CLIMATEMASTER®
A NIBE GROUP MEMBER

Tranquility® 20 Digital (TS) Series

97B0113N01

Residential Horizontal & Vertical
Packaged Geothermal Heat Pumps

Installation, Operation &
Maintenance Instructions

Rev.: July 13, 2023

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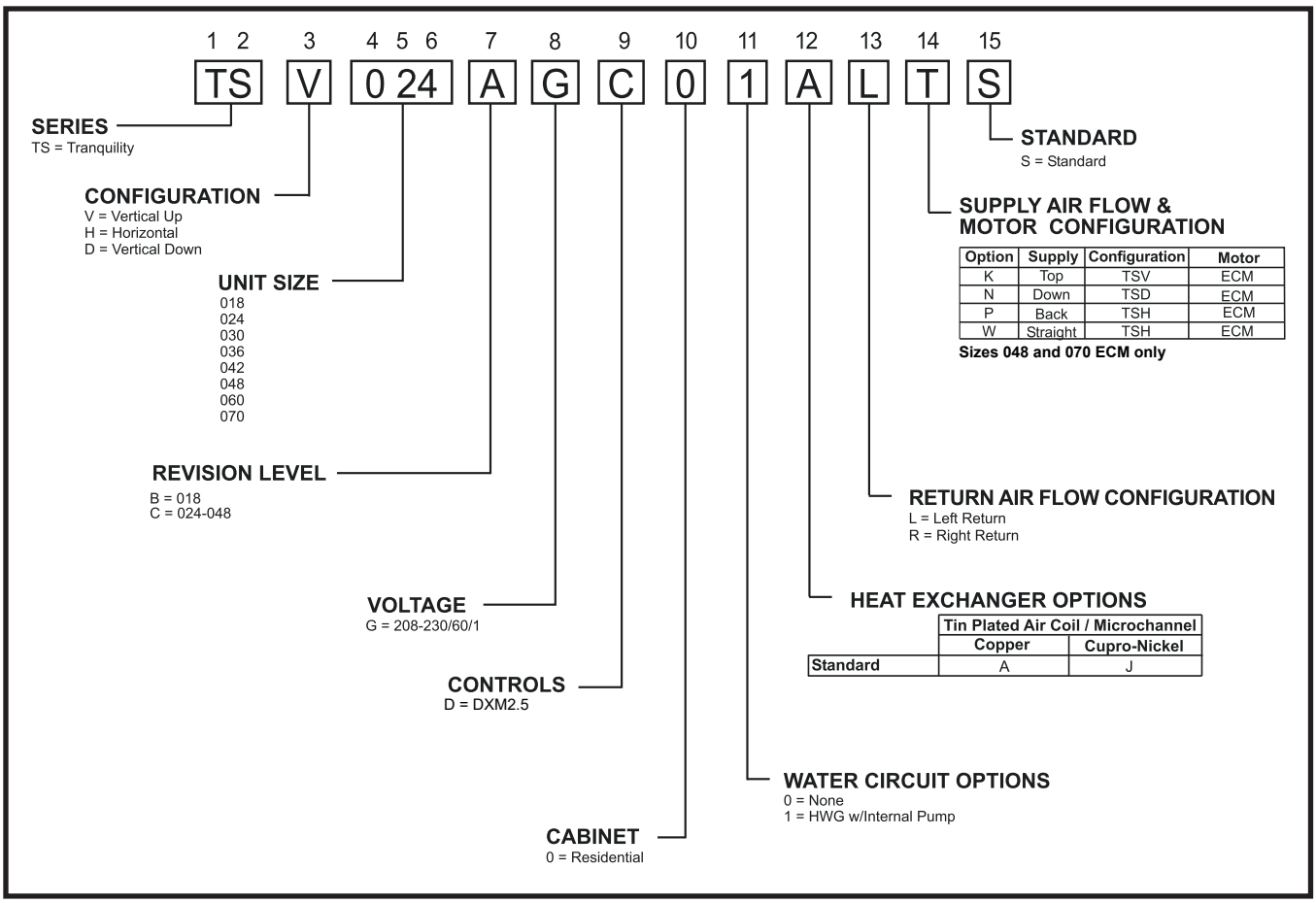
Model Nomenclature



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.

The following warning complies with State of California law, Proposition 65.

⚠ WARNING! ⚠

WARNING! This product can expose you to chemicals including Carbon Black, which is known to the State of California to cause cancer and Methanol, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

⚠ WARNING! ⚠

WARNING! The EarthPure® Application and Service Manual should be read and understood before attempting to service refrigerant circuits with HFC-410A.

⚠ WARNING! ⚠

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.

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! ⚠

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.

⚠ CAUTION! ⚠

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.

General Information, Cont'd.

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. Insure 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.

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. Loosen compressor bolts on units equipped with compressor grommet vibration isolation until the compressor ride freely on the grommets.
7. Locate and verify any hot water generator (HWG), hanger, or other accessory kit located in the compressor section or blower section.

⚠ 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 may 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.

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 specifications catalog 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 specifications catalog. Size the access opening to accommodate the service technician during the removal or replacement of the compressor and the removal or installation of the unit itself.
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.

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 1a: Hanger Bracket

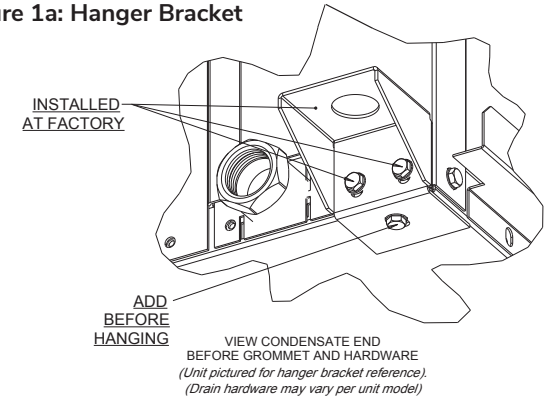
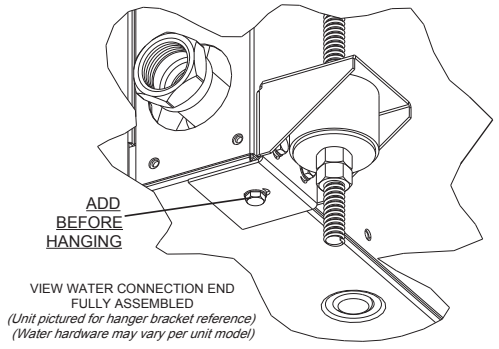


Figure 1b: Hanger Bracket



Horizontal Installation, Cont'd.

Figure 2: Horizontal Unit Pitch

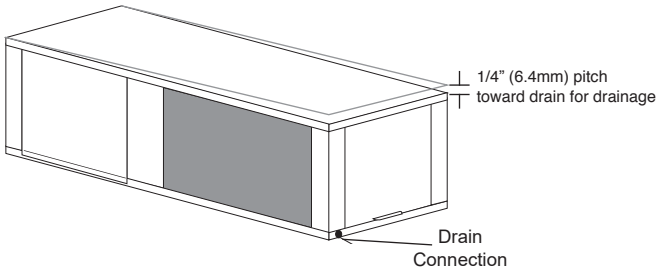
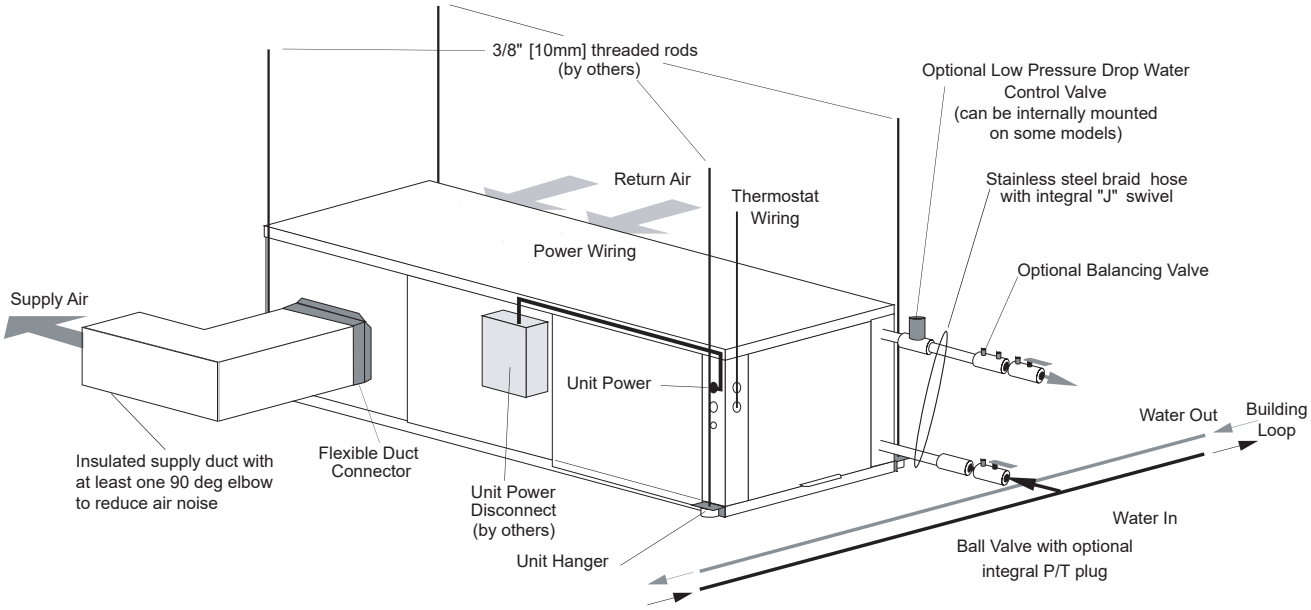


Figure 3: Typical Horizontal Unit Installation

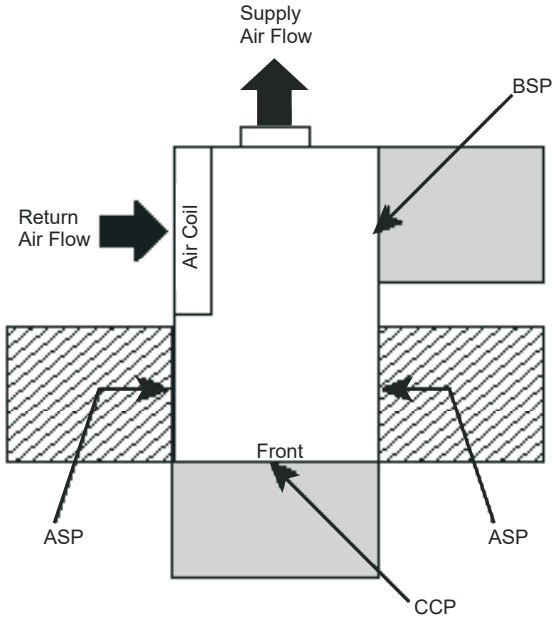


AIR COIL

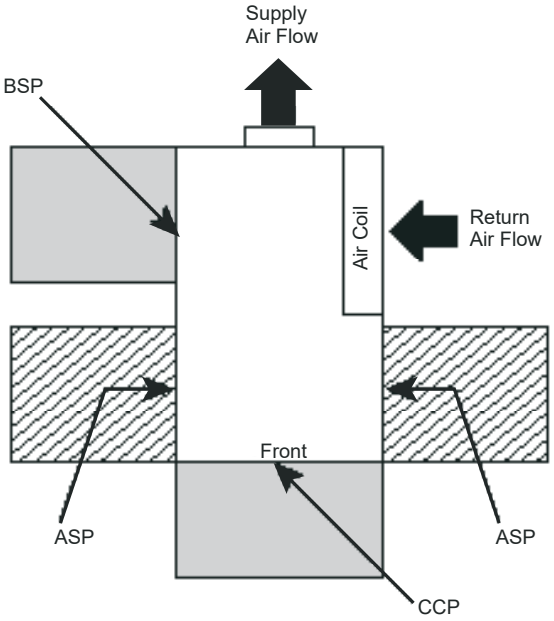
To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. A thorough water rinse should follow.

Horizontal Service Access

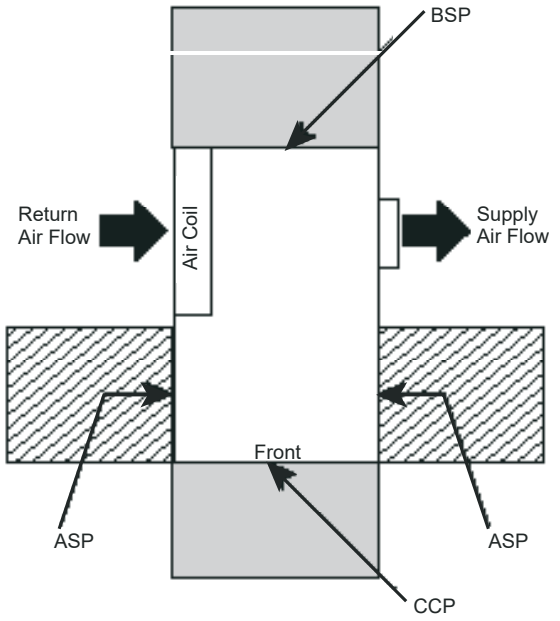
Left Return Back Discharge



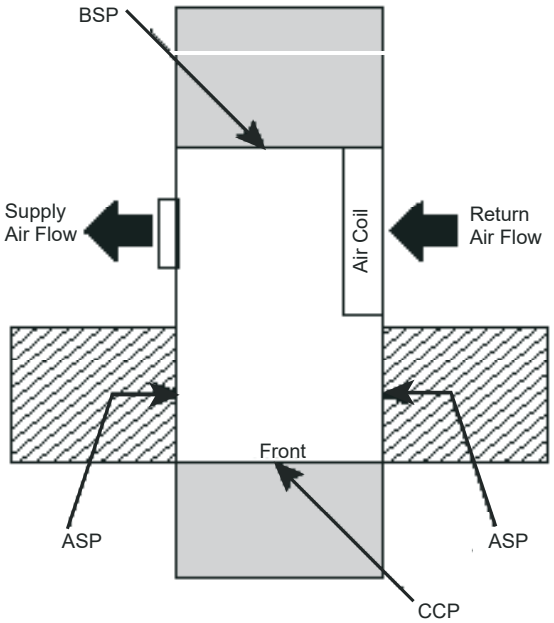
Right Return Back Discharge



Left Return Straight Discharge



Right Return Straight Discharge



= mandatory 2' (61cm) service access

= (optional) additional 2' (61cm) service access

NOTES:

1. While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. CCP and BSP requires 2' service access.
3. Blower service access is through back panel on straight discharge units or through panel opposite air coil on back, discharge units.
4. ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not to be used in place of the mandatory CC and BSP panels.

LEGEND:
CCP = Control/Compressor Access Panel
BSP = Blower Service Panel
ASP = Additional Service Panel (not required)

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. Reroute 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

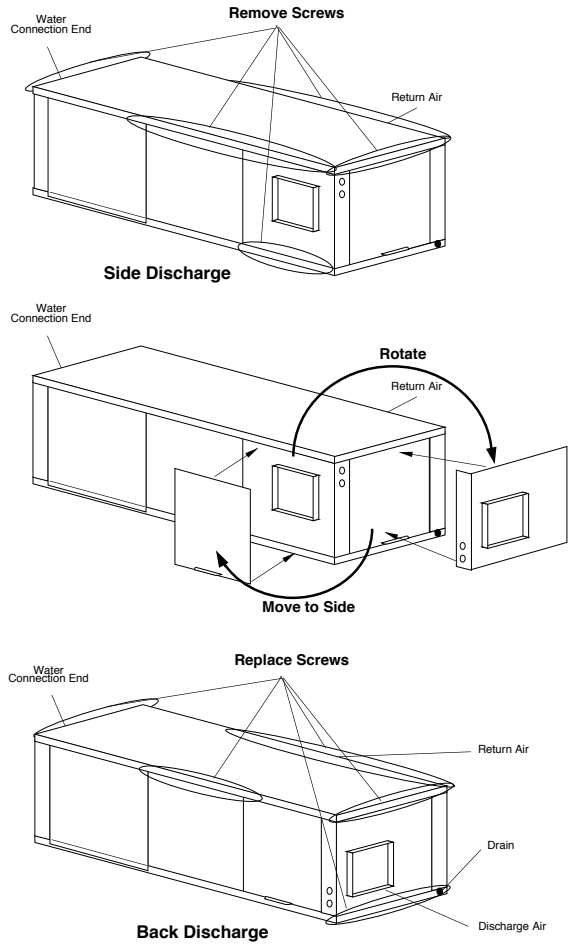
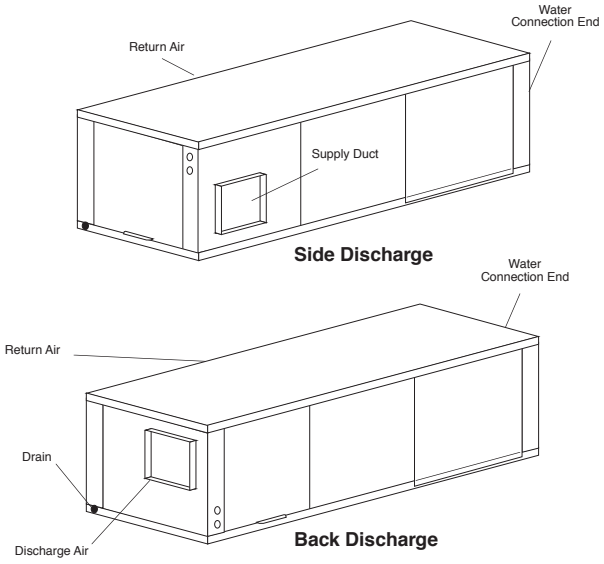


Figure 5: Right Return Side to Back



Horizontal Installation

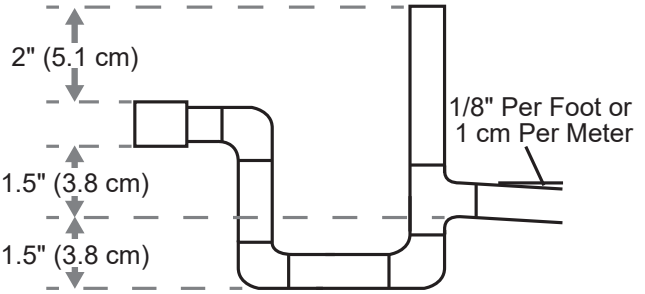
CONDENSATE PIPING – HORIZONTAL UNITS
Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 2.5 tons/8.8 kW), insure that unit pitch does not cause condensate leaks inside the cabinet.

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 [51mm] of ESP capability requires 2 inches [51mm] of trap depth). As a general rule, 1-1/2 inch [38mm] 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.

Figure 6: Horizontal Condensate Connection



⚠ CAUTION! ⚠

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

DUCT SYSTEM INSTALLATION

The duct system should be sized to handle the design airflow quietly. 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 will be adversely affected.

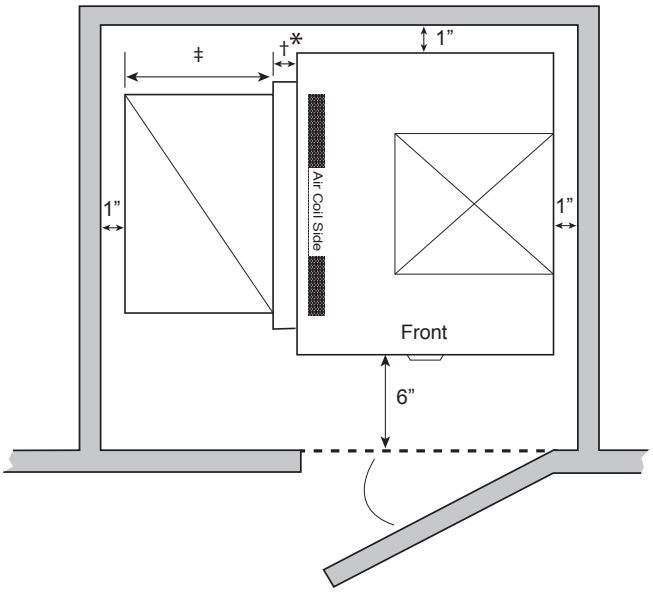
At least one 90° elbow should be included in the supply duct to reduce air noise. If air noise or excessive air flow is a problem, the blower speed can be changed. For airflow charts, consult specifications catalog for the series and model of the specific unit.

If the unit is connected to existing ductwork, a previous check should have been made to insure 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.

Vertical Installation Clearances

Recommended Minimum Installation Clearances for Vertical Units*	
1”	Back of unit
	Side opposite return air
6”	Front if hard piped
Return Air Side	
1”	Ducted return - ‡ *Add for duct width - † Add 2” for 1” filter frame/rail or 3” for 2” filter frame/rail
	Free (open) return - calculate required dimension for a maximum velocity of 600 fpm

* Field installed accessories (hoses, air cleaners, etc.) and factory WSE option will require additional space. Top supply air is shown, the same clearances apply to bottom supply air units.

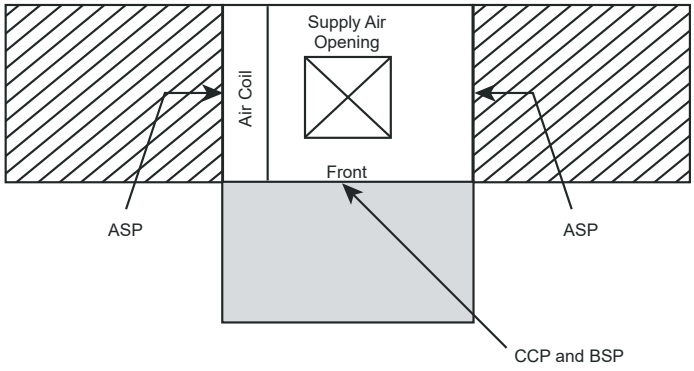


NOTES:

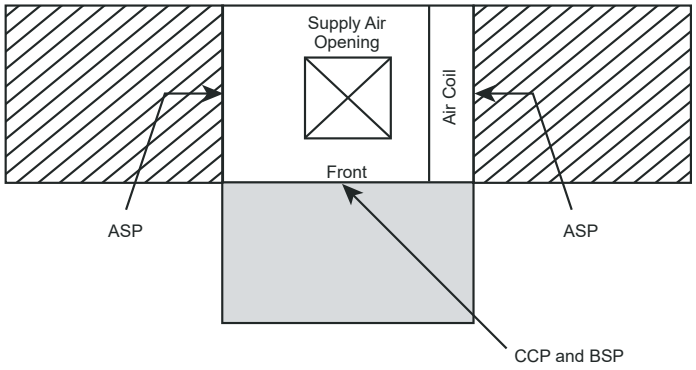
1. While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Front & Side access is preferred for service access. However, all components may be serviced from the front access panel if side access is not available.
3. ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not to be used in place of the mandatory CCPand BSP panels.
4. Top supply air is shown, the same clearances apply to bottom supply air units.

LEGEND:
CCP = Control/Compressor Access Panel
BSP = Blower Service Panel
ASP = Additional Service Panel (not required)

Left Return



Right Return



= mandatory 2' (61 cm) service access

= (optional) additional 2' (61 cm) service access

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 specifications catalog 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" [10mm] to 1/2" [13mm] 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 specifications 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.

Downflow units may be installed directly on the floor. The optional internal electric heat is rated for zero clearance to combustible materials.

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.

Figure 7: Vertical Unit Mounting

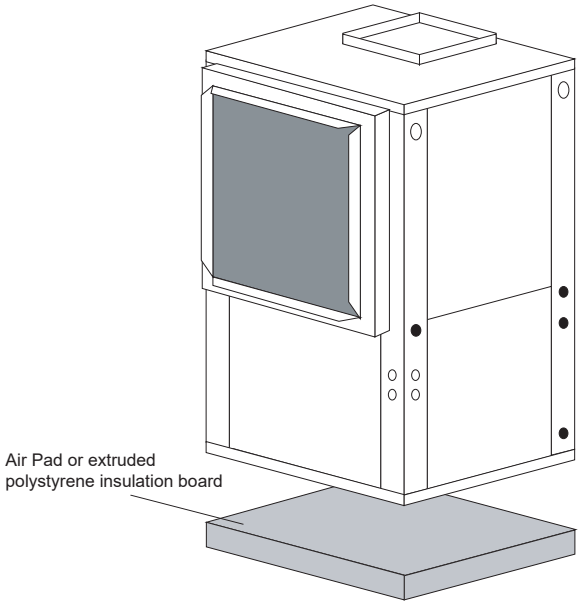
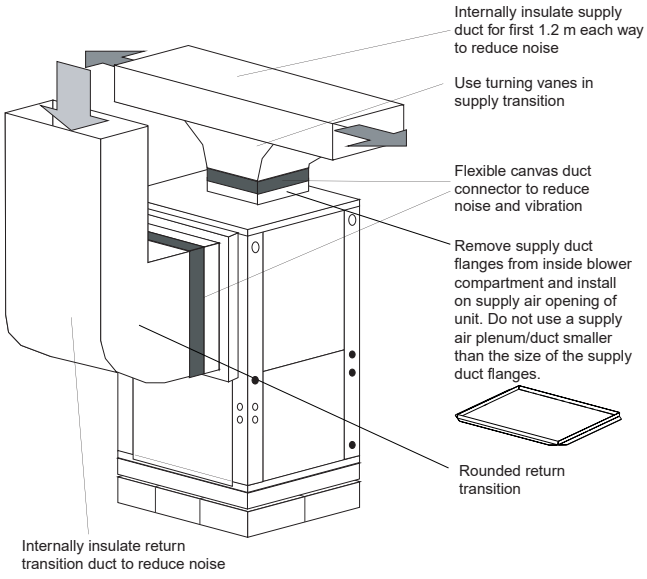


Figure 8: Typical Vertical Unit Installation Using Ducted Return Air

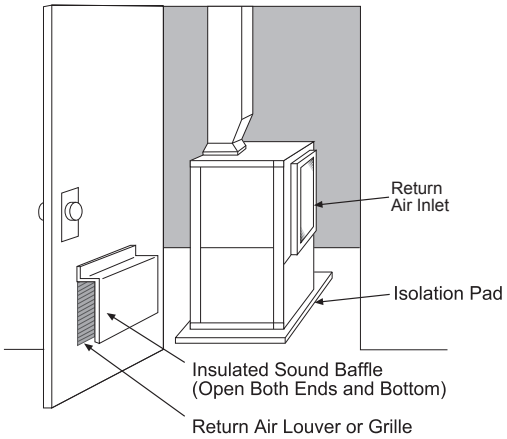


Vertical Installation, Cont'd.

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 Tranquility Unit Isolation Pad to minimize vibration transmission to the building structure. For more information on Tranquility Unit Isolation Pads, contact your distributor.

Figure 9: Vertical Sound Attenuation



CONDENSATE PIPING FOR VERTICAL UNITS - Some units utilize a condensate hose inside the cabinet as a trapping loop; therefore an external trap is not necessary, other units require an external condensate trap. Observe the condensate drain connection to determine if a field provided trap is necessary. Units with a PVC socket connection are internally trapped, units with stainless steel MPT connection require an external trap. Figures 10a and b show typical condensate connections. Figure 10c illustrates the internal trap that is present in some units. 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.

⚠ CAUTION! ⚠

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

Install the external condensate trap with the top of the trap positioned below the unit condensate drain connection as shown in figure 10b. Design the depth of the trap (water-seal) based upon the amount of the ESP capability of the blower (ex. 2 inches (51mm) of ESP capability requires 2 inches (51mm) of trap depth). As a general rule, 1-1/2 inch (38mm) trap depth is the minimum.

Figure 10a: Vertical Unit with Internal Condensate Trap

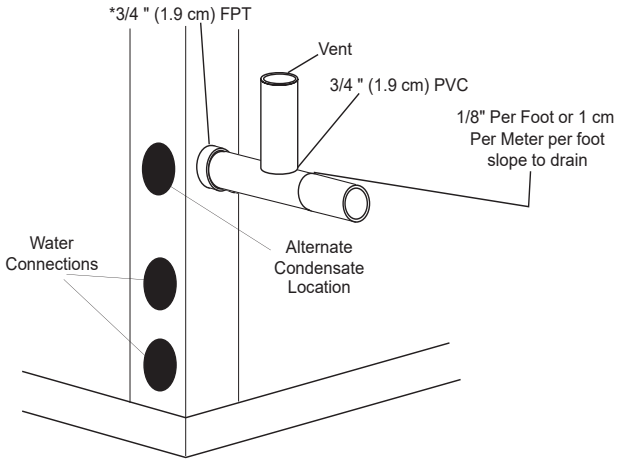


Figure 10b: Vertical Unit with External Condensate Trap

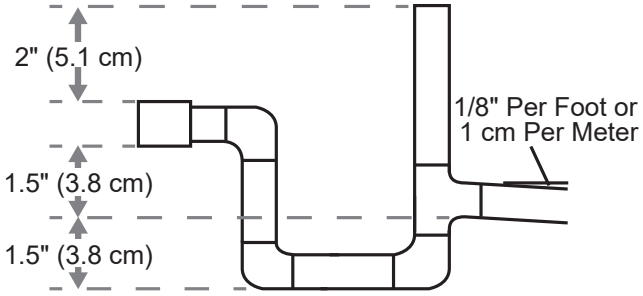
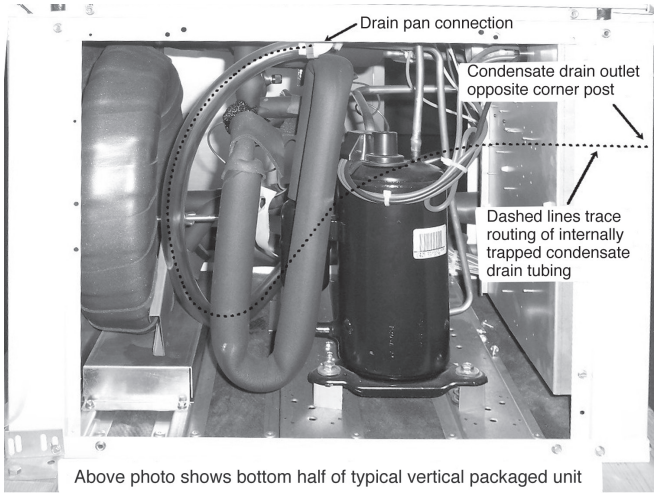


Figure 10c: Vertical Internal Condensate Trap



Above photo shows bottom half of typical vertical packaged unit

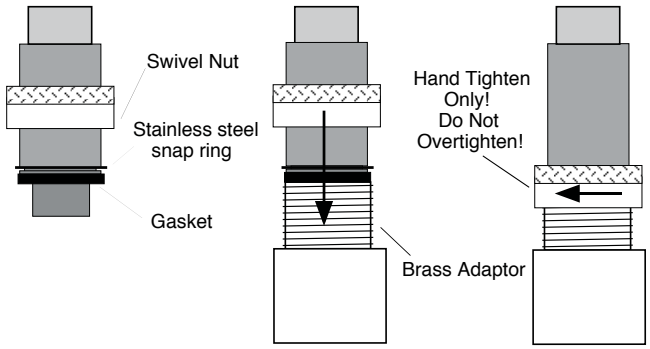
Water Connection Installation

WATER CONNECTIONS
Swivel piping fittings are used for water connections that are rated for 450 psi (3101 kPa) operating pressure. The connections have a rubber gasket seal similar to a garden hose gasket, which when mated to the flush end of most 1" threaded male pipe fittings provides a leak-free seal without the need for thread sealing tape or joint compound. Check for burrs and ensure that the rubber seal is in the swivel connector prior to attempting any connection (rubber seals are shipped attached to the swivel connector). DO NOT OVER TIGHTEN or leaks may occur.

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

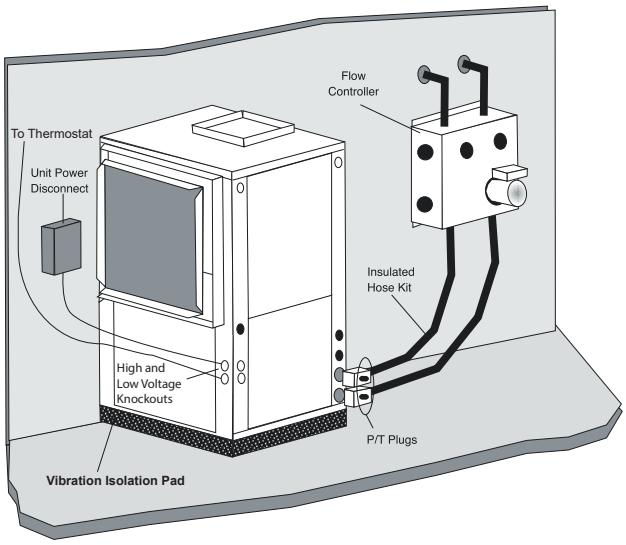
EXTERNAL FLOW CONTROLLER MOUNTING
The Flow Controller can be mounted beside the unit as shown in Figure 12. Review the Flow Controller installation manual for more details.

Figure 11: Water Connections



Ground-Loop Heat Pump Applications

Figure 12: Typical Ground-Loop Application



⚠ 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.

PRE-INSTALLATION

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

PIPING INSTALLATION

The typical closed loop ground source system is shown in Figure 12. 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 in earth coupled applications. A flanged fitting should be substituted. P/T plugs should be used so that flow can be measured using the pressure drop of the unit heat exchanger.

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

Test individual horizontal loop circuits before backfilling. Test vertical U-bends and pond loop assemblies prior to installation. 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

Once piping is completed between the unit, Flow Controller and the ground loop (Figure 12), the loop is ready for final purging and charging. A flush cart with at least a 1.5 hp [1.1 kW] pump is required to achieve enough fluid velocity in the loop piping system to purge air and dirt particles.

ANTIFREEZE SELECTION - GENERAL

In areas where minimum entering loop temperatures drop below 40°F [4.4°C] or where piping will be routed through areas subject to freezing, antifreeze is needed. Alcohols and glycols are commonly used as antifreeze solutions. Your local representative should be consulted for the antifreeze best suited to your area. Freeze protection should be maintained to 15°F [8.5°C] below the lowest expected entering loop temperature.

Initially calculate the total volume of fluid in the piping system using Table 3. Then use the percentage by volume shown in Table 4 for the amount of antifreeze. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Table 3: Fluid Volume

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

⚠ WARNING! ⚠

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

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

Ground-Loop Heat Pump Applications, Cont'd.

Table 4: 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	21%	17%	13%	8%
Propylene Glycol	29%	24%	18%	12%
Ethanol*	23%	20%	16%	11%

* Must not be denatured with any petroleum based product

Contact your ClimateMaster distributor if you have any questions as to antifreeze selection.

⚠ WARNING! ⚠

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

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

⚠ CAUTION! ⚠

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

ANTIFREEZE CHARGING

It is highly recommended to utilize premixed antifreeze fluid where possible to alleviate many installation problems and extra labor.

The following procedure is based upon pure antifreeze and can be implemented during the Full Flush procedure with three way valves in the Figure 15c - Valve Position C. If a premixed mixture of 15°F [-9.4°C] freeze protection is used, the system can be filled and flushed with the premix directly to prevent handling pure antifreeze during the installation.

1. Flush loop until all air has been purged from system and pressurize to check for leaks before adding any antifreeze.
2. Run discharge line to a drain and hook up antifreeze drum to suction side of pump (if not adding below water level through approved container). Drain flush cart reservoir down to pump suction inlet so reservoir can accept the volume of antifreeze to be added.
3. Calculate the amount of antifreeze required by first calculating the total fluid volume of the loop from Table 3. Then calculate the amount of antifreeze needed using Table 4 for the appropriate freeze protection level. Many southern applications require freeze protection because of exposed piping to ambient conditions.
4. Isolate unit and prepare to flush only through loop (see Figure 15a). Start flush cart, and gradually introduce the required amount of liquid to the flush cart tank (always introduce alcohols under water or use suction of pump to draw in directly to prevent fuming) until attaining the proper antifreeze protection. The rise in flush reservoir level indicates amount of antifreeze added (some carts are marked with measurements in gallons or liters). A ten inch [25.4 cm] diameter cylinder, 3 foot [91.4 cm] tall holds approximately 8 gallons [30.3 liters] of fluid plus the hoses (approx. 2 gallons, [7.6 liters], which equals about 10 gallons [37.9 liters] total. If more than one tankful is required, the tank should be drained immediately by opening the waste valve of the flush cart noting the color of the discharge fluid. Adding food coloring to the antifreeze can help indicate where the antifreeze is in the circuit and prevents the dumping of antifreeze out the waste port. Repeat if necessary.
5. Be careful when handling methanol (or any alcohol). Always wear eye protection and rubber gloves. The fumes are flammable, and care should be taken with all flammable liquids. Open flush valves to flush through both the unit and the loop and flush until fluid is homogenous and mixed. It is recommended to run the unit in the heating and cooling mode for 15-20 minutes each to 'temper' the fluid temperature and prepare it for pressurization. Devoting this time to clean up can be useful. This procedure helps prevent the periodic "flat" loop condition.
6. Close the flush cart return valve; and immediately thereafter, close the flush cart supply valve, leaving a positive pressure in the loop of approximately 50 psi [345 kPa]. This is a good time to pressure check the system as well. Check the freeze protection of the fluid with the proper hydrometer to ensure that the correct amount of antifreeze has been added to the system. The hydrometer can be dropped into the flush reservoir and the reading compared to Chart 1a for Methanol, 1b for Propylene Glycol, and 1c for Ethanol to indicate the level of freeze protection. Do not antifreeze more than a +10°F [-12.2°C] freeze point. Specific gravity hydrometers are available in the residential price list. Repeat after reopening and flushing for a minute to ensure good second sample of fluid. Inadequate antifreeze protection can cause nuisance low temperature lockouts during cold weather.

⚠ WARNING! ⚠

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

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

Ground-Loop Heat Pump Applications, Cont'd.

7. Close the flush cart return valve; immediately thereafter, close the flush cart supply valve, shut off the flush cart leaving a positive pressure in the loop of approximately 50-75 psi [345-517 kPa]. Refer to Figure 15d for more details.

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°F [-12.2°C]) set point and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual).

Chart 1a: Methanol Specific Gravity

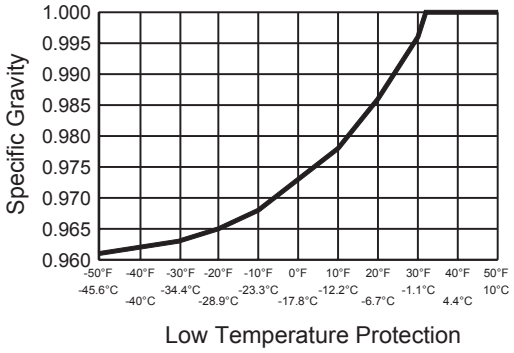


Chart 1b: Propylene Glycol Specific Gravity

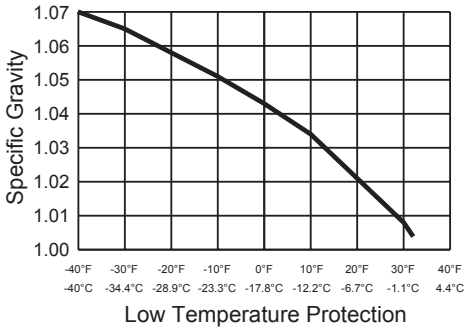


Chart 1c: Ethanol Specific Gravity

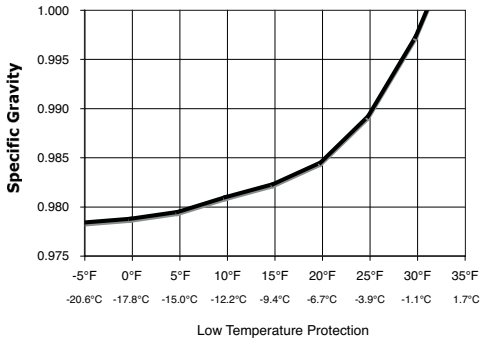
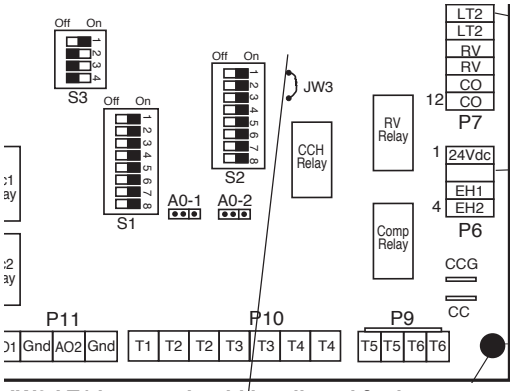
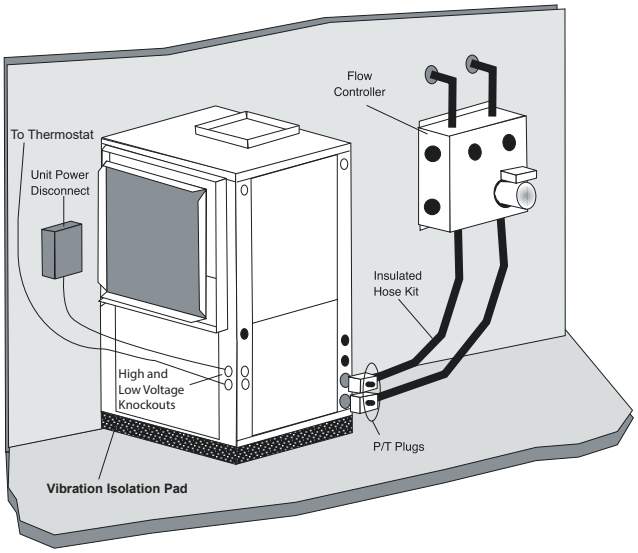


Figure 19: Low Temperature Cutout Selection



JW3-LT1 jumper should be clipped for low temperature operation. Do not clip JW3-LT1 in open-loop applications

Figure 13: Typical Ground-Loop Application



Ground-Water Heat Pump Applications

OPEN LOOP – GROUND WATER SYSTEMS

Typical open loop piping is shown in Figure 14. 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 so that pressure drop and temperature can be measured. Supply and return water piping materials should be limited to copper, PE, or similar material. PVC or CPVC should never be used as they are incompatible with the POE oils used in HFC-410A products and piping system failure and property damage may result.

⚠ 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 guidelines. 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 indecies 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 drawdown 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

Note the placement of the water control valve in Figure 14. 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. This can overload smaller 40 or 50 VA transformers depending on the other controls in the circuit. A typical pilot operated solenoid valve draws approximately 15VA (see Figure 19). Note the special wiring diagrams for slow closing valves (Figures 20 & 21).

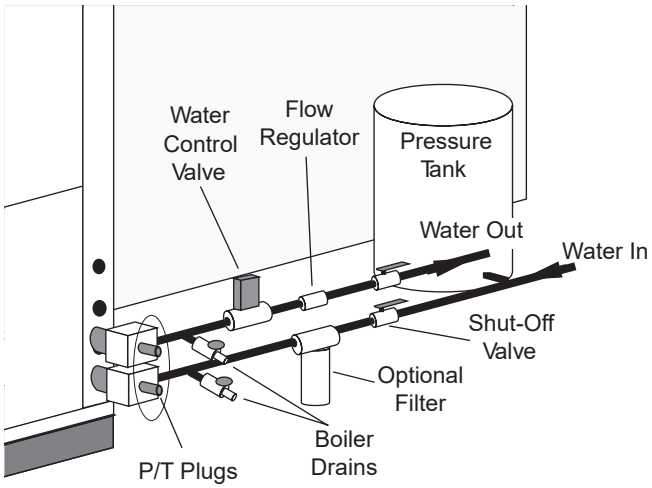
Ground-Water Heat Pump Applications, Cont'd.

FLOW REGULATION

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 8. 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.

Figure 14: Typical Open Loop/Well Application



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 standards listed in this table.

WATER QUALITY REQUIREMENTS

For Closed-Loop and Open-Loop Systems

				Heat Exchanger Type			
				Closed Loop Recirculating	Open Loop, Tower, Ground Source Well		
	Description	Symbol	Units	All Heat Exchanger Types	COAXIAL HX Copper Tube in Tube	COAXIAL HX Cupronickel	Brazed Plate HX 316 SS
Scaling Potential	pH - Chilled Water <85°F			7.0 to 9.0	7.0 to 9.0	7.0 to 9.0	7.0 to 9.0
	pH - 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	($HCO3^-$)	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	(CaCO3)	ppm - CaCO3 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)		ppm	<20	<20	<125	<125
	Hydrogen Sulfide[α]	(H_2S)	ppb	<0.5	<0.5	<0.5	<0.5
	Carbon Dioxide	(CO_2)	ppm	0	<50	10 to 50	10 to 50
	Iron Oxide	(Fe)	ppm	<1.0	<1.0	<1.0	<0.2
	Manganese	(Mn)	ppm	< 0.4	<0.4	<0.4	<0.4
	Ammonia	(NH_3)	ppm	<0.05	<0.1	<0.1	<0.1
	Chloramine	(NH_2CL)	ppm	0	0	0	0
Fouling & Biological	Iron Bacteria		cells/mL	0	0	0	0
	Slime Forming Bacteria		cells/mL	0	0	0	0
	Sulfate reducing bacteria		cells/mL	0	0	0	0
	Suspended Solids[β]	(TSS)	ppm	<10	<10	<10	<10
Electrolysis All HX types	Earth Ground Resistance[χ]		Ohms	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 ClimateMaster 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.

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

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.

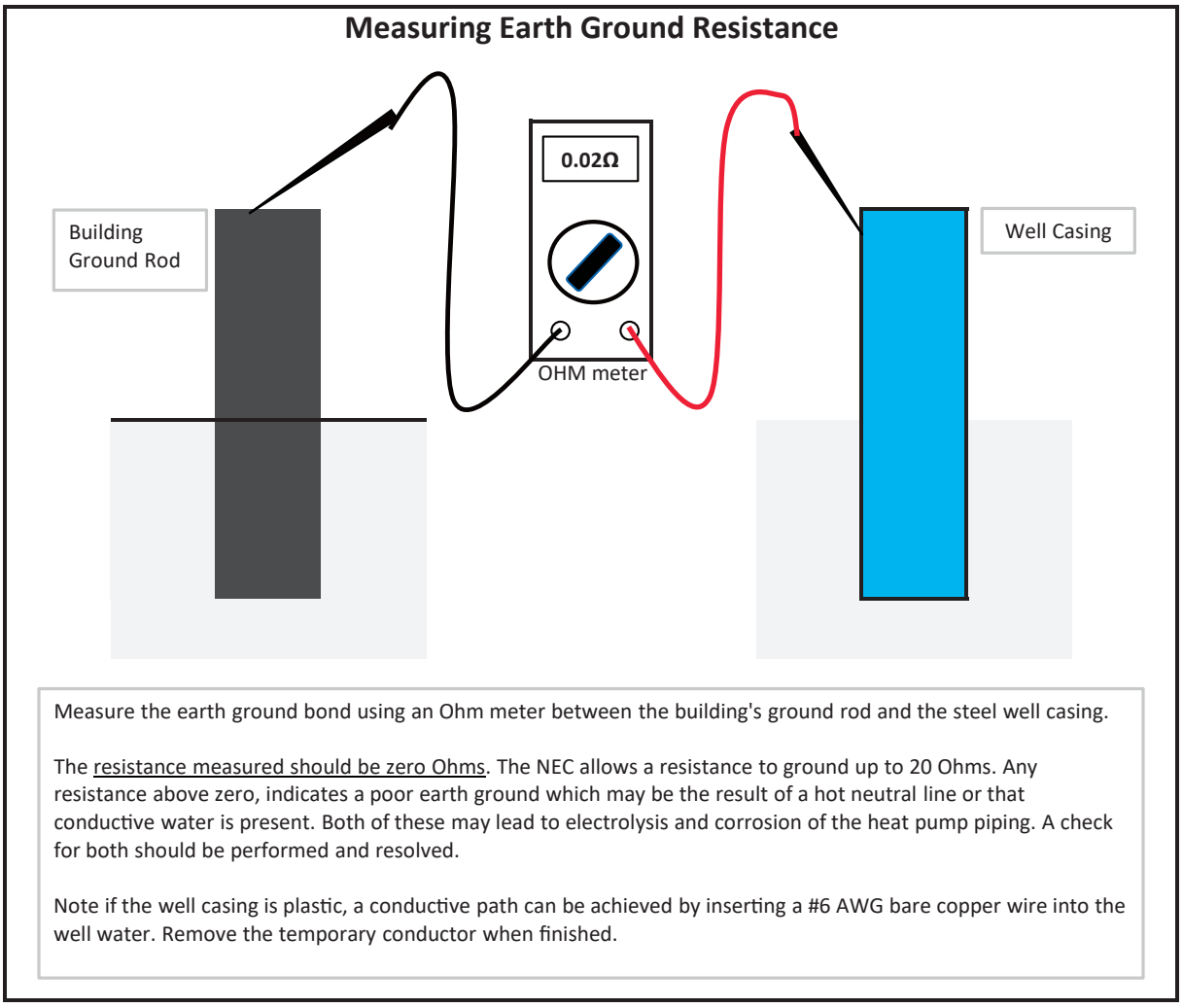
β Suspended solids and particulates must be filtered to prevent fouling and failure of heat exchangers. Strainers or particulate filters must be installed to provide a maximum particle size of 600 micron (0.60 mm, 0.023 in.) using a 20 to 30 mesh screen size. When a loop is installed in areas with fine 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.

Water Quality Requirements, Cont'd.



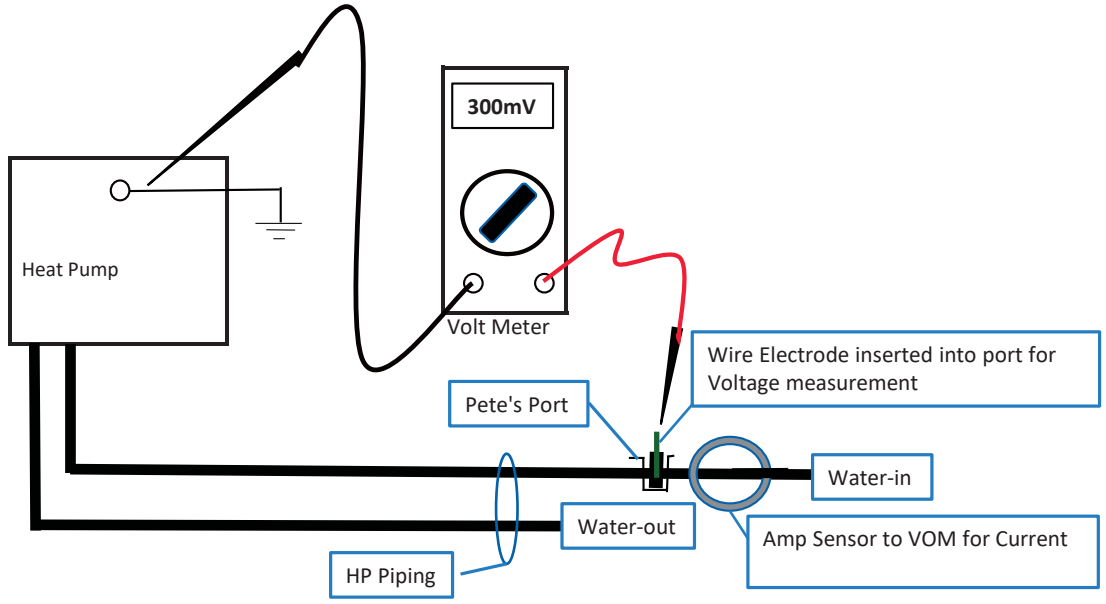
Measure the earth ground bond using an Ohm meter between the building's ground rod and the steel well casing.

The resistance measured should be zero Ohms. The NEC allows a resistance to ground up to 20 Ohms. Any resistance above zero, indicates a poor earth ground which may be the result of a hot neutral line or that conductive water is present. Both of these may lead to electrolysis and corrosion of the heat pump piping. A check for both should be performed and resolved.

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

Water Quality Requirements, Cont'd.

Measuring Electrolysis Voltage and Current



Measure the electrolysis voltage using a volt meter between the heat pump ground and a #14 AWG solid copper wire electrode inserted into the water using a Pete's style access port.

The HP must be operating and the water stream flowing.

The voltage measured should be less than 300mV (0.300 V). If higher than 500mV electrolysis will occure and corrosion will result.

If voltage is measured, the cause is a high resistance earth ground or current on the neutral conductor. Remedial measures should be performed.

Measure the current flowing through the piping system by using an amp clamp probe on the water-in line. The HP must be operating and the water stream flowing.

There should be zero amps measured. If current is present, there is leakage current to the plumbing system and it must be rectified to prevent pipe corrosion.

Hot Water Generator

The HWG (Hot Water Generator) or desuperheater option provides considerable operating cost savings by utilizing excess heat energy from the heat pump 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. Figure 14 shows a typical example of HWG water piping connections on a unit with built-in circulating pump. This piping layout reduces scaling potential.

The temperature set point of the HWG is field selectable to 125°F or 150°F . The 150°F set point allows more heat storage from the HWG. For example, consider the amount of heat that can be generated 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).

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.

This example ignored standby losses of the tank. When those losses are considered the additional savings are even greater.

⚠ 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.

Electric water heaters are recommended. If a gas, propane, or oil water heater is used, a second preheat tank must be installed (Figure 15). 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 52 gallons (235 liters) is used to limit installation costs and space. However, a dual tank, as shown in Figure 15, is the most efficient system, providing 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 3 for scaling potential tests.

Figure 14: Typical HWG Installation

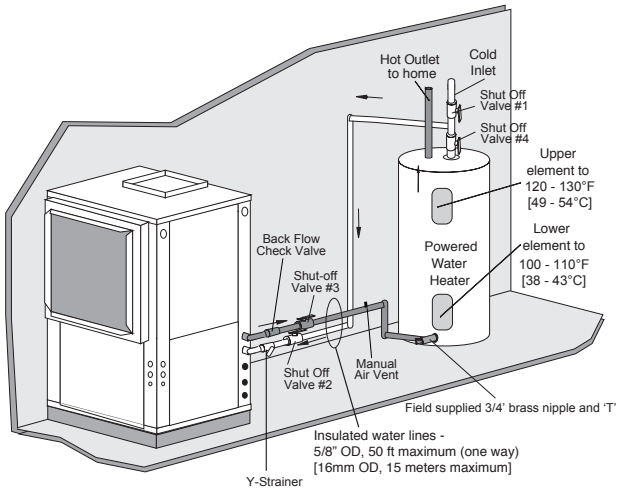
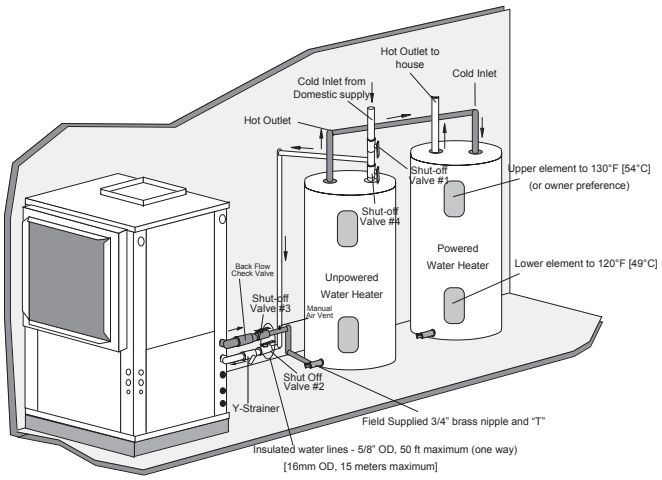


Figure 15: HWG Double Tank Installation



Hot Water Generator, Cont'd.

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

⚠ WARNING! ⚠

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

The microprocessor control monitors the refrigerant and water temperatures to determine when to operate the HWG. The HWG will operate any time the refrigerant temperature is sufficiently above the water temperature. Once the HWG has satisfied the water heating demand during a heat pump run cycle, the controller will cycle the pump at regular Intervals to determine if an additional HWG cycle can be utilized. The microprocessor control Includes 3 DIP switches, SW10 (HWG PUMP TEST), SW11 (HWG TEMP), and SW12 (HWG STATUS).

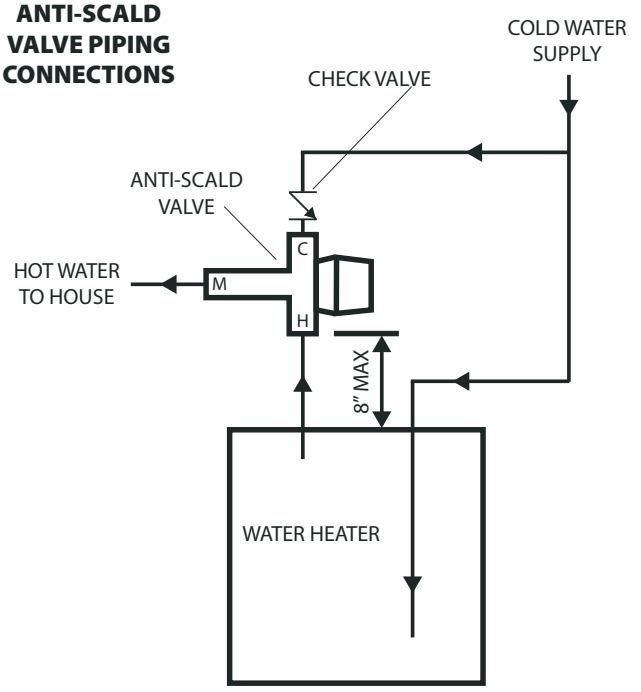
SW10 HWG PUMP TEST - When this switch is in the "ON" position, the HWG pump is forced to operate even if there is no call for the HWG. This mode may be beneficial to assist in purging the system of air during Initial start up. When SW10 is in the "OFF" position, the HWG will operate normally. This switch is shipped from the factory in the "OFF" (normal) position. NOTE; If left in the "On" position for 5 minutes, the pump control will revert to normal operation.

SW11 HWG TEMP - The control setpoint of the HWG can be set to either of two temperatures, 125°F or 150°F. When SW11 is in the "ON" position the HWG setpoint is 150°F. When SW11 is in the "OFF" position the HWG setpoint is 125°F. This switch Is shipped from the factory in the "OFF" (125°F) position.

⚠ WARNING! ⚠

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

ANTI-SCALD VALVE PIPING CONNECTIONS



SW12 HWG STATUS - This switch controls operation of the HWG. When SW12 is in the "ON" position the HWG is disabled and will not operate. When SW12 is in the "OFF" position the HWG is in the enabled mode and will operate normally. This switch is shipped from the factory in the "ON" (disabled) position. **CAUTION: DO NOT PLACE THIS SWITCH IN THE ENABLED POSITION UNITL THE HWG PIPING IS CONNECTED, FILLED WITH WATER, AND PURGED OR PUMP DAMAGE WILL OCCUR.**

When the control is powered and the HWG pump output is not active, the status LED (AN1) will be "On". When the HWG pump output is active for water temperature sampling or HWG operation, the status LED will slowly flash (On 1 second, Off 1 second).

If the control has detected a fault, the status LED will flash a numeric fault code as follows:

Hot Water Sensor Fault	1 flash
Compressor Discharge sensor fault	2 flashes
High Water Temperature (>160°F)	3 flashes
Control Logic Error	4 flashes

Fault code flashes have a duration of 0.4 seconds with a 3 second pause between fault codes. For example, a "Compressor Discharge sensor fault" will be four flashes 0.4 seconds long, then a 3 second pause, then four flashes again, etc.

Hot Water Generator, Cont'd.

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 7 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 connect the pump wiring until "Initial Start-Up" section, below. Powering the pump before all installation steps are completed may 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 5/8" [16mm] O.D. copper, route and install the water piping and valves as shown in Figures 14 or 15. 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 Figures 14 and 15) 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" [10mm] 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 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 (Fig 15).
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 SW12 to the "OFF" position (enabled) to engage the HWG.
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 7: HWG Water Piping Sizes and Length

Unit Nominal Tonnage	Nominal HWG Flow (gpm)	1/2" Copper (max length*)	3/4" Copper (max length*)
1.5	0.6	50	-
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.

Electrical Data

⚠ 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.

Table 4: Tranquility® 20 (TS) Series Electrical Data – Standard Unit: ECM Blower

TS Electrical Table							CV ECM			
MODEL	VOLTAGE CODE	RATED VOLTAGE	VOLTAGE MIN/MAX	COMPRESSOR			FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR
				QTY	RLA	LRA				
018	G	208-230/60/1	187.2/253	1	9.00	48.02	4.20	13.20	15.45	20.00
	E	265/60/1	238.5/291.5	1	7.10	43.00	3.40	10.50	12.28	15.00
024	G	208-230/60/1	187.2/253	1	13.50	58.30	4.20	17.70	21.08	30.00
	E	265/60/1	238.5/291.5	1	9.00	54.00	3.40	12.40	14.65	20.00
	H	208-230/60/3	187.2/253	1	7.10	55.40	4.20	11.30	13.08	20.00
	F*	460/60/3	414/506	1	3.50	28.00	3.40	6.90	7.78	15.00
030	G	208-230/60/1	187.2/253	1	12.80	64.00	5.90	18.70	21.90	30.00
	E	265/60/1	238.5/291.5	1	10.90	60.00	4.80	15.70	18.43	25.00
	H	208-230/60/3	187.2/253	1	8.30	58.00	5.90	14.20	16.28	20.00
	F*	460/60/3	414/506	1	5.10	28.00	4.80	9.90	11.18	15.00
036	G	208-230/60/1	187.2/253	1	16.00	77.00	4.20	20.20	24.20	40.00
	E	265/60/1	238.5/291.5	1	12.20	72.00	3.40	15.60	18.65	30.00
	H	208-230/60/3	187.2/253	1	10.00	71.00	4.20	14.20	16.70	25.00
	F*	460/60/3	414/506	1	4.70	38.00	3.40	8.10	9.28	15.00
042	G	208-230/60/1	187.2/253	1	16.70	79.00	5.90	22.60	26.78	40.00
	E	265/60/1	238.5/291.5	1	13.50	72.00	4.80	18.30	21.68	35.00
	H	208-230/60/3	414/506	1	10.40	73.00	5.90	16.30	18.90	25.00
	F*	460/60/3	238.5/291.5	1	5.80	38.00	4.80	10.60	12.05	15.00
048	G	208-230/60/1	187.2/253	1	21.80	117.00	7.50	29.30	34.75	50.00
	E	265/60/1	238.5/291.5	1	16.30	98.00	6.20	22.50	26.58	40.00
	H	208-230/60/3	414/506	1	13.70	83.10	7.50	21.20	24.63	35.00
	F*	460/60/3	238.5/291.5	1	6.20	41.00	6.20	12.40	13.95	20.00
060	G	208-230/60/1	187.2/253	1	26.40	134.00	7.50	33.90	40.50	60.00
	E	265/60/1	238.5/291.5	1	19.90	130.00	6.20	26.10	31.08	50.00
	H	208-230/60/3	414/506	1	16.00	110.00	7.50	23.50	27.50	40.00
	F*	460/60/3	238.5/291.5	1	7.80	52.00	6.20	14.00	15.95	20.00
070	G	208-230/60/1	187.2/253	1	30.80	178.00	7.50	38.30	46.00	70.00
	H	208-230/60/3	414/506	1	19.60	136.00	7.50	27.10	32.00	50.00
	F*	460/60/3	238.5/291.5	1	8.20	66.10	6.20	14.40	16.45	20.00

*460 volt units CV ECM Require a Neutral
Rated Voltage of 208-230/60/1
Min/Max Voltage of 197/254
HACR circuit breaker in USA only
All fuses Class RK-5
Wire length based on one way measurement with 2% voltage drop
Wire size based on 60°C copper conductor and Minimum Circuit Ampacity.

Electrical Data, Cont'd.

Standard Unit with Internal Secondary Pump: ECM Blower

TS **Electrical Table ISP**							**CV ECM**				
MODEL	**VOLTAGE CODE**	**RATED VOLTAGE**	**VOLTAGE MIN/MAX**	**COMPRESSOR**			**PUMP FLA"**	**FAN MOTOR FLA"**	**TOTAL UNIT FLA"**	**MIN CIRCUIT AMP**	**MAX FUSE/ HACR**
				QTY	**RLA**	**LRA**					
018	**G**	208-230 / 60 / 1	187.2 / 253	1	9.00	48.02	0.43	4.20	13.63	15.88	20.00
	E	265 / 60 / 1	238.5 / 291.5	1	7.10	43.00	0.7	3.40	11.20	12.98	20.00
024	**G**	208-230 / 60 / 1	187.2 / 253	1	13.50	58.30	0.8	4.20	18.50	21.88	35.00
	E	265 / 60 / 1	238.5 / 291.5	1	9.00	54.00	0.7	3.40	13.10	15.35	20.00
	H	208-230 / 60 / 3	187.2 / 253	1	7.10	55.40	0.8	4.20	12.10	13.88	20.00
	F*	460 / 60 / 3	414 / 506	1	3.50	28.00	0.7	3.40	7.60	8.48	15.00
030	**G**	208-230 / 60 / 1	187.2 / 253	1	12.80	64.00	0.8	5.90	19.50	22.70	35.00
	E	265 / 60 / 1	238.5 / 291.5	1	10.90	60.00	0.7	4.80	16.40	19.13	30.00
	H	208-230 / 60 / 3	187.2 / 253	1	8.30	58.00	0.8	5.90	15.00	17.08	25.00
	F*	460 / 60 / 3	414 / 506	1	5.10	28.00	0.7	4.80	10.60	11.88	15.00
036	**G**	208-230 / 60 / 1	187.2 / 253	1	16.00	77.00	0.8	4.20	21.00	25.00	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	12.20	72.00	0.7	3.40	16.30	19.35	30.00
	H	208-230 / 60 / 3	187.2 / 253	1	10.00	71.00	0.8	4.20	15.00	17.50	25.00
	F*	460 / 60 / 3	414 / 506	1	4.70	38.00	0.7	3.40	8.80	9.98	15.00
042	**G**	208-230 / 60 / 1	187.2 / 253	1	16.70	79.00	0.8	5.90	23.40	27.58	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	13.50	72.00	0.7	4.80	19.00	22.38	35.00
	H	208-230 / 60 / 3	414 / 506	1	10.40	73.00	0.8	5.90	17.10	19.70	30.00
	F*	460 / 60 / 3	238.5 / 291.5	1	5.80	38.00	0.7	4.80	11.30	12.75	15.00
048	**G**	208-230 / 60 / 1	187.2 / 253	1	21.80	117.00	0.8	7.50	30.10	35.55	50.00
	E	265 / 60 / 1	238.5 / 291.5	1	16.30	98.00	0.7	6.20	23.20	27.28	40.00
	H	208-230 / 60 / 3	414 / 506	1	13.70	83.10	0.8	7.50	22.00	25.43	35.00
	F*	460 / 60 / 3	238.5 / 291.5	1	6.20	41.00	0.7	6.20	13.10	14.65	20.00
060	**G**	208-230 / 60 / 1	187.2 / 253	1	26.40	134.00	1.1	7.50	34.97	41.57	60.00
	E	265 / 60 / 1	238.5 / 291.5	1	19.90	130.00	1.3	6.20	27.40	32.38	50.00
	H	208-230 / 60 / 3	414 / 506	1	16.00	110.00	1.1	7.50	24.57	28.57	40.00
	F*	460 / 60 / 3	238.5 / 291.5	1	7.80	52.00	1.3	6.20	15.30	17.25	25.00
070	**G**	208-230 / 60 / 1	187.2 / 253	1	30.80	178.00	1.1	7.50	39.37	47.07	70.00
	H	208-230 / 60 / 3	414 / 506	1	19.60	136.00	1.1	7.50	28.17	33.07	50.00
	F*	460 / 60 / 3	238.5 / 291.5	1	8.20	66.10	1.3	6.20	15.70	17.75	25.00

*460 volt units with Internal Source Pump and/or CV ECM Require a Neutral

Electrical – Power 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.

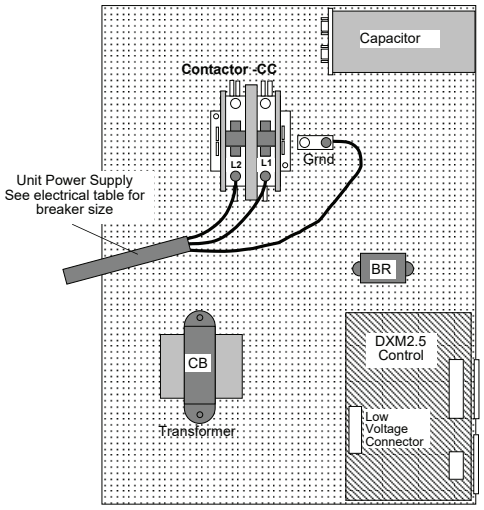
ELECTRICAL – LINE VOLTAGE

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.

Figure 15: Single Phase Line Voltage Field Wiring. Three phase wiring is similar except that all three power wires are directly connected to the contactor.



Note: 460V units with ECM, ClimaDry® II, or Internal Secondary Pump require a neutral wire.

POWER CONNECTION

Line voltage connection is made by connecting the incoming line voltage wires to the "L" side of the contactor as shown in Figure 15. Consult electrical data tables for correct fuse size.

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.

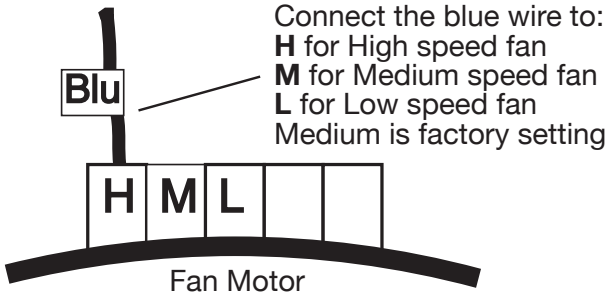
BLOWER SPEED SELECTION – UNITS WITH PSC MOTOR

PSC (Permanent Split Capacitor) blower fan speed can be changed by moving the blue wire on the fan motor terminal block to the desired speed as shown in Figure 16. Most ClimateMaster units are shipped on the medium speed tap. Consult submittal data or engineering design guide for specific unit airflow tables. Typical unit design delivers rated airflow at nominal static (0.15 in. w.g. [37Pa]) on medium speed and rated airflow at a higher static (0.4 to 0.5 in. w.g. [100 to 125 Pa]) on high speed for applications where higher static is required. Low speed will deliver approximately 85% of rated airflow at 0.10 in. w.g. [25 Pa]. An optional high static blower is available on some models.

SPECIAL NOTE FOR AHRI TESTING

To achieve rated airflow for AHRI testing purposes on all PSC products, it is necessary to change the fan speed to "HI" speed. 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.

Figure 16: PSC Motor Speed Selection



Electrical – Low Voltage Wiring

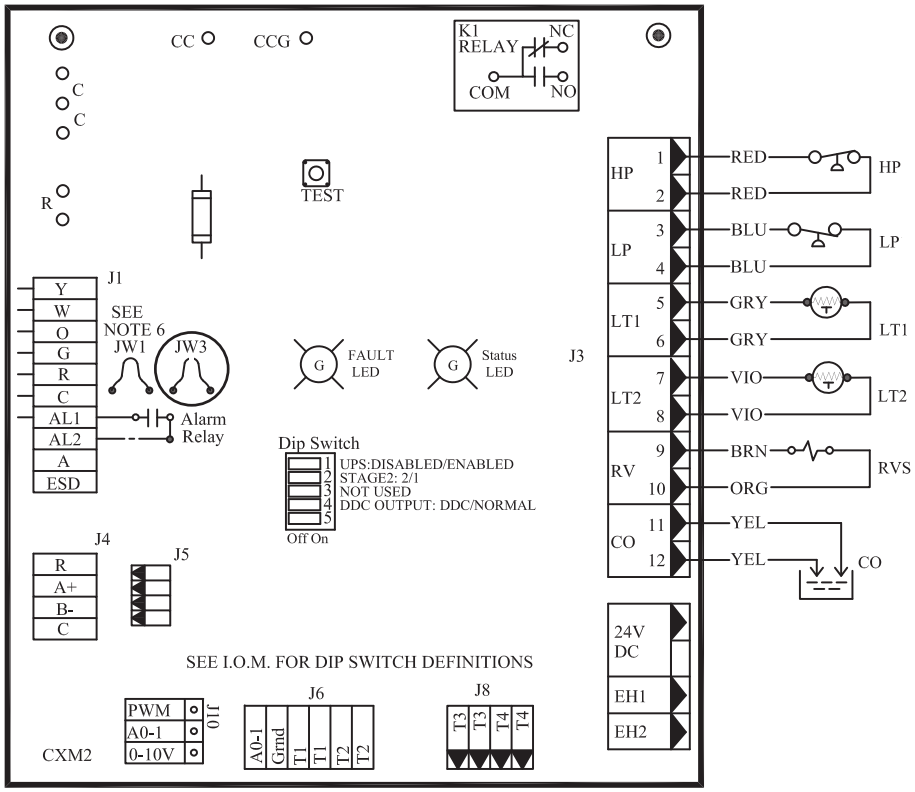
THERMOSTAT CONNECTIONS
The thermostat should be wired directly to the DXM2.5 board. See "Electrical – Thermostat" for specific terminal connections. Review the appropriate AOM (Application, Operation and Maintenance) manual for units with DDC controls.

LOW WATER TEMPERATURE CUTOUT SELECTION
DXM2.5 control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW3 (see Figure 17), 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 ClimateMaster 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.

Note: 460V units with ECM motor require a neutral wire.

Figure 17: LT1 Limit Setting



Electrical – Low Voltage Wiring, Cont'd.

ACCESSORY CONNECTIONS

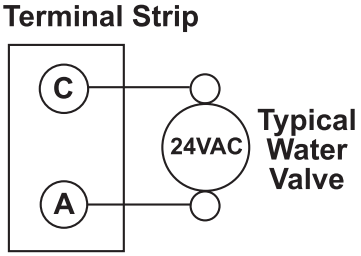
A terminal paralleling the compressor contactor coil has been provided on the DXM2.5 control. Terminal "A" is designed to control accessory devices, such as water valves. NOTE: This terminal should be used only with 24 Volt signals and not line voltage. Terminal "A" is energized with the compressor contactor. See Figure 18 or the specific unit wiring diagram for details.

LOW VOLTAGE VA RATINGS

Component	VA
Typical Blower Relay	6 - 7
Typical Reversing Valve Solenoid	4 - 6
30A Compressor Contactor	6 - 9
Subtotal	16 - 22
+ DXM2.5 board (5 - 9 VA)*	21 - 31
Remaining VA for Accessories	19 - 29
+ DXM2.5 board (8 - 12 VA)*	24 - 34
Remaining VA for Accessories	41 - 51

*Standard transformer for DXM2.5 board is 50VA.
Optional DXM2.5 board and/or DDC controls
Include 75VA transformer.

Figure 18: Accessory Wiring



WATER SOLENOID VALVES

An external solenoid valve(s) should be used on ground water installations to shut off flow to the unit when the compressor is not operating. A slow closing valve may be required to help reduce water hammer. Figure 18 shows typical wiring for a 24VAC external solenoid valve. Figures 19 and 20 illustrates a slow closing water control valve wiring for two styles of typical accessory water 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.

Figure 19: Accessory Motorized Water Valve - Typical Wiring Example #1

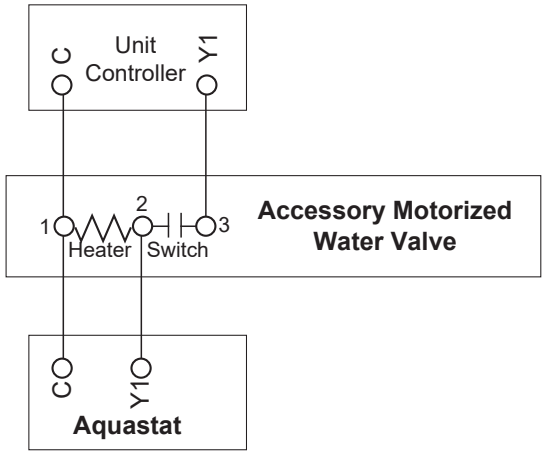
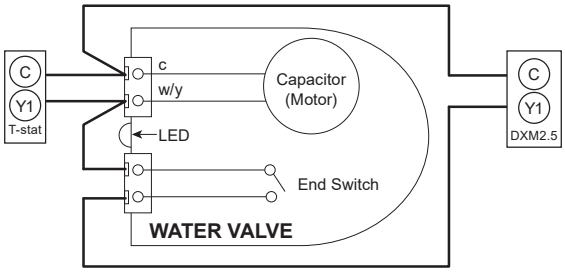


Figure 20: Accessory Motorized Water Valve - Typical Wiring Example #2



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 21 and 21a however, actual wiring connections should be determined from the thermostat IOM and or unit wiring diagram. Practically any heat pump thermostat will work with ClimateMaster heat pump units, provided it has the correct number of heating and cooling stages. Heat/Cool thermostats are required for the hydronic heating option.

Figure 21: Units with PSC Fan

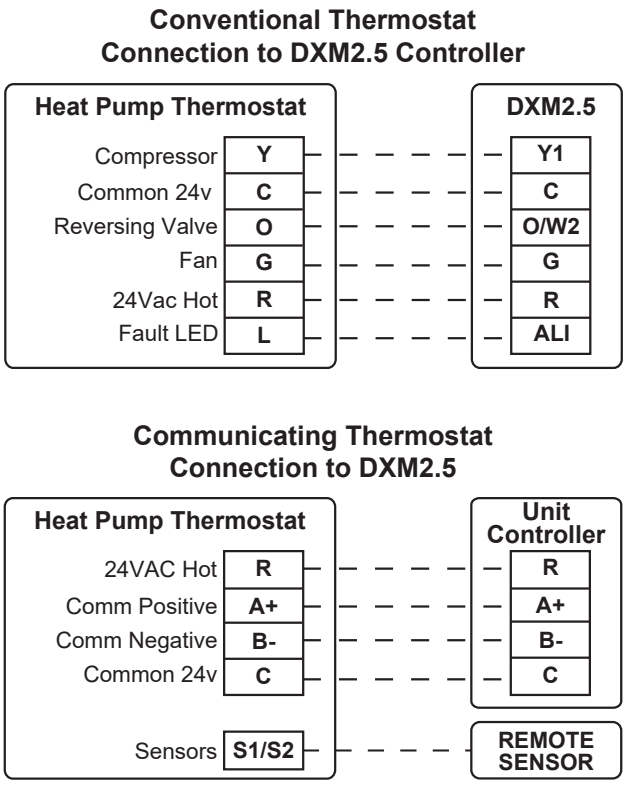
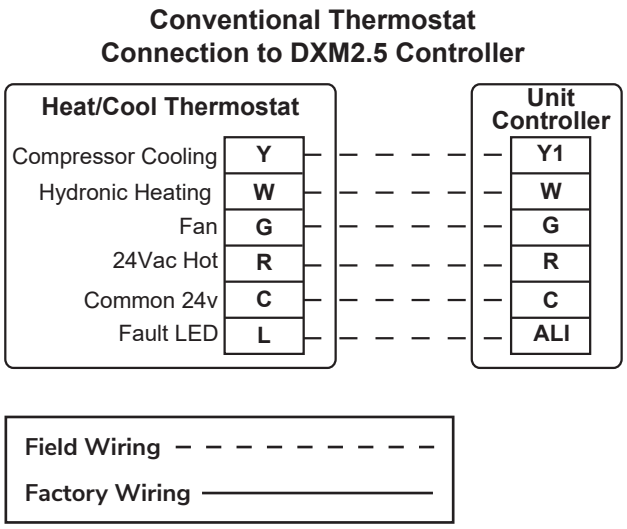


Figure 21a: Units with Hydronic Heating and CT ECM Fan



Constant Volume (CV) ECM

The Intelligent Constant Volume (CV) ECM blower motor provides unmatched functionality that saves installing and service technicians time while also providing increased comfort levels to occupants.

CV ECM's are programed to maintain a constant CFM across a wide range of external static pressures (ESP). This functionality differs from traditional PSC or even Constant Torque (CT) ECM's. With traditional PSC and CT ECM fan motors, as ESP is increased CFM is reduced. To increase or decrease the speed of the fan motor requires a fan motor switch or a technician to wire into a different motor tap. CT ECM's provide increased efficiency over PSC motors but with no additional functionality. With a CV ECM, as changes in ESP occur the fan motor will adjust its speed to deliver the desired CFM (within its operating range). This ensures the system is delivering the airflow and capacity it was designed for.

A major benefit of the CV ECM over other fan motor types its ability to adjust airflow remotely through the iGate® 2 web portal/mobile app or directly at the unit with a communicating diagnostic service tool or thermostat. Airflow levels can be adjusted in increments of 25 CFM from the units minimum and maximum CFM range (see CV ECM configuration table for details). This functionality allows technicians to dial in airflow during start-up and commissioning via an easy to use service tool. During operation occupants may have a desire for airflow adjustments. Reducing CFM can reduce airflow sound levels and increase cooling dehumidification (latent capacity). Technicians can easily make these adjustments without making wiring changes reducing service time with minimal disruption to the occupants.

The fan motor operating modes include:

- First Stage Cooling (Y1 & O)
- Second Stage Cooling (Y1, Y2, & O)
- First Stage Heating (Y1)
- Second Stage Heating (Y1 & Y2)
- Fan (G with no Y1, Y2, or W)

The CV ECM motor includes "soft start" and "ramp down" features. The soft start feature gently increases the motors rpm at blower start up resulting quieter blower start cycles. Likewise, the ramp down feature allows the blower to slowly decrease rpm to a full stop resulting in a quieter end to each blower cycle. The ramp down feature (also known as the heating or cooling "Off Delay") also has the functionality to be field selected by the technician in the allowable range of 0 to 255 seconds.

Airflow Configuration Screen on Mobile App

Blower Performance Data

Airflow in CFM with wet coil and clean air filter

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
18	750	450	CV ECM	MIN	RPM	571	666	754	852	942	1012	1073	1134	1196	1254
					Power (W)	44	56	69	84	99	111	122	135	149	161
					CFM	450	450	450	450	450	450	450	450	450	450
				DEFAULT	RPM	717	787	855	920	982	1045	1113	1182	1248	1307
					Power (W)	95	110	125	142	157	175	195	216	237	258
					CFM	750	750	750	750	750	750	750	750	750	750
				MAX	RPM	739	807	873	937	997	1054	1113	1184	1248	1306
					Power (W)	105	119	136	153	170	186	205	228	250	271
					CFM	800	800	800	800	800	800	800	800	800	800
24	950	600	CV ECM	MIN	RPM	674	759	835	902	969	1035	1101	1161	1219	1273
					Power (W)	71	85	100	114	127	143	159	174	190	205
					CFM	600	600	600	600	600	600	600	600	600	600
				DEFAULT	RPM	906	945	990	1047	1102	1153	1202	1248	1292	1337
					Power (W)	180	195	209	230	251	272	291	311	331	351
					CFM	950	950	950	950	950	950	950	950	950	950
				MAX	RPM	988	1027	1069	1109	1160	1212	1260	1304	1347	1390
					Power (W)	236	253	270	288	311	336	359	382	404	428
					CFM	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
30	1000	750	CV ECM	MIN	RPM	721	797	865	930	991	1049	1105	1157	1209	1259
					Power (W)	93	108	124	140	156	173	189	205	221	237
					CFM	750	750	750	750	750	750	750	750	750	750
				DEFAULT	RPM	884	946	1007	1061	1115	1165	1214	1260	1304	1349
					Power (W)	187	209	232	252	274	295	316	338	358	380
					CFM	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
				MAX	RPM	1091	1148	1202	1255	1305					
					Power (W)	373	405	438	471	503					
					CFM	1250	1250	1250	1250	1250					
36	1200	900	CV ECM	MIN	RPM	646	730	805	873	936	996	1083	1127	1171	1215
					Power (W)	104	128	152	176	199	223	260	281	302	324
					CFM	900	900	900	900	900	900	900	900	900	900
				DEFAULT	RPM	777	849	913	973	1028	1080	1129	1178	1223	1270
					Power (W)	199	232	263	294	323	353	383	413	444	477
					CFM	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
				MAX	RPM	906	968	1025	1077	1129					
					Power (W)	346	387	426	465	505					
					CFM	1500	1500	1500	1500	1500					
42	1400	1000	CV ECM	MIN	RPM	533	617	679	725	781	838	805	942	988	1030
					Power (W)	95	124	147	167	192	220	252	277	303	330
					CFM	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
				DEFAULT	RPM	650	722	788	844	893	937	966	996	1038	1078
					Power (W)	203	244	286	324	357	390	413	437	471	506
					CFM	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
				MAX	RPM	749	809	862	918	968	1015	1060	1099	1135	
					Power (W)	352	402	449	500	547	596	645	688	733	
					CFM	1750	1750	1750	1750	1750	1750	1750	1750	1750	

Table continued on next page.

Blower Performance Data, Cont'd.

Table continued from previous page.

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
48	1600	1100	CV ECM	MIN	RPM	560	628	692	754	810	863	911	955	1007	1059
					Power (W)	125	152	179	208	234	262	289	315	347	380
					CFM	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
				DEFAULT	RPM	707	763	815	863	910	954	997	1038	1082	1122
					Power (W)	291	329	367	404	441	478	516	554	596	637
					CFM	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
				MAX	RPM	827	880	926	970	1011	1050	1086	1122	1158	1193
					Power (W)	508	561	610	658	706	754	798	845	892	939
					CFM	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
60	1950	1500	CV ECM	MIN	RPM	770	812	848	886	926	965	1006	1047		
					Power (W)	305	330	351	375	400	427	455	483		
					CFM	1500	1500	1500	1500	1500	1500	1500	1500		
				DEFAULT	RPM	937	972	581	1036	1068	1100	1130	1164	1196	1228
					Power (W)	570	600	628	659	690	720	750	783	819	857
					CFM	1950	1950	1950	1950	1950	1950	1950	1950	1950	1950
				MAX	RPM	1005	1036	1068	1096	1125					
					Power (W)	724	758	792	822	854					
					CFM	2150	2150	2150	2150	2150					
70	2050	1750	CV ECM	MIN	RPM	846	892	934	974	1013	1049	1085	1120	1158	1196
					Power (W)	417	458	499	537	577	615	654	694	737	782
					CFM	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
				DEFAULT	RPM	959	997	1035	1070	1103	1137	1170	1189		
					Power (W)	620	664	710	754	796	842	886	888		
					CFM	2050	2050	2050	2050	2050	2050	2050	2050		
				MAX	RPM	1019	1055	1089	1118						
					Power (W)	759	805	851	885						
					CFM	2250	2250	2250	2250						

Controls – DXM2.5

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

Operating & 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 8a for operating limits.

COMMISSIONING LIMITS

Consult Table 8b for commissioning limits. Starting limits vary depending upon model and are based upon the following notes:

NOTES:

1. Conditions in Table 8b are not normal or continuous operating limits. Minimum/maximum limits are start-up conditions to bring the building space up to occupancy temperatures. Units are not designed to operate under these limits on a regular basis.
2. Voltage utilization complies with AHRI Standard 110.

Table 8a: Operating Limits

Operating Limits	Unit	
	Cooling	Heating
Air Limits		
Min. Ambient Air, DB	45°F [7°C]	39°F [4°C]
Rated Ambient Air, DB	80.6°F [27°C]	68°F [20°C]
Max. Ambient Air, DB	130°F [54°C]	85°F [29°C]
Min. Entering Air, DB/WB	60/50°F [16/10°C]	45°F [7°C]
Rated Entering Air, DB/WB	80.6/66.2°F [27/19°C]	68°F [20°C]
Max. Entering Air, DB/WB	95/75°F [35/24°C]	80°F [27°C]
Water Limits		
Min. Entering Water	30°F [-1°C]	20°F [-6.7°C]
Normal Entering Water	50-110°F [10-43°C]	30-70°F [-1 to 21°C]
Max. Entering Water	120°F [49°C]	90°F [32°C]
Normal Water Flow	1.5 to 3.0 gpm/ton [1.6 to 3.2 l/m per kW]	

Table 8b: Commissioning Limits

Commissioning Limits	Unit	
	Cooling	Heating
Air Limits		
Min. Ambient Air, DB	45°F [7°C]	39°F [4°C]
Rated Ambient Air, DB	80.6°F [27°C]	68°F [20°C]
Max. Ambient Air, DB	130°F [54°C]	85°F [29°C]
Min. Entering Air, DB/WB	50/45°F [10/7°C]	40°F [4.5°C]
Rated Entering Air, DB/WB	80.6/66.2°F [27/19°C]	68°F [20°C]
Max. Entering Air, DB/WB	110/83°F [43/28°C]	80°F [27°C]
Water Limits		
Min. Entering Water	30°F [-1°C]	20°F [-6.7°C]
Normal Entering Water	50-110°F [10-43°C]	30-70°F [-1 to 21°C]
Max. Entering Water	120°F [49°C]	90°F [32°C]
Normal Water Flow	1.5 to 3.0 gpm/ton [1.6 to 3.2 l/m per kW]	

Unit & System Checkout

⚠ 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 and System Checkout

BEFORE POWERING SYSTEM, please check the following:

UNIT CHECKOUT

- ❑ **Balancing/shutoff valves:** Insure 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:** Insure that transformer has the properly selected voltage tap. Residential 208-230V units are factory wired for 230V operation unless specified otherwise.
- ❑ Loop/water piping is complete and purged of air. Water/piping is clean.
- ❑ Antifreeze has been added if necessary.
- ❑ **Entering water and air:** Insure that entering water and air temperatures are within operating limits of Table 8.
- ❑ **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 insure 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.
- ❑ HWG pump is disconnected unless piping is completed and air has been purged from the system.
- ❑ **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:** Insure 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. Low voltage wiring is complete.
- ❑ Blower speed is set.
- ❑ Service/access panels are in place.

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 air is purged from the system. Air in the system can cause poor operation or system corrosion. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Some antifreeze solutions may require distilled water.
- ❑ **Flow Controller pump(s):** Verify that the pump(s) is wired, purged of air, 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 set properly (FP1 - JW3).
- ❑ **Miscellaneous:** Note any questionable aspects of the installation.

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 position. Turn on the line power to all heat pump units.
4. Room temperature should be within the minimum-maximum ranges of Table 8b. During start-up checks, loop water temperature entering the heat pump should be between 30°F [-1°C] and 95°F [35°C].
5. Two factors determine the operating limits of water source 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 insure 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 bypassed on the DXM2.5 control board as shown below in Figure 27. See controls description for details.
   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 Tables 9.
   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 10. 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 11. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in Table 9. Heat of rejection (HR) can be calculated and compared to catalog data capacity pages. The formula for HR for systems with water is as follows:
   HR = TD x GPM x 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 Tables 9a through 9b.
   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 10. 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 11. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in Table 9. 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 = TD x GPM x 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 9.
   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 insure proper diagnosis and repair of the equipment.
8. When testing is complete, set system to maintain desired comfort level.
9. BE CERTAIN TO FILL OUT AND RETURN ALL WARRANTY REGISTRATION PAPERWORK.

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.

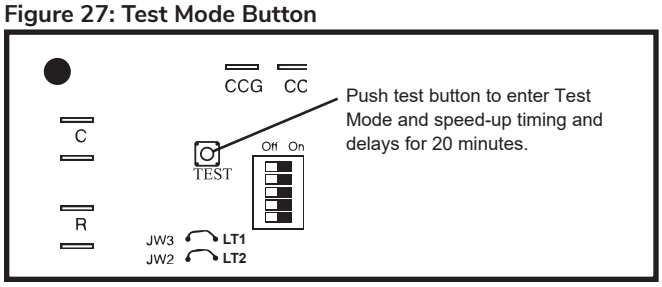
⚠ WARNING! ⚠

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.

Figure 27: Test Mode Button



Unit Operating Conditions

Table 9: TS Coax Water Pressure Drop

Model	GPM	Pressure Drop (psi)			
		30°F	50°F	70°F	90°F
018	2.8	0.7	0.5	0.3	0.2
	4.1	2.1	1.7	1.4	1.1
	5.5	3.5	2.8	2.4	2.0
024	3.0	1.2	0.3	0.2	0.1
	4.5	1.9	1.0	0.7	0.5
	6.0	2.0	1.4	1.2	1.0
030	3.8	0.9	0.8	0.8	0.7
	5.6	1.6	1.4	1.3	1.3
	7.5	2.5	2.2	2.1	2.0
036	4.5	1.2	0.8	0.9	0.8
	6.8	2.4	1.9	1.8	1.7
	9.0	4.0	3.2	3.0	2.8
042	5.5	1.0	0.9	0.8	0.8
	8.3	2.2	1.9	1.8	1.8
	11.0	3.8	3.4	3.2	3.1
048	6.0	1.1	0.9	0.7	0.8
	9.0	2.3	1.8	1.8	1.8
	12.0	3.9	3.2	3.2	3.0
060	7.5	1.3	0.6	0.5	0.5
	11.3	3.5	2.5	2.1	2.0
	15.0	6.1	4.7	4.1	3.9
070	9.0	2.7	1.7	1.5	1.6
	13.5	5.2	3.8	3.3	3.2
	18.0	8.1	6.4	5.7	5.5

Table 10: Water Temperature Change Through Heat Exchanger

Water Flow, gpm (l/m)	Rise, Cooling °F	Drop, Heating °F
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton	9 - 12	4 - 9
For Open Loop: Ground Water Systems at 1.5 gpm per ton	18 - 26	7 - 19

Unit Operating Conditions, Cont'd.

Table 11: TS Series Typical Unit Operating Pressures and Temperatures

018		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	120-130	155-175	27-32	11-16	16.9-19.9	16-22	73-83	268-288	8-13	4-9	6.1-8.1	15-21
	2.25	120-130	142-162	27-32	9-14	12.5-14.5	17-23	75-85	270-290	8-13	4-9	4.4-6.4	16-22
	3	120-130	128-148	27-32	9-14	8.1-10.1	17-23	78-88	272-292	8-13	4-9	2.9-4.9	16-22
50	1.5	137-147	220-240	16-21	10-15	17-19	16-22	102-112	295-315	8-13	8-13	9.1-11.1	20-26
	2.25	137-147	206-226	16-21	8-13	12.6-14.6	17-23	106-116	297-317	8-13	8-13	6.9-8.9	21-27
	3	137-147	192-212	16-21	8-13	8.4-10.4	17-23	110-120	299-319	8-13	8-13	4.7-6.7	21-27
70	1.5	142-152	287-307	7-12	10-15	15.9-17.9	16-22	131-141	324-344	9-14	10-15	12.1-14.1	25-33
	2.25	142-152	273-239	7-12	8-13	11.8-13.8	17-23	137-147	326-346	9-14	10-15	9.3-11.3	26-34
	3	142-152	259-279	7-12	8-13	7.8-9.8	17-23	144-154	328-348	9-14	10-15	6.6-8.6	26-34
90	1.5	146-156	375-395	6-11	10-15	14.9-16.9	16-22	174-184	360-380	10-15	12-17	15.8-17.8	32-40
	2.25	146-156	361-381	6-11	8-13	11-13	17-23	180-190	367-387	11-16	12-17	11.9-13.9	33-41
	3	146-156	347-367	6-11	8-13	7.2-9.2	17-23	187-197	374-394	12-17	12-17	8-10	33-41
110	1.5	154-164	478-498	6-11	10-15	14-16	16-22						
	2.25	154-164	461-481	6-11	8-13	10.2-12.2	16-22						
	3	154-164	445-465	6-11	8-13	6.5-8.5	16-22						

*Based on 15% Methanol antifreeze solution

024		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	115-125	154-174	40-45	8-13	16.5-18.5	19-25	73-83	283-303	8-12	6-11	5.9-7.9	16-22
	2.25	115-125	141-161	40-45	6-11	12.1-14.1	20-26	75-85	285-305	8-12	6-11	4.2-6.2	17-23
	3	115-125	127-147	40-45	6-11	77.7-9.7	20-26	78-88	287-307	8-12	6-11	2.7-4.7	18-24
50	1.5	115-120	209-229	24-29	10-15	15.7-17.7	18-24	102-112	313-333	8-12	8-13	8.9-10.9	22-28
	2.25	115-120	195-215	24-29	8-13	11.6-13.6	18-24	106-116	314-334	8-12	8-13	6.7-8.7	23-29
	3	115-120	181-201	24-29	8-13	7.6-9.6	18-24	110-120	316-336	8-12	8-13	4.5-6.5	23-29
70	1.5	136-146	275-295	6-11	6-11	15.7-17.7	18-24	128-138	340-360	9-14	9-14	11.3-13.3	27-34
	2.25	136-146	261-281	6-11	5-10	11.6-13.6	18-24	134-144	342-362	9-14	9-14	8.5-10.5	28-35
	3	136-146	247-267	6-11	4-9	7.6-9.6	18-24	141-151	344-364	9-14	9-14	5.8-7.8	28-35
90	1.5	140-150	361-381	6-11	6-11	14.9-16.9	18-24	162-172	370-390	14-19	9-14	14.4-16.4	32-40
	2.25	140-150	347-367	6-11	5-10	11-13	18-24	166-176	376-396	15-20	9-14	10.8-12.8	34-42
	3	140-150	333-353	6-11	4-9	7.2-9.2	18-24	171-181	383-403	16-21	9-14	7.1-9.1	34-42
110	1.5	144-154	460-480	6-11	6-11	13.9-15.9	17-23						
	2.25	144-154	445-465	6-11	4-9	10.2-12.2	17-23						
	3	144-154	428-448	6-11	4-9	6.5-8.5	17-23						

*Based on 15% Methanol antifreeze solution

030		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	116-126	146-166	27-32	7-13	19.6-21.6	16-22	69-79	275-295	7-12	6-11	7.2-9.2	16-22
	2.25	115-125	138-158	27-32	6-11	14.3-16.3	17-23	73-83	277-297	7-12	6-11	5.4-7.4	17-23
	3	115-125	128-148	27-32	6-11	8-10	17-23	76-86	279-299	7-12	6-11	3.5-5.5	17-23
50	1.5	129-139	217-237	12-17	6-11	20.8-22.8	17-23	96-106	300-320	10-15	9-14	10.5-12.5	21-27
	2.25	128-138	203-223	12-17	5-10	15-17	18-24	100-110	304-324	10-15	9-14	7.6-9.6	22-28
	3	128-138	189-209	12-17	5-10	9.2-11.2	18-24	105-115	309-329	10-15	9-14	4.8-6.8	22-28
70	1.5	132-142	293-313	9-14	6-11	20.1-22.1	17-23	123-133	327-347	11-16	11-16	13.2-15.2	25-32
	2.25	131-141	274-294	9-14	5-10	14.4-16.4	18-24	129-139	333-353	11-16	11-16	9.8-11.8	26-33
	3	131-141	256-276	9-14	5-10	8.6-10.6	18-24	135-145	339-359	11-16	11-16	6.4-8.4	27-34
90	1.5	137-147	383-403	7-12	5-10	19.4-21.4	16-22	155-165	355-375	13-18	11-16	16.8-18.8	30-38
	2.25	137-147	362-382	7-12	5-10	13.8-15.8	16-22	162-172	362-382	14-19	11-16	12.7-14.7	31-39
	3	137-147	342-362	7-12	5-10	8.2-10.2	16-22	169-179	369-389	16-21	11-16	8.6-10.6	32-40
110	1.5	143-153	475-495	6-11	9-14	18.2-20.2	16-22						
	2.25	143-153	457-477	6-11	6-11	13-14	16-22						
	3	143-153	439-459	6-11	6-11	7.7-9.7	16-22						

*Based on 15% Methanol antifreeze solution

Unit Operating Conditions, Cont'd.

036		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	117-127	142-162	33-38	8-14	19.1-21.1	15-22	69-79	276-296	10-15	10-15	7.2-9.2	17-23
	2.25	116-126	134-154	33-38	7-12	13.8-15.8	15-22	73-83	278-298	10-15	10-15	5.3-7.3	18-24
	3	116-126	124-144	33-38	7-12	7.4-9.4	15-22	76-86	280-300	10-15	10-15	3.5-5.5	18-24
50	1.5	136-146	211-231	11-16	6-11	20.6-22.6	17-23	99-109	302-322	10-15	13-18	10.6-12.6	22-28
	2.25	136-146	197-217	11-16	5-10	14.8-16.8	17-23	103-113	306-326	10-15	13-18	7.7-9.7	23-29
	3	136-146	183-203	11-16	5-10	9-11	17-23	108-118	311-331	10-15	13-18	5-7	23-29
70	1.5	137-147	275-295	9-14	10-15	19-21	18-24	127-137	332-352	10-15	15-20	13.5-15.5	27-34
	2.25	137-147	260-280	9-14	9-14	13.8-15.8	19-25	133-143	338-358	10-15	15-20	10.1-12.1	28-35
	3	137-147	245-265	9-14	9-14	8-10	19-25	139-149	344-364	10-15	15-20	6.7-8.7	29-36
90	1.5	142-152	373-393	7-12	10-15	19.5-21.5	17-23	164-174	365-385	11-16	15-20	17.4-19.4	34-42
	2.25	142-152	352-372	8-13	6-11	13.9-15.9	17-23	172-182	372-392	11-16	15-20	13.2-15.2	35-43
	3	142-152	332-352	8-13	6-11	8.3-10.3	17-23	181-191	379-399	12-17	15-20	9-11	36-44
110	1.5	147-157	467-487	6-11	10-15	16.2-18.2	16-22						
	2.25	147-157	448-468	6-11	8-13	11.9-13.9	16-22						
	3	147-157	430-450	6-11	7-12	7.6-9.6	16-22						

*Based on 15% Methanol antifreeze solution

042		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	114-124	170-190	27-32	10-15	17.2-19.2	17-23	69-79	286-306	5-10	5-10	4.5-6.5	16-22
	2.25	113-123	150-170	27-32	9-14	12.7-14.7	17-23	72-82	289-309	5-10	6-11	3.9-5.9	17-23
	3	113-123	131-151	27-32	7-12	8.2-10.2	17-23	75-85	292-312	6-11	6-11	3.2-5.2	18-24
50	1.5	130-140	226-246	10-15	6-11	17.8-19.8	20-26	100-110	315-335	7-12	6-11	9-11	22-28
	2.25	129-139	208-228	10-15	5-10	13.3-15.3	20-26	105-115	322-342	8-13	6-11	7-9	23-29
	3	129-139	190-210	10-15	4-9	8.8-10.8	20-26	110-120	330-350	10-15	7-12	5-7	24-30
70	1.5	132-142	290-310	6-11	6-11	17.3-19.3	19-25	131-141	347-367	11-16	6-11	13.4-15.4	29-35
	2.25	131-141	273-293	6-11	5-10	12.8-14.8	19-25	138-148	358-378	13-18	8-13	10-12	30-36
	3	131-141	255-275	6-11	4-9	8.3-10.3	19-25	145-155	369-389	16-21	9-14	6.9-8.9	31-37
90	1.5	136-146	370-390	6-11	6-11	16-18	17-23	175-185	393-413	19-24	7-12	17.6-19.6	36-42
	2.25	135-145	350-370	6-11	5-10	11.8-13.8	17-23	177-187	401-421	20-25	9-14	13.2-15.2	37-43
	3	135-145	330-350	6-11	4-9	7.6-9.6	17-23	180-190	409-429	22-27	12-17	8.7-10.7	38-44
110	1.5	143-153	469-489	6-11	6-11	14-16	16-22						
	2.25	142-152	448-468	6-11	5-10	11-13	16-22						
	3	141-151	427-447	6-11	4-9	7-9	16-22						

*Based on 15% Methanol antifreeze solution

048		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	108-118	180-200	27-32	12-17	19.8-21.8	19-25	65-75	293-313	7-12	9-14	8.2-10.2	17-23
	2.25	107-117	161-181	28-33	10-15	14.8-16.8	19-25	68-78	297-217	8-13	9-14	6.2-8.2	18-24
	3	107-117	142-162	29-34	9-14	9.8-11.8	19-25	72-82	301-321	9-14	9-14	4.2-6.2	19-25
50	1.5	123-133	236-256	16-21	8-13	20.2-22.2	21-27	92-102	321-341	10-15	11-16	11.6-13.6	23-29
	2.25	122-132	218-238	17-22	7-12	15.2-18.2	21-27	100-110	330-350	11-16	11-16	8.9-10.9	24-30
	3	122-132	200-220	17-22	6-11	10.2-12.2	21-27	108-118	340-360	12-17	11-16	6-8	26-32
70	1.5	130-140	305-325	10-15	8-13	20-22	20-26	122-132	353-373	12-17	11-16	15-17	29-35
	2.25	129-139	285-305	11-16	6-11	15-17	20-26	133-143	365-385	14-19	11-16	11.5-13.5	31-37
	3	129-139	265-285	11-16	5-10	10-12	20-26	144-154	378-398	16-21	11-16	8-10	33-39
90	1.5	133-143	390-410	8-13	8-13	19-21	19-25	166-176	397-417	16-21	9-14	19.5-21.5	37-43
	2.25	132-142	368-388	9-14	6-11	14-16	19-25	173-183	407-727	18-23	9-14	14.7-16.7	38-44
	3	132-142	345-365	9-14	5-10	9-11	19-25	181-191	417-437	19-24	10-15	9.9-11.9	40-46
110	1.5	141-151	497-517	6-11	8-13	18-20	18-24						
	2.25	140-150	472-492	7-12	6-11	13.5-15.5	18-24						
	3	140-150	447-467	8-13	5-10	8.7-10.7	18-24						

*Based on 15% Methanol antifreeze solution

Unit Operating Conditions, Cont'd.

060		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	98-108	160-180	40-45	12-17	20-22	19-25	62-72	276-296	6-11	6-11	8-10	17-23
	2.25	97-107	149-169	41-46	12-17	14.3-16.3	19-25	66-76	280-300	6-11	6-11	6-8	18-24
	3	96-106	137-157	42-48	11-16	8.5-10.5	20-26	70-80	284-304	7-12	6-11	4-6	19-25
50	1.5	118-128	225-245	36-41	11-16	21.2-23.2	19-25	88-98	306-326	10-15	8-13	11-13	23-29
	2.25	117-127	210-230	37-42	10-15	15.7-17.7	20-26	94-104	311-331	10-15	8-13	8.3-10.3	24-30
	3	115-125	195-215	38-43	9-14	10.2-12.2	21-27	100-110	317-337	11-16	9-14	5.5-7.5	25-31
70	1.5	135-145	300-320	12-17	9-14	20.3-22.3	21-27	112-122	333-353	12-17	10-15	14-16	28-34
	2.25	133-143	285-305	14-19	8-13	15-17	21-27	122-132	342-362	14-19	10-15	10.5-12.5	30-36
	3	132-142	270-290	16-21	7-12	10-12	22-28	130-140	351-371	15-20	11-16	7.3-9.3	32-38
90	1.5	139-149	390-410	8-13	7-12	19.3-21.3	20-26	147-157	369-389	15-20	10-15	17.7-19.7	36-42
	2.25	138-148	370-390	8-13	6-11	14.3-16.3	21-27	154-164	377-397	18-23	10-15	13.4-15.4	37-43
	3	138-148	350-370	8-13	6-11	9.3-11.3	21-27	160-170	385-405	19-24	11-16	9-11	38-44
110	1.5	144-154	488-508	8-13	8-13	18.4-20.4	21-27						
	2.25	143-153	468-488	7-12	6-11	13.6-15.6	21-27						
	3	142-152	448-468	7-12	5-10	8.8-10.8	21-27						

*Based on 15% Methanol antifreeze solution

070		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	110-120	177-197	36-41	15-20	20.2-22.2	21-27	61-71	290-310	12-18	9-14	8-10	19-25
	2.25	109-119	162-182	37-42	13-18	15-17	21-27	65-75	292-312	12-18	10-15	6-8	20-26
	3	107-117	147-167	38-43	11-16	9.7-11.7	22-28	68-78	296-316	12-18	10-15	4-6	21-27
50	1.5	128-138	246-266	18-23	11-16	21-23	22-28	88-98	320-340	11-17	13-18	11.7-13.7	26-32
	2.25	128-138	228-248	19-24	9-14	15.6-17.6	23-29	96-106	330-350	11-17	11-16	9-11	27-33
	3	127-137	210-230	20-25	6-11	10.2-12.2	24-30	105-115	338-358	11-17	9-14	6-8	29-35
70	1.5	134-144	305-325	9-14	11-16	20.8-22.8	23-29	118-128	355-375	10-16	14-19	15.2-17.2	33-39
	2.25	133-143	289-309	9-14	9-14	15.4-17.4	23-29	130-140	368-388	12-18	13-18	11.7-13.7	35-41
	3	131-141	273-293	9-14	6-11	10-12	23-29	141-151	380-400	15-21	11-16	8-10	37-43
90	1.5	140-150	390-410	10-15	11-16	19.6-21.6	22-28	158-168	401-421	9-15	13-18	19.5-21.5	41-47
	2.25	139-149	373-393	10-15	9-14	14.5-16.5	22-28	168-178	412-432	10-16	12-17	14.8-16.8	43-49
	3	138-148	355-375	10-15	6-11	9.3-11.3	22-28	178-188	423-443	12-18	12-17	10-12	45-51
110	1.5	144-154	488-508	10-15	9-14	18.4-20.4	20-27						
	2.25	143-153	468-488	10-15	6-11	13.6-15.6	20-27						
	3	142-152	448-468	9-14	5-10	8.8-10.8	20-27						

*Based on 15% Methanol antifreeze solution

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 [2.0 l/m per kW] is recommended as a minimum flow. Minimum flow rate for entering water temperatures below 50°F [10°C] is 2.0 gpm per ton [2.6 l/m per kW].

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

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

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 insure 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 insure 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 insure amp draw is no more than 10% greater than indicated on serial plate data.

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

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 Functional Troubleshooting Flow Chart" 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. If desired, this reading can be compared to the thermistor resistance chart shown in Table 18. An ice bath can be used to check the calibration of the thermistor.

Table 18: Nominal resistance at various temperatures

Temp (ºC)	Temp (ºF)	Resistance (kOhm)
-17.8	0.0	85.34
-17.5	0.5	84.00
-16.9	1.5	81.38
-12	10.4	61.70
-11	12.2	58.40
-10	14.0	55.30
-9	15.8	52.38
-8	17.6	49.64
-7	19.4	47.05
-6	21.2	44.61
-5	23.0	42.32
-4	24.8	40.15
-3	26.6	38.11
-2	28.4	36.18
-1	30.2	34.37
0	32.0	32.65
1	33.8	31.03
2	35.6	29.50
3	37.4	28.05
4	39.2	26.69
5	41.0	25.39
6	42.8	24.17
7	44.6	23.02
8	46.4	21.92
9	48.2	20.88
10	50.0	19.90
11	51.8	18.97
12	53.6	18.09
13	55.4	17.26
14	57.2	16.46
15	59.0	15.71
16	60.8	15.00
17	62.6	14.32
18	64.4	13.68
19	66.2	13.07
20	68.0	12.49
21	69.8	11.94
22	71.6	11.42
23	73.4	10.92
24	75.2	10.45
25	77.0	10.00
26	78.8	9.57
27	80.6	9.16
28	82.4	8.78
29	84.2	8.41
30	86.0	8.06
31	87.8	7.72
32	89.6	7.40
33	91.4	7.10
34	93.2	6.81
35	95.0	6.53
36	96.8	6.27
37	98.6	6.01
38	100.4	5.77
39	102.2	5.54
40	104.0	5.33
41	105.8	5.12
42	107.6	4.92
43	109.4	4.72
44	111.2	4.54
45	113.0	4.37
46	114.8	4.20
47	116.6	4.04
48	118.4	3.89
49	120.2	3.74
50	122.0	3.60
51	123.8	3.47
52	125.6	3.34
53	127.4	3.22
54	129.2	3.10
55	131.0	2.99
56	132.8	2.88
57	134.6	2.77
58	136.4	2.67
59	138.2	2.58
60	140.0	2.49
61	141.8	2.40
62	143.6	2.32
63	145.4	2.23
64	147.2	2.16
65	149.0	2.08
66	150.8	2.01
67	152.6	1.94
68	154.4	1.88
69	156.2	1.81
70	158.0	1.75
71	159.8	1.69
72	161.6	1.64
73	163.4	1.58
74	165.2	1.53
75	167.0	1.48
76	168.8	1.43
77	170.6	1.39
78	172.4	1.34
79	174.2	1.30
80	176.0	1.26
81	177.8	1.22
82	179.6	1.18
83	181.4	1.14
84	183.2	1.10
85	185.0	1.07
86	186.8	1.04
87	188.6	1.01
88	190.4	0.97
89	192.2	0.94
90	194.0	0.92
91	195.8	0.89
92	197.6	0.86
93	199.4	0.84
94	201.2	0.81
95	203.0	0.79
96	204.8	0.76
97	206.6	0.74
98	208.4	0.72
99	210.2	0.70
100	212.0	0.68
101	213.8	0.66
102	215.6	0.64
103	217.4	0.62
104	219.2	0.60
105	221.0	0.59
106	222.8	0.57
107	224.6	0.55
108	226.4	0.54
109	228.2	0.52
110	230.0	0.51
111	231.8	0.50
112	233.6	0.48
113	235.4	0.47
114	237.2	0.46
115	239.0	0.44
116	240.8	0.43
117	242.6	0.42
118	244.4	0.41
119	246.2	0.40
120	248.0	0.39
121	249.8	0.38
122	251.6	0.37
123	253.4	0.36

Troubleshooting, Cont'd.

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 push button. The DXM2.5 board will automatically exit test mode after 20 minutes.

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

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

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

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

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

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

Fault Temp Conditions – This option displays the DXM2.5 temperature and voltage values when the lockout occurred.

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

Fault I/O Conditions – This option displays the status of the DXM2.5 physical and communicated inputs and the relay outputs when the lockout occurred.

Fault Configuration Conditions – This option displays the status of the DXM2.5 option selections when the lockout occurred.

Fault Possible Causes – This option displays a list of potential causes of the stored fault.

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

DXM2.5 FUNCTIONAL TROUBLESHOOTING FLOW CHART
The "DXM2.5 Functional Troubleshooting Flow Chart" 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 Flow 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.

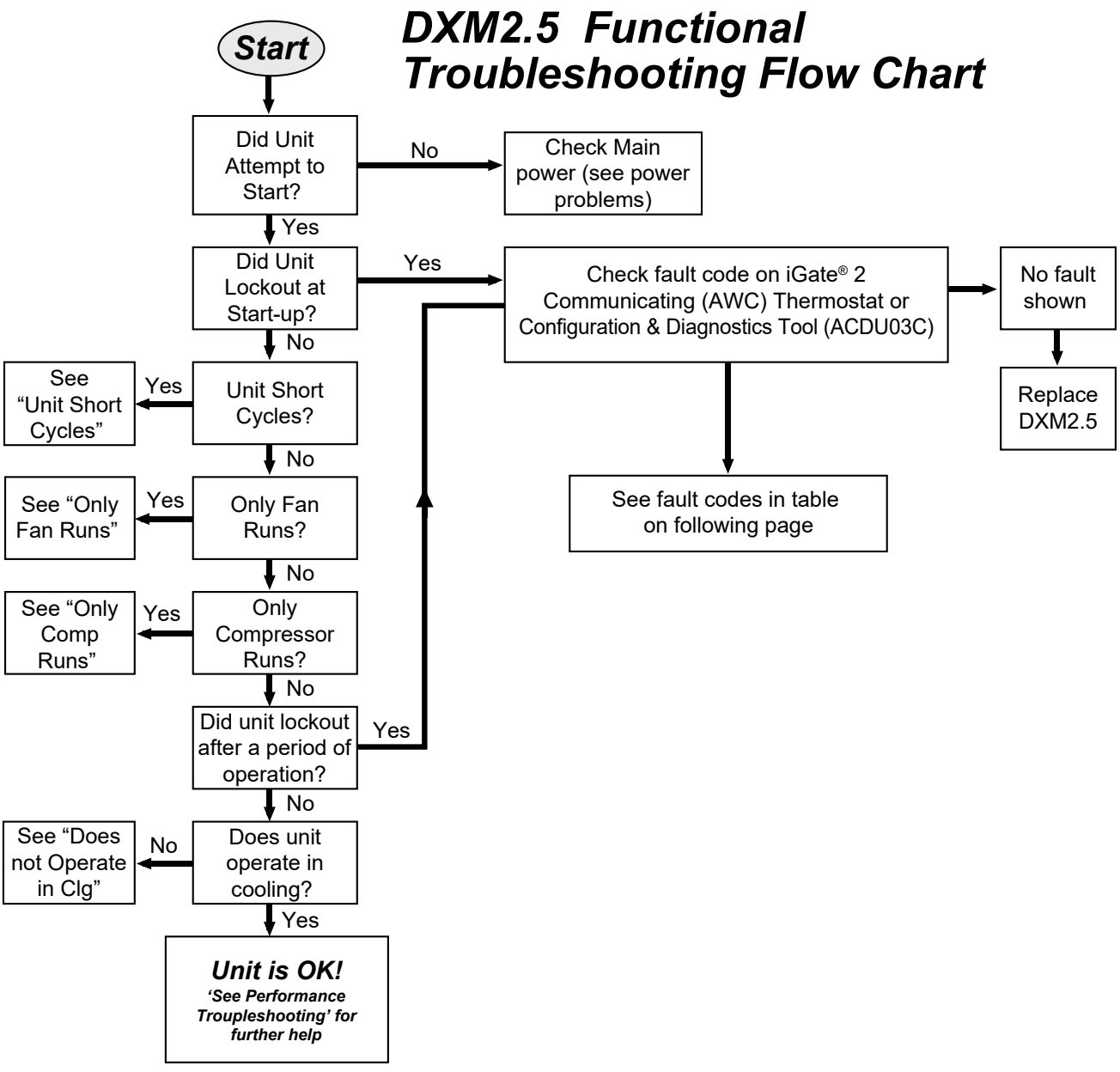
⚠ WARNING! ⚠

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

⚠ 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.



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 airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty Air Coil - construction dust etc.
				Too high of external static? Check static vs blower table.
	X		Air temperature out of range in heating	Bring return air temp within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table.
	X	X	Bad HP Switch	Check switch continuity and operation. Replace.
LP/LOC Fault Code 3 **Low Pressure / Loss of Charge**	X	X	Insufficient charge	Check for refrigerant leaks.
	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 airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
		X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
		X	Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Normal airside applications will require 30°F [-1°C] only.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
Condensate Fault Code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting? Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
	X	X	Plugged air filter	Replace air filter.
	X	X	Restricted Return Airflow	Find and eliminate restriction. Increase return duct and/or grille size.

Table continued on next page.

Functional Troubleshooting

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.
				Check compressor starting. Need hard start kit?
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
	X	X	Over Voltage	Check power supply voltage and 24VAC before and during operation.
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
Unit Performance Sentinel Code 8	X		Heating mode LT2>125°F [52°C]	Check for poor airflow or overcharged unit.
		X	Cooling Mode LT1>125°F [52°C] OR LT2< 40ºF [4ºC])	Check for poor water flow or airflow.
Swapped Thermistor Code 9	X	X	LT1 and LT2 swapped	Reverse position of thermistors
No Fault Code Shown	X	X	No compressor operation	See "Only Fan Operates".
	X	X	Compressor overload	Check and replace, if necessary.
	X	X	Control board	Reset power and check operation.
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in "test mode"	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace, if necessary.
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor Overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X		Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across BR contacts.
	X	X		Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil and at DXM2.5 board.
		X		If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'click'.
		X		Put thermostat in cooling mode. Check 24 VAC on O (check between C and O); check for 24 VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, thermostat may be bad or wired incorrectly.

Performance Troubleshooting

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 too 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 air flow 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 air flow 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.

Troubleshooting Form

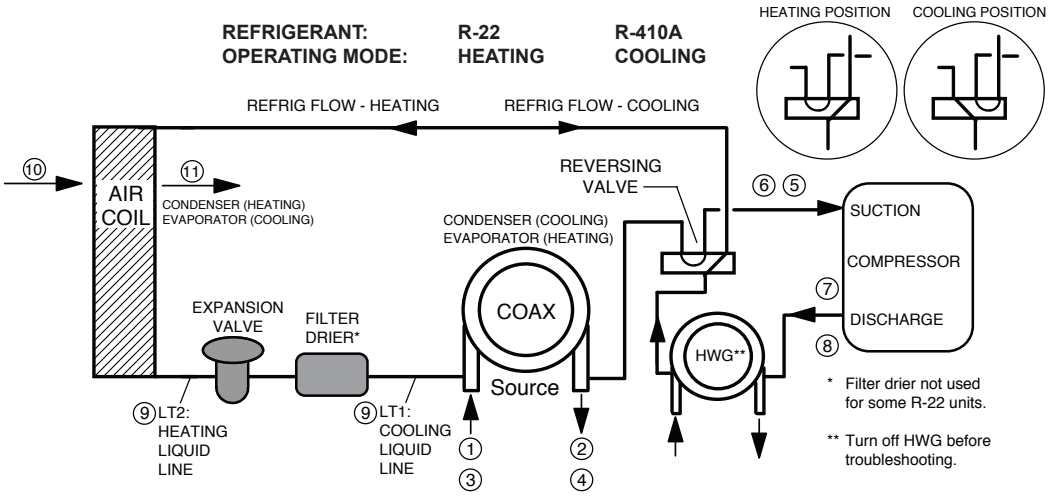
Packaged Water-to-Air Troubleshooting Form

RP929

Customer: _____ Loop Type: _____ Startup Date: _____

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

Complaint: _____



	Description	Heating	Cooling	Notes
	Water Side Analysis			
1	Water In Temp.			
2	Water Out Temp.			Temp. Diff. =
3	Water In Pressure			
4	Water Out Pressure			
4a	Pressure Drop			
4b	GPM			
	Heat of Extraction (Absorption) or Heat of Rejection:			**Fluid Factor: 500 (Water); 485 (Antifreeze)**
	HE or HR (Btuh) = _____ **Enter HE or HR:** _____			
	_____ **Flow Rate (GPM) x** _____ **Temp. Diff (deg F) x** _____ **Fluid Factor**			
	Refrigerant Analysis			
5	Suction Temp.			
6	Suction Pressure			
6a	Saturation Temp.			
6b	Superheat			
7	Discharge Temp.			
8	Discharge Pressure			
8a	Saturation Temp.			
8b	Subcooling			
9	Liquid Line Temp			
10	Return Air Temp.			
11	Supply Air Temp.			Temp. Diff. =
	Voltage			
	Compress Amps			

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.

CLIMATE MASTER, INC.
LIMITED EXPRESS WARRANTY AND LIMITATION OF LIABILITY AND REMEDIES FOR RESIDENTIAL CLASS PRODUCTS WITH LABOR ALLOWANCE

This Limited Express Warranty And Limitation Of Liability And Remedies Affects Your Legal Rights And Should Be Read Carefully In Its Entirety.

Subject to the terms and conditions below, Climate Master, Inc. ("CM") extends a limited warranty ("Limited Warranty") for Residential Class heating and cooling equipment manufactured or sold by CM ("Products"), that was purchased on or after May 1, 2010 (this would generally include CM Units with serial numbers beginning with "N118" and higher), and installed in a one or two family residential dwelling, for personal, household or family purposes in the United States of America or Canada, ("Application"), to be free from defects and workmanship under normal use and maintenance. If you are unsure if this Limited Warranty applies to a Product you have purchased, contact CM at the phone number or address reflected below.

This Limited Warranty DOES NOT cover commercial applications of the Products. Commercial applications include any application other than installation in a one or two family residential dwelling for personal, household or family purposes. Refer to ClimateMaster Commercial Limited Express Warranty for details. Full copies are available for download at ClimateMaster.com .

This Limited Warranty provides a complete statement of CM's responsibilities to purchasers of the Products. No oral or written statement made by CM, any person or entity associated with CM or by any person or entity claiming to be associated with CM, including but not limited to statements made in sales literature, catalogs, or agreements to purchase or install the Products, is intended to provide an express or implied warranty of any kind and does not form a part of the basis of the bargain. Further, no such statement shall operate to extend, alter or modify the scope or terms of this Limited Warranty.

EXCEPT AS SPECIFICALLY SET FORTH HEREIN, THERE IS NO EXPRESS WARRANTY AS TO ANY OF CM'S PRODUCTS. CM MAKES NO WARRANTY AGAINST LATENT DEFECTS, OF MERCHANTABILITY OF THE PRODUCTS OR OF THE PRODUCTS FOR ANY PARTICULAR PURPOSE.

TERM: This Limited Warranty shall commence on the earliest to occur of the following dates: (i) proof of date of first occupancy; (ii) proof of date of start-up of the Product by a qualified and trained HVAC contractor; or (iii) six (6) months from the shipment date of the Product from CM if items (i) or (ii) are not available ("Warranty Inception Date"). The Limited Warranty shall extend as follows:

Costs of Repair or Replacement of Covered Product Parts

(1) Ten (10) years from the Warranty Inception date for air conditioning, heating and/or heat pump units built or sold by CM ("CM Units");
(2) Ten (10) years from the Warranty Inception Date for thermostats, auxiliary electric heaters, water storage tanks, and geothermal pumping modules built or sold by CM, when installed with CM Units;
(3) One (1) year from the date of shipment from CM for any other accessories or parts built or sold by CM, when installed with CM Units; and
(4) Ninety (90) days from the date of shipment from CM for all repair or replacement parts that are not supplied under this warranty.

Costs of Labor to Install Repaired or Replaced Covered Product Parts

(1) Five (5) years from the Warranty Inception Date for CM Units;
(2) Five years from the Warranty Inception Date for thermostats, auxiliary electric heaters, water storage tanks, and geothermal pumping modules built or sold by CM, when installed with CM Units
This Limited Warranty does not cover labor costs for installation of other accessories or parts built or sold by CM or any repaired or replacement parts that are not supplied under this Limited Warranty.

WHO IS COVERED: This Limited Warranty is provided only to the original owner of the one or two family residential dwelling in which the Products are first installed. This Limited Warranty is not transferrable. CM reserves the right to request any documentation necessary in its sole discretion to determine the date of purchase and occupancy of the residential dwelling or the date of installation and start-up of the Product(s). For the avoidance of any doubt, this Limited Warranty shall not extend to, and shall provide no remedies whatsoever for, any distributor or installer of the Products.

CLAIM PROCESS: To make a claim under this warranty, the Product or parts must be returned to CM in Oklahoma City, Oklahoma, freight prepaid, no later than ninety (90) days after the date of the failure of the part. If CM determines the Product or part to be defective and covered by this Limited Warranty, CM will either repair or replace the Product or part and send it to a CM-recognized distributor, dealer or service organization, F.O.B. CM, Oklahoma City, Oklahoma, freight prepaid. The Limited Warranty on any Product or part repaired or replaced under this Limited Warranty extends only through the original warranty period.

WHAT IS COVERED: Subject to the Term, this Limited Express Warranty covers the: (i) the cost of repair or replacement of any covered Product or Product parts; and (ii) the cost of labor incurred by CM authorized service personnel in connection with the installation of a repaired or replaced covered Product or Product part.

If a Product part is not available, CM will, at its option, provide a free suitable substitute part or provide a credit in the amount of the then factory selling price for a new suitable substitute part to be used by the claimant towards the retail purchase price of a new CM product. All labor costs are subject and limited to amounts specifically set forth in the then existing labor allowance\ schedule provided by CM's Warranty Department. Actual labor costs are not covered by this Limited Warranty to the extent they: (i) exceed the amount allowed under the allowance schedule; (ii) are not specifically provided for in the allowance schedule; (iii) are not performed by CM authorized service personnel; (iv) are incurred in connection installation of a part not covered by this Limited Warranty; or (v) are incurred outside the Term.

WHAT IS NOT COVERED: This Limited Warranty does not cover and does not apply to: (1) air filters, fuses, refrigerant, fluids, oil; (2) Products relocated after initial installation; (3) any portion or component of any system that is not supplied by CM, regardless of the cause of the failure of such portion or component; (4) Products on which the unit identification tags or labels, or rating labels, have been removed or defaced; (5) Products on which payment to CM, or to the owner's seller or installing contractor, is in default; (6) Products which have not been installed and maintained by a qualified and trained HVAC contractor; (7) Products installed in violation of applicable building codes or regulations including but not limited to wiring or voltage conditions; (8) Products subjected to accident, misuse, negligence, abuse, fire, flood, freezing, lightning, unauthorized alteration, misapplication, contaminated or corrosive air or liquid supply, operation at abnormal air or liquid temperatures or flow rates, or opening of the refrigerant circuit by unqualified personnel; (9) mold, fungus or bacteria damages; (10) corrosion or abrasion of the Product; (11) products supplied by others; (12) Products that have been operated in a manner contrary to CM's printed instructions; (13) Products which have insufficient performance as a result of improper system design, sizing or the improper application, installation, or use of CM's products; (14) electricity or fuel costs, or any increases or unrealized savings in same, for any reason whatsoever; or (15) operating any water storage tanks when they are empty or partially empty (i.e., dry firing), at temperatures exceeding the maximum setting of the operating or high limit controls, at pressures greater than those shown on the rating label, with non-potable water, with alterations or attachments (including energy savings devises) not specifically authorized in writing by CM, or without the free circulation of water. CM may request written documentation showing compliance with the above limitations.

In connection with repair or replacement of covered Product parts, CM is not responsible for: (1) the costs of any fluids, refrigerant or system components supplied by others, or associated labor to repair or replace the same, which is incurred as a result of repair or replacement of a covered Product part; (2) the costs of labor, refrigerant, materials or service incurred in diagnosis and removal of a covered Product part subject to repair or replacement under this Limited Warranty; (3) shipping costs incurred in sending a claimed defective part from the installation site to CM; (4) shipping costs to return a claimed defective part from CM to the installation site if the part is not covered by this Limited Warranty; (5) removal or disposal costs associated with the repair or replacement of covered Product Parts; or (6) the costs of normal maintenance.

OTHER WARRANTY LIMITATION: This Limited Warranty is given in lieu of all other warranties express or implied, in law or in fact. If, notwithstanding the disclaimers contained herein, it is determined that other warranties apply, any such warranty, including without limitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited in time to the Term of this Limited Warranty

LIMITATION OF REMEDIES: In the event of a breach of the Limited Warranty, a claimant's remedies will be limited to repair or replacement of a part or unit, or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to CM's factory in Oklahoma City, Oklahoma of each defect, malfunction or other failure, and a reasonable number of attempts by CM to correct the defect, malfunction or other failure, the remedy fails of its essential purpose. CM shall refund the purchase price paid to CM in exchange for the return of the sold good(s). Said refund shall be the maximum liability of CM. THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR THEIR PURCHASER AGAINST CM FOR ANY ACTION FOR BREACH OF CONTRACT, BREACH OF ANY WARRANTY, PATENT INFRINGEMENT, OR FOR CM'S NEGLIGENCE OR IN STRICT LIABILITY. NO ACTION ARISING OUT OF ANY CLAIMED BREACH OF THIS LIMITED WARRANTY MAY BE BROUGHT MORE THAN ONE (1) YEAR AFTER THE CAUSE OF ACTION HAS ARISEN.

LIMITATION OF LIABILITY: CM shall have no liability for any damages if CM's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, shortages of transportation, fuel, material, or labor, acts of God or any other reason beyond the sole control of CM.

CM EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL, INCIDENTAL, SPECIAL AND/OR PUNITIVE DAMAGES BASED ON ANY THEORY IN CONTRACT, BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, PATENT INFRINGEMENT, OR IN TORT, WHETHER FOR CM's NEGLIGENCE OR AS STRICT LIABILITY AND REGARDLESS OF WHETHER CM IS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

OBTAINING WARRANTY PERFORMANCE: Normally, the dealer or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any CM recognized distributor, dealer or service organization. If assistance is required in obtaining warranty performance, write or call:

Climate Master, Inc. • Customer Service • 7300 SW 44th Street • Oklahoma City, Oklahoma 73179 • (405) 745-6000 • e-service@climatemaster.com

NOTE: Some states or Canadian provinces do not allow the exclusion or limitation of implied warranties or the limitation of incidental or consequential damages for certain products supplied to consumers, or the limitation of liability for personal injury, so the above limitations and exclusions may be limited in their application to you. When the implied warranties are not allowed to be excluded in their entirety, they will be limited to the duration of the applicable written warranty. This warranty gives you specific legal rights, which may vary depending on local law. IF ANY PRODUCT TO WHICH THIS LIMITED WARRANTY APPLIES IS DETERMINED TO BE A "CONSUMER PRODUCT" UNDER THE MAGNUSON-MOSS WARRANTY ACT (15 U.S.C.A. §2301, ET SEQ.) OR OTHER APPLICABLE LAW, THE FOREGOING DISCLAIMER OF IMPLIED WARRANTIES SHALL NOT APPLY TO YOU, AND ALL IMPLIED WARRANTIES ON THIS PRODUCT, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR THE PARTICULAR PURPOSE, SHALL APPLY FOR THE SAME TERM SET FORTH ABOVE (ONE YEAR) AS PROVIDED UNDER APPLICABLE LAW. The portions of this Limited Warranty and limitation of liability shall be considered fully severable, and all portions which are not disallowed by applicable law shall remain in full force and effect.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province. Refer to your local laws for your specific rights under this Limited Warranty.

Please refer to the CM Installation, Operation and Maintenance Manual for operating and maintenance instructions.

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Notes

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Revision History

Date:	Page #:	Description:
13 July, 23	All	Various text updates for document consistency
17 April. 23	All	Discontinued CXM controls and PSC fan motors. Upgraded the ECM fan motor functionality and blower tables. Transitioned from DXM2 to DXM2.5 unit controls. Introduced new communicating Wi-Fi color touch screen iGate 2 thermostat.
05 Oct., 21	18-21	Updated Water Quality Standards
10 Sept, 19	All	Text Edits, removed TT unit, removed ClimaDry
21 Aug, 18	4	Added warning
25 July,17	5	Updated hanger mounting instructions
30 Jan., 17	20	Add Caution
10 October 16	5	Text Update
6 October 16	69	Troubleshooting Form
6 Feb, 16	72	updated certification logos
22 July, 15	49, 50	Updated HWC Data
6 Oct., 14	69	Updated Troubleshooting Form
18 Aug., 14	All	GWHP Loop Piping Desc., Water Quality Notes, TT LWT Data Edited
31 March, 14	All	TS 024-070 Rev. C Updates, TS 070 PSC Removed
7 June, 13	19	Updated Electrical Data - Ext Pump FLA
7 June, 13	5, 33	Edit Cabinet Pitch Text, Update EAT Limits
10 Jan., 13	13	Antifreeze Percentage Table Updated
7 Jan., 13	47-62	TS Performance Data Added
19 Nov., 12	All	First Published

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