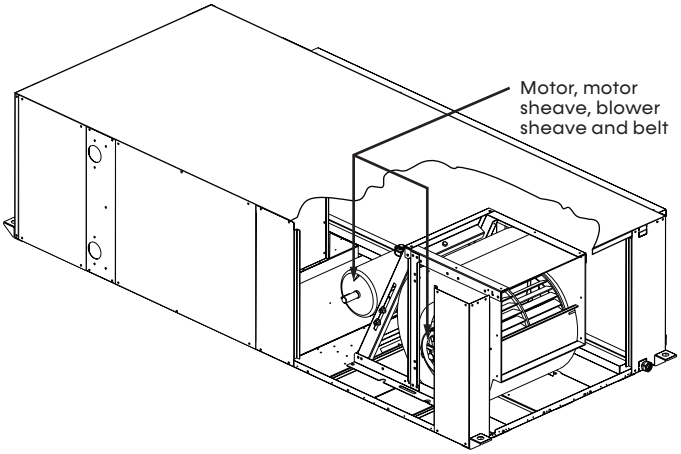
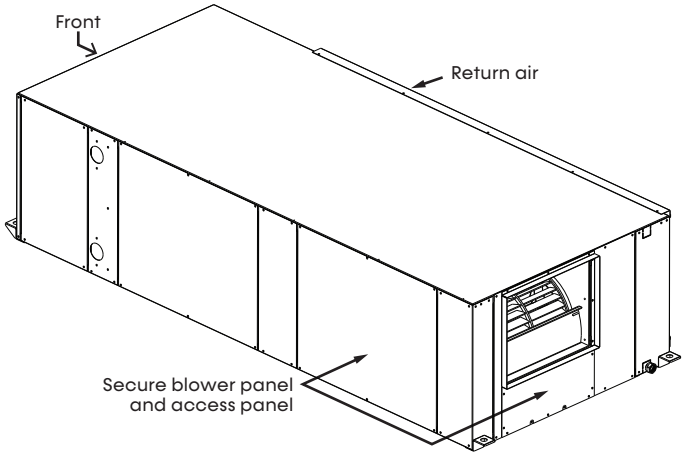
Horizontal Installation
Field Conversion of Air Discharge

Models:
MB
072-300

Step 7: Secure Motor, Motor Sheave, Blower Sheave, and Belt



Step 8: Secure Blower Panel and Access Panel



Models:
MB
072-300

Vertical Installation

VERTICAL LOCATION AND ACCESS

MB units are not designed for outdoor installation. Locate the unit in an INDOOR area that allows enough space for installation and for service personnel to perform typical maintenance or repairs. MB units are typically installed in a floor level closet or in a small mechanical room. Refer to the **Typical Vertical Unit Installation** figure for an example of a typical installation. Install units with adequate clearance to allow maintenance and servicing. **NOTE: Minimum clearances for installation are the same as the minimum required service clearances. Consult the service clearances on for reference of installation clearances.** Conform to the following guidelines when selecting unit location:

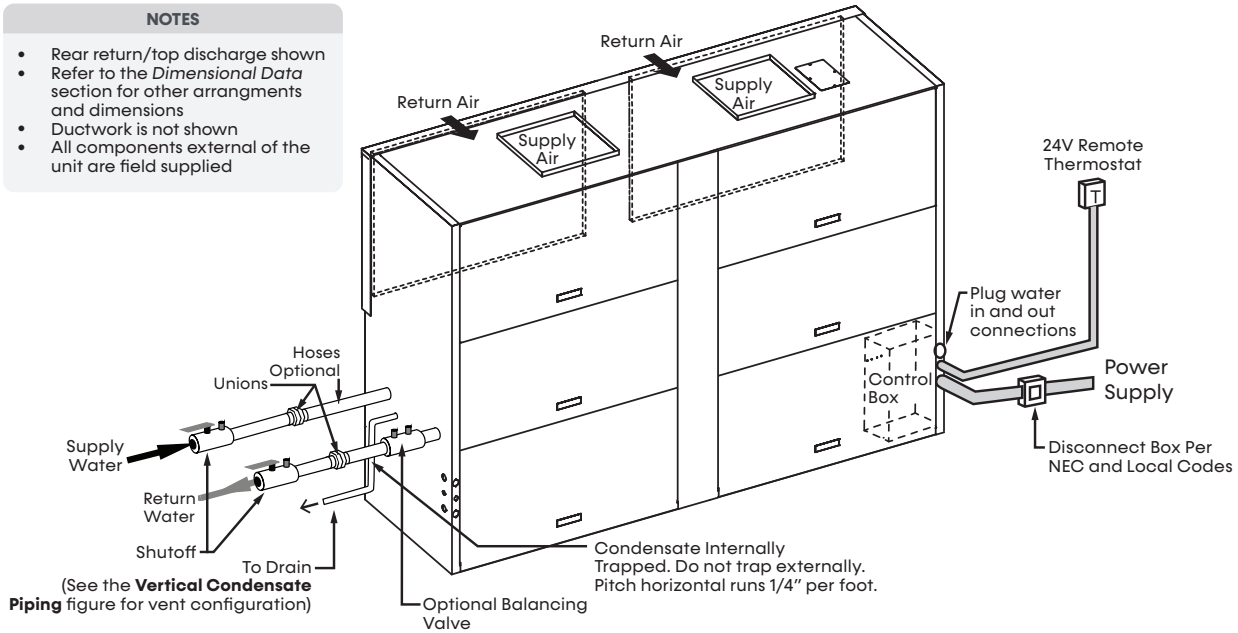
- Provide adequate clearance for filter replacement and drain pan cleaning. DO NOT block filter access with piping, conduit, or other materials. Refer to the product catalog for unit dimensions.
- Provide access for fan and fan motor maintenance and for servicing of the compressor and coils without removal of the unit.
- Provide an unobstructed path to the unit within the closet or mechanical room to enable removal of the unit if necessary.
- Provide access to water valves and fittings, and screwdriver access to the unit side panels, discharge collar and all electrical connections

DUCT SYSTEM DESIGN AND INSTALLATION GUIDELINES

The following application guidelines must be used when installing the MB. Failure to follow these guidelines could result in unsatisfactory unit performance and/or premature failure of some unit components. The manufacturer will not warranty, or accept responsibility for products which fail, have defects, damage or insufficient performance as a result of improper application.

- The duct system must be sized to handle the airflow quietly and must not exceed the maximum allowable External Static Pressure. To maximize sound attenuation, metal supply and return ducts should include internal insulation or be of duct-board construction for the first 10 feet or end of first full-sized elbow.
- Install a flexible connector in all supply and return air ducts close to the unit to inhibit sound transfer to the ducts.
- Do not install uninsulated ducts in an unconditioned space. The unit performance will be adversely affected and damage from condensate can occur.

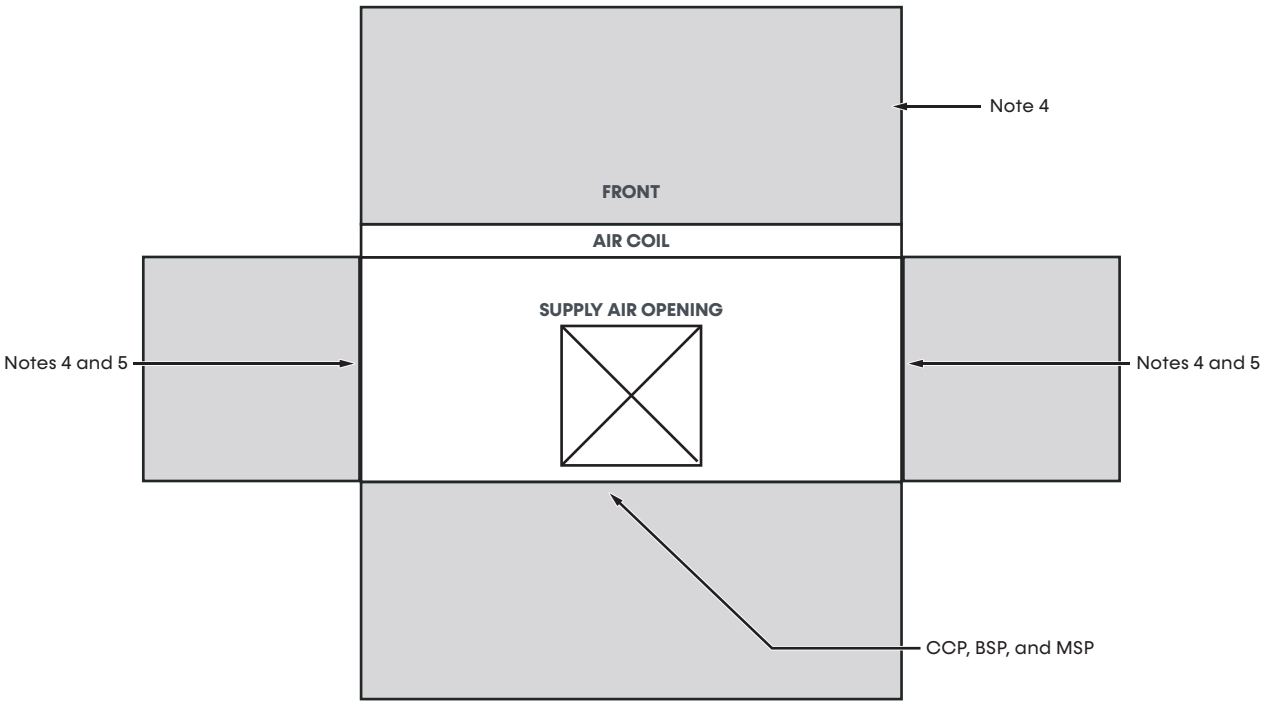
Figure 6: Typical Vertical Unit Installation



Vertical Installation Service Access

Models:
MB
072-300

VERTICAL UNITS



NOTES

1. Condensate drain is available on either side (left or right) of unit. Drain hose and drain connection will be tied inside the unit. The installer will untie the drain hose, form trap, and connect to the condensate drain hole of installer's choice.
2. Electrical access is available on either side (left or right) of unit and is also available in the front on the left or right side of the unit.
3. Overall cabinet height and depth dimension does not includeduct fange for or filter rails.
4. Units require 3 feet (91 cm) of clearance, CBP, CSP, MSP and BSP service access. While access to all removable panels may not be required, the installer should take care to comply with all building codes and allow adequate clearance for future field service.
5. Filter removal is from right or left side of filter frame. Allow 3 feet (91 cm) of access for servicing.

LEGEND

CCP = CONTROL/COMPRESSOR ACCESS
BSP = BLOWER SERVICE PANEL
MSP = MOTOR SERVICE PANEL

= Mandatory Service Access 3 feet (91.4 cm)

Models:
MB
072-300

Vertical Installation
Field Conversion of Air Discharge (072-120)

⚠ WARNING

To prevent injury or death from electrical shock, disconnect electrical power source.

OVERVIEW

Vertical unit sizes 072-120 can be field converted between top and straight (side) discharge and back (end) discharge using the instructions below.

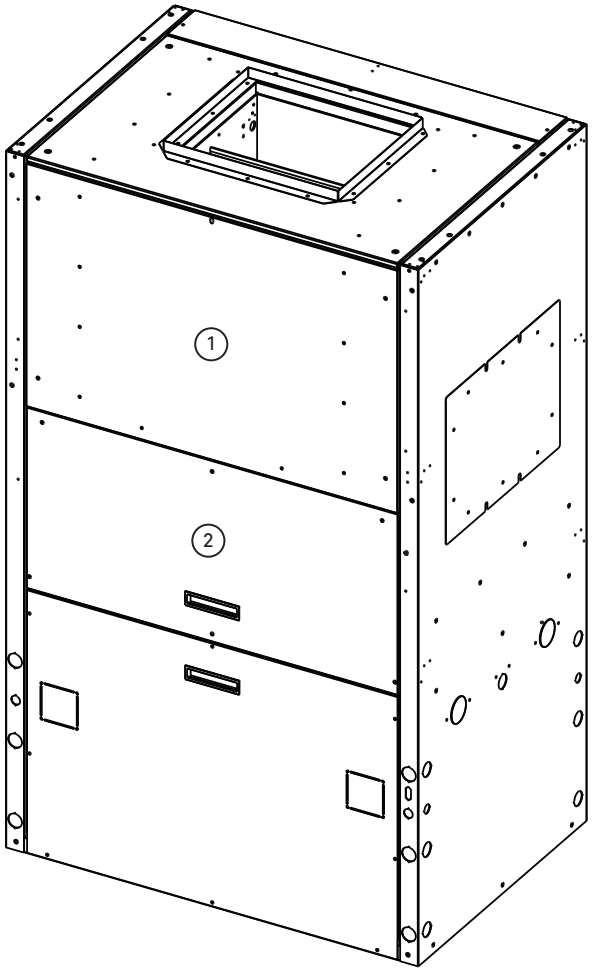
NOTE: Field conversion of discharge air is not available in vertical unit sizes 168 to 300. Be sure to order your unit with the proper discharge air configuration.

PREPARATION

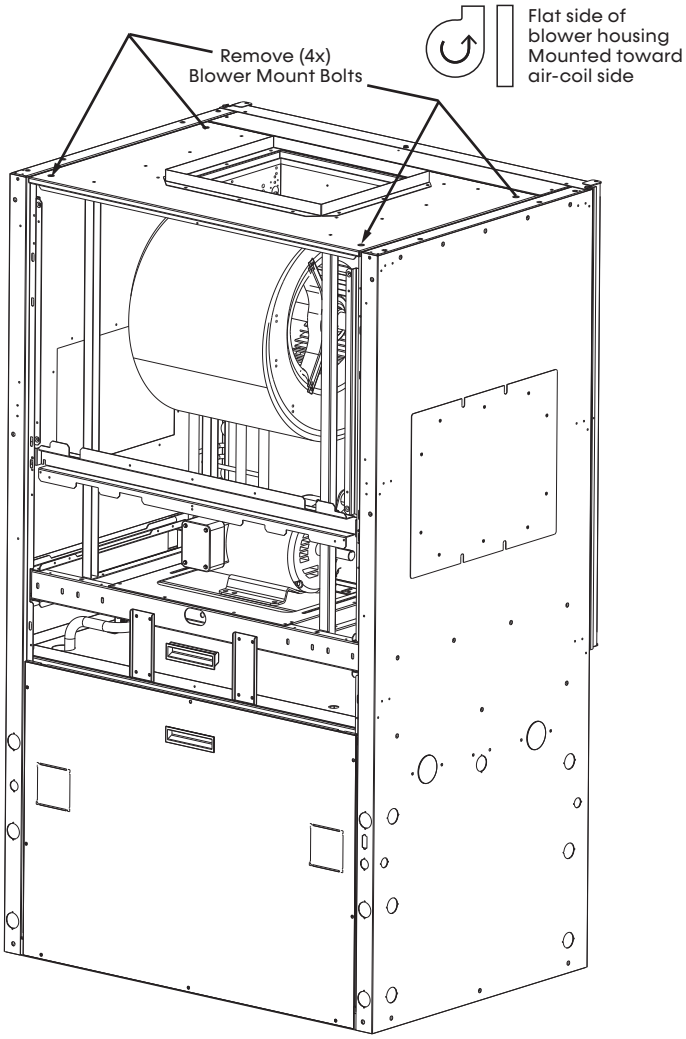
Place in a well-lit area. Conversion should only be attempted by qualified service technicians.

NOTE: To convert from straight discharge to top discharge, reverse the following steps.

Step 1: Remove Panels



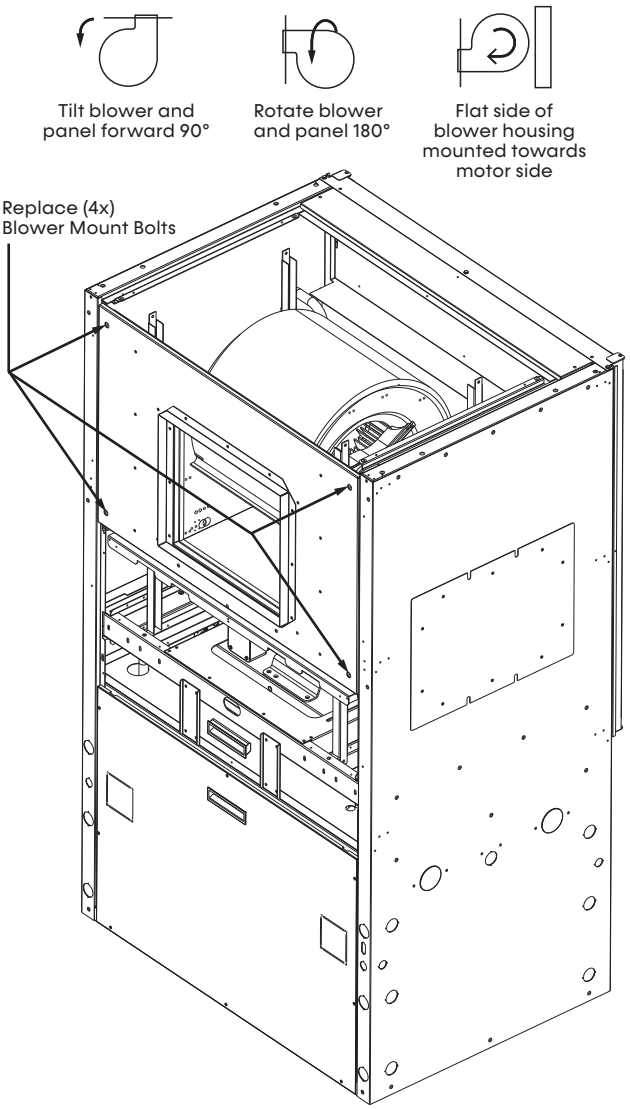
Step 2: Remove Screws



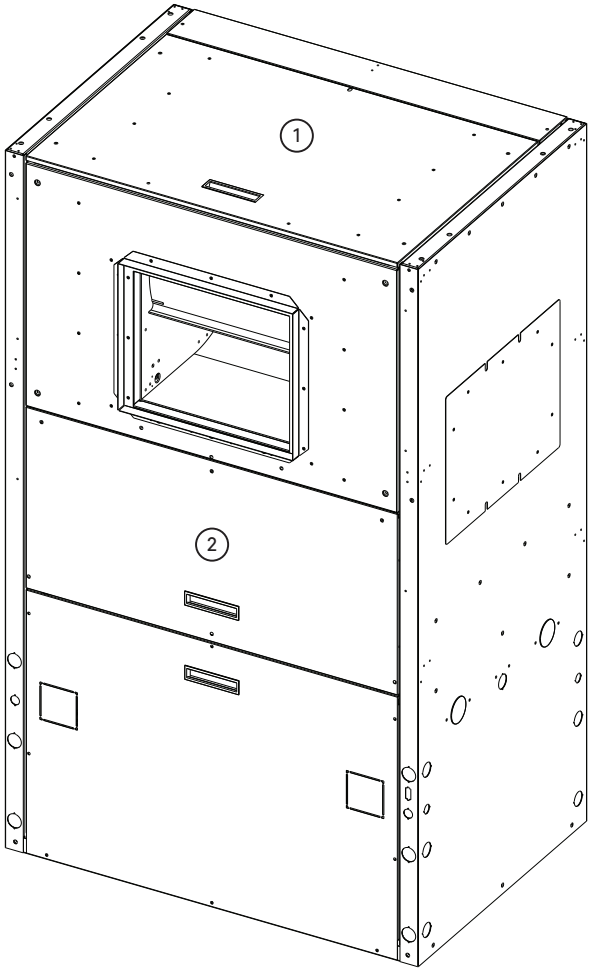
Vertical Installation
Field Conversion of Air Discharge (072-120)

Models:
MB
072-300

Step 3: Rotate and reattach blower



Step 4: Replace and Secure Panels



Models:
MB
072-300

Vertical Installation
Field Conversion of Control Box (072-300)

⚠ WARNING

To prevent injury or death from electrical shock, disconnect electrical power source.

⚠ NOTICE

You must provide three feet service access (or meet code requirements) for the new control box location.

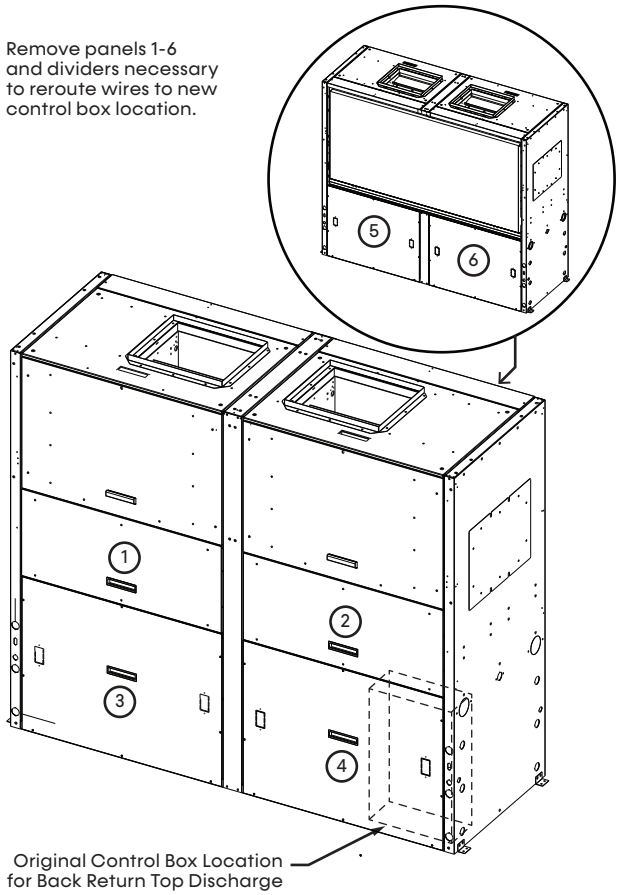
OVERVIEW

The vertical unit control box can be field converted from front to any other corner for unit sizes 168-300, or opposite corner (water coil side) for unit sizes 072-120.

PREPARATION

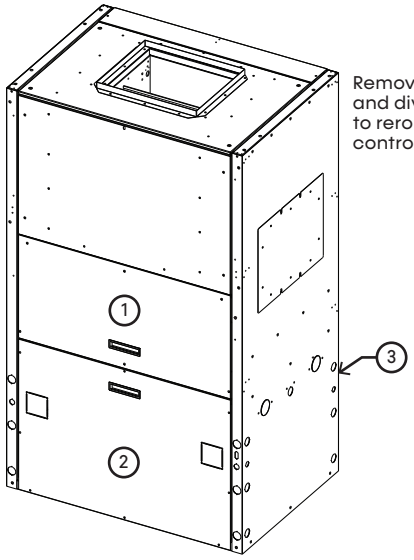
Place in a well-lit area. Conversion should only be attempted by a qualified service technician.

Step 1: Remove Panels (MB168-300)



Note: SB168-240 chassis shown.

Step 2: Remove Panels (MB072-120)



NOTE: After completing step 1, follow steps 2-7 for all sizes.

1. Tag and detach all wires from components, pull wires out of control box, then remove the control box.
2. Attach box to new location.
3. Reroute wires.

   NOTE: Keep wires away from hot lines and sharp edges.

4. Reattach wires.

   NOTE: Reattach Circuit 1 to the same compressor so that the compressor configuration does not change. Only the location of the control box should change.

5. Verify wiring in the unit matches the configuration wiring diagram.
6. Replace panels.

Vertical Installation
Field Conversion of Water Connections (072-240)

Models:
MB
072-300

⚠ WARNING

To prevent injury or death from electrical shock, disconnect electrical power source.

OVERVIEW

For vertical unit sizes 072-240, the water connection can be field converted to opposite side. Connections can be both left, right, or one on each side.

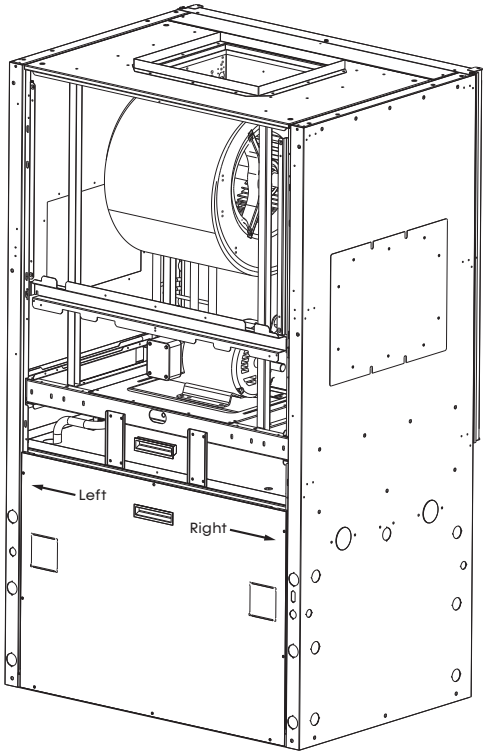
NOTE: Field Conversion of Water Connections is not available on unit size 300. Be sure to order the proper water-connection hand configuration.

PREPARATION

Field conversion must be completed on the ground. If the unit is already hung it should be taken down for the field conversion. Place in a well-lit area. Conversion should only be attempted by a qualified service technician.

Left or Right Side-to-Back Discharge Conversion

NOTE: Water connection direction is determined when facing the motor side of the unit:



1. Remove panels needed for access to water connections.
2. Remove screws from side panels. Loosen (4x) screws in slots but do not remove.
3. Both water in and out have a union centered in the middle of the unit. Undo both unions, rotate the water legs for opposite configuration, retighten unions, then reattach connection flanges to wrappers. Use slots to adjust and retighten screws in slots.
4. Replace panels.
5. Ensure wiring is per wire diagram.

Models:
MB
072-300

Vertical Installation Condensate Installation

CONDENSATE PIPING

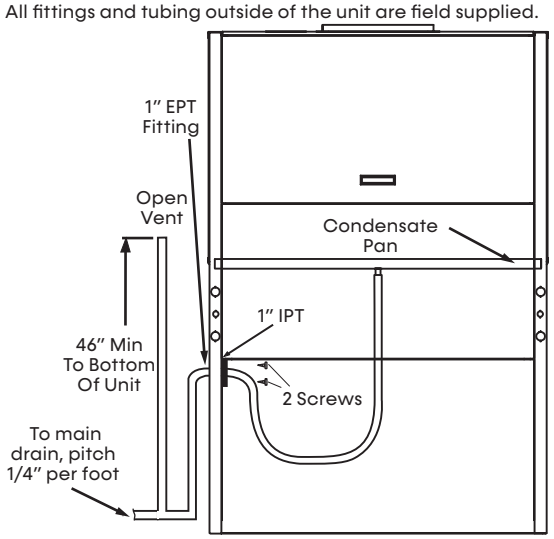
Remove KO on the side to which that drain will be connected. Remove access panels. Inside the unit, untie and uncoil drain hose. Form a trap in the hose ensuring the hose is not kinked or deformed. Connect plate assembly to the side frame with two screws.

Outside of unit, connect 1-inch MPT fitting to the plate assembly. Run the line to building drain. Horizontal runs must be pitched ¼ inch per foot (10 mm per 46 cm) toward drain. Do not trap externally.

The **Vertical Condensate Piping** figure illustrates a typical trap and vent used with the MB.

Figure 7: Vertical Condensate Piping

All fittings and tubing outside of the unit are field supplied.



Each unit must be installed with its own individual line to the building's main condensate drain line or riser. Provide a means to flush or blow out the condensate line. DO NOT install units with a common trap and or vent. Always vent the condensate line when dirt or air can collect in the line or a long horizontal drain line is required. Also vent when large units are working against higher external-static pressure than other units connected to the same condensate main since this may cause poor drainage for all units on the line. **WHEN A VENT IS INSTALLED IN THE DRAIN LINE, IT MUST BE LOCATED AFTER THE TRAP IN THE DIRECTION OF THE CONDENSATE FLOW** and opening 46 inches (117 cm) minimum from bottom of unit. Vent the condensate piping per code.

⚠ WARNING

Ensure condensate line is pitched toward drain ¼ inch per foot [10mm per 46cm] of run.

Horizontal and Vertical Installations – Drain main or riser must be sized for all units connected to it.

Pipe Size inch (mm)	Connected Tons	Connected kW
3/4 (19)	<4	<14
1 (25)	<6	<21
1-1/4 (32)	<30	<105
1-1/2 (38)	<50	<175
2 (51)	<150	<527
3 (76)	<300	<1055
4 (102)	<500	<1758

Ensure all connections are secure and water tight.

After drain is connected to main and all drain connections are secure and water tight, pour one gallon of water into condensate pan. The water should drain out freely. Repair any leaks.

- On units with multiple fan outlets a "pair of pants" duct connection must be used for proper air balance and distribution and to prevent fan oscillation.
- Include at least one 90-degree turn in supply air ducts to reduce noise transmission.
- Existing ducts must be checked to ensure proper size and configuration prior to installation of any replacement unit. Also inspect for and repair all air leaks in existing ducts.
- Units may only be connected to a dedicated duct system. Consult the factory BEFORE connecting multiple units to a common duct system.
- Never connect a unit to a duct system with automatic or modulating dampers, VAV boxes, etc. in the supply air system. Never allow a situation where the total unit CFM can drop below the minimum required for proper unit operation.
- Never connect a bypass damper from the supply air duct to the return air duct. Never allow the return air temperature to drop below the minimum allowable normal temperature for proper unit operation.
- Do not use MB units for 100% outdoor air treatment. Do not add hot-gas-bypass to "convert" a unit for outdoor air treatment. Always use a dedicated outdoor air unit for outdoor air treatment.
- Do not exceed 10% of the total unit CFM with untreated outdoor air.

Piping Installation

Models:
MB
072-300

SUPPLY AND RETURN PIPING

Follow these piping guidelines:

1. Install a drain valve at the base of each supply and return riser to facilitate system flushing.
2. Install shutoff/balancing valves and unions at each unit to permit unit removal for servicing.
3. Place strainers at the inlet of each system circulating pump.
4. Select the proper hose length to allow slack between connection points. Hoses may vary in length by +2% to -4% under pressure.
5. Refer to the **Metal Hose Minimum Bend Radius** table. Do not go below the minimum bend radius for the hose selected. Going below the minimum bend radius may cause the hose to collapse, which reduces water flow rate. Install an angle adapter to avoid sharp bends in the hose when the radius falls below the required minimum.

Insulation is not required on loop water piping except where the piping runs through unheated areas, outside the building or when the loop water temperature is below the minimum expected dew point of the pipe ambient conditions. Insulation is required if loop water temperature drops below the dew point (insulation is required for ground loop applications in most climates).

Pipe joint compound is not necessary when water thread sealant tape is pre-applied to hose assemblies or when flared-end connections are used. If pipe joint compound is preferred, use compound only in small amounts on the external pipe threads of the fitting adapters. Prevent sealant from reaching the flared surfaces of the joint.

NOTE: When antifreeze is used in the water loop, ensure that it is compatible with the thread-sealant tape or pipe-joint compound that is applied.

Maximum allowable torque for brass fittings is 30 ft-lbs (41 N-m). If a torque wrench is not available, tighten finger-tight plus one quarter turn. Tighten steel fittings as necessary.

Optional pressure-rated hose assemblies designed specifically for use with units are available. Similar hoses can be obtained from alternate suppliers. Supply and return hoses are fitted with swivel-joint fittings at one end to prevent kinking during installation.

The **Supply/Return Hose Kit** figure illustrates a typical hose kit used in these applications. Adapters secure hose assemblies to the unit and risers. Install hose assemblies properly and check regularly to avoid system failure and reduced service life.

⚠ WARNING

Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with R-454B refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water-source heat pump products containing R-454B as system failures and property damage may result.

⚠ CAUTION

Corrosive system water requires corrosion resistant fittings and hoses, and may require water treatment.

⚠ CAUTION

Do not bend or kink supply lines or hoses.

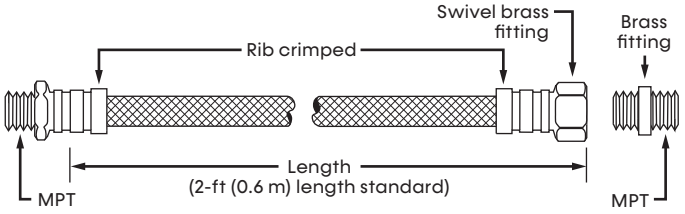
Table 2: Metal Hose Minimum Bend Radius

Hose Diameter	Minimum Bend Radius
1/2" [12.7 mm]	2-1/2" [6.4 cm]
3/4" [19.1 mm]	4" [10.2 cm]
1" [25.4 mm]	5-1/2" [14 cm]
1-1/4" [31.8 mm]	6-3/4" [17.1 cm]

⚠ ATTENTION

Do not allow hoses to rest against structural building components. Compressor vibration may be transmitted through the hoses to the structure, causing unnecessary noise complaints.

Figure 8: Supply/Return Hose Kit



Models:
MB
072-300

Applications
Water-Loop Heat Pump

COMMERCIAL WATER-LOOP APPLICATIONS

Commercial systems typically include a number of units connected to a common piping system. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major portion of the mechanical room plumbing. To avoid condensation, consider insulating the piping surfaces. The manufacturer recommends piping insulation any time the water temperature is below 60°F (15.6°C). Do not use metal to plastic threaded joints due to their tendency to leak over time.

Water thread-sealant tape or thread sealant is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access. Hose kits are available from the manufacturer in different configurations for connection between the unit and the piping system. Depending on selection, hose kits may include shutoff valves, P/T plugs for performance measurement, high pressure stainless-steel braided hose, "Y" type strainer with blow down valve, and/or with blow down valve, auto-flow valve and swivel connections.

Flush the piping system to remove dirt, piping chips, and other foreign material prior to operation. See the *Piping System Cleaning and Flushing* section for more information. The flow rate is usually set between 2.25 and 3.5 GPM per ton (2.9 and 4.5 l/m per kW) of cooling capacity. The manufacturer recommends 3 GPM per ton (3.9 l/m per kW) for most water-loop heat pump applications. To ensure proper maintenance and servicing, P/T ports are imperative for temperature, flow verification, and performance checks.

Water-loop heat pump (cooling tower/boiler) systems typically utilize a common loop maintained between 60 - 90°F (16 - 32°C). The use of a closed-circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop is recommended. If an open type cooling tower is used continuously, chemical treatment and filtering is necessary.

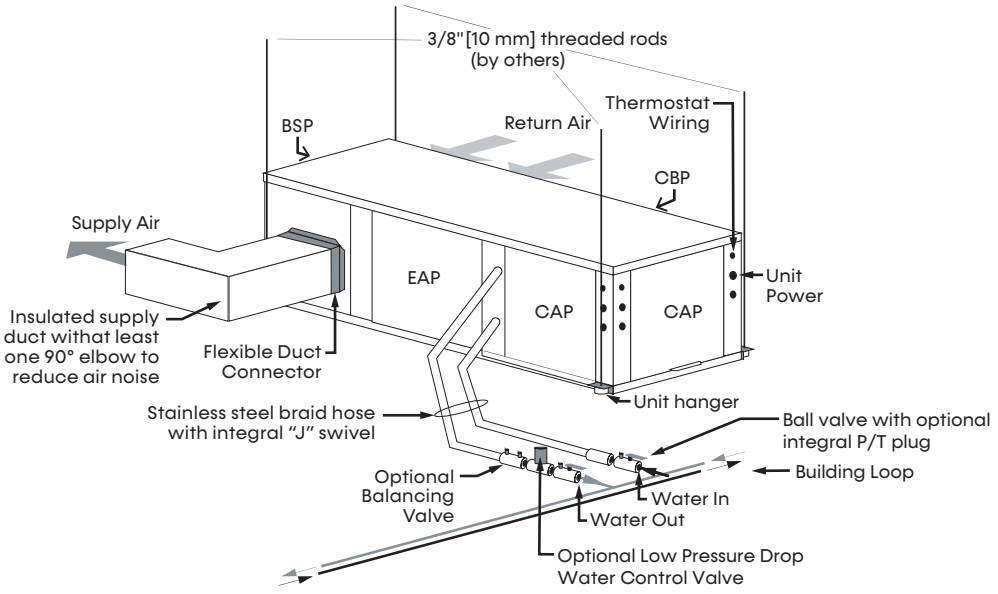
⚠ WARNING

Never jumper terminal "A" from CXM2 #1 to CXM2 #2 on multi-compressor/multi-control board units. For more information, see the motorized water valve wiring examples in the *Electrical Low-Voltage Wiring* section of this IOM.

⚠ CAUTION

Many units are installed with a factory or field-supplied manual or electric shutoff valve. DAMAGE WILL OCCUR if shutoff valve is closed during unit operation. A high-pressure switch must be installed on the heat pump side of any field-provided shutoff valves and connected to the heat pump controls in series with the built-in refrigerant circuit high pressure switch to disable compressor operation if water pressure exceeds pressure switch setting. The field-installed high pressure switch shall have a cut-out pressure of 300 psig and a cut-in pressure of 250 psig. You can order this pressure switch from the manufacturer with a ¼-inch internal-flare connection as part number 39B0005N02.

Figure 9: Typical Water-Loop Application



Applications
Ground-Loop Heat Pump Application

Models:
MB
072-300

⚠ CAUTION

The following instructions represent industry accepted installation practices for closed loop earth coupled heat pump systems. Instructions are provided to assist the contractor in installing trouble free ground loops. These instructions are recommendations only. State/provincial and local codes MUST be followed and installation MUST conform to ALL applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

⚠ CAUTION

Ground loop applications require extended range equipment and optional refrigerant/water circuit insulation.

PRE-INSTALLATION

Prior to installation, locate and mark all existing underground utilities, piping, etc. Install loops for new construction before sidewalks, patios, driveways, and other construction has begun. During construction, accurately mark all ground loop piping on the plot plan as an aid in avoiding potential future damage to the installation.

PIPING INSTALLATION

Limit all ground-loop piping materials to polyethylene fusion only for in-ground sections of the loop. Do not use galvanized or steel fittings at any time due to their tendency to corrode. Avoid all plastic-to-metal threaded fittings due to their potential to leak in ground-coupled applications. The manufacturer recommends using flanged fittings. Use P/T plugs to allow for flow measurement using the pressure drop of the unit heat exchanger.

Ground-loop temperatures can range between 25 and 110°F (-4 to 43°C). Flow rates between 2.25 and 3 GPM (2.41 to 3.23 l/m per kW) of cooling capacity is recommended in these applications.

Table 3: Antifreeze Percentages by Volume

Type	Minimum Antifreeze Concentration % for Low Temperature Protection			
	10°F [-12.2°C]	15°F [-9.4°C]	20°F [-6.7°C]	25°F [-3.9°C]
Methanol	21%	17%	13%	9%
100% USP food grade Propylene Glycol	29%	24%	19%	12%
Ethanol[1]	28%	24%	18%	12%

1. Must not be denatured with any petroleum based product

Test individual horizontal loop circuits before backfilling. Test vertical U-bends and pond loop assemblies prior to installation. Use pressures of at least 100 psi (689 kPa) when testing. Do not exceed the pipe pressure rating. Test entire system when all loops are assembled.

FLUSHING THE GROUND LOOP

Upon completion of system installation and testing, flush the system to remove all foreign objects and purge to remove all air.

ANTIFREEZE

For operation when water is used instead of an antifreeze solution, you must calculate the leaving water temperature (LWT). Flow must be maintained to a level such that the LWT is maintained above 40°F (4.4°C) when the JW3 jumper is not clipped. Otherwise, use appropriate levels of a proper antifreeze solution in systems with leaving water temperatures of 40°F (4.4°C) or below (or where piping is routed through areas subject to freezing) and clip the JW3 jumper. Alcohols and glycols are commonly used as antifreeze. Consult your local sales office to determine the antifreeze best suited to your area. Maintain freeze protection to 15°F (9°C) below the lowest expected entering loop temperature. For example, if 30°F (-1°C) is the minimum expected entering loop temperature, the leaving loop temperature would be 22 to 25°F (-6 to -4°C) and freeze protection should be at 15°F (-10°C).

Calculation is as follows:

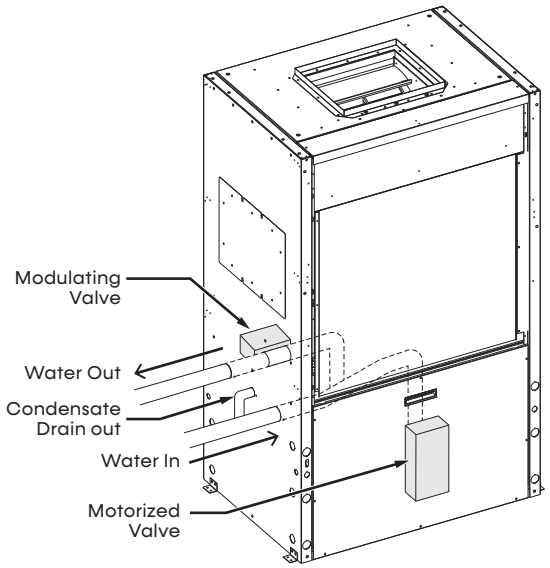
30°F - 15°F = 15°F [-1°C - 9°C = -10°C]

To prevent fumes, premix and pump alcohols from a reservoir outside of the building. If alcohols cannot be from outside the building, introduce them under the water level. Calculate the total volume of fluid in the piping system then use the **Antifreeze Percentages by Volume** table to determine the amount of antifreeze needed. Confirm antifreeze concentration in a homogeneous sample using a hydrometer or refractometer to measure specific gravity.

Models:
MB
072-300

Applications
Closed-Loop External Central Pumping

Figure 10: Typical Closed-Loop with Central-Pumping Application



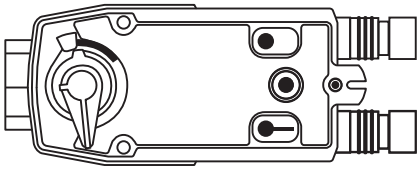
MB units are available with a modulating water valve option for closed-loop applications with external central pumping (designated by a C, or N in the 11th position of the unit model number). With this option, the Modulating Valve is regulated by the CXM2 Communicating Controls based on entering and leaving water temperature (ΔT). The CXM2 outputs a 0-10V signal to determine valve position (flow rate). The modulating valve defaults to closed position if it loses signal but still receives 24V power. If the motorized modulating valve loses both signal from the CXM2 AND 24V power, it remains in the same position as when it lost 24V power.

NOTE: The C_v (flow coefficient) of the valve used in these units is DIFFERENT than the C_v of the valve used in the open loop unit. It is not advisable for use in open loop applications as sound/noise issues may result. Units with the water circuit for closed-loop central-pumping option are only available with a copper water coil.

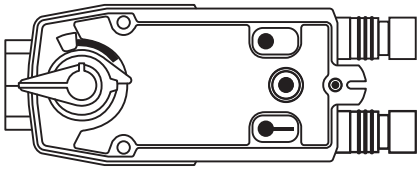
To manually open the internal modulating motorized water valve in MB vertical configurations, push down on the lock-release button while turning the handle to the open position as shown in the figure, Internal Modulating Motorized Valve Positions. This fully opens the valve for flushing. Once flushing is complete, press the lock release again and return the valve handle to its normally closed position.

Figure 11: Internal Modulating Motorized Valve Positions

Closed



Open



Water Quality Requirements

Models:
MB
072-300

Table 4: Water Quality Requirements

Clean water is essential to the performance and life span of water source heat pumps. Contaminants, chemicals, and minerals all have the potential to cause damage to the water heat exchanger if not treated properly. All closed-loop water systems should undergo water quality testing and be maintained to the water quality standards listed in this table. All open-loop water systems shall be tested upon installation and periodically to ensure water quality standard in the table below are met.

Water Quality Requirements
For Closed-Loop and Open-Loop Systems

	Description	Symbol	Units	Heat Exchanger Type			
				Closed Loop Recirculating		Open Loop, Tower, Ground Source Well	
				All Heat Exchanger Types	Coaxial HX Copper Tube in Tube	Coaxial HX Cupronickel	Brazed-Plate HX 316 SS
Scaling Potential	pH - Chilled Water <85°F			7.0 to 9.0	7.0 to 9.0	7.0 to 9.0	7.0 to 9.0
	pH - Chilled Water >85°F			8.0 to 10.0	8.0 to 10.0	8.0 to 10.0	8.0 to 10.0
	Alkalinity	($HCO3^-$)	ppm - $CaC0_3$ equivalent	50 to 500	50 to 500	50 to 500	50 to 500
	Calcium	(Ca)	ppm	<100	<100	<100	<100
	Magnesium	(Mg)	ppm	<100	<100	<100	<100
	Total Hardness	($CaCO_3$)	ppm - $CaC0_3$ equivalent	30 to 150	150 to 450	150 to 450	150 to 450
	Langelier Saturation Index	LSI		-0.5 to +0.5	-0.5 to +0.5	-0.5 to +0.5	-0.5 to +0.5
	Ryznar Stability Index	RSI		6.5 to 8.0	6.5 to 8.0	6.5 to 8.0	6.5 to 8.0
Corrosion Prevention	Total Dissolved Solids	(TDS)	ppm - $CaC0_3$ equivalent	<1000	<1000	<1000	<1000
	Sulfate	(SO_4^{2-})	ppm	<200	<200	<200	<200
	Nitrate	(NO_3^-)	ppm	<100	<100	<100	<100
	Chlorine (free)	(Cl)	ppm	<0.5	<0.5	<0.5	<0.5
	Chloride (water < 80°F)	(Cl^-)	ppm	<20	<20	<150	<150
	Chloride (water > 120°F)	(Cl^-)	ppm	<20	<20	<125	<125
	Hydrogen Sulfide[α]	(H_2S)	ppb	<0.5	<0.5	<0.5	<0.5
	Carbon Dioxide	(CO_2)	ppm	0	<50	10 to 50	10 to 50
	Iron Oxide	(Fe)	ppm	<1.0	<1.0	<1.0	<0.2
	Manganese	(Mn)	ppm	<0.4	<0.4	<0.4	<0.4
	Ammonia	(NH_3)	ppm	<0.05	<0.1	<0.1	<0.1
	Chloramine	(NH_2CL)	ppm	0	0	0	0
Fouling & Biological	Iron bacteria		cells/mL	0	0	0	0
	Slime-forming bacteria		cells/mL	0	0	0	0
	Sulfate-reducing bacteria		cells/mL	0	0	0	0
	Suspended Solids[β]	(TSS)	ppm	<10	<10	<10	<10
Electrolysis All HX types	Earth Ground Resistance[χ]		Ohms	Consult NEC and local electrical codes for grounding requirements			
	Electrolysis Voltage[δ]		mV	Measure voltage and internal water loop to HP ground			
	Leakage Current[δ]		mA	Measure current in water loop pipe			
	Building Primary Electrical Ground to unit, must meet local diameter and penetration length requirements. Do not connect heat pump to steel pipe unless dissimilar materials are separated by using Di-electric unions. Galvanic corrosion of heat pump water pipe will occur						

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Water Quality Requirements

1. The **Water Quality Requirements** table provides water quality requirements for coaxial and brazed-plate heat exchangers.
2. The water must be evaluated by an independent testing facility comparing site samples against this table. When water properties are outside of these parameters, the water must either be treated by a professional water treatment specialist to bring the water quality within the boundaries of this specification, or an external secondary heat exchanger must be used to isolate the heat pump water system from the unsuitable water. Failure to do so will void the warranty of the heat pump system and will limit liability for damage caused by leaks or system failure.
3. Regular sampling, testing and treatment of the water is necessary to assure that the water quality remains within acceptable levels thereby allowing the heat pump to operate at optimum levels.
4. If closed-loop systems are turned off for extended periods, water samples must be tested prior to operating the system.
5. For optimal performance, it is recommended that the closed-loop piping systems are initially filled with deionized water.
6. Well water with chemistry outside of these boundaries, and salt water or brackish water requires an external secondary heat exchanger. Surface/Pond water should not be used.
7. If water temperature is expected to fall below 40°F (4.4°C), antifreeze is required. Refer to the heat pump IOM for the correct solution ratios to prevent freezing.

Strainer / Filter Sizing

Mesh Size	Particle Size		
	Microns	Millimeter	Inch
20	840	0.840	0.0340
30	533	0.533	0.0210
60	250	0.250	0.0100
100	149	0.149	0.0060
150	100	0.100	0.0040
200	74	0.074	0.0029

- ppm = parts per million
- ppb = parts per billion

α Hydrogen sulfide has an odor of rotten eggs. If one detects this smell, a test for H_2S must be performed. If H_2S is detected above the limit indicated, remediation is necessary. Consult with your water testing/treatment professional. If a secondary heat exchanger is required, use appropriate materials as recommended by the heat exchanger supplier.

β Suspended solids and particulates must be filtered to prevent fouling and failure of heat exchangers. Strainers or particulate filters must be installed to provide a maximum particle size of 600 micron (0.60 mm, 0.023 inch) using a 20 to 30 mesh screen size. When a loop is installed in areas with fine material such as sand or clay, further filtration is required to a maximum of 100 micron. Refer to the Strainer / Filter Sizing Chart to capture the particle sizes encountered on the site.

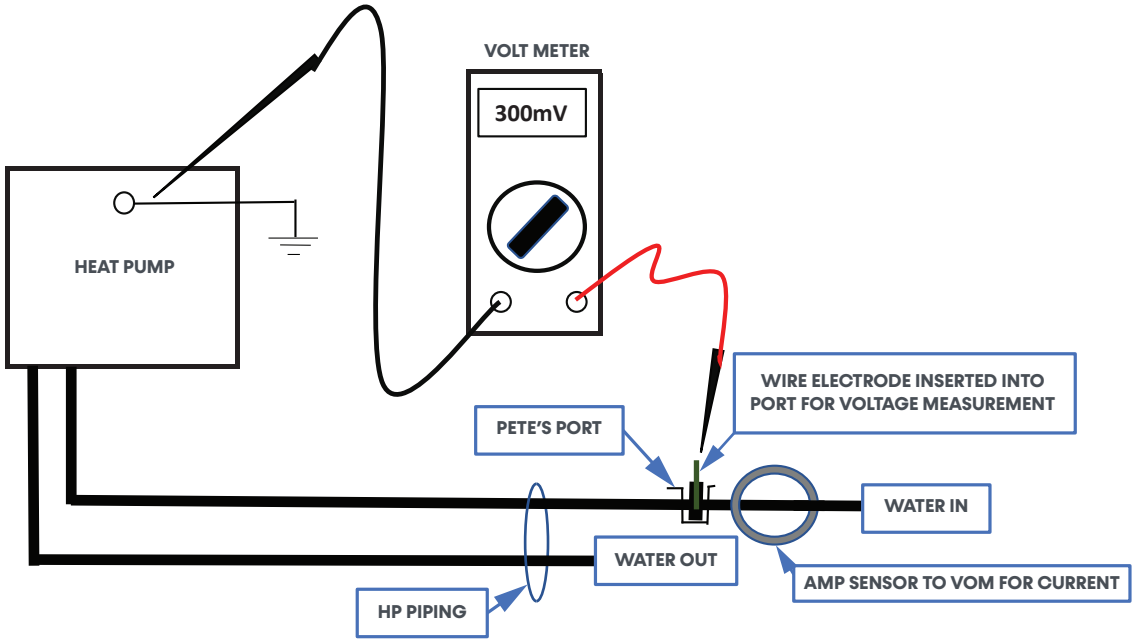
χ The WSHP piping system or other plumbing pipes must not be used as the building ground. An electrical grounding system using a dedicated ground rod meeting NEC and local electrical codes must be installed.

δ Refer to the **Antifreeze Percentages by Volume** table for instructions on measuring resistance and leakage currents within water loops.

Water Quality Requirements

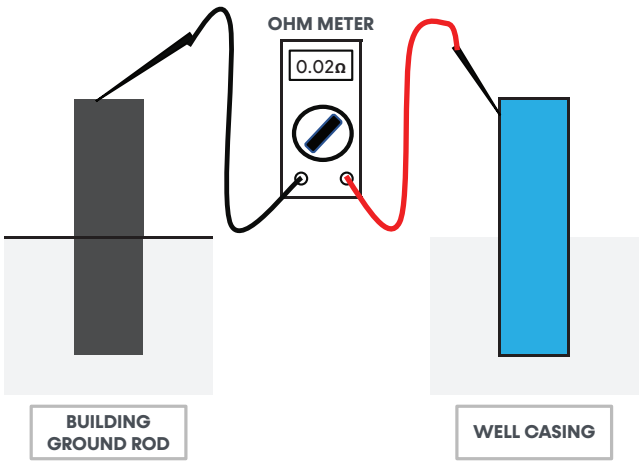
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Measuring Electrolysis, Voltage, and Current for Ground-Water Applications



- Measure the electrolysis voltage using a volt meter between the heat pump ground and a #14 AWG solid copper wire electrode inserted into the water using a Pete's style access port.
- The heat pump must be operating and the water stream flowing.
- The voltage measured should be less than 300mV (0.300V). If the voltage is higher than 500mV, electrolysis occurs resulting in corrosion.
- If voltage is measured, the cause is a high-resistance earth ground or current on the neutral conductor. Remedial measures should be performed.
- Measure the current flowing through the piping system by using an amp clamp probe on the water-in line. The heat pump must be operating and the water stream flowing.
- There should be zero amps measured. If current is present, there is leakage current to the plumbing system and it must be rectified to prevent pipe corrosion.

Measuring Earth Ground Resistance



- Measure the earth ground bond using an Ohm meter between the building's ground rod and the steel well casing.
- The resistance measured should be zero Ohms. The NEC allows a resistance to ground up to 20 Ohms. Any resistance above zero indicates a poor earth ground, which may be the result of a hot neutral line or that conductive water is present. Both of these may lead to electrolysis and corrosion of the heat pump piping. A check for both should be performed and resolved.

NOTE: If the well casing is plastic, create a conductive path by inserting a #6 AWG bare copper wire into the well water. Remove the temporary conductor when finished.

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Model	Voltage Code	Voltage	Min/Max Voltage	Blower Option	Compressor			Fan Motor FLA	Rated Current Amps	Min Circuit Amps	SCCR kA RMS Symetrical	SCCR Volts Maximum	Max Fuse HACR Amps
					Qty	RLA	LRA						
MB072	K	208/230-3-60	187/252	1,2,3	2	12.2	97.5	3.0	27.4	30.5	5	600	40
				4,5	2	12.2	97.5	5.8	30.2	33.3	5	600	45
				6	2	12.2	97.5	6.0	30.4	33.5	5	600	45
	L	460-3-60	432/504	1,2,3	2	5.8	44.3	1.4	13.0	14.5	5	600	20
				4,5	2	5.8	44.3	2.9	14.5	16.0	5	600	20
				6	2	5.8	44.3	4.6	16.2	17.7	5	600	20
	M	575-3-60	540/630	1,2,3	2	4.5	27.1	1.2	10.2	11.3	5	600	15
				4,5	2	4.5	27.1	2.2	11.2	12.3	5	600	15
MB096	K	208/230-3-60	187/252	1,2,3	2	12.8	120.4	5.8	31.4	34.6	5	600	45
				4,5	2	12.8	120.4	8.2	33.8	37.0	5	600	45
				6	2	12.8	120.4	16.0	41.6	45.6	5	600	60
	L	460-3-60	432/504	1,2,3	2	6.0	49.4	2.9	14.9	16.4	5	600	20
				4,5	2	6.0	49.4	4.1	16.1	17.6	5	600	20
				6	2	6.0	49.4	6.9	18.9	20.6	5	600	25
	M	575-3-60	540/630	1,2,3	2	5.8	41.0	2.2	13.8	15.3	5	600	20
				4,5	2	5.8	41.0	3.2	14.8	16.3	5	600	20
MB120	K	208/230-3-60	187/252	1,2,3	2	18.6	155.0	8.2	45.4	50.1	5	600	60
				4,5	2	18.6	155.0	14.0	51.2	55.9	5	600	70
				6	2	18.6	155.0	20.3	57.5	62.6	5	600	80
	L	460-3-60	432/504	1,2,3	2	8.3	58.1	4.1	20.7	22.8	5	600	30
				4,5	2	8.3	58.1	6.5	23.1	25.2	5	600	30
				6	2	8.3	58.1	10.3	26.9	29.5	5	600	35
	M	575-3-60	540/630	1,2,3	2	7.7	47.8	3.2	18.6	20.5	5	600	25
				4,5	2	7.7	47.8	5.2	20.6	22.5	5	600	30
MB168	K	208/230-3-60	187/252	1,2,3	2	24.4	200.0	8.2	57.0	63.1	5	600	80
				4,5	2	24.4	200.0	14.0	62.8	68.9	5	600	90
				6	2	24.4	200.0	10.0	58.8	64.9	5	600	80
	L	460-3-60	432/504	1,2,3	2	11.9	103.0	4.1	27.9	30.9	5	600	40
				4,5	2	11.9	103.0	6.5	30.3	33.3	5	600	45
				6	2	11.9	103.0	10.3	34.1	37.1	5	600	45
	M	575-3-60	540/630	1,2,3	2	9.4	78.0	3.2	22.0	24.4	5	600	30
				4,5	2	9.4	78.0	5.2	24.0	26.4	5	600	35

Table continued on next page.

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Table continued from previous page.

Model	Voltage Code	Voltage	Min/Max Voltage	Blower Option	Compressor			Fan Motor FLA	Rated Current Amps	Min Circuit Amps	SCCR kA RMS Symetrical	SCCR Volts Maximum	Max Fuse HACR Amps
					Qty	RLA	LRA						
MB192	K	208/230-3-60	187/252	1,2,3	2	27.7	178.5	8.2	63.6	70.5	5	600	90
				4,5	2	27.7	178.5	14.0	69.4	76.3	5	600	100
				6	2	27.7	178.5	20.3	75.7	82.6	5	600	110
	L	460-3-60	432/504	1,2,3	2	11.5	103.0	4.1	27.1	30.0	5	600	40
				4,5	2	11.5	103.0	6.5	29.5	32.4	5	600	40
				6	2	11.5	103.0	10.3	33.3	36.2	5	600	45
	M	575-3-60	540/630	1,2,3	2	9.0	78.0	3.2	21.2	23.5	5	600	30
				4,5	2	9.0	78.0	5.2	23.2	25.5	5	600	30
MB240	K	208/230-3-60	187/252	1,2,3	2	28.5	255.0	14.0	71.0	78.1	5	600	100
				4,5	2	28.5	255.0	20.6	77.6	84.7	5	600	110
				6	2	28.5	255.0	30.5	87.5	95.1	5	600	125
	L	460-3-60	432/504	1,2,3	2	13.5	123.0	6.5	33.5	36.9	5	600	50
				4,5	2	13.5	123.0	9.8	36.8	40.2	5	600	50
				6	2	13.5	123.0	14.8	41.8	45.5	5	600	60
	M	575-3-60	540/630	1,2,3	2	10.7	93.7	5.2	26.6	29.3	5	600	35
				4,5	2	10.7	93.7	8.0	29.4	32.1	5	600	40
MB300	K	208/230-3-60	187/252	1,2,3	2	40.8	270.0	20.6	102.2	112.4	5	600	150
				4,5	2	40.8	270.0	26.8	108.4	118.6	5	600	150
				6	2	40.8	270.0	25.0	106.6	116.8	5	600	150
	L	460-3-60	432/504	1,2,3	2	19.4	147.0	9.8	48.6	53.5	5	600	70
				4,5	2	19.4	147.0	12.7	51.5	56.4	5	600	70
				6	2	19.4	147.0	20.3	59.1	64.2	5	600	80
	M	575-3-60	540/630	1,2,3	2	13.7	109.0	8.0	35.4	38.8	5	600	50
				4,5	2	13.7	109.0	10.0	37.4	40.8	5	600	50

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Electrical Data
Dual Point Power

Model	Voltage Code	Voltage	Min/Max Voltage	Blower Option	Compressor Power Supply								Fan Power Supply				
					Qty	RLA	LRA	Rated Current Amps	Min Circuit Amps	SCCR kA RMS Symmetrical	SCCR Volts Max	Max Fuse HACR Amps	Fan Motor FLA	Min Circuit Amps	SCCR kA RMS Symmetrical	SCCR Volts Max	Max Fuse HACR Amps
MB072	K	208/230-3-60	187/252	A,B,C	2	12.2	97.5	24.4	27.5	5	600	35	3.0	3.8	5	600	15
				D,E	2	12.2	97.5	24.4	27.5	5	600	35	5.8	7.3	5	600	15
				F	2	12.2	97.5	24.4	27.5	5	600	35	6.0	7.5	5	600	15
	L	460-3-60	432/504	A,B,C	2	5.8	44.3	11.6	13.1	5	600	15	1.4	1.8	5	600	15
				D,E	2	5.8	44.3	11.6	13.1	5	600	15	2.9	3.6	5	600	15
				F	2	5.8	44.3	11.6	13.1	5	600	15	4.6	5.8	5	600	15
	M	575-3-60	540/630	A,B,C	2	4.5	27.1	9.0	10.1	5	600	15	1.2	1.5	5	600	15
				D,E	2	4.5	27.1	9.0	10.1	5	600	15	2.2	2.8	5	600	15
MB096	K	208/230-3-60	187/252	A,B,C	2	12.8	120.4	25.6	28.8	5	600	40	5.8	7.3	5	600	15
				D,E	2	12.8	120.4	25.6	28.8	5	600	40	8.2	10.3	5	600	15
				F	2	12.8	120.4	25.6	28.8	5	600	40	16.0	20.0	5	600	35
	L	460-3-60	432/504	A,B,C	2	6.0	49.4	12.0	13.5	5	600	15	2.9	3.6	5	600	15
				D,E	2	6.0	49.4	12.0	13.5	5	600	15	4.1	5.1	5	600	15
				F	2	6.0	49.4	12.0	13.5	5	600	15	6.9	8.6	5	600	15
	M	575-3-60	540/630	A,B,C	2	5.8	41	11.6	13.1	5	600	15	2.2	2.8	5	600	15
				D,E	2	5.8	41	11.6	13.1	5	600	15	3.2	4.0	5	600	15
MB120	K	208/230-3-60	187/252	A,B,C	2	18.6	155	37.2	41.9	5	600	60	8.2	10.3	5	600	15
				D,E	2	18.6	155	37.2	41.9	5	600	60	14.0	17.5	5	600	30
				F	2	18.6	155	37.2	41.9	5	600	60	20.3	25.4	5	600	45
	L	460-3-60	432/504	A,B,C	2	8.3	58.1	16.6	18.7	5	600	25	4.1	5.1	5	600	15
				D,E	2	8.3	58.1	16.6	18.7	5	600	25	6.5	8.1	5	600	15
				F	2	8.3	58.1	16.6	18.7	5	600	25	10.3	12.9	5	600	20
	M	575-3-60	540/630	A,B,C	2	7.7	47.8	15.4	17.3	5	600	25	3.2	4.0	5	600	15
				D,E	2	7.7	47.8	15.4	17.3	5	600	25	5.2	6.5	5	600	15

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Electrical Data
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Table continued from previous page.

Model	Voltage Code	Voltage	Min/Max Voltage	Blower Option	Compressor Power Supply								Fan Power Supply				
					Qty	RLA	LRA	Rated Current Amps	Min Circuit Amps	SCCR kA RMS Symmetrical	SCCR Volts Max	Max Fuse HACR Amps	Fan Motor FLA	Min Circuit Amps	SCCR kA RMS Symmetrical	SCCR Volts Max	Max Fuse HACR Amps
MB168	K	208/230-3-60	187/252	A,B,C	2	24.4	200	48.8	54.9	5	600	70	8.2	10.3	5	600	15
				D,E	2	24.4	200	48.8	54.9	5	600	70	14.0	17.5	5	600	30
				F	2	24.4	200	48.8	54.9	5	600	70	10.0	12.5	5	600	20
	L	460-3-60	432/504	A,B,C	2	11.9	103	23.8	26.8	5	600	35	4.1	5.1	5	600	15
				D,E	2	11.9	103	23.8	26.8	5	600	35	6.5	8.1	5	600	15
				F	2	11.9	103	23.8	26.8	5	600	35	10.3	12.9	5	600	20
	M	575-3-60	540/630	A,B,C	2	9.4	78	18.8	21.2	5	600	30	3.2	4.0	5	600	15
				D,E	2	9.4	78	18.8	21.2	5	600	30	5.2	6.5	5	600	15
MB192	K	208/230-3-60	187/252	A,B,C	2	27.7	178.5	55.4	62.3	5	600	90	8.2	10.3	5	600	15
				D,E	2	27.7	178.5	55.4	62.3	5	600	90	14.0	17.5	5	600	30
				F	2	27.7	178.5	55.4	62.3	5	600	90	20.3	25.4	5	600	45
	L	460-3-60	432/504	A,B,C	2	11.5	103	23.0	25.9	5	600	35	4.1	5.1	5	600	15
				D,E	2	11.5	103	23.0	25.9	5	600	35	6.5	8.1	5	600	15
				F	2	11.5	103	23.0	25.9	5	600	35	10.3	12.9	5	600	20
	M	575-3-60	540/630	A,B,C	2	9.0	78	18.0	20.3	5	600	25	3.2	4.0	5	600	15
				D,E	2	9.0	78	18.0	20.3	5	600	25	5.2	6.5	5	600	15
MB240	K	208/230-3-60	187/252	A,B,C	2	28.5	255	57.0	64.1	5	600	90	14.0	17.5	5	600	30
				D,E	2	28.5	255	57.0	64.1	5	600	90	20.6	25.8	5	600	45
				F	2	28.5	255	57.0	64.1	5	600	90	30.5	38.1	5	600	60
	L	460-3-60	432/504	A,B,C	2	13.5	123	27.0	30.4	5	600	40	6.5	8.1	5	600	15
				D,E	2	13.5	123	27.0	30.4	5	600	40	9.8	12.3	5	600	20
				F	2	13.5	123	27.0	30.4	5	600	40	14.8	18.5	5	600	30
	M	575-3-60	540/630	A,B,C	2	10.7	93.7	21.4	24.1	5	600	30	5.2	6.5	5	600	15
				D,E	2	10.7	93.7	21.4	24.1	5	600	30	8.0	10.0	5	600	15
MB300	K	208/230-3-60	187/252	A,B,C	2	40.8	270	81.6	91.8	5	600	125	20.6	25.8	5	600	45
				D,E	2	40.8	270	81.6	91.8	5	600	125	26.8	33.5	5	600	60
				F	2	40.8	270	81.6	91.8	5	600	125	25.0	31.3	5	600	50
	L	460-3-60	432/504	A,B,C	2	19.4	147	38.8	43.7	5	600	60	9.8	12.3	5	600	20
				D,E	2	19.4	147	38.8	43.7	5	600	60	12.7	15.9	5	600	25
				F	2	19.4	147	38.8	43.7	5	600	60	20.3	25.4	5	600	45
	M	575-3-60	540/630	A,B,C	2	13.7	109	27.4	30.8	5	600	40	8.0	10.0	5	600	15
				D,E	2	13.7	109	27.4	30.8	5	600	40	10.0	12.5	5	600	20

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Electrical
Power and Low-Voltage Wiring

ELECTRICAL

Line Voltage - All field installed wiring, including electrical ground, must comply with NFPA 70: National Electrical Code (NEC), CSA C22.1: Canadian Electrical Code (CE Code), as well as applicable local codes. Refer to the unit electrical data for fuse sizes. Consult wiring diagram for field connections that must be made by the installing (or electrical) contractor. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

GENERAL LINE-VOLTAGE WIRING

Be sure the available power is the same voltage and phase shown on the unit serial plate.
Line- and low-voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

TRANSFORMER

All 208/230V units are factory wired for 230V.
If supply voltage is 208V, installer must rewire transformer. See the wiring diagram for connections.

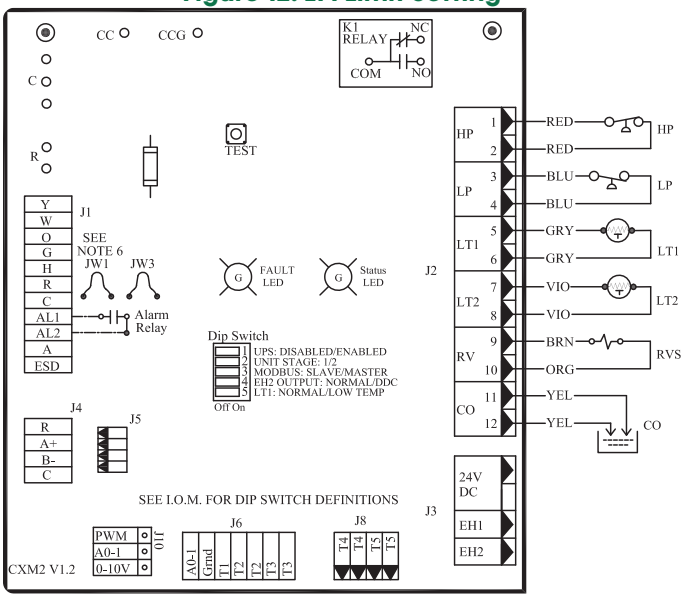
DISCONNECT

Units with a factory-installed disconnect switch will provide full separation of all poles and disconnection from main line voltage. For units where factory disconnect is not selected as an option, the installer must incorporate the means to fully disconnect the line voltage in the fixed wiring in accordance with wiring rules and local electrical codes.

LOW WATER-TEMPERATURE CUTOUT SELECTION

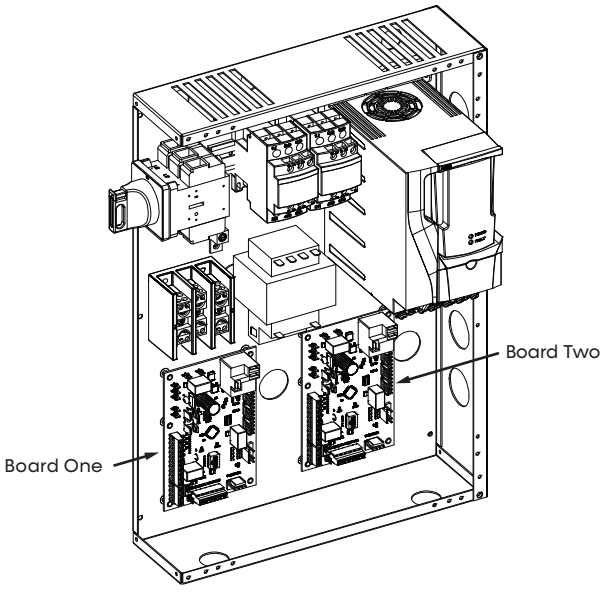
The CXM2 allows the field selection of low-water (or water-antifreeze solution) temperature limit by clipping jumper JW3, which changes the sensing temperature associated with thermistor LT1. Note that the LT1 thermistor is located on the refrigerant line between the coaxial heat exchanger and expansion device (TXV or cap tube). Therefore, LT1 is sensing refrigerant temperature, not water temperature, which is a better indication of how water flow rate/ temperature is affecting the refrigeration circuit.

Figure 12: LT1 Limit Setting



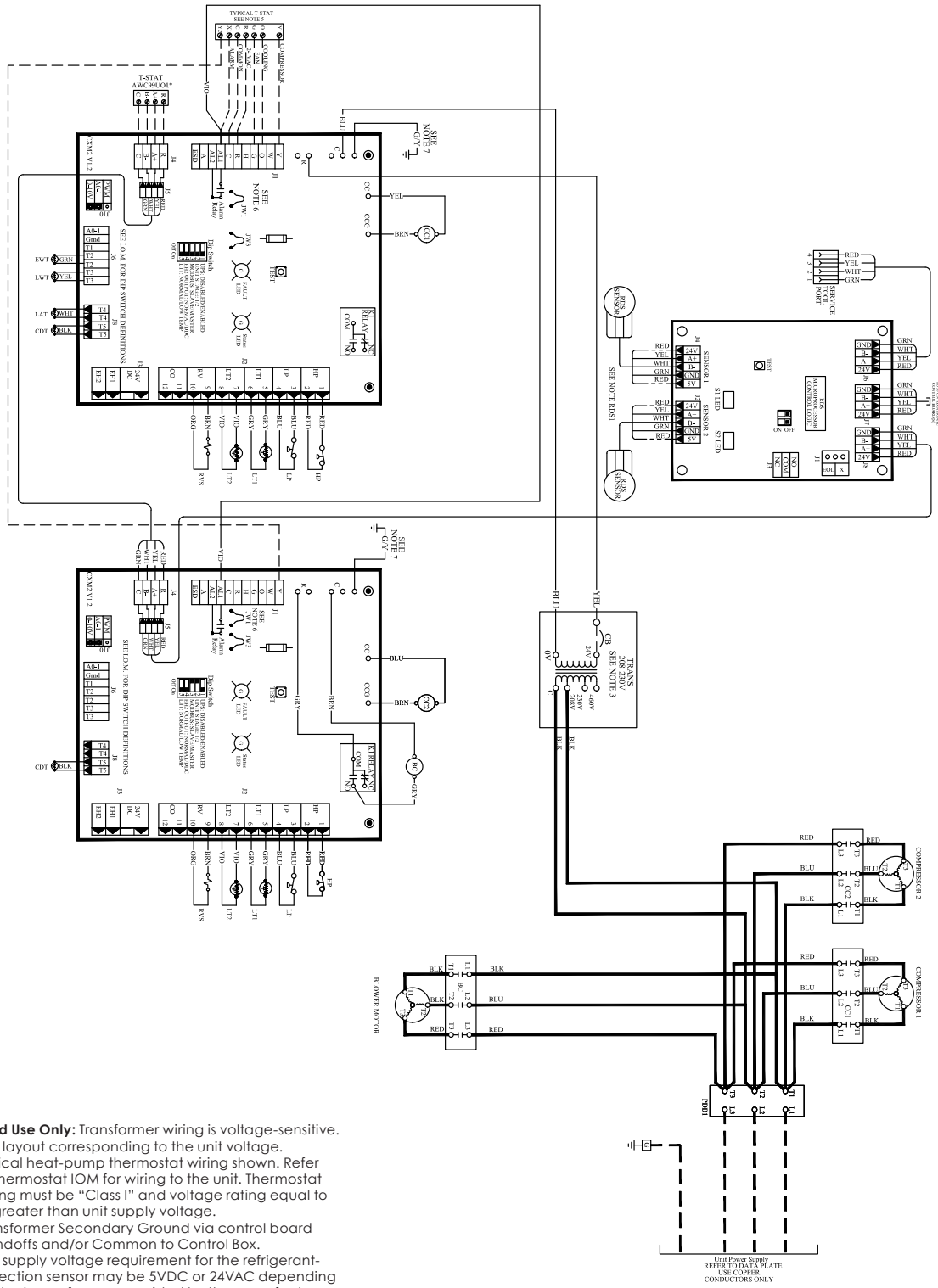
The factory setting for LT1 is for systems using water (30°F [-1.1°C] refrigerant temperature). In low water temperature (extended range) applications with antifreeze (most ground loops), clip the JW3 jumper JW3 as shown in the **LT1 Limit Setting** figure to change the setting to 10°F (-12.2°C) refrigerant temperature, a more suitable temperature when using an antifreeze solution. All MB units operating with entering water temperatures below 59°F (15°C) must include the optional water/refrigerant circuit insulation package to prevent internal condensation.

Figure 13: MB Horizontal Control Box (Representative)



Electrical Example Wiring Diagram

Models:
MB
072-300



NOTES:

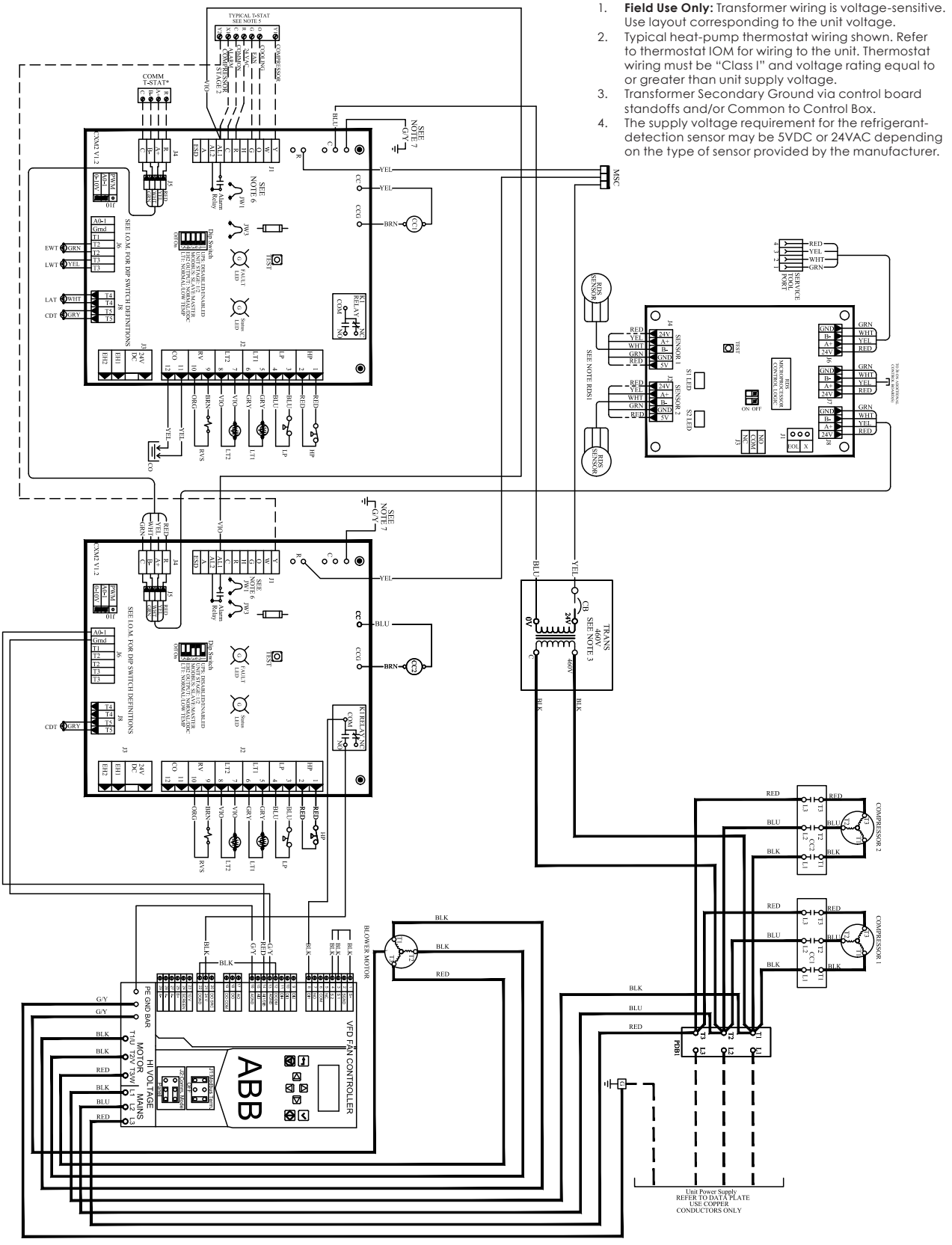
1. **Field Use Only:** Transformer wiring is voltage-sensitive. Use layout corresponding to the unit voltage.
2. Typical heat-pump thermostat wiring shown. Refer to thermostat IOM for wiring to the unit. Thermostat wiring must be "Class I" and voltage rating equal to or greater than unit supply voltage.
3. Transformer Secondary Ground via control board standoffs and/or Common to Control Box.
4. The supply voltage requirement for the refrigerant-detection sensor may be 5VDC or 24VAC depending on the type of sensor provided by the manufacturer.

Models:
MB
072-300

Electrical
Example VFD Wiring Diagram

NOTES:

1. **Field Use Only:** Transformer wiring is voltage-sensitive. Use layout corresponding to the unit voltage.
2. Typical heat-pump thermostat wiring shown. Refer to thermostat IOM for wiring to the unit. Thermostat wiring must be "Class I" and voltage rating equal to or greater than unit supply voltage.
3. Transformer Secondary Ground via control board standoffs and/or Common to Control Box.
4. The supply voltage requirement for the refrigerant-detection sensor may be 5VDC or 24VAC depending on the type of sensor provided by the manufacturer.



Electrical
VFD EMC and VAR Screws

Models:
MB
072-300

While installing MB units configured with a VFD-powered blower, ensure that the drive is compatible with the grounding system.

You can connect all drive types to a symmetrically grounded TN-S system (center-grounded wye). The drive is delivered with the EMC and VAR screws installed.

The screw material is plastic or metal depending on the product variant. The **VFD Screw Removal** table details when to remove the metal EMC screw (disconnect the internal EMC filter) or metal VAR screw (disconnect the varistor circuit).

Table 5: VFD Screw Identification



Table 6: VFD Screw Removal

Screw Label	Factory Default Screw Material	Grounding Systems		
		Symmetrically Grounded TN-S (center-grounded wye) Systems	Corner-Grounded Delta, Midpoint-Grounded Delta, and TT Systems	IT Systems (ungrounded or high-resistance grounded)
EMC	Metal	Do not remove	Remove	Remove
	Plastic	Do not remove[2]	Do not remove	Do not remove
VAR	Metal	Do not remove	Do not remove	Remove
	Plastic	Do not remove	Do not remove	Do not remove

1. Drives sold in North America have a plastic EMC screw.
2. You can install the metal screw (included in the drive delivery) to connect the internal EMC filter.

Models:
MB
072-300

Electrical
Low-Voltage Wiring

MODELS WITH WATERSIDE ECONOMIZER

Controller is factory assembled. Factory settings are 45°F (7.2°C), valve opens, closes at 55°F (12.8°C), and 5 minute short cycle delay. Settings are adjustable.

ACCESSORY CONNECTIONS

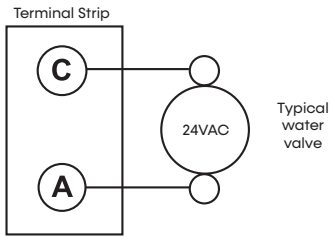
A terminal paralleling the compressor contactor coil is provided on the CXM2. Terminal "A" is designed to control accessory devices, such as water valves. **NOTE: Only use this terminal with 24V signals and not line voltage.** Terminal "A" is energized with the compressor contactor. See the specific unit wiring diagram for details.

Table 7: Low Voltage VA Ratings

Component	VA
Typical Blower Relay	6 - 7
Typical Reversing Valve Solenoid	4 - 6
30 A Compressor Contactor	6 - 9
Subtotal	16 - 22
+ CXM2 (5 - 9VA)[1]	21 - 31
Remaining VA for Accessories	19 - 29

1. Standard transformer for MB units is 100VA.

Figure 14: Accessory Wiring



⚠ CAUTION

Many units are installed with a factory or field-supplied manual or electric shut-off valve. DAMAGE WILL OCCUR if shut-off valve is closed during unit operation. A high-pressure switch must be installed on the heat-pump side of any field provided shut-off valves and connected to the heat-pump controls in series with the built-in refrigerant circuit high-pressure switch to disable compressor operation if water pressure exceeds pressure switch setting. The field-installed high-pressure switch shall have a cut-out pressure of 300 psig and a cut-in pressure of 250 psig. This pressure switch can be ordered from the manufacturer with a ¼-inch internal flare connection as part number 39B0005N02.

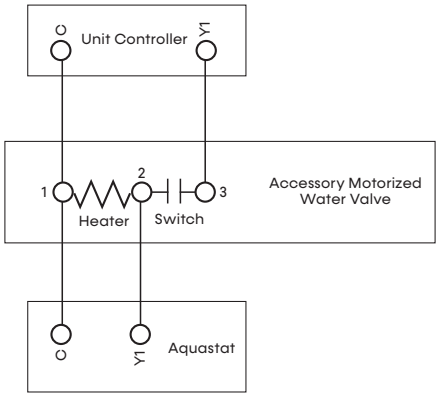
WATER SOLENOID VALVES

An external solenoid valve(s) should be used on ground water installations to shut off flow to the unit when the compressor is not operating. A slow closing valve may be required to help reduce water hammer. The **Accessory Wiring** figure shows typical wiring for a 24VAC external solenoid valve. The **Optional Motorized Water Valve Wiring** figure illustrates a slow-closing water control valve wiring for a style of typical accessory water valve. Slow-closing valves take approximately 60 seconds to open (very little water flows before 45 seconds). Once fully open, an end switch allows the compressor to be energized. Only relay or triac based electronic thermostats should be used with slow-closing valves. When wired as shown, the slow-closing valve operate properly with the following notations:

- The valve remains open during a unit lockout.
- The valve draws approximately 25-35VA through the "Y" signal of the thermostat.

NOTE: This valve can overheat the anticipator of an electromechanical thermostat. Therefore, only relay or triac based thermostats should be used.

Figure 15: Optional Motorized Water Valve Wiring



THERMOSTAT CONNECTIONS

The thermostat should be wired directly to the CXM2. See *Electrical Thermostat Wiring* for specific terminal connections. Review the appropriate AOM (Application, Operation and Maintenance) manual for units with DDC controls.

Electrical Thermostat Wiring

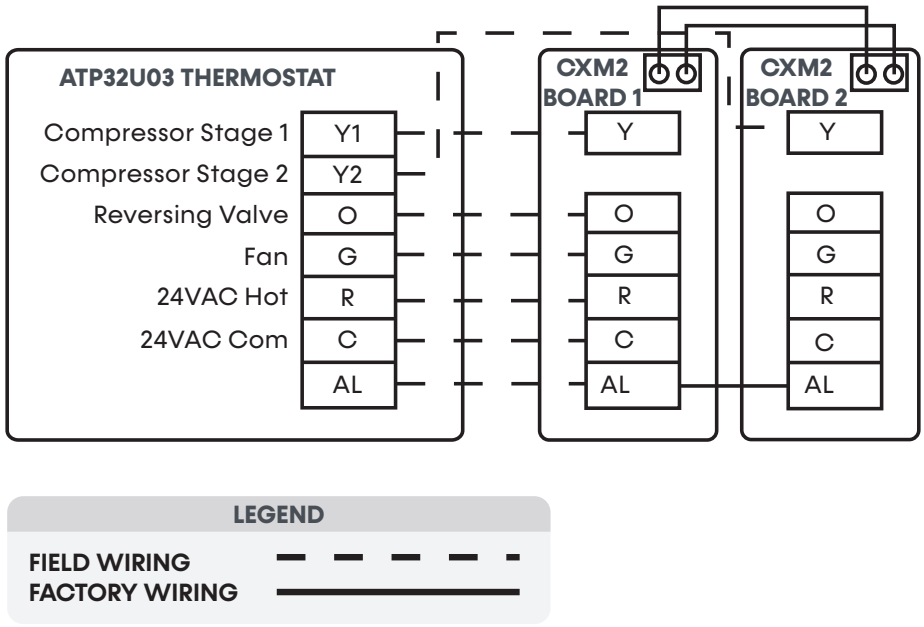
Models:
MB
072-300

THERMOSTAT INSTALLATION

The thermostat should be located on an interior wall in a larger room, away from supply duct drafts. DO NOT locate the thermostat in areas subject to sunlight, drafts or on external walls. The wire access hole behind the thermostat may in certain cases need to be sealed to prevent erroneous temperature measurement.

Position the thermostat back plate against the wall so that it appears level and so the thermostat wires protrude through the middle of the back plate. Mark the position of the back plate mounting holes and drill holes with a 3⁄16-inch (5-mm) bit. Install supplied anchors and secure plate to the wall.
Thermostat wire must be 18 AWG wire. Wire the appropriate thermostat as shown in the **Thermostat Wiring** figure to the low-voltage terminal strip on the CXM2. Most heat pump thermostats are compatible with heat pump units provided they have the correct number of heating and cooling stages.

Figure 16: Thermostat Connection



Models:
MB
072-300

Electrical
External Pump Control

Figure 17: External Pump Control Diagram

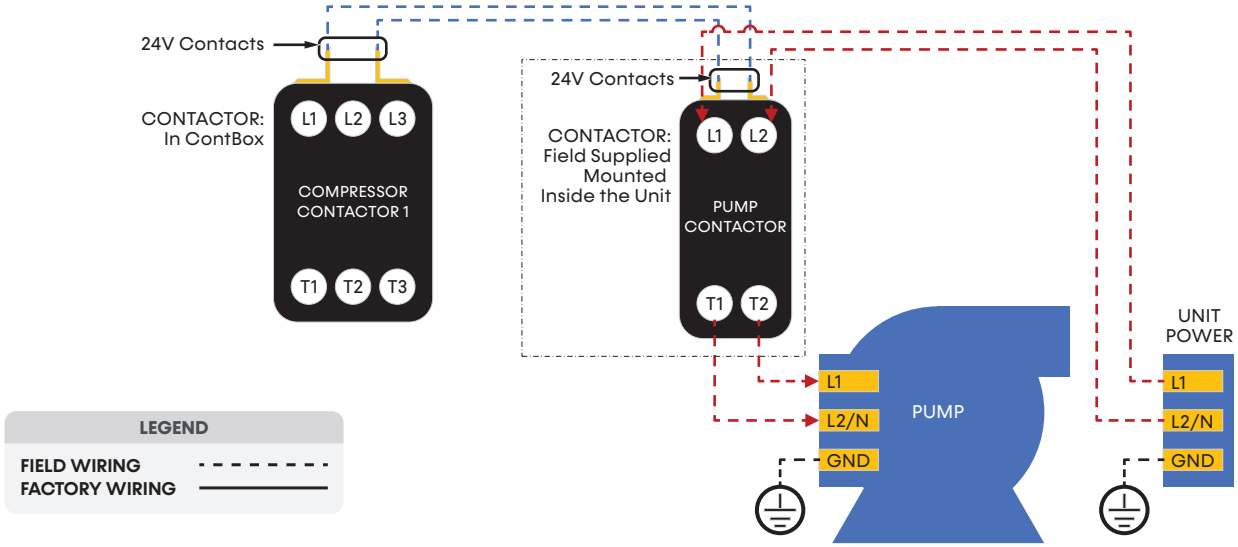


Figure 18: External Pump Control with VFD Diagram

