RESIDENTIAL

MARS 30 (MJ) PREMIER INDOOR SPLIT SYSTEMS

INSTALLATION, OPERATION & MAINTENANCE MANUAL

Part#: 97B0707N01 | Created: May 16, 2025

Models: MJ 024-060

60Hz – R-454B

Model:
MJ
024-060

Table of Contents

Model Nomenclature

Model:
MJ
024-060

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	J	N	0	2	4	A	J	D	0	0	N	0	N	S

PRODUCT NAME
M = R-454B Refrigerant

MODEL TYPE
J = Split Indoor Water-side

FUTURE
N = Not Applicable

SIZE
024 036
048 060

REVISION
A = Current

VOLTAGE
J = 208/230-1-60 with Refrigerant Detection System

CONTROLS

Control	Standard
DXM2.5	D
DXM2.5 with Disconnect	B
DXM2.5 with Soft Starter	4

CABINET
0 = Residential

STANDARD
S = Standard

FUTURE
N = Not Applicable

EXTENDED OPTIONS
0 = Standard
P = HWG and Pump

FUTURE
N = Not Applicable

WATER/HEAT EXCHANGER OPTIONS

Water Option	Standard	Cupro Nickel
None	0	Z
Modulating Valve, Low System Pressure Drop	C	-
Modulating Valve, High System Pressure Drop	-	P
Internal Flow Controller Standard Head with Check Valve[1]	1	-
Internal Flow Controller Standard Head without Check Valve[1]	G	-
Internal Flow Controller High Head with Check Valve	2	-
Internal Flow Controller High Head without Check Valve	H	-

NOTES:
1. Available with sizes 024-036
2. All Open Loop vFlow Water Circuit Options require a Cupro-Nickel Heat Exchanger.
   All Closed Loop vFlow Water Circuit Options require a Standard Heat Exchanger.
   If no Water Circuit Option is selected, then the Heat Exchanger can be either Standard or Cupro-Nickel.

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Attentions, Cautions, and Warnings

SAFETY

Warnings, cautions, and notices appear throughout this manual. Read these items carefully before attempting any installation, service, or troubleshooting of the equipment.

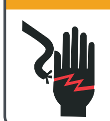
DANGER: Indicates an immediate hazardous situation, which if not avoided will result in death or serious injury. DANGER labels on unit access panels must be observed.

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

CAUTION: Indicates a potentially hazardous situation or an unsafe practice, which if not avoided could result in minor or moderate injury or product or property damage.

NOTICE: Notification of installation, operation, or maintenance information, which is important, but which is not hazard-related.

⚠ WARNING



Disconnect power supply(ies) before servicing. Refer servicing to qualified service personnel. Electric shock hazard. May result in injury or death!

⚠ WARNING

To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must be serviced only by technicians who meet local, state, and federal proficiency requirements.

⚠ WARNING

The installation of water-source heat pumps and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

⚠ WARNING

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).

⚠ WARNING

If an R-454B unit is connected to one or more rooms via an air duct system, and is installed in a room with an area less than A_{min} or has an Effective Dispersal Volume less than minimum, that room shall be without continuously operating open flames or other POTENTIAL IGNITION SOURCES. A flame-producing device may be installed in the same space if the device is provided with an effective flame arrest.

⚠ WARNING

All refrigerant discharged from this unit must be recovered WITHOUT EXCEPTION. Technicians must follow industry accepted guidelines and all local, state, and federal statutes for the recovery and disposal of refrigerants. If a compressor is removed from this unit, refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, refrigerant lines of the compressor must be sealed after it is removed.

⚠ WARNING

This appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

⚠ WARNING

An unventilated area where the appliance using FLAMMABLE REFRIGERANTS is installed shall be so constructed that should any refrigerant leak, it will not stagnate so as to create a fire or explosion hazard.

⚠ WARNING

Auxiliary devices which may be a POTENTIAL IGNITION SOURCE shall not be installed in the duct work. Examples of such POTENTIAL IGNITION SOURCES are hot surfaces with a temperature exceeding 1,292°F (700°C)

⚠ WARNING

An unventilated area where a water source heat pump is installed and surpasses a R-454B refrigerant charge of 62 oz (1.76 kg), shall be without continuously operating open flames (for example an operating gas appliance) or other POTENTIAL IGNITION SOURCES (for example, an operating electric heater, hot surfaces).

⚠ WARNING

Only auxiliary electric heaters approved by The Factory shall be installed in connecting ductwork. The installation of any other auxiliary devices is beyond The Factory's responsibility.

⚠ WARNING

For mechanical ventilation, the lower edge of the air extraction opening where air is exhausted from the room shall not be more than 3.94 inches (100 mm) above the floor. The location where the mechanical ventilation air extracted from the space is discharged shall be separated by a sufficient distance, but not less than 9.84 feet (3 m), from mechanical ventilation air intake openings, to prevent recirculation to the space.

⚠ WARNING

Children being supervised are NOT to play with the appliance.

⚠ WARNING

Do not pierce or burn.

⚠ WARNING

Be aware that refrigerants may not contain odor.

Attentions, Cautions, and Warnings

⚠ CAUTION

DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move and store units in an upright position. Tilting units on their sides will cause equipment damage.

⚠ CAUTION

CUT HAZARD - Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing heat pumps.

⚠ CAUTION

To avoid equipment damage, DO NOT use these units as a source of heating or cooling during the construction process. The mechanical components and filters can quickly become clogged with construction dirt and debris, which may cause system damage and void product warranty.

⚠ CAUTION

All three phase scroll compressors must have direction of rotation verified at startup. Verification is achieved by checking compressor Amp draw. Amp draw will be substantially lower compared to nameplate values. Additionally, reverse rotation results in an elevated sound level compared to correct rotation. Reverse rotation will result in compressor internal overload trip within several minutes. Verify compressor type before proceeding.

⚠ CAUTION

Maximum allowed inlet water temperature 150°F for HWG applications.

⚠ NOTICE

Servicing shall be performed only as recommended by the manufacturer.

⚠ NOTICE

REFRIGERANT SENSORS for REFRIGERANT DETECTION SYSTEMS shall only be replaced with sensors specified by the appliance manufacturer.

⚠ NOTICE

An unconditioned attic is not considered natural ventilation.

⚠ NOTICE

This unit is equipped with electrically powered safety measures.
To be effective, the unit must be electrically powered at all times after installation, other than when servicing.

⚠ NOTICE

For Installation Only in Locations Not Accessible to the General Public.

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General Information

INSPECTION

Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the packaging of each unit, and inspect each unit for damage. Ensure that the carrier makes proper notation of any shortages or damage on all copies of the freight bill and completes a common carrier inspection report. Concealed damage not discovered during unloading must be reported to the carrier within 15 days of receipt of shipment. If not filed within 15 days, the freight company can deny the claim without recourse.

NOTE: It is the responsibility of the purchaser to file all necessary claims with the carrier. Notify your equipment supplier of all damage within 15 days of shipment.

STORAGE

Equipment should be stored in its original packaging in a clean, dry area. Store units in an upright position at all times. You may stack vertical configurations a maximum of two units high and horizontal configurations a maximum of three units high.

UNIT PROTECTION

Cover units on the job site with either the original packaging or an equivalent protective covering. Cap the open ends of pipes stored on the job site. In areas where painting, plastering, and/or spraying has not been completed, all due precautions must be taken to avoid physical damage to the units and contamination by foreign material. Physical damage and contamination may prevent proper startup and may result in costly equipment cleanup.

Examine all pipes, fittings, and valves before installing any of the system components. Remove any dirt or debris found in or on these components.

PRE-INSTALLATION

Installation, Operation, and Maintenance instructions are provided with each unit. The installation site chosen should include adequate service clearance around the unit. Before unit startup, read all manuals and become familiar with the unit and its operation. Thoroughly check the system before operation.

PREPARE UNITS FOR INSTALLATION AS FOLLOWS:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Keep the cabinet covered with the original packaging until installation is complete and all plastering, painting, etc. is finished.
3. Verify refrigerant tubing is free of kinks or dents and that it does not touch other unit components.
4. Inspect all electrical connections. Connections must be clean and tight at the terminals.
5. Locate and verify any hot water generator (HWG), hanger, or other accessory kit located in the compressor section.

CHECKS TO THE AREA

Prior to beginning work on systems containing FLAMMABLE REFRIGERANTS, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the REFRIGERATING SYSTEM, these steps shall be completed prior to conducting work on the system.

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Work Procedure

Work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.

General Work Area

All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.

Checking for Presence of Refrigerant

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.

Presence of Fire Extinguisher

If any hot work is to be conducted on the refrigeration equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO_2 fire extinguisher adjacent to the charging area.

No Ignition Sources

No person carrying out work in relation to a REFRIGERATION SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. "No Smoking" signs shall be displayed.

Ventilated area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

Checks to the Refrigeration Equipment

The following checks shall be applied to installations using FLAMMABLE REFRIGERANTS:

- The actual REFRIGERANT CHARGE is in accordance with the room size within which the refrigerant containing parts are installed;
- The ventilation machinery and outlets are operating adequately and are not obstructed;
- If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant;
- Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected;
- Refrigerant piping or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

Checks to Electrical Devices

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.

Initial safety checks shall include:

- Capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking;
- That no live electrical components and wiring are exposed while charging, recovering, or purging the system;
- That there is continuity of earth bonding.

REPAIR TO INTRINSICALLY SAFE COMPONENTS

Intrinsically safe components must be replaced.

General Information

CABLING

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

REQUIRED AREA FOR INSTALLATION

The minimum room area of the space (A_{min}) or a minimum room area of conditioned space (TA_{min}) shall be corrected for unit's location altitude by multiplying A_{min} or TA_{min} by the applicable altitude adjustment factor (AF) for building ground-level altitude (H_{alt}) in feet or meters, as shown in Table 1.

NOTE:

- You can use Imperial or Metric measurements to calculate A_{min} or TA_{min}.
- The maximum allowable altitude of installation for this product is 6,561 ft (2,000 m).

Table 1: Altitude Adjustment

H_{alt} ft (m)	AF
0 (0)	1.00
656 (200)	1.00
1,312 (400)	1.00
1,968 (600)	1.00
2,624 (800)	1.02
3,280 (1,000)	1.05
3,937 (1,200)	1.07
4,593 (1,400)	1.10
5,249 (1,600)	1.12
5,905 (1,800)	1.15
6,561 (2,000)	1.18

GENERAL

Proper indoor coil selection is critical to system efficiency. Using an older-model coil can affect efficiency and may not provide the customer with rated or advertised EER and COP. Coil design and technology have dramatically improved operating efficiency and capacity in the past 20 years. Homeowners using an older coil are not reaping these cost savings and comfort benefits. **NEVER MATCH AN R-22/HFC-410A INDOOR COIL WITH AN R-454B COMPRESSOR SECTION.**

Newer indoor coils have a larger surface area, enhanced fin design, and grooved tubing. These features provide a larger area for heat transfer, improving efficiency and expanding capacity. Typical older coils may only have one-third to one-half the face area of these redesigned coils.

INDOOR COIL SELECTION - MARS MJ

MARS Indoor Split system heat pumps are rated in the AHRI directory with a specific indoor coil match. MARS Premier models are rated with MARS Premier Air Handlers and Cased Coils.

Table 2: MARS Indoor Split System AHRI-Rated Components

Compressor Section	Air Handler	Cased Coil
MJ024	MA024	MK024
MJ036	MA036	MK036
MJ048	MA048	MK048
MJ060	MA060	MK060

COMMUNICATING SYSTEM

To receive full benefits of the 4-wire communicating system, always select a MARS Air Handler with DXM2.5 Advanced Communicating Controls and a compatible communicating thermostat with MARS Premier Splits (MJ).

INDOOR APPLICATION

Select MARS 30 (MJ) Premier Indoor Split Series for applications where the compressor will be installed indoors. Never install a MARS (MJ) in areas subject to freezing or where humidity levels could cause cabinet condensation.

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Minimum Installation Area

MINIMUM INSTALLATION AREA

Minimum installation area for units that do not have a blower (e.g. w-w) where you do not need mechanical/natural ventilation.

Model	Charge (oz)	Minimum Installation Area ft² [A_{min}]			
		Floor	Window	Wall	Ceiling
MJ024	60	290	115	66	54
MJ036	96	743	231	105	87
MJ048	106	906	282	117	96
MJ060	136	1,492	464	153	123

A_{min}	=	Minimum area where the unit is installed where ventilation is not required.
h_{inst} (floor)	=	0.0 ft (0.0 m)
h_{inst} (window)	=	3.3 ft (1.0 m)
h_{inst} (wall)	=	5.9 ft (1.8 m)
h_{inst} (ceiling)	=	7.2 ft (2.2 m)

Minimum area where the unit can be installed if it has a blower so that you do not need mechanical/natural ventilation.

Model	Charge (oz)	Minimum Installation Area ft² [A_{min}]			
		Floor	Window	Wall	Ceiling
MA/MK024	60	206	115	66	54
MA/MK036	96	330	184	106	87
MA/MK048	106	364	203	117	96
MA/MK060	136	467	261	150	123

A_{min}	=	Minimum area where unit is installed when unit has incorporated airflow.
h_{inst} (floor)	=	0.0 ft (0.0 m)
h_{inst} (window)	=	3.3 ft (1.0 m)
h_{inst} (wall)	=	5.9 ft (1.8 m)
h_{inst} (ceiling)	=	7.2 ft (2.2 m)

Minimum CFM of unit that has a blower needed for mitigation mode.

Model	Charge (oz)	Minimum CFM [Q_{min}]
MA/MK024	60	101.5
MA/MK036	96	162.4
MA/MK048	106	179.3
MA/MK060	136	230.0

Q_{min}	=	Minimum CFM provided by unit

Minimum area and CFM requirements for the conditioned space (with a blower).

Model	Charge (oz)	Conditioned Area	
		TA_{min} ft²	Q_{min} (ft²/min)
MA/MK024	60	101.5	3.07
MA/MK036	96	162.4	4.92
MA/MK048	106	179.3	5.43
MA/MK060	136	230.0	6.97

TA_{min}	=	Minimum conditioned area for venting leaked refrigerant
Q_{min}	=	Minimum ventilation flow rate for conditioned space if space is less than TA_{min}

Minimum area of opening for natural ventilation to the outdoors (with or without a blower).

Model	Charge (oz)	A_{nv} in²
MA/MK/MJ024	60	104.0
MA/MK/MJ036	96	131.6
MA/MK/MJ048	106	138.3
MA/MK/MJ060	136	156.6

A_{nv}	=	Minimum natural ventilation area opening to the outdoors

Minimum Installation Area

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When the openings for connected rooms or natural ventilation are required, the following conditions shall be applied:

- The area of any openings above 11.8 inches (300 mm) from the floor shall not be considered in determining compliance with Anv_{min}.
- At least 50% of the required opening area Anv_{min} shall be below 7.8 inches (200 mm) from the floor.
- The bottom of the lowest openings shall not be higher than the point of release when the unit is installed and not more than 3.9 inches (100 mm) from the floor.
- Openings are permanent openings which cannot be closed.
  - For openings extending to the floor, the height shall not be less than 0.78 inch (20 mm) above the surface of the floor covering.
- A second higher opening shall be provided. The total size of the second opening shall not be less than 50% of minimum opening area for Anv_{min} and shall be at least 3.3 ft (1.5 m) above the floor.

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Refrigerant System Servicing

REFRIGERANT SYSTEM

Verify that air- and water-flow rates are at proper levels before servicing the refrigerant circuit. To maintain sealed-circuit integrity, do not install service gauges unless unit operation appears abnormal. Reference the operating charts for pressures and temperatures.

Removal and Evacuation

When breaking into the refrigerant circuit to make repairs - or for any other purpose - conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

- Safely remove refrigerant following local and national regulations
- Evacuate
- Purge the circuit with Nitrogen
- Evacuate
- Continuously flush or purge with Nitrogen when using flame to open circuit
- Open the circuit

The refrigerant charge shall be recovered into the correct recovery cylinders as venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for FLAMMABLE REFRIGERANT). This process shall be repeated until no refrigerant is remains in the system (optional for FLAMMABLE REFRIGERANT). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Charging Procedures

In addition to conventional charging procedures, the following requirements shall be followed:

- Ensure that contamination of different refrigerants does not occur when using charging equipment
- Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them
- Cylinders shall be kept in an appropriate position according to the instructions to ensure charging with liquid refrigerant
- Ensure that the REFRIGERATION SYSTEM is grounded prior to charging the system with refrigerant
- Label the system when charging is complete (if not already):
    - For packaged units, the data plate dictates the charge level
    - For split systems, write the charge level on the data plate
- Extreme care shall be taken not to overfill the REFRIGERATION SYSTEM

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Leak Detection

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

The following leak detection methods are deemed acceptable for all refrigerant systems.

A2L-Compliant electronic leak detectors may be used to detect refrigerant leaks but, in the case of FLAMMABLE REFRIGERANTS, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of Ignition and is suitable for the refrigerant used.

Refrigerant System Servicing

Leak-detection equipment shall be set at a percentage of the lower flammability limit of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.

Leak-detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

NOTE:
Examples of leak detection fluids are:

- Bubble method
- Fluorescent method agents

If a leak is suspected, all naked flames shall be removed/extinguished.

If a refrigerant leak that requires brazing is identified, all of the refrigerant shall be recovered from the system, or isolated (by means of shutoff valves) in a part of the system remote from the leak. Removal of refrigerant shall be according to Removal and Evacuation section.

DECOMMISSIONING

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is a recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation
2. Isolate system electrically
3. Before attempting the procedure, ensure that:
    - Mechanical-handling equipment is available, if required, for handling refrigerant cylinders
    - All personal protective equipment is available and being used correctly
    - The recovery process is supervised at all times by a competent person
    - Recovery equipment and cylinders conform to the appropriate standards
4. Pump down refrigerant system, if possible
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system
6. Ensure that cylinder is situated on the scales before recovery takes place
7. Start the recovery machine and operate in accordance with instructions
8. Do not overfill cylinders (no more than 80% volume liquid charge)
9. Do not exceed the maximum working pressure of the cylinder, even temporarily
10. When the cylinders have been filled correctly and the process completed, ensure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off
11. Recovered refrigerant shall not be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked

Labeling - Upon decommissioning, equipment shall be labeled stating that is has been decommissioned and emptied of refrigerant. The label shall be dated and signed.

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Refrigerant System Servicing

RECOVERY

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shutoff valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted.

In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.

The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

Physical Data

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MARS MJ Physical Data

Model Size	024	036	048	060
Compressor (1 each)	Scroll			
Factory Charge R-454B - (oz.)[1]	60	96	100	136
Refrigerant Leak Detection System	R[2]	R[2]	R[2]	R[2]
Number of Sensors	1	1	1	1
Water Connection Size				
Swivel (NPSH)	1"	1"	1"	1"
MJ Weight				
Weight - Operating lbs.	233	251	280	295
Weight - Packaged lbs.	248	266	295	310
Hot Water Generator				
Swivel (MJ)	1	1	1	1

- All dimensions displayed above are in inches unless otherwise marked.
- All units have TXV expansion device
- NPSH = National Pipe Straight Hose
- O = Optional, R = Required

1. The factory charge is sized for a nominal 25 ft (7.62 m) line set. See the IOM for more information.
2. RDS is required on all MARS MJ sizes

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Installation

The installation of geothermal heat-pump units and all associated components, parts and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

Removing Existing Condensing Unit (Where Applicable)

1. Pump down the condensing unit. Close the liquid-line service valve of existing condensing unit and start the compressor to pump refrigerant back into compressor section. Then, close suction service valve while compressor is still running to trap refrigerant in outdoor section. Immediately kill power to the condensing unit.
2. Disconnect power and low voltage, then remove old condensing unit. Cut or unbraze line set from the unit.
3. If the condensing unit is not operational or does not pump down, recover refrigerant using appropriate equipment.
4. Replace the line set, especially if upgrading system from R-22 or HFC-410A to R-454B refrigerant. If the line set cannot be replaced, thoroughly flush it before installing the new compressor section. R-454B compressors use POE oil instead of mineral oil (R-22 systems). Mineral oil is not compatible with POE oil, and may cause system damage if not completely flushed from the line set.

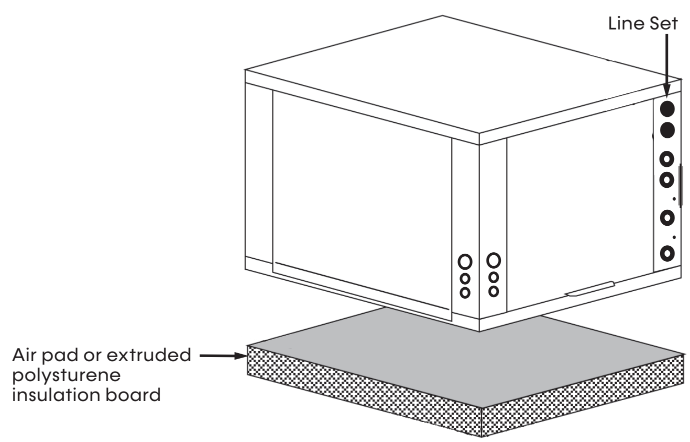
Indoor Compressor Section Location

The indoor model is not designed for outdoor installation. Locate the unit in an indoor area that allows enough space for service personnel to perform typical maintenance or repairs without removing unit. Units are typically installed in a mechanical room or closet. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air). Carefully consider the access panel locations and plan for easy removal of service access panels. Provide sufficient room to make water, electrical, and line set connections.

Remove any access-panel screws that may be difficult to remove after the unit is installed prior to setting the unit. Refer to Figure 1 for an illustration of a typical installation. Refer to Physical Dimensions section for dimensional data. Conform to the following guidelines when selecting unit location:

1. Install the unit on a piece of rubber, neoprene or other mounting pad material for sound isolation. The pad must be at least ⅜-inch (10 mm) to ½-inch (13 mm) thick. Extend the pad beyond all four edges of the unit.
2. Provide adequate clearance for maintenance and service. Do not block access panels with piping, conduit, or other materials.
3. Provide access for servicing the compressor and heat exchanger without removing the unit.
4. Provide an unobstructed path to the unit within the closet or mechanical room. Ensure that space is sufficient to allow removal of the unit, if necessary.
5. Provide access to water valves and fittings and screwdriver access to the unit's side panels and all electrical connections.

Figure 1: MJ Installation



Installation

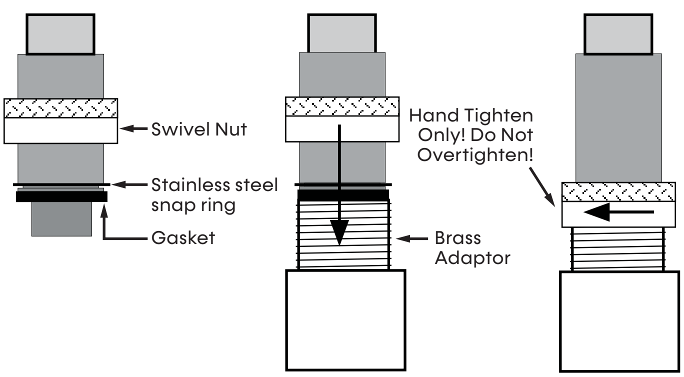
Model:
MJ
024-060

WATER CONNECTIONS

Swivel piping fittings rated for 300 PSIG (2,068 kPa) operating pressure are used for water connections. The connections have a rubber-gasket seal similar to a garden-hose gasket, which when mated to the flush end of most 1-inch-threaded male pipe fittings provides a leak-free seal without the need for thread-sealing tape or joint compound. Check for burrs and ensure that the rubber seal is in the swivel connector prior to attempting any connection (rubber seals are shipped attached to the swivel connector). **DO NOT OVER TIGHTEN** or leaks may occur.

The female locking ring is threaded onto the pipe threads which holds the male pipe end against the rubber gasket, and seals the joint. **HAND TIGHTEN ONLY! DO NOT OVERTIGHTEN!**

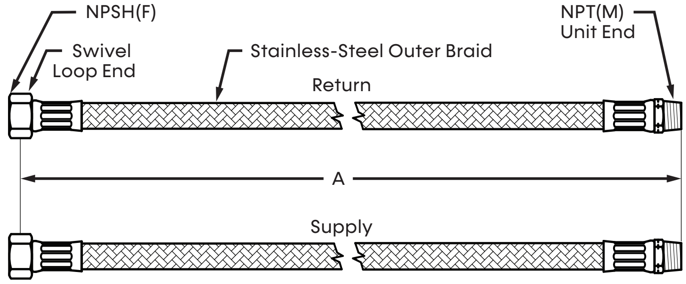
Figure 2: Water Connections



⚠ 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.

Figure 3: Water Connections



AIR HANDLER INSTALLATION

This manual specifically addresses the compressor section of the system. Air handler location and installation must be according to the instructions provided with the air handling unit (MARS Premier Indoor Split Series Air Handler).

⚠ CAUTION

To avoid equipment damage to MJ units with expansion tank, DO NOT allow system water pressure to exceed 145 psi (1,000 kPa). The expansion tank used in MJ units has a maximum working water pressure of 145 psi (1,000 kPa). Any pressure in excess of 145 psi (1000 kPa) may damage the expansion tank.

Variable Water Flow Heat-Pump Applications Overview

OPTIONAL VARIABLE WATER FLOW INTERNAL VARIABLE WATER-FLOW CONTROL

Variable Water Flow is an efficient means of circulating water (or water plus antifreeze) using internal factory-installed variable-speed pump or modulating motorized valve. Variable Water Flow technology improves performance of the unit by reducing the amount of energy required to move water throughout the geothermal heat-pump system and also reduces the space, cost, and labor required to install external water flow control mechanisms (such as pumps, flow controllers, solenoid, and flow control valves)

VARIABLE WATER FLOW CONFIGURATIONS

1. **Internal Flow Controller – Closed-Loop Applications**

   This is the most common configuration for closed loops. With this factory-installed option, the unit is built with an internal variable-speed pump and other components to flush and operate the unit correctly (including an expansion tank, flush ports, and flushing valves). The pump speed is controlled by DXM2.5 Advanced Communicating Controls based on the difference in entering and leaving water temperatures (ΔT). The internal flow controller pump includes an internal check valve for multiple unit installations. A copper water coil is standard with this option.

   NOTE: Internal flow controllers are also suitable for multiple-unit installations depending on pump-performance requirements.

2. **Internal Modulating Motorized Valve – Large Closed-Loop Applications (external central pumping)**

   Primarily for use on multi-unit closed-loop applications with central pumping. With this factory-installed option, the unit includes a low-pressure drop modulating motorized valve that is controlled by DXM2.5 Advanced Communicating Controls based on the difference in the entering and leaving water temperatures (ΔT). A copper water coil is standard with this option. The modulating valve in this option has a higher C_v than the open-loop option.

3. **Internal Modulating Motorized Valve – For Open-Loop Applications**

   For use on open-loop applications. With this factory-installed option, the unit is built with an internal modulating motorized valve controlled by DXM2.5 Advanced Communicating Controls based on entering and leaving water temperatures (ΔT). A low C_v modulating motorized valve is used for this application to provide more precise control against the higher system-pressure differential of open-loop applications. A cupronickel water coil comes standard with this option.

   Details on these options are included in the following sections on ground-loop and ground-water applications.

Variable Water Flow Heat-Pump Applications Overview

Model:
MJ
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Figure 4: Typical Closed-Loop Application (with Internal Flow Controller Shown)

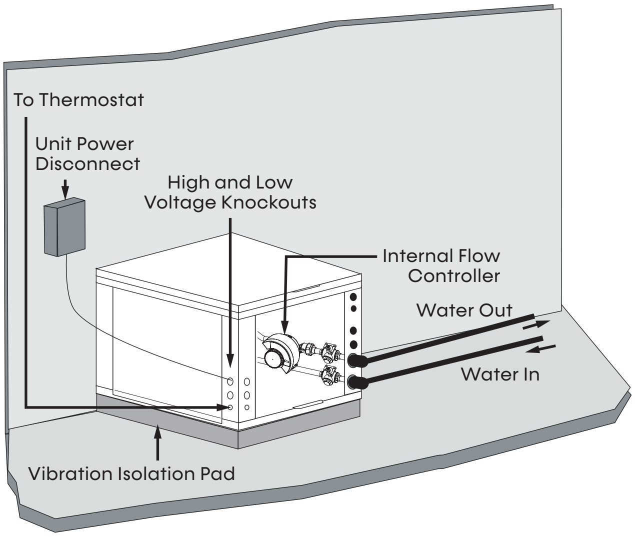
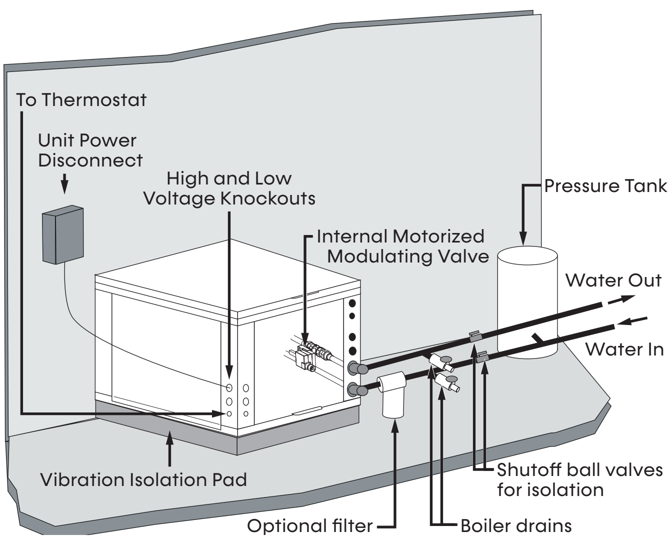


Figure 5: Typical Open-Loop Application (with Internal Modulating Motorized Valve Shown)



⚠ 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.

Model:
MJ
024-060

Closed-Loop Heat-Pump Applications with Internal Flow Controller

Units with internal flow control come with a built-in variable-speed pump, an expansion tank, flushing ports, and three-way valves (used to flush the unit). The variable-speed pump is controlled by the DXM2.5 based on the difference between the entering and leaving water temperature (ΔT). When entering water temperatures are abnormally low for cooling, or abnormally high for heating, the DXM2.5 modulates the water flow to maintain a constant ΔT, allowing the unit to operate properly under those conditions. The internal expansion tank helps to maintain constant loop pressure despite the natural expansion and contraction of the loop as the seasons and loop temperatures vary. The expansion tank also helps to avoid flat-loop callbacks.

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.

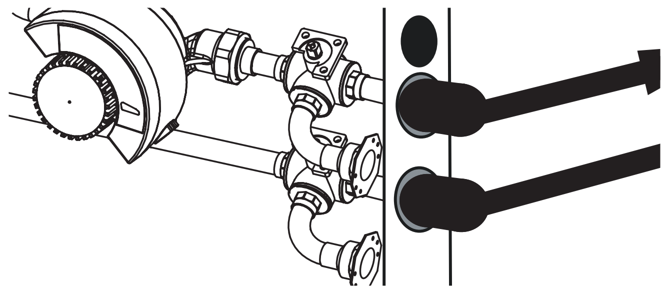
PIPING INSTALLATION

The typical closed-loop ground-source system is shown in Figure 4. Limit all earth-loop piping materials polyethylene fusion only for in-ground sections of the loop. Polyethylene fusion is also recommended for inside piping. 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-loop applications. Loop temperatures can range between 25 and 110°F (-4 to 43°C). Flow rates between 2.25 and 3 gpm per ton (2.41 to 3.23 l/m per kW) of cooling capacity is recommended in these applications.

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

Use the following guidance for flushing a unit with internal flow control.

Figure 6: Internal Flow Controller



⚠ NOTICE

If installing multiple Variable Water Flow Internal Variable Speed Flow Controller units (in parallel) on one loop, please refer to section 'Multiple Unit Piping and Flushing' (later in this document).

WATER PRESSURE SCHRADER PORTS

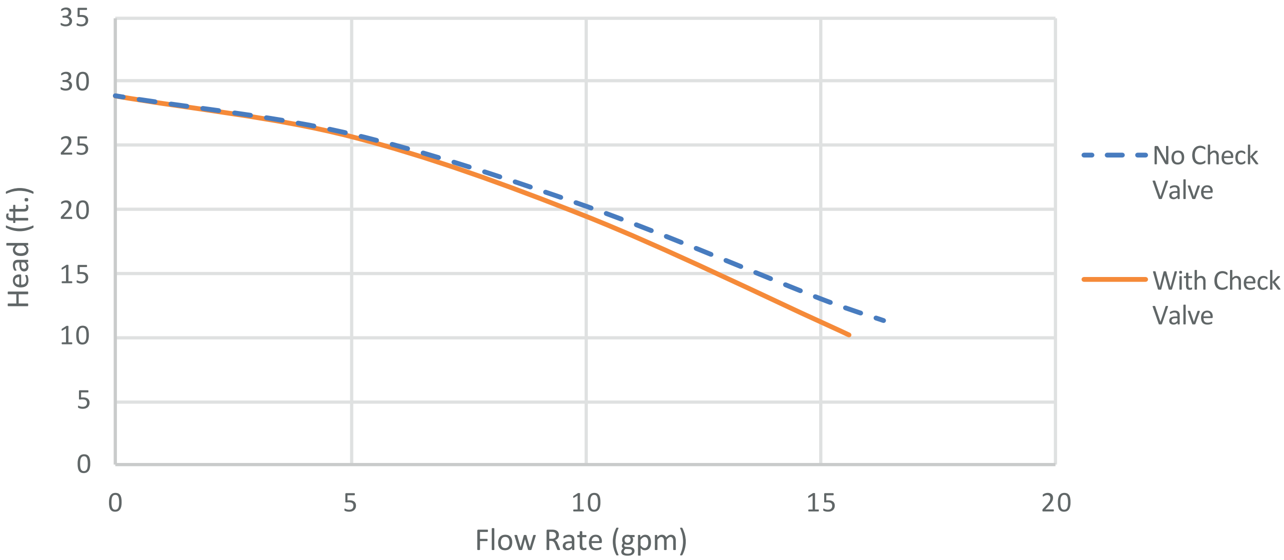
The pressure ports built in to the unit are provided to measure pressure drop through the water-to-refrigerant heat exchanger. The water-pressure ports are Schrader ports smaller than refrigerant Schrader ports. They are the same size as tire Schrader ports. A digital pressure gauge is recommended for taking pressure readings through these ports. Determine the water flow through the unit by measuring the water pressure at the "water pressure out" port and subtracting it from the water pressure at the "water pressure in" port. Comparing the pressure differential to the pressure-drop table (Table 15) in this manual determines the flow rate through the unit.

Digital Tire Pressure Gauge

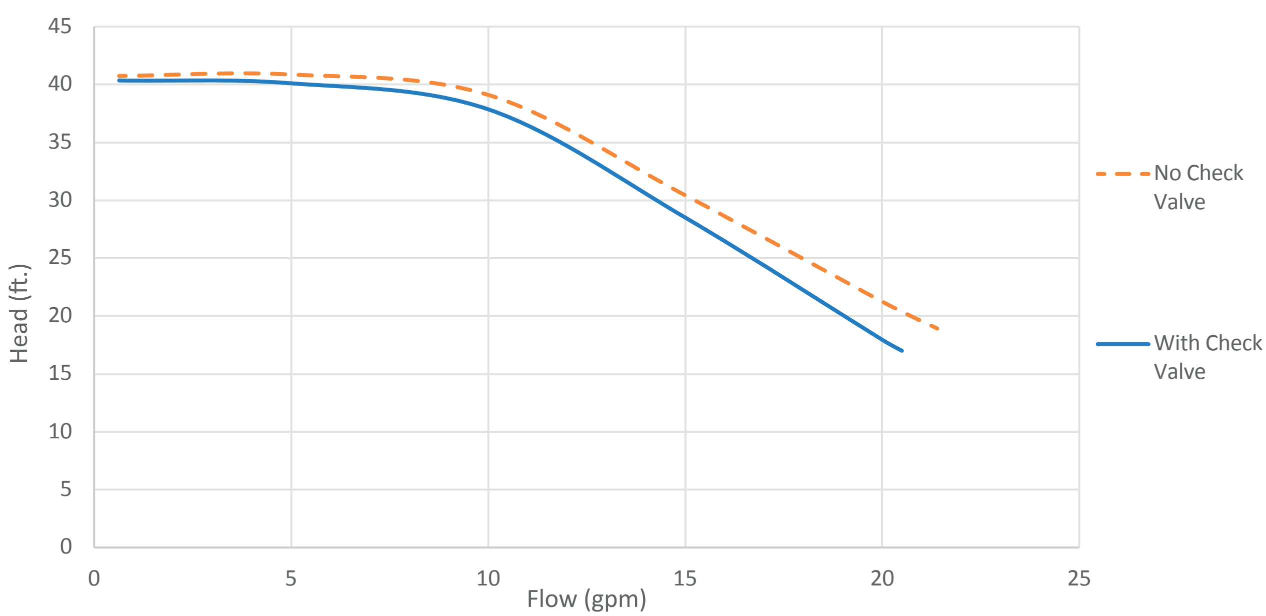
Closed-Loop Heat-Pump Applications with Internal Flow Controller

Model:
MJ
024-060

Standard Head Variable Pump Performance



High Head Variable Pump Performance



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Ground-Loop Cleaning and Flushing

After piping is complete between the unit and the ground loop, final purging and charging of the loop is required.

A flush cart with at least a 1.5 hp (1.1 kW) pump is required to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop. Antifreeze solution is used in most areas to prevent freezing. Remove all air and debris from the earth loop piping system before operation. Flush the loop with a high volume of water at 2 fps (0.6 m/s) in all piping. Use a filter in the loop return line of the flush cart to eliminate debris from the loop system. See Table 3 for flow rate required to attain 2 fps (0.6 m/s). Follow the steps below for proper flushing.

Table 3: Minimum Flow Required to Achieve 2 fps variety

PE Pipe Size	Flow (GPM)
3/4"	4 (4.3 L/M per KW)
1"	6 (6.5 L/M per KW)
1 1/4"	10 (10.8 L/M per KW)
1 1/2"	13 (14.0 L/M per KW)
2"	21 (22.6 L/M per KW)

Units with internal variable-speed pumps include a check valve internal to the pump. It is not possible to flush backwards through this pump. Take care to connect the flush cart hoses so that the flush cart discharge is connected to the water in flushing valve of the heat pump.

LOOP FILL

Fill the loop with water from a garden hose through flush cart before using flush cart pump to ensure an even fill and increase flushing speed (valve position A, see Figure 9). When water consistently returns back to the flush reservoir, switch to valve position B (see Figure 10).

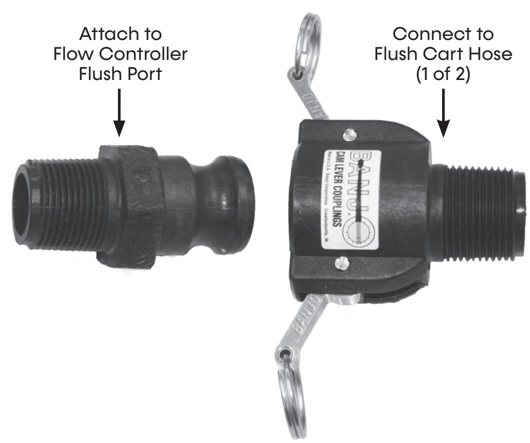
Isolate the expansion tank for this flushing procedure using the ball valve. During dead heading of flush cart pump, isolation prevents compression of the bladder in the expansion tank, and prevents the flush cart fluid level from dropping below available capacity.

⚠ WARNING

DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK.

Figure 7: Typical Cleanable Flush-Cart Strainer (100 mesh [0.149 mm])

Figure 8: Cam Fittings for Flush Cart Hoses



Ground-Loop Cleaning and Flushing

Model:
MJ
024-060

Figure 9: Valve Position A – Loop Fill/Flush

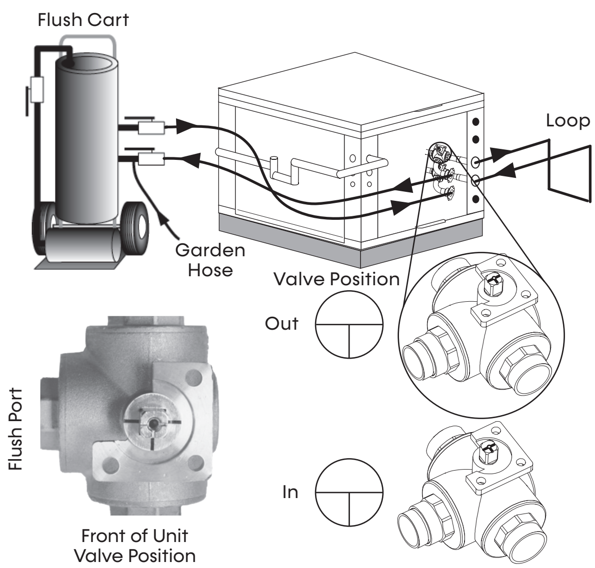
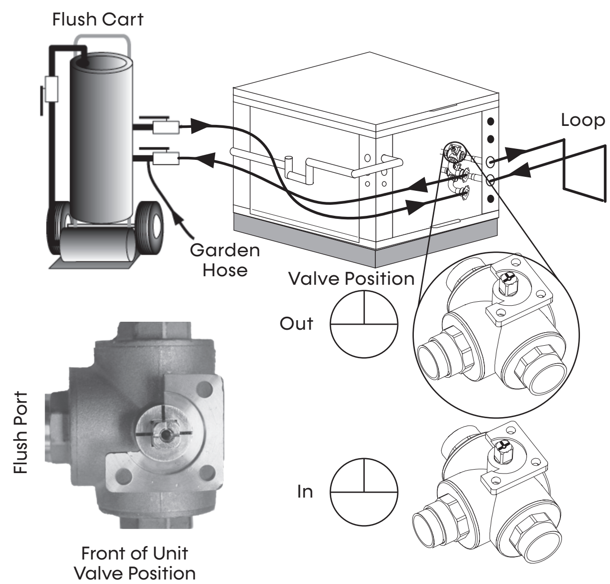


Figure 10: Valve Position B – Unit Fill/Flush



UNIT FILL

Switch the unit fill valves to Position B while flush cart is pumping to fill the unit heat exchanger (see Figure 10). Maintain Position B until water is consistently returned into the flush reservoir.

LOOP FLUSH

Switch to valve Position A. Shut off the supply water and turn on the flush cart to begin flushing. Once the flush reservoir is full, do not allow the water level in the flush cart tank to drop below the pump inlet line or air can be pumped out to the earth loop. Try to maintain a fluid level in the tank above the return tee so that air cannot be continuously mixed back into the fluid. Use surges of 50 psi (345 kPa) to help purge air pockets by shutting off the flush cart return valve going into the flush cart reservoir. This process 'dead heads' the pump to 50 psi (345 kPa). To dead head the pump until maximum pumping pressure is reached, open the valve. Pressure surges through the loop to purge air pockets from the piping system. Notice the drop in fluid level in the flush cart tank. If all air is purged from the system, the level only drops ⅜ inch in a 10-inch (25.4 cm) diameter PVC flush tank (about a half gallon [1.9 liters]) since liquids are incompressible. If the level drops more than this level, continue flushing until air is not being compressed in the loop fluid. Do this a number of times to ensure all air is purged.

⚠ NOTICE

Actual flushing time required varies for each installation due to piping length, configuration, and flush cart pump capacity. ⅜-inch or less fluid level drop is the ONLY indication that flushing is complete.

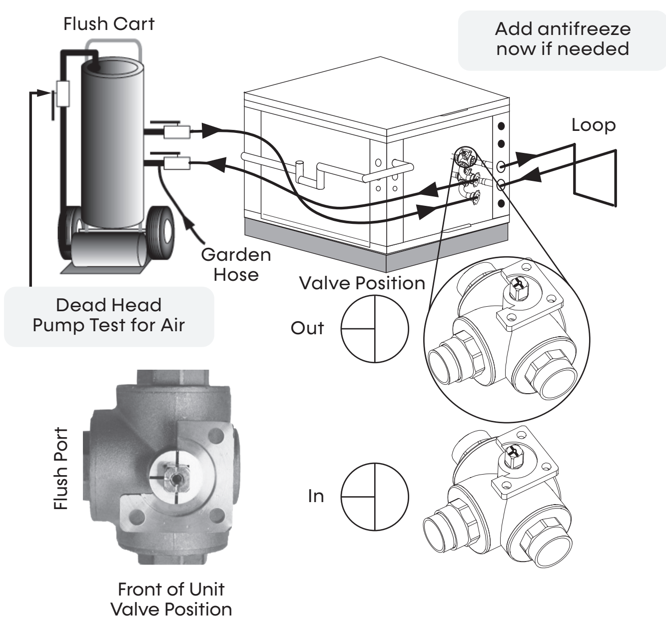
Switch valves to Position B to flush the unit. Flush through the unit until all air pockets are removed.

Move valves to Position C. Switching both valves to Position C allows water to flow through the loop and the unit heat exchanger. Dead head again to check for air in the loop. Fluid level drop is your only indication of air in the loop.

Model:
MJ
024-060

Ground-Loop Cleaning and Flushing

Figure 11: Valve Position C – Full Flush



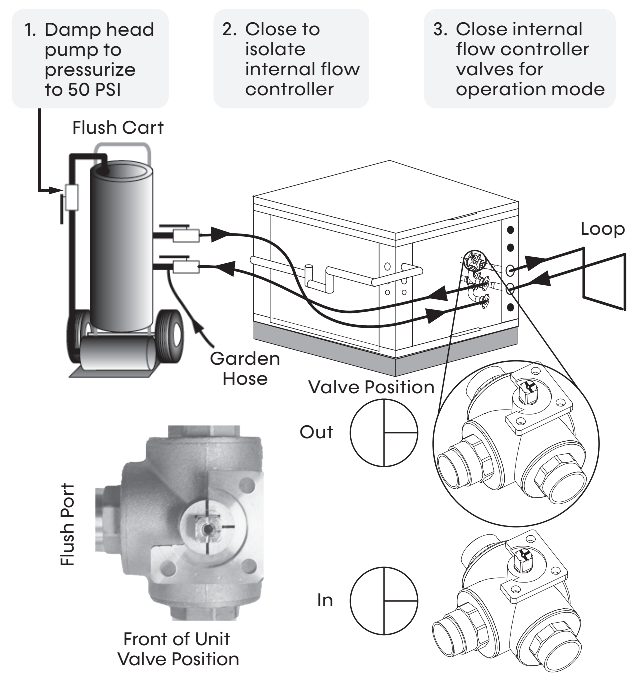
PRESSURIZE AND OPERATE

Close the flush cart return valve to pressurize the loop to at least 50 psi (345 kPa) as shown in Figure 12. Do not exceed 75 psi (517 kPa). Open the isolation valve to the expansion tank and bleed air from the expansion tank piping using the Schrader valve located in front of the expansion tank. This allows loop pressure to compress the expansion tank bladder and charges the expansion tank with liquid. After pressurizing, close the flush cart supply valve to isolate the flush cart. Move the flow controller valves to Position D.

The loop's static pressure fluctuates seasonally with higher pressures in the winter months than during the cooling season. This fluctuation is normal and should be considered when charging the system for the first time. Unhook the flush cart from the internal flow controller. Install flow controller caps to ensure that any condensation or leakage remains contained within the flow controller package.

After completely flushing, target a loop pressure between 50 and 75 psi (345 to 517 kPa) for sufficient pressure for all seasons.

Figure 12: Valve Position D – Pressurize and Operation



⚠ NOTICE

It is recommended to run the unit in the cooling, then heating mode for 15-20 minutes each to 'temper' the fluid temperature and prepare it for pressurization. This procedure helps prevent the periodic "flat" loop condition of no pressure.

Multiple-Unit Piping and Flushing

Often projects require more than one heat pump. Where possible, it is recommended to use a common ground loop with multiple units. Common ground loops with multiple units bring new challenges, including the need to avoid backward flow through inactive units, increase pumping requirements, and more complex flushing needs. Three types of multi-unit systems are described below with guidelines for installation of each type.

Variable Water Flow internal variable flow technology improves efficiency and longevity for multi-unit systems. Variable Water Flow is available in three different configurations:

1. Internal variable-speed pump
2. Internal modulating valve for closed loops
3. Internal modulating valve for open loops

Never use the high head internal modulating valve for open loops with closed loop systems.

The internal variable-speed pump version of Variable Water Flow includes an internal variable-speed circulator controlled by the DXM2.5, internal three-way flushing valves, an internal bladder type expansion tank, and front-mounted pressure ports that allow access only to the pressure drop across the coaxial heat exchanger. The internal expansion tank operates as a pressure battery for the geothermal system. It absorbs fluid from the loop when loop pressure rises and injects fluid into the loop when loop pressure falls. This expansion tank helps to maintain constant loop pressure and avoids flat loops due to seasonal pressure changes in the loop.

When using the internal variable-speed pump as the loop pump in multi-unit installations, it is important to ensure that the variable-speed pump provides adequate flow through the heat pump against the loop head when all units are operating.

Do not combine units with the standard head pump with units with high head pumps on the same loop. Standard head pumps are best suited for small applications with a single unit.

It is possible to flush a multi-unit system through the unit's flushing valves with suitable equipment. Calculate the valve's flushing pressure drop to determine if it is acceptable. Find engineering data for the three-way flushing valves in the following Table:

Table 4: Internal Three-Way Flushing Valve Data

Model	Flushing Connection	Straight Flow C_v	90° Flow C_v
MJ024 - 036	3/4" FPT	25	10.3
MJ048 - 060	1" FPT	58	14.5

For example, if a system includes two 2-ton units and four ¾-loop circuits, calculate the flushing pressure drop as follows:

Using the data provided in Table 2, 4 gpm is required to flush each ¾-inch circuit. If there is no provision to isolate the circuits for flushing, flush with a minimum of four circuits x 4 gpm/circuit = 16 gpm total. Verify the other pipe sizes used to ensure that 16 gpm total flow is sufficient to flush all piping.

Calculate pressure drop through the flushing valve using the following formula:

ΔP = $(GPM/C_v)2$ where,

ΔP = pressure drop in psi through the valve while flushing

GPM = flushing flow in gallons per minute

C_v = valve C_v in flushing mode

Table 4 details that the C_v for the flushing valve in a MJ024 is 10.3 in the flushing mode (90° flow). Therefore, $\Delta P = (GPM/C_v)2 = (16/10.3)\ 2 = 2.4$ psi (5.54 ft hd) per valve (there are two flushing valves). As long as the flushing pump is capable of providing 16 gpm at the flushing pressure drop of the loop plus the 2.4 x 2 valves = 4.8 psi (11.09 ft hd) of the flushing valves, use the internal flushing valves. If the flushing pump is not able to overcome the pressure drop of the internal flushing valves, use larger external flushing valves.

Model:
MJ
024-060

Multiple-Unit Piping and Flushing

UNIT CONFIGURATION

The **VS PUMP PARALLEL** configuration is required for multiple Variable Water Flow units with internal variable-speed flow controllers and check valves piped in parallel and sharing a common loop. Find and configure **VS PUMP PARALLEL** in the DXM2.5 **Installer Settings** menu.

Installer Settings ➡ System Config ➡ Unit Config ➡ Loop Config

UNIT CONFIGURATION	
CURRENT CONFIG	MJ024
HEAT PUMP FAMILY	MJ
HEAT PUMP SIZE	024
BLOWER TYPE	ECM
LOOP CONFIG	VS PUMP PARALLEL
SELECT OPTION ▲▼	
◄ PREVIOUS	SAVE ■

MULTIPLE UNITS WITH INTERNAL FLOW CONTROLLERS

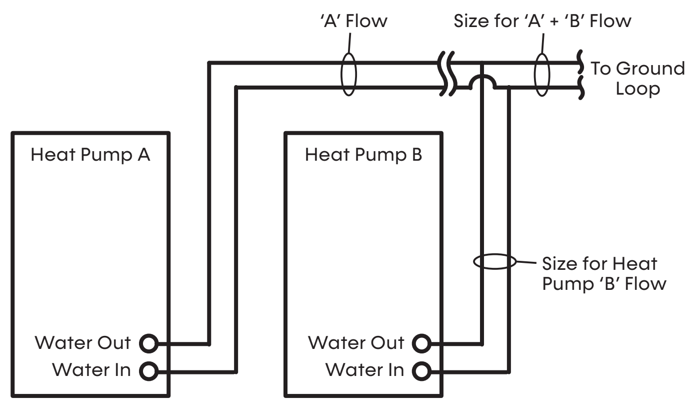
The simplest multi-unit systems consist of internal flow controllers without external pumps or external flushing valves. The units are piped in parallel and use the internal flushing valves for system flushing. The variable-speed pump includes an internal check valve to prevent back flow (short circuiting) through the units.

In this configuration, begin by flushing the unit farthest from the loop using the internal flushing valves. After the loop is flushed, change the internal flushing valves to flush the heat pump. Next, move the flushing cart to the next closest unit to the loop.

Flush the loop through the internal flushing valves. This is important as there may be air and debris in the lines from this unit to the common piping. After flushing starts, flush the air moved into the loop. After the loop is flushed through the second unit, change the flushing valves to flush the second unit. Repeat this process for additional units. Always begin with the unit farthest from the loop and end with the unit closest to the loop.

Use this flushing application for systems up to 12 tons, depending on loop design. It is important to perform appropriate calculations to confirm that the variable-speed pump provides adequate flow through all heat pumps.

Figure 13: Multiple Units with Internal Flow Controllers



MULTIPLE UNITS WITH INTERNAL FLOW CONTROLLERS AND EXTERNAL FLUSHING VALVES

When the number of units or flushing requirements reaches a point where it is no longer feasible to flush through the internal valves, install external flushing valves. In this configuration, use three-way flushing valves or install additional isolation valves to isolate the loop during flushing.

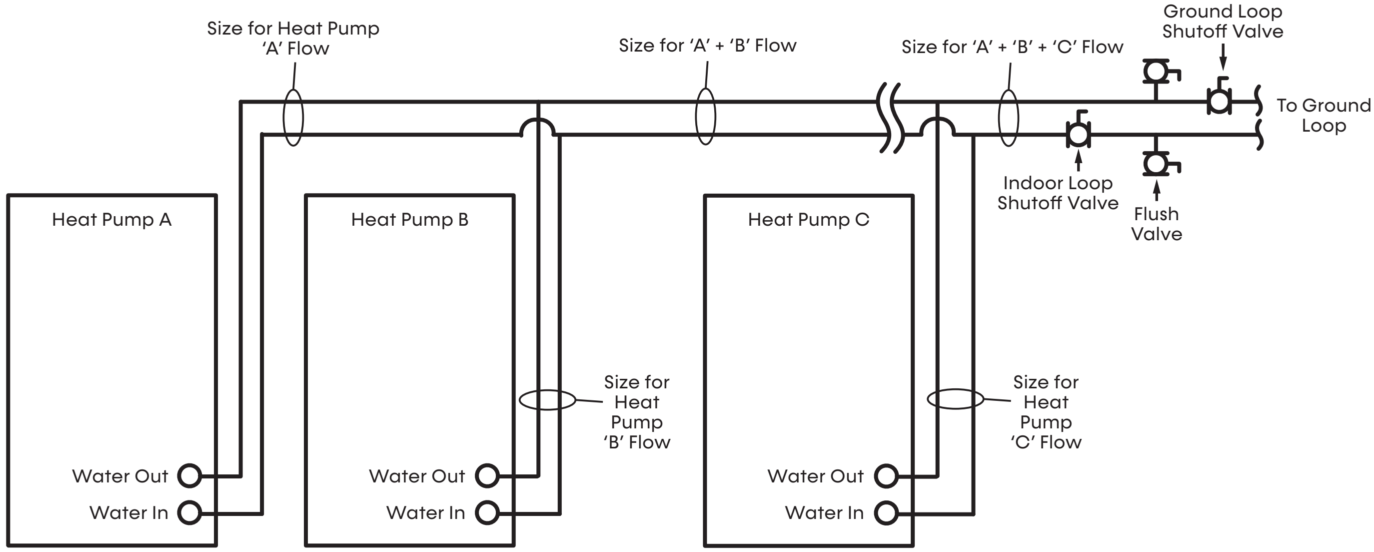
First, flush the ground loop. Close the indoor-loop shutoff valve (or the internal flushing valves in all units) and open the ground-loop shutoff valve to prevent flow through the indoor loop while flushing the ground loop.

After the ground loop is flushed, close the ground-loop shutoff valve and open the indoor-loop valve(s) to flush the units and indoor piping. Remember that there is an internal check valve in the variable-speed pump and that backward flow the unit is not possible.

Multiple-Unit Piping and Flushing

Model:
MJ
024-060

Figure 14: Multiple Units with Internal Flow Controllers and External Flushing Valves



MULTIPLE UNITS WITH INTERNAL MODULATING VALVES AND CENTRAL PUMP

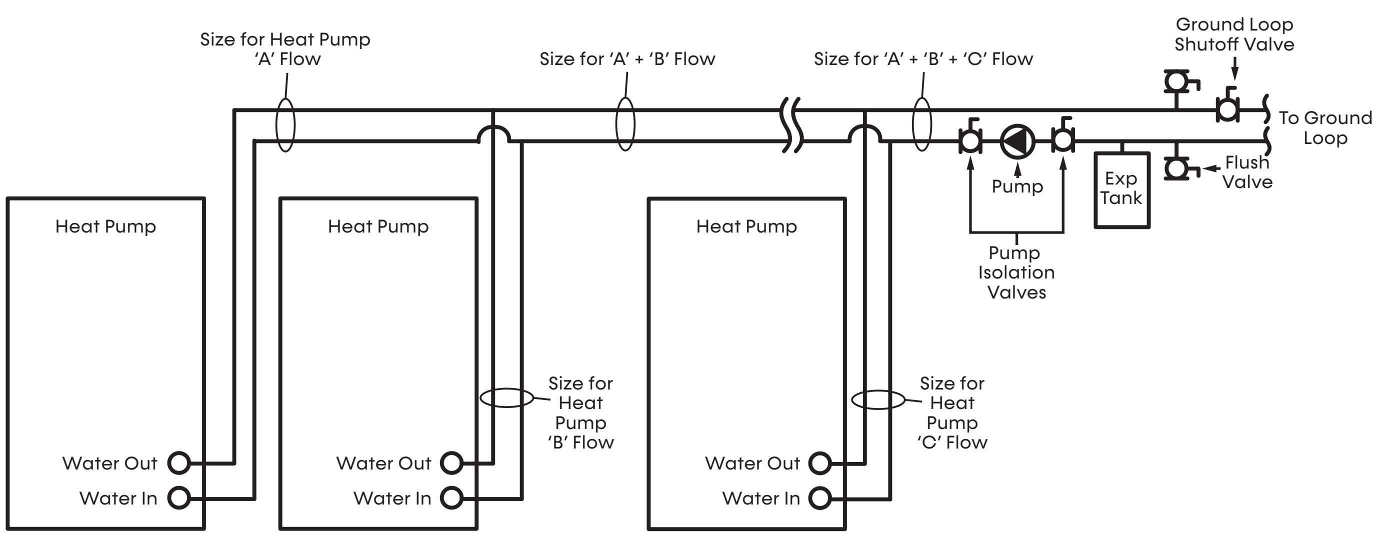
In this configuration, multiple units are used in conjunction with a central variable-speed pump and units with closed-loop modulating valves are used. **NOTE: Do not use open-loop modulating valves on a closed-loop system.** External flushing valves are required. This application is for larger systems, including commercial.

Before flushing, manually open all modulating valves as detailed in Closed Loop – External Central Pumping section of this manual. Next, flush the ground loop.

Close a pump-isolation valve and open the ground-loop shutoff valve to prevent flow through the indoor loop while flushing the ground loop.

After the ground loop is flushed, close the ground-loop shutoff valve and open the pump-isolation valve to flush the units and indoor piping. After the system is flushed, remember to return the modulating valves to their normal operating position.

Figure 15: Multiple Units with Internal Modulating Valves and Central Pump



Model:
MJ
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Ground-Loop Antifreeze Charging

GROUND-LOOP ANTIFREEZE CHARGING

It is highly recommended to use premixed antifreeze fluid where possible to ensure proper concentration levels.

The following procedure is based on pure antifreeze. Implement this procedure during the Full Flush procedure with three-way valves as shown in the Valve Position C figure. When using a premixed mixture of 15°F (-9.4°C) freeze protection, you can fill and flush the system with the premix directly to prevent handling pure antifreeze during installation.

⚠ WARNING

Always use properly marked vehicles (D.O.T. placards), and clean/ suitable/properly identified containers for handling flammable antifreeze mixtures. Post and advise those on the job site of chemical use and potential dangers of handling and storage

⚠ CAUTION

Always obtain MSDS safety sheets for all chemicals used in ground loop applications including chemicals used as antifreeze.

⚠ NOTICE

DO NOT use automotive windshield washer fluid as antifreeze. Washer fluid contains chemicals that cause foaming.

Table 5: Fluid Volume

Fluid Volume (gal [liters] per 100' [30 meters] Pipe)		
Pipe	**Size**	**Volume (gal) [liters]**
Copper	1"	4.1 [15.3]
	1.25"	6.4 [23.8]
	2.5"	9.2 [34.3]
Polyethylene	3/4" IPS SDR11	2.8 [10.4]
	1" IPS SDR11	4.5 [16.7]
	1.25" IPS SDR11	8.0 [29.8]
	1.5" IPS SDR11	10.9 [40.7]
	2" IPS SDR11	18.0 [67.0]
Unit Heat Exchanger	Typical	1.0 [3.8]
Flush Cart Tank	10" Dia x 3ft tall [25.4cm x 91.4cm tall]	10 [37.9]

1. Flush the loop until all air is purged from system then pressurize to check for leaks before adding any antifreeze.
2. Run the discharge line to a drain and hook up an antifreeze drum to the suction side of the pump (if not adding below water level through approved container). Drain the flush cart reservoir down to the pump suction inlet so the reservoir can accept the volume of antifreeze.
3. Calculate the amount of antifreeze required by first calculating the total fluid volume of the loop using Table 5. Next, calculate the amount of antifreeze needed using Table 6 to determine appropriate freeze-protection level. Many southern applications require freeze protection because of piping exposed to ambient conditions.
4. Isolate the unit and prepare to flush only through loop (see the Valve Position A – Loop Fill/Flush figure). Start the flush cart and gradually introduce the required amount of liquid to the flush cart tank until attaining the proper antifreeze protection. Always introduce alcohols under water or use suction of pump to draw in directly to prevent fuming. The rise in flush reservoir level indicates amount of antifreeze added (some carts are marked with measurements in gallons or liters). A 10-inch-diameter (25.4 cm) cylinder, 3-feet (91.4 cm) tall holds approximately 8-gallons (30.3 liters) of fluid, plus the hoses, approximately 2 gallons (7.6 liters), which equals about 10 gallons (37.9 liters) total. If more than one tank full is required, immediately drain the tank by opening the waste valve of the flush cart. Note the color of the discharge fluid. Add food coloring to the antifreeze to help indicate where the antifreeze is in the circuit and prevent the dumping of antifreeze out the waste port. Repeat if necessary.
5. Take care when handling methanol (or any alcohol). Always wear eye protection and rubber gloves. Alcohol fumes are flammable and care should be taken with all flammable liquids. Open flush valves to flush through both the unit and the loop, then flush until fluid is homogenous. It is recommended to run the unit in the heating and cooling mode for 15-20 minutes each to temper the fluid temperature and prepare it for pressurization. Use this period to clean the area. This procedure helps prevent the periodic "flat" loop condition.
6. Close the flush cart return valve then immediately close the flush cart supply valve, leaving a positive pressure in the loop of approximately 50 psi (345 kPa). Pressure check the system. Check the freeze protection of the fluid with the proper hydrometer to ensure that the correct amount of antifreeze is added to the system. Drop the hydrometer into the flush reservoir then compare the reading to Figure 17 for methanol, Figure 18 for propylene glycol, and Figure 19 for ethanol

Ground-Loop Antifreeze Charging

Model:
MJ
024-060

to indicate the level of freeze protection. Do not antifreeze more than a +10°F (-12.2°C) freeze point. Specific gravity hydrometers are available in the residential price list. Repeat after reopening and flushing for a minute to ensure good second sample of fluid. Inadequate antifreeze protection can cause nuisance low temperature lockouts during cold weather.

⚠ WARNING

Always dilute alcohols with water (at least 50% solution) before using. Alcohol fumes are flammable and can cause serious injury or death if not handled properly.

When handling methanol (or any alcohol), always wear eye protection and rubber gloves as alcohols are easily absorbed through the skin.

7. Close the flush cart return valve then immediately close the flush cart supply valve and shut off the flush cart, leaving a positive pressure in the loop of approximately 50-75 psi (345-517 kPa). Refer to Figure 12 for more details.

LOW WATER TEMPERATURE CUTOUT SETTING – DXM2.5

When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10°F [-12.2°C]) set point and avoid nuisance faults. See Low Water Temperature Cutout Selection in this manual.

Figure 16: Low Temperature Cutout Selection

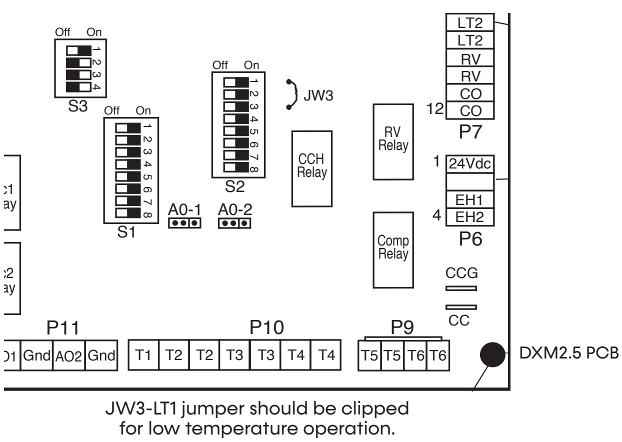


Figure 17: Methanol Specific Gravity

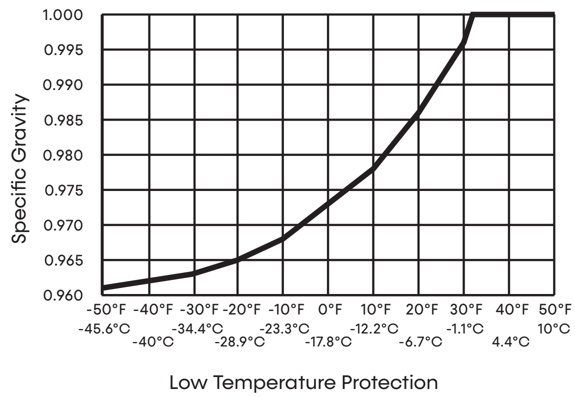


Figure 18: Propylene Glycol Specific Gravity

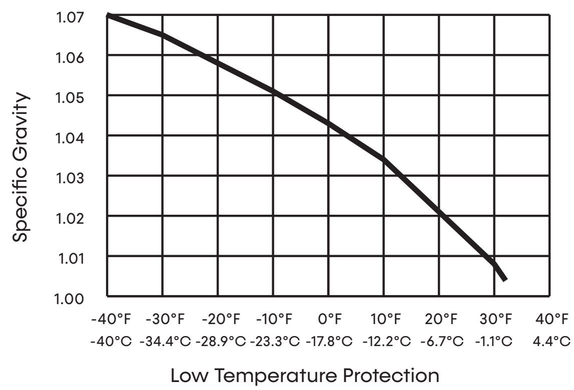


Figure 19: Ethanol Specific Gravity

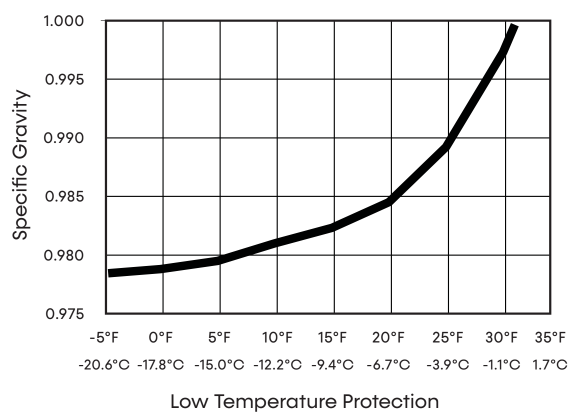


Table 6: Antifreeze Percentages by Volume

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%	8%
100% USP food grade Propylene Glycol	29%	24%	18%	12%
Ethanol[1]	23%	20%	16%	11%

1. Must not be denatured with any petroleum based product

Model:
MJ
024-060

Ground-Loop Heat-Pump Applications

⚠ CAUTION

The following instructions represent industry accepted installation practices for closedloop 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. Do not use any plastic-to-metal threaded fittings due to their potential to leak in earth-coupled applications. Use flanged fittings as a substitute. Use P/T plugs for easy 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.

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 the entire system when all loops are assembled.

FLUSHING THE GROUND LOOP

After system installation and testing is complete, flush the system to remove all foreign objects and purge to remove all air. For more information, see Ground-Loop Cleaning and Flushing section.

ANTIFREEZE

In areas where minimum entering loop temperatures drop below 40°F (5°C) or where piping is routed through areas subject to freezing, antifreeze is required. 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 is 22 to 25°F (-6 to -4°C) and freeze protection is at 15°F (-10°C).

Calculation is as follows:

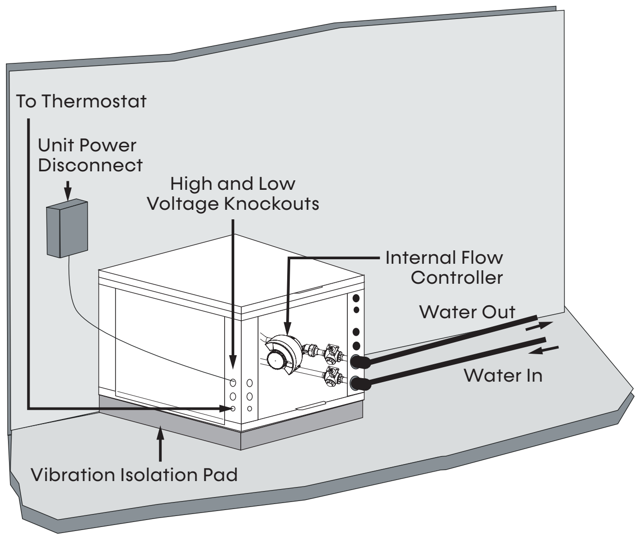
30°F - 15°F = 15°F [-1°C - 9°C = -10°C]

Premix and pump all alcohols from a reservoir outside of the building when possible. If an outside reservoir is not available, introduce alcohol under the water level to prevent fumes. Calculate the total volume of fluid in the piping system, then use the percentage by volume shown in the Antifreeze Percentages by Volume table for the amount of antifreeze needed. Check antifreeze concentration from a well mixed sample using a hydrometer or refractometer to measure specific gravity.

Closed Loop External Central-Pumping Applications

Model:
MJ
024-060

Figure 20: Typical Closed-Loop with Central-Pumping Application (with Internal Modulating Motorized Valve Shown)



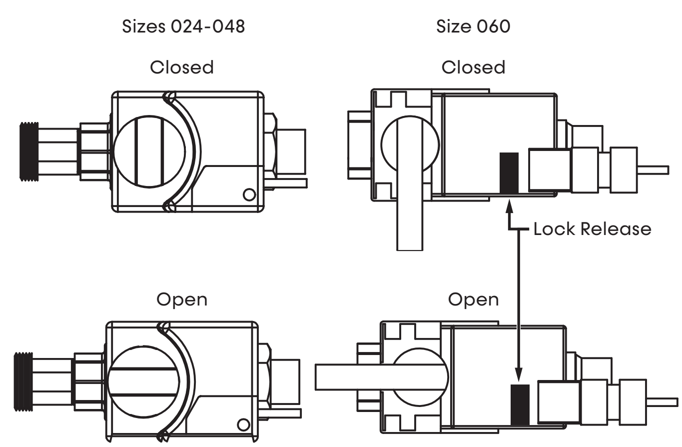
MARS Premier Indoor Split units are available with a modulating water valve option for closed-loop applications with external central pumping (designated by a 5 in the 11th position of the unit model number). With this option, the Modulating Valve is regulated by the DXM2.5 Advanced Communicating Controls based on entering and leaving water temperature (ΔT). The DXM2.5 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 DXM2.5 AND 24V power, it remains in the same position it was in 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 MJ024-048 push down on the handle to unlock it. Then rotate the handle to the open position as shown in Figure 21. This fully opens the valve for flushing. Once flushing is complete, return the valve handle to its normally closed position.

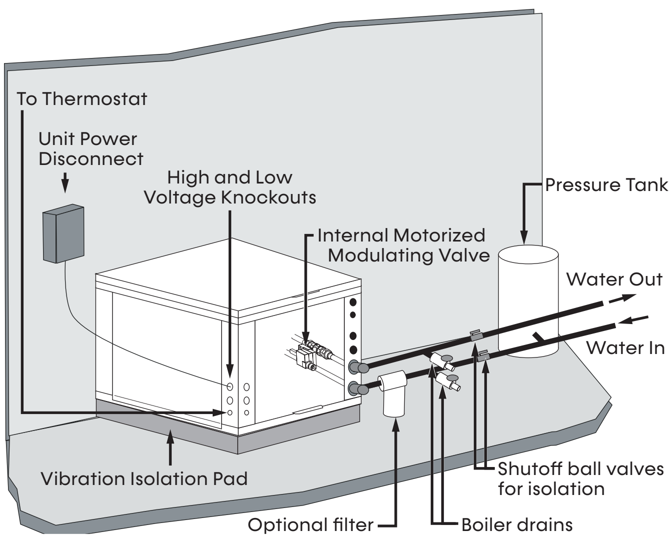
To manually open the internal modulating motorized water valve in MJ060, push down on the lock-release button while turning the handle to the open position as shown in Figure 21. This fully opens the valve for flushing. Once flushing is complete, press the lock release again and return the valve handle to its normally closed position.

Figure 21: Internal Modulating Motorized Valve Positions



Open-Loop or Ground-Water Heat-Pump Applications

Figure 22: Typical Open-Loop/Well Application



⚠ CAUTION

Refrigerant pressure-activated water-regulating valves should never be used with this equipment.

Indoor MARS (MJ) Premier Indoor Split units are available with a water-circuit option for open-loop applications (designated by a 6 in the 11th position of the unit model number).

The motorized modulating valve is regulated by DXM2.5 Advanced Communicating Controls based on entering and leaving water temperature (ΔT). The DXM2.5 gives a 0-10V signal to determine flow rate. The motorized modulating valve defaults to closed position if it loses signal but still has 24V power running to it. If the motorized modulating valve loses both signal from the DXM2.5 AND 24V power, it remains in the same position it was in when it lost 24V power. DO NOT USE open-loop units in closed-loop applications due to significant pressure drop through the open-loop motorized modulating valve. This option is only available with cupronickel water coil.

To manually open the internal modulating motorized water valve in MJ024-048 push down on the handle to unlock it, then rotate the handle to the open position as shown in Figure 21. This fully opens the valve for flushing. Once flushing is complete, return the valve handle to its normally closed position.

To manually open the internal modulating motorized water valve in MJ060, push down on the lock-release button while turning the handle to the open position as shown in Figure 21. 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.

OPEN LOOP - GROUND WATER SYSTEMS

Typical open-loop piping is shown in Figure 22. Include shutoff valves for ease of servicing. "Tee" Boiler drains or other valves into the lines to allow for acid flushing of the heat exchanger. Position shutoff valves to allow flow through the coax via the boiler drains without allowing flow into the piping system. You may use the built-in Schrader ports to measure heat-exchanger pressure drop. You can view water temperature on a compatible thermostat or Wireless Service Tool. Limit supply- and return-water piping to copper, HPDE, or other acceptable high-temperature material. Note that PVC or CPVC material is not recommended as they are not compatible with the polyolester oil used in R-454B products.

Water quantity should be plentiful and of good quality. Consult Table 9 for water quality requirements. Variable Water Flow units for open-loop applications always come with cupronickel coils. In ground-water situations where scaling could be heavy or where biological growth such as iron bacteria is present, an open-loop system is not recommended. Heat-exchanger coils may lose heat-exchange capabilities over time due to build up of mineral deposits. Heat exchangers must only be serviced by a qualified technician, as acid and special pumping equipment is required. Desuperheater coils can become scaled and possibly plugged. In areas with extremely hard water, inform the owner that the heat exchanger may require occasional acid flushing. In some cases, the desuperheater option should not be recommended due to hard-water conditions and additional maintenance required.

Open-Loop or Ground-Water Heat-Pump Applications

Model:
MJ
024-060

WATER QUALITY STANDARDS

Consult Table 9 for water quality requirements. Assess scaling potential using the pH/Calcium hardness method. If the pH <7.5 and the calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, implement a monitoring plan in these probable scaling situations. Reference other water quality issues such as iron fouling, corrosion prevention, erosion, and clogging in Table 9.

PRESSURE TANK AND PUMP

Use a closed, bladder-type pressure tank to minimize mineral formation due to air exposure. Size the pressure tank to provide at least one minute continuous run time of the pump using its drawdown capacity rating to prevent pump short cycling. Discharge water from the unit is not contaminated in any manner and you disposed it in various ways, depending on local building codes (e.g. recharge well, storm sewer, drain field, adjacent stream or pond, etc.). Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning department to assure compliance in your area.

Size the pump to handle the home's domestic water load (typically 5-9 gpm [23-41 l/m]) plus the flow rate required for the heat pump. You must consider pump and expansion tank sizing as complimentary items. For example, an expansion tank that is too small can cause premature pump failure due to short cycling. Consider variable-speed pumping applications for the inherent energy savings and smaller pressure-tank requirements.

Model:
MJ
024-060

Water Quality Requirements

Table 7: 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 water loop systems should undergo water quality testing and be maintained to the water quality standards listed in this table.

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

	Description	Symbol	Units	Heat Exchanger Type – Closed Loop Recirculating: All Heat Exchanger Types	Heat Exchanger Type – Closed Loop Recirculating: Coaxial HX Copper Tube in Tube	Heat Exchanger Type – Open Loop, Tower, Ground Source Well: Coaxial HX Cupronickel	Heat Exchanger Type – Open Loop, Tower, Ground Source Well: 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	(CaC03)	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						

Water Quality Requirements

Model:
MJ
024-060

1. The Water Quality 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 de-ionized 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.

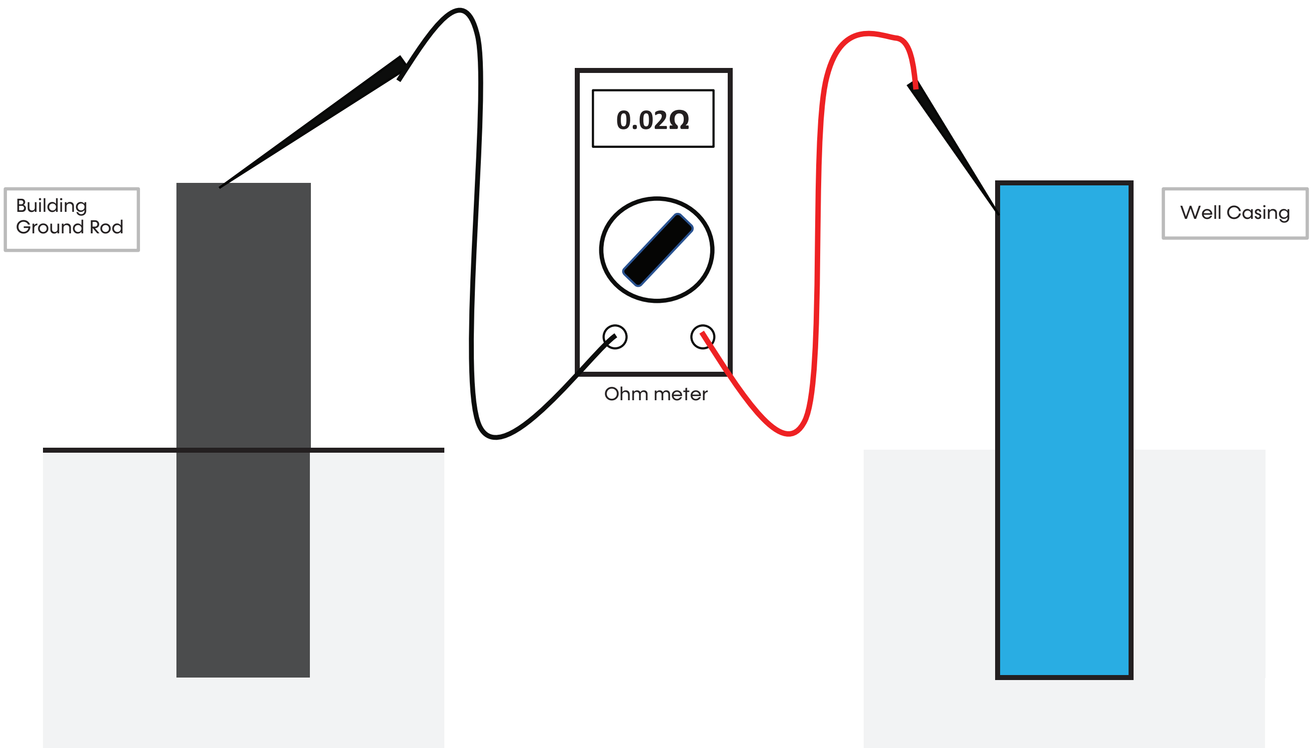
χ The WSHP piping system or other plumbing pipes must not be used as the building ground. An electrical grounding system using a dedicated ground rod meeting NEC and local electrical codes must be installed.

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

Model:
MJ
024-060

Water Quality Requirements

Measuring Earth Ground Resistance for Ground-Water Applications



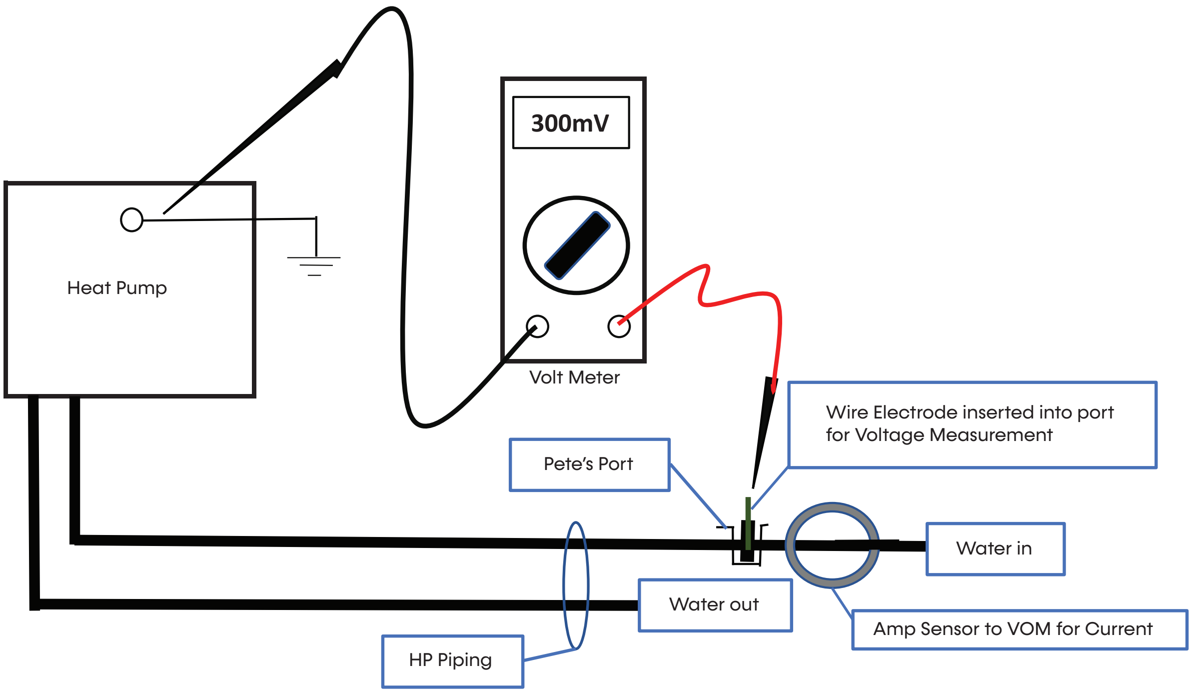
Measure the earth ground bond using an Ohm meter between the building's ground rod and the steel well casing.

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, a conductive path can be achieved by inserting a #6 AWG bare copper wire into the well water. Remove the temporary conductor when finished.

Water Quality Requirements

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 will occur and corresion will result.

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.

Model:
MJ
024-060

Refrigeration Installation

LINE SET INSTALLATION

Figures 27 and 28 illustrate typical installations of a compressor section matched to either an air handler or add-on furnace cased coil. Table 10 shows typical line set diameters at various lengths. Line-set lengths should be kept to a minimum and should always be installed with care to avoid kinking. Line sets are limited to 60 feet in length (one way). Line sets over 60 feet void the equipment warranty. If the line set is kinked or distorted, and it cannot be formed back into its original shape, the damaged portion of the line should be replaced. A restricted line set will effect the performance of the system.

Split units are shipped with a filter drier (loose) inside the cabinet that must be installed in the liquid line at the line set.

Perform all brazing using nitrogen circulating at 2-3 psi (13.8-20.7 kPa) to prevent oxidation inside the tubing. Insulated all line sets with a minimum of ½-inch-thick (13 mm) closed-cell insulation. Insulate liquid lines for sound-control purposes. Seal all insulation tubing using a UV-resistant paint or covering to prevent deterioration from sunlight.

When passing refrigerant lines through a wall, seal the opening with silicon-based caulk. Avoid direct contact with water pipes, duct work, floor joists, wall studs, floors, or other structural components that could transmit compressor vibration. Do not suspend refrigerant tubing from joists with rigid straps. Do not attach line set to the wall. When necessary, use hanger straps with isolation sleeves to minimize transmission of line set vibration to the structure.

INSTALLING THE LINE SET AT THE COMPRESSOR SECTION

Braze the line set to the service-valve stubs as shown in Figure 23. Remove the Schrader cores and heat trap the valves to avoid overheating and damage. Circulate nitrogen through the system at 2-3 psi (13.8-20.7 kPa) to prevent oxidation contamination. Use a low-silver phos-copper braze alloy on all brazed connections. The compressor section is shipped with a factory charge. Do not open service valves until the line set has been leak tested, purged, and evacuated. See Charging the System.

INSTALLING THE INDOOR COIL AND LINE SET

Figure 24 shows the installation of the line set and TXV to a typical-indoor coil. An indoor coil or air handler (fan coil) with a TXV is required. Coils with cap tubes may not be used. If the coil includes removable-fixed orifice, the orifice must be removed and a TXV must be installed as shown in Figure 24. Fasten the copper line set to the coil. Circulate nitrogen through the system at 2-3 psi (13.8-20.7 kPa) to prevent oxidation inside the refrigerant tubing. Use a low-silver phos-copper braze alloy on all brazed connections.

Use a brazing shield to protect all heat-sensitive and painted parts.

Table 8: Line Set Diameters and Charge Information

Model	†Factory Charge (oz) [kg]	20 Feet [6 meters]		40 Feet [12 meters]		60 Feet [18 meters][1]	
		Liquid	Suction	Liquid	Suction	Liquid	Suction
MJ024	60 [1.70]	3/8"	3/4"	3/8"	3/4"	3/8"	3/4"
MJ036	96 [2.72]	3/8"	7/8"	3/8"	7/8"	3/8"	7/8"
MJ048	100 [2.83]	3/8"	7/8"	3/8"	7/8"	3/8"	7/8"
MJ060	136 [3.86]	1/2"	7/8"	1/2"	7/8"	1/2"	7/8"

Notes:
1. 60 feet is the maximum line set length.

- An additional amount of refrigerant should be added allowing 0.6 oz per ft. for 3/8" [0.6g per cm] and 1.2 oz per ft. for 1/2" [1.1g per cm] of line set used.
- † Factory charge is preset for 25 feet [7.6 meters] line set.

Refrigeration Installation

Model:
MJ
024-060

Figure 23: Brazing Instructions

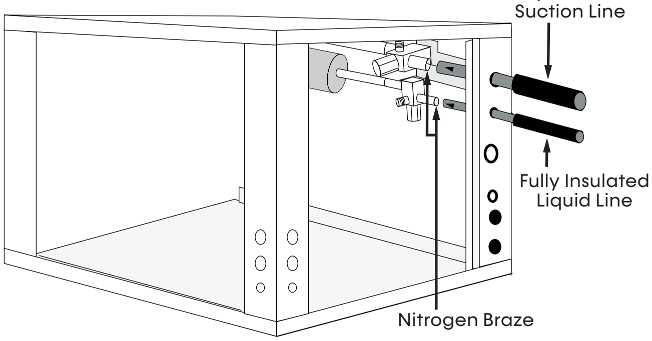


Table 9: Service Valve Positions

Position	Description	System	Service Port
CCW-Full Out	Operation Position	Open	Open
CW-Full In	Shipping Position	Closed	Open

⚠ NOTICE

TXV-sensing bulb should be located on a horizontal section of copper suction line, just outside of coil box. The copper sensing bulb must never be placed on any aluminum tube as this will result in galvanic corrosion and eventual failure of the aluminum tube.

⚠ NOTICE

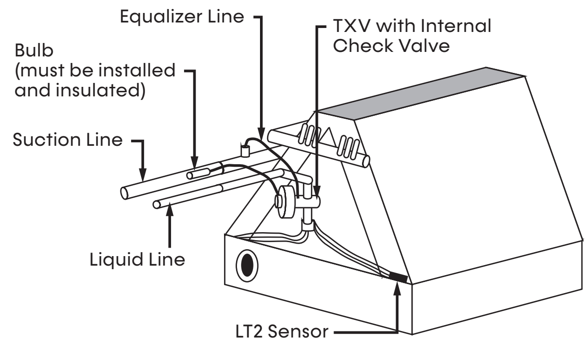
Do not perform any brazing with the TXV bulb attached to any line. After brazing operations have been completed, clamp the TXV bulb securely on the suction line at the 10 to 2 o'clock position with the strap provided. Insulate the bulb and line with pressure-sensitive tape.

REUSING EXISTING LINE SET R-22/HFC-410A TO R-454B CONVERSION

New line sets are always recommended, but are required if:

- The previous system had a compressor burn out.
- The existing line set has oil traps.
- The existing line set is larger or smaller than the recommended line set for the R-454B system.
- The existing line set is damaged, corroded, or shows signs of abrasion/fatigue

Figure 24: Air Coil Connection



⚠ WARNING

If at all possible, it is recommended that a new line set be used when replacing an existing R-22/ HFC-410A system with a R-454B system. In rare instances where replacing the line set is not possible, the line set must be flushed prior to installation of the R-454B system. It is also important to empty all existing traps. Polyolester (POE) oils are used in units charged with R-454B refrigerant. In the case of R-22, residual mineral oil can act as an insulator on the wall of the coil tubing, hindering proper heat transfer and thus reducing system efficiency and capacity. Another important reason to thoroughly flush the line set is remove any trash and other contaminants that may be present which could clog the thermal-expansion valve.

Failure to properly flush the system per the instructions below will void the warranty.

Model:
MJ
024-060

Refrigeration Installation

REQUIRED EQUIPMENT

The following equipment is required to flush the indoor coil and existing line set:

- Two R-22/HFC-410A recovery cylinders
- Refrigerant-recovery machine with a pump-down feature
- Two sets of gauges (one used for R-22/HFC-410A and one used with the R-454B).
- Cylinder of clean R-454B (the minimum amount required to adequately flush as shown below)
    - ¾-inch-diameter suction lines: ¼ lb. per foot of line set + 1 lb. per ton for indoor coil.
    - ⅞-inch-diameter suction lines: ⅓ lb. per foot of line set + 1 lb. per ton for indoor coil
    - 1⅛-inch-diameter suction lines: ½ lb. per foot of line set + 1 lb. per ton for indoor coil.

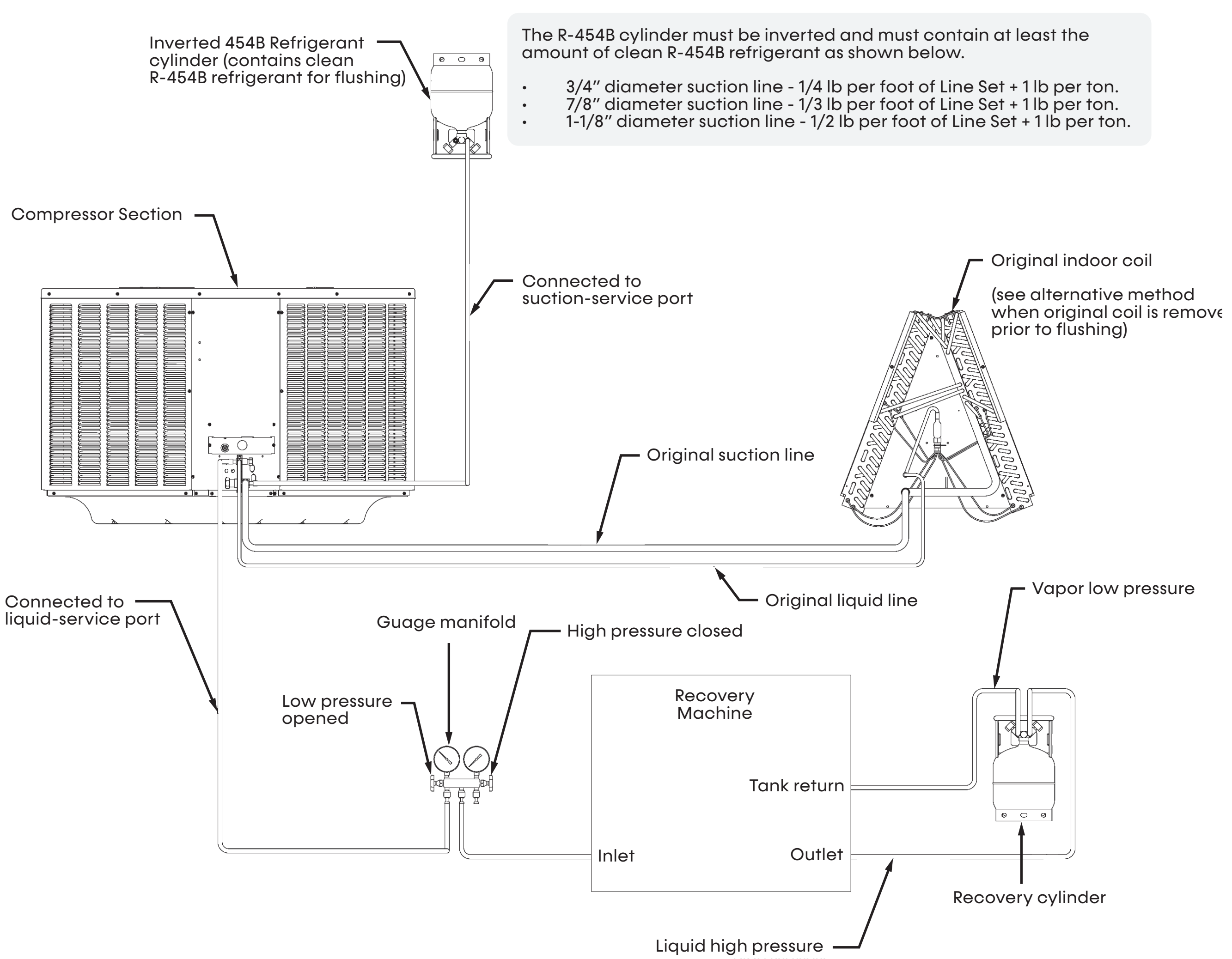
Example: 3-ton system with 40-foot-long line set and ¾-inch suction line.

Line Set: ¼ lb./ft. x 40 ft. = 10 lb.

Indoor coil: 1 lb./ton x 3 tons = 3 lbs. (not required if coil is removed and lines are connected together)

Total: 10 lbs. + 3 lbs. = 13 lbs. to adequately flush line set and indoor coil.

Figure 25: Refrigeration Installation



Refrigeration Installation

FLUSHING PROCEDURE

1. Remove the existing R-22/HFC-410A refrigerant by selecting the appropriate procedure below.

   If the unit is not operational, follow steps a-e.

   a. First, disconnect all power supply to the existing outdoor unit.
   b. Connect a clean refrigerant-recovery cylinder and the refrigerant-recovery machine to the existing unit according to the instructions provided with the recovery machine.
   c. Remove all R-22/HFC-410A refrigerant from the existing system.
   d. Check the gauges after shutdown to confirm all refrigerant is completely removed from the entire system.
   e. Disconnect the liquid and vapor lines from the existing outdoor unit.

   If the unit is operational, follow steps f-l.

   f. First, start the existing system in the cooling mode and close the liquid line valve.
   g. Completely pump all existing R-22/HFC-410A refrigerant into the outdoor unit. It is necessary to bypass the low pressure switch if the unit is so equipped to ensure that the refrigerant is completely evacuated.
   h. The low-side system pressures will eventually reach 0 psig. When this happens, close the vapor-line valve and immediately shut off the outdoor unit.
   i. Check the gauges after shutdown to confirm that the valves are not allowing refrigerant to leak back into the low side of the system.
   j. Disconnect power to the indoor furnace or air handler to stop low voltage to the outdoor unit.
   k. Disconnect the power supply wiring from the existing outdoor unit.
   l. Unsweat the liquid and vapor lines from the existing outdoor unit.
2. Remove the existing outdoor unit.
3. Set the new R-454B unit in place and braze the liquid and vapor lines to the unit connections. Connect the low voltage and line voltage to the new indoor unit. Do not turn on power supply to the unit and do not open the unit service valves at this time.
4. The indoor coil may be left in place for the flushing process or removed.
5. If the indoor coil is removed, the suction and liquid line must be connected together on the indoor coil end. See illustration for recommended method for connecting these together.
6. If the indoor coil is left in place during flushing, removing the existing refrigerant-flow control orifice or thermal-expansion valve prior to flushing is highly recommended to ensure proper flushing. Use a field-provided fitting or piece of copper tubing to reconnect the lines where the thermal-expansion valve was removed.
7. Remove the pressure-tap valve cores from the unit's service valves.
8. Connect an R-22/HFC-410A cylinder of clean R-22/HFC-410A refrigerant to the vapor service valve. (See Required Equipment Section for minimum required amount of R-22/HFC-410A for adequate flushing.)
9. Connect the low pressure side of an R-22/HFC-410A gauge set to the liquid-line valve.
10. Connect a hose from the recovery machine with an empty recovery drum to the common port of the gauge set.
11. Set the recovery machine for liquid recovery and start the machine.
12. Open the gauge set low-side valve. This allows the recovery machine to pull a vacuum on the existing system line set.
13. Make sure to invert the cylinder of clean R-22/HFC-410A refrigerant and open the cylinder's valve to allow liquid refrigerant to flow into the system through the vapor line valve. (This should allow the refrigerant to flow from the cylinder and through the line set before it enters the recovery machine.) If the cylinder has separate liquid and vapor valves, do not invert it. Use the liquid valve on the cylinder in this case, keeping the cylinder upright.

Refrigeration Installation

14. After the liquid refrigerant is completely recovered, switch the recovery machine to vapor recovery so that the R-22/HFC-410A vapor can be completely recovered.

NOTICE

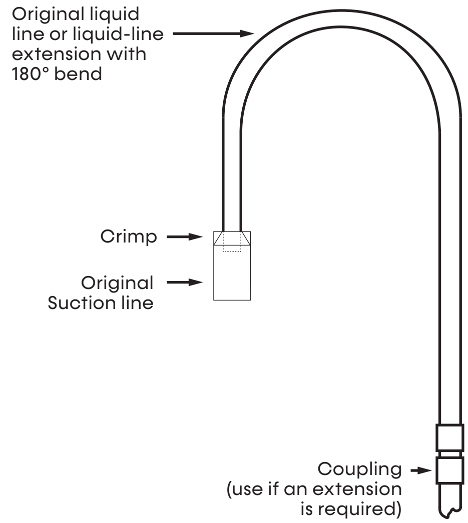
Always remember that every time the system is flushed, you must always pull a vacuum with a recovery machine on the system at the end of each procedure. (If desired, a second flushing with clean refrigerant may be performed if insufficient amounts of mineral oil were removed during the initial flush.)

15. Tightly close the valve on the inverted R-22/HFC-410A cylinder and the gauge-set valves.
16. Completely pump all remaining R-22/HFC-410A refrigerant out of the recovery machine and turn the machine off.
17. Before removing the recovery machine, R-22/HFC-410A refrigerant cylinder and gauges, break the vacuum on the refrigerant lines and indoor coil using dry-nitrogen.
18. Unsweat the liquid and vapor lines from the old indoor coil or from each other and install a new matched R-454B indoor coil, connecting the flushed refrigerant lines to the new coil using field-supplied connectors and tubing.
19. Reinstall pressure-tap valve cores into unit service valves.
20. Pressurize the lines and coil and check for leaks in the line set connection points using a soap solution.
21. Thoroughly evacuate the line set and indoor coil per the instructions found in this manual.
22. Open the liquid and vapor service valves, releasing the R-454B refrigerant contained in the unit into the evacuated line set and indoor coil.
23. Energize the system and adjust the refrigerant charge according to the charging procedures found in this manual.

ALTERNATE METHOD

Depending on the line configuration, choose the option that best fits the system.

Figure 26: Alternate Method



Step 1: Pull and make a 180° bend in the original liquid line then feed it into the original suction line (see Figure 26). Ensure it is inserted deep enough to avoid plugging during brazing. Move to Step 5

OR

Step 2: Obtain an appropriate sized coupling for the original liquid line if an extension is required.

1. Using the same size copper tubing as the original liquid line, braze the extension to the coupling.
2. Braze the coupling to the original liquid line.
3. Feed the opposite end of the liquid-line extension into the original suction line. Ensure it is inserted deep enough to avoid plugging during brazing.
4. Crimp the original suction line onto the original liquid line or extension.
5. Braze the crimp shut.
6. Use tubing cutter to cut tubes.

Refrigeration Installation

FP2 SENSOR INSTALLATION

An LT2 air coil low temperature protection sensor is factory installed on the MARS MA and is available as an option for the MARS MK. Install the LT2 sensor on the cased coil as indicated in Figure 28 of this manual using thermal compound and the supplied mounting clip. Ensure that the sensor makes good thermal contact and insulate the sensor. An optional LT2 sensor kit may be ordered using part number S17S0031N12.

NOTE: Air-coil low-temperature protection will not be active if this sensor is installed incorrectly or is not installed.

ADD-ON HEAT PUMP APPLICATIONS

Locate the indoor coil in the supply side of the furnace to avoid condensation damage to the furnace heat exchanger for add-on heat-pump applications. Install a high-temperature limit switch as shown in Figure 28 just upstream of the coil to de-energize the compressor any time the furnace is energized to avoid blowing hot air directly into the coil, elevating refrigerant pressures during operation. The heat pump trips out on high-pressure lockout without some method of disengaging the compressor during furnace operation. Alternatively, some thermostats with "dual fuel" mode automatically de-energize the compressor when second-stage (backup) heat is required.

EVACUATION AND CHARGING THE UNIT

Leak Testing

Pressurize and check the refrigeration line set for leaks before evacuating and charging the unit. To pressurize the line set, attach refrigerant gauges to the service ports and add an inert gas (nitrogen or dry carbon dioxide) until pressure reaches 60-90 psig (413-620 kPa). Never use oxygen or acetylene to pressure test. Use a halogen leak tester or a good quality bubble solution to detect leaks on all connections made in the field. Check the service-valve ports and stem for leaks. If a leak is found, repair it and repeat the above steps. For safety reasons do not pressurize system above 150 psig (1,034 kPa). The system is now ready for evacuation and charging.

Turn the service valves full out CCW and then turn back in one-half turn to open service ports (see Water Quality Requirements Table). Add the required refrigerant so that the total charge calculated for the unit and line set is now in the system. Open the service valve fully counter clockwise so that the stem backseats and prevents leakage through the Schrader port while it is not in use. Start the unit in heating mode and measure superheat and subcooling values after 5 minutes of run time. See Unit Operating Conditions for superheat and sub-cooling values. Superheat is measured using suction temperature and pressure at the compressor suction line. Measure subcooling using the liquid line temperature immediately outside the compressor section cabinet and either the liquid line service valve pressure or the compressor discharge pressure. Note that different values from Unit Operating Conditions will be obtained due to the pressure losses through the condenser heat exchanger. Adding refrigerant increases subcooling while superheat should remain fairly constant allowing for a slight amount of hunting in TXV systems. Wait for 5 minutes of operation to pass before measuring the increase in subcooling. After values are measured, compare to the chart and see FINAL EVALUATION.

PARTIAL CHARGE METHOD

Open service valve fully counterclockwise and then turn back in one half turn to open service port. Add vaporized (Gas) into the suction side of the compressor until the pressure in the system reaches approximately 100-120 psig (689-827 kPa). Never add liquid refrigerant into the suction side of a compressor. Start the unit in heating and add gas to the suction port at a rate not to exceed 5 pounds (2.27 kg) per minute. Keep adding refrigerant until the complete charge is entered. Superheat is measured using suction temperature and pressure at the compressor-suction line. Measure subcooling using the liquid line temperature immediately outside the compressor section cabinet and either the liquid line service valve pressure or the compressor discharge pressure. Note that different values from Unit Operating Conditions will be obtained due to the pressure losses through the condenser heat exchanger.

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MJ
024-060

Refrigeration Installation

Adding refrigerant increases subcooling while superheat should remain fairly constant allowing for a slight amount of hunting in TXV systems. Wait for 5 minutes of operation to pass before measuring the increase in subcooling. After values are measured, compare to the chart and go to "FINAL EVALUATION."

FINAL EVALUATION

In a split system, cooling-subcooling values can be misleading depending on the location of the measurement. Therefore, it is recommended that charging be monitored in the heating mode. Evaluate charge by monitoring the subcooling in the heating mode. After initial check of heating subcooling, shut off unit and allow to sit 3-5 minutes until pressures equalize. Restart unit in the cooling mode and check the cooling superheat against Unit Operating Conditions. If unit runs satisfactorily, charging is complete. If unit does not perform to specifications the cooling TXV (air-coil side) may need to be readjusted (if possible) until the cooling superheat values are met.

CHECKING SUPERHEAT AND SUBCOOLING

Determining Superheat

1. Measure the temperature of the suction line at a point near the expansion-valve bulb.
2. Determine the suction pressure by attaching refrigeration gauges to the suction Schrader connection at the compressor.
3. Convert the pressure obtained in Step 2 to saturation temperature (boiling point) by using the pressure/temperature conversion table on the gauge set.
4. Subtract the temperature obtained in Step 3 from Step 1. The difference is the superheat of the unit or the total number of degrees above saturation temperature. Refer to Unit Operating Conditions for superheat ranges at specific entering water conditions.

Example:

The temperature of the suction line at the sensing bulb is 50°F (10°C). The suction pressure at the compressor is 110 psig (758 kPa) which is equivalent to 36°F (2°C) saturation temperature from the HFC-410A press/temp conversion table on the gauge set. 36°F (2°C) subtracted from 50°F (10°C) = 14°F (8°C) Superheat.

Determining Sub-Cooling

1. Measure the temperature of the liquid line on the smaller refrigerant line (liquid line) just outside of the cabinet. This location is adequate for measurement in both modes unless a significant temperature drop in the liquid line is anticipated.
2. Determine the condenser pressure (high-side) by attaching refrigerant gauges to the Schrader connection on the liquid-line service valve. If the hot-gas discharge line of the compressor is used, refer to the appropriate column in Unit Operating Conditions.
3. Convert the pressure obtained in Step 2 to the saturation temperature by using the press/temp conversion table on the gauge set.
4. Subtract the temperature of Step 3 from the temperature of Step 1. The difference is the subcooling value for that unit (total degrees below the saturation temperature). Refer to Tables Unit Operating Conditions for subcooling values at specific entering water temperatures.

Example:

The condenser pressure at the service port is 335 psig (2,310 kPa), which is equivalent to 104°F (40°C) saturation temperature. Discharge pressure is 365 psig (2,517 kPa) at the compressor (109°F [43°C] saturation temperature). The measured liquid-line temperature is 100°F (38°C). 100°F (38°C) subtracted from 104°F (40° C) = 4°F (2°C) subcooling (9°F [50°C] if using the compressor discharge pressure).

Refrigeration Installation

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Figure 27: Typical Split/Air Handler Installation

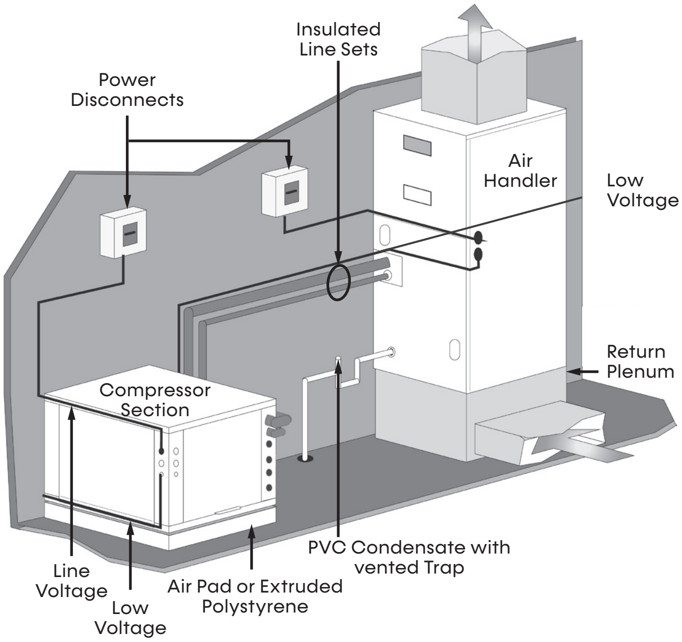
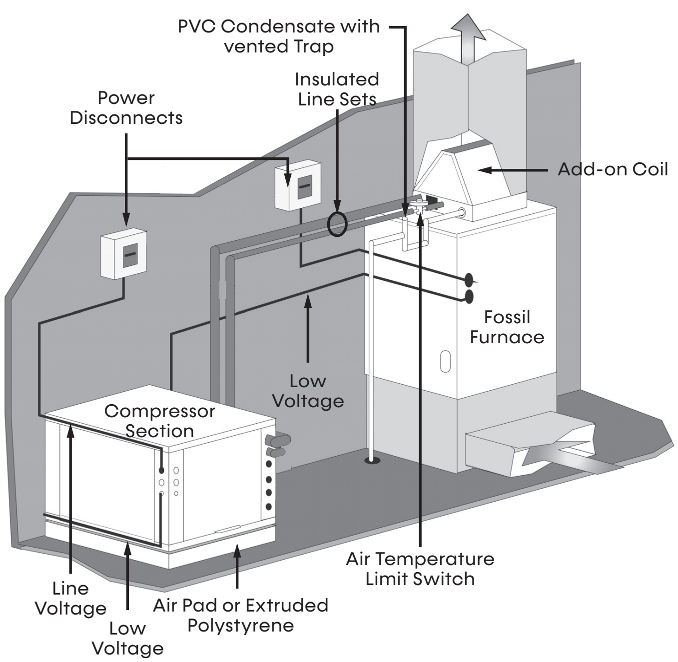


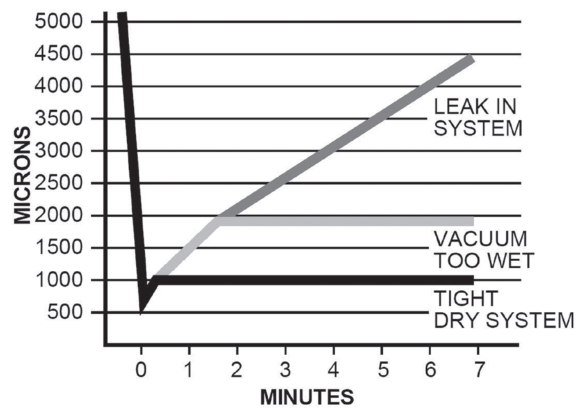
Figure 28: Typical Split/Add-on Coil Fossil Fuel Furnace Installation



EVACUATION OF THE LINESET AND COIL

The line set and coil must be evacuated to at least 500 microns to remove any moisture and noncondensables. Evacuate the system through both service ports in the shipping position (full CW in - see Water Quality Requirements Table) to prevent false readings on the gauge because of pressure drop through service ports. A vacuum gauge or thermistor capable of accurately measuring the vacuum depth is crucial in determining if the system is ready for charging. If the system meets the requirements in Figure 29, it is ready for charging.

Figure 29: Evacuation Graph



CHARGING THE SYSTEM

The following are two methods of charging a refrigerant system.

- **Total-Charge Method** - the volume of the system is determined and the refrigerant is measured and added into the evacuated system.
- **Partial-Charge Method** - a small initial charge is added to an evacuated system, and remaining refrigerant added during operation.

Total-Charge Method - See Table 8 for the compressor-section basic charge. For line sets with ⅜-inch liquid lines, add 0.6 ounces of refrigerant to the basic charge for every installed foot of liquid line (0.6 grams per cm). Add 1.2 oz. per foot (1.1 grams per cm) if using ½-inch line. Once the total charge is determined, the factory pre-charge (Table 8) is subtracted and the remainder is the amount needed to be added to the system. This method should be used with the AHRI-matched air handler or cased coil.

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Hot Water Generator

The Hot Water Generator (HWG) or desuperheater option provides considerable operating-cost savings by utilizing heat energy from the compressor discharge line to help satisfy domestic hot water requirements. The HWG is active throughout the year, providing virtually free hot water when the heat pump operates in the cooling mode or hot water at the COP of the heat pump during operation in the heating mode. Actual HWG water-heating capacities are provided in the appropriate heat-pump performance data.

Heat pumps equipped with the HWG option include a built-in water-to-refrigerant heat exchanger that eliminates the need to tie into the heat pump's refrigerant circuit in the field. The control circuit and pump are also built in for residential equipment. The figue below shows a typical example of HWG water-piping connections on a unit with built-in circulating pump. This piping layout prevents sludge/debris from the bottom of the tank being pulled into the HWG pump.

The temperature setpoint of the HWG is field-selectable to 125°F or 150°F. The 150°F setpoint allows more heat storage from the HWG. For example, consider the amount of heat that can be stored by the HWG when using the 125°F setpoint, versus the amount of heat that can be generated by the HWG when using the 150°F setpoint.

In a typical 50-gallon two-element electric water heater, the lower element should be turned down to 100°F, or the lowest setting, to get the most from the HWG. The tank eventually stratifies so that the lower 80% of the tank, or 40 gallons, becomes 100°F (controlled by the lower element). The upper 20% of the tank, or 10 gallons, is maintained at 125°F (controlled by the upper element).

⚠ WARNING

A 150°F setpoint may lead to scalding or burns. The 150°F setpoint must only be used on systems that employ an approved anti-scald valve.

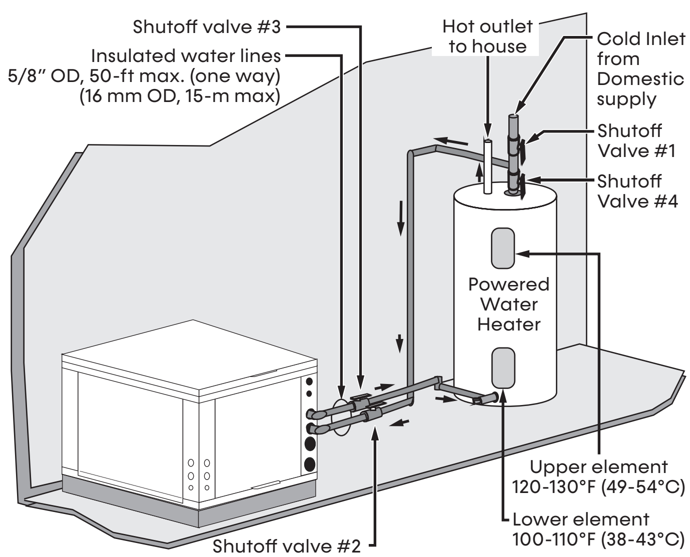
Using a 125°F setpoint, the HWG can heat the lower 40 gallons of water from 100°F to 125°F, providing up to 8,330 btu's of heat. Using the 150°F setpoint, the HWG can heat the same 40 gallons of water from 100°F to 150°F and the remaining 10 gallons of water from 125°F to 150°F, providing a total of up to 18,743 Btu's of heat, or more than twice as much heat as when using the 125°F setpoint.

Electric water heaters are recommended. If a gas, propane, or oil water heater is used, a second preheat tank must be installed (Figure 31). If the electric water heater has only a single center element, the dual-tank system is recommended to ensure a usable entering water temperature for the HWG.

Typically a single tank of at least 50 gallons (189 liters) is used to limit installation costs and space. However, a dual tank, as shown in Figure 31, is the preferred system, as it provides the maximum storage and temperate source water to the HWG.

It is always advisable to use water-softening equipment on domestic-water systems to reduce the scaling potential and lengthen equipment life. In extreme water conditions, it may be necessary to avoid the use of the HWG option since the potential cost of frequent maintenance may offset or exceed any savings. Consult Table 10 for scaling potential tests.

Figure 30: Typical HWG Installation



Hot Water Generator

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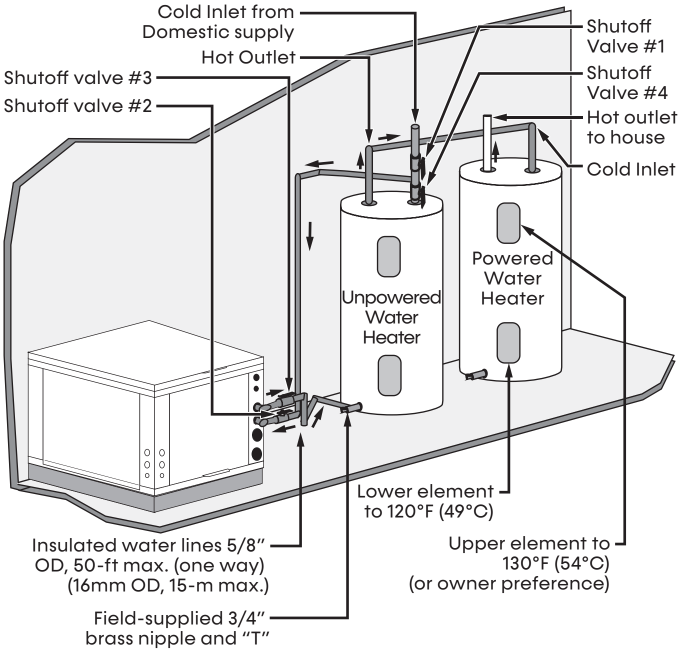
Figure 31: Two-tank HWG Installation



INSTALLATION

The HWG is controlled by two sensors and the DXM2.5. One sensor is located on the compressor discharge line to sense the discharge refrigerant temperature. The other sensor is located on the HWG heat exchanger's "Water In" line to sense the potable water temperature.

⚠ WARNING

Under no circumstances should the sensors be disconnected or removed. Full-load conditions can drive hot water tank temperatures far above safe temperature levels if sensors are disconnected or removed.

The DXM2.5 monitors the refrigerant and water temperatures to determine when to operate the HWG. The HWG operates any time the refrigerant temperature is sufficiently above the water temperature. Once the HWG has satisfied the water heating demand during a heat-pump run cycle, the controller cycles the pump at regular Intervals to determine if an additional HWG cycle can be utilized.

When the control is powered and the HWG pump output is active for water temperature sampling or HWG operation, the DXM2.5 status LED slowly flashes (On 1 second, Off 1 second).

If the control detects a HWG fault, the DXM2.5 status LED flashes a numeric fault code as follows:

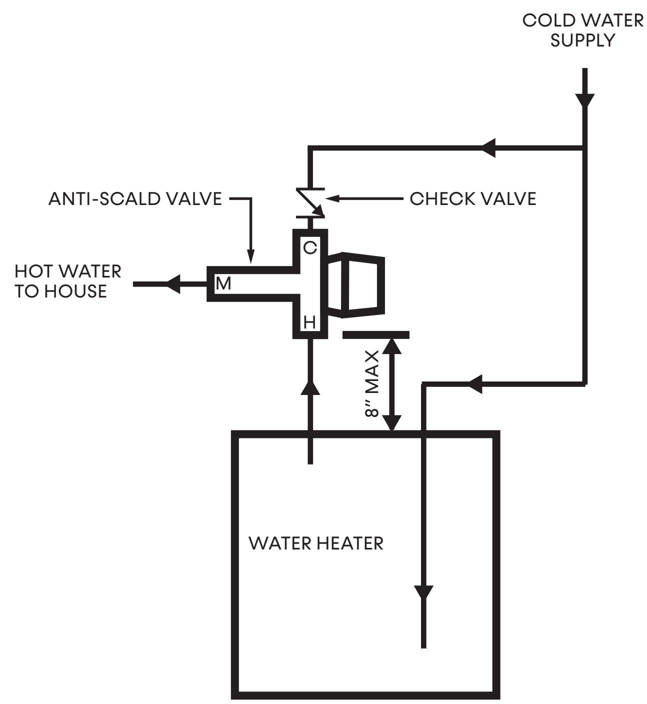
- High Water Temperature (> 160°F) (five flashes)
- Hot Water Sensor Fault (six flashes)
- Compressor Discharge Sensor Fault (six flashes)

Fault code flashes have a duration of 0.3 seconds with a 10-second pause between fault codes. For example, a Compressor Discharge Sensor Fault is six flashes 0.3 seconds long, then a 10 second pause, then six flashes again, etc.

⚠ WARNING

Using 150°F setpoint on the HWG results in water temperatures sufficient to cause severe physical injury in the form of scalding or burns, even when the hot water tank temperature setting is visibly set below 150°F. The 150°F HWG setpoint must only be used on systems that employ an approved anti-scald valve (part number (AVAS4) at the hot water storage tank with such valve properly set to control water temperatures distributed to all hot water outlets at a temperature level that prevents scalding or burns.

Figure 32: Anti-scald Valve-Piping Connection



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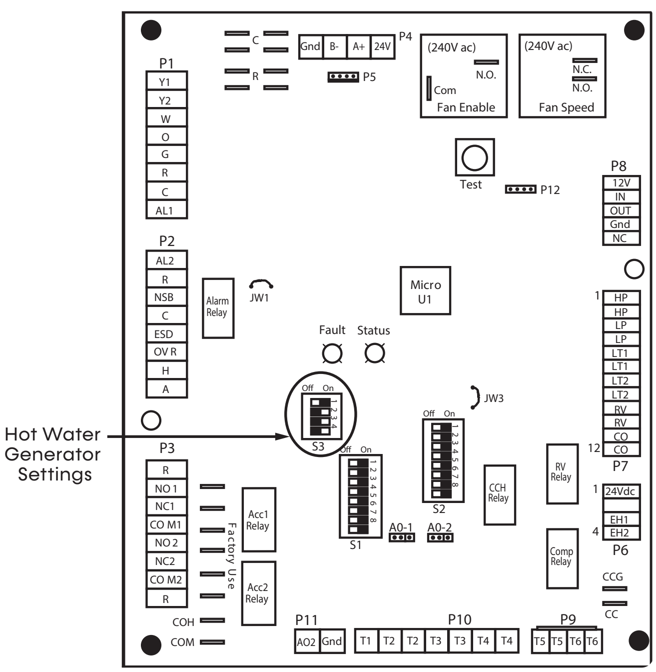
Hot Water Generator

- Hot Water Generator settings are determined by DIP switches 3-2, 3-3, and 3-4.
- DIP 3-2 controls the HWG Test Mode and provides for forced operation of the HWG output, activating the HWG pump for up to five minutes.
- ON = HWG test mode, OFF = normal HWG operation.
- The control reverts to standard operation after five minutes regardless of switch position.
- DIP 3-3 determines HWG setpoint temperature and provides for selection of the HWG operating setpoint.
- ON = 150°F (66°C), OFF = 125°F (52°C)
- DIP 3-4 is for the HWG status and provides HWG operation control
- ON = HWG mode enabled, OFF = HWG mode disabled
- Units are shipped from the factory with this switch in the OFF position.

Figure 33: Hot Water Generator Settings



> **⚠ WARNING**
>
> The HWG pump is fully wired from the factory. Use extreme caution when working around the microprocessor control as it contains line voltage connections that presents a shock hazard that can cause severe injury or death.

The heat pump, water piping, pump, and hot water tank should be located where the ambient temperature does not fall below 50°F (10°C). Keep water piping lengths at a minimum. DO NOT use a one way length greater than 50 feet one way (15 m). See Table 10 for recommended piping sizes and maximum lengths.

All installations must be in accordance with local codes. The installer is responsible for knowing the local requirements, and for performing the installation accordingly. DO NOT activate the HWG (turn DIP 3-4 to the ON position) until Initial Startup section is completed. Powering the pump before all installation steps are completed will damage the pump.

WATER TANK PREPARATION

1. Turn off power or fuel supply to the hot water tank.
2. Connect a hose to the drain valve on the water tank.
3. Shut off the cold water supply to the water tank.
4. Open the drain valve and open the pressure-relief valve or a hot water faucet to drain tank.
5. When using an existing tank, it should be flushed with cold water after it is drained until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.
7. Install HWG water piping.

HWG WATER PIPING

1. Using at least ½-inch (12.7 mm) I.D. copper, route and install the water piping and valves. Install an approved anti-scald valve if the 150°F HWG setpoint is or will be selected. An appropriate method must be employed to purge air from the HWG piping. This may be accomplished by flushing water through the HWG or by installing an air vent at the high point of the HWG piping system.
2. Insulate all HWG water piping with no less than ⅜-inch (10-mm) wall closed-cell insulation.
3. Open both shut-off valves and make sure the tank-drain valve is closed.

Hot Water Generator

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WATER TANK REFILL

1. Close valve #4. Ensure that the HWG valves (valves #2 and #3) are open. Open the cold water supply (valve #1) to fill the tank through the HWG piping. This will force water flow through the HWG and purge air from the HWG piping.
2. Open a hot water faucet to vent air from the system until water flows from faucet; turn off faucet. Open valve #4.
3. Depress the hot water tank pressure-relief valve handle to ensure that there is no air remaining in the tank.
4. Inspect all work for leaks.
5. Before restoring power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to insure maximum utilization of the heat available from the refrigeration system and conserve the most energy. On tanks with both upper and lower elements and thermostats, the lower element should be turned down to 100°F (38°C) or the lowest setting; the upper element should be adjusted to 120-130°F (49-54°C). Depending upon the specific needs of the customer, you may want to adjust the upper element differently. On tanks with a single thermostat, a preheat tank should be used (Figure 31).
6. Replace access cover(s) and restore power or fuel supply.

INITIAL STARTUP

7. Make sure all valves in the HWG water circuit are fully open.
8. Turn on the heat pump and allow it to run for 10-15 minutes.
9. Set S3-4 to the “ON” position (enabled) to engage the HWG. See Figure 33.
10. The HWG pump should not run if the compressor is not running.
11. The temperature difference between the water entering and leaving the HWG coil should be approximately 5-10°F (3-6°C).
12. Allow the unit to operate for 20 to 30 minutes to insure that it is functioning properly.

Table 10: HWG Water Piping Sizes and Length

Unit Nominal Tonnage	Nominal HWG Flow (gpm)	1/2" Copper (max length[1])	3/4" Copper (max length[1])
2.0	0.8	50	-
2.5	1.0	50	-
3.0	1.2	50	-
3.5	1.4	50	-
4.0	1.6	45	50
5.0	2.0	25	50
6.0	2.4	10	50

13. Maximum length is equivalent length (in feet) one way of type L copper.

⚠ WARNING

Use only copper piping for HWG piping due to the potential of high water temperatures for water that has been in the HWG heat exchanger during periods of no-flow conditions (HWG pump not energized). Piping other than copper may rupture due to high water temperature and potable water pressure. CPVC, PEX, or other plastic pipe should not be used HWG piping

Model:
MJ
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Electrical Data

MJ Standard with Modulating Valve

Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor A				Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
				MCC	RLA	LRA	Qty			
MJ024	J	208/230-1-60	187/252	16.0	10.3	62.0	1	10.3	12.9	20
MJ036	J	208/230-1-60	187/252	22.7	14.6	76.0	1	14.6	18.3	30
MJ048	J	208/230-1-60	187/252	28.6	18.3	138.0	1	18.3	22.9	40
MJ060	J	208/230-1-60	187/252	34.8	22.3	149.0	1	22.3	27.9	50

MJ with HWG Pump

Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor A				HWG Pump FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
				MCC	RLA	LRA	Qty				
MJ024	J	208/230-1-60	187/252	16.0	10.3	62.0	1	0.28	10.6	13.2	20
MJ036	J	208/230-1-60	187/252	22.7	14.6	76.0	1	0.28	14.9	18.5	30
MJ048	J	208/230-1-60	187/252	28.6	18.3	138.0	1	0.28	18.6	23.2	40
MJ060	J	208/230-1-60	187/252	34.8	22.3	149.0	1	0.28	22.6	28.2	50

MJ with Standard Head Flow Controller

Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor A				GEO Pump FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
				MCC	RLA	LRA	Qty				
MJ024	J	208/230-1-60	187/252	16.0	10.3	62.0	1	0.64	10.9	13.5	20
MJ036	J	208/230-1-60	187/252	22.7	14.6	76.0	1	0.64	15.2	18.9	30
MJ048	J	208/230-1-60	187/252	28.6	18.3	138.0	1	0.64	18.9	23.5	40
MJ060	J	208/230-1-60	187/252	34.8	22.3	149.0	1	0.64	22.9	28.5	50

MJ with High Head Flow Controller

Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor A				UPMXL Pump FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
				MCC	RLA	LRA	Qty				
MJ024	J	208/230-1-60	187/252	16.0	10.3	62.0	1	1.44	11.7	14.3	20
MJ036	J	208/230-1-60	187/252	22.7	14.6	76.0	1	1.44	16.0	19.7	30
MJ048	J	208/230-1-60	187/252	28.6	18.3	138.0	1	1.44	19.7	24.3	40
MJ060	J	208/230-1-60	187/252	34.8	22.3	149.0	1	1.44	23.7	29.3	50

Electrical Data

Model:
MJ
024-060

MJ with Standard Head Flow Controller and HWG Pump

Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor A				GEO Pump FLA	HWG Pump FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
				MCC	RLA	LRA	Qty					
MJ024	J	208/230-1-60	187/252	16.0	10.3	62.0	1	0.64	0.28	11.2	13.8	20
MJ036	J	208/230-1-60	187/252	22.7	14.6	76.0	1	0.64	0.28	15.5	19.2	30
MJ048	J	208/230-1-60	187/252	28.6	18.3	138.0	1	0.64	0.28	19.2	23.8	40
MJ060	J	208/230-1-60	187/252	34.8	22.3	149.0	1	0.64	0.28	23.2	28.8	50

MJ with High Head Flow Controller and HWG Pump

Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor A				UPMXL Pump FLA	HWG Pump FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
				MCC	RLA	LRA	Qty					
MJ024	J	208/230-1-60	187/252	16.0	10.3	62.0	1	1.44	0.28	12.0	14.6	20
MJ036	J	208/230-1-60	187/252	22.7	14.6	76.0	1	1.44	0.28	16.3	20.0	30
MJ048	J	208/230-1-60	187/252	28.6	18.3	138.0	1	1.44	0.28	20.0	24.6	40
MJ060	J	208/230-1-60	187/252	34.8	22.3	149.0	1	1.44	0.28	24.0	29.6	50

MA Standard

Model	Voltage Code	Rated Voltage	Voltage Min/Max	Fan Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
MA024	J	208/230-1-60	187/252	4.20	4.20	5.3	15
MA036	J	208/230-1-60	187/252	5.90	5.90	7.4	15
MA048	J	208/230-1-60	187/252	5.90	5.90	7.4	15
MA060	J	208/230-1-60	187/252	7.50	7.50	9.4	15

Model:
MJ
024-060

Electrical: Line Voltage

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

DISCONNECT

Field-installed disconnect switches connected to supply terminals must have contact separation for **all poles** providing full disconnection. Manufacturer-installed disconnect (optional) provides all-pole disconnection from the supply mains.

GENERAL LINE VOLTAGE WIRING

Ensure 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.

POWER CONNECTION

Line voltage connection is made by connecting the incoming line voltage wires to the "L" side of the contactor as shown in the unit wiring diagram. Consult electrical data tables for correct fuse size.

TRANSFORMER

All 208/230V units are factory wired for 230V operation. The transformer may be switched to the 208V tap as illustrated on the wiring diagram by switching the 208V and 230V wires at the contactor terminal.

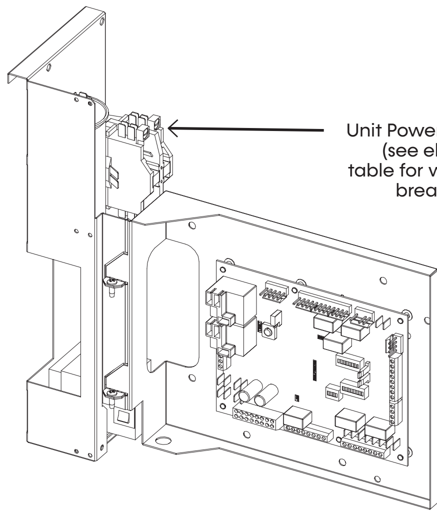
Electrical: Power Wiring

Model:
MJ
024-060

⚠ WARNING

Electrical shock hazard - Lock unit disconnect switch in open position before servicing unit. Failure to follow this warning could result in property damage, personal injury, or death.

Figure 34: Indoor Compressor Section (MJ) Line Voltage Field Wiring



HWG WIRING

208-230 Volt Operation

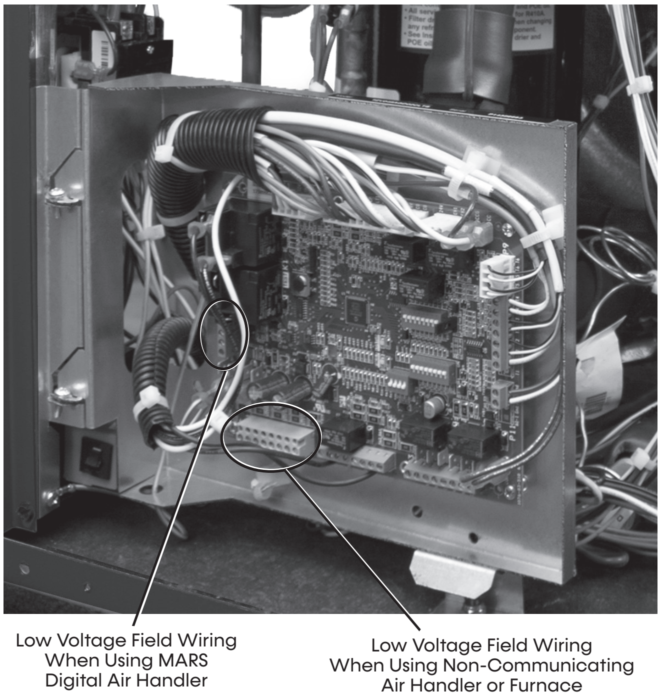
Verify transformer tap with air handler wiring diagram to ensure that the transformer tap is set to the correct voltage, 208V or 230V.

See wiring diagrams for 115V and 230V.

Model:
MJ
024-060

Electrical: Low-Voltage Wiring

Figure 35: MJ Low Voltage Field Wiring



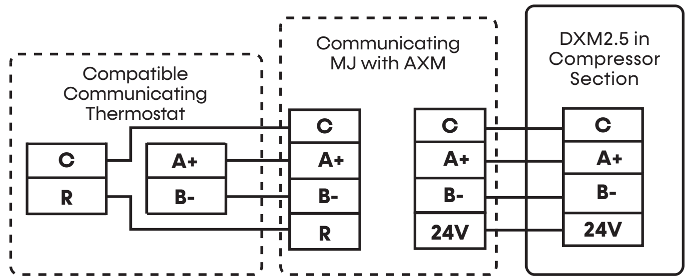
CONNECTION TO COMPATIBLE COMMUNICATING THERMOSTATS AND AXM COMMUNICATING CONTROL IN MARS DIGITAL AIR HANDLER

AXM Communicating Controls in MARS Premier Series Air Handler allows 4-wire connection with DXM2.5 Advanced Communicating Controls and a compatible communicating thermostat.

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 need to be sealed to prevent erroneous temperature measurement due to air infiltration through the wall cavity. Thermostat wire must be 18 AWG or larger. Wire the appropriate thermostat as shown in Figures 37-39. Most heat-pump thermostats are compatible with MARS units, provided the have the appropriate number of heating and cooling stages. However, using a compatible communicating thermostat is highly recommended for on-site, easy configuration, monitoring, and diagnosis.

Figure 36: Connection to a Compatible Communicating Thermostat

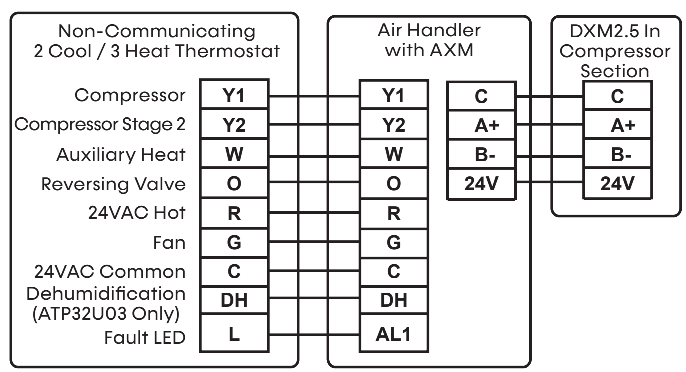


Thermostat connections:

- **C** = 24V Common for Control Circuit
- **R** = 24V Supply for Control Circuit
- **A+** = Communications (Positive)
- **B–** = Communications (Negative)

NOTE: 4-wire connections can ONLY be used when a communicating air handler and the AWC Thermostat is used. The thermostat can be connected either to the air handler (AXM) or compressor section (DXM2.5) when all are communicating.

Figure 37: Connection to Non-Communicating Thermostat and AXM Communicating Control in MARS MA Premier Air Handler

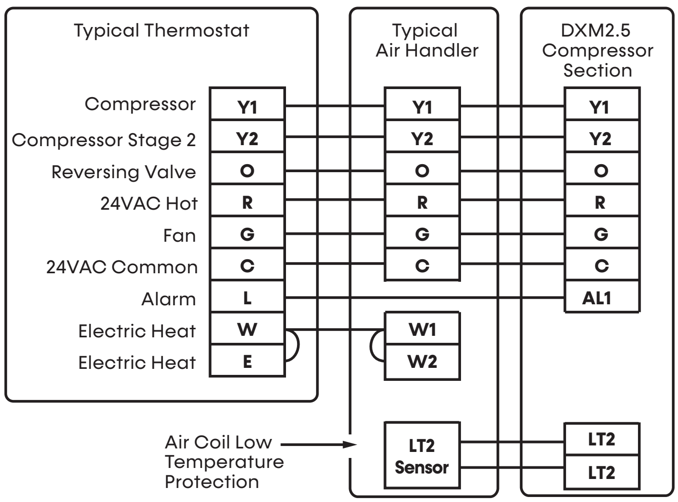


When a non-communicating thermostat is used to control the system, a compatible communicating thermostat must be installed to maintain proper system communications and operation. Install the thermostat at an inconspicuous location near the air handler and wire it to the TB1 terminal strip of the AXM. Set the thermostat to the OFF mode.

Electrical: Low-Voltage Wiring

Model:
MJ
024-060

Figure 38: Connection to Non-Communicating Thermostat and Non-communicating Air Handler/Furnace



NOTE: Air coil low-temperature protection is not active if LT2 sensor is not installed or installed incorrectly.

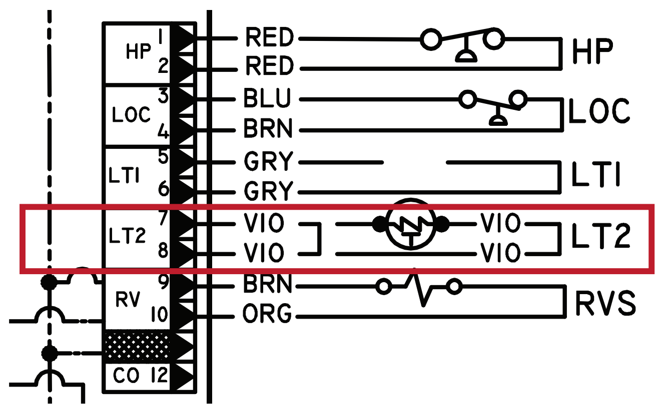
LT2 SENSOR

An LT2 air coil low-temperature protection sensor is factory installed on the MA air handler and is available as an option for the MK cased coils. Install the LT2 sensor on the cased coil as indicated in Figure 24 of this manual using thermal compound and the supplied mounting clip. Ensure that the sensor makes good thermal contact and insulate the sensor.

An optional LT2 sensor kit may be ordered using part number S17S0031N12.

Mount the LT2 sensor to the cased coil. On the DXM2.5 in the compressor section, clip the VIO wires (see diagram) and wire the violet leads from LT2 sensor to the violet leads clipped on the DXM2.5.

Figure 39: DXM2.5 LT2 VIO Connection



⚠ CAUTION

Refrigerant pressure-activated water regulating valves should never be used with MARS equipment.

⚠ CAUTION

If a communicating thermostat is not installed, a communicating service tool must be used to configure and diagnose this system.

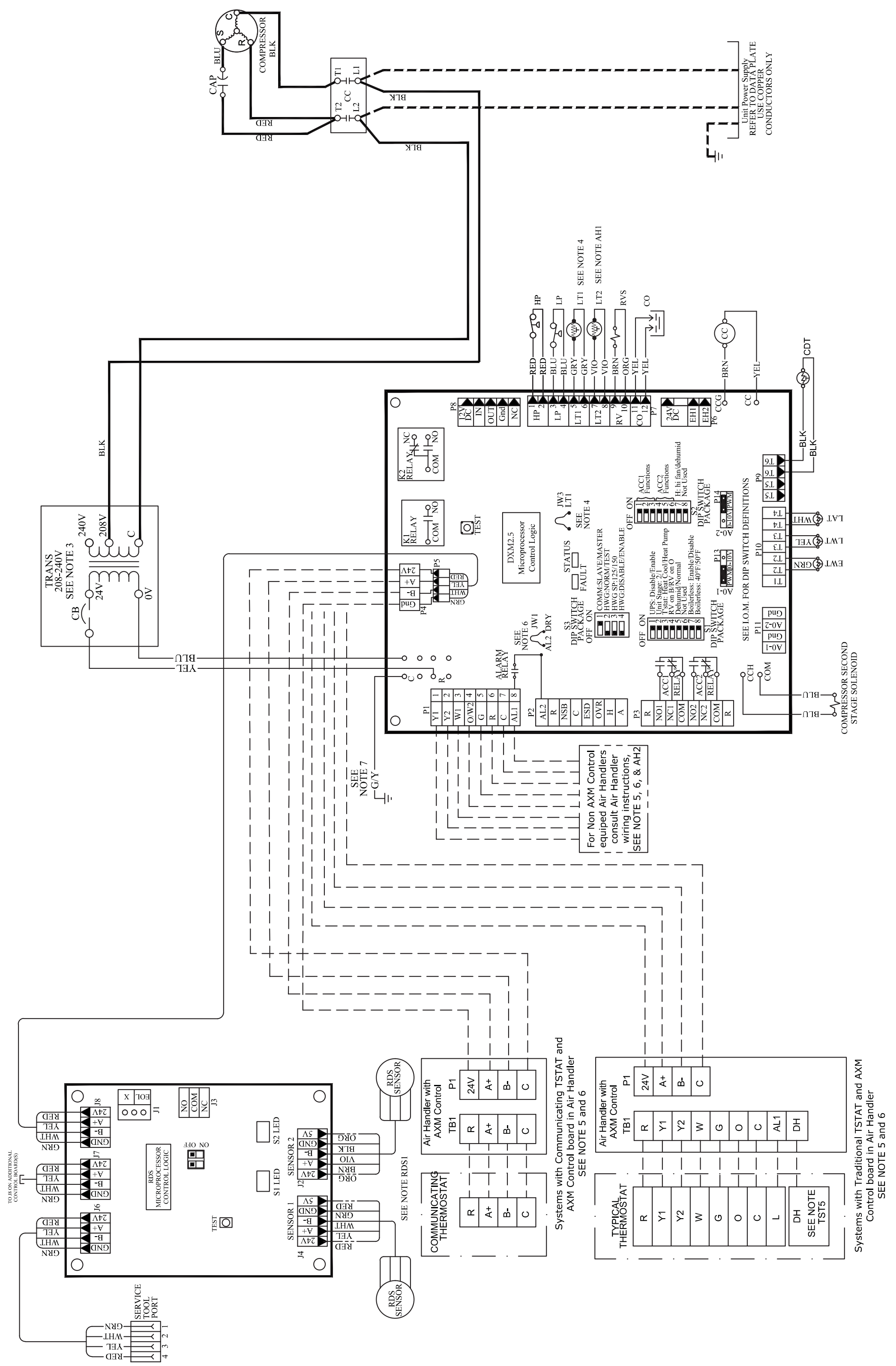
Model:
MJ
024-060

DXM2.5 Advanced Communicating Controls

DXM2.5 Advanced Communicating Controls
For detailed controller information, see the DXM2.5 Application, Operation, and Maintenance (AOM) manual (part # 97B0142N01). To confirm the controller type of your particular unit, refer to digit 9 on the unit model number and the unit nomenclature diagram found on page 3 of this manual.

Example Wiring Diagram

Model:
MJ
024-060



Model:
MJ
024-060

Unit Operating and Commissioning Limits

OPERATING LIMITS

Environment – MJ units are designed for indoor installation only. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air).

Power Supply – Voltage utilization shall comply with AHRI Standard 110 or values provided in the electrical data tables.

Determination of operating limits is dependent primarily upon three factors: 1) return air temperature. 2) water temperature, and 3) ambient temperature. When any one of these factors is at minimum or maximum levels, the other two factors should be at normal levels to ensure proper unit operation. Extreme variations in temperature and humidity and/or corrosive water or air will adversely affect unit performance, reliability, and service life.

COMMISSIONING CONDITIONS

Starting conditions vary depending upon model and are based upon the following notes:

NOTES:

1. Commissioning Conditions are not normal or continuous operating conditions. Minimum/ maximum limits are startup conditions to bring the building space up to occupancy temperatures. Units are not designed to operate under these conditions on a regular basis.
2. Voltage utilization range complies with AHRI Standard 110.

Table 11: Operating Limits

Operating Limits	Cooling	Heating
Air Limits		
Min. ambient air, DB	*10°F [-12°C]	*10°F [-12°C]
Max. ambient air, DB	130°F [54.4°C]	130°F [54.4°C]
Min. entering air, DB/WB	65/45°F [18/7°C]	50°F [10°C]
Max. entering air, DB/WB	90/72°F [32/22°C]	80°F [27°C]
Min/Max Airflow (CFM/Ton)	**300 to 500 CFM/Ton	
Water Limits		
Min. entering water	***30°F [-1°C]	20°F [-6.7°C]
Max. entering water	120°F [49°C]	90°F [32°C]
Water Flow Range	1.5 to 3.0 GPM/ton [1.6 to 3.2 l/m per kW]****	

Notes:
*To prevent unit damage, the water loop should contain antifreeze to prevent freezing when not in operation.
** Refer to specific blower tables for each model size
***With unit flow-control automation.
**** Unless specified different on performance table for any model size

Table 12: Commissioning Conditions

Commissioning Conditions	Cooling	Heating
Air Limits		
Min. ambient air, DB	*10°F [-12°C]	*10°F [-12°C]
Max. ambient air, DB	130°F [54.4°C]	130°F [54.4°C]
Min. entering air, DB/WB	65/45°F [18/7°C]	[2]40°F [4.4°C]
Max. entering air, DB/WB	[1]100/75°F [38/24°C]	80°F [27°C]
Min/Max Airflow (CFM/Ton)	**300 to 500 CFM/Ton	
Water Limits		
Min. entering water	***20°F [-6.7°C]	20°F [-6.7°C]
Max. entering water	120°F [49°C]	90°F [32°C]
Water Flow Range	1.5 to 3.0 GPM/ton [1.6 to 3.2 l/m per kW]****	

Notes:
*To prevent unit damage, the water loop should contain antifreeze to prevent freezing when not in operation.
** Refer to specific blower tables for each model size
***With unit flow-control automation.
**** Unless specified different on performance table for any model size
1. Commission units for cooling at entering air temperatures of 100/75°F (38/24°C) only at rated water flow or 3 GPM/ton.
2. Commission units for heating at entering air temperature of 40°F (4.4°C) only at rated water flow or 3 GPM/ton.

Unit and System Checkout

Model:
MJ
024-060

⚠ 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.

UNIT AND SYSTEM CHECKOUT

BEFORE POWERING SYSTEM, please check the following:

UNIT FEATURES

- ☐ **Shutoff valves:** Ensure all isolation valves are open and water control valves are wired.
- ☐ **Line voltage and wiring:** Verify that voltage is within an acceptable range for the unit and wiring and fuses/breakers are properly sized. Verify that low voltage wiring is complete.
- ☐ **Unit control transformer:** Ensure transformer has the properly selected voltage tap. Residential 208-230V units are factory wired for 230V operation unless specified otherwise.
- ☐ **Loop/water piping:** Ensure loop or water piping is complete and purged of air. Water/piping is clean.
- ☐ **Antifreeze:** Has been added if necessary.
- ☐ **Entering water and air:** Ensure entering water and air temperatures are within operating limits of Table 11 and Table 12.
- ☐ **Low water-temperature cutout:** Verify that low water-temperature cutout on the DXM2.5 is properly set.
- ☐ **Unit fan:** Manually rotate fan to verify free rotation and ensure blower wheel is secured to the motor shaft. Be sure to remove any shipping supports if needed. DO NOT oil motors upon startup. Fan motors are pre-oiled at the factory. Check unit fan CFM selection and compare to design requirements.
- ☐ **Condensate line:** Verify condensate line is open and properly pitched toward drain.
- ☐ **Water flow balancing:** Record inlet and outlet water temperatures for each heat pump upon startup. This check can eliminate nuisance trip outs and high velocity water flow that could erode heat exchangers.
- ☐ **Hot Water Generator:** Ensure HWG is switched off at SW 3-4 unless piping is completed and air has been purged from the system.
- ☐ **Unit air coil and filters:** Ensure filter is clean and accessible. Clean air coil of all manufacturing oils.
- ☐ **Unit controls:** Verify DXM2.5 field selection options are properly set. Low-voltage wiring is complete.
- ☐ Blower CFM and Water ΔT is set on communicating thermostats or diagnostic tool.
- ☐ Service/access panels are in place.

SYSTEM CHECKOUT

- ☐ **System water temperature:** Check water temperature for proper range. Verify heating and cooling set points for proper operation.
- ☐ **System pH:** Check and adjust water pH if necessary to maintain a level between 6 and 8.5. Proper pH promotes longevity of hoses and fittings (see Table 7).
- ☐ **System flushing:** Verify all hoses are connected end-to-end when flushing to ensure that debris bypasses the unit heat exchanger, water valves and other components. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify all air is purged from the system. Air in the system can cause poor operation or system corrosion.
- ☐ **System controls:** Verify system controls function and operate in the proper sequence.
- ☐ **Low water temperature cutout:** Verify low water-temperature cutout controls are provided for the outdoor portion of the loop. (LT1 - JW3)
- ☐ **Miscellaneous:** Note any questionable aspects of the installation.

⚠ CAUTION

Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

⚠ CAUTION

To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to the water loop. Heat exchangers never fully drain by themselves and will freeze unless winterized with antifreeze.

Model:
MJ
024-060

Unit Startup Procedure

UNIT STARTUP PROCEDURE

1. Turn the thermostat fan position to ON. The system blower should start.
2. Turn blower off.
3. Ensure all valves are adjusted to their full open position. Ensure line power to the heat pump is on.
4. Room temperature should be within the minimum-maximum ranges listed in the unit IOM. During start-up checks, loop water temperature entering the heat pump should be between 30°F (-1°C) and 95°F (35°C).
5. It is recommended that water-to-air units be first started in the cooling mode, when possible. This will allow liquid refrigerant to flow through the filter-drier before entering the TXV, allowing the filter-drier to catch any debris that might be in the system before it reaches the TXV.
6. Two factors determine the operating limits of geothermal heat pumps, (a) return air temperature, and (b) entering water temperature. When either of the factors is at a minimum or maximum level, the other factor must be at normal levels to ensure proper unit operation.

    a. Place the unit in **Manual Operation**. When in Manual Operation activate Y1, Y2, and O to initiate the cooling mode. Also manually increase CFM until desired cooling CFM is achieved. Next, adjust pump speed percentage until desired loop-temperature difference (leaving water temperature minus entering water temperature) is achieved. (For modulating valve adjust valve %).

```
INSTALLER SETTINGS

THERMOSTAT CONFIG
SYSTEM CONFIG
ACCESSORY CONFIG
INPUT DEALER INFO
HUMIDITY CONFIG
TEMPERATURE ALGORITHM
DEMAND REDUCTION CNFG
SERVICE MODE
RESTORE DEFAULTS

AWC99U01
SELECT OPTION ▲▼
◄ PREVIOUS
```

```
SERVICE MODE

MANUAL OPERATION
CONTROL DIAGNOSTICS
DIPSWITCH CONFIG
FAULT HISTORY
CLEAR FAULT HISTORY

SELECT OPTION ▲▼
◄ PREVIOUS                SELECT ■
```

```
MANUAL OPERATING MODE

Y1    COMM   OUTPUT       OFF
Y2    COMM   OUTPUT       OFF
W     COMM   OUTPUT       OFF
O     COMM   OUTPUT       OFF
G     COMM   OUTPUT       OFF
H     COMM   OUTPUT       OFF
DH    COMM   OUTPUT       OFF
ECM   AIRFLOW               0
PUMP  SPEED                0%
TEST  MODE                OFF

SELECT OPTION ▲▼
◄ PREVIOUS           SELECT ■
```

    b. A few minutes after the unit starts operating, check for cool air at the unit's grille.

    NOTE: Units have a 5-minute time delay in the control circuit that can be bypassed on the DXM2.5 by placing the unit in the Test mode as shown in the unit IOM. Check for normal air temperature drop of 15°F to 25°F (cooling mode).

    c. Verify that the compressor is on and that the water temperature rise (cooling mode) is within normal range.

Table 13: Water-Temperature Rise

Water Flow, gpm (l/m)	Rise, Cooling °F
For Closed Loop: Ground-Source or Closed-Loop Systems at 3 gpm per ton (3.9 l/m per kw)	9 - 12
For Open Loop: Ground-Water Systems at 1.5 gpm per ton (2.0 l/m per kw)	20 - 26

    d. Check the elevation and cleanliness of the condensate lines. Dripping may be a sign of a blocked line. Check that the condensate trap is filled to provide a water seal.

Unit Startup Procedure

e. Turn thermostat to "OFF" position. A hissing noise indicates proper functioning of the reversing valve.

7. Allow five (5) minutes between tests for pressure to equalize before beginning heating test.

   a. Go into Manual Mode to activate Y1 and Y2 for Heating. Also manually increase CFM until desired heating CFM is achieved. Next adjust pump speed percentage until desired loop-temperature difference (entering water temperature minus leaving water temperature) is achieved. For modulating valves, adjust valve percentage.

   b. A few minutes after the unit starts operating, check for warm air at the unit's grille.

   NOTE: Units have a 5-minute time delay in the control circuit that can be bypassed on the DXM2.5 by placing the unit in the Test mode as shown in the unit IOM. Check for normal air temperature rise of 20°F to 30°F (heating mode).

   c. Verify that the compressor is on and that the water temperature fall (heating mode) is within normal range.

   d. Check for vibration, noise, and water leaks.

Table 14: Water-Temperature Fall

Water Flow, gpm (l/m)	Drop, Heating °F
For Closed Loop: Ground-Source or Closed-Loop Systems at 3 gpm per ton (3.9 l/m per kw)	4 - 8
For Open Loop: Ground-Water Systems at 1.5 gpm per ton (2.0 l/m per kw)	10 - 17

8. If the unit fails to operate properly, perform troubleshooting analysis (see troubleshooting section in the unit IOM). If the check described fails to reveal the problem and the unit still does not operate, contact a trained service technician to ensure proper diagnosis and repair of the equipment.

9. When testing is complete, exit the Installer Menu and set thermostat to maintain desired comfort level for normal operation.

Unit performance may be verified by calculating the unit's Heat of Rejection and heat of extraction. Heat of Rejection (HR) can be calculated and compared to the performance data pages in this IOM. The formula for HR is as follows:

HR = TD x GPM x 500 (or 485 for antifreeze solutions)

where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM determined by comparing the unit heat exchanger pressure drop to Table 15.

Heat of Extraction (HE) can also be calculated and compared to the performance data pages in this IOM. The formula for HE is as follows:

HE = TD x GPM x 500 (or 485 for antifreeze solutions)

where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM determined by comparing the unit heat exchanger pressure drop to Table 15.

If performance during any mode appears abnormal, refer to the DXM2.5 section or troubleshooting section of this manual.

AIR COIL

To obtain maximum performance of a newly manufactured air coil, it should be cleaned before startup. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. A thorough water rinse should follow.

Model:
MJ
024-060

Unit Operating Conditions

Table 15: MJ Coax Water Pressure Drop

Model	U.S. GPM	Pressure Drop, psi [kPa]				
		30°F [-1°C]	50°F [10°C]	70°F [21°C]	90°F [32°C]	110°F [43°F]
MJ024	2.20	0.8	0.5	0.4	0.3	0.3
	3.00	1.3	0.8	0.6	0.6	0.5
	4.50	2.4	1.6	1.3	1.2	1.1
	6.00	3.5	2.5	2.1	2.0	1.8
MJ036	3.40	1.0	0.7	0.6	0.6	0.6
	4.50	1.6	1.1	1.0	0.9	0.9
	6.80	3.0	2.0	1.7	1.7	1.6
	9.00	4.4	3.3	2.8	2.7	2.6
MJ048	4.20	0.6	0.6	0.7	0.7	0.5
	6.00	1.4	1.2	1.1	1.0	1.0
	9.00	3.0	2.6	2.3	2.1	2.0
	12.00	4.9	4.4	4.0	3.6	3.3
MJ060	5.25	1.6	1.3	1.1	1.0	1.0
	7.50	2.6	2.3	2.0	1.9	1.7
	11.25	5.1	4.4	4.0	3.7	3.4
	15.00	8.2	7.2	6.5	6.1	5.6

*Based on 20% methanol antifreeze solution.

Table 16: Water Temperature Change Through Heat Exchanger

Water Flow, gpm (l/m)	Rise, Cooling °F	Drop, Heating °F
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton (3.9 l/m per kw)	9 - 12	4 - 9
For Open Loop: Ground Water Systems at 1.5 gpm per ton (2.0 l/m per kw)	18 - 24	7 - 19

Table 17: Antifreeze Correction

Antifreeze Type	Antifreeze %	Cooling			WPD Correction Factor EWT 40°F
		EWT 40°F			
		Total Cap	Sens Cap	Power	
Propylene Glycol	15	0.968	0.968	0.990	1.210
	25	0.947	0.947	0.983	1.360
Methanol	15	0.968	0.968	0.990	1.160
	25	0.949	0.949	0.984	1.220
Ethanol	15	0.944	0.944	0.983	1.300
	25	0.917	0.917	0.974	1.360
Ethylene Glycol	15	0.980	0.980	0.994	1.120
	25	0.966	0.966	0.990	1.200

Unit Operating Conditions

Model:
MJ
024-060

Operating Pressure/Temperature tables include the following notes:

- Airflow is at nominal (rated) conditions
- Entering air is based upon 70°F (21°C) DB in heating and 80/67°F (27/19°C) DB/WB in cooling
- Subcooling is based upon head pressure at compressor service port
- Cooling air and water values can vary greatly with changes in humidity level

MJ Series Typical Unit Operating Pressures and Temperatures

MJ024		Full Load Cooling- without HWG active						Full Load Heating- without HWG active					
Entering Water Temp °F	Water Flow GPM	Discharge Pressure PSIG	Suction Pressure PSIG	Superheat °F	Subcooling °F	Water Temp Rise°F	Air Temp Drop °F DB	Discharge Pressure PSIG	Suction Pressure PSIG	Superheat °F	Subcooling °F	Water Temp Drop °F	Air Temp Rise °F DB
30[1]	3	167-177	99-109	33-37	13-17	15-25	12-22	276-286	60-70	8-12	7-11	2-12	13-23
	4.5	152-162	96-106	35-39	12-16	10-20	12-22	278-288	62-72	8-12	7-11	1-11	14-24
	6	136-146	94-104	37-41	11-15	5-15	11-21	281-291	65-75	8-12	7-11	0-10	14-24
50	3	216-226	110-120	27-31	11-15	15-25	13-23	294-304	86-96	8-12	8-12	4-14	18-28
	4.5	201-211	107-117	29-33	10-14	10-20	13-23	297-307	88-98	8-12	8-12	3-13	18-28
	6	186-196	105-115	32-36	9-13	5-15	13-23	300-310	90-100	8-12	8-12	1-11	19-29
70	3	282-292	121-131	19-23	9-13	15-25	15-25	325-335	116-126	10-14	9-13	6-16	23-33
	4.5	268-278	118-128	21-25	8-12	10-20	14-24	327-337	118-128	10-14	9-13	4-14	23-33
	6	252-262	116-126	23-27	8-12	5-15	14-24	330-340	121-131	10-14	9-13	3-13	24-34
90	3	365-375	130-140	12-16	9-13	15-25	15-25	393-403	154-164	15-19	10-14	7-17	33-43
	4.5	350-360	128-138	14-18	8-12	10-20	15-25	396-406	157-167	15-19	10-14	6-16	34-44
	6	335-345	125-135	16-20	7-11	5-15	14-24	398-408	159-169	15-19	11-15	4-14	34-44
120	3	515-525	137-147	12-16	11-15	15-25	12-22						
	4.5	500-510	135-145	14-18	10-14	9-19	12-22						
	6	485-495	132-142	16-20	9-13	4-14	12-22						

1. Based on 20% methanol antifreeze solution
- For servicing the unit, HWG option must be disabled

MJ036		Full Load Cooling- without HWG active						Full Load Heating- without HWG active					
Entering Water Temp °F	Water Flow GPM	Discharge Pressure PSIG	Suction Pressure PSIG	Superheat °F	Subcooling °F	Water Temp Rise°F	Air Temp Drop °F DB	Discharge Pressure PSIG	Suction Pressure PSIG	Superheat °F	Subcooling °F	Water Temp Drop °F	Air Temp Rise °F DB
30[1]	4.5	156-166	105-115	14-18	11-15	17-27	14-24	271-281	59-69	15-19	3-7	4-14	14-24
	6.75	142-152	103-113	16-20	10-14	12-22	14-24	273-283	61-71	14-18	3-7	2-12	15-25
	9	129-139	101-111	19-23	9-13	6-16	14-24	276-286	63-73	14-18	3-7	0-10	15-25
50	4.5	209-219	122-132	12-16	7-11	18-28	18-28	289-299	84-94	14-18	4-8	5-15	19-29
	6.75	196-206	120-130	14-18	6-10	12-22	17-27	292-302	86-96	14-18	4-8	3-13	20-30
	9	183-193	118-128	17-21	5-9	6-16	17-27	295-305	89-99	13-17	4-8	1-11	20-30
70	4.5	271-281	127-137	11-15	8-12	17-27	18-28	323-333	115-125	15-19	4-8	7-17	25-35
	6.75	257-267	125-135	14-18	7-11	12-22	18-28	326-336	117-127	15-19	5-9	5-15	26-36
	9	244-254	123-133	17-21	6-10	6-16	17-27	328-338	120-130	15-19	5-9	3-13	26-36
90	4.5	352-362	130-140	11-15	10-14	17-27	16-26	362-372	146-156	18-22	5-9	8-18	28-38
	6.75	339-349	128-138	14-18	9-13	11-21	16-26	364-374	149-159	18-22	5-9	6-16	28-38
	9	325-335	126-136	16-20	8-12	6-16	16-26	367-377	151-161	18-22	5-9	4-14	29-39
120	4.5	538-548	153-163	9-13	12-16	17-27	13-23						
	6.75	525-535	151-161	11-15	11-15	11-21	13-23						
	9	511-521	148-158	14-18	10-14	5-15	13-23						

1. Based on 20% methanol antifreeze solution
- For servicing the unit, HWG option must be disabled

Model:
MJ
024-060

Unit Operating Conditions

MJ048		Full Load Cooling- without HWG active						Full Load Heating- without HWG active					
Entering Water Temp °F	Water Flow GPM	Discharge Pressure PSIG	Suction Pressure PSIG	Superheat °F	Subcooling °F	Water Temp Rise°F	Air Temp Drop °F DB	Discharge Pressure PSIG	Suction Pressure PSIG	Superheat °F	Subcooling °F	Water Temp Drop °F	Air Temp Rise °F DB
30[1]	6	168-178	98-108	33-37	10-14	16-26	13-23	271-281	53-63	10-14	5-9	3-13	14-24
	9	152-162	95-105	37-41	10-14	11-21	13-23	272-282	54-64	10-14	5-9	3-13	14-24
	12	136-146	91-101	41-45	10-14	5-15	12-22	279-289	61-71	11-15	6-10	0-10	16-26
50	6	218-228	117-127	16-20	5-9	17-27	17-27	300-310	83-93	9-13	5-9	5-15	20-30
	9	202-212	114-124	20-24	5-9	11-21	16-26	301-311	84-94	9-13	5-9	4-14	21-31
	12	186-196	111-121	24-28	5-9	6-16	16-26	308-318	91-101	10-14	5-9	1-11	22-32
70	6	281-291	125-135	9-13	5-9	17-27	17-27	338-348	118-128	11-15	6-10	6-16	27-37
	9	265-275	122-132	13-17	5-9	11-21	17-27	339-349	119-129	11-15	6-10	6-16	27-37
	12	249-259	118-128	18-22	5-9	6-16	16-26	346-356	125-135	13-17	7-11	3-13	28-38
90	6	359-369	127-137	9-13	8-12	16-26	16-26	383-393	154-164	16-20	8-12	8-18	33-43
	9	343-353	124-134	13-17	8-12	11-21	15-25	384-394	155-165	17-21	8-12	8-18	33-43
	12	327-337	121-131	17-21	8-12	5-15	15-25	391-401	162-172	18-22	8-12	5-15	35-45
120	6	503-513	135-145	10-14	11-15	16-26	13-23						
	9	487-497	131-141	14-18	11-15	10-20	13-23						
	12	471-481	128-138	18-22	11-15	5-15	12-22						

1. Based on 20% methanol antifreeze solution

- For servicing the unit, HWG option must be disabled

MJ060		Full Load Cooling- without HWG active						Full Load Heating- without HWG active					
Entering Water Temp °F	Water Flow GPM	Discharge Pressure PSIG	Suction Pressure PSIG	Superheat °F	Subcooling °F	Water Temp Rise°F	Air Temp Drop °F DB	Discharge Pressure PSIG	Suction Pressure PSIG	Superheat °F	Subcooling °F	Water Temp Drop °F	Air Temp Rise °F DB
30[1]	7.5	152-162	102-112	33-37	8-12	14-24	11-21	269-279	57-67	13-17	3-7	4-14	15-25
	11.25	138-148	98-108	36-40	8-12	9-19	11-21	269-279	56-66	13-17	3-7	4-14	14-24
	15	125-135	95-105	39-43	8-12	3-13	11-21	277-287	63-73	13-17	3-7	0-10	16-26
50	7.5	213-223	119-129	16-20	5-9	17-27	17-27	287-297	81-91	14-18	4-8	5-15	19-29
	11.25	199-209	116-126	19-23	5-9	11-21	17-27	286-296	80-90	14-18	4-8	5-15	19-29
	15	186-196	112-122	22-26	5-9	6-16	16-26	294-304	87-97	15-19	5-9	1-11	21-31
70	7.5	282-292	125-135	11-15	7-11	17-27	18-28	313-323	106-116	18-22	5-9	6-16	24-34
	11.25	268-278	121-131	14-18	7-11	11-21	17-27	312-322	105-115	18-22	5-9	6-16	23-33
	15	254-264	118-128	17-21	7-11	6-16	17-27	320-330	112-122	19-23	5-9	2-12	25-35
90	7.5	361-371	126-136	12-16	10-14	16-26	16-26	343-353	130-140	24-28	6-10	7-17	28-38
	11.25	348-358	123-133	15-19	10-14	11-21	16-26	342-352	129-139	24-28	6-10	8-18	28-38
	15	334-344	119-129	18-22	10-14	5-15	16-26	351-361	136-146	25-29	6-10	3-13	30-40
120	7.5	509-519	138-148	10-14	10-14	16-26	14-24						
	11.25	495-505	134-144	13-17	10-14	10-20	14-24						
	15	481-491	131-141	16-20	10-14	5-15	14-24						

1. Based on 20% methanol antifreeze solution

- For servicing the unit, HWG option must be disabled

Performance Data
MJ024 - Full Load with Variable Water Flow

Model:
MJ
024-060

800 CFM Rated Airflow

EWT °F	WPD			Cooling - EAT 80/67°F						HWG Cap	WPD			HEATING - EAT 70°F					
	FLOW GPM	PSI	FT	TC	SC	Power kW	HR	EER	LWT		FLOW GPM	PSI	FT	HC	Power kW	HE	COP	LWT	HWG Cap
20	Operation Not Recommended										6.00	1.4	3.1	15.0	1.47	10.0	3.0	16.5	1.5
30	1.86	0.1	0.2	24.1	15.3	1.13	27.9	21.4	60.0	1.4	3.00	0.3	0.7	16.7	1.47	11.6	3.3	21.9	1.6
											4.50	0.9	2.0	17.1	1.48	12.0	3.4	24.4	1.8
											6.00	1.4	3.3	17.5	1.49	12.4	3.4	25.7	1.8
40	2.80	0.4	0.8	24.3	15.6	1.08	28.0	22.5	60.0	1.4	3.00	0.2	0.5	20.5	1.52	15.3	4.0	34.3	2.0
											4.50	0.8	1.8	20.9	1.53	15.7	4.0	37.7	2.1
											6.00	1.3	3.1	21.3	1.53	16.1	4.1	39.4	2.2
50	3.00	0.4	0.9	24.5	16.2	1.18	28.6	20.7	69.8	1.5	3.00	0.2	0.4	21.8	1.53	16.6	4.2	38.5	2.4
	4.50	0.8	1.9	24.4	15.9	1.13	28.2	21.7	63.1	1.4	4.50	0.7	1.7	22.2	1.54	17.0	4.2	42.1	2.5
	6.00	1.3	2.9	24.3	15.7	1.07	27.9	22.7	59.7	1.4	6.00	1.3	3.0	22.6	1.55	17.3	4.3	44.0	2.6
60	3.00	0.3	0.7	24.5	16.8	1.30	28.9	18.9	80.1	1.9	3.00	0.1	0.2	24.5	1.58	19.1	4.5	46.7	2.7
	4.50	0.8	1.8	24.4	16.6	1.24	28.6	19.6	73.3	1.6	4.50	0.7	1.5	24.9	1.59	19.4	4.6	51.0	2.9
	6.00	1.2	2.8	24.3	16.3	1.19	28.3	20.4	69.8	1.4	6.00	1.2	2.8	25.2	1.60	19.8	4.6	53.1	3.0
70	3.00	0.3	0.6	24.3	17.3	1.44	29.2	16.9	90.3	2.4	3.00	0.1	0.1	27.1	1.63	21.5	4.9	55.0	3.1
	4.50	0.7	1.7	24.1	17.0	1.38	28.8	17.5	83.4	2.0	4.50	0.6	1.4	27.4	1.64	21.9	4.9	59.8	3.3
	6.00	1.2	2.7	24.0	16.8	1.32	28.5	18.1	79.9	1.9	6.00	1.2	2.7	27.8	1.65	22.2	5.0	62.3	3.4
80	3.00	0.2	0.6	23.8	17.6	1.59	29.2	14.9	100.4	3.1	3.00	0.1	0.3	29.6	1.69	23.8	5.1	63.3	3.4
	4.50	0.7	1.6	23.7	17.3	1.54	28.9	15.4	93.5	2.6	4.50	0.7	1.6	30.0	1.70	24.2	5.2	68.7	3.5
	6.00	1.1	2.6	23.5	17.0	1.48	28.6	15.9	90.0	2.4	6.00	1.3	2.9	30.4	1.71	24.6	5.2	71.4	3.5
90	3.00	0.2	0.5	23.1	17.6	1.77	29.1	13.0	110.5	3.8	2.59	0.1	0.2	31.8	1.75	25.9	5.3	70.0	3.5
	4.50	0.7	1.5	23.0	17.3	1.72	28.8	13.4	103.5	3.3									
	6.00	1.1	2.6	22.8	17.0	1.66	28.5	13.8	100.0	3.0									
100	3.00	0.2	0.4	22.2	17.2	1.97	28.9	11.2	120.4	4.6	1.72	0.1	0.2	31.8	1.75	25.9	5.3	70.0	3.5
	4.50	0.6	1.4	22.1	16.9	1.92	28.6	11.5	113.5	4.0									
	6.00	1.1	2.5	21.9	16.7	1.86	28.3	11.8	110.0	3.8									
110	3.00	0.1	0.3	21.1	16.5	2.20	28.6	9.6	130.4	5.5	1.29	0.1	0.2	31.8	1.75	25.9	5.3	70.0	3.5
	4.50	0.6	1.4	21.0	16.2	2.14	28.3	9.8	123.4	4.9									
	6.00	1.0	2.4	20.9	15.9	2.09	28.0	10.0	120.0	4.6									
120	3.00	0.1	0.2	19.8	15.3	2.45	28.2	8.1	140.3	6.5	1.03	0.1	0.2	31.8	1.75	25.9	5.3	70.0	3.5
	4.50	0.6	1.3	19.7	15.0	2.39	27.9	8.2	133.4	5.8									
	6.00	1.0	2.3	19.6	14.7	2.34	27.5	8.4	129.9	5.5									

- Interpolation is permissible; extrapolation is not.
- All entering air conditions are 80°F (26.6°C) DB and 67°F (19.4°C) WB in cooling, and 70°F (21°C) DB in heating.
- AHRI/ISO certified conditions are 80.6°F (27°C) DB and 66.2°F (19°C) WB in cooling and 68°F (20°C) DB in heating.
- Table does not reflect fan or pump power corrections for AHRI/ISO conditions.
- All performance is based upon the lower voltage of dual voltage rated units.
- Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.
- Operation below 50°F (10.0°C) EWT is based upon 15% methanol antifreeze solution.
- Operation below 60°F (15.5°C) EWT requires optional insulated water/refrigerant circuit.
- See performance correction tables for operating conditions other than those listed above.
- See Performance Data Selection Notes for operation in the shaded areas.
- Regular Cooling operation with an EWT of less than 50°F (10.0°C) is not recommended unless variable water flow is available.
- Regular Heating operation with an EWT of more than 90°F (32°C) is not recommended unless variable water flow is available.
- For quiet operation and long term reliability, it is recommended that systems be designed to avoid continuous operation in the outlined areas.
- Performance capacities shown in thousands of Btuh.

Model:
MJ
024-060

Performance Data:
MJ036 - Full Load with Variable Water Flow

1,200 CFM Rated Airflow

EWT °F	WPD			Cooling - EAT 80/67°F						HWG Cap	WPD			HEATING - EAT 70°F					
	FLOW GPM	PSI	FT	TC	SC	Power kW	HR	EER	LWT		FLOW GPM	PSI	FT	HC	Power kW	HE	COP	LWT	HWG Cap
20	Operation Not Recommended										9.00	8.9	20.6	25.8	2.29	18.0	3.3	15.8	1.9
30											4.50	2.6	6.1	25.7	2.18	18.3	3.5	21.5	2.2
	3.03	2.1	4.8	39.5	25.5	1.74	45.5	22.7	60.0	1.8	6.75	4.9	11.3	26.5	2.19	19.0	3.5	24.1	2.4
											9.00	7.2	16.6	27.2	2.21	19.7	3.6	25.4	2.4
40											4.50	0.8	1.7	31.0	2.25	23.3	4.0	34.2	2.7
	4.77	2.2	5.2	41.7	28.4	1.75	47.7	23.8	60.0	1.8	6.75	3.0	7.0	31.7	2.26	24.0	4.1	37.6	2.8
											9.00	5.3	12.2	32.5	2.28	24.7	4.2	39.3	2.9
50	4.50	1.7	4.0	41.8	29.6	1.90	48.3	22.0	72.4	1.8	4.50	0.3	0.7	33.2	2.30	25.4	4.2	38.3	3.1
	6.75	3.6	8.2	41.8	29.2	1.83	48.0	22.8	64.8	1.8	6.75	2.6	6.0	33.9	2.32	26.0	4.3	42.0	3.3
	9.00	5.4	12.4	41.8	28.8	1.77	47.8	23.7	61.1	1.8	9.00	4.9	11.3	34.7	2.33	26.7	4.4	43.8	3.4
60	4.50	1.4	3.1	41.2	30.1	2.05	48.1	20.1	82.3	2.5	4.50	0.1	0.2	37.7	2.42	29.4	4.6	46.4	3.6
	6.75	3.2	7.3	41.2	29.7	1.98	47.9	20.8	74.8	2.0	6.75	2.0	4.7	38.4	2.43	30.1	4.6	50.7	3.8
	9.00	5.0	11.5	41.1	29.3	1.91	47.7	21.5	71.0	1.8	9.00	4.3	9.9	39.1	2.45	30.8	4.7	52.9	3.9
70	4.50	1.1	2.7	39.8	29.8	2.21	47.3	18.0	92.0	3.2	4.50	0.1	0.2	41.6	2.51	33.0	4.8	54.7	4.1
	6.75	3.0	6.8	39.8	29.4	2.15	47.1	18.6	84.6	2.7	6.75	1.8	4.2	42.3	2.53	33.7	4.9	59.6	4.3
	9.00	4.8	11.0	39.8	29.0	2.08	46.9	19.2	80.9	2.4	9.00	4.1	9.5	43.0	2.54	34.4	5.0	62.0	4.4
80	4.50	1.1	2.5	38.0	29.0	2.40	46.2	15.8	101.5	4.1	4.50	0.1	0.2	44.1	2.55	35.5	5.1	63.5	4.5
	6.75	2.9	6.6	38.0	28.6	2.34	46.0	16.3	94.3	3.5	6.75	2.0	4.6	44.9	2.56	36.1	5.1	68.8	4.6
	9.00	4.7	10.8	38.0	28.2	2.27	45.7	16.7	90.6	3.1	9.00	4.3	9.9	45.6	2.58	36.8	5.2	71.4	4.6
90	4.50	1.1	2.5	36.1	27.9	2.63	45.1	13.7	111.1	5.1									
	6.75	2.9	6.7	36.1	27.5	2.56	44.8	14.1	104.0	4.5	3.56	0.1	0.2	44.0	2.46	35.6	5.2	70.0	4.6
	9.00	4.7	10.8	36.1	27.1	2.49	44.6	14.5	100.4	4.1									
100	4.50	1.1	2.6	34.5	26.8	2.90	44.3	11.9	120.9	6.3									
	6.75	2.9	6.8	34.4	26.5	2.83	44.1	12.2	113.9	5.5	2.37	0.1	0.2	44.0	2.46	35.6	5.2	70.0	4.6
	9.00	4.7	10.9	34.4	26.1	2.76	43.9	12.5	110.3	5.1									
110	4.50	1.2	2.7	33.3	26.1	3.21	44.3	10.4	131.1	7.7									
	6.75	3.0	6.8	33.3	25.7	3.15	44.1	10.6	124.0	6.7	1.78	0.1	0.2	44.0	2.46	35.6	5.2	70.0	4.6
	9.00	4.8	11.0	33.3	25.3	3.08	43.8	10.8	120.4	6.4									
120	4.50	1.1	2.6	33.1	26.0	3.59	45.4	9.2	141.8	9.2									
	6.75	2.9	6.8	33.1	25.6	3.52	45.1	9.4	134.4	8.2	1.42	0.1	0.2	44.0	2.46	35.6	5.2	70.0	4.6
	9.00	4.7	10.9	33.1	25.2	3.45	44.9	9.6	130.8	7.7									

- Interpolation is permissible; extrapolation is not.
- All entering air conditions are 80°F (26.6°C) DB and 67°F (19.4°C) WB in cooling, and 70°F (21°C) DB in heating.
- AHRI/ISO certified conditions are 80.6°F (27°C) DB and 66.2°F (19°C) WB in cooling and 68°F (20°C) DB in heating.
- Table does not reflect fan or pump power corrections for AHRI/ISO conditions.
- All performance is based upon the lower voltage of dual voltage rated units.
- Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.
- Operation below 50°F (10.0°C) EWT is based upon 15% methanol antifreeze solution.
- Operation below 60°F (15.5°C) EWT requires optional insulated water/refrigerant circuit.
- See performance correction tables for operating conditions other than those listed above.
- See Performance Data Selection Notes for operation in the shaded areas.
- Regular Cooling operation with an EWT of less than 50°F (10.0°C) is not recommended unless variable water flow is available.
- Regular Heating operation with an EWT of more than 90°F (32°C) is not recommended unless variable water flow is available.
- For quiet operation and long term reliability, it is recommended that systems be designed to avoid continuous operation in the outlined areas.
- Performance capacities shown in thousands of Btuh.

Performance Data: MJ048 - Full Load with Variable Water Flow

Model: MJ 024-060

1,600 CFM Rated Airflow

EWT °F	WPD			Cooling - EAT 80/67°F						HWG Cap	WPD			HEATING - EAT 70°F					
	FLOW GPM	PSI	FT	TC	SC	Power kW	HR	EER	LWT		FLOW GPM	PSI	FT	HC	Power kW	HE	COP	LWT	HWG Cap
20	Operation Not Recommended										12.00	3.7	8.5	30.2	3.16	19.5	2.8	16.6	3.0
30	3.81	0.2	0.4	48.9	31.7	2.44	57.2	20.0	60.0	2.3	6.00	0.9	2.2	33.3	3.13	22.6	3.1	22.1	3.2
											9.00	2.1	5.0	34.7	3.15	23.9	3.2	24.4	3.2
											12.00	3.4	7.8	36.1	3.18	25.3	3.3	25.6	3.3
40	6.05	0.8	2.0	52.4	35.7	2.36	60.5	22.2	60.0	2.3	6.00	0.7	1.5	41.9	3.24	30.8	3.8	34.3	3.4
											9.00	1.9	4.3	43.3	3.26	32.2	3.9	37.5	3.5
											12.00	3.1	7.1	44.7	3.29	33.5	4.0	39.2	3.6
50	6.00	0.8	1.8	53.0	37.1	2.59	61.8	20.5	71.5	2.4	6.00	0.6	1.4	44.7	3.29	33.5	4.0	38.4	3.7
	9.00	1.9	4.5	52.9	36.7	2.47	61.3	21.4	64.2	2.3	9.00	1.8	4.2	46.1	3.32	34.8	4.1	41.9	3.8
	12.00	3.1	7.2	52.8	36.2	2.36	60.8	22.4	60.6	2.3	12.00	3.0	7.0	47.6	3.34	36.1	4.2	43.7	3.9
60	6.00	0.7	1.7	52.8	37.9	2.81	62.4	18.8	81.7	2.9	6.00	0.6	1.3	50.3	3.42	38.6	4.3	46.6	4.1
	9.00	1.9	4.4	52.7	37.5	2.70	61.9	19.5	74.3	2.5	9.00	1.8	4.1	51.7	3.45	39.9	4.4	50.7	4.2
	12.00	3.0	7.0	52.6	37.0	2.58	61.4	20.4	70.7	2.3	12.00	3.0	6.9	53.1	3.47	41.3	4.5	52.8	4.3
70	6.00	0.7	1.6	51.5	37.6	3.07	62.0	16.8	91.6	3.7	6.00	0.5	1.3	55.7	3.57	43.5	4.6	54.8	4.5
	9.00	1.8	4.3	51.4	37.2	2.95	61.5	17.4	84.3	3.1	9.00	1.8	4.1	57.2	3.60	44.9	4.7	59.6	4.7
	12.00	3.0	6.9	51.3	36.7	2.83	61.0	18.1	80.6	2.9	12.00	3.0	6.9	58.6	3.63	46.2	4.7	62.0	4.7
80	6.00	0.7	1.5	49.5	36.5	3.35	60.9	14.8	101.3	4.5	6.00	0.5	1.2	61.1	3.74	48.3	4.8	63.1	4.8
	9.00	1.8	4.2	49.4	36.1	3.23	60.4	15.3	94.1	3.9	9.00	1.7	4.0	62.5	3.77	49.7	4.9	68.4	5.0
	12.00	3.0	6.9	49.3	35.6	3.12	59.9	15.8	90.5	3.6	12.00	3.0	6.8	64.0	3.79	51.0	4.9	71.1	5.0
90	6.00	0.6	1.5	47.0	34.9	3.67	59.5	12.8	110.9	5.6	5.25	0.1	0.2	65.8	3.90	52.5	4.9	70.0	5.0
	9.00	1.8	4.1	46.9	34.5	3.56	59.0	13.2	103.8	4.9									
	12.00	3.0	6.8	46.8	34.0	3.44	58.5	13.6	100.3	4.6									
100	6.00	0.6	1.4	44.4	33.1	4.04	58.2	11.0	120.6	6.9	3.50	0.1	0.2	65.8	3.90	52.5	4.9	70.0	5.0
	9.00	1.8	4.1	44.3	32.7	3.92	57.7	11.3	113.6	6.1									
	12.00	2.9	6.8	44.2	32.2	3.81	57.2	11.6	110.1	5.7									
110	6.00	0.6	1.4	42.1	31.5	4.45	57.2	9.5	130.4	8.5	2.62	0.1	0.2	65.8	3.90	52.5	4.9	70.0	5.0
	9.00	1.7	4.0	42.0	31.1	4.33	56.7	9.7	123.5	7.5									
	12.00	2.9	6.7	41.9	30.6	4.22	56.3	9.9	120.0	7.0									
120	6.00	0.5	1.3	40.3	30.4	4.92	57.0	8.2	140.5	10.4	2.10	0.1	0.2	65.8	3.90	52.5	4.9	70.0	5.0
	9.00	1.7	3.9	40.2	30.0	4.80	56.5	8.4	133.6	9.1									
	12.00	2.9	6.6	40.1	29.5	4.68	56.1	8.6	130.1	8.6									

- Interpolation is permissible; extrapolation is not.
- All entering air conditions are 80°F (26.6°C) DB and 67°F (19.4°C) WB in cooling, and 70°F (21°C) DB in heating.
- AHRI/ISO certified conditions are 80.6°F (27°C) DB and 66.2°F (19°C) WB in cooling and 68°F (20°C) DB in heating.
- Table does not reflect fan or pump power corrections for AHRI/ISO conditions.
- All performance is based upon the lower voltage of dual voltage rated units.
- Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.
- Operation below 50°F (10.0°C) EWT is based upon 15% methanol antifreeze solution.
- Operation below 60°F (15.5°C) EWT requires optional insulated water/refrigerant circuit.
- See performance correction tables for operating conditions other than those listed above.
- See Performance Data Selection Notes for operation in the shaded areas.
- Regular Cooling operation with an EWT of less than 50°F (10.0°C) is not recommended unless variable water flow is available.
- Regular Heating operation with an EWT of more than 90°F (32°C) is not recommended unless variable water flow is available.
- For quiet operation and long term reliability, it is recommended that systems be designed to avoid continuous operation in the outlined areas.
- Performance capacities shown in thousands of Btuh.

Model:
MJ
024-060

Performance Data:
MJ060 - Full Load with Variable Water Flow

1,500 CFM Rated Airflow

EWT °F	WPD			Cooling - EAT 80/67°F						HWG Cap	WPD			HEATING - EAT 70°F					
	FLOW GPM	PSI	FT	TC	SC	Power kW	HR	EER	LWT		FLOW GPM	PSI	FT	HC	Power kW	HE	COP	LWT	HWG Cap
20	Operation Not Recommended										15.00	7.1	16.3	40.0	3.84	26.9	3.1	16.2	3.5
30											7.50	1.7	4.0	43.2	3.88	30.0	3.3	21.6	3.7
	4.29	0.9	2.0	54.8	38.4	2.83	64.4	19.4	60.0	2.8	11.25	3.6	8.4	44.5	3.89	31.2	3.3	24.2	3.8
											15.00	5.5	12.7	45.8	3.91	32.4	3.4	25.5	3.8
40											7.50	0.3	0.7	51.6	4.03	37.9	3.8	34.5	4.0
	7.42	1.3	3.1	64.2	44.8	2.93	74.2	21.9	60.0	2.8	11.25	2.2	5.1	52.9	4.04	39.1	3.8	37.7	4.1
											15.00	4.1	9.4	54.2	4.06	40.3	3.9	39.4	4.2
50	7.50	1.2	2.7	67.3	48.0	3.27	78.5	20.6	71.8	2.8	7.50	0.1	0.2	54.3	4.08	40.4	3.9	38.8	4.3
	11.25	2.8	6.4	66.3	46.8	3.12	76.9	21.2	64.3	2.8	11.25	1.9	4.4	55.6	4.10	41.6	4.0	42.3	4.5
	15.00	4.3	10.0	65.2	45.6	2.97	75.4	21.9	60.5	2.8	15.00	3.8	8.7	56.9	4.12	42.9	4.1	44.0	4.6
60	7.50	0.9	2.2	68.7	50.1	3.62	81.0	19.0	82.5	3.4	7.50	0.1	0.2	59.6	4.20	45.2	4.2	47.4	4.7
	11.25	2.5	5.8	67.6	48.8	3.47	79.5	19.5	74.7	2.9	11.25	1.6	3.6	60.8	4.22	46.4	4.2	51.4	4.9
	15.00	4.1	9.5	66.6	47.6	3.33	78.0	20.0	70.8	2.7	15.00	3.4	7.9	62.1	4.23	47.7	4.3	53.4	5.0
70	7.50	0.8	1.9	67.2	50.0	3.96	80.6	17.0	92.5	4.3	7.50	0.1	0.2	64.5	4.32	49.7	4.4	56.1	5.1
	11.25	2.4	5.6	66.1	48.8	3.81	79.1	17.4	84.7	3.7	11.25	1.4	3.3	65.7	4.33	51.0	4.4	60.5	5.4
	15.00	4.0	9.2	65.1	47.5	3.66	77.6	17.8	80.8	3.4	15.00	3.3	7.6	67.0	4.35	52.2	4.5	62.7	5.5
80	7.50	0.8	1.9	63.8	48.5	4.30	78.5	14.8	101.9	5.4	7.50	0.1	0.2	69.0	4.42	53.9	4.6	64.9	5.7
	11.25	2.4	5.5	62.8	47.3	4.15	76.9	15.1	94.3	4.7	11.25	1.4	3.1	70.3	4.44	55.1	4.6	69.7	5.7
	15.00	4.0	9.2	61.7	46.1	4.01	75.4	15.4	90.5	4.3	15.00	3.2	7.5	71.6	4.46	56.4	4.7	72.1	5.7
90	7.50	0.8	1.8	59.7	46.4	4.69	75.7	12.7	111.3	6.7									
	11.25	2.4	5.5	58.6	45.2	4.54	74.1	12.9	103.9	5.8	5.64	0.1	0.2	71.8	4.49	56.4	4.7	70.0	5.7
	15.00	4.0	9.1	57.6	43.9	4.39	72.6	13.1	100.2	5.4									
100	7.50	0.7	1.7	55.8	44.3	5.14	73.4	10.9	120.7	8.1									
	11.25	2.3	5.4	54.8	43.1	4.99	71.8	11.0	113.5	7.2	3.76	0.1	0.2	71.8	4.49	56.4	4.7	70.0	5.7
	15.00	3.9	9.0	53.8	41.9	4.85	70.3	11.1	109.9	6.7									
110	7.50	0.6	1.4	53.4	43.1	5.70	72.8	9.4	130.7	9.7									
	11.25	2.2	5.1	52.3	41.9	5.55	71.2	9.4	123.5	8.7	2.82	0.1	0.2	71.8	4.49	56.4	4.7	70.0	5.7
	15.00	3.8	8.8	51.3	40.6	5.40	69.7	9.5	119.9	8.2									
120	7.50	0.4	0.9	53.3	43.4	6.38	75.1	8.4	141.6	11.5									
	11.25	2.0	4.5	52.2	42.1	6.23	73.5	8.4	134.1	10.4	2.26	0.1	0.2	71.8	4.49	56.4	4.7	70.0	5.7
	15.00	3.5	8.2	51.2	40.9	6.09	72.0	8.4	130.4	9.9									

- Interpolation is permissible; extrapolation is not.
- All entering air conditions are 80°F (26.6°C) DB and 67°F (19.4°C) WB in cooling, and 70°F (21°C) DB in heating.
- AHRI/ISO certified conditions are 80.6°F (27°C) DB and 66.2°F (19°C) WB in cooling and 68°F (20°C) DB in heating.
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- See performance correction tables for operating conditions other than those listed above.
- See Performance Data Selection Notes for operation in the shaded areas.
- Regular Cooling operation with an EWT of less than 50°F (10.0°C) is not recommended unless variable water flow is available.
- Regular Heating operation with an EWT of more than 90°F (32°C) is not recommended unless variable water flow is available.
- For quiet operation and long term reliability, it is recommended that systems be designed to avoid continuous operation in the outlined areas.
- Performance capacities shown in thousands of Btuh.

Preventative Maintenance

Model:
MJ
024-060

WATER COIL MAINTENANCE (DIRECT GROUND-WATER APPLICATIONS ONLY)

If the system is installed in an area with a known high mineral content (125 P.P.M. or greater) in the water, it is best to establish a periodic maintenance schedule with the owner so the coil can be checked regularly. Consult the well water applications section of this manual for a more detailed water coil material selection. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. Therefore, 1.5 gpm per ton (2.0 l/m per kW) is recommended as a minimum flow. Minimum flow rate for entering water temperatures below 50°F (10°C) is 2.0 gpm per ton (2.6 l/m per kW).

WATER COIL MAINTENANCE (ALL OTHER WATER-LOOP APPLICATIONS)

Generally water coil maintenance is not needed for closed-loop systems. However, if the piping is known to have high dirt or debris content, it is best to establish a periodic maintenance schedule with the owner so the water coil can be checked regularly. Dirty installations are typically the result of deterioration of iron or galvanized piping or components in the system. Open cooling towers requiring heavy chemical treatment and mineral buildup through water use can also contribute to higher maintenance. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with both the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. However, flow rates over 3 gpm per ton (3.9 l/m per kW) can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

HOT WATER GENERATOR COILS

See water coil maintenance for ground-water units. If the potable water is hard or not chemically softened, the high temperatures of the desuperheater will tend to scale even quicker than the water coil and may need more frequent inspections. In areas with extremely hard water, a HWG is not recommended.

COMPRESSOR

Conduct annual amperage checks to insure that amp draw is no more than 10% greater than indicated on the serial plate data.

CABINET – INDOOR COMPRESSOR SECTION

Do not allow water to stay in contact with the cabinet for long periods of time to prevent corrosion of the cabinet sheet metal. Generally, cabinets are set up from the floor a few inches [7 - 8 cm] to prevent water from entering the cabinet. The cabinet can be cleaned using a mild detergent.

REFRIGERANT SYSTEM

To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Reference the operating charts for pressures and temperatures. Verify that air- and water-flow rates are at proper levels before servicing the refrigerant circuit.

AIR COIL

The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Care must be taken not to damage the aluminum fins while cleaning.

⚠ CAUTION

Fin edges are sharp and may cause injury.

CABINET

Do not allow water to stay in contact with the cabinet for long periods of time to prevent corrosion of the cabinet sheet metal. Generally, vertical cabinets are set up from the floor a few inches (7 - 8 cm) to prevent water from entering the cabinet. The cabinet can be cleaned using a mild detergent.

Model:
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Troubleshooting

GENERAL

If operational difficulties are encountered, perform the preliminary checks below before referring to the troubleshooting charts.

- Verify that the unit is receiving electrical supply power.
- Make sure the fuses in the fused disconnect switches are intact.

After completing the preliminary checks described above, inspect for other obvious problems such as leaking connections, broken or disconnected wires, etc. If everything appears to be in order, but the unit still fails to operate properly, refer to the DXM2.5 Troubleshooting Process Flowchart or "Functional Troubleshooting Chart.

DXM2.5 ADVANCED COMMUNICATING CONTROLS

The DXM2.5 troubleshooting in general is best summarized as verifying inputs and outputs. After inputs and outputs have been verified, board operation is confirmed and the problem must be elsewhere. Below are some general guidelines for troubleshooting the DXM2.5.

Field Inputs

Conventional thermostat inputs are 24VAC from the thermostat and can be verified using a voltmeter between C and Y1, Y2, W, O, G. 24VAC will be present at the terminal (for example, between "Y1" and "C") if the thermostat is sending an input to the DXM2.5.

Proper communications with a thermostat can be verified using the Fault LED on the DXM2.5. If the control is NOT in the Test mode and is NOT currently locked out or in a retry delay, the Fault LED on the DXM2.5 flashes very slowly (1 second on, 5 seconds off), if the DXM2.5 is properly communicating with the thermostat.

Sensor Inputs

All sensor inputs are 'paired wires' connecting each component to the board. Therefore, continuity on pressure switches, for example can be checked at the board connector. The thermistor resistance should be measured with the connector removed so that only the impedance of the thermistor is measured. If desired, this reading can be compared to the thermistor resistance chart shown in Table 18. An ice bath can be used to check the calibration of the thermistor.

Outputs

The compressor and reversing valve relays are 24VAC and can be verified using a voltmeter. For units with ECM blower motors, the DXM2.5 controls the motor using serial communications, and troubleshooting should be done with a communicating thermostat or diagnostic tool. The alarm relay can either be 24VAC as shipped or dry contacts for use with DDC controls by clipping the JW1 jumper. Electric heat outputs are 24VDC "ground sinking" and require a voltmeter set for DC to verify operation. The terminal marked "24VDC" is the 24VDC supply to the electric heat board; terminal "EH1" is stage 1 electric heat; terminal "EH2" is stage 2 electric heat. When electric heat is energized (thermostat is sending a "W" input to the DXM2.5), there will be 24VDC between terminal "24VDC" and "EH1" (stage 1 electric heat) and/or "EH2" (stage 2 electric heat). A reading of 0VDC between "24VDC" and "EH1" or "EH2" will indicate that the DXM2.5 is NOT sending an output signal to the electric heat board.

Test Mode

Test mode can be entered for 20 minutes by pressing the Test push button. The DXM2.5 automatically exits test mode after 20 minutes.

Advanced Diagnostics

To properly troubleshoot advanced control features, and to aid in troubleshooting basic control features, a communicating thermostat or diagnostic tool must be used.

Troubleshooting

Service Mode

The Service Mode provides the installer with several functions for troubleshooting, including Manual Operation, Control Diagnostics, Control Configuration, and Fault History.

Manual Operation

The Manual Operation mode allows the installer to bypass normal thermostat timings and operating modes, to directly activate the thermostat inputs to the DXM2.5, activate the DXM2.5 Test mode, and directly control the ECM blower, internal flow center, and proportional valve.

Control Diagnostics

The Control Diagnostics menus allow the installer to see the current status of all DXM2.5 switch inputs, values of all temperature sensor inputs, control voltage, ECM blower, internal flow center, and proportional valve operating status and parameters.

DIP Switch Configuration

The DIP Switch Configuration menus allow the installer to easily see the current DXM2.5 configuration.

Fault History

In addition to the fault code, the DXM2.5 stores the status of all control inputs and outputs when a fault condition is detected. The fault history covering the last five lockout conditions is stored and may be retrieved from the DXM2.5. After a specific fault in the fault history is selected, the operating mode and time when the fault occurred are displayed, with options to select specific control status values when the lockout occurred.

Fault Temp Conditions

This option displays the DXM2.5 temperature and voltage values when the lockout occurred.

⚠ WARNING

HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.

Failure to disconnect power before servicing can cause severe personal injury or death.

Fault Flow Conditions

This option displays the DXM2.5 ECM blower, pump, and valve operating parameters when the lockout occurred.

Fault I/O Conditions

This option displays the status of the DXM2.5 physical and communicated inputs and the relay outputs when the lockout occurred.

Fault Configuration Conditions

This option displays the status of the DXM2.5 option selections when the lockout occurred.

Possible Fault Causes

This option displays a list of potential causes of the stored fault.

Clear Fault History

The Clear Fault History option allows the fault history stored in the non-volatile memory of the DXM2.5 to be cleared.

DXM2.5 Troubleshooting Process Flowchart/ Functional Troubleshooting Chart

The DXM2.5 Functional Troubleshooting Process Flowchart is a quick overview of how to start diagnosing a suspected problem, using the fault recognition features of the DXM2.5. The Functional Troubleshooting Chart on the following page is a more comprehensive method for identifying a number of malfunctions that may occur, and is not limited to just the DXM2.5. Within the chart are five columns:

- The Fault column describes the symptoms.
- Columns 2 and 3 identify in which mode the fault is likely to occur, heating or cooling.
- The Possible Cause column identifies the most likely sources of the problem.
- The Solution column describes what should be done to correct the problem.

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MJ
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Troubleshooting

Table 18: Nominal Resistant per Temperature

Temp (°C)	Temp (°F)	Resistance (kOhm)
-17.8	0.0	85.34
-17.5	0.5	84.00
-16.9	1.5	81.38
-12.0	10.4	61.70
-11.0	12.2	58.40
-10.0	14.0	55.30
-9.0	15.8	52.38
-8.0	17.6	49.64
-7.0	19.4	47.05
-6.0	21.2	44.61
-5.0	23.0	42.32
-4.0	24.8	40.15
-3.0	26.6	38.11
-2.0	28.4	36.18
-1.0	30.2	34.37
0.0	32.0	32.65
1.0	33.8	31.03
2.0	35.6	29.50
3.0	37.4	28.05
4.0	39.2	26.69
5.0	41.0	25.39
6.0	42.8	24.17
7.0	44.6	23.02
8.0	46.4	21.92
9.0	48.2	20.88
10.0	50.0	19.90
11.0	51.8	18.97
12.0	53.6	18.09
13.0	55.4	17.26
14.0	57.2	16.46
15.0	59.0	15.71
16.0	60.8	15.00
17.0	62.6	14.32
18.0	64.4	13.68
19.0	66.2	13.07

Temp (°C)	Temp (°F)	Resistance (kOhm)
20.0	68.0	12.49
21.0	69.8	11.94
22.0	71.6	11.42
23.0	73.4	10.92
24.0	75.2	10.45
25.0	77.0	10.00
26.0	78.8	9.57
27.0	80.6	9.16
28.0	82.4	8.78
29.0	84.2	8.41
30.0	86.0	8.06
31.0	87.8	7.72
32.0	89.6	7.40
33.0	91.4	7.10
34.0	93.2	6.81
35.0	95.0	6.53
36.0	96.8	6.27
37.0	98.6	6.01
38.0	100.4	5.77
39.0	102.2	5.54
40.0	104.0	5.33
41.0	105.8	5.12
42.0	107.6	4.92
43.0	109.4	4.72
44.0	111.2	4.54
45.0	113.0	4.37
46.0	114.8	4.20
47.0	116.6	4.04
48.0	118.4	3.89
49.0	120.2	3.74
50.0	122.0	3.60
51.0	123.8	3.47
52.0	125.6	3.34
53.0	127.4	3.22
54.0	129.2	3.10

Temp (°C)	Temp (°F)	Resistance (kOhm)
55.0	131.0	2.99
56.0	132.8	2.88
57.0	134.6	2.77
58.0	136.4	2.67
59.0	138.2	2.58
60.0	140.0	2.49
61.0	141.8	2.40
62.0	143.6	2.32
63.0	145.4	2.23
64.0	147.2	2.16
65.0	149.0	2.08
66.0	150.8	2.01
67.0	152.6	1.94
68.0	154.4	1.88
69.0	156.2	1.81
70.0	158.0	1.75
71.0	159.8	1.69
72.0	161.6	1.64
73.0	163.4	1.58
74.0	165.2	1.53
75.0	167.0	1.48
76.0	168.8	1.43
77.0	170.6	1.39
78.0	172.4	1.34
79.0	174.2	1.30
80.0	176.0	1.26
81.0	177.8	1.22
82.0	179.6	1.18
83.0	181.4	1.14
84.0	183.2	1.10
85.0	185.0	1.07
86.0	186.8	1.04
87.0	188.6	1.01
88.0	190.4	0.97
89.0	192.2	0.94

Temp (°C)	Temp (°F)	Resistance (kOhm)
90.0	194.0	0.92
91.0	195.8	0.89
92.0	197.6	0.86
93.0	199.4	0.84
94.0	201.2	0.81
95.0	203.0	0.79
96.0	204.8	0.76
97.0	206.6	0.74
98.0	208.4	0.72
99.0	210.2	0.70
100.0	212.0	0.68
101.0	213.8	0.66
102.0	215.6	0.64
103.0	217.4	0.62
104.0	219.2	0.60
105.0	221.0	0.59
106.0	222.8	0.57
107.0	224.6	0.55
108.0	226.4	0.54
109.0	228.2	0.52
110.0	230.0	0.51
111.0	231.8	0.50
112.0	233.6	0.48
113.0	235.4	0.47
114.0	237.2	0.46
115.0	239.0	0.44
116.0	240.8	0.43
117.0	242.6	0.42
118.0	244.4	0.41
119.0	246.2	0.40
120.0	248.0	0.39
121.0	249.8	0.38
122.0	251.6	0.37
123.0	253.4	0.36

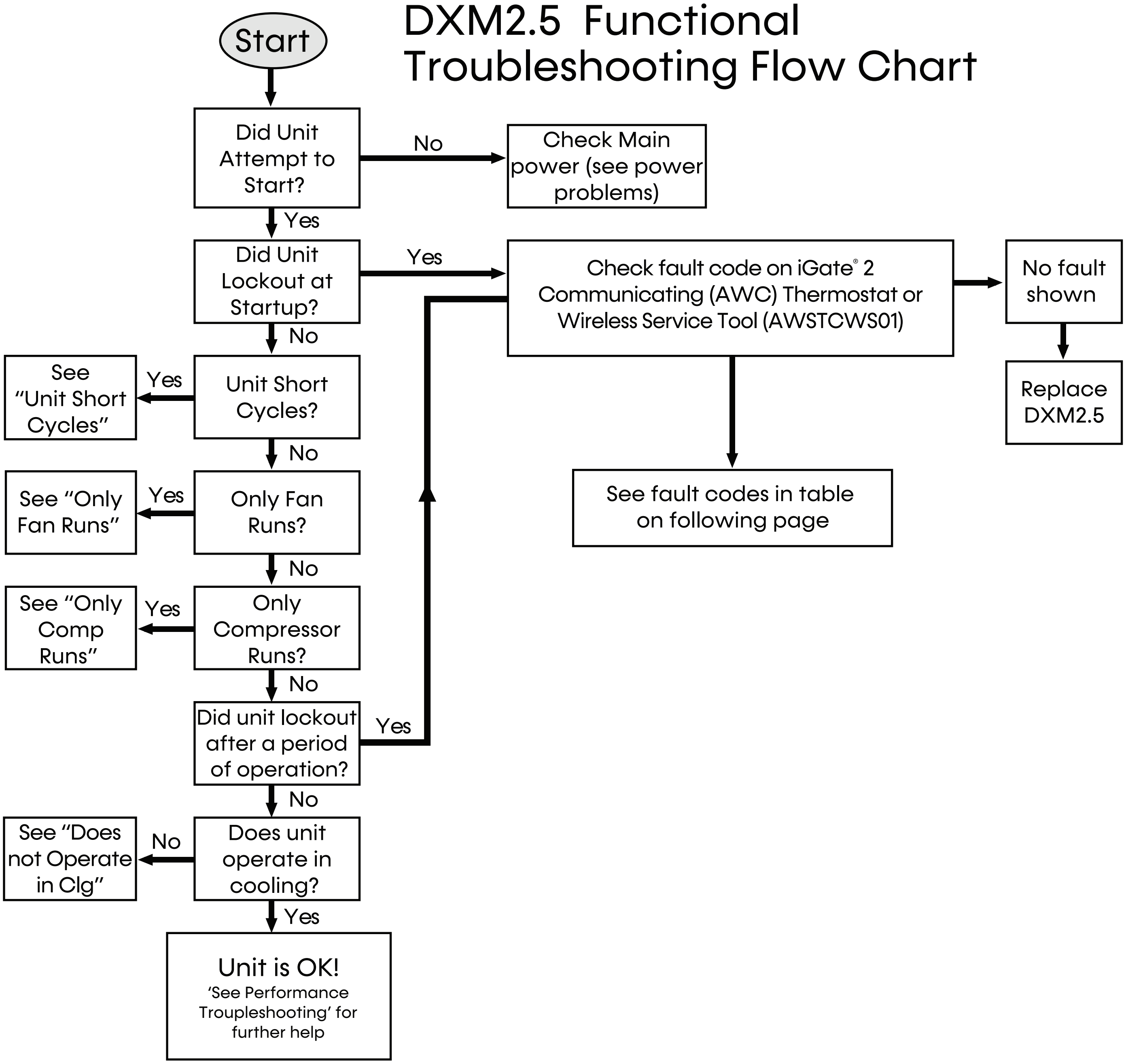
DXM2.5 Functional Troubleshooting Flow Chart

Model:
MJ
024-060

⚠ WARNING

HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.

Failure to disconnect power before servicing can cause severe personal injury or death.



Model:
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Functional Troubleshooting

Fault	Htg	Clg	Possible Cause	Solution
Main power problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24VAC between R and C on CXM2/DXM2.5.
				Check primary/secondary voltage on transformer.
HP Fault Code 2 High Pressure		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow and adjust to proper flow rate.
		X	Water Temperature out of range in cooling	Bring water temp within design parameters.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty Air Coil - construction dust etc.
				Too high of external static? Check static vs blower table.
	X		Air temperature out of range in heating	Bring return air temp within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table.
	X	X	Bad HP Switch	Check switch continuity and operation. Replace.
LP Fault Code 3 Low Pressure	X	X	Insufficient charge	Check for refrigerant leaks.
	X		Compressor pump down at startup	Check charge and startup water flow.
LT1 Fault Code 4 Water coil low-temperature limit	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter? Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (30°F vs 10°F [-1°C vs -2°C])	Clip JW3 jumper for antifreeze (10°F [-12°C]) use.
	X		Water Temperature out of range	Bring water temp within design parameters.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
LT2 Fault Code 5 Air coil low-temperature limit		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
		X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
		X	Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Normal airside applications will require 30°F [-1°C] only.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
Condensate Fault Code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting? Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
	X	X	Plugged air filter	Replace air filter.
	X	X	Restricted Return Airflow	Find and eliminate restriction. Increase return duct and/or grille size.

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Functional Troubleshooting

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Fault	Htg	Clg	Possible Cause	Solution
Over/Under Voltage Code 7 (Auto resetting)	X	X	Under Voltage	Check power supply and 24VAC voltage before and during operation.
				Check power supply wire size.
				Check compressor starting. Need hard start kit?
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
	X	X	Over Voltage	Check power supply voltage and 24VAC before and during operation.
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
Unit Performance Sentinel Code 8	X		Heating mode LT2>125°F [52°C]	Check for poor airflow or overcharged unit.
		X	Cooling Mode LT1>125°F [52°C] OR LT2< 40°F [4°C])	Check for poor water flow or airflow.
Swapped Thermistor Code 9	X	X	LT1 and LT2 swapped	Reverse position of thermistors
Low Water Flow Code 13	X	X	Reduced or no water flow	Check pump or valve operation setting.
				Check water flow and adjust to proper flow rate.
				Clogged Y strainer, replace mesh.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
Leaving Water Temperature Low Code 14	X		Reduced or no water flow in heating	Check pump or valve operation setting.
				Check water flow and adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (30°F vs 15°F [-1°C vs -9°C]	Clip JW3 jumper for antifreeze (15°F [-9°C]) use.
	X		Water temperature out of range	Bring water temperature within design parameters.
	X	X	Bad thermistor	Check temperature impedence correlation per chart.
Refrigerant and RDS Code 15	X	X	Refrigerant Leak	Check refrigerant charge. If the charge is low, identify and repair the leak.
			Faulty RDS sensor	Check refrigerant charge. If the charge is not low, replace the RDS sensor.
No Fault Code Shown	X	X	No compressor operation	See "Only Fan Runs".
	X	X	Compressor overload	Check and replace, if necessary.
	X	X	Control board	Reset power and check operation.
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in "test mode"	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace, if necessary.
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor Overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.

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Functional Troubleshooting

Table continued from previous page

Fault	Htg	Clg	Possible Cause	Solution
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X		Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across BR contacts.
	X	X		Check fan power and enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil and at CXM2/DXM2.5.
		X		If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'click'.
		X		Put thermostat in cooling mode. Check 24VAC on O (check between C and O); check for 24VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, thermostat may be bad or wired incorrectly.

Performance Troubleshooting

Model:
MJ
024-060

Symptom	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating properly	X	X	Dirty filter	Replace or clean.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers. If significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling per chart.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind stat.
	X	X	Unit undersized	Recheck loads & sizing. Check sensible cooling load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or cold	Check load, loop sizing, loop backfill, ground moisture.
High Head Pressure	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow. Adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Re-weigh in charge.
	X	X	Non-condensables in system	Vacuum system and re-weigh in charge.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
Low Suction Pressure	X		Reduced water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter? Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Water temperature out of range	Bring water temperature within design parameters.
		X	Reduced airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
		X	Air temperature out of range	Too much cold vent air? Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.

Table continued on next page

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Performance Troubleshooting

Table continued from previous page

Symptom	Htg	Clg	Possible Cause	Solution
Low Discharge Air Temperature in Heating	X		Too high of airflow	Check fan motor speed selection and airflow chart.
	X		Poor performance	See 'Insufficient Capacity'
High humidity		X	Too high of airflow	Check fan motor speed selection and airflow chart.
		X	Unit oversized	Recheck loads & sizing. Check sensible cooling load and heat-pump capacity.
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across blower relay contacts.
				Check fan power. Enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check thermostat wiring at DXM2.5. Put in Test Mode and then jumper Y1 and W1 to R to give call for fan, compressor and electric heat.
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil.
				If RV is stuck, run high pressure up by reducing water flow and, while operating, engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	For DXM2.5, check for "O' RV setup, not "B".
		X	Thermostat wiring	Check O wiring at heat pump. DXM2.5 requires call for compressor. To get RV coil, "Click".
Modulating Valve Troubleshooting	X	X	Improper output setting	Verify the AO-2 jumper is in the 0-10V position.
	X	X	No valve output signal	Check DC voltage between AO2 and GND. Should be O when valve is off and between 3.3v and 10v when valve is on.
	X	X	No valve operation	Check voltage to the valve.
				Replace valve if voltage and control signals are present at the valve and it does not operate.

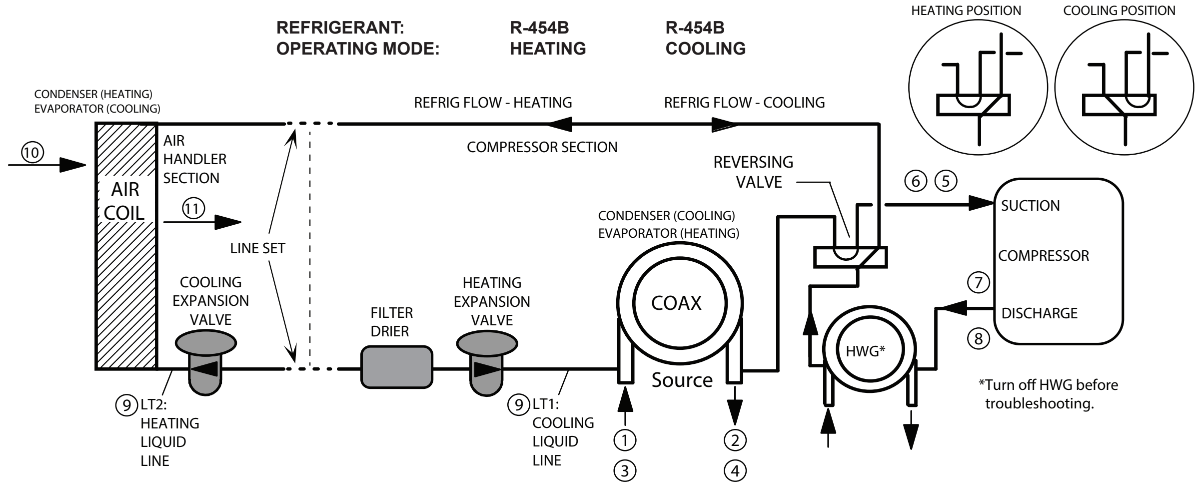
Troubleshooting Form

Model:
MJ
024-060

Customer: ____________ Loop Type: ____________ Startup Date: ____________

Model #: ____________ Serial #: ____________ Antifreeze Type & %: ____________

Complaint: ____________



Description		Heating	Cooling	Notes
Water Side Analysis				
1	Water In Temp.			
2	Water Out Temp.			Temp. Diff. =
3	Water In Pressure			
4	Water Out Pressure			
4a	Pressure Drop			
4b	GPM			

Heat of Extraction (Absorption) or Heat of Rejection:

HE or HR (Btuh) = ____________ Enter HE or HR: ____________

Fluid Factor:
500 (Water); 485 (Antifreeze)

____________ Flow Rate (GPM) X ____________ Temp. Diff (deg F) X ____________ Fluid Factor

Refrigerant Analysis				
5	Suction Temp.			
6	Suction Pressure			
6a	Saturation Temp.			
6b	Superheat			
7	Discharge Temp.			
8	Discharge Pressure			
8a	Saturation Temp.			
8b	Subcooling			
9	Liquid Line Temp			
10	Return Air Temp.			
11	Supply Air Temp.			Temp. Diff. =
	Voltage			
	Compress Amps			

Line Set

Length: ______ Ft.

Liquid: ______ In. Dia

Suction: ______ In. Dia

Model:
MJ
024-060

Warranty

LIMITED EXPRESS WARRANTY

Congratulations on purchasing your new HVAC equipment. It's been designed for long life and reliable service, and is backed by one of the strongest warranties in the industry. Your unit automatically qualifies for the warranty coverage listed below, providing you keep your proof of purchase (receipt) for the equipment and meet the warranty conditions.

LIMITED TWELVE (12) YEAR EXPRESS WARRANTY

MARS warrants all parts of the MJ Series residential geothermal heat pump including the compressor to be free from defects in workmanship and materials for normal use and maintenance for twelve (12) years from the date of purchase by the original consumer for the original installation. This Express Limited Warranty applies only when the geothermal heat pump is installed as a complete matched system, and only when the system is installed per MARS installation instructions and in accordance with all local, state and national codes for normal use. Thermostats, auxiliary electric heaters, and geothermal pump flow centers purchased through MARS and installed with an MJ Series geothermal heat pump will be covered by the same twelve (12) year express warranty. All other accessories will have one (1) year.

LIMITED FIVE (5) YEAR LABOR ALLOWANCE

Labor is allowed for warranty service for a period of five (5) years from the date of purchase when the unit is properly registered and commissioned according to the start-up procedure specified in the Installation/Operation Manual, and when the Geothermal Start-Up Certification Form is completed and submitted to MARS.

EXCEPTIONS

The Limited Express Warranty does not cover normal maintenance—MARS recommends that regular inspection/maintenance be performed at least once a season and proof of maintenance be kept. Additionally, labor charges, transportation charges for replacement parts, replacement of refrigerant or filters, any other service calls/repairs are not covered by this Limited Warranty. It also does not cover any portion or component of the system that is not supplied by MARS, regardless of the cause of failure of such portion or component.

CONDITIONS FOR WARRANTY COVERAGE

- Unit must be operated according to MARS operating instructions included with the unit and cannot have been subjected to accident, alteration, improper repair, neglect or misuse, or an act of God (such as a flood)
- Installation was done by a trained, licensed or otherwise qualified HVAC dealer/contractor
- Performance cannot be impaired by use of any product not authorized by MARS, or by any adjustments or adaptations to components
- Serial numbers and/or rating plate have not been altered or removed
- Damage has not been a result of inadequate wiring or voltage conditions, use during brown-out conditions, or circuit interruptions
- Air flow around any section of the unit has not been restricted
- Unit remains in the original installation
- Unit was not purchased over the internet

DURATION OF WARRANTY & REGISTRATION

The warranty begins on the date of purchase by the original consumer. The consumer must retain a receipted bill of sale as proof of warranty period. Without this proof, the express warranty begins on the date of shipment from the factory.

REMEDY PROVIDED BY THE LIMITED EXPRESS WARRANTY

The sole remedy under the Limited Warranty is replacement of the defective part. If replacement parts are required within the period of this warranty, MARS replacement parts shall be used; any warranty on the replacement part(s) shall not affect the applicable original unit warranty. Ready access to the unit for service is the owner's responsibility. Labor to diagnose and replace the defective part is not covered by this Limited Express Warranty. If for any reason the replacement part/product is no longer available during the warranty period, MARS shall have the right to allow a credit in the amount of the current suggested retail price of the part/product instead of providing repair or replacement.

LIMITATION OF LIABILITY

1. There are no other express or implied warranties. MARS makes no warranty of merchantability. We do not warrant that the unit is suitable for any particular purpose or can be used in buildings or rooms of any particular size or condition except as specifically provided in this document. There are no other warranties, express or implied, which extend beyond the description in this document.
2. All warranties implied by law are limited in duration to the seven-year term of the parts warranty. Your exclusive remedy is limited to the replacement of defective parts. **We will not be liable for any consequential or incidental damages caused by any defect in this unit.**
3. This warranty gives you specific legal rights and you may also have other rights which vary from state to state. Some states do not allow limitation on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.
4. No warranties are made for units sold outside the continental United States and Canada. Your distributor or final seller may provide a warranty on units sold outside these areas.
5. MARS will not be liable for damages if our performance regarding warranty resolution is delayed by events beyond our control including accident, alteration, abuse, war, government restrictions, strikes, fire, flood, or other acts of God.

HOW TO OBTAIN WARRANTY SERVICE OR PARTS

If you have a warranty claim, notify your installer promptly. If the installer does not remedy your claim, write to MARS, 1900 Wellworth Ave., Jackson MI 49203. Enclose a report of inspection by your installer or service person. Include model number, serial number, and date of purchase.

Owner responsibilities are set forth in the instruction manual—read it carefully.

KEEP THIS INFORMATION AS A RECORD OF YOUR PURCHASE

GEOTHERMAL HEAT PUMP	INSTALLATION
Model Number	Installer Name
Serial Number	Phone Number/Contact Information
Date of Purchase	Date Installation Completed

☐ Component of new HVAC system ☐ Replacement heat pump only

Remember to retain your bill of sale as proof of warranty period.

Please visit www.marsdelivers.com to register your new product

Delivering Confidence

MJ_WARRANTY_2/2025

Notes

Model:
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Notes

Notes

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Revision History

Date	Section	Description
05/16/25	All	Created

97B0707N01

1900 Wellworth Ave. | Jackson, MI 49203
Phone: 517.787.2100
www.marsdelivers.com