharge - Ozs.)	230/220 x 2
	Salt Spray Resistance Cabinet/Evap (Hrs.)	1000
MHP0810R	Domestic Water Connections	2" FPT x 6
	Source Water Connections	2" FPT x 6
	Internal DHW Water Volume (Gal.)	14.2
	Internal Source Water Volume (Gal.)	1.2
	Dimensions (in.)	110-1/8" L x 39-1/4" D x 74-1/4" H
	Weight (lbs.)	3440 Dry / 3559 Operating
	Compressor Type	Scroll
	Refrigerant	R513A
	Factory Charge	38.5 x 3
	Oil Charge (Initial/Recharge - Ozs.)	230/220 x 3
	Salt Spray Resistance Cabinet/Evap (Hrs.)	1000
MHP1080R	Domestic Water Connections	2" FPT x 8
	Source Water Connections	2" FPT x 8
	Internal DHW Water Volume (Gal.)	18.9
	Internal Source Water Volume (Gal.)	1.6
	Dimensions (in.)	142-1/2" L x 39-1/4" D x 74-1/4" H
	Weight (lbs.)	4542 Dry / 4700 Operating
	Compressor Type	Scroll
	Refrigerant	R513A
	Factory Charge	38.5 x 4
	Oil Charge (Initial/Recharge - Ozs.)	230/220 x 4
	Salt Spray Resistance Cabinet/Evap (Hrs.)	1000
MHP1350R	Domestic Water Connections	2" FPT x 10
	Source Water Connections	2" FPT x 10
	Internal DHW Water Volume (Gal.)	23.6
	Internal Source Water Volume (Gal.)	2.0
	Dimensions (in.)	174-3/4" L x 39" D x 74-1/4" H
	Weight (lbs.)	5650 Dry / 5848 Operating
	Compressor Type	Scroll
	Refrigerant	R513A
	Factory Charge	38.5 x 5
	Oil Charge (Initial/Recharge - Ozs.)	230/220 x 5
	Salt Spray Resistance Cabinet/Evap (Hrs.)	1000

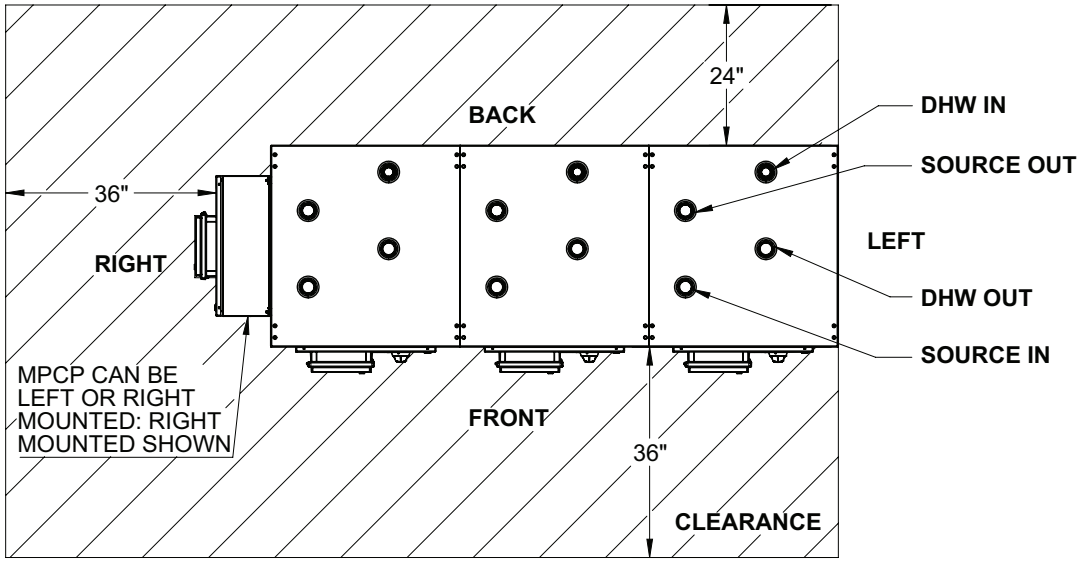
Figure 1: MHP0540R Water Connections and Required Clearances



TOP 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.*

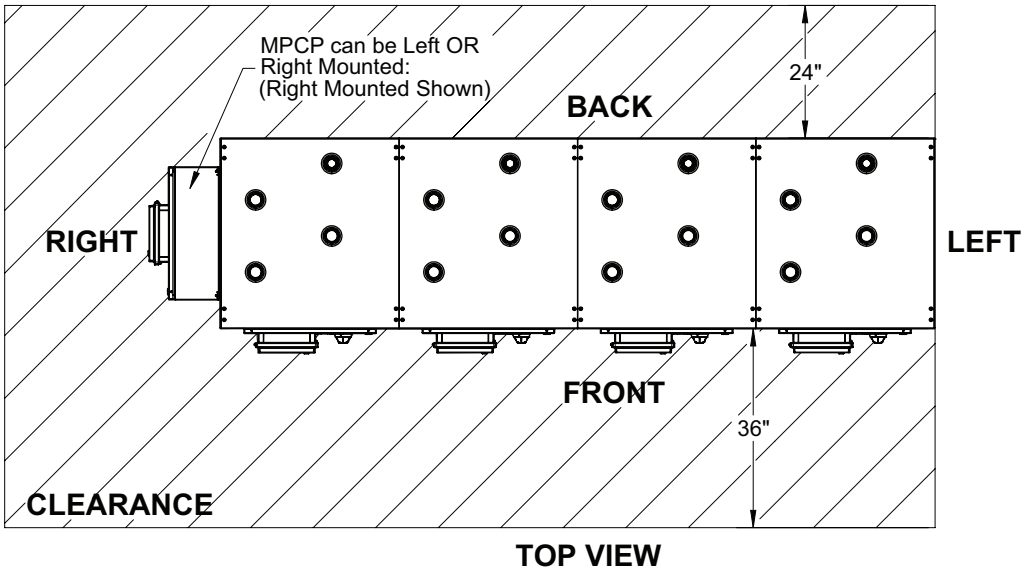
Figure 2: MHP0810R Water Connections and Required Clearances



TOP VIEW

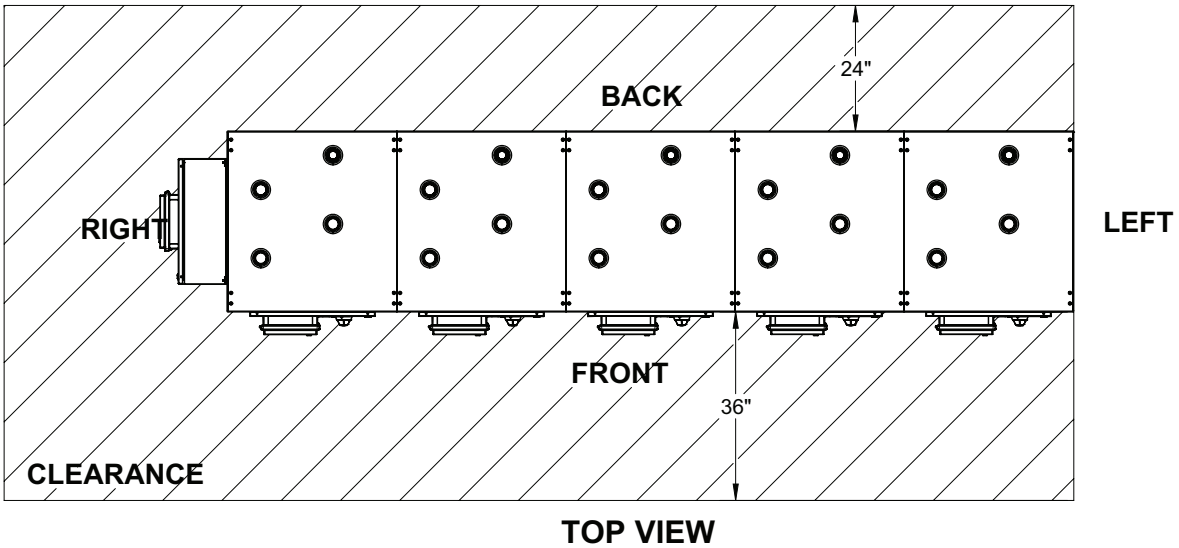
Note: *If vibration transmission and/or seismic activity is a concern for your installation, account for the additional height of vibration isolation or seismic measures as recommended by a qualified engineer.*

Figure 3: MHP1080R Water Connections and Required Clearances



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.*

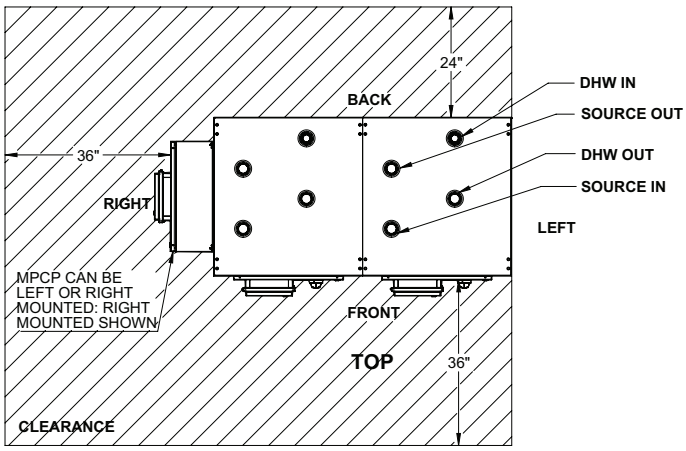
Figure 4: MHP1350R Water Connections and Required Clearances



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.*

MHP0540R Unit Dimensions

Water Connections and Required Clearances



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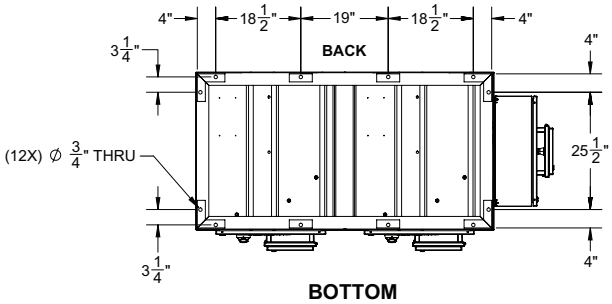

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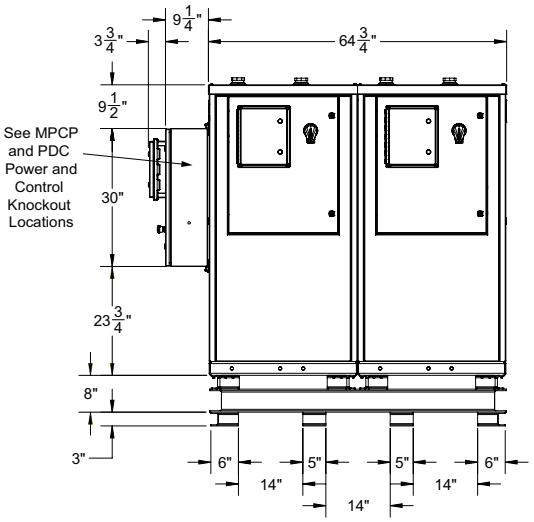

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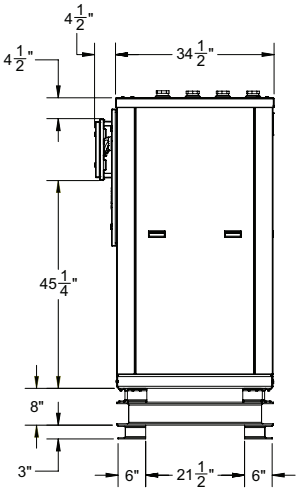

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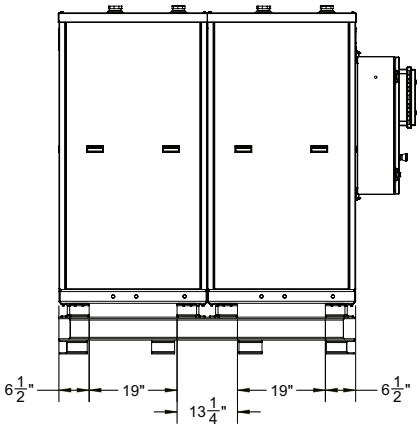

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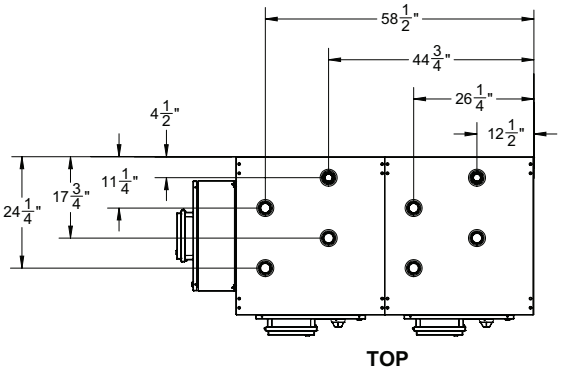

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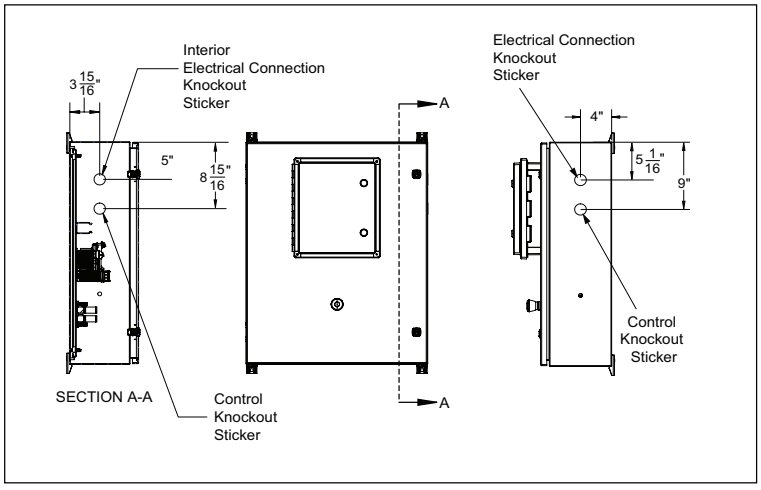
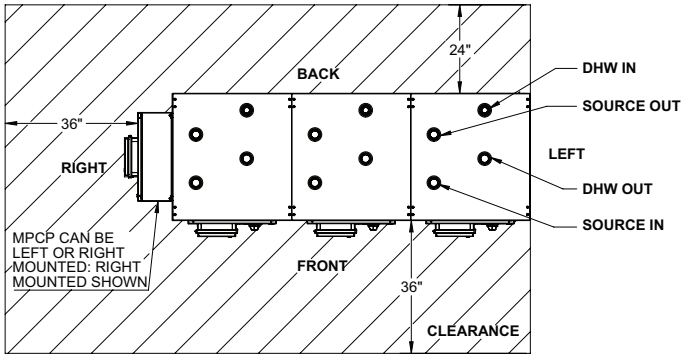
MPCP and PDC Power and Control Knockout Locations



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.*

MHP0810R Unit Dimensions

Water Connections and Required Clearances



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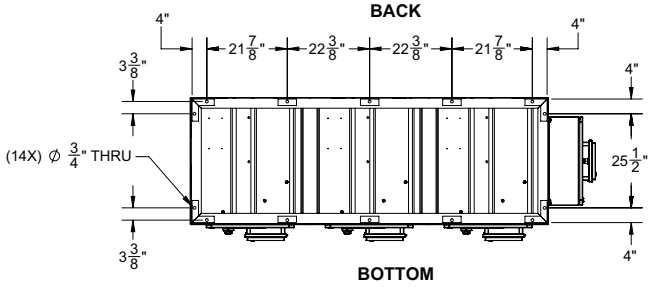

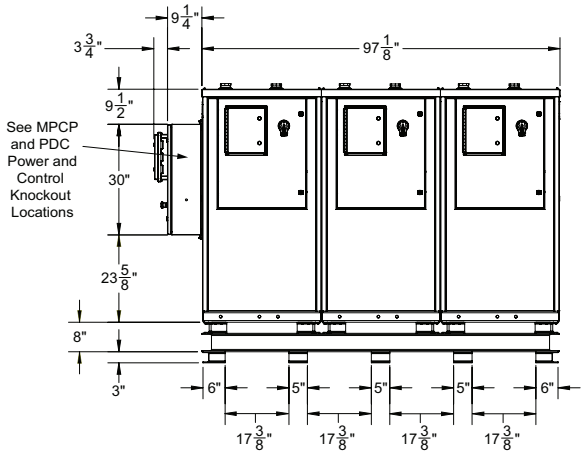

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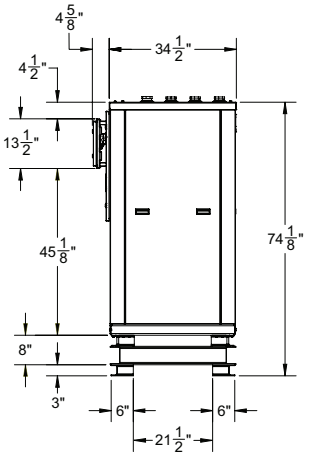

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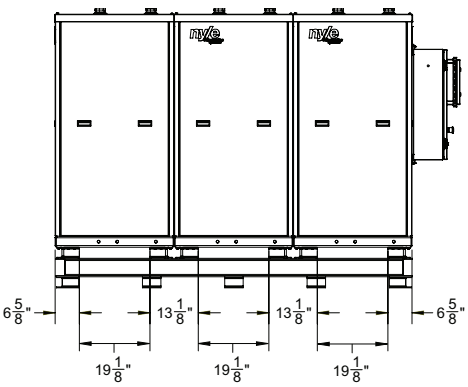

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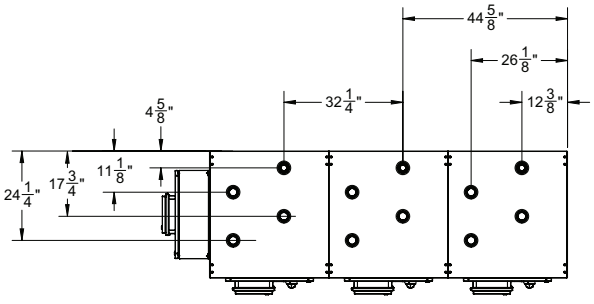

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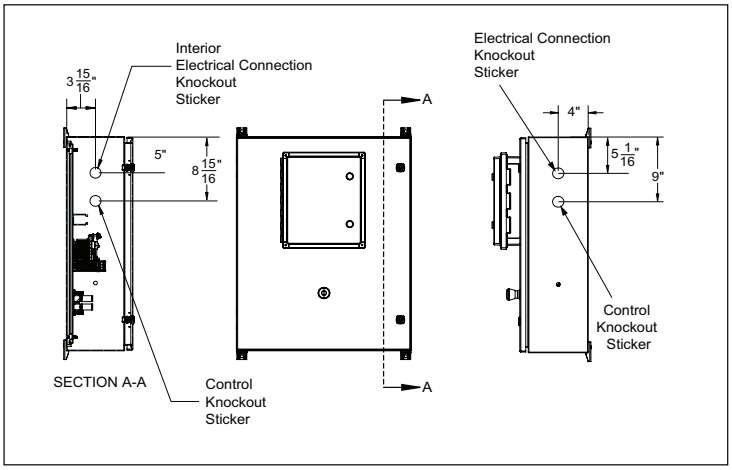
MPCP and PDC Power and Control Knockout Locations

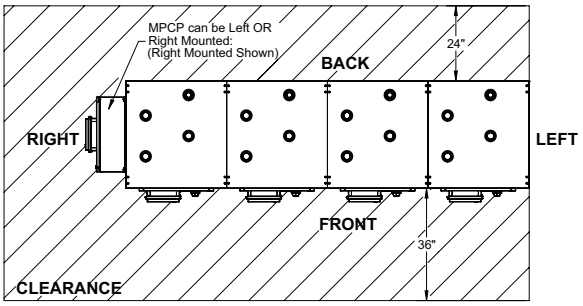


Note: *If vibration transmission and/or seismic activity is a concern for your installation, account for the additional height of vibration isolation or seismic measures as recommended by a qualified engineer.*

Lochinvar®

MHP1080R Unit Dimensions

Water Connections and Required Clearances



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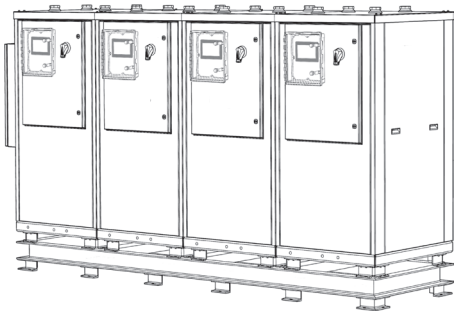

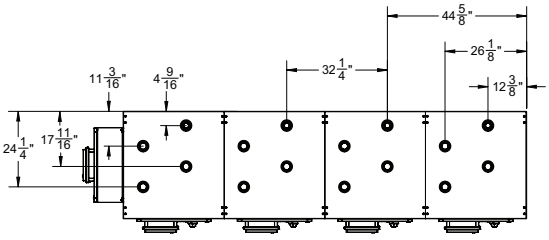

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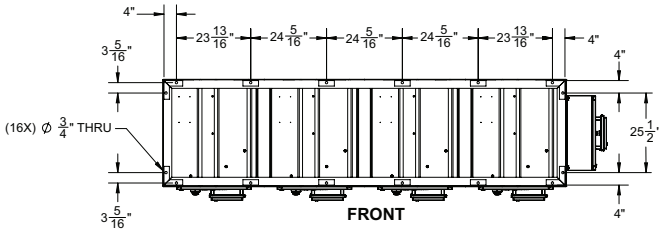
Anchor Locations



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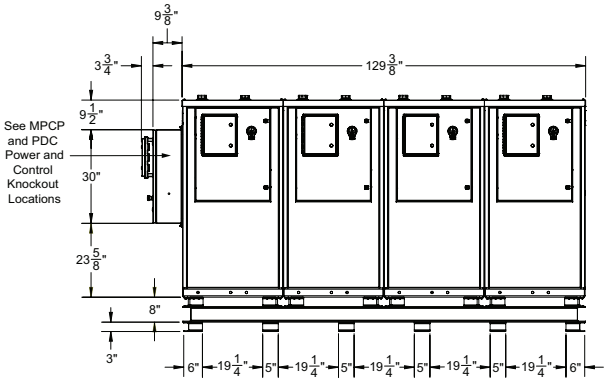
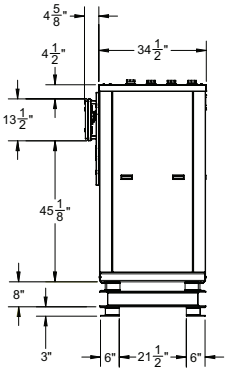
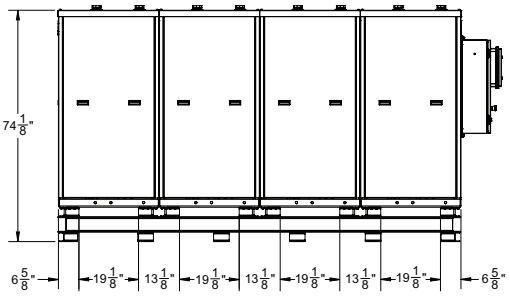
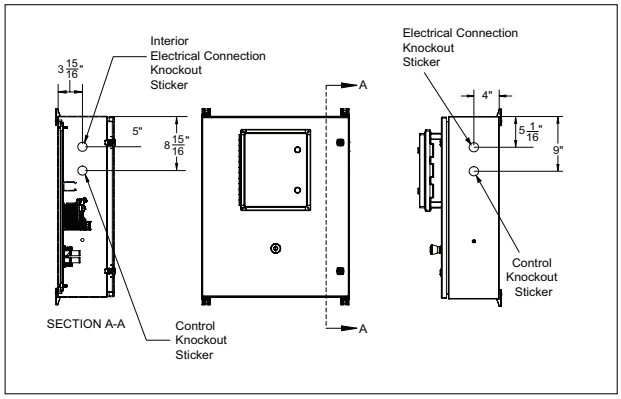






MPCP and PDC Power and Control Knockout Locations



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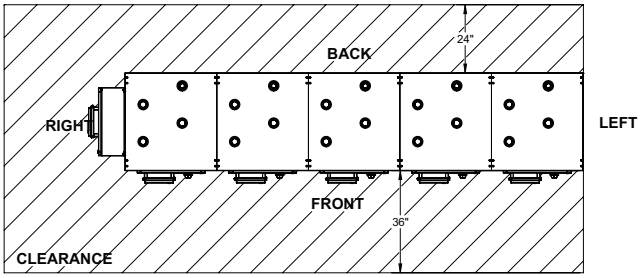
MHP1350R Unit Dimensions

Water Connections and Required Clearances



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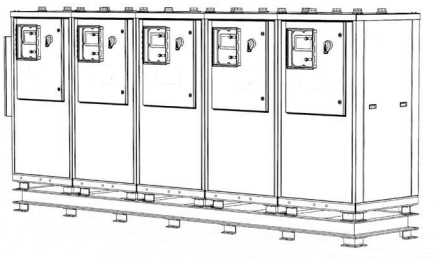

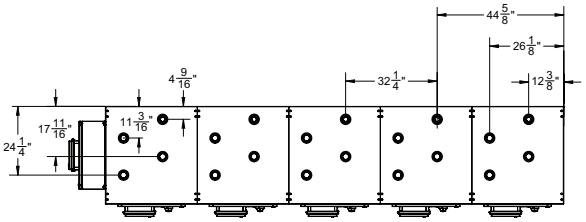

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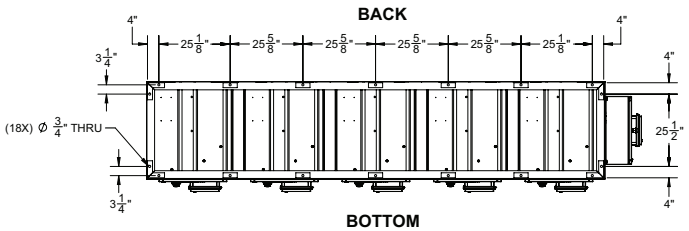
Anchor Locations



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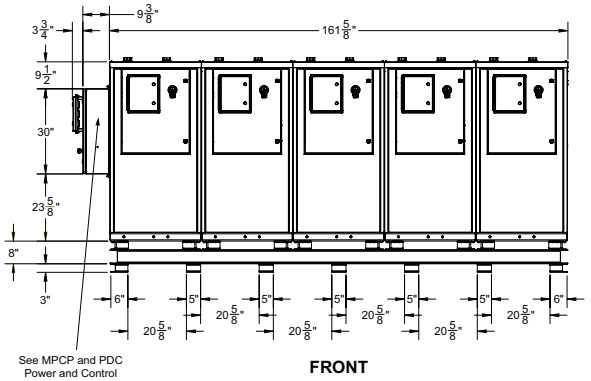
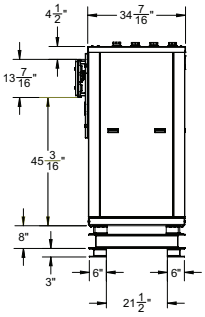


See MPCP and PDC Power and Control Knockout Locations

FRONT



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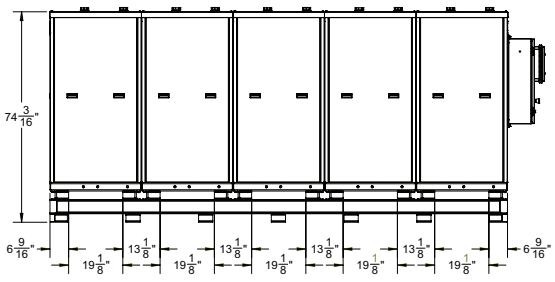

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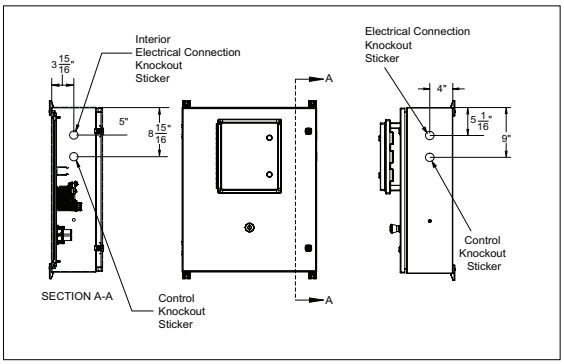
MPCP and PDC Power and Control Knockout Locations



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.*

Lochinvar

Before Ordering Your Heat Pump

Please follow 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.** Units 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 factory representative to discuss support options.

Exterior Installation Considerations

This heat pump is not intended for installation outdoors. Only install this heat pump in enclosed, protected spaces that will remain above freezing at all times.

Unit Diagram and Key Components

Figure 5: Individual Module

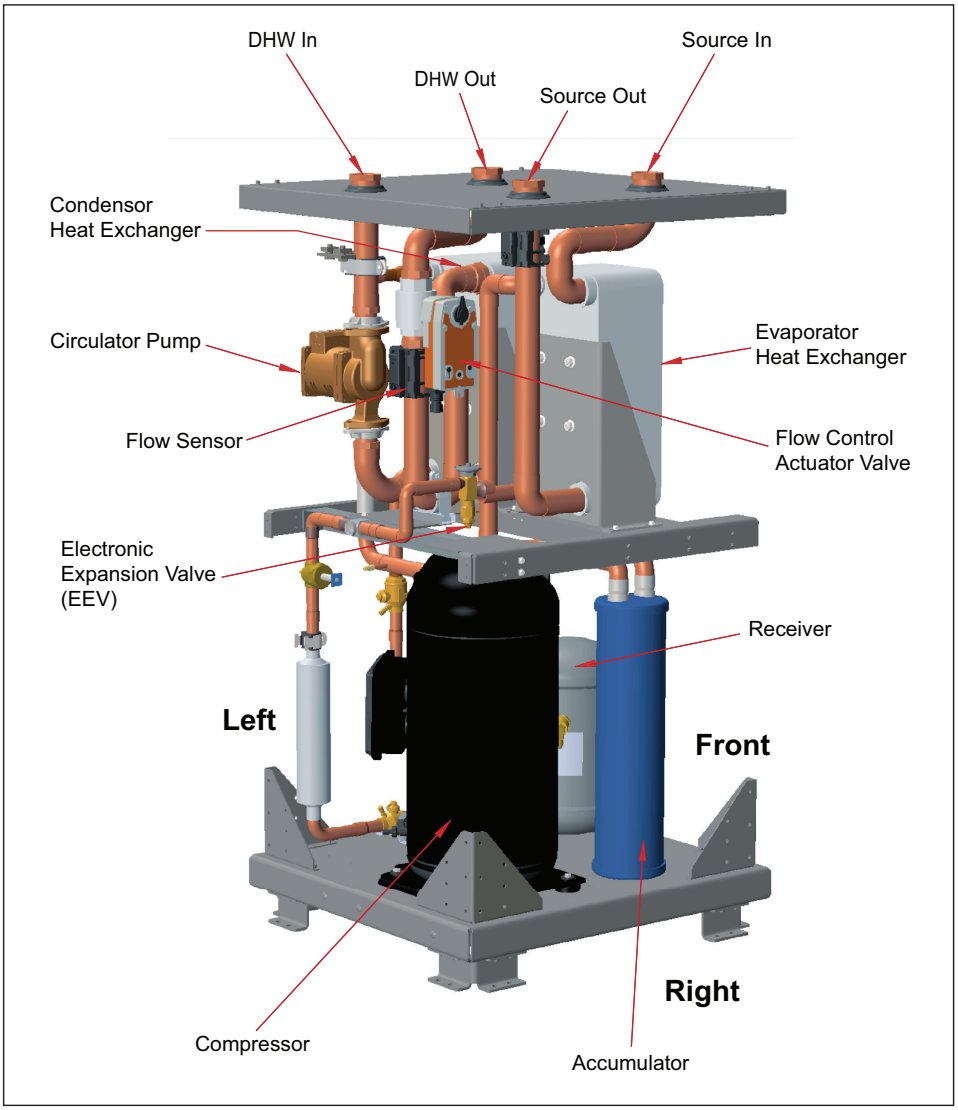
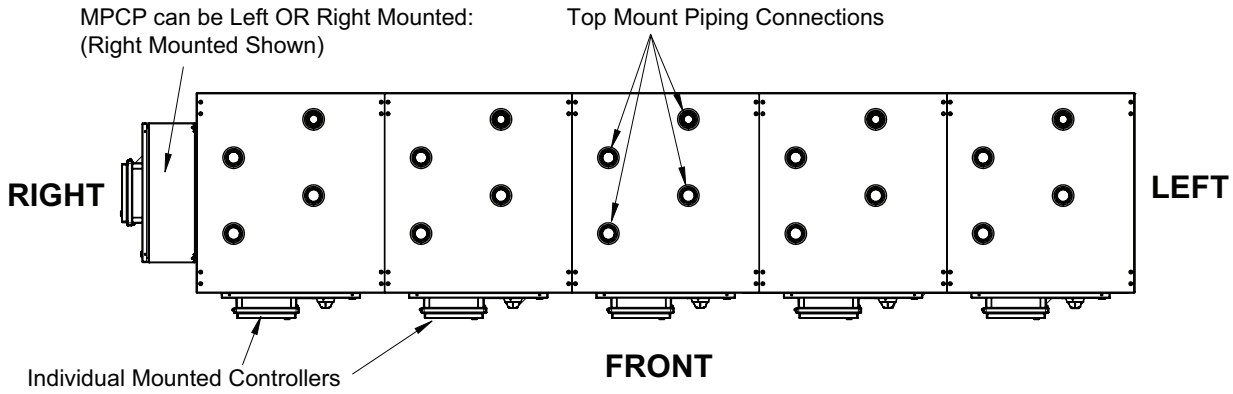


Figure 6: MHP1350R Unit



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° at any time. For handling purposes, see center of gravity diagram below.
3. Do not hoist the unit with chains or straps unless spreader bars are furnished and used as depicted in the figures on this page. 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 hosting 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 7: Rigging and Hoisting Unit

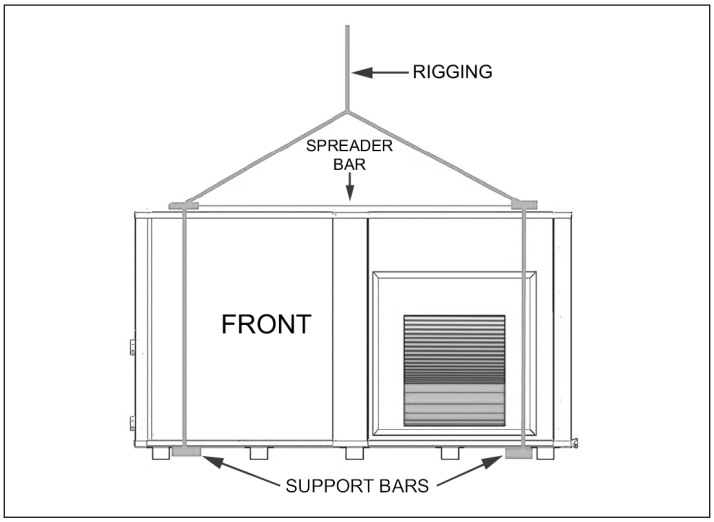


Figure 8: Rigging and Hoisting Unit - Side View

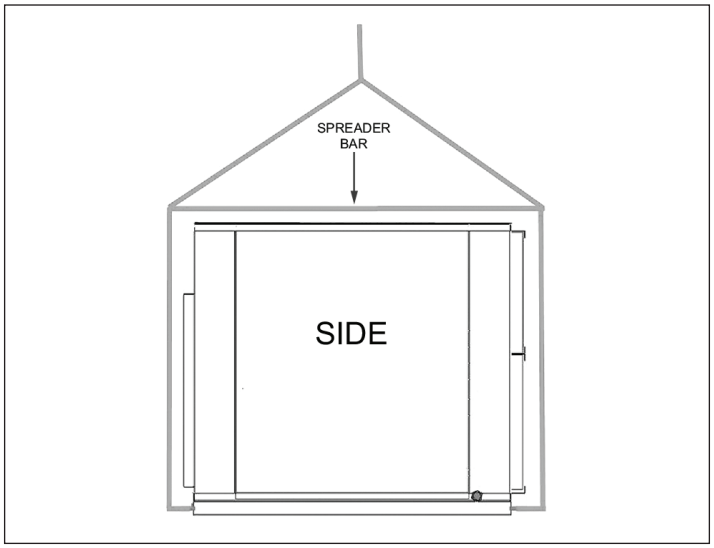
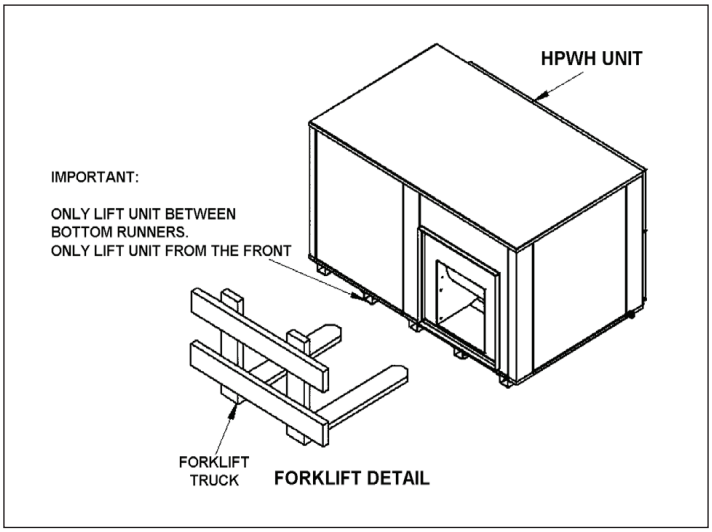


Figure 9: Lifting and Moving Unit with Forklift



Heat Pump Placement

Heat Pump Placement Checklist

- ☐ Ensure the location meets all requirements for ambient temperature, structural support, unit dimensions, operational and service clearances. See performance and physical specifications to confirm.
- ☐ 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.

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 can be utilized.
- ☐ Site prep for mounting the heat pump.

Note: Refer to the appropriate sections of this manual for the specific details associated with each item.

Water Piping: DHW Loop

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

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.

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 7: 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

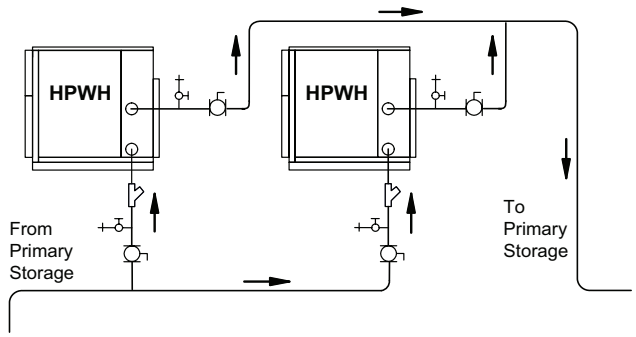
⚠ CAUTION

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

All modular heat pumps require piping to each module in the array. Heat pump modules should always be piped in parallel to each other, but do not require reverse-return piping, check valves, or solenoids on their branch piping to the common header, as internal shutoffs and circulators are included.

Figure 10: Parallel Piping Example



Legend

Ball Valve w/Hose Bibb | Wye Strainer | Full Port Ball Valve

WARNING: *This drawing shows a suggested piping configuration and other devices.*
Check with local codes and ordinances for additional requirements.

CAUTION

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

Check Valves: All C-series heat pumps 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 vary flow velocities, CAN NOT use check valves on the heat pump supply or return 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 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.

Single-Pass with Swing in Series Piping (continued)

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

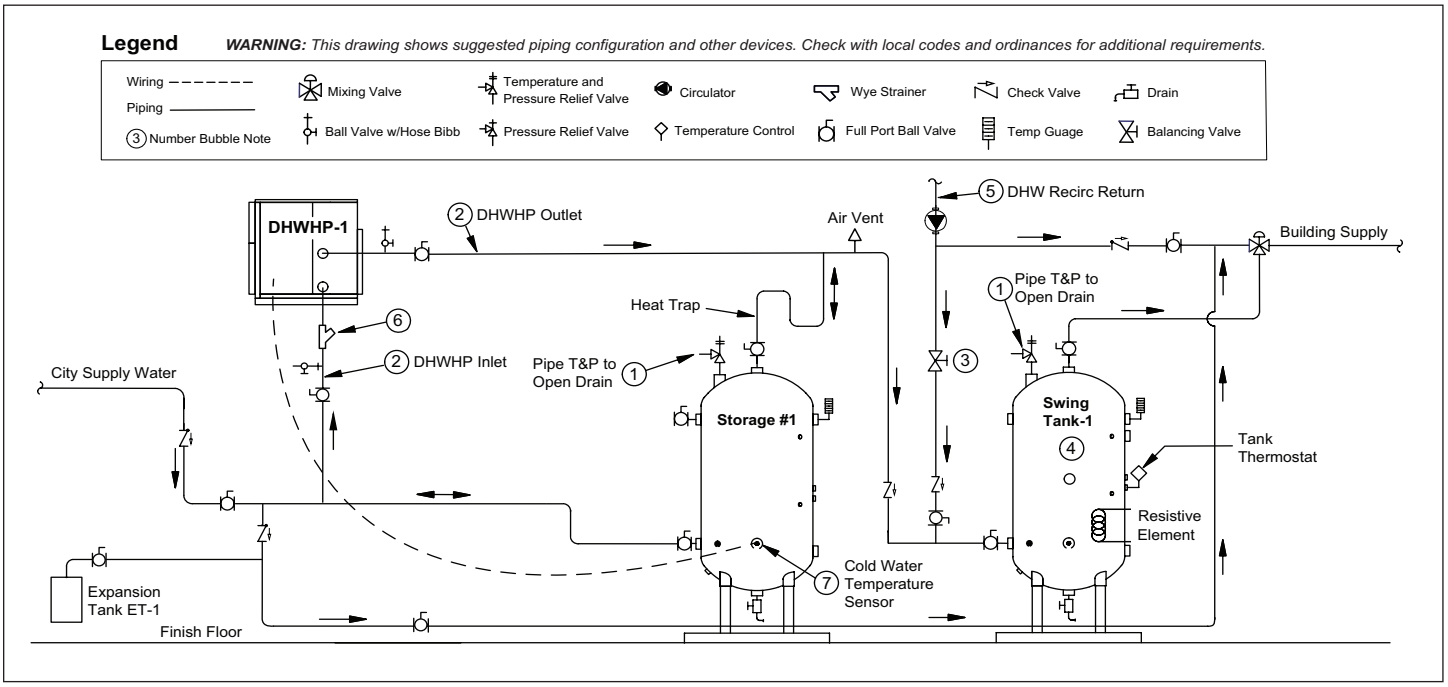


Diagram 2 Notes:

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

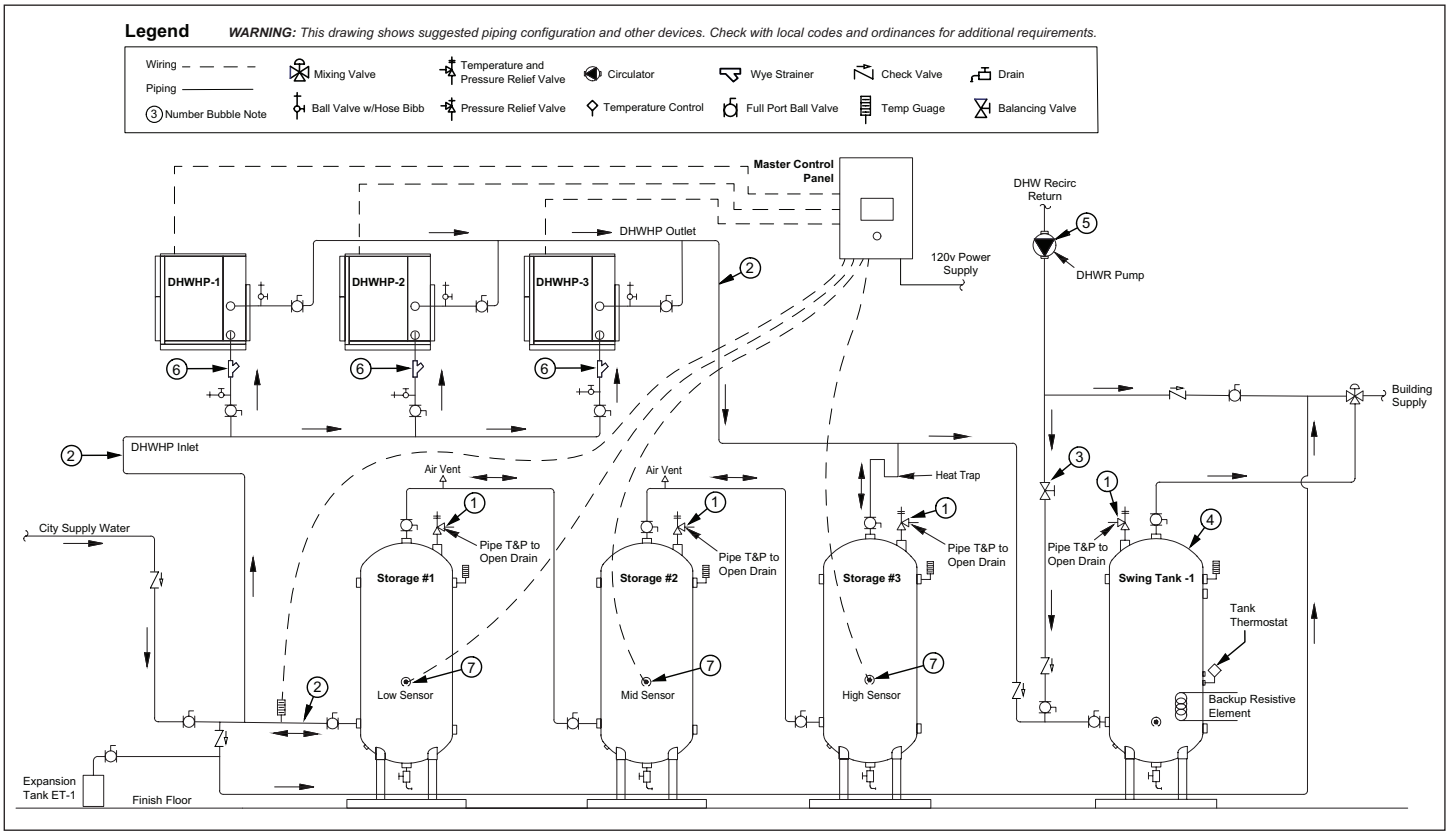


Diagram 3 Notes:

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

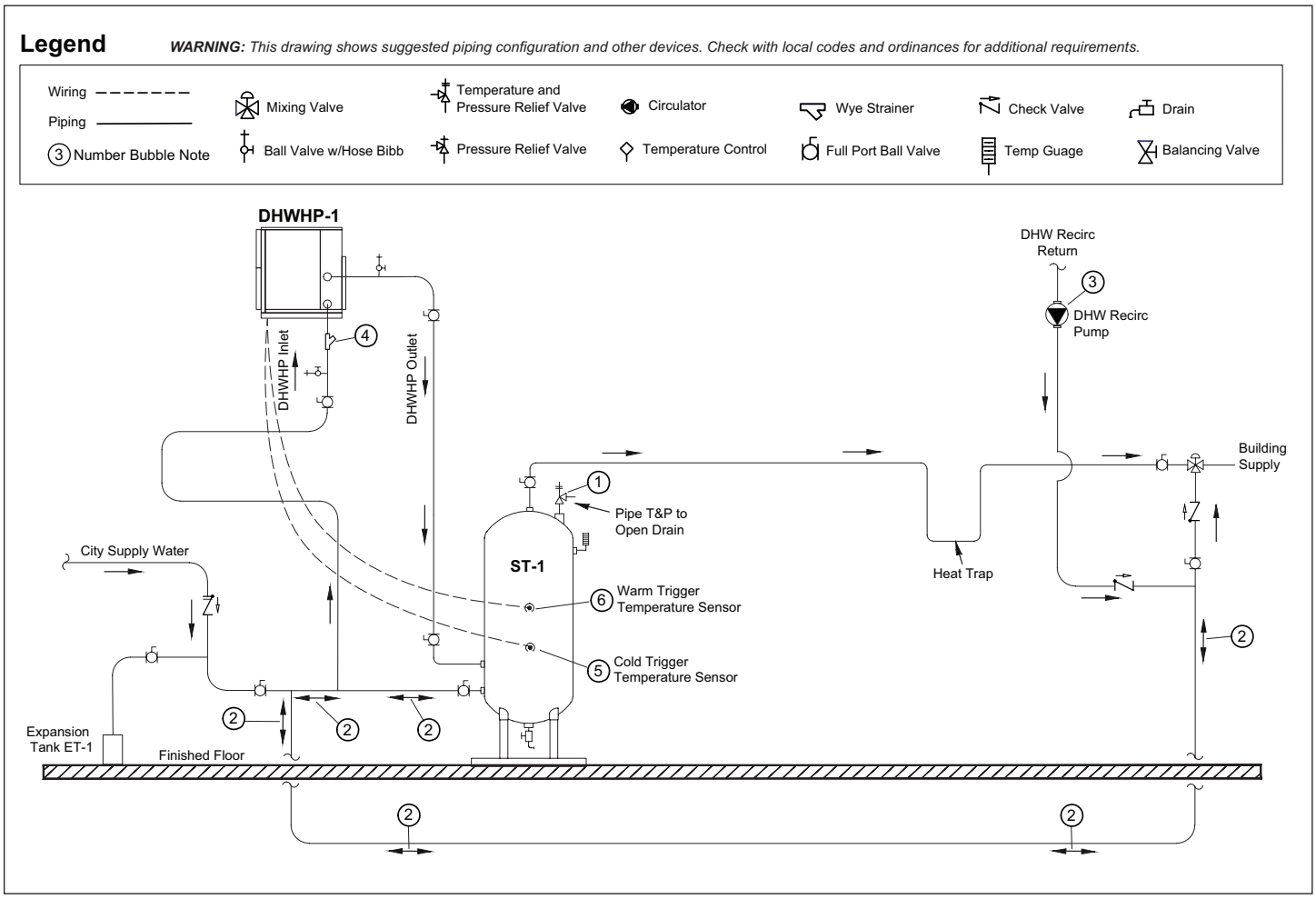


Diagram 4 Notes:

1. The temperature and pressure relief valve setting shall not exceed the pressure rating of any component in the system.
2. There shall be no check valve on bi-directional lines.
3. The recirculation pump shall deliver the minimum flow rate of the mixing valve.
4. The wye strainer has a 20-mesh screen.
5. Minimum cold cycle volume of heat pump shall 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 Multi-Unit Concept

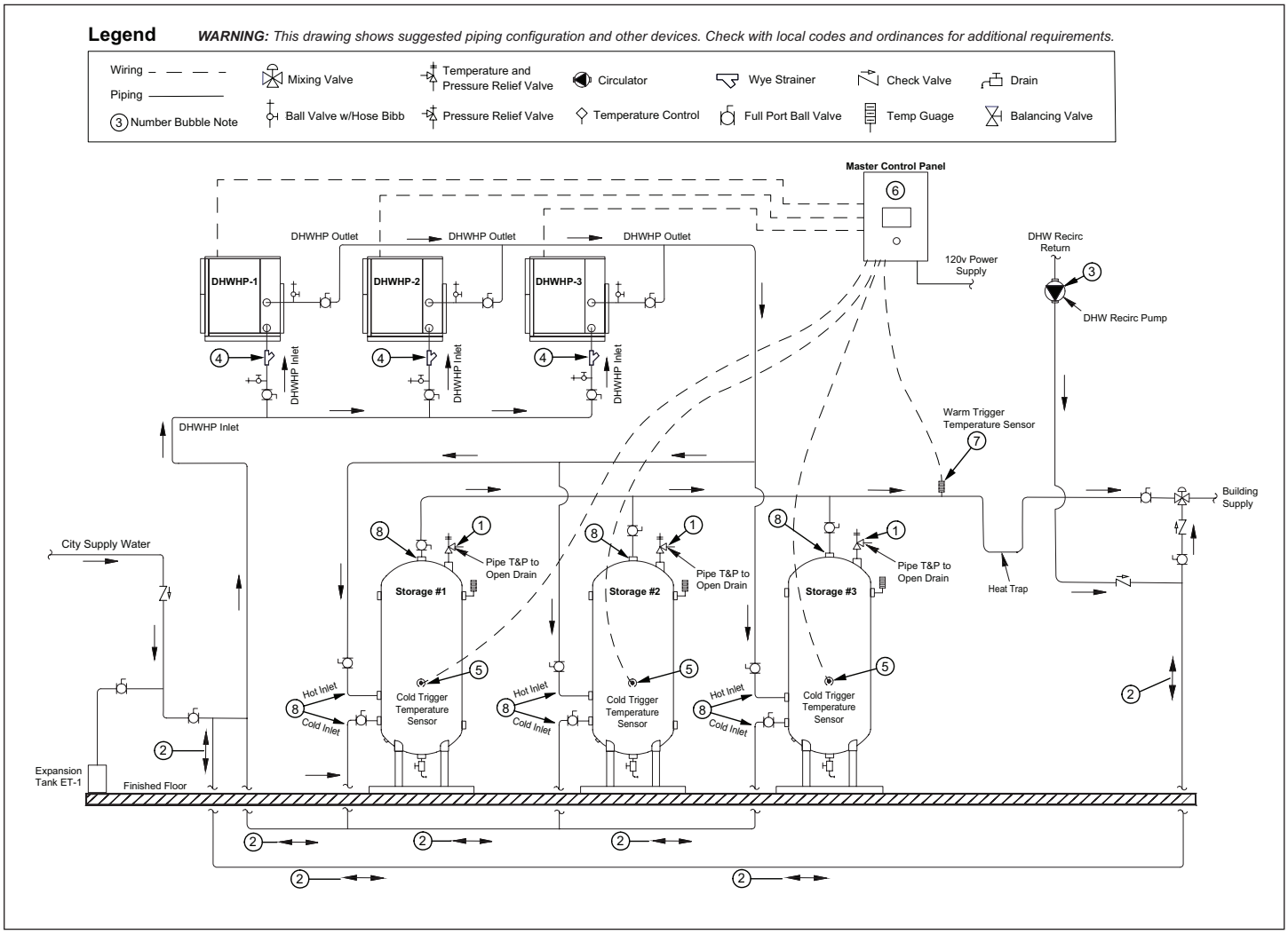


Diagram 5 Notes:

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. The recirculation 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. Warm sensor shall be set above the mixing valve temperature.
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 beginning on page 24 regarding those topics.

Like DHW piping, source loop piping must connect to each module in the array, and modules should be piped in parallel. However, since the source loop does NOT have internal shut offs or circulators, flow balancing and/or check valves for individual modules should be considered during piping design.

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 8: Water Module 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 Applications

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 the individual heat pump modules DO NOT have integral circulators.

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 module 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.

Individual heat pump modules 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, or the "run signal" contacts on the individual modules can be used as a control signal to trigger source side flow control equipment for each module.

In addition, centralized controllers often provide single or variable speed outputs for centralized pumping strategies: modular heat pumps with the MPCP or MPCP-G option provide pump contacts for this purpose, and other external controls have their own pump control options. If an external control is used, please refer to its installation manual for the pump control options available.

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 installation instructions below before attempting to connect the heat pump to the building's electrical infrastructure.

⚠ WARNING

Improper handling of unit electrical power can result in immediate equipment damage, fires, 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.

Heat pump water heaters are voltage-specific, and require proper planning to provide the electrical support appropriate to each unit. Refer to the Electrical Specifications in this manual and specific product submittals, project documentation and requirements, and the following installation instructions.

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 PDC or MPCP enclosure on the heat pump to connect primary power.

A white "Electrical Connection-Knock Out Hole Here" sticker marks the suggested location for the power wire entry power inside the electrical enclosure. See "Electrical Knockout Stickers" on page 35.

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. Open the electrical enclosure access door.
2. Identify the white "Electrical access - knockout hole location" sticker on the interior of the electrical enclosure.
3 Drill or knock out the sticker location.
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.

Figure 11: Electrical Knockout Stickers

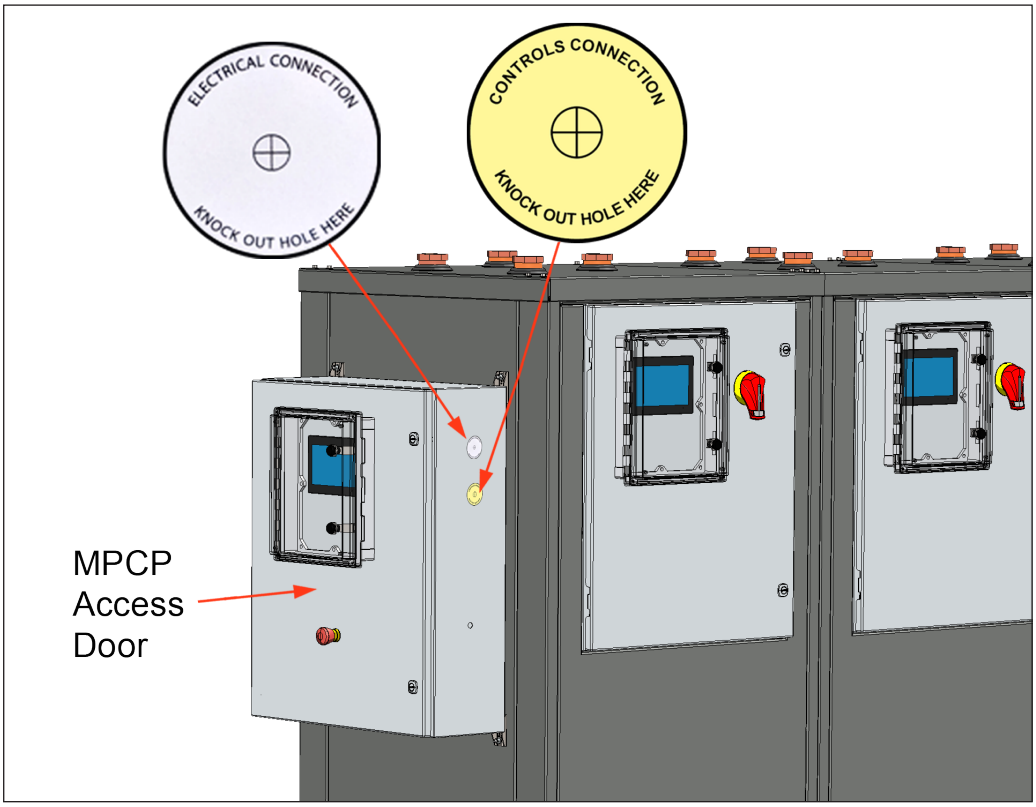


Figure 12: MPCP and PDC Power and Control Knockout Locations

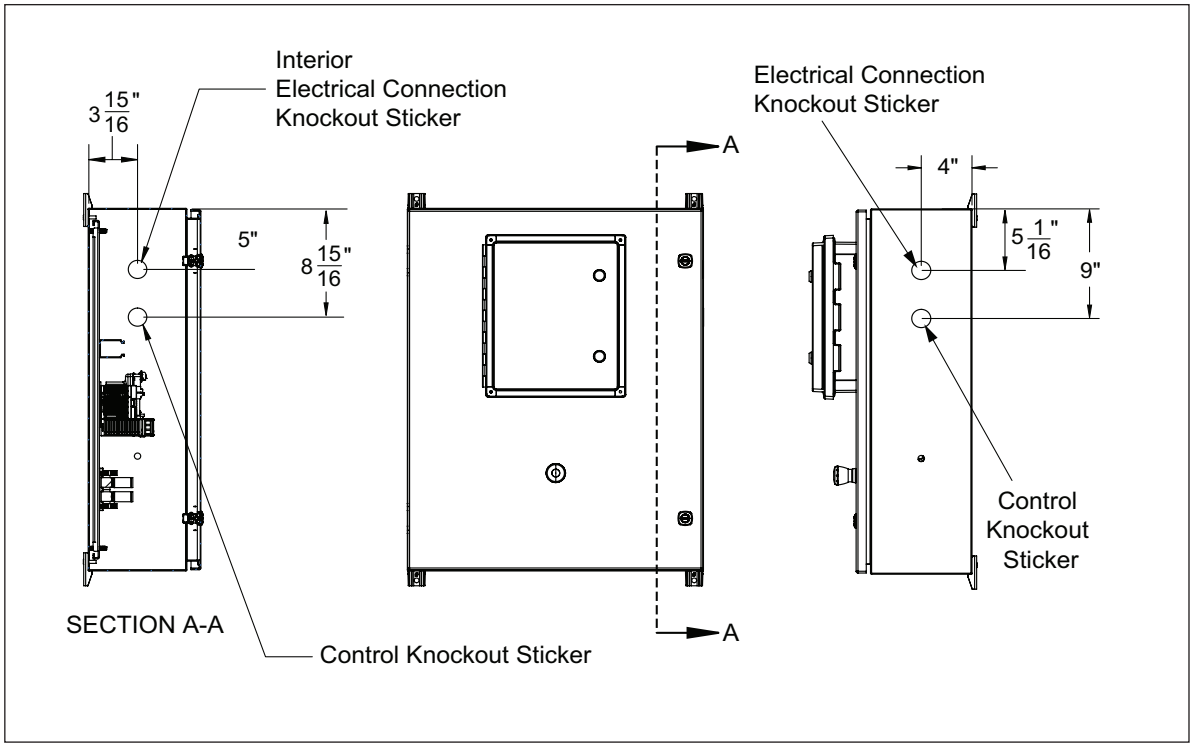
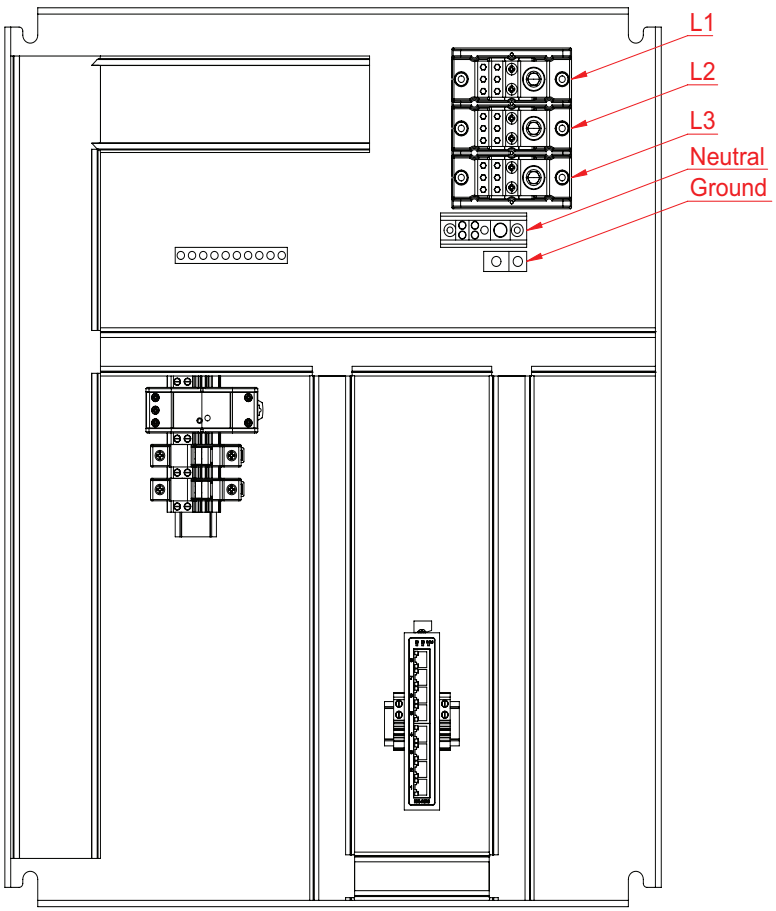
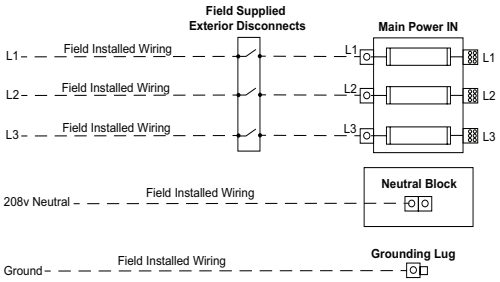


Diagram 6: Power Wire Connections

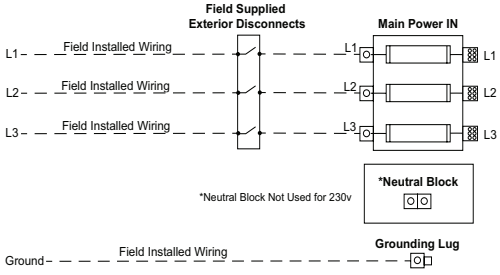
Power Wiring Backboard



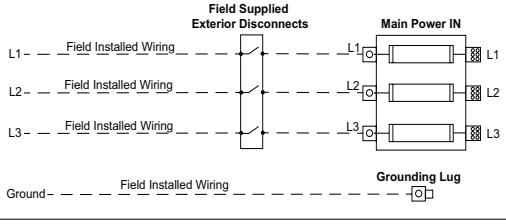
Primary Power - 208v



Primary Power - 230v



Primary Power - 460v or 575v



Backup Generators

Generator Test Interlock

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 “Remote 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.

Partial Backup Interlock

Sizing a generator to run the heat pump in regular operation can result in very large and expensive backup power arrays. Some heat pumps allow for split power feeds, so the control power and freeze protection circuits can be backed up separately from the main power feed, with a much smaller generator.

However, heat pumps with single point power can also utilize smaller backup generators. To set up a heat pump with freeze protection backup only, follow these guidelines:

1.. Provide at least 1500 watts of backup generation capacity per heat pump.

2. Install a normally open relay, with its activation coil constantly powered on an external power circuit that is NOT backed up by the generator, so it will lose power if the building loses power.

3. Wire the normally open contacts of the relay to the heat pumps “Remote Enable” terminals.

In this configuration, the heat pump will not be allowed to run when the relay opens its contacts during power failure, but the backup provided to the main power feed of the heat pump will be sufficient to power its onboard controls and freeze protection equipment.

Control Wiring

Modular heat pump arrays come with two control options: either an onboard Main Power and Control Panel (MPCP), or an onboard Power Distribution Center (PDC).

Arrays built with the MPCP option have all necessary controls onboard. Arrays using the PDC option require an external, field mounted controller to be wired to the PDC with an ethernet cable for the array to function properly. In both cases, most field wiring will occur in the MPCP or PDC enclosure, except in special circumstances where individual module control points are needed for unique applications, and to connect individual source flow control devices to individual modules in the heat pump array.

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 for both PDC and MPCP configurations, 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 - MPCP or PDC

Control wiring installed in the MPCP or PDC should use the following process. Field wiring points and their descriptions follow in subsequent sections.

1. Ensure the heat pump is powered down when making electrical connections.
2. 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.
3. Run all external sensor wires and/or control wiring for field accessories through the access point.
4. Wire and tug test the new connections, and then close the electrical enclosure

Control Wiring Installation - Individual Modules

For source loop flow controls on each module or special applications requiring control wires to individual modules, use the following process. Field wiring points and their descriptions follow in subsequent sections.

1. Ensure the module is powered down when making electrical connections.
2. Identify a control wire access point on the module’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 on the module you are wiring to. 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 “Individual Module Control Wiring Connections” diagram for specific wire run termination points.
5. Wire and tug test the new connections, and then close the electrical enclosure.

Field Wiring Control Points - MPCP Option

Modular arrays using the MPCP option will wire sensors and accessories to the MPCP enclosure itself, which is factory mounted on the left or right hand side of the array as a specifiable option at the time of order.

Analog Pump Output: These terminals output a 0-10v or 4-20ma signal to control modulating equipment, such as an external circulator, in response to current staging demands.

BMS (MPCP-G Only): The Ethernet or Serial connection used to connect to building automation systems.

Ethernet: Ethernet is used for connecting to all attached heat pumps. Each heat pump to be controlled needs to be connected to the ethernet switch. No more than six heat pumps can be connected in this way.

Pump Contacts (HPR and SPR): These dry sets of contacts close when the system is operating for a heat demand. They are intended to trigger control devices such as valves or pumps on the heating side (HPR) of the system, or the source loop side (SPR) for water source heat pumps.

Tank Sensor terminals (P1, P4, P7): These sensor inputs allow the MCP to monitor and control the tank temperatures. Take care that the tank sensors are installed in accordance with the sensor diagrams appropriate to the type of heat pump in use, single- or multi-pass. Tank sensor behavior changes in different modes of operation. See Tank Sensor detail sections following this section.

Outlet/Termination Sensor (P10): Sensor input for single-pass demand termination, or multi-pass “Minimum Outlet” trigger in multi-tank applications. In single-tank multi-pass applications, this sensor is a “Warm Trigger” sensor. See Tank Sensor detail sections following this section.

Table 9: MPCP Control Wiring Specifications

Contact	Location	Terminals		Wire Type	Power
Analog Pump Output	Analog	P13	0v	Stranded/Shielded	4-20ma
BMS [1]	RX-	TX+	G	Stranded/Shielded	Variable
Ethernet	(Note [2])	–	–	CAT-5 or CAT-6	–
Pump Contact HPR	Relay	9	5	Any	Dry [3]
Pump Contact SPR	Relay	12	8	Any	Dry [3]
Tank Sensor (High/Cold) [4]	Analog	P7	0v	Stranded/Shielded	24Vdc
Tank Sensor (Med/Cold) [4]	Analog	P4	0v	Stranded/Shielded	24Vdc
Tank Sensor (Low/Cold) [4]	Analog	P1	0v	Stranded/Shielded	24Vdc
Termination/Outlet Sensor [4]	Analog	P10	0v	Stranded/Shielded	24Vdc

Notes:

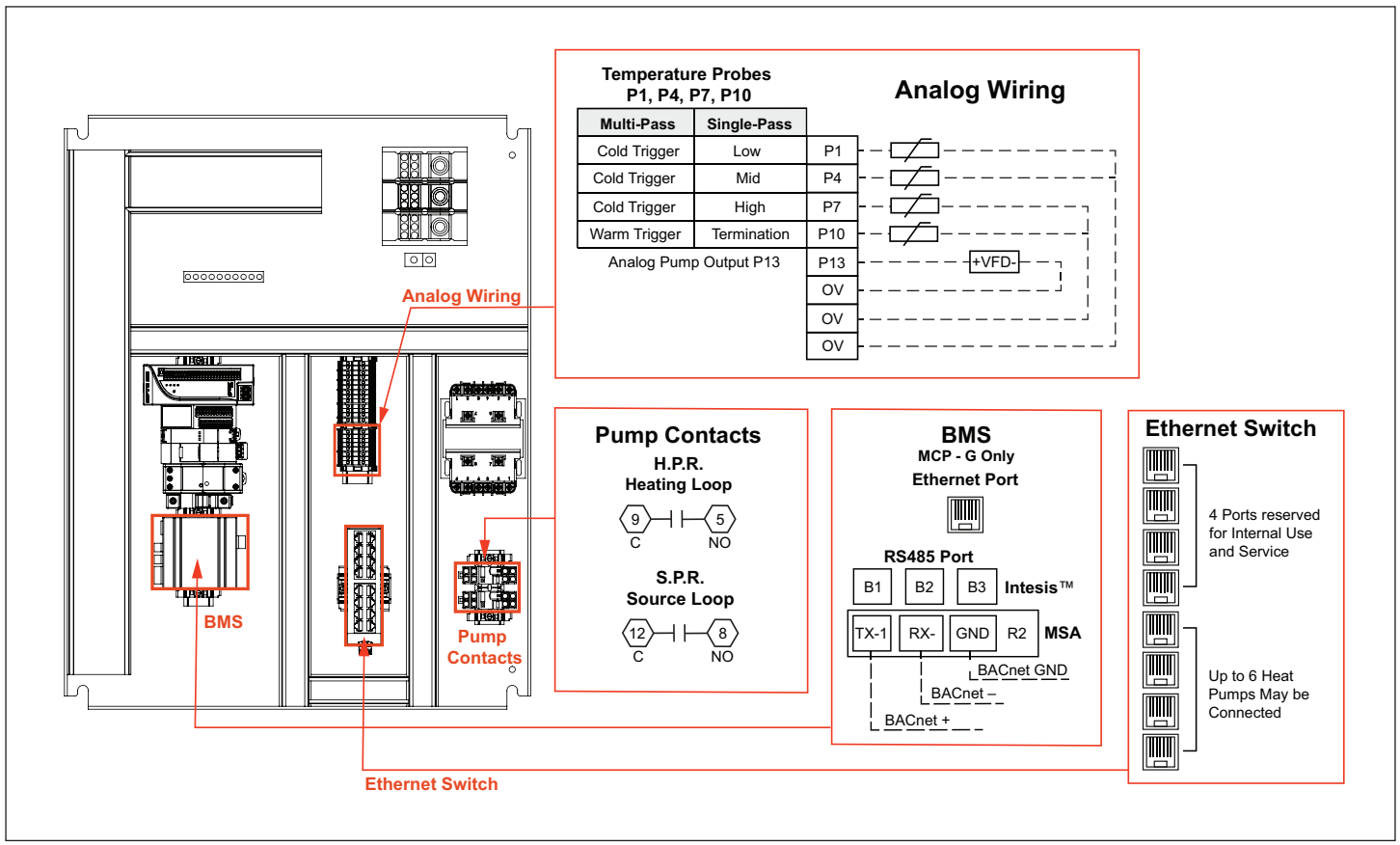
1 For MPCP Only.

2 Ethernet Port on BMS for BACnet IP, and on switch for heat pump connections.

3 All Relay contacts are rated for 15A/250VAC, or 6A/28VDC max.

4. Sensor outputs vary by mode of operation. See tank sensor sections for details.

Diagram 7: MPCP Field Wiring Connections



Single-pass Tank Sensors for MPCP

Single-pass systems utilizing the MPCP option require 2 or 3 tank sensors to determine how many individual modules, or “stages”, to call to satisfy a heat demand. In addition, one pipe mounted sensor is used to terminate the demand.

Sensor placement must consider the “cold cycle volume” of all modules that may run when a given sensor is triggered. This means that sensors must be placed so that at least that much water volume exists between the tank sensor in question, and the termination sensor. If a sensor will call 2 modules, you will need double the “cold cycle volume” of the heat pump model in use.

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, with any minimum cycle volumes, used to the size the tank.

The termination sensor is used to end the demand. This is a dedicated sensor installed on the common pipe to the heat pump inlets of all attached heat pumps.

Staging is achieved with the additional sensors in the storage tank to track the movement of the stratified hot water layer. For MPCPs, staging includes sensors for a single stage, a sensor for 50% of available stages, and a sensor for all stages to run.

Field Wiring Control Points - PDC Option

Modular arrays using the PDC option expect an external controller to be wired to the PDC enclosure by ethernet cable. Any available ethernet port in the PDC enclosure may be used.

Field wiring to the external controller is addressed in the installation manual for the specific controller in use. Refer to the controller’s manuals for sensor, BMS and accessory wiring as needed.

Field Wiring Control Points - Individual Modules

The following control points are available on individual modules of the heat pump for field wiring:

Alarm Status Contacts: This dry set of contacts close whenever the module's compressor will not run because of lockout.

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 module's operation can use this as a trigger, such as source loop solenoid valves and/or booster pump relays.

Source Pump Relay: These relay contacts engage when the heat pump begins evaporator flow verification mode and stay engaged through unit operation, providing a control signal specifically for connected source side flow control devices.

Diagram 8: Individual Module Field Wiring

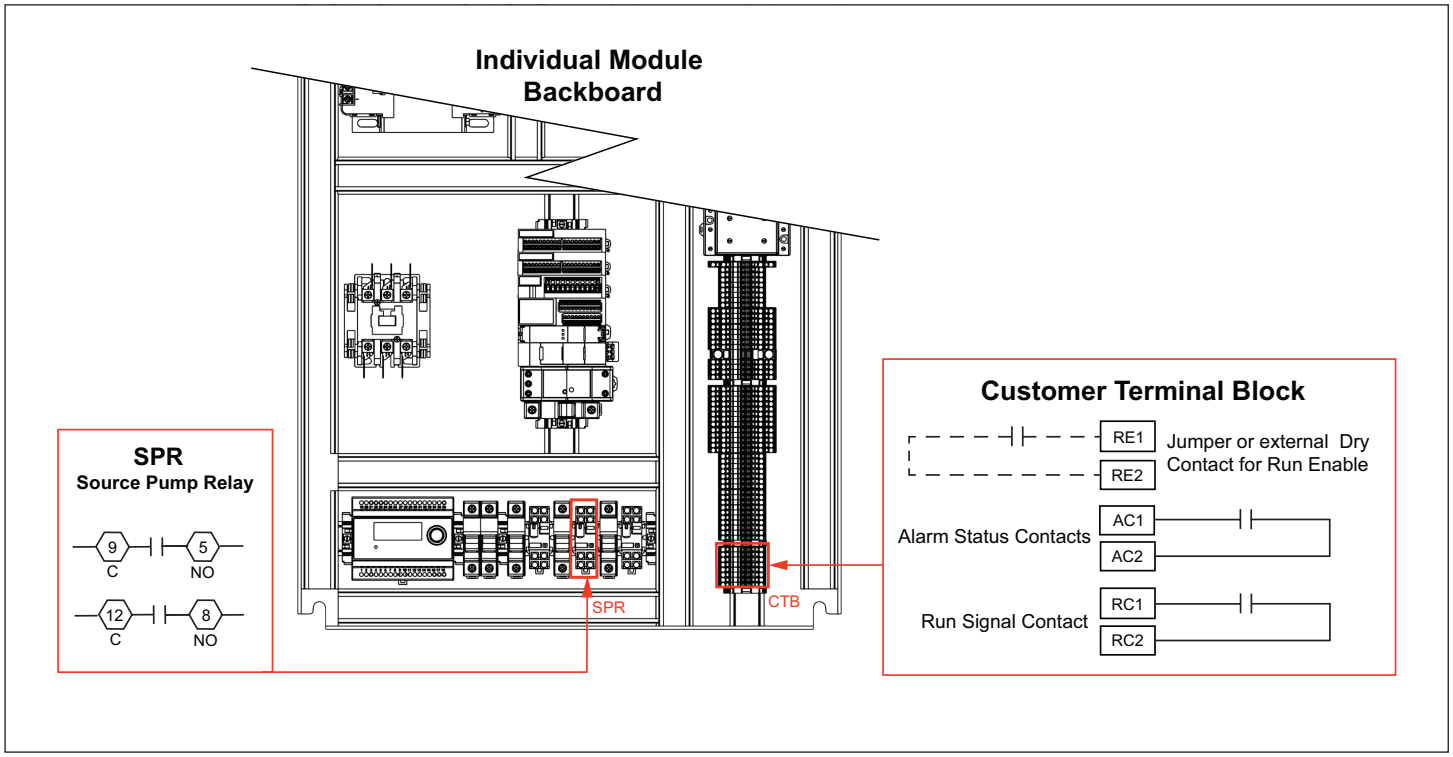


Table 10: Individual Module Control Wiring Specifications

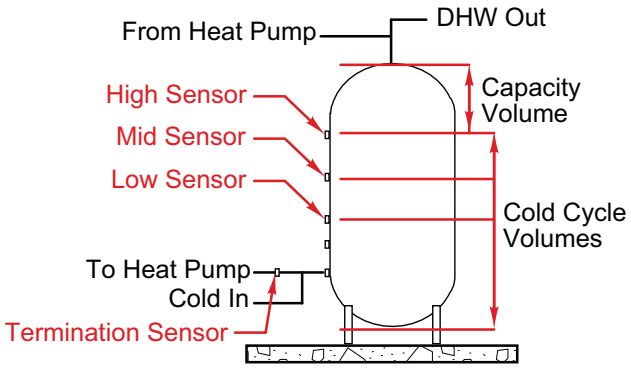
Contact	Location	Terminals			Wire Type	Power
Alarm Status	CTB	AC1	AC2	--	Any	Dry [2]
Run Signal	CTB	RC1	RC2	--	Any	Dry [2]
Source Pump Relay (N.O.)	--	5	9	--	Any	Dry [2]
Source Pump Relay (N.C.)	--	8	12	--	Any	Dry [2]
Service Mode [1]	TB2	i7	24v	--	Any	24Vdc

Notes:

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

2 All Dry contacts are rated for 6A/250VAC, or 6A/30VDC max.

Figure 13: 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 modules to operate simultaneously for each sensor position.
3. Ensure high sensor point allows for adequate capacity volume above the sensor.

Multi-pass Tank Sensors for MPCP

MPCPs on multi-pass systems are set up one of two ways, depending on whether the heat pump array is serving a single tank, or multiple tanks in parallel.

On a single tank, two sensors are used: a cold trigger sensor, and a warm trigger sensor. The cold trigger sensor is positioned so there is at least the “cold cycle volume” of water between the sensor and the heat pump outlet pipe on the tank, and the warm trigger sensor is positioned so there is at least the “warm cycle volume” of water between the sensor and the heat pump outlet pipe.

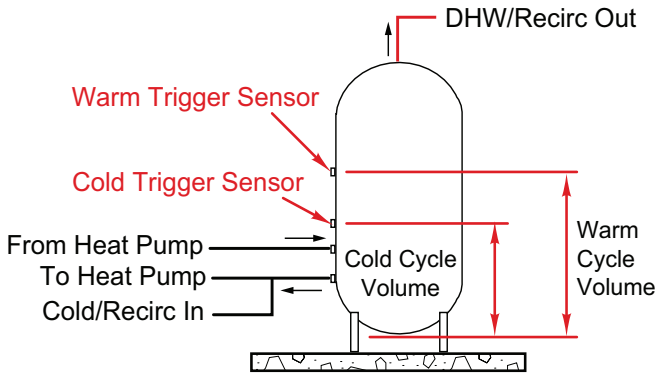
On multiple-tank arrays, multiple cold trigger sensors can be used, up to a maximum of three, one in each tank. One outlet sensor is then mounted on the pipe serving hot water to the mixing valve, which will trigger a maximum stage demand if necessary.

For more specific information about multi-pass systems, cycle volumes, and tank sensor installation, please refer to the tank sensor installation manual.

Staging in multi-pass systems is activated on time and temperature, and sensors participate in this process differently:

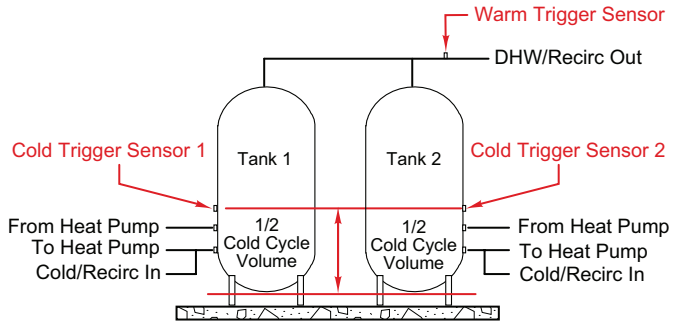
Cold Trigger Sensor(s): If the cold trigger sensors activate, one module will run, with more modules triggering over time if the average sensed temperature doesn’t rise. When any cold trigger sensor is satisfied, all demands end.

Figure 14: Multi-pass, Tank Sensor Locations



Notes:
1. CT sensors mounted at a maximum of 1/5 of total tank height.
2. WT sensors mounted at a maximum of 2/5 of total tank height.
3. Min CCV, WCV, and tank size are in heat pump specifications.

Figure 15: 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.

Configuration

Individual Module Configuration:

Modular arrays do not typically need to configure the individual modules on site: all module configuration occurs in the factory. However, if it is necessary to modify timers for external devices, you will need a copy of the Programming and Operation Manual for the software installed on the individual heat pump modules.

Modular Arrays with the PDC Package:

These heat pumps do all configuration via their external controller: to configure these systems, refer to the installation manual of the specific controller your project is using.

Modular Arrays with the MPCP Package:

These heat pumps have a main controller installed on either the left or right hand side of the heat pump module array that must be configured to properly operate the array. You will need a copy of the Programming and Operation Manual (POM) for the software installed on your MPCP to properly configure the array.

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 or MPCP, it is best practice to throw any out of date paper copies of the POM away.

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

BMS Installation and Configuration (MPCP-G Only)

⚠ WARNING

DO NOT connect the heat pump to the building network prior to gateway configuration! This will potentially overwrite the default IP address of the gateway and make finding the gateway on the network more difficult. If this occurs, it may be necessary to find the gateway on the network using the MAC address on the gateway label.

MPCP packages can be ordered in the MPCP–G configuration, which adds a BMS gateway to the onboard controls. External controllers can also have BMS gateways: however, to configure those controllers, refer to their installation manuals.

To integrate an MPCP-G system into a local BMS, use the following instructions.

Configuration Prep and Login

1. Power up the controller, and allow it to finish its startup, before attempting to configure the BMS gateway. After startup is completed, connect a laptop directly to the gateway, using the ethernet port on the gateway. This component is shown in the “field wiring control points” diagram in the “control wiring” section of this manual, for reference.
2. Open a web browser and connect directly to https://192.168.1.24
3. You may get a “Web Server Security Unconfigured” message. It is okay to proceed with HTTPS from that warning message.
4. You may get a “Your Connection is not Private” message. If so, click “Advanced”, and click “proceed to 192.168.1.24 (unsafe)”.
5. Login to the gateway web interface. Username is “admin”. Password is written on the gateway’s label, and is also available via QR code on the gateway. It may be necessary to temporarily unseat the gateway from the DIN rail to read the label.
6. On the first login, the security mode will need to be set. Lochinvar recommends “Basic HTTP” or “HTTPS with own trusted certificate”.

After selecting a mode, you will get a “redirecting” message, and then the Field server GUI should open.

Network Settings

1. To configure network settings, on the GUI landing page, click on the “Settings” tab. Within “Settings”, click on the “Network” tab.
   a. On the first connection, you will get a warning message that you are about to leave the registration process. Click “Exit Registration”.
2. You should now see a page with “ETH 1” and “Routing” tabs. Click the “Routing” tab.
   a. Select the default connection in the first row of the table.
   b. Click the “Add Rule Button” to add a new row.
   c. Set a new Destination Network, Netmask, and Gateway IP Address as needed.
   d. Set the priority for each connection from 1 (highest) to 255 (lowest).
   e. Click the “Save” button.
3. Now click the “ETH 1” tab to access the ethernet settings.

Be advised, if IP addresses are changed, you will need to reconnect to the gateway via your browser using the new IP address before you can continue with configuration settings! Only proceed once ready to connect to the building’s network.

4. DHCP to automatically accept IP settings can be enabled here, or IP settings can be manually configured.
   a. For manual configuration, set IP Address, Netmask, Default Gateway, and Domain Name Server.
   b. If the gateway will be connected to a router, the gateway MUST set the “Gateway” field to the IP address of the router.
5. Click “Save” to activate the settings changes.

Protonode Configuration

To configure the protonode, start from the “Device List” page in the GUI and click “Settings”.

1. Choose “Configuration”, and click the “Profiles Configuration” Button. Set the “protocol_select” field
   a. Set to 1 for BACnet IP
   b. Set to 2 for BACnet MSTP
   c. Set to 3 for BACnet MSTP (Single Node)
   d. Hit “submit” after entering the correct value.

Selecting a protocol will change the list of visible parameters to only parameters applicable to your protocol.

2. Set the remaining parameters according to the needs of your network and BMS system. Press “submit” to save each value.

Table 11: Configuration Parameters for BMS Gateway

Parameter	Protocol	Values	Description
protocol_select	All	1,2,3	Protocol Selector: set to 1: BACnet IP. 2: BACnet MSTP. 3: BACnet MSTP (single node).
mod_baud_rate	All	9600-19200-38400-57600	Set to the Modbus RTU baud rate required.
mod_parity	All	None,Even,Odd	Set to the Modbus parity required (Factory Set)
mod_data_bits	All	7,8	Set to the Modbus data bits required (Factory Set)
mod_stop_bits	All	1,2	Set to the Modbus stop bits required (Factory Set)
network_nr	1, 3	1 - 65535	Sets the BACnet network number for the gateway.
node_offset	1, 3	0 - 4194303	Sets the BACnet device instance (Device address plus offset).
bac_ip_port	1	1 - 65535	Set to the BACnet IP port required for the gateway.
bac_cov_option	ALL	enable, disable	Enables or Disables COVs for the BACnet application
bac_bbmd_option	1	BBMD, -	Enables or Disables BBMD for the BACnet application
bac_virt_nodes	1, 3	No, Yes	No: single heat pump on gateway. Yes: multiple heat pumps on gateway.
bac_device_id	2	1 - 4194303	Sets this BACnet device instance
bac_mac_addr	2, 3	1 - 127	Sets the BACnet MSTP MAC address
bac_baud_rate	2, 3	9600-19200-38400-76800	Sets the BACnet MSTP Baud Rate
bac_max_master	2, 3	1 - 127	Sets the BACnet MSTP max master
bac_max_info_fr	2, 3	1 - 65535	Sets max number of frames before token must be passed

3. Connect the gateway to the building network.
4. Reconnect to the new gateway IP address with your web browser, if necessary. Verify communications in accordance with the “Testing” instructions in the next section.
5. The gateway should now allow for building management system integration. Points lists for your equipment is available in a following subsection of this manual

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Points List

Following is the list of available points on the MPCP-G for integration with BACnet BMS systems. Points for up to six attached heat pumps are available, in addition to the central control parameters.

Table 12: MPCP-G BMS Table

Profile Description	Profile Name	Description of Operation
Cycle State	Cycle	Set to 1 to enable operation, 0 to disable operation.
Leaving Water Setpoint (SP) / (DR)	Lw_Set	Target leaving water temperature for single-pass operation (Deg F)
Cut-In/Out Setpoint (SP)	Cut_in_out_set	Activation/Termination temperature for single-pass operation (Deg F)
Temperature Setpoint Tank	Tank_Set	Target tank temperature (Deg F)
Cold Setpoint / Shed (DR)	Cold_Set	Activation temperature for cold sensor in multi-pass operation (Deg F)
Hot Setpoint (MP) / Loadup (DR)	Hot_Set	Activation temperature for warm sensor in multi-pass operation (Deg F)

Table 13: Relevant Data Points for MCP-G: Read-Only Values

Profile Description	Profile Name	Description of Operation
Control Mode (Local/BMS)	Display_Lock	0= Local Control. 1= BMS Control
Pump Speed	Pump_Status	0-100% readout for variable speed pump outputs.
System Cycle Status	Cycle_Status	Whether MCP-G is currently on or off
System Status (Idle / Active / Others)	System_Status	Whether heat demand is active or idle
System Alarms (MCP Generated)	System_Alarm	Communication Fault, Probe Fault, Ambient (out of operating range) faults.
Number of Installed Units	Installed_Units	The number of heat pumps the MCP is configured to operate.
Number of Units Currently Running	Running_Units	The number of heat pumps currently in active demand status.
Tank Probe 1	TankProbe1	Cold Trigger 1 (Multi-pass) / Low Sensor (Single-pass)
Tank Probe 2	TankProbe2	Cold Trigger 2 (Multi-pass) / Mid Sensor (Single-pass)
Tank Probe 3	TankProbe3	Cold Trigger 3 (Multi-pass) / High Sensor (Single-pass)
Tank Probe 4	TankProbe4	Termination sensor for single-pass operation. Warm trigger or Min Outlet sensor for multi-pass. (Deg F.)
Alarm Number Unit 1	UnitAlarm1	Alarm Status of Heat Pump 1
Alarm Number Unit 2	UnitAlarm2	Alarm Status of Heat Pump 2
Alarm Number Unit 3	UnitAlarm3	Alarm Status of Heat Pump 3
Alarm Number Unit 4	UnitAlarm4	Alarm Status of Heat Pump 4
Alarm Number Unit 5	UnitAlarm5	Alarm Status of Heat Pump 5
Alarm Number Unit 6	UnitAlarm6	Alarm Status of Heat Pump 6
Compressor Run Hours1	CompressorRunHRS1	Cumulative Run Hours for Heat Pump 1
Compressor Run Hours2	CompressorRunHRS2	Cumulative Run Hours for Heat Pump 2
Compressor Run Hours3	CompressorRunHRS3	Cumulative Run Hours for Heat Pump 3
Compressor Run Hours4	CompressorRunHRS4	Cumulative Run Hours for Heat Pump 4
Compressor Run Hours5	CompressorRunHRS5	Cumulative Run Hours for Heat Pump 5
Compressor Run Hours6	CompressorRunHRS6	Cumulative Run Hours for Heat Pump 6

BMS Testing

Good practice will include thorough verification that values reported by the heat pump match the values received in the BMS system. Ideally, this would include monitoring through an active heat demand and comparing BMS reported values to heat pump reported values.

In addition, system communication can be checked. For serial connections, check that the TX and RX LEDs are rapidly flashing.

You can also log into the field server GUI with a web browser, as in the “configuration” section. From there, clicking on “Diagnostics and Debugging”, and then on “connections”, shows you a table of communication connections. The “errors” column would indicate if there are errors requiring additional troubleshooting.

Communication errors are usually caused by:

- Baud rate, parity, data bits or stop bits set incorrectly
- Device addresses incorrect
- Wiring problems
- Device not listed in the Web Configurator
- IP Addressing incorrect

BMS Testing (continued)

If communication errors cannot be troubleshot, a “Diagnostic Capture” can be taken and emailed to the factory for assistance.

1. Connect to the field server GUI with your web browser
2. Click on “Diagnostics”
3. Select “Full Diagnostic”
4. Set the capture time period
5. Click start. When the capture period is finished, a download button will appear.
6. Download the capture
7. Email the capture to the factory, along with any supporting information needed to describe your problem.

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

- ☐ Heat pump is level, stable, and securely mounted.
- ☐ Heat pump has all appropriate service clearances, and access panels are not obstructed by pipes, wires, or other obstacles.
- ☐ Heat pump 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 sensor diagrams in the “control wiring” section of this manual 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 canceled, 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 includes:

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

You may also need to refer to installation manuals for installed accessories for some 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. You may need the "production date" from the nameplate of your heat pump to get accurate wiring schematics.

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

Table 14: Initial Troubleshooting and Alert/Faults for Individual Modules

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 Config/Diag Screens	Service jumper is installed, and secure.
Heat Pump won't run at all	Primary power is active.
	No alarms or alerts present on control screen.
	Heat demand conditions are present.
	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 temp is insufficient	Tank and/or outlet temps are set correctly.
	Single-pass: Internal control valve is working properly.
	Outlet temp is allowed by current source conditions.

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 Pump” 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.

Table 15: Individual Module Resistance Test Values

Heat Pump Voltage	Component	Check Point	Terminals	Ohms
208-230v	Compressor	Compressor [1]	T1-T2, T2-T3, T1-T3	0.14
460v	Compressor	Compressor [1]	T1-T2, T2-T3, T1-T3	0.49
575v	Compressor	Compressor [1]	T1-T2, T2-T3, T1-T3	0.81

[1] Check compressor with wires to contactor disconnected. Record ohms at each service and track changes over time for early warning of potential component failure.

Service Log

Issue Description	Date	Servicer

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