



Installation, Operation & Maintenance

HZ Series

Two-Stage Horizontal, Vertical,
and Downflow Systems

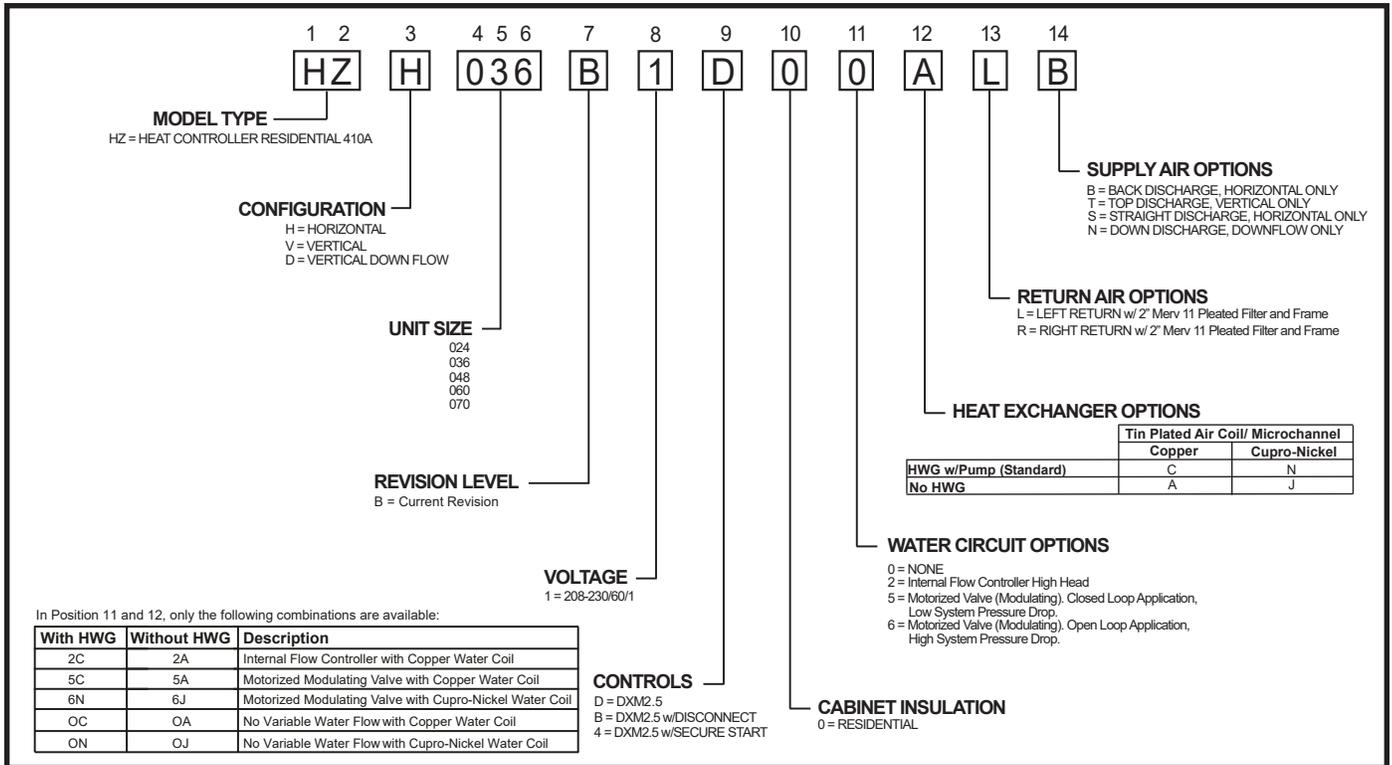
HZ 024-070

60Hz - HFC-410A

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Model Nomenclature



Note: Above model nomenclature is a general reference. Not all configurations are available on all models. Consult engineering submittal for detailed information.

General Information

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! 
<p>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.</p>
 CAUTION! 
<p>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.</p>
 WARNING! 
<p>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.</p>

 WARNING! 
<p>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.</p>

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 fifteen (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. Stack units a maximum of 3 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 start-up and may result in costly equipment clean-up.

General Information, Cont'd.

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. Horizontal equipment is designed for installation above false ceiling or in a ceiling plenum. Other unit configurations are typically installed in a mechanical room. The installation site chosen should include adequate service clearance around the unit. Before unit start-up, 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. Remove any blower support packaging (water-to-air units only).
6. Some airflow patterns are field convertible (horizontal units only). Locate the airflow conversion section of this IOM.
7. Locate and verify any hot water generator (HWG), hanger, or other accessory kit located in the compressor section or blower section.

CAUTION!

CAUTION! All three phase scroll compressors must have direction of rotation verified at start-up. 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!

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!

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.

Unit Physical Data

Model	024	036	048	060	070
Compressor (1 Each)	Two-Stage Scroll				
Factory Charge (HFC-410A) (oz) [kg]	44 [1.25]	52 [1.47]	69 [1.96]	142 [4.03]	140 [3.97]
ECM Fan Motor & Blower					
Fan Motor (hp) [W]	1/2 [373]	1/2 [373]	1 [746]	1 [746]	1 [746]
Blower Wheel Size (dia x w) - (in) [mm]	9 x 7 [229 x 178]	11 x 10 [279 x 254]			
Water Connection Size					
FPT (in)	3/4	3/4	1	1	1
HWG Connection Size					
FPT (in)	1/2	1/2	1/2	1/2	1/2
Coax Volume					
Volume (US Gallons) [liters]	0.76 [2.88]	0.92 [3.48]	1.24 [4.69]	1.56 [5.91]	1.56 [5.91]
Vertical Upflow/Downflow					
Air Coil Dimensions (h x w) - (in) [mm]	28 x 20 [711 x 508]	28 x 25 [711 x 635]	32 x 25 [813 x 635]	36 x 25 [914 x 635]	36 x 25 [914 x 635]
Standard Filter - 1" [25.4mm] Throwaway, qty (in) [mm]	1 - 28 x 24 [711 x 610]	1 - 28 x 30 [712 x 762]	2 - 16 x 30 [406 x 762]	1 - 16 x 30 [406 x 762] 1 - 20 x 30 [508 x 762]	1 - 16 x 30 [406 x 762] 1 - 20 x 30 [508 x 762]
Weight - Operating, (lbs) [kg]	298 [135]	359 [163]	448 [203]	475 [215]	475 [215]
Weight - Packaged, (lbs) [kg]	308 [140]	369 [167]	458 [208]	485 [220]	485 [220]
Horizontal					
Air Coil Dimensions (h x w) - (in) [mm]	18 x 31 [457 x 787]	20 x 35 [508 x 889]	20 x 40 [508 x 1016]	20 x 45 [508 x 1143]	20 x 45 [508 x 1143]
Standard Filter - 1" [25.4mm] Throwaway, qty (in) [mm]	2 - 18 x 18 [457 x 457]	1 - 12 x 20 [305 x 508] 1 - 20 x 25 [508 x 635]	1 - 18 x 20 [457 x 508] 1 - 20 x 24 [508 x 610]	2 - 20 x 24 [508 x 610]	2 - 20 x 24 [508 x 610]
Weight - Operating, (lbs) [kg]	298 [135]	359 [163]	448 [203]	475 [215]	475 [215]
Weight - Packaged, (lbs) [kg]	308 [140]	369 [167]	458 [208]	485 [220]	485 [220]

NOTE: All units have TXV expansion device and 1/2" & 3/4" electrical knockouts.

Unit Maximum Working Water Pressure	
Options	Max Pressure PSIG [kPa]
Base Unit	500 [3447]
Unit with Internal Modulation Water Valve Option	300 [2,068]
Unit with Internal Water Pump Option	145 [999]

Horizontal Installation

Horizontal Unit Location

Units are 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 from the ceiling. Horizontal units are typically installed above a false ceiling or in a ceiling plenum. 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). Consideration should be given to access for easy removal of the filter and access panels. Provide sufficient room to make water, electrical, and duct connection(s).

If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. Refer to Figure 3 for an illustration of a typical installation. Refer to unit submittal data or engineering design guide for dimensional data.

Conform to the following guidelines when selecting unit location:

1. Provide a hinged access door in concealed-spline or plaster ceilings. Provide removable ceiling tiles in T-bar or lay-in ceilings. Refer to horizontal unit dimensions for specific series and model in unit submittal data. Size the access opening to accommodate the service technician during the removal or replacement of the compressor, control, or blower assembly.
2. Provide access to hanger brackets, water valves and fittings. Provide screwdriver clearance to access panels, discharge collars and all electrical connections.
3. DO NOT obstruct the space beneath the unit with piping, electrical cables and other items that prohibit future removal of components or the unit itself.
4. Use a manual portable jack/lift to lift and support the weight of the unit during installation and servicing.

The installation of water source 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. **NOTE: Minimum clearances for installation are the same as the minimum required service clearances. Consult the service clearances on page 8 for reference of installation clearances.**

Mounting Horizontal Units

Horizontal units have 4 hanger brackets partially attached at the factory, one at each corner. Enclosed within the unit there is a hanger kit hardware bag containing vibration isolation grommets, washers, screws and a hanger installation instruction page. One additional screw from the hardware bag must be added to each hanger bracket before unit installation. Tighten each screw to 75 in-lbs (8.5 Nm). See Figure 1. Refer to the hanger installation instruction page contained in the hardware bag for details of final hanger bracket attachment and unit suspension. See Figure 1a.

Use four (4) field supplied threaded rods and factory provided vibration isolators to suspend the unit. Safely lift the unit into position supporting the bottom of the unit. Ensure the top of the unit is not in contact with any external objects. Connect the top end of the 4 all-thread rods, slide rods through the brackets and grommet then assemble washers and double nuts at each rod. Ensure that the unit is approximately level and that the threaded rod extends past the nuts.

Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 2.5 tons/8.8kW) ensure that unit pitch does not cause condensate leaks inside the cabinet.

Figure 1: Hanger Bracket

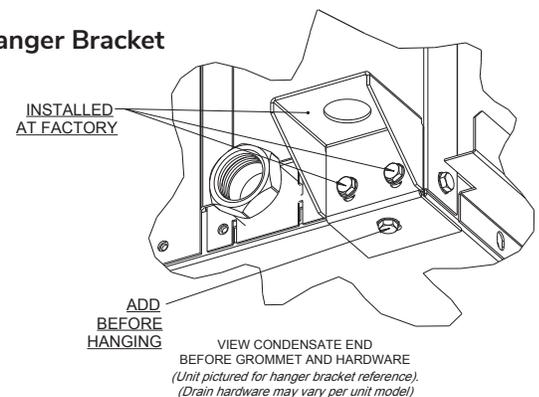
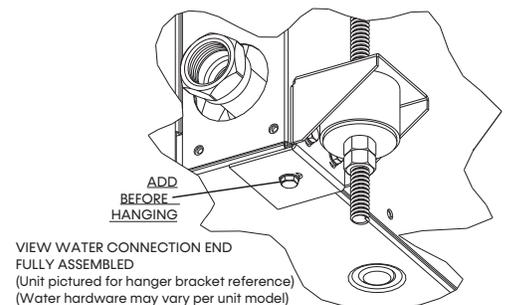


Figure 1a:



Horizontal Installation, Cont'd.

Figure 2: Horizontal Unit Pitch

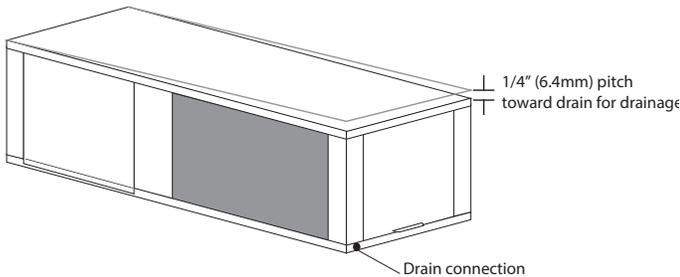
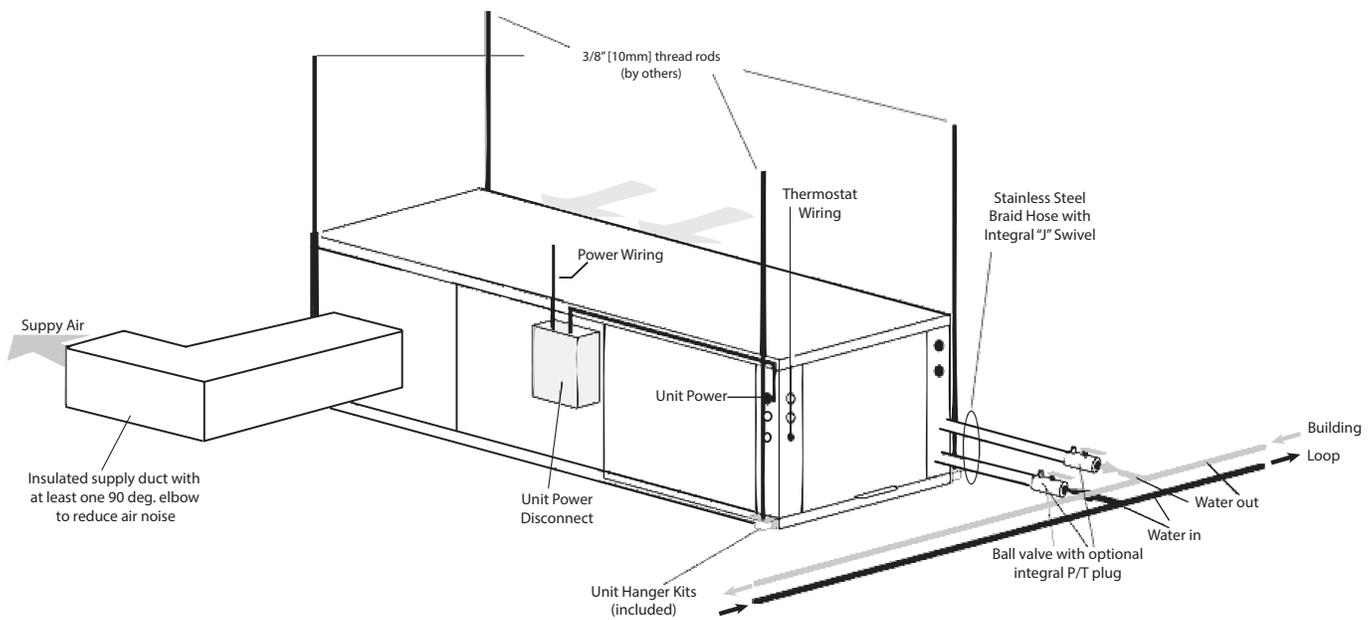


Figure 3: Typical Horizontal Unit Installation



Air Coil - To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. A thorough water rinse should follow. **UV based anti-bacterial systems may damage coated air coils.**

Notice! Installation Note - Ducted Return: Many horizontal WSHPs are installed in a return air ceiling plenum application (above ceiling). Vertical WSHPs are commonly installed in a mechanical room with free return (e.g. louvered door). Therefore, filter rails are the industry standard and are included on water source heat pumps for the purposes of holding the filter only. For ducted return applications, the filter rail must be removed and replaced with a duct flange or filter frame. Canvas or flexible connectors should also be used to minimize vibration between the unit and ductwork.

Field Conversion of Air Discharge

Overview - Horizontal units can be field converted between side (straight) and back (end) discharge using the instructions below.

NOTE: It is not possible to field convert return air between left or right return models due to the necessity of refrigeration copper piping changes.

Preparation - It is best to field convert the unit on the ground before hanging. If the unit is already hung it should be taken down for the field conversion.

Side to Back Discharge Conversion

1. Place unit in well lit area. Remove the screws as shown in Figure 4 to free top panel and discharge panel.
2. Lift out the access panel and set aside. Lift and rotate the discharge panel to the other position as shown, being careful with the blower wiring.
3. Check blower wire routing and connections for tension or contact with sheet metal edges. Re-route if necessary.
4. Check refrigerant tubing for contact with other components.
5. Reinstall top panel and screws noting that the location for some screws will have changed.
6. Manually spin the fan wheel to ensure that the wheel is not rubbing or obstructed.
7. Replace access panels.

Back to Side Discharge Conversion - If the discharge is changed from back to side, use above instruction noting that illustrations will be reversed.

Left vs. Right Return - It is not possible to field convert return air between left or right return models due to the necessity of refrigeration copper piping changes. However, the conversion process of side to back or back to side discharge for either right or left return configuration is the same. In some cases, it may be possible to rotate the entire unit 180 degrees if the return air connection needs to be on the opposite side. **Note that rotating the unit will move the piping to the other end of the unit.**

Figure 4: Left Return Side to Back

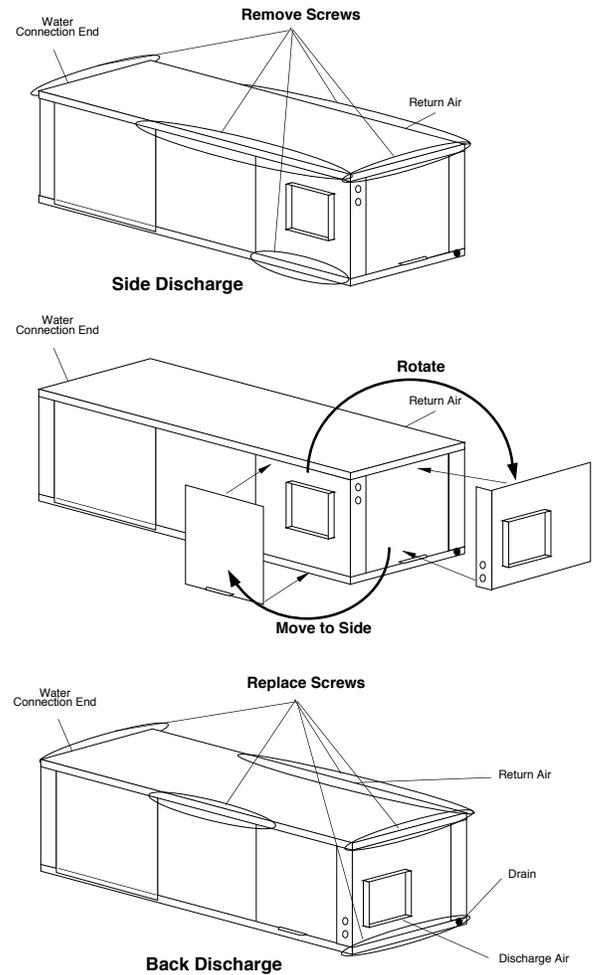
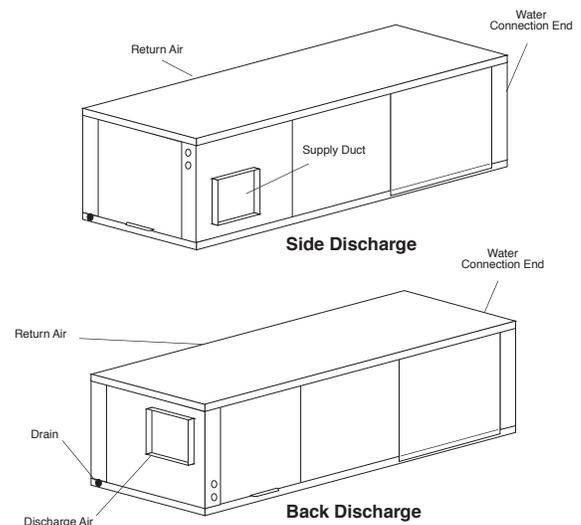


Figure 5: Right Return Side to Back



Horizontal Installation

Condensate Piping - Horizontal Units - A condensate drain line must be installed and pitched away for the unit to allow for proper drainage. This connection must meet all local plumbing/building codes.

Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 2.5 tons/8.8 kW), ensure that unit pitch does not cause condensate leaks inside the cabinet.

Install condensate trap at each unit with the top of the trap positioned below the unit condensate drain connection as shown in Figure 6. Design the depth of the trap (water-seal) based upon the amount of ESP capability of the blower (where 2 inches [51 mm] of ESP capability requires 2 inches [51 mm] of trap depth). As a general rule, 1-1/2 inch [38 mm] trap depth is the minimum.

Each unit must be installed with its own individual trap and connection to the condensate line (main) or riser. Provide a means to flush or blow out the condensate line. DO NOT install units with a common trap and/or vent.

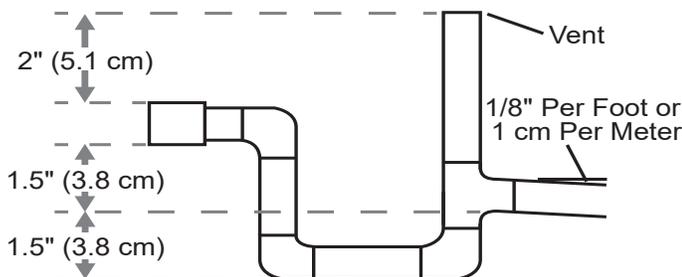
Always vent the condensate line when dirt or air can collect in the line or a long horizontal drain line is required. Also vent when large units are working against higher external static pressure than other units connected to the same condensate main since this may cause poor drainage for all units on the line. **WHEN A VENT IS INSTALLED IN THE DRAIN LINE, IT MUST BE LOCATED AFTER THE TRAP IN THE DIRECTION OF THE CONDENSATE FLOW.**

Duct System Installation - Proper duct sizing and design is critical to the performance of the unit. The duct system should be designed to allow adequate and even airflow through the unit during operation. Air flow through the unit MUST be at or above the minimum stated airflow for the unit to avoid equipment damage. Duct systems should be designed for quiet operation. Refer to Figure 3 for horizontal duct system details or Figure 8 for vertical duct system details. A flexible connector is recommended for both discharge and return air duct connections on metal duct systems to eliminate the transfer of vibration to the duct system. To maximize sound attenuation of the unit blower, the supply and return plenums should include internal fiberglass duct liner or be constructed from ductboard for the first few feet. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended, as the unit's performance may be adversely affected.

At least one 90° elbow should be included in the supply duct to reduce air noise. If air noise or excessive air flow is a problem, the blower speed can be changed. For airflow charts, consult submittal data for the series and model of the specific unit.

If the unit is connected to existing ductwork, a previous check should have been made to ensure that the ductwork has the capacity to handle the airflow required for the unit. If ducting is too small, as in the replacement of a heating only system, larger ductwork should be installed. All existing ductwork should be checked for leaks and repaired as necessary.

Figure 6: Horizontal Condensate Connection



CAUTION! Ensure condensate line is pitched toward drain 1/8 inch per ft [11 mm per m] of run.

Vertical Installation

Vertical Unit Location - Units are 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 from the mechanical room/closet. Vertical 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). Consideration should be given to access for easy removal of the filter and access panels. Provide sufficient room to make water, electrical, and duct connection(s).

If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. Refer to Figures 7 and 8 for typical installation illustrations. Refer to unit submittal data or engineering design guide for dimensional data.

1. Install the unit on a piece of rubber, neoprene or other mounting pad material for sound isolation. The pad should be at least 3/8" [10 mm] to 1/2" [13 mm] in thickness. Extend the pad beyond all four edges of the unit.
2. Provide adequate clearance for filter replacement and drain pan cleaning. Do not block filter access with piping, conduit or other materials. Refer to unit submittal data or engineering design guide for dimensional data.
3. Provide access for fan and fan motor maintenance and for servicing the compressor and coils without removing the unit.
4. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow removal of the unit, if necessary.
5. Provide access to water valves and fittings and screwdriver access to the unit side panels, discharge collar and all electrical connections.

Notice! Installation Note - Ducted Return: Many horizontal WSHPs are installed in a return air ceiling plenum application (above ceiling). Vertical WSHPs are commonly installed in a mechanical room with free return (e.g. louvered door). Therefore, filter rails are the industry standard and are included on Heat Controller commercial heat pumps for the purposes of holding the filter only. For ducted return applications, the filter rail must be removed and replaced with a duct flange or filter frame. Canvas or flexible connectors should also be used to minimize vibration between the unit and ductwork.

Figure 7: Vertical Unit Mounting

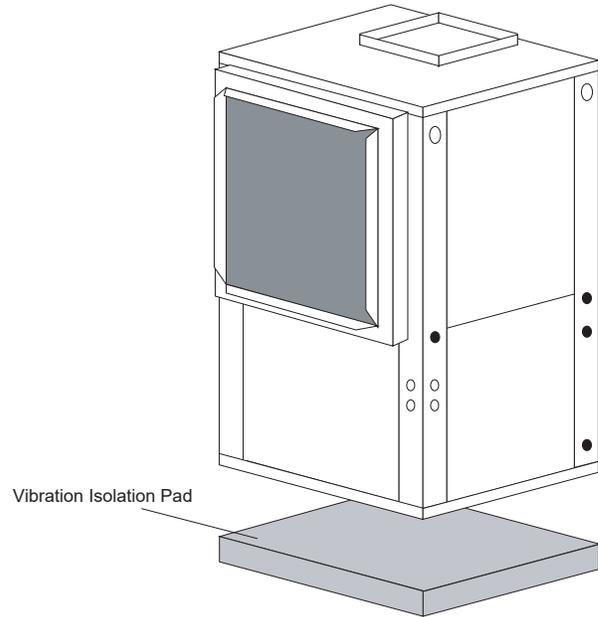
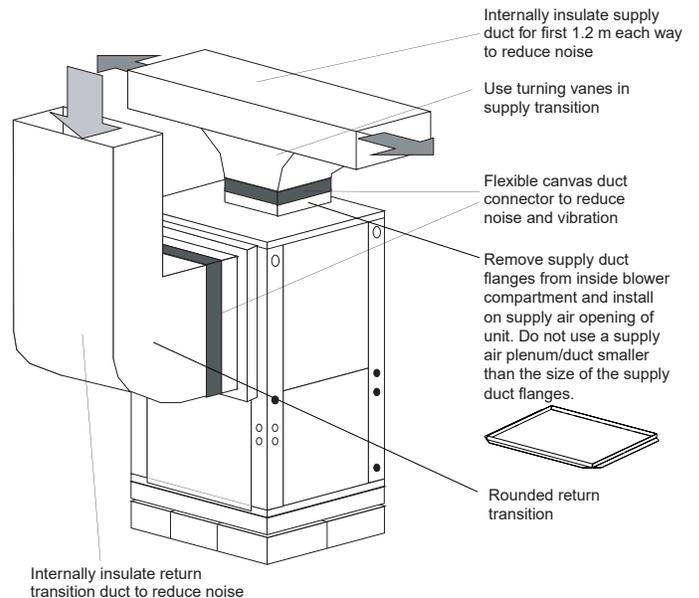


Figure 8: Typical Vertical Unit Installation Using Ducted Return Air

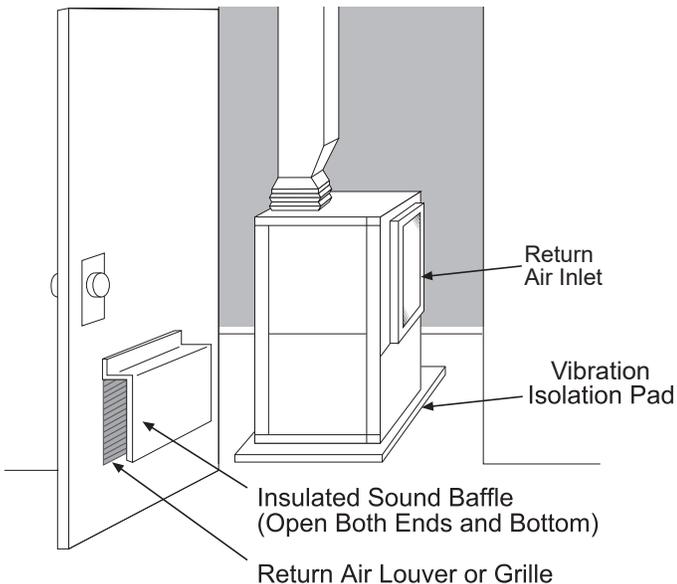


Vertical Installation, Cont'd.

Sound Attenuation for Vertical Units - Sound attenuation is achieved by enclosing the unit within a small mechanical room or a closet. Additional measures for sound control include the following:

1. Mount the unit so that the return air inlet is 90° to the return air grille. Refer to Figure 9. Install a sound baffle as illustrated to reduce line-of-sight sound transmitted through return air grilles.
2. Mount the unit on a rubber or neoprene isolation pad to minimize vibration transmission to the building structure.

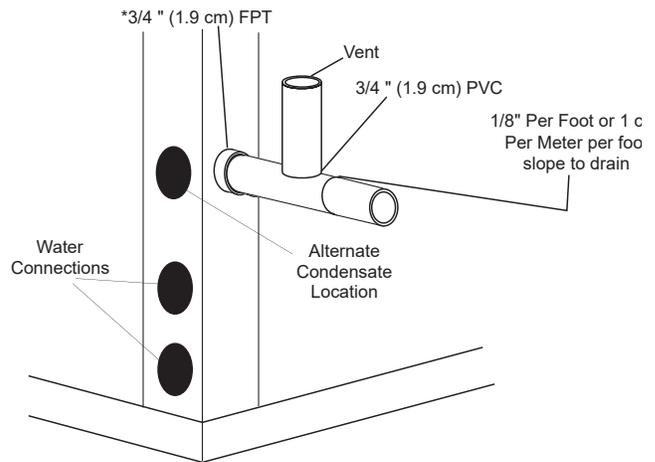
Figure 9: Vertical Sound Attenuation



NOTICE! Units with clear plastic drain lines should have regular maintenance (as required) to avoid buildup of debris, especially in new construction.

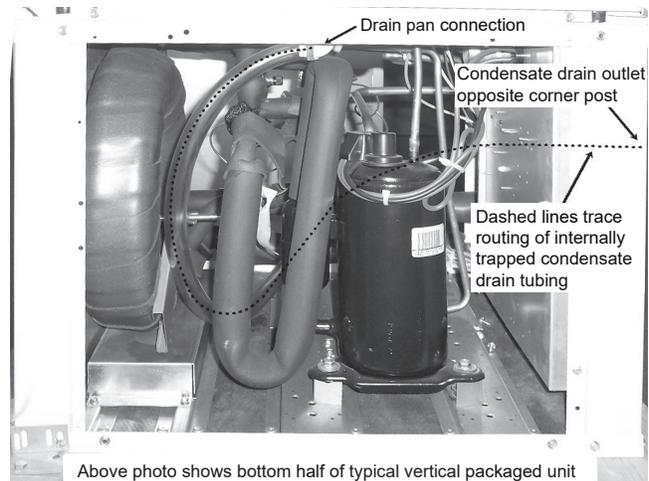
Condensate Piping for Vertical Units - A condensate line must be installed and pitched away from the unit to allow for proper drainage. This connection must meet all local plumbing/building codes. Vertical units utilize a condensate hose inside the cabinet as a trapping loop; therefore an external trap is not necessary. Figure 10a shows typical condensate connections. Figure 10b illustrates the internal trap for a typical vertical heat pump. Each unit must be installed with its own individual vent (where necessary) and a means to flush or blow out the condensate drain line. Do not install units with a common drain and/or vent.

Figure 10a: Vertical Condensate Drain



* Some units include a painted drain connection. Using a threaded pipe or similar device to clear any excess paint accumulated inside this fitting may ease final drain line installation.

Figure 10b: Vertical Internal Condensate Trap



Above photo shows bottom half of typical vertical packaged unit

Piping Installation

Installation of Supply and Return Piping

Follow these piping guidelines.

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

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

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

NOTE: When antifreeze is used in the loop, ensure that it is compatible with the Teflon® tape or pipe joint compound that is applied.

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

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

Refer to Figure 11 for an illustration of a typical supply/return hose kit. Adapters secure hose assemblies to the unit and risers. Install hose assemblies properly and check regularly to avoid system failure and reduced service life.

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A 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 HFC-410A as system failures and property damage may result.

⚠ CAUTION! ⚠

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

⚠ CAUTION! ⚠

CAUTION! Do not bend or kink supply lines or hoses.

⚠ CAUTION! ⚠

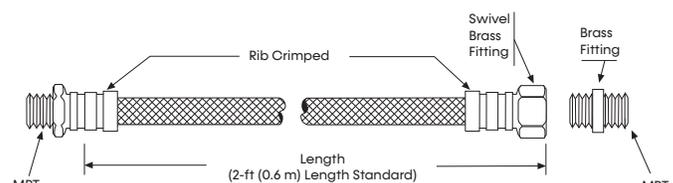
CAUTION! Piping must comply with all applicable codes.

Table 1: Metal Hose Minimum Bend Radii

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

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

Figure 11: Supply/Return Hose Kit



Variable Water Flow Heat Pump Applications Overview

Variable Water Flow is a revolutionary new, intelligent, and efficient way to circulate water (or water plus antifreeze) using internal, variable speed water flow control. The factory installed high efficiency variable speed pumps uses almost half the wattage of traditional fixed speed pump. Variable Water Flow technology improves the life expectancy of the unit by reducing the amount of energy required to optimize the flow of water throughout the system and also reduces the space, cost, and labor required to install external water flow control mechanisms (flow controllers, solenoid and flow control valves).

Variable Water Flow Configurations:

1. Low System Pressure Drop Modulating Motorized Valve – Typical for External Central Pumping.

Primarily for use on multi-unit applications with central pumping. With this option the unit includes a low pressure drop, high Cv modulating motorized water valve that is controlled by the DXM2.5 control based on the difference in the entering and leaving water temperature delta T. This valve is a standard factory installed feature for the HZ unit.

2. High System Pressure Drop Modulating Motorized Valve – Typical for High Pressure Water System such as Water Well Pumps.

With this option the unit includes a high pressure drop modulating water valve that is controlled by the DXM2.5 control based on the difference in the entering and leaving water temperature delta T. A low Cv valve is used to provide more precise control against high system pressure differential type of loops. This valve is a factory installed option for the HZ unit and when selected replaces the modulating valve.

3. Standard Head Variable Pump – Typical for Multiple Unit Central Pumping.

With this option the unit includes an internal variable speed pump that is best suited to low pressure drop systems such as primary/secondary pumping. The pump speed is controlled by the DXM2.5 control based on the difference in the entering and leaving water temperature delta T. This pump can be selected with an internal check valve for multiple unit installations. This pump is a factory installed option for the HZ unit and when selected replaces the modulating valve.

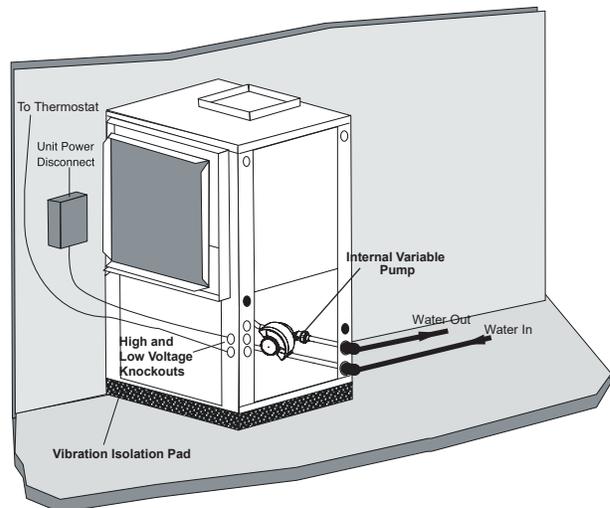
4. High Head Variable Pump – Typical for Individual Unit Pumping.

With this option the unit includes an internal variable speed pump that is capable of higher system pressure drops. The pump speed is controlled by the DXM2.5 control based on the difference in the entering and leaving water temperature delta T. This pump can be selected with an internal check valve for multiple unit installations. This pump is a factory installed option for the HZ unit and when selected replaces the modulating valve.



Variable speed pump or motorized modulating valve delivers variable water flow, controlled by DXM2.5 control, based on loop water ΔT .

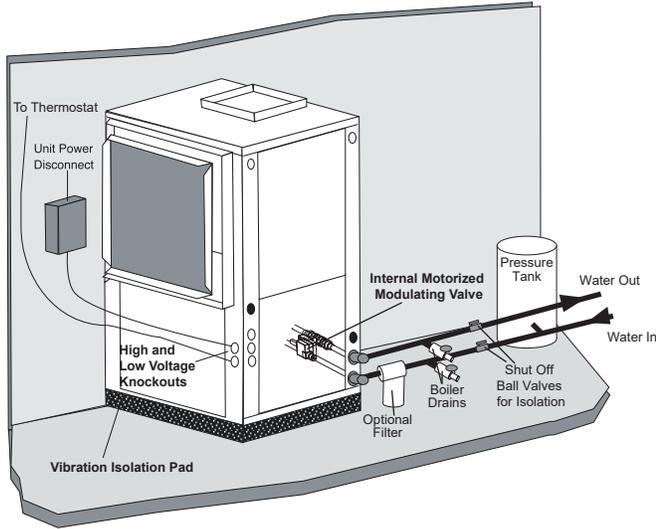
Typical Closed-Loop Application (with Internal Variable Pump Shown)



Variable Water Flow Heat Pump Applications Overview, Cont'd.

Typical Open Loop Application (with Internal Modulating Motorized Valve Shown)

For use on applications using external source for flow.



Modulating Valves for Closed Loop Applications, Low System Pressure Drop

Model	CV	Close Off	MOPD	WPD Adders		
				GPM	PSI	FT
024	4.7	200	30	3	0.41	0.94
	4.7	200	30	4.5	0.92	2.12
	4.7	200	30	6	1.63	3.76
036	7.4	200	30	4.5	0.37	0.85
	7.4	200	30	6.8	0.84	1.95
	7.4	200	30	9	1.48	3.42
048	10	200	30	6	0.36	0.83
	10	200	30	9	0.81	1.87
	10	200	30	12	1.44	3.33
060	19	200	30	7.5	0.16	0.36
	19	200	30	11.3	0.35	0.82
	19	200	30	15	0.62	1.44
070	19	200	30	8.5	0.20	0.46
	19	200	30	12.8	0.45	1.05
	19	200	30	17	0.80	1.85

Water Pressure Schrader Ports

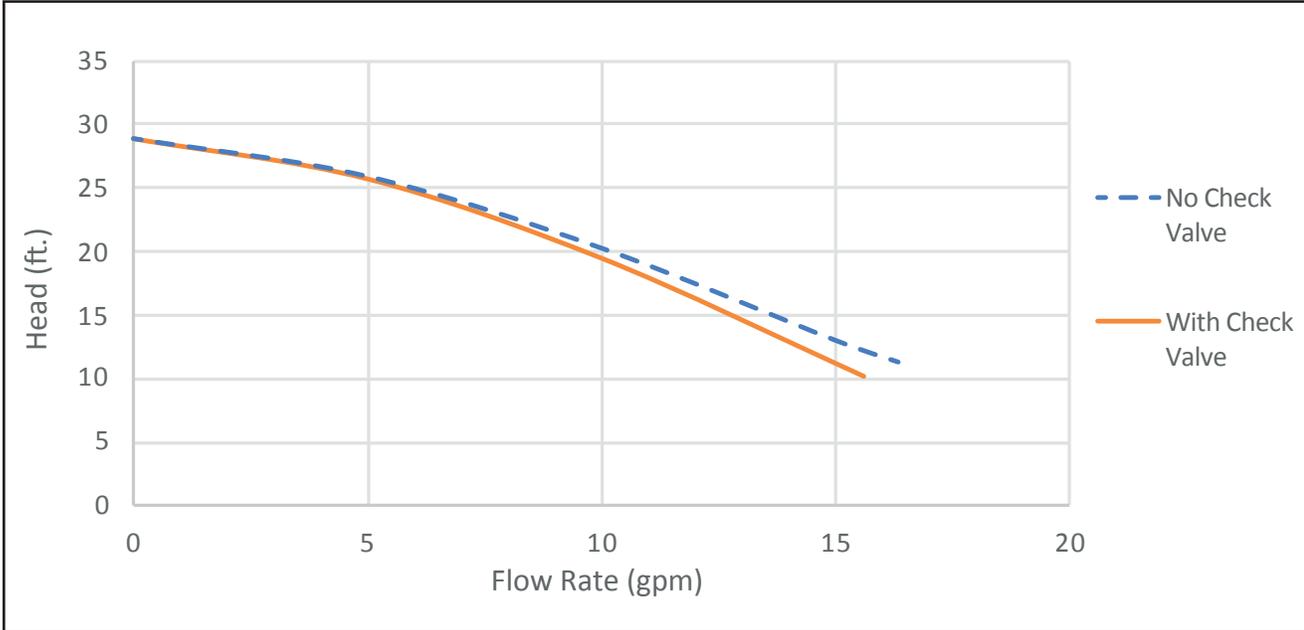
The pressure ports built in to the unit are provided as a means of measuring pressure drop through the water-to-refrigerant heat exchanger. The water pressure ports are schrader ports smaller than refrigerant schrader ports. They are the same size as tire schrader ports. A digital pressure gauge is recommended for taking pressure readings through these ports. The water flow through the unit can be determined 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 shown in the two tables to the right in this manual will determine the flow rate through the unit.

Modulating Valves for Open Loop Applications, High System Pressure Drop

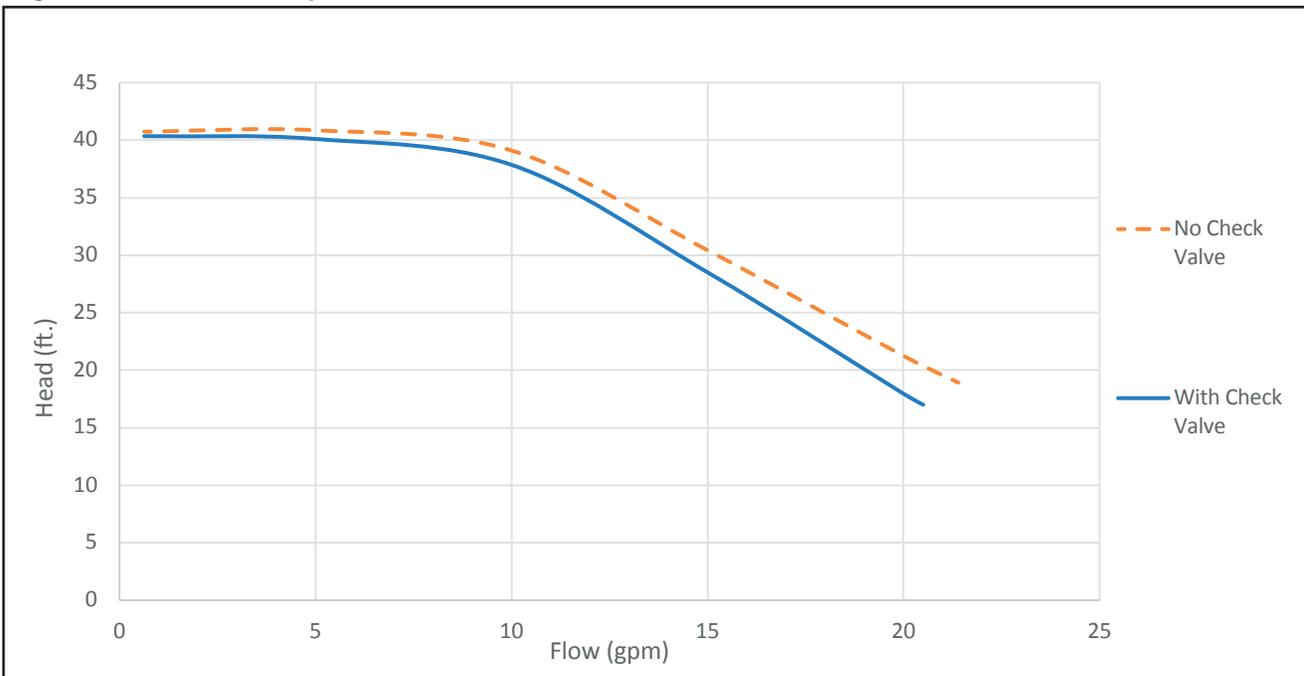
Model	CV	Close Off	MOPD	WPD Adders		
				GPM	PSI	FT
024	4.7	200	30	3	0.41	0.94
	4.7	200	30	4.5	0.92	2.12
	4.7	200	30	6	1.63	3.76
036	4.7	200	30	4.5	0.92	2.12
	4.7	200	30	6.8	2.09	4.84
	4.7	200	30	9	3.67	8.47
048	4.7	200	30	6	1.63	3.76
	4.7	200	30	9	3.67	8.47
	4.7	200	30	12	6.52	15.06
060	7.4	200	30	7.5	1.03	2.37
	7.4	200	30	11.3	2.33	5.39
	7.4	200	30	15	4.11	9.49
070	7.4	200	30	8.5	1.32	3.05
	7.4	200	30	12.8	2.99	6.91
	7.4	200	30	17	5.28	12.19

Variable Water Flow Heat Pump Applications Overview, Cont'd.

Standard Head Variable Pump Performance



High Head Variable Pump Performance



Water-Loop Heat Pump Applications

Commercial Water Loop Applications

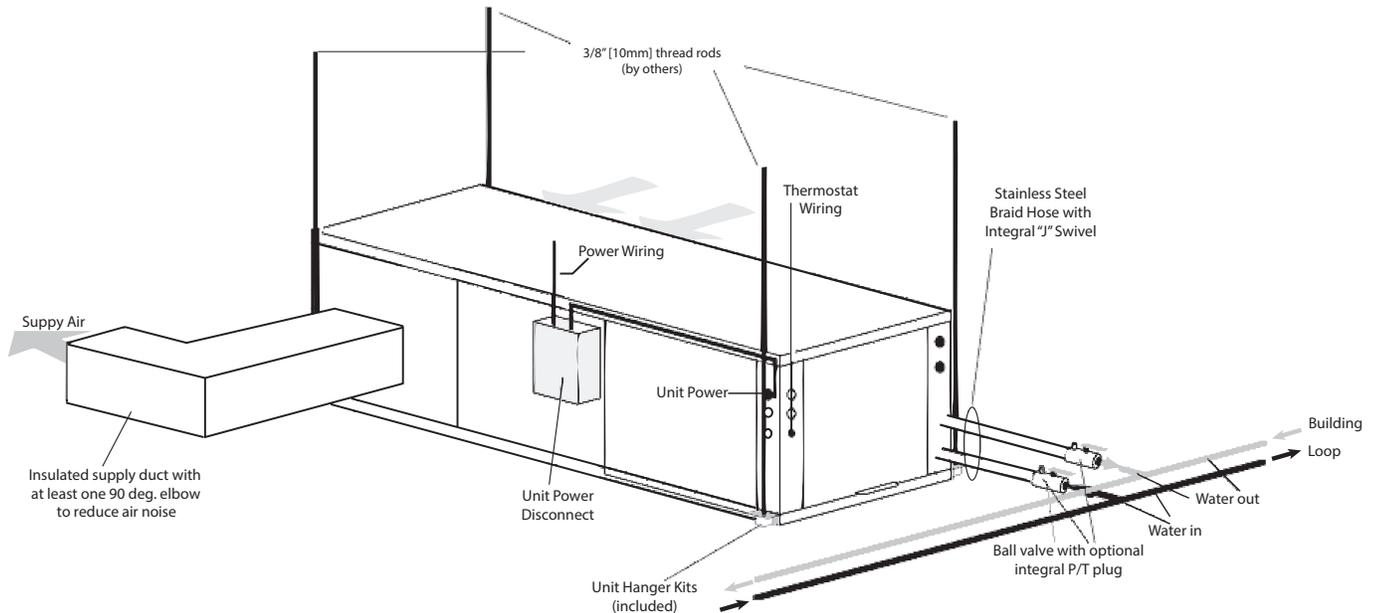
Commercial systems typically include a number of units connected to a common piping system. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major portion of the mechanical room plumbing. Consideration should be given to insulating the piping surfaces to avoid condensation. Heat Controller recommends unit insulation any time the water temperature is expected to be below 60°F (15.6°C). Metal to plastic threaded joints should never be used due to their tendency to leak over time.

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

The piping system should be flushed to remove dirt, piping chips, and other foreign material prior to operation (see “Piping System Cleaning and Flushing Procedures” in this manual). The flow rate is usually set between 2.25 and 3.5 gpm per ton [2.9 and 4.5 l/m per kW] of cooling capacity. Heat Controller recommends 3 gpm per ton [3.9 l/m per kW] for most applications of water loop heat pumps. To ensure proper maintenance and servicing, P/T ports are imperative for temperature and flow verification, as well as performance checks.

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

Typical Water-Loop Application



Low Water Temperature Cutout Setting - DXM2.5 Control

When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10.0°F [-12.2°C]) setpoint and avoid nuisance faults (see “Low Water Temperature Cutout Selection” in this manual). **NOTE: Low water temperature operation requires extended range equipment.**

Ground-Loop Heat Pump Applications

⚠ CAUTION! ⚠

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

⚠ CAUTION! ⚠

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

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

Flushing the Earth Loop

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

Antifreeze

In areas where minimum entering loop temperatures drop below 40°F [5°C] or where piping will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze; however your local sales office should be consulted to determine the antifreeze best suited to your area. Freeze protection should be maintained to 15°F [9°C] below the lowest expected entering loop temperature. For example, if 30°F [-1°C] is the minimum expected entering loop temperature, the leaving loop temperature would be 22 to 25°F [-6 to -4°C] and freeze protection should be at 15°F [-10°C]. Calculation is as follows:

$$30^{\circ}\text{F} - 15^{\circ}\text{F} = 15^{\circ}\text{F} \quad [-1^{\circ}\text{C} - 9^{\circ}\text{C} = -10^{\circ}\text{C}]$$

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced 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 table 2 for the amount of antifreeze needed. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Low Water Temperature Cutout Setting - DXM2.5 Control

When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10.0°F [-12.2°C]) setpoint and avoid nuisance faults (see “Low Water Temperature Cutout Selection” in this manual).

NOTE: Low water temperature operation requires extended range equipment.

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

All earth loop piping materials should be limited to polyethylene fusion only for in-ground sections of the loop. Galvanized or steel fittings should not be used at any time due to their tendency to corrode. All plastic to metal threaded fittings should be avoided due to their potential to leak. A flanged fitting should be substituted. P/T plugs should be used with units that do not include Variable Water Flow so that flow can be measured using the pressure drop of the unit heat exchanger. Units equipped with any of the four Variable Water Flow configurations have built in Schrader ports. Water temperature may be viewed on the communicating service tool.

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

Table 2: Antifreeze Percentages by Volume

Type	Minimum Temperature 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	25%	21%	16%	10%
100% USP food grade Propylene Glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

* Must not be denatured with any petroleum based product

Ground-Loop and Ground-Water Heat Pump Applications

Figure 12a:
Ground-Loop Heat Pump Applications Typical Closed Loop with Central Pumping
(unit with internal modulating water valve)

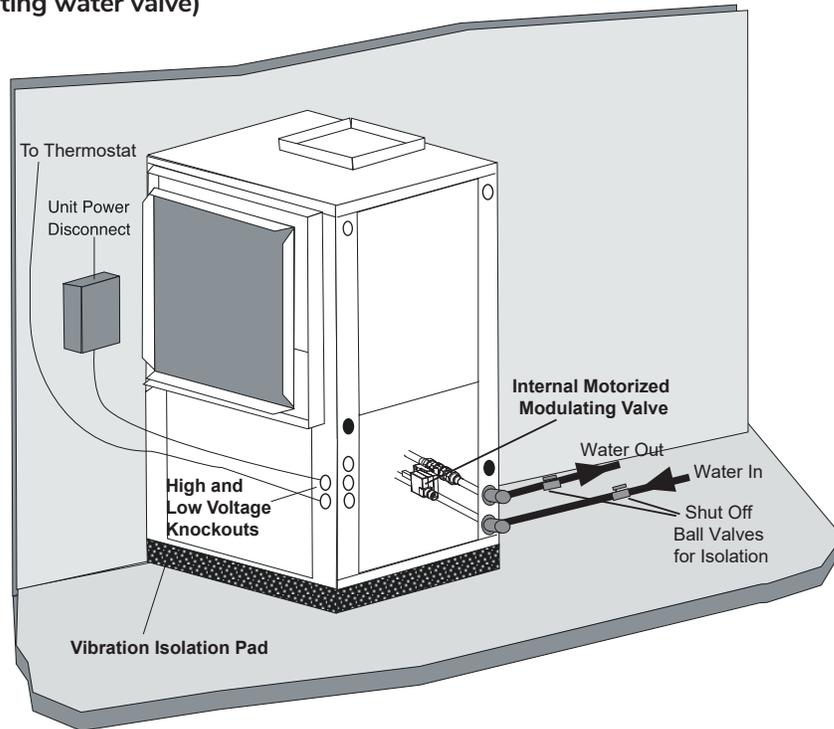
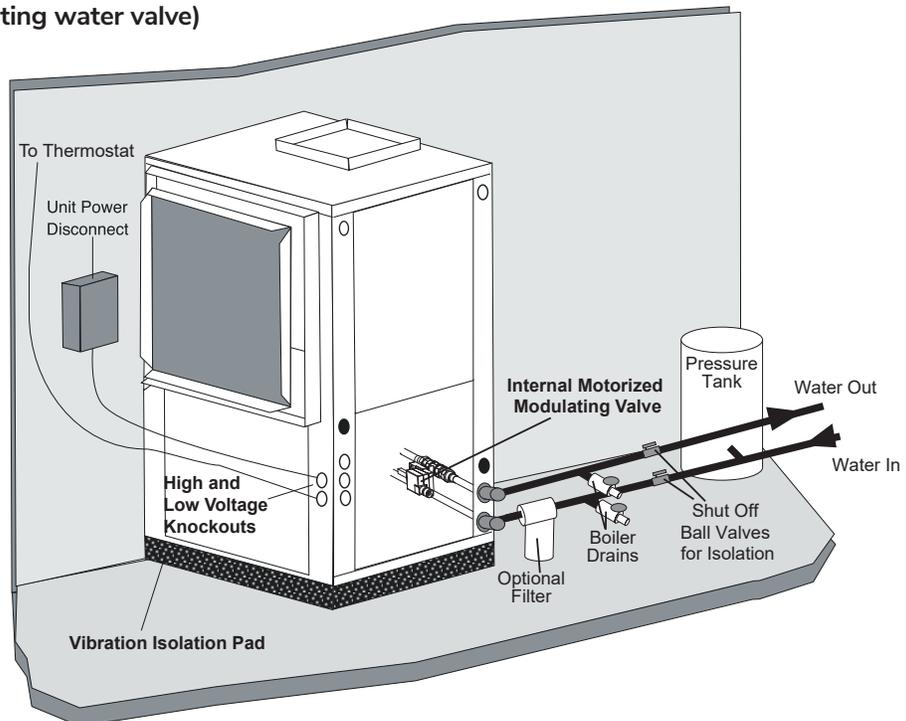


Figure 12b:
Ground-Water Heat Pump Applications Typical Open Loop/Well
(unit with internal modulating water valve)



Ground-Water Heat Pump Applications

Open Loop: Ground Water Systems - Typical open loop piping is shown in Figure 12b. Shut off valves should be included for ease of servicing. Boiler drains or other valves should be “tee’d” into the lines to allow acid flushing of the heat exchanger. Shut off valves should be positioned to allow flow through the coax via the boiler drains without allowing flow into the piping system. P/T plugs should be used with units that do not include internal Variable Water Flow so that flow can be measured using the pressure drop of the unit heat exchanger. Units equipped with any of the four Variable Water Flow configurations have built in Schrader ports. Water temperature may be viewed on the communicating service tool. Supply and return water piping should be limited 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 HFC-410A products.

WARNING!

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A 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 HFC-410A as system failures and property damage may result.

Water quantity should be plentiful and of good quality. Consult table 3 for water quality requirements. The unit can be ordered with either a copper or cupro-nickel water heat exchanger. Consult Table 3 for recommendations. Copper is recommended for closed loop systems and open loop ground water systems that are not high in mineral content or corrosiveness. In conditions anticipating heavy scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, an open loop system is not recommended. Heat exchanger coils may over time lose heat exchange capabilities 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 likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed 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.

Water Quality Requirements - Table 3 should be consulted for water quality requirements. Scaling potential should be assessed 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, the Ryznar Stability and Langelier Saturation indexes should be calculated. Use the appropriate scaling surface temperature for the application, 150°F [66°C] for direct use (well water/open loop) and DHW (desuperheater); 90°F [32°F] for indirect use. A monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 3.

Expansion Tank and Pump - Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. The expansion tank should be sized to provide at least one minute continuous run time of the pump using its draw down capacity rating to prevent pump short cycling. Discharge water from the unit is not contaminated in any manner and can be disposed of 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.

Water Control Valve: Units without Variable Water Flow - Always maintain water pressure in the heat exchanger by placing the water control valve(s) on the discharge line to prevent mineral precipitation during the off-cycle. Pilot operated slow closing valves are recommended to reduce water hammer. If water hammer persists, a mini-expansion tank can be mounted on the piping to help absorb the excess hammer shock. Ensure that the total ‘VA’ draw of the valve can be supplied by the unit transformer. For instance, a slow closing valve can draw up to 35VA. A typical pilot operated solenoid valve draws approximately 15VA. Note the special wiring diagrams for slow closing valves (shown later in this manual).

Ground-Water Heat Pump Applications, Cont'd.

Flow Regulation: Units without Variable Water Flow -

Flow regulation can be accomplished by two methods. One method of flow regulation involves simply adjusting the ball valve or water control valve on the discharge line. Measure the pressure drop through the unit heat exchanger, and determine flow rate from Table 4. Since the pressure is constantly varying, two pressure gauges may be needed. Adjust the valve until the desired flow of 1.5 to 2 gpm per ton [2.0 to 2.6 l/m per kW] is achieved. A second method of flow control requires a flow control device mounted on the outlet of the water control valve. The device is typically a brass fitting with an orifice of rubber or plastic material that is designed to allow a specified flow rate. On occasion, flow control devices may produce velocity noise that can be reduced by applying some back pressure from the ball valve located on the discharge line. Slightly closing the valve will spread the pressure drop over both devices, lessening the velocity noise.

NOTE: When EWT is below 50°F [10°C], 2 gpm per ton (2.6 l/m per kW) is required.

Water Coil Low Temperature Limit Setting - For all open loop systems the 30°F [-1.1°C] LT1 setting (factory setting-water) should be used to avoid freeze damage to the unit. See “Low Water Temperature Cutout Selection” in this manual for details on the low limit setting.

Water Quality Requirements

Table 3: 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 requirements listed in this table.

WATER QUALITY REQUIREMENTS							
For Closed-Loop and Open-Loop Systems							
	Description	Symbol	Units	Heat Exchanger Type			
				All Heat Exchanger Types	Open Loop, Tower, Ground Source Well		
					COAXIAL HX Copper Tube in Tube	COAXIAL HX Cupronickel	Brazed Plate HX 316 SS
Scaling Potential	pH - Chilled Water <85°F			7.0 to 9.0	7.0 to 9.0	7.0 to 9.0	7.0 to 9.0
	pH - Heated Water >85°F			8.0 to 10.0	8.0 to 10.0	8.0 to 10.0	8.0 to 10.0
	Alkalinity	(HCO ₃ ⁻)	ppm - CaCO ₃ equiv.	50 to 500	50 to 500	50 to 500	50 to 500
	Calcium	(Ca)	ppm	<100	<100	<100	<100
	Magnesium	(Mg)	ppm	<100	<100	<100	<100
	Total Hardness	(CaCO ₃)	ppm - CaCO ₃ equiv.	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 - CaCO ₃ equiv.	<1000	<1000	<1000	<1500
	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 ^a	(H ₂ S)	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 ₂ CL)	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 ^b	(TSS)	ppm	<10	<10	<10	<10
Electrolysis All HX types	Earth Ground Resistance ^x		Ohms	0	Consult NEC & local electrical codes for grounding requirements		
	Electrolysis Voltage ^δ		mV	<300	Measure voltage internal water loop to HP ground		
	Leakage Current ^δ		mA	<15	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, Cont'd.

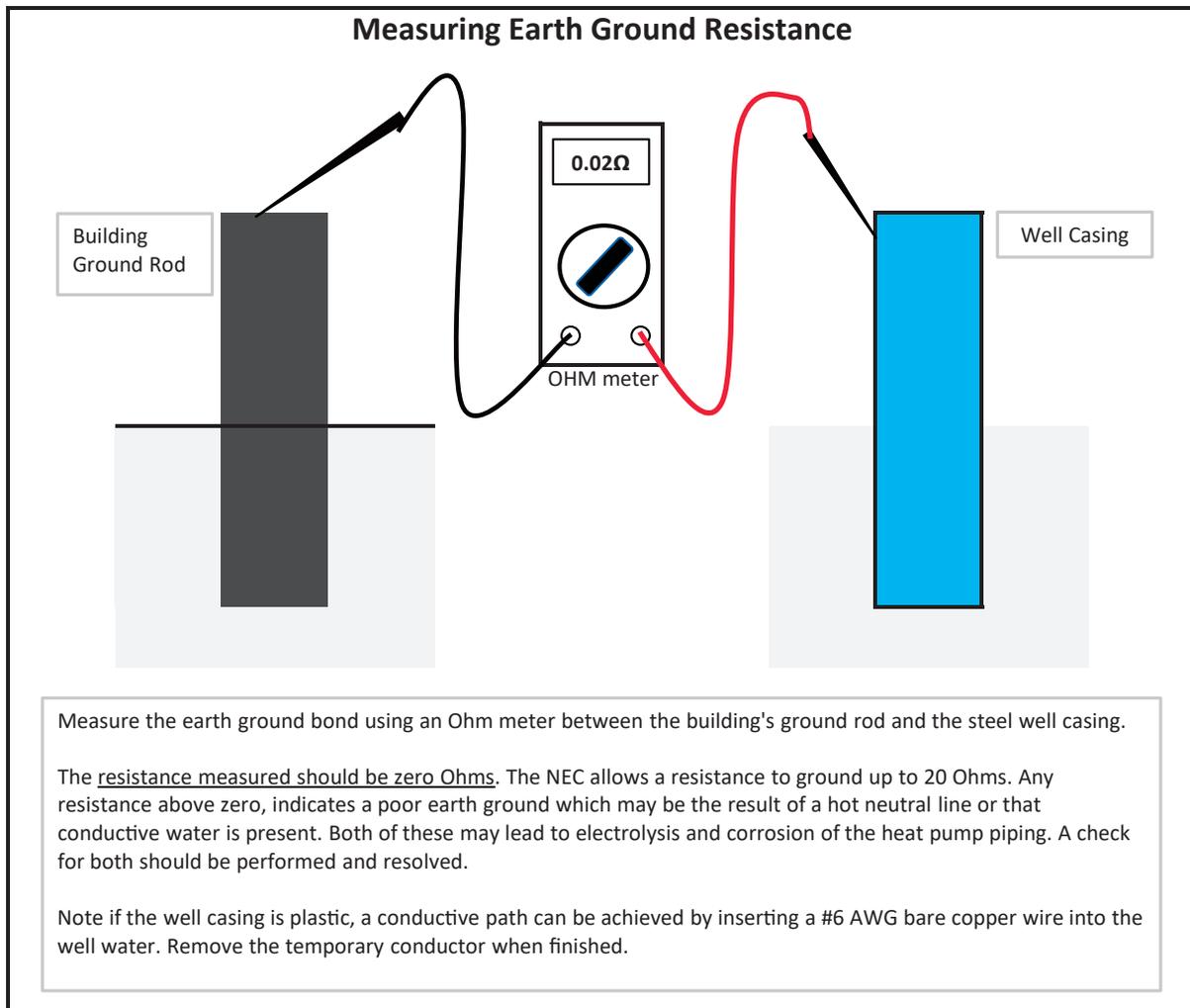
1. The Water Quality Table provides water quality requirements for coaxial & brazed plate heat exchangers.
2. The water must be evaluated by an independent testing facility comparing site samples against this Table. When water properties are outside of these parameters, the water must either be treated 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, antifreeze is required. Refer to the heat pump IOM for the correct solution ratios to prevent freezing.
 - α Hydrogen Sulfide has an odor of rotten eggs. If one detects this smell, a test for H₂S must be performed. If H₂S is detected above the limit indicated, remediation is necessary (Consult with your Water Testing/Treatment Professional) or a secondary heat exchanger is required using 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 in.) 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 An electrical grounding system using a dedicated ground rod meeting NEC and Local Electrical codes must be installed. Building Ground must not be connected the WSHP piping system or other plumbing pipes.
 - δ Refer to IOM for instructions on measuring resistance and leakage currents within water loops.

Do not use PVC pipe for water loop (compressor POE oil and glycols damage PVC) use of HDPE pipe is recommended.

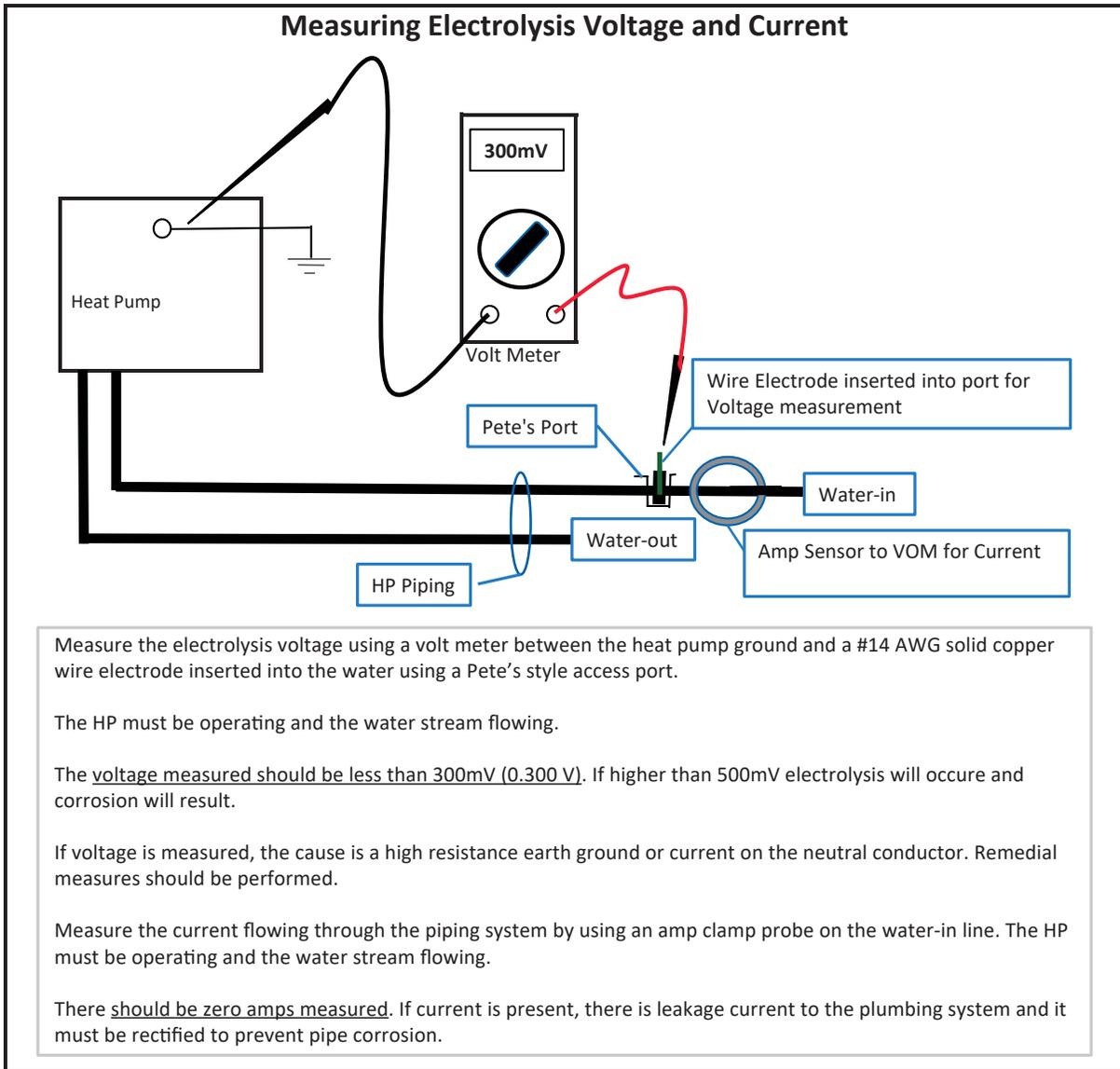
Strainer / Filter Sizing			
Mesh Size	Particle Size		
	Microns	MM	Inch
20	840	0.840	0.0340
30	533	0.533	0.0210
60	250	0.250	0.0100
100	149	0.149	0.0060
150	100	0.100	0.0040
200	74	0.074	0.0029

ppm = parts per million
ppb = parts per billion

Water Quality Requirements, Cont'd.



Water Quality Requirements, Cont'd.



Hot Water Generator

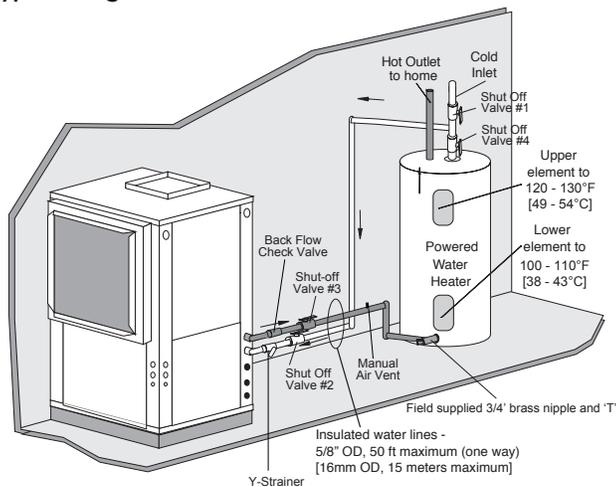
The HWG (Hot Water Generator) or desuperheater option provides considerable operating cost savings by utilizing heat energy from the compressor discharge line to help satisfy domestic hot water requirements. The HWG is active throughout the year, providing virtually free hot water when the heat pump 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 refrigerant circuit in the field. The control circuit and pump are also built in for residential equipment. The figure to the left 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 set point 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 set point, versus the amount of heat that can be generated by the HWG when using the 150°F set point.

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 will eventually stratify 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, will be maintained at 125°F (controlled by the upper element).

Typical Single Tank HWG Installation



Using a 125°F set point, 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 set point, 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 set point.

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

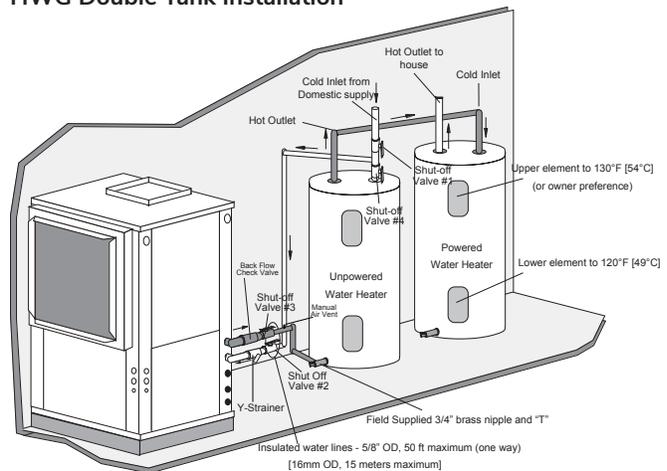
Typically a single tank of at least 50 gallons (189 liters) is used to limit installation costs and space. However, a dual tank, as shown in the HWG Double Tank Installation Figure, is the preferred system, as it provides the maximum storage and temperate source water to the HWG.

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 4 for scaling potential tests.

⚠ WARNING! ⚠

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.

HWG Double Tank Installation



Hot Water Generator

WARNING!

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 ft. (one way) [15 m]. See Table 5 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 Start-Up” section, below 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 1/2 inches [12.7 mm] I.D. copper, route and install the water piping and valves as shown in Figures 20 or 21. 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 (as in the figures on page 23) 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 3/8 inch [10 mm] wall closed cell insulation.
3. Open both shut off valves and make sure the tank drain valve is closed.

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 (HWG Double Tank Installation Figure on page 23).
6. Replace access cover(s) and restore power or fuel supply.

INITIAL START-UP

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

Table 4: HWG Water Piping Sizes and Length

Unit Nominal Tonnage	Nominal HWG Flow (gpm)	1/2" Copper (max length*)	3/4" Copper (max length*)
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

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

CAUTION!

CAUTION! 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

Electrical – Line Voltage

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

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

Transformer - All 208/230 voltage units are factory wired for 208 volt. If supply voltage is 230 volt, installer must rewire transformer. See wire diagram for connections.

WARNING!

WARNING! To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

CAUTION!

CAUTION! Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

Electrical – Line Voltage, Cont'd.

Standard Units, Units with Modulating Motorized Valve

Model	Voltage Code	Voltage	Min/Max Voltage	Compressor			Fan Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR
				RLA	LRA	Qty				
024	G	208/230/60/1	197/252	11.7	58.3	1	3.9	15.6	18.5	30
	E	265/60/1	239/292	9.1	54.0	1	3.2	12.3	14.6	20
	H	208/230/60/3	197/252	6.5	55.4	1	3.9	10.4	12.0	15
	*F	*460/60/3	414/506	3.5	28.0	1	3.2	6.7	7.6	15
036	G	208/230/60/1	197/252	15.3	83.0	1	3.9	19.2	23.0	35
	E	265/60/1	239/292	13.0	72.0	1	3.2	16.2	19.5	30
	H	208/230/60/3	197/252	11.6	73.0	1	3.9	15.5	18.4	30
	*F	*460/60/3	414/506	5.7	38.0	1	3.2	8.9	10.3	15
048	G	208/230/60/1	197/252	21.2	104.0	1	6.9	28.1	33.4	50
	E	265/60/1	239/292	16.0	109.7	1	6.0	22.0	26.0	40
	H	208/230/60/3	197/252	14.0	83.1	1	6.9	20.9	24.4	35
	*F	*460/60/3	414/506	6.4	41.0	1	6.0	12.4	14.0	20
060	G	208/230/60/1	197/252	27.1	152.9	1	6.9	34.0	40.8	60
	E	265/60/1	239/292	22.4	130.0	1	6.0	28.4	34.0	50
	H	208/230/60/3	197/252	16.5	110.0	1	6.9	23.4	27.5	40
	*F	*460/60/3	414/506	7.2	52.0	1	6.0	13.2	15.0	20
070	G	208/230/60/1	197/252	29.7	179.2	1	6.9	36.6	44.0	70
	H	208/230/60/3	197/252	17.6	136.0	1	6.9	24.5	28.9	45
	*F	*460/60/3	414/506	8.5	66.1	1	6.0	14.5	16.6	25

Wire length based on one way measurement with 2% voltage drop
 Wire size based on 60°C copper conductor
 All fuses Class RK-5

* NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ECM motors require a four wire power supply with neutral. ECM motor is rated 265 vac and is wired between one hot leg and neutral.

Units with Secondary Pump

Model	Voltage Code	Voltage	Min/Max Voltage	Compressor			Internal Pump FLA	Fan Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR
				RLA	LRA	Qty					
024	G	208/230/60/1	197/252	11.7	58.3	1	0.8	3.9	16.4	19.3	30
	E	265/60/1	239/292	9.1	54.0	1	0.7	3.2	13.0	15.3	20
	H	208/230/60/3	197/252	6.5	55.4	1	0.8	3.9	11.2	12.8	15
	*F	*460/60/3	414/506	3.5	28.0	1	0.7	3.2	7.4	8.3	15
036	G	208/230/60/1	197/252	15.3	83.0	1	0.8	3.9	20.0	23.8	35
	E	265/60/1	239/292	13.0	72.0	1	0.7	3.2	16.9	20.2	30
	H	208/230/60/3	197/252	11.6	73.0	1	0.8	3.9	16.3	19.2	30
	*F	*460/60/3	414/506	5.7	38.0	1	0.7	3.2	9.6	11.0	15
048	G	208/230/60/1	197/252	21.2	104.0	1	0.8	6.9	28.9	34.2	50
	E	265/60/1	239/292	16.0	109.7	1	0.7	6.0	22.7	26.7	40
	H	208/230/60/3	197/252	14.0	83.1	1	0.8	6.9	21.7	25.2	35
	*F	*460/60/3	414/506	6.4	41.0	1	0.7	6.0	13.1	14.7	20
060	G	208/230/60/1	197/252	27.1	152.9	1	1.1	6.9	35.1	41.8	60
	E	265/60/1	239/292	22.4	130.0	1	1.1	6.0	29.5	35.1	50
	H	208/230/60/3	197/252	16.5	110.0	1	1.1	6.9	24.5	28.6	45
	*F	*460/60/3	414/506	7.2	52.0	1	1.1	6.0	14.3	16.1	20
070	G	208/230/60/1	197/252	29.7	179.2	1	1.1	6.9	37.7	45.1	70
	H	208/230/60/3	197/252	17.6	136.0	1	1.1	6.9	25.6	30.0	45
	*F	*460/60/3	414/506	8.5	66.1	1	1.1	6.0	15.6	17.7	25

Wire length based on one way measurement with 2% voltage drop
 Wire size based on 60°C copper conductor
 All fuses Class RK-5

* NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ECM motors/internal secondary circulators require a four wire power supply with neutral.

Electrical Data

Units with Variable Pump High Head

Model	Voltage Code	Voltage	Min/Max Voltage	Compressor			Pump FLA	Fan Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR
				RLA	LRA	Qty					
024	G	208/230/60/1	197/252	11.7	58.3	1	1.44	3.9	17.0	20.0	30
	E	265/60/1	239/292	9.1	54.0	1	1.25	3.2	13.6	15.8	25
	H	208/230/60/3	197/252	6.5	55.4	1	1.44	3.9	11.8	13.5	20
	*F	*460/60/3	414/506	3.5	28.0	1	1.25	3.2	8.0	8.8	15
036	G	208/230/60/1	197/252	15.3	83.0	1	1.44	3.9	20.6	24.5	40
	E	265/60/1	239/292	13.0	72.0	1	1.25	3.2	17.5	20.7	30
	H	208/230/60/3	197/252	11.6	73.0	1	1.44	3.9	16.9	19.8	30
	*F	*460/60/3	414/506	5.7	38.0	1	1.25	3.2	10.2	11.6	15
048	G	208/230/60/1	197/252	21.2	104.0	1	1.44	6.9	29.5	34.8	50
	E	265/60/1	239/292	16.0	109.7	1	1.25	6.0	23.3	27.3	40
	H	208/230/60/3	197/252	14.0	83.1	1	1.44	6.9	22.3	25.8	40
	*F	*460/60/3	414/506	6.4	41.0	1	1.25	6.0	13.7	15.3	20
060	G	208/230/60/1	197/252	27.1	152.9	1	1.44	6.9	35.4	42.2	60
	E	265/60/1	239/292	22.4	130.0	1	1.25	6.0	29.7	35.3	50
	H	208/230/60/3	197/252	16.5	110.0	1	1.44	6.9	24.8	29.0	45
	*F	*460/60/3	414/506	7.2	52.0	1	1.25	6.0	14.5	16.3	20
070	G	208/230/60/1	197/252	29.7	179.2	1	1.44	6.9	38.0	45.5	70
	H	208/230/60/3	197/252	17.6	136.0	1	1.44	6.9	25.9	30.3	45
	*F	*460/60/3	414/506	8.5	66.1	1	1.25	6.0	15.8	17.9	25

Wire length based on one way measurement with 2% voltage drop
 Wire size based on 60°C copper conductor
 All fuses Class RK-5

*** NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ECM motors/internal pumps require a four wire power supply with neutral. ECM motors/internal pumps are rated 265 vac and are wired between one hot leg and neutral.**

Units with Variable Pump Standard Head

Model	Voltage Code	Voltage	Min/Max Voltage	Compressor			Pump FLA	Fan Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR
				RLA	LRA	Qty					
024	G	208/230/60/1	197/252	11.7	58.3	1	0.7	3.9	16.3	19.2	30
	E	265/60/1	239/292	9.1	54.0	1	0.6	3.2	12.9	15.2	20
	H	208/230/60/3	197/252	6.5	55.4	1	0.7	3.9	11.1	12.7	15
	*F	*460/60/3	414/506	3.5	28.0	1	0.6	3.2	7.3	8.2	15
036	G	208/230/60/1	197/252	15.3	83.0	1	0.7	3.9	19.9	23.7	35
	E	265/60/1	239/292	13.0	72.0	1	0.6	3.2	16.8	20.1	30
	H	208/230/60/3	197/252	11.6	73.0	1	0.7	3.9	16.2	19.1	30
	*F	*460/60/3	414/506	5.7	38.0	1	0.6	3.2	9.5	10.9	15
048	G	208/230/60/1	197/252	21.2	104.0	1	0.7	6.9	28.8	34.1	50
	E	265/60/1	239/292	16.0	109.7	1	0.6	6.0	22.6	26.6	40
	H	208/230/60/3	197/252	14.0	83.1	1	0.7	6.9	21.6	25.1	35
	*F	*460/60/3	414/506	6.4	41.0	1	0.6	6.0	13.0	14.6	20
060	G	208/230/60/1	197/252	27.1	152.9	1	0.7	6.9	34.7	41.5	60
	E	265/60/1	239/292	22.4	130.0	1	0.6	6.0	29.0	34.6	50
	H	208/230/60/3	197/252	16.5	110.0	1	0.7	6.9	24.1	28.2	40
	*F	*460/60/3	414/506	7.2	52.0	1	0.6	6.0	13.8	15.6	20
070	G	208/230/60/1	197/252	29.7	179.2	1	0.7	6.9	37.3	44.7	70
	H	208/230/60/3	197/252	17.6	136.0	1	0.7	6.9	25.2	29.6	45
	*F	*460/60/3	414/506	8.5	66.1	1	0.6	6.0	15.1	17.2	25

Wire length based on one way measurement with 2% voltage drop
 Wire size based on 60°C copper conductor
 All fuses Class RK-5

*** NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ECM motors/internal pumps require a four wire power supply with neutral. ECM motors/internal pumps are rated 265 vac and are wired between one hot leg and neutral.**

Electrical – Power & Low Voltage Wiring

WARNING!

WARNING! Disconnect electrical power source to prevent injury or death from electrical shock.

CAUTION!

CAUTION! Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

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.

460 volt units require a neutral wire.

Transformer - All 208/230 voltage units are factory wired for 208 volt. If supply voltage is 230 volt, installer must rewire transformer. See wire diagram for connections.

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

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

ELECTRICAL – LOW VOLTAGE WIRING

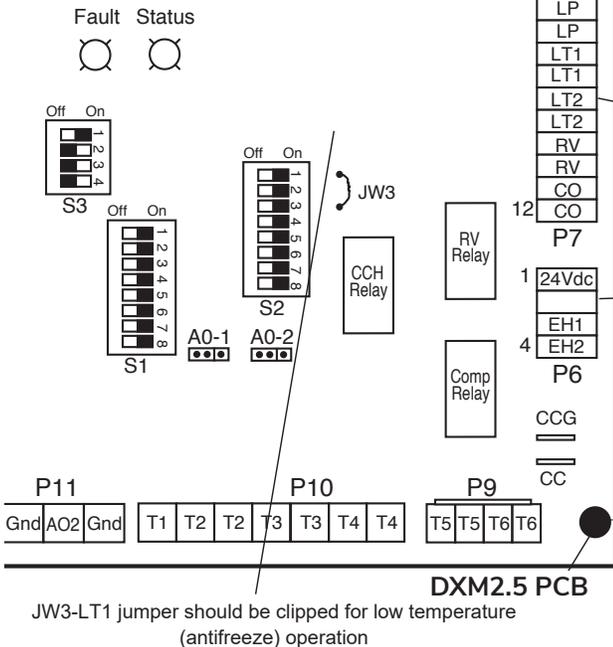
Thermostat Connections - The thermostat will be wired to the DXM2.5 board located within the unit control box. Refer to the unit wiring diagram for specific details.

Low Water Temperature Cutout Selection - The DXM2.5 control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW3, which changes the sensing temperature associated with thermistor LT1. Note that the LT1 thermistor is located on the refrigerant line between the coaxial heat exchanger and expansion device (TXV). Therefore, LT1 is sensing refrigerant temperature, not water temperature, which is a better indication of how water flow rate/temperature is affecting the refrigeration circuit.

The factory setting for LT1 is for systems using water (30°F [-1.1°C] refrigerant temperature). In low water temperature (extended range) applications with antifreeze (most ground loops), jumper JW3 should be clipped as shown in Figure 17 to change the setting to 10°F [-12.2°C] refrigerant temperature, a more suitable temperature when using an antifreeze solution. All Heat Controller units operating with entering water temperatures below 60°F [15.6°C] must include the optional water/refrigerant circuit insulation package to prevent internal condensation.

Electrical – Low Voltage Wiring, Cont'd.

Figure 13: LT1 Limit Setting



Accessory Connections - A terminal paralleling the compressor contactor coil has been provided on the DXM2.5 control. Terminal "A" is designed to control accessory devices. **NOTE: This terminal should be used only with 24 Volt signals and not line voltage. Terminal "A" is energized with the compressor contactor.**

The DXM2.5 controller includes two accessory relays ACC1 and ACC2. Each relay includes a normally open (NO) and a normally closed (NC) contact. Accessory relays may be configured to operate as shown in the tables below.

Accessory Relay 1 Configuration

DIP 2.1	DIP 2.2	DIP 2.3	ACC1 Relay Option
ON	ON	ON	Cycle with fan
OFF	ON	ON	N/A for Residential Applications
ON	OFF	ON	Water valve – Slow opening
ON	ON	OFF	Outside air damper
OFF	OFF	ON	N/A for Residential Applications
ON	OFF	OFF	N/A for Residential Applications

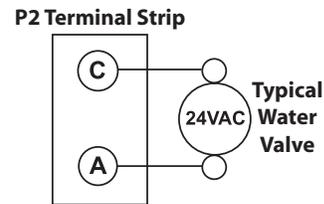
All other DIP combinations are invalid

Accessory Relay 2 Configuration

DIP 2.4	DIP 2.5	DIP 2.6	ACC2 Relay Option
ON	ON	ON	Cycle with compressor
OFF	ON	ON	N/A for Residential Applications
ON	OFF	ON	Water valve – Slow opening
OFF	OFF	ON	Humidifier
ON	ON	OFF	Outside air damper

All other DIP combinations are invalid

Figure 14: Accessory Wiring



Unit Without Variable Water Flow - An external solenoid valve(s) should be used on ground water installations to shut off flow to the unit when the compressor is not operating. A slow closing valve may be required to help reduce water hammer. Figure 14 shows typical wiring for a 24VAC external solenoid valve. Figures 15 and 16 illustrate typical slow closing water control valve wiring for Taco 500 series and Taco SBV series valves. Slow closing valves take approximately 60 seconds to open (very little water will flow before 45 seconds). Once fully open, an end switch allows the compressor to be energized. Only relay or triac based electronic thermostats should be used with slow closing valves. When wired as shown, the slow closing valve will operate properly with the following notations:

1. The valve will remain open during a unit lockout.
2. The valve will draw approximately 25-35 VA through the "Y" signal of the thermostat.

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

Two-stage Units

Two-stage units without Variable Water Flow should be designed with two parallel valves for ground water applications to limit water use during first stage operation. For example, at 1.5 gpm/ton [2.0 l/m per kW], a HZ049 unit requires 6 gpm [23 l/m] for full load (2nd stage) operation, but only 4 gpm [15 l/m] during 1st stage operation. Since the unit will operate on first stage 80-90% of the time, significant water savings can be realized by using two parallel solenoid valves with two flow regulators. In the example above, stage one solenoid would be installed with a 4 gpm [15 l/m] flow regulator on the outlet, while stage two would utilize a 2 gpm [8 l/m] flow regulator. When stage one is operating, the second solenoid valve will be closed. When stage two is operating, both valves will be open, allowing full load flow rate.

Figure 17 illustrates piping for two-stage solenoid valves. Review figures 18-20 for wiring of stage one valve. Stage two valve should be wired between terminal "Y2" and terminal "C." **NOTE: When EWT is below 50°F [10°C], 2 gpm per ton (2.6 l/m per kW) is required.**

Electrical – Low Voltage Wiring for non-Variable Water Flow Control Units Using External Motorized Water Valve

Figure 15: Accessory Motorized Water Valve - Typical Wiring Example #1

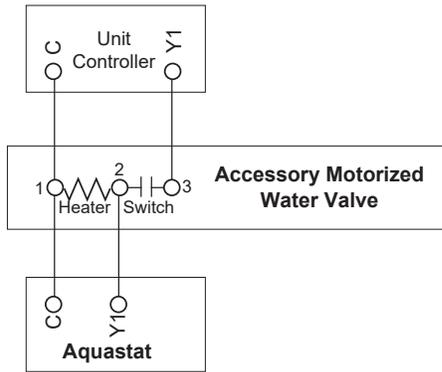


Figure 17: Two-Stage Piping

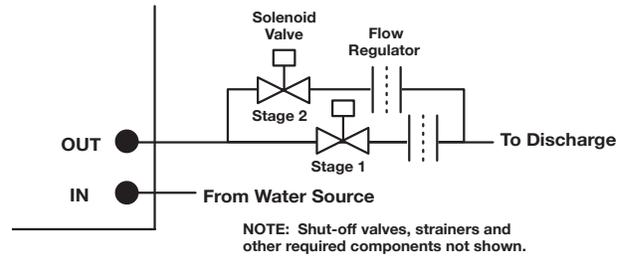
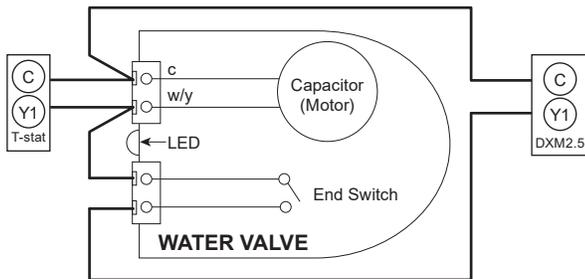


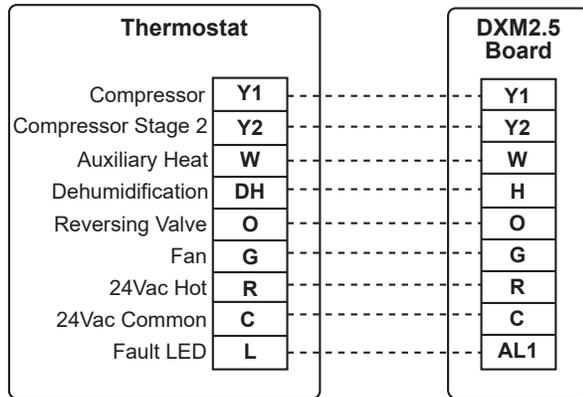
Figure 16: Accessory Motorized Water Valve - Typical Wiring Example #2



Electrical – Thermostat Wiring

Thermostat Installation - The thermostat should be located on an interior wall in a larger room, away from supply duct drafts. DO NOT locate the thermostat in areas subject to sunlight, drafts or on external walls. The wire access hole behind the thermostat may in certain cases need to be sealed to prevent erroneous temperature measurement. Position the thermostat back plate against the wall so that it appears level and so the thermostat wires protrude through the middle of the back plate. Mark the position of the back plate mounting holes and drill holes with a 3/16" (5mm) bit. Install supplied anchors and secure plate to the wall. Thermostat wire must be 18 AWG wire. Representative thermostat wiring is shown in Figures 18a-b however, actual wiring connections should be determined from the thermostat IOM and or unit wiring diagram. Practically any heat pump thermostat will work with Heat Controller units, provided it has the correct number of heating and cooling stages.

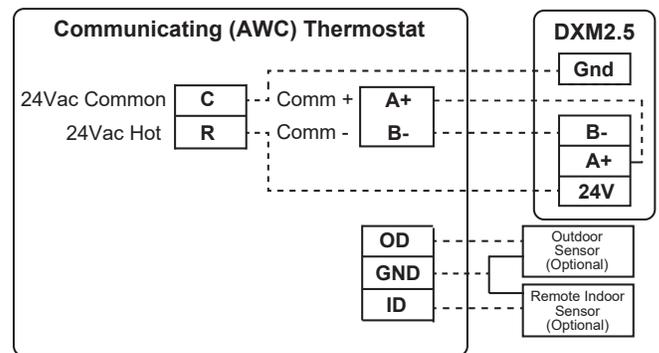
Figure 18a: Conventional 3 Heat / 2 Cool Thermostat Connection to DXM2.5 Control



NOTES:

- 1) ECM automatic dehumidification mode operates with dehumidification airflows in the cooling mode when the dehumidification output from thermostat is active. Normal heating and cooling airflows are not affected.
- 2) DXM2.5 board DIP switch S2-7 must be in the auto dehumidification mode for automatic dehumidification.
- 3) DH connection not possible with units with internal variable speed pump. Use communicating service tool.
- 4) Only use communicating thermostat when using Humidifier (H Input) in units with internal variable speed pump.

Figure 18b: Communicating Thermostat Connection to DXM2.5 Control



Field Wiring - - - - -
Factory Wiring _____

Blower Performance Data

Airflow in CFM with wet coil and clean air filter

Model	Max ESP (in wg)	Fan Motor (hp)	Range	Cooling Mode		Dehumid Mode		Heating Mode		Fan Only Mode
				Stg 2	Stg 1	Stg 2	Stg 1	Stg 2	Stg 1	
024	1.0	1/2	Default	700	525	550	425	750	600	350
			Maximum	1000	800	800	600	1000	850	1000
			Minimum	600	450	550	400	600	450	300
036	0.9	1/2	Default	1050	800	850	650	1100	850	550
			Maximum	1500	1100	1200	900	1500	1100	1500
			Minimum	900	600	825	550	900	600	450
048	1.0	1	Default	1400	1050	1100	850	1500	1150	700
			Maximum	2000	1500	1600	1200	2000	1500	2000
			Minimum	1200	900	1100	825	1200	900	600
060	0.7	1	Default	1750	1300	1400	1050	1875	1450	875
			Maximum	2300	1900	2000	1500	2300	1900	2300
			Minimum	1500	1100	1375	1000	1500	1100	750
070	0.7	1	Default	1900	1450	1650	1250	2000	1650	950
			Maximum	2300	2200	2000	1800	2300	2200	2300
			Minimum	1800	1350	1650	1250	1800	1350	900

Airflow is controlled within +/- 5% up to Max ESP shown with wet coil and standard 1" fiberglass filter.

ECM Blower Control

The ECM fan is controlled directly by the DXM2.5 control board that converts thermostat inputs and CFM settings to signals used by the ECM motor controller. To take full advantage of the ECM motor features, the Communicating (ATC) Thermostat should be used.

The DXM2.5 control maintains a selectable operating airflow [CFM] for each heat pump operating mode. For each operating mode there are maximum and minimum airflow limits. See the ECM Blower Performance tables for the maximum, minimum, and default operating airflows.

Airflow levels are selected using the configuration menus of the web portal/mobile app or PC Service tool. The configuration menus allow the installer to independently select and adjust the operating airflow for each of the operating modes. Air flow can be selected in 25 CFM increments within the minimum and maximum limits shown in the ECM Blower Performance Table. The blower operating modes include:

- First Stage Cooling (Y1 & O)
- Second Stage Cooling (Y1, Y2, & O)
- First Stage Cooling in Dehumidification Mode (Y1, O, & Dehumid)
- Second Stage Cooling in Dehumidification Mode (Y1, Y2, O, & Dehumid)
- First Stage Heating (Y1)
- Second Stage Heating (Y1 & Y2)
- Third Stage (Auxiliary) Heating (Y1, Y2, & W)
- Emergency Heating (W with no Y1 or Y2)
- Fan (G with no Y1, Y2, or W)

It is highly recommended that the Communicating (ATC) Thermostat or ACDU03C be used to set dehumidification mode electronically. Dehumidification can NOT be selected when using a non-communicating thermostat with a Variable Water Flow unit with Internal Flow Controller (pump). For dehumidification settings on other units using the non-communicating stat, refer to DXM2.5 AOM (part #97B0142N01).

The ECM motor includes “soft start” and “ramp down” features. The soft start feature is a gentle increase of motor rpm at blower start up. This creates a much quieter blower start cycle.

The ramp down feature allows the blower to slowly decrease rpm to a full stop at the end of each blower cycle. This creates a much quieter end to each blower cycle and adds overall unit efficiency.

The ramp down feature is eliminated during an ESD (Emergency Shut Down) situation. When the DXM2.5 ESD input is activated, the blower and all other control outputs are immediately de-activated.

The ramp down feature (also known as the heating or cooling “Off Delay”) is field selectable by the installer. The allowable range is 0 to 255 seconds.

Special Note for AHRI Testing:

To achieve rated airflow for AHRI testing purposes, it is necessary to change the CFM settings to rated airflow.

Wiring Diagram Matrix

All current 60 Hz wire diagrams can be downloaded at: files.hvac-wiringdiagrams.com/MARS/marswire.html.

Unit Controller	Hydronic Options	208-230/60/1
DXM2.5	Modulating Water Valve	96B0242N01
	Variable Speed Water Pump	96B0242N12

Controls – DXM2.5



DXM2.5 Controls

For detailed control information, see the DXM2.5 Application, Operation, and Maintenance (AOM) manual (part # 97B0142N01).

Operating and Commissioning Limits

Operating Limits

Environment – 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 – A voltage variation of +/- 10% of nameplate utilization voltage is acceptable.

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. Consult Table 5a for operating limits.

Table 5a: Operating Limits

Operating Limits	HZ	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45°F [7°C]	39°F [4°C]
Rated ambient, DB	80.6°F [27°C]	68°F [20°C]
Max. ambient air, DB	130°F [54.4°C]	85°F [29°C]
Min. entering air, DB/WB	65/45°F [18/7°C]	50°F [10°C]
Rated entering air, DB/WB	80.6/66.2°F [27/19°C]	68°F [20°C]
Max. entering air, DB/WB	100/75°F [38/24°C]	80°F [27°C]
Water Limits		
Min. entering water	*20°F [-6.7°C]	20°F [-6.7°C]
Normal entering water	50-110°F [10-43.3°C]	30-80°F [-1.1-26.7°C]
Max. entering water	120°F [48.9°C]	*120°F [48.9°C]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

* = Temperatures shown are for units with Variable Water Flow internal pump or modulating valve. For units without a Variable Water Flow device the minimum entering water temperature for cooling is 30°F (-1.1°C) and the maximum for heating is 90°F (32.2°C).

Commissioning Limits

Consult Table 5b for the particular model. Starting limits vary depending upon model and are based upon the following notes:

Notes:

- Limits in Table 5b are not normal or continuous operating limits. Minimum/maximum limits are start-up limits to bring the building space up to occupancy temperatures. Units are not designed to operate under these limits on a regular basis.
- Voltage utilization range complies with AHRI Standard 110.

Table 5b: Commissioning Limits

Commissioning Limits	HZ	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45°F [7°C]	39°F [4°C]
Rated ambient, DB	80.6°F [27°C]	68°F [20°C]
Max. ambient air, DB	130°F [54.4°C]	85°F [29°C]
Min. entering air, DB/WB	60/45°F [16/7°C]	50°F [10°C]
Rated entering air, DB/WB	80.6/66.2°F [27/19°C]	68°F [20°C]
Max. entering air, DB/WB	100/75°F [38/24°C]	80°F [27°C]
Water Limits		
Min. entering water	*20°F [-6.7°C]	20°F [-6.7°C]
Normal entering water	50-110°F [10-43.3°C]	30-80°F [-1.1-26.7°C]
Max. entering water	120°F [48.9°C]	*120°F [48.9°C]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

* = Temperatures shown are for units with Variable Water Flow internal pump or modulating valve. For units without a Variable Water Flow device the minimum entering water temperature for cooling is 30°F (-1.1°C) and the maximum for heating is 90°F (32.2°C).

Piping System Cleaning and Flushing

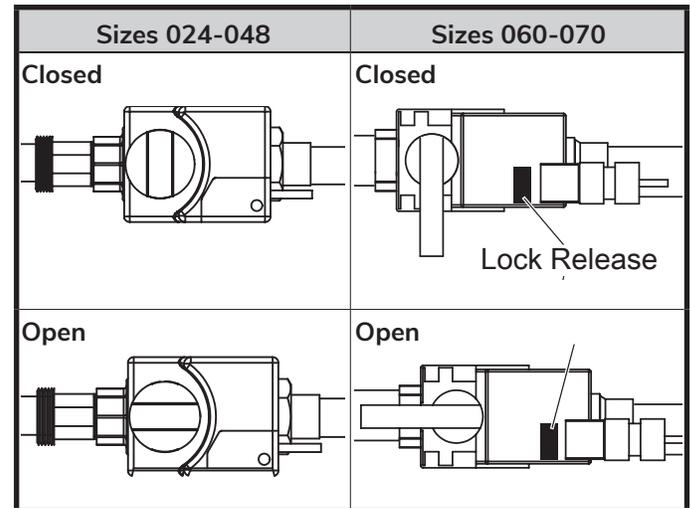
Piping System Cleaning and Flushing - Cleaning and flushing the WLHP piping system is the single most important step to ensure proper start-up and continued efficient operation of the system.

Follow the instructions below to properly clean and flush the system:

1. Ensure that electrical power to the unit is disconnected.
2. Install the system with the supply hose connected directly to the return riser valve. Use a single length of flexible hose.
3. Open all air vents. Fill the system with water. DO NOT allow system to overflow. Bleed all air from the system. Pressurize and check the system for leaks and repair as appropriate.
4. Verify that all strainers are in place (Heat Controller recommends a strainer with a #20 stainless steel wire mesh). Start the pumps, and systematically check each vent to ensure that all air is bled from the system.
5. Verify that make-up water is available. Adjust make-up water as required to replace the air which was bled from the system. Check and adjust the water/air level in the expansion tank.
6. Set the boiler to raise the loop temperature to approximately 86°F [30°C]. Open a drain at the lowest point in the system. Adjust the make-up water replacement rate to equal the rate of bleed.
7. Refill the system and add trisodium phosphate in a proportion of approximately one pound per 150 gallons (.8 kg per 1000 l) of water (or other equivalent approved cleaning agent). Reset the boiler to raise the loop temperature to 100°F [38°C]. Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
8. When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.
9. Test the system pH with litmus paper. The system water should be in the range of pH 6.0 - 8.5 (see table 3). Add chemicals, as appropriate to maintain neutral pH levels.
10. When the system is successfully cleaned, flushed, refilled and bled, check the main system panels, safety cutouts and alarms. Set the controls to properly maintain loop temperatures.

NOTE: The manufacturer strongly recommends all piping connections, both internal and external to the unit, be pressure tested by an appropriate method prior to any finishing of the interior space or before access to all connections is limited. Test pressure may not exceed the maximum allowable pressure for the unit and all components within the water system. The manufacturer will not be responsible or liable for damages from water leaks due to inadequate or lack of a pressurized leak test, or damages caused by exceeding the maximum pressure rating during installation.

Internal Modulating Motorized Valve Positions



To manually open the internal modulating motorized water valve in HZ024 – 048 push down on the handle to unlock it. Then rotate the handle to the open position as shown in the illustration above. 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 HZ060 – 070, push down on the lock release button while turning the handle to the open position as shown in the illustration above. 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.

Unit and System Checkout

WARNING!

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A 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 HFC-410A as system failures and property damage may result.

Unit and System Checkout

BEFORE POWERING SYSTEM, please check the following:

UNIT CHECKOUT

- Balancing/shutoff valves: Ensure that 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 that transformer has the properly selected voltage tap.
- Entering water and air: Ensure that entering water and air temperatures are within operating limits of Table 5a.
- Low water temperature cutout: Verify that low water temperature cut-out on the DXM2.5 control is properly set.
- Unit fan: Manually rotate fan to verify free rotation and ensure that blower wheel is secured to the motor shaft. Be sure to remove any shipping supports if needed. DO NOT oil motors upon start-up. Fan motors are pre-oiled at the factory. Check unit fan speed selection and compare to design requirements.
- Condensate line: Verify that 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.
- Unit air coil and filters: Ensure that filter is clean and accessible. Clean air coil of all manufacturing oils.
- Unit controls: Verify that DXM2.5 field selection options are properly set.

SYSTEM CHECKOUT

- System water temperature: Check water temperature for proper range and also 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 3).
- System flushing: Verify that 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 that all air is purged from the system. Air in the system can cause poor operation or system corrosion.
- Cooling tower/boiler: Check equipment for proper setpoints and operation.
- Standby pumps: Verify that the standby pump is properly installed and in operating condition.
- System controls: Verify that system controls function and operate in the proper sequence.
- Low water temperature cutout: Verify that low water temperature cut-out controls are provided for the outdoor portion of the loop. Otherwise, operating problems may occur.
- System control center: Verify that the control center and alarm panel have appropriate setpoints and are operating as designed.
- Miscellaneous: Note any questionable aspects of the installation.

CAUTION!

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!

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.

Unit Start-Up Procedure

Unit Start-up Procedure

1. Turn the thermostat fan position to "ON". Blower should start.
 2. Balance air flow at registers.
 3. Adjust all valves to their full open positions. Turn on the line power to all heat pumps.
 4. Room temperature should be within the minimum-maximum ranges of Table 5a. During start-up checks, loop water temperature entering the heat pump should be between 60°F [16°C] and 95°F [35°C].
 5. Two factors determine the operating limits of Heat Controller heat pumps, (a) return air temperature, and (b) water temperature. When any one of these factors is at a minimum or maximum level, the other factor must be at normal level to ensure proper unit operation.
 - a. Adjust the unit thermostat to the warmest setting. Place the thermostat mode switch in the "COOL" position. Slowly reduce thermostat setting until the compressor activates.
 - b. Check for cool air delivery at the unit grille within a few minutes after the unit has begun to operate.

NOTE: Units have a five minute time delay in the control circuit that can be eliminated by pushing the test button on the DXM2.5 control board.
 - c. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using the P/T plugs and comparing to water pressure drop table.
 - 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.
 - e. Refer to Table 8. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in Table 6. Heat of rejection (HR) can be calculated and compared to submittal data capacity pages. The formula for HR for systems with water is as follows:

$$HR \text{ (Btuh)} = TD \times GPM \times 500$$
 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 pressure drop across the heat exchanger to Table 6. In S-I units, the formula is as follows: $HR \text{ (kW)} = TD \times l/s \times 4.18$.
 - f. Check air temperature drop across the air coil when compressor is operating. Air temperature drop should be between 15°F and 25°F [8°C and 14°C].
 - g. Turn thermostat to "OFF" position. A hissing noise indicates proper functioning of the reversing valve.
6. Allow five (5) minutes between tests for pressure to equalize before beginning heating test.
 - a. Adjust the thermostat to the lowest setting. Place the thermostat mode switch in the "HEAT" position.
 - b. Slowly raise the thermostat to a higher temperature until the compressor activates.
 - c. Check for warm air delivery within a few minutes after the unit has begun to operate.
 - d. Refer to Table 8. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. If temperature is outside of the operating range, check refrigerant pressures and compare to Table 7. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in Table 6. Heat of extraction (HE) can be calculated and compared to submittal data capacity pages. The formula for HE for systems with water is as follows:

$$HE \text{ (kW)} = TD \times GPM \times 500$$
 where TD is the temperature difference between the entering and leaving water, and l/s is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to Table 6. In S-I units, the formula is as follows: $HE \text{ (kW)} = TD \times l/s \times 4.18$.
 - e. Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 20°F and 30°F [11°C and 17°C].
 - f. Check for vibration, noise, and water leaks.
7. If unit fails to operate, perform troubleshooting analysis (see troubleshooting section). 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.
8. When testing is complete, set system to maintain desired comfort level.
- NOTE: If performance during any mode appears abnormal, refer to the DXM2.5 section or troubleshooting section of this manual. To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended.**

Unit Operating Conditions

Table 6: HZ Coax Water Pressure Drop

Model	GPM	Pressure Drop (psi)			
		30°F	50°F	70°F	90°F
024	2.3	0.47	0.41	0.40	0.40
	3.0	0.68	0.60	0.57	0.57
	3.4	0.79	0.70	0.67	0.66
	4.5	1.14	1.01	0.95	0.93
	6.0	1.75	1.56	1.45	1.40
036	3.0	0.91	0.79	0.79	0.82
	4.5	1.52	1.30	1.24	1.24
	6.0	2.21	1.89	1.76	1.72
	6.8	2.62	2.25	2.06	1.99
	9.0	3.92	3.41	3.13	3.00
048	4.5	0.24	0.11	0.10	0.12
	6.0	0.89	0.72	0.66	0.65
	6.8	1.19	1.00	0.93	0.90
	9.0	2.13	1.87	1.75	1.68
	12.0	3.82	3.48	3.29	3.19
060	6.0	0.9	0.2	0.2	0.3
	7.5	1.7	0.9	0.7	0.8
	9.0	2.5	1.5	1.3	1.4
	11.3	3.7	2.6	2.3	2.3
	12.0	4.1	3.0	2.6	2.6
	15.0	6.1	4.7	4.1	4.0
070	7.0	1.4	0.7	0.5	0.7
	8.5	2.2	1.3	1.1	1.2
	10.5	3.3	2.2	1.9	2.0
	12.8	4.6	3.4	3.0	2.9
	14.0	5.4	4.1	3.6	3.5
	17.0	7.6	6.0	5.4	5.2

! WARNING! !

WARNING! When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with energized equipment.

! CAUTION! !

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.

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] 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.

Unit Operating Conditions, Cont'd.

Table 7: HZ Series Typical Unit Operating Pressures and Temperatures (60Hz – I-P Units)

HZ024		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5							72-83	273-293	6-11	3-8	5.9-7.9	16-22
	2.25							75-85	275-295	6-11	3-8	4.2-6.2	17-23
	3							78-88	277-297	6-11	3-8	2.7-4.7	18-24
50	1.5	128-138	186-206	18-23	8-13	16.3-18.3	19-25	102-112	302-322	8-12	6-11	8.9-10.9	22-28
	2.25	128-138	172-192	18-23	6-11	12.1-14.1	20-26	106-116	303-323	8-12	6-11	6.7-8.7	23-29
	3	128-138	158-178	18-23	6-11	7.8-9.8	20-26	110-120	305-325	8-12	6-11	4.5-6.5	23-29
70	1.5	136-146	281-301	7-12	7-12	15.7-17.7	19-25	128-138	330-350	10-15	8-13	11.3-13.3	27-34
	2.25	136-146	267-287	7-12	5-10	11.6-13.6	19-25	134-144	332-352	10-15	8-13	8.5-10.5	28-35
	3	136-146	253-273	7-12	4-9	7.6-9.6	19-25	141-151	334-354	10-15	8-13	5.8-7.8	28-35
90	1.5	139-149	368-388	6-11	7-12	14.9-16.9	18-24	162-172	367-387	14-19	10-15	14.4-16.4	33-41
	2.25	139-149	354-374	6-11	5-10	11-13	18-24	166-176	372-392	15-20	10-15	10.8-12.8	34-42
	3	139-149	340-360	6-11	5-10	7.2-9.2	18-24	171-181	377-397	17-22	10-15	7.1-9.1	34-42
110	1.5	143-153	465-485	6-11	7-12	13.9-15.9	17-23						
	2.25	143-153	450-470	6-11	5-10	10.2-12.2	17-23						
	3	143-153	433-453	6-11	5-10	6.5-8.5	17-23						

*Based on 15% Methanol antifreeze solution

HZ036		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5							69-79	293-313	7-12	14-19	8.9-10.9	17-23
	2.25							73-83	297-317	7-12	14-19	6.7-8.7	18-24
	3							76-86	300-320	7-12	14-19	4.5-6.5	19-25
50	1.5	129-139	225-245	15-20	10-15	21.9-23.9	18-24	96-106	322-342	10-15	17-22	12.2-14.2	23-29
	2.25	128-138	211-231	15-20	9-14	16.1-18.1	19-25	100-110	326-346	10-15	17-22	9.3-11.3	24-30
	3	128-138	197-217	15-20	9-14	10.3-12.3	19-25	105-115	331-351	10-15	17-22	6.4-8.4	24-30
70	1.5	136-146	302-322	9-14	13-18	21.5-23.5	18-24	123-133	352-372	11-16	19-24	15-17	28-35
	2.25	135-145	283-303	9-14	12-17	15.8-17.8	19-25	129-139	358-378	11-16	19-24	11.6-13.6	29-36
	3	135-145	265-285	9-14	12-17	10-12	19-25	135-145	364-384	11-16	19-24	8.2-10.2	30-37
90	1.5	140-150	390-410	7-12	13-18	20.5-22.5	17-23	157-167	390-410	13-18	18-23	21-23	36-44
	2.25	140-150	369-389	8-13	8-13	14.9-16.9	17-23	169-179	399-419	13-18	16.5-21.5	15.5-17.5	37-45
	3	140-150	349-369	8-13	8-13	9.3-11.3	17-23	181-191	408-428	14-19	15-20	10.5-12.5	39-47
110	1.5	145-155	488-508	7-12	13-18	19-21	17-23						
	2.25	145-155	467-487	8-13	8-13	14-16	17-23						
	3	145-155	447-467	8-13	8-13	9-11	17-23						

*Based on 15% Methanol antifreeze solution

HZ048		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5							66-76	286-306	7-12	8-13	8-10	18-24
	2.25							69-79	289-309	7-12	9-14	6-8	19-25
	3							72-82	292-312	7-12	9-14	4-6	19-25
50	1.5	125-135	242-262	13-18	10-15	20.9-22.9	19-25	93-103	314-334	8-13	10-15	11.5-13.5	23-29
	2.25	132-142	224-244	13-18	9-14	15.6-17.6	19-25	98-108	320-340	8-13	10-15	8.7-10.7	24-30
	3	122-132	205-225	14-19	7-12	10.2-12.2	19-25	103-113	326-346	8-13	10-15	5.9-7.9	25-31
70	1.5	133-143	310-330	8-13	8-13	20.5-22.5	19-25	123-133	344-364	9-14	9-14	15-17	28-35
	2.25	132-142	290-310	8-13	7-12	15.2-17.2	19-25	130-140	354-374	9-14	9-14	11.5-13.5	29-36
	3	131-141	270-290	9-14	5-10	9.9-11.9	19-25	137-147	361-381	9-14	9-14	7.9-9.9	30-37
90	1.5	138-148	396-416	7-12	7-12	19.2-21.2	18-24	165-175	390-410	13-18	8-13	19.6-21.6	37-45
	2.25	137-147	374-394	7-12	6-11	14.3-16.3	18-24	175-185	401-421	15-20	8-13	15-17	38-46
	3	136-146	352-372	7-12	4-9	9.3-11.3	18-24	185-195	413-433	17-22	8-13	10.3-12.3	39-47
110	1.5	144-154	497-517	7-12	5-10	18-20	17-23						
	2.25	143-153	472-492	7-12	4-9	13.3-15.3	17-23						
	3	142-152	447-467	7-12	3-8	8.5-10.5	17-23						

*Based on 15% Methanol antifreeze solution

Unit Operating Conditions, Cont'd.

Table 7, cont'd.: HZ Series Typical Unit Operating Pressures and Temperatures (60Hz – I-P Units)

HZ060		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5							66-76	282-302	10-16	9-14	8-10	19-25
	2.25							69-79	285-305	10-16	9-14	6-8	19-25
	3							72-82	289-309	10-16	10-15	4-6	20-26
50	1.5	128-138	238-258	16-21	14-19	20.5-22.5	21-27	90-100	310-330	11-17	12-17	11.3-13.3	24-30
	2.25	126-136	222-242	21-26	13-18	14.9-16.9	21-27	95-105	313-333	11-17	12-17	8.5-10.5	25-31
	3	125-135	205-225	26-31	12-17	9.2-11.2	21-27	99-109	316-336	11-17	12-17	5.7-7.7	26-32
70	1.5	135-145	315-335	10-15	14-19	21-23	22-28	115-125	337-357	12-18	14-19	14-16	28-35
	2.25	134-144	296-316	12-17	13-18	15.5-17.5	22-28	120-130	341-361	12-18	14-19	10.6-12.6	29-36
	3	133-143	276-296	15-20	11-16	10-12	22-28	126-136	345-365	12-18	15-20	7.3-9.3	30-37
90	1.5	139-149	408-428	10-15	15-20	20.1-22.1	21-27	157-167	390-410	15-20	14-19	18.2-20.2	37-45
	2.25	138-148	386-406	10-15	13-18	14.8-16.8	21-27	161-171	394-414	15-20	14-19	13.9-15.9	38-46
	3	138-148	364-384	10-15	11-16	9.5-11.5	21-27	166-176	398-418	15-20	15-20	9.6-11.6	39-47
110	1.5	144-154	515-535	8-13	14-19	19-21	20-26						
	2.25	143-153	493-513	8-13	13-18	14-16	20-26						
	3	142-152	469-489	8-13	12-17	9-11	20-26						

*Based on 15% Methanol antifreeze solution

HZ070		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5							61-71	292-312	11-16	13-18	7.2-9.2	19-25
	2.25							65-75	296-316	11-16	14-19	5.4-7.4	20-26
	3							68-78	300-320	10-15	15-20	3.5-5.5	21-27
50	1.5	131-141	210-230	10-15	12-17	18.5-20.5	22-28	89-99	327-347	10-15	19-24	10.9-12.9	26-32
	2.25	130-140	205-225	11-16	12-17	14-16	23-29	98-108	337-357	10-15	14-19	8.3-10.3	28-34
	3	129-139	200-220	13-18	12-17	9.5-11.5	24-30	106-116	348-368	10-15	9-14	5.7-7.7	30-36
70	1.5	135-145	300-320	10-15	15-20	17.6-19.6	23-29	119-129	365-385	10-15	21-26	14.7-16.7	33-39
	2.25	131-141	295-315	11-16	14-19	13.8-15.8	23-29	132-142	380-400	10-15	16-21	11.3-13.3	36-42
	3	128-138	290-310	13-18	14-19	10-12	23-29	144-154	395-415	10-15	11-16	7.9-9.9	38-44
90	1.5	139-149	390-410	10-15	16-21	16.7-18.7	22-28	162-172	418-438	10-15	19-24	19.4-21.4	43-49
	2.25	137-147	370-390	10-15	14-19	12.6-14.6	22-28	172-182	430-450	10-15	19-24	14.7-16.7	45-51
	3	135-145	350-370	10-15	13-18	8.5-10.5	22-28	182-192	444-464	11-16	19-24	10.1-12.1	47-53
110	1.5	145-155	490-510	10-15	16-21	15.9-17.9	20-27						
	2.25	145-155	470-490	10-15	14-19	11.7-13.7	20-27						
	3	144-154	452-472	9-14	13-18	7.4-9	20-27						

*Based on 15% Methanol antifreeze solution

Table 8: Water Temperature Change Through Heat Exchanger

Water Flow, gpm [l/m]	Rise, Cooling °F, [°C]	Drop, Heating °F, [°C]
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton [3.2 l/m per kW]	9 - 12 [5 - 6.7]	4 - 8 [2.2 - 4.4]
For Open Loop: Ground Water Systems at 1.5 gpm per ton [1.6 l/m per kW]	20 - 26 [11.1 - 14.4]	10 - 17 [5.6 - 9.4]

Preventive Maintenance

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 [1.6 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 [2.2 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.

Filters - Filters must be clean to obtain maximum performance. Filters should be inspected every month under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

Washable, high efficiency, electrostatic filters, when dirty, can exhibit a very high pressure drop for the fan motor and reduce air flow, resulting in poor performance. It is especially important to provide consistent washing of

these filters (in the opposite direction of the normal air flow) once per month using a high pressure wash similar to those found at self-serve car washes.

Condensate Drain - In areas where airborne bacteria may produce a “slimy” substance in the drain pan, it may be necessary to treat the drain pan chemically with an algaecide approximately every three months to minimize the problem. The condensate pan may also need to be cleaned periodically to ensure indoor air quality. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect the drain twice a year to avoid the possibility of plugging and eventual overflow.

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

Fan Motors - All units have lubricated fan motors. Fan motors should never be lubricated unless obvious, dry operation is suspected. Periodic maintenance oiling is not recommended, as it will result in dirt accumulating in the excess oil and cause eventual motor failure. Conduct annual dry operation check and amperage check to ensure amp draw is no more than 10% greater than indicated on serial plate data.

Air Coil - The air coil must be clean 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. When the heat pump has experienced less than 100 operational hours and the coil has not had sufficient time to be “seasoned”, it is necessary to clean the coil with a mild surfactant such as Calgon to remove the oils left by manufacturing processes and enable the condensate to properly “sheet” off of the coil.

CAUTION: Fin edges are sharp.

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.

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.

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 Board - DXM2.5 board 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 control.

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 board.

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 will flash 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.

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 controller), 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 board 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 pushbutton. The DXM2.5 board will automatically exit test mode after 20 minutes.

WARNING!

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.

Troubleshooting, Cont'd.

Advanced Diagnostics - If a communicating thermostat or diagnostic tool is connected to the DXM2.5, additional diagnostic information and troubleshooting capabilities are available. The current status of all DXM2.5 inputs can be verified, including the current temperature readings of all temperature inputs. With a communicating thermostat the current status of the inputs can be accessed from the Service Information menu. In the manual operating mode, most DXM2.5 outputs can be directly controlled for system troubleshooting. With a communicating thermostat the manual operating mode can be accessed from the Installer menu. For more detailed information on the advanced diagnostics of the DXM2.5, see the DXM2.5 Application, Operation and Maintenance (AOM) manual (part #97B0142N01).

DXM2.5 Troubleshooting Process Flowchart/Functional Troubleshooting Chart

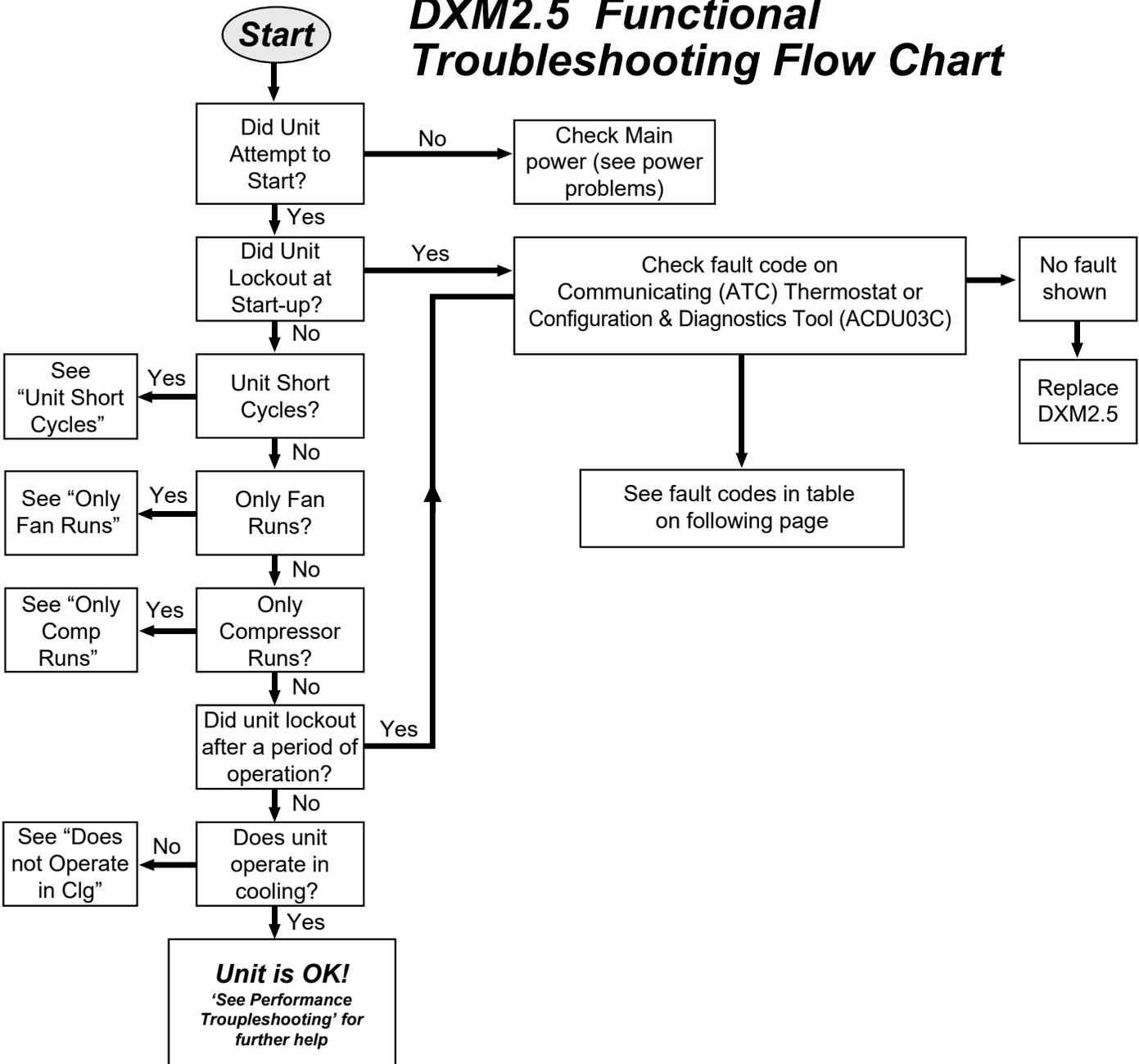
The “DXM2.5 Functional Troubleshooting Process Flowchart” is a quick overview of how to start diagnosing a suspected problem, using the fault recognition features of the DXM2.5 board. The “Functional Troubleshooting Chart” on the following page is a more comprehensive method for identifying a number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

DXM2.5 Functional Troubleshooting Flow Chart

⚠ WARNING! ⚠
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.

DXM2.5 Functional Troubleshooting Flow Chart



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 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 adjust to proper flow rate.
		X	Water Temperature out of range in cooling	Bring water temp within design parameters.
	X		Reduced or no air flow 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/LOC Fault Code 3	X	X	Insufficient charge	Check for refrigerant leaks.
Low Pressure / Loss of Charge	X		Compressor pump down at start-up	Check charge and start-up 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 air flow 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 air side 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 Air Flow	Find and eliminate restriction. Increase return duct and/or grille size.

Table continued on next page.

Functional Troubleshooting, Cont'd.

Table continued from previous page.

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.
	X	X	Over Voltage	Check compressor starting. Need hard start kit.
				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 air flow or overcharged unit.
		X	Cooling Mode LT1>125°F [52°C] OR LT2< 40°F [4°C]	Check for poor water flow, or air flow.
Swapped Thermistor Code 9	X	X	LT1 and LT2 swapped	Reverse position of thermistors.
ECM Fault Code 10	X	X	Blower does not operate	Check blower line voltage.
				Check blower low voltage wiring.
	X	X	Blower operating with incorrect airflow	Wrong unit size selection.
				Wrong unit family selection.
ESD - ERV Fault (DXM2.5 Only) Green Status LED Code 3	X	X	ERV unit has fault (Rooftop units only)	Wrong motor size.
				Incorrect blower selection.
No Fault Code Shown	X	X	No compressor operation	Troubleshoot ERV unit fault.
			Compressor overload	See 'Only Fan Operates'.
			Control board	Check and replace if necessary.
Unit Short Cycles	X	X	Dirty air filter	Reset power and check operation.
			Unit in 'Test Mode'	Check and clean air filter.
			Unit selection	Reset power or wait 20 minutes for auto exit.
			Compressor overload	Unit may be oversized for space. Check sizing for actual load of space.
Only Fan Runs	X	X	Compressor overload	Check and replace if necessary.
			Thermostat position	Check thermostat set for heating or cooling operation.
			Unit locked out	Check for lockout codes. Reset power.
			Thermostat wiring	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check thermostat wiring at DXM2.5. Put in Test Mode and jumper Y1 and R to give call for compressor.

Performance Troubleshooting

Symptom	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating	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.	
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.

Table continued on next page.

Performance Troubleshooting, Cont'd.

Table continued from previous page.

Symptom	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	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 0 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.

Start-Up Log Sheet

Installer: Complete unit and system checkout and follow unit start-up procedures in the IOM. Use this form to record unit information, temperatures and pressures during start-up. Keep this form for future reference.

Job Name: _____ **Street Address:** _____

Model Number: _____ **Serial Number:** _____

Unit Location in Building: _____

Date: _____ **Sales Order No.:** _____

In order to minimize troubleshooting and costly system failures, complete the following checks and data entries before the system is put into full operation.

Fan Motor	Description	Value
PSC	Speed Tap	
CT ECM	Speed Tap	
CV ECM	CFM Setting	

Temperatures: F or C

Antifreeze: _____%

Pressures: PSIG or kPa

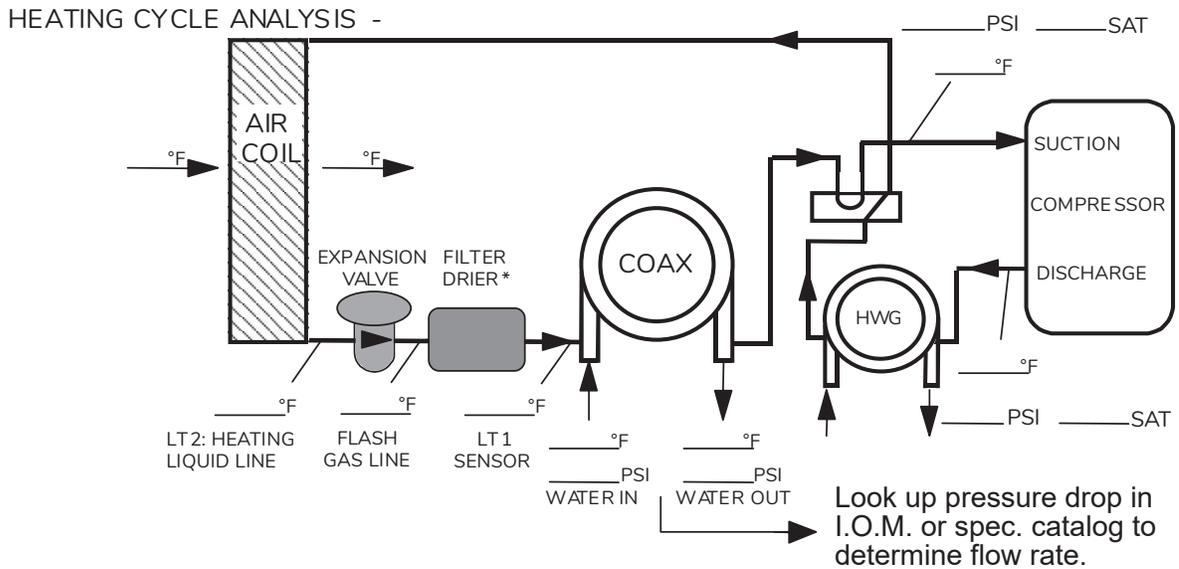
Type _____

	Cooling Mode	Heating Mode
Entering Fluid Temperature		
Leaving Fluid Temperature		
Temperature Differential		
Return-Air Temperature	DB	WB DB
Supply-Air Temperature	DB	WB DB
Temperature Differential		
Water Coil Heat Exchanger (Water Pressure IN)		
Water Coil Heat Exchanger (Water Pressure OUT)		
Pressure Differential		
Water Flow GPM		
Compressor		
Amps		
Volts		
Discharge Line Temperature		
Motor		
Amps		
Volts		

Allow unit to run 15 minutes in each mode before taking data.

NOTE: Never connect refrigerant gauges during startup procedures. Conduct water-side analysis using P/T ports to determine water flow and temperature difference. If water-side analysis shows poor performance, refrigerant troubleshooting may be required. Connect refrigerant gauges as a last resort.

Functional Troubleshooting Form



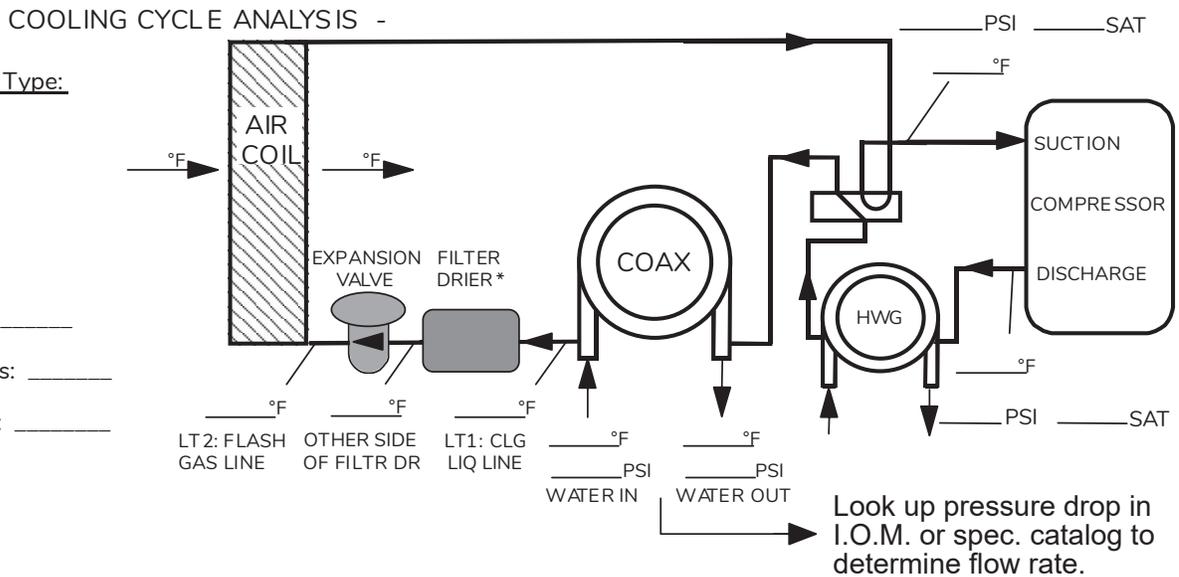
Refrigerant Type:

HFC-410A

Voltage: _____

Comp Amps: _____

Total Amps: _____



Heat of Extraction (Absorption) or Heat of Rejection =

$$\text{_____ flow rate (gpm)} \times \text{_____ t emp.diff. (deg. F)} \times \text{_____ fluid factor}^{\dagger} = \text{_____ (Btu/hr)}$$

Superheat = Suction temperature - suction saturation temp. = _____ (deg F)

Subcooling = Discharge saturation temp. - liquid line temp. = _____ (deg F)

[†] Use 500 for water, 485 for antifreeze.

NOTE: Never connect refrigerant gauges during startup procedures. Conduct water-side analysis using P/T ports to determine water flow and temperature difference. If water-side analysis shows poor performance, refrigerant troubleshooting may be required. Connect refrigerant gauges as a last resort.

Notes:

Notes:

Revision History

Date:	Item:	Action:
05/10/2024	Pages 26-29	Added HWG content
11/18/2022	All	Transitioned DXM2 to DXM2.5 unit controls, Eliminated ClimDry References.
10/05/21	Pages 22-25	Updated Water Quality Requirements table
09/24/21	All	LON Controls Removal
06/05/20	Page 62	Updated Start-Up Log Sheet
04/16/20	ALL	Updated CiimaDry II verbiage, Tables/ Figures sequencing, Unit Decoder, and Variable Pump Curves
04/02/20	ALL	Updated Format
01/30/19	Page 15, 16, 25	Update variable heat pump data
11/8/18	Decoder	Updated water circuit options
07/25/17	Page 7	Update hanger and mounting instructions
06/19/17	ClimaDry II Option	Added
10/7/16	Page 7	Text Update
04/15/16	Text	Updated
06/12/15	Decoder - Page 3; Text - Page 25	Updated
09/30/14	Text Edit - Page 14	Updated
07/21/14	First Published	

Due to ongoing product improvements, specifications and dimensions are subject to change and correction without notice or incurring obligations. Determining the application and suitability for use of any product is the responsibility of the installer. Additionally, the installer is responsible for verifying dimensional data on the actual product prior to beginning any installation preparations.

Incentive and rebate programs have precise requirements as to product performance and certification. All products meet applicable regulations in effect on date of manufacture; however, certifications are not necessarily granted for the life of a product. Therefore, it is the responsibility of the applicant to determine whether a specific model qualifies for these incentive/rebate programs.



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