Form No. 92-103352-02

H&V Geothermal Products

RPV V/H/D Series

Residential Horizontal & Vertical
Packaged Geothermal Heat Pumps

Installation, Operation &
Maintenance Instructions
97B0077N01
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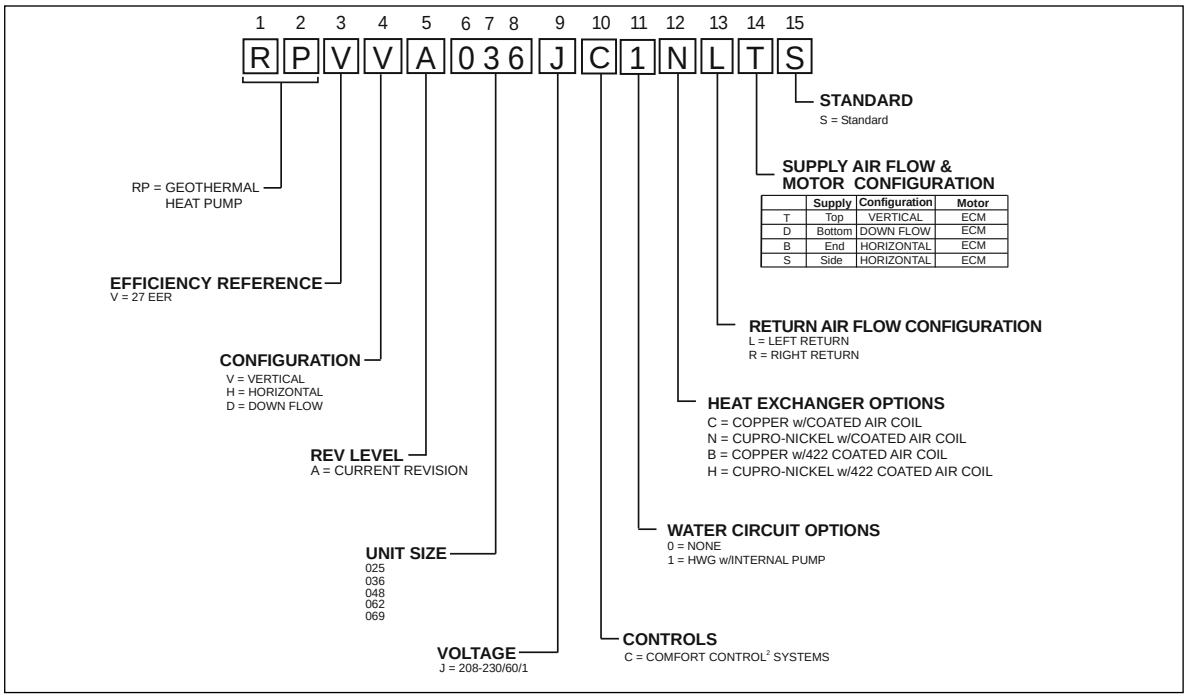
Model Nomenclature: General Overview For All RPV V/H/D Series



	Supply	Configuration	Motor
T	Top	VERTICAL	ECM
D	Bottom	DOWN FLOW	ECM
B	End	HORIZONTAL	ECM
S	Side	HORIZONTAL	ECM

NOTE: Above model nomenclature is a general reference. Consult individual specification sections for detailed 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.

⚠ 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 will quickly become clogged with construction dirt and debris, which may cause system damage.

General Information

Inspection
Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the packaging of each unit, and inspect each unit for damage. 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.
6. Loosen compressor bolts on units equipped with compressor vibration isolation until the compressor rides freely on the grommets.
7. Some airflow patterns are field convertible (horizontal units only). Locate the airflow conversion section of this IOM.
8. 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 hanger kits pre-installed from the factory as shown in Figure 1. Figure 3 shows a typical horizontal unit installation.

Horizontal heat pumps are typically suspended above a ceiling or within a soffit using field supplied, threaded rods sized to support the weight of the unit.

Use four (4) field supplied threaded rods and factory provided vibration isolators to suspend the unit. Hang the unit clear of the floor slab above and support the unit by the mounting bracket assemblies only. DO NOT attach the unit flush with the floor slab above.

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

Figure 1: Hanger Bracket

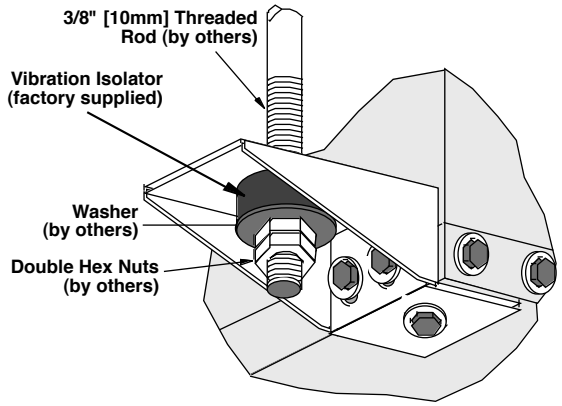
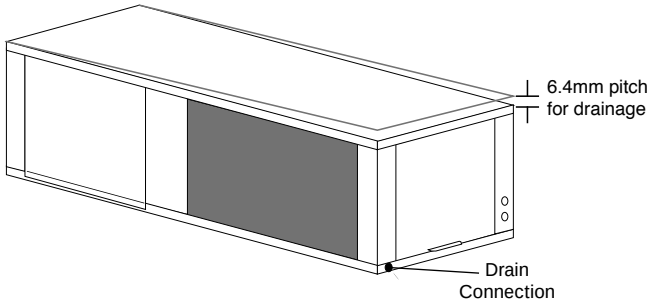
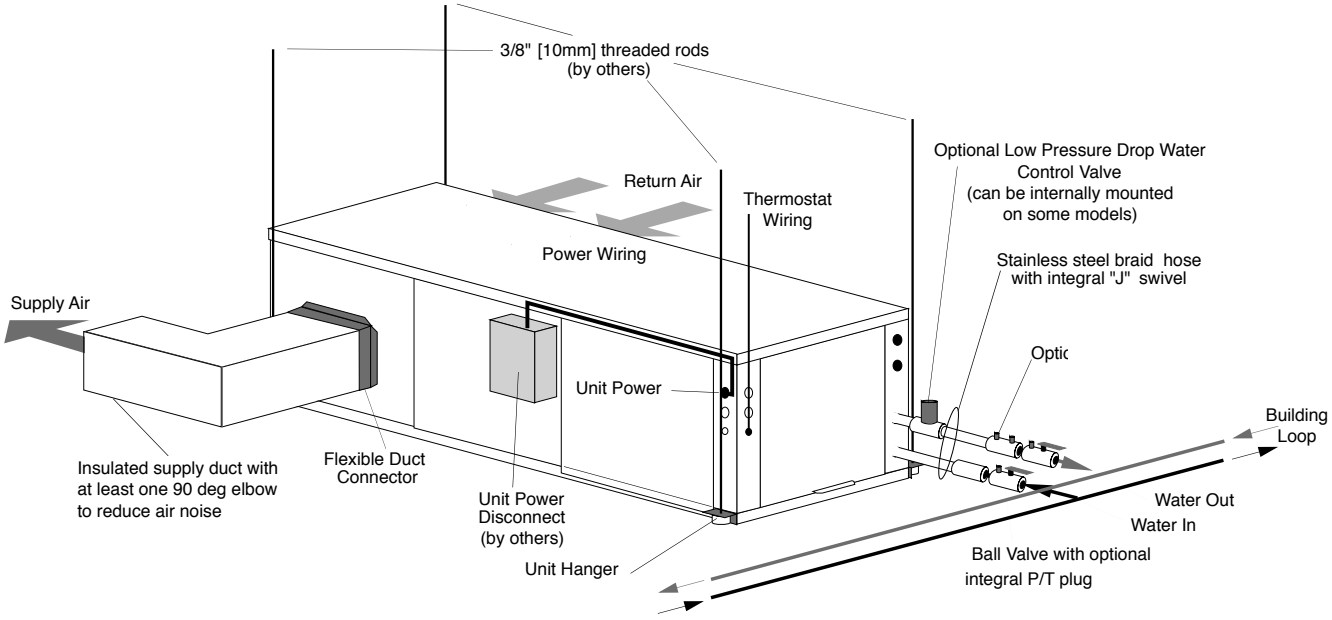


Figure 2: Horizontal Unit Pitch



Horizontal Installation

Figure 3: Typical Horizontal Unit Installation



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

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

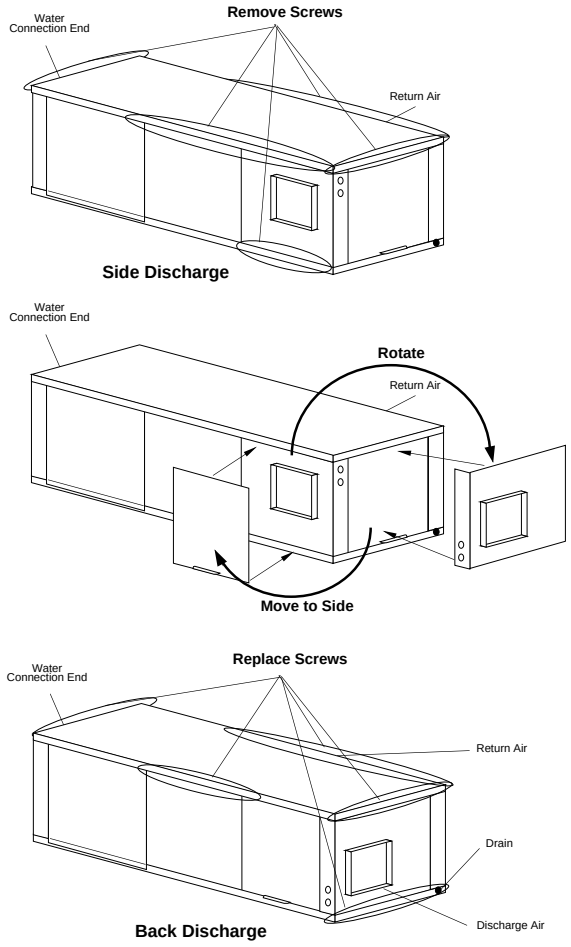
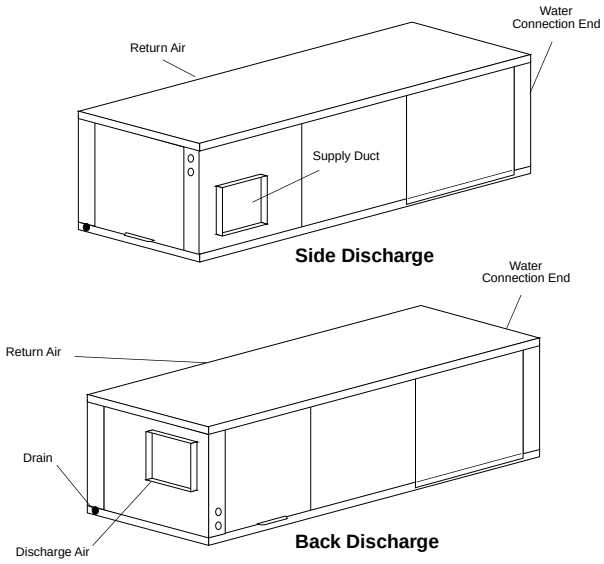


Figure 5: Right Return Side to Back



Horizontal Installation

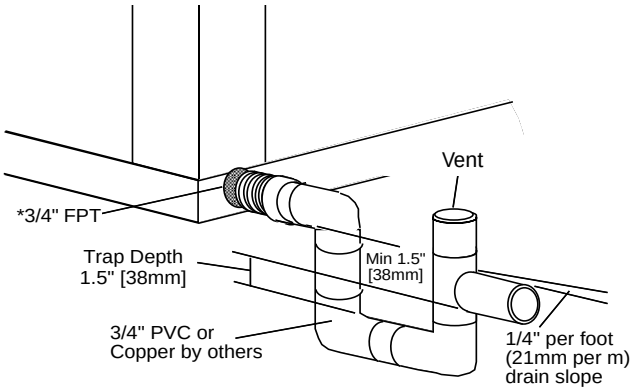
Condensate Piping – Horizontal Units
Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 2.5 tons/8.8 kW), insure that unit pitch does not cause condensate leaks inside the cabinet.

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



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⚠ CAUTION! ⚠

CAUTION! Ensure condensate line is pitched toward drain 1/4 inch per ft [21mm per m] of run.

DUCT SYSTEM INSTALLATION

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

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

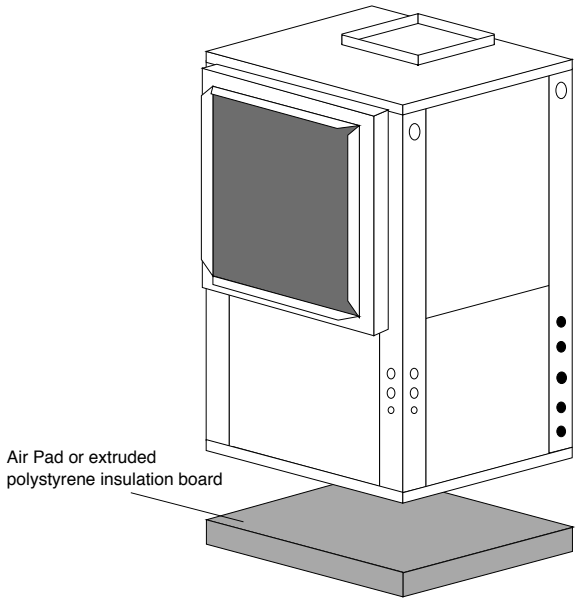
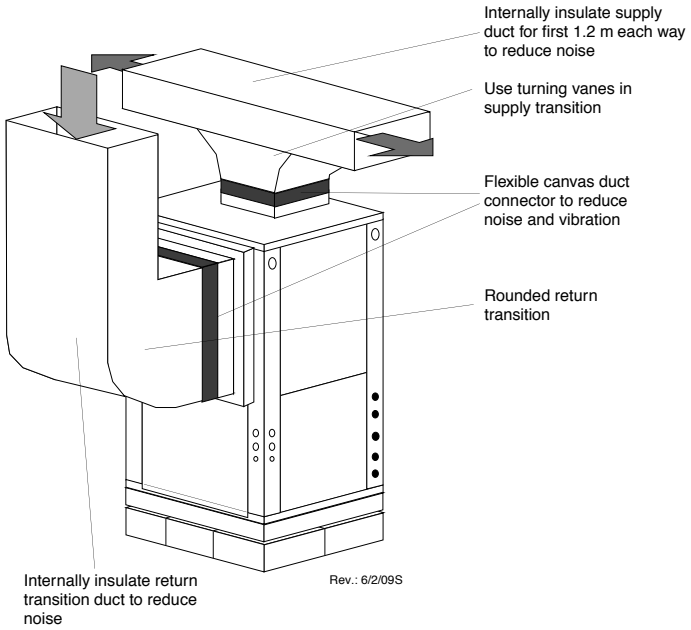


Figure 8: Typical Vertical Unit Installation Using Ducted Return Air

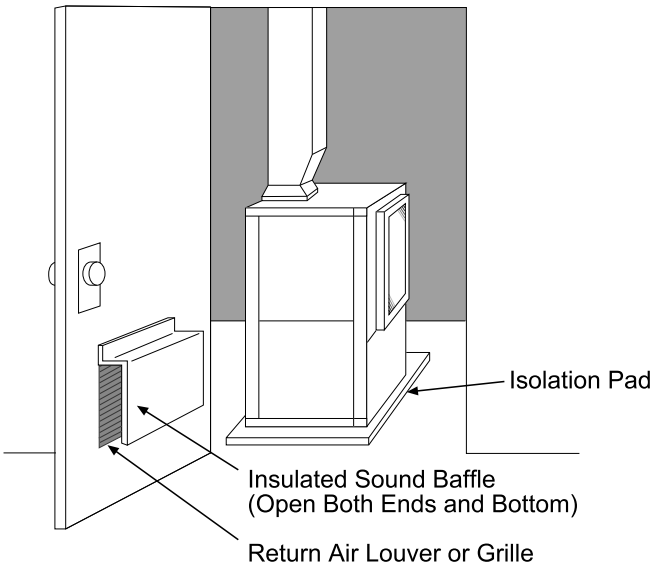


Vertical Installation

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 - Vertical units utilize a condensate hose inside the cabinet as a trapping loop; therefore an external trap is not necessary. Figure 10a shows typical condensate connections. Figure 10b illustrates the internal trap for a typical vertical heat pump. Each unit must be installed with its own individual vent (where necessary) and a means to flush or blow out the condensate drain line. Do not install units with a common trap and/or vent.

Figure 10a: Vertical Condensate Drain

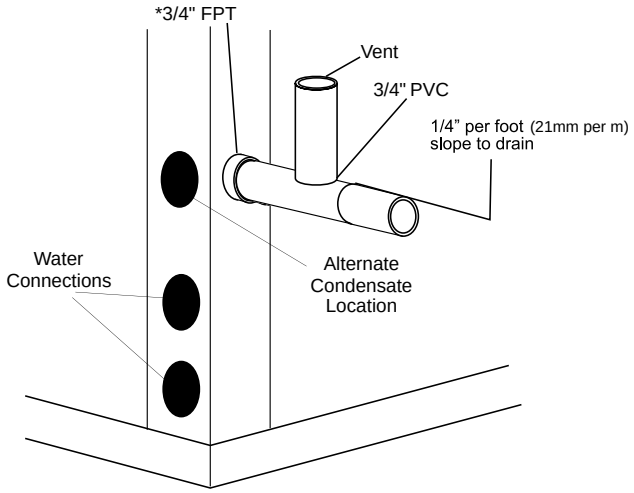
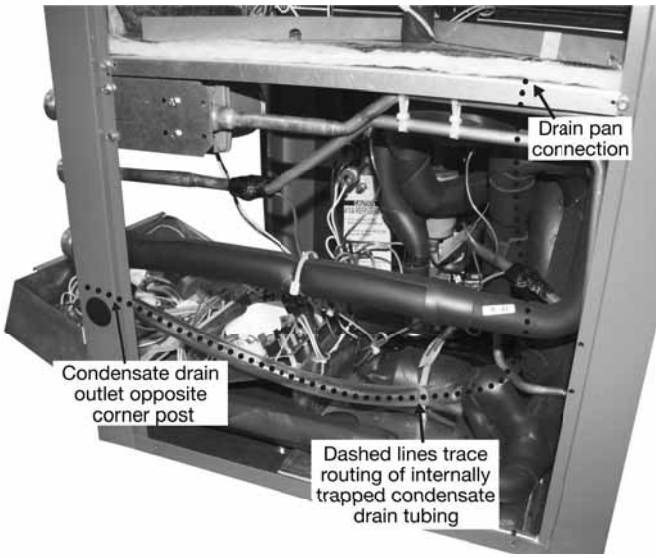


Figure 10b: Vertical Internal Condensate Trap



Above photo shows half of typical vertical packaged unit

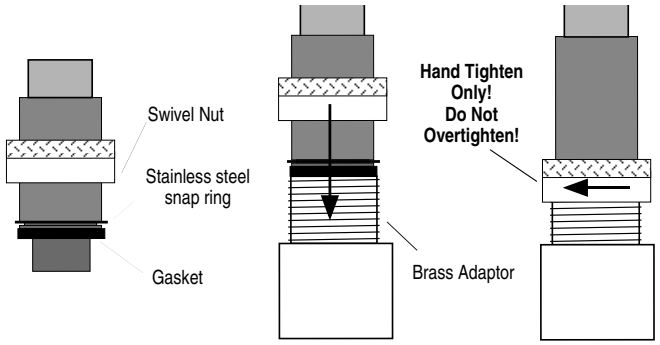
Water Connection Installation

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.

Water Connections
Residential models utilize swivel piping fittings 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. Insure that the rubber seal is in the swivel connector prior to attempting any connection (rubber seals are shipped attached to the swivel connector). DO NOT OVER TIGHTEN or leaks may occur.

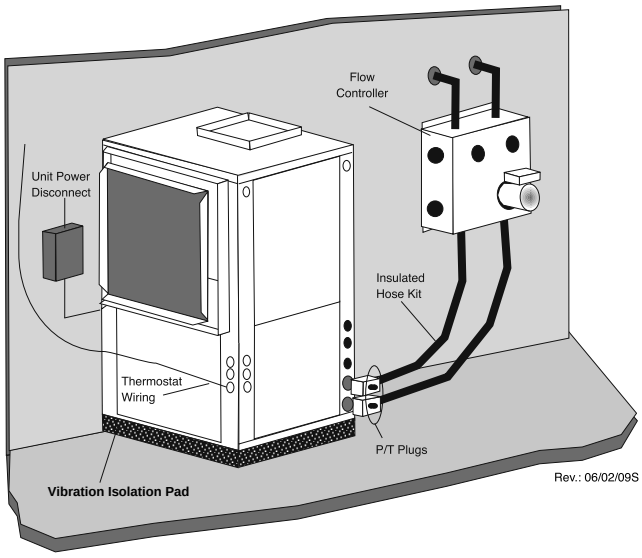
The female locking ring is threaded onto the pipe threads which holds the male pipe end against the rubber gasket, and seals the joint. HAND TIGHTEN ONLY! DO NOT OVERTIGHTEN!

Figure 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. An

Ground-Loop Heat Pump Applications

antifreeze solution is used in most areas to prevent freezing. All air and debris must be removed from the earth loop piping before operation. Flush the loop with a high volume of water at a minimum velocity of 2 fps (0.6 m/s) in all piping. The steps below must be followed for proper flushing.

1. Fill loop with water from a garden hose through the flush cart before using the flush cart pump to insure an even fill.
2. Once full, the flushing process can begin. Do not allow the water level in the flush cart tank to drop below the pump inlet line to avoid air being pumped back out to the earth loop.
3. Try to maintain a fluid level in the tank above the return tee so that air cannot be continuously mixed back into the fluid. Surges of 50 psi (345 kPa) can be used to help purge air pockets by simply shutting off the return valve going into the flush cart reservoir. This “dead heads” the pump to 50 psi (345 kPa). To purge, dead head the pump until maximum pumping pressure is reached. Open the return valve and a pressure surge will be sent through the loop to help purge air pockets from the piping system.
4. Notice the drop in fluid level in the flush cart tank when the return valve is shut off. If air is adequately purged from the system, the level will drop only 1-2 inches (2.5 - 5 cm) in a 10” (25 cm) diameter PVC flush tank (about a half gallon [2.3 liters]), since liquids are incompressible. If the level drops more than this, flushing should continue since air is still being compressed in the loop fluid. Perform the “dead head” procedure a number of times. **Note: This fluid level drop is your only indication of air in the loop.**

Antifreeze may be added before, during or after the flushing procedure. However, depending upon which time is chosen, antifreeze could be wasted when emptying the flush cart tank. See antifreeze section for more details.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the cooling season. This fluctuation is normal and should be considered when charging the system initially. Run the unit in either heating or cooling for a number of minutes to condition the loop to a homogenous temperature. This is a good time for tool cleanup, piping insulation, etc. Then, perform final flush and pressurize the loop to a static pressure of 50-75 psi [345-517 kPa] (winter) or 35-40 psi [241-276 kPa] (summer). After pressurization, be sure to loosen the plug at the end of the Grundfos loop pump motor(s) to allow trapped air to be discharged and to insure the motor housing has been flooded. This is not required for Taco circulators. Insure that the Flow Controller provides adequate flow through the unit by checking pressure drop across the heat exchanger and compare to the pressure drop tables at the back of the manual.

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

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under the water level to prevent fumes. Calculate the total volume of fluid in the piping system. Then use the percentage by volume shown in Table 1 for the amount of antifreeze needed. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Low Water Temperature Cutout Setting - ICC Control
When antifreeze is selected, the FP1 jumper (JW1) 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). NOTE: Low water temperature operation requires extended range equipment.

Table 1: Approximate Fluid Volume (gal.) per 100' of Pipe

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]
Rubber Hose	1”	3.9 [14.6]
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]
	1.25” IPS SCH40	8.3 [30.9]
	1.5” IPS SCH40	10.9 [40.7]
	2” IPS SCH40	17.0 [63.4]
Unit Heat Exchanger	Typical	1.0 [3.8]
Flush Cart Tank	10” Dia x 3ft tall [254mm x 91.4cm tall]	10 [37.9]

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Table 2: Antifreeze Percentages by Volume

Type	Minimum Temperature for Low Temperature Protection			
	10°F [-12.2°C]	15°F [-9.4°C]	20°F [-6.7°C]	25°F [-3.9°C]
Methanol	25%	21%	16%	10%
100% USP food grade Propylene Glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

* Must not be denatured with any petroleum based product

GROUND-WATER HEAT PUMP APPLICATIONS

Open Loop - Ground Water Systems
Typical open loop piping is shown in Figure 13. 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. Piping materials should be limited to copper or PVC SCH80. Note: Due to the pressure and temperature extremes, PVC SCH40 is not recommended.

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 Standards
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.
The pump should be sized to handle the home’s domestic water load (typically 5-9 gpm [23-41 l/m]) plus the flow rate required for the heat pump. Pump sizing and expansion tank must be chosen as complimentary items. For example, an expansion tank that is too small can causing premature pump failure due to short cycling. Variable speed pumping applications should be considered for the inherent energy savings and smaller expansion tank requirements.

Water Control Valve
Note the placement of the water control valve in figure 13. 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. Insure 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 20). Note the special wiring diagrams for slow closing valves (Figures 21 & 22).

Flow Regulation
Flow regulation can be accomplished by two methods. One method of flow regulation involves simply adjusting the ball

Ground-Water Heat Pump Applications

valve or water control valve on the discharge line. Measure the pressure drop through the unit heat exchanger, and determine flow rate from tables 8a through 8c. 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], a minimum of 2 gpm per ton (2.6 l/m per kW) is required.**

Water Coil Low Temperature Limit Setting
For all open loop systems the 30°F [-1.1°C] FP1 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.

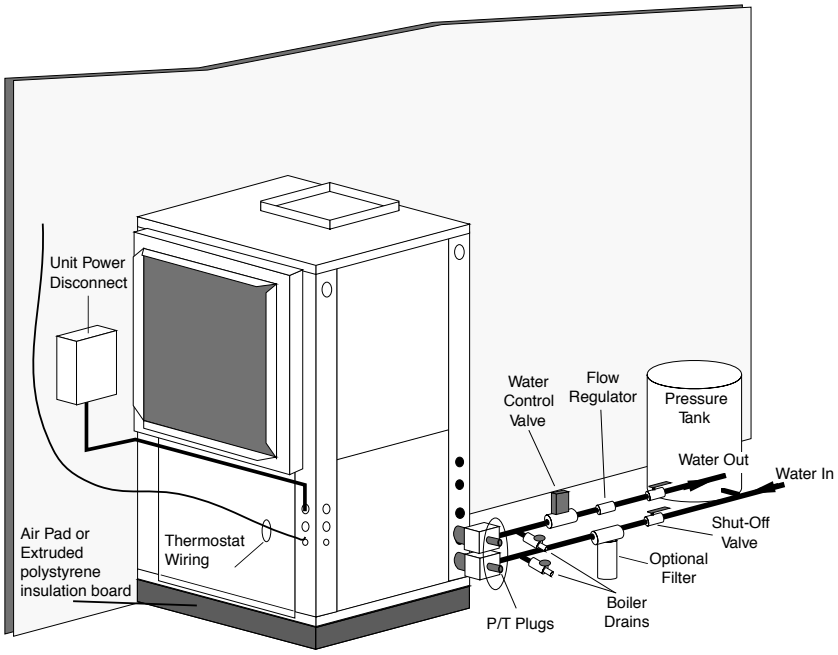
⚠ CAUTION! ⚠

CAUTION! Many units installed with a factory or field supplied manual or electric shut-off valve. **DAMAGE WILL OCCUR** if shut-off valve is **closed** during unit operation. A high pressure switch must be installed on the heat pump side of any field provided shut-off valves and connected to the heat pump controls in series with the built-in refrigerant circuit high pressure switch to disable compressor operation if water pressure exceeds pressure switch setting. The field installed high pressure switch shall have a cut-out pressure of 300 psig and a cut-in pressure of 250 psig. This pressure switch can be ordered with a 1/4” internal flare connection as part number 39B0005N02.

⚠ CAUTION! ⚠

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

Figure 13: Typical Open Loop/Well Application



Water Quality Standards

Table 3: Water Quality Standards

Water Quality Parameter	HX Material	Closed Recirculating	Open Loop and Recirculating Well		
Scaling Potential - Primary Measurement					
Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below					
pH/Calcium Hardness Method	All	-	**pH < 7.5 and Ca Hardness <100ppm**		
Index Limits for Probable Scaling Situations - (Operation outside these limits is not recommended)					
Scaling indexes should be calculated at 66°C for direct use and HWG applications, and at 32°C for indirect HX use. A monitoring plan should be implemented.					
Ryznar Stability Index	All	-	**6.0 - 7.5** If >7.5 minimize steel pipe use.		
Langelier Saturation Index	All	-	**-0.5 to +0.5** If <-0.5 minimize steel pipe use. Based upon 66°C HWG and Direct well, 29°C Indirect Well HX		
Iron Fouling					
Iron Fe^{2+} (Ferrous) (Bacterial Iron potential)	All	-	**<0.2 ppm (Ferrous)** If Fe^{2+} (ferrous)>0.2 ppm with pH 6 - 8, O2<5 ppm check for iron bacteria.		
Iron Fouling	All	-	**<0.5 ppm of Oxygen** Above this level deposition will occur.		
Corrosion Prevention					
pH	All	**6 - 8.5** Monitor/treat as needed	**6 - 8.5** Minimize steel pipe below 7 and no open tanks with pH <8		
Hydrogen Sulfide (H_2S)	All	-	**<0.5 ppm** At H_2S>0.2 ppm, avoid use of copper and copper nickel piping or HX's. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are OK to <0.5 ppm.		
Ammonia ion as hydroxide, chloride, nitrate and sulfate compounds	All	-	**<0.5 ppm**		
Maximum Chloride Levels			Maximum Allowable at maximum water temperature.		
			10°C	24°C	38 °C
	Copper	-	<20ppm	NR	NR
	Cupronickel	-	<150 ppm	NR	NR
	304 SS	-	<400 ppm	<250 ppm	<150 ppm
	316 SS	-	<1000 ppm	<550 ppm	< 375 ppm
	Titanium	-	>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging					
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 1.8 m/s Filtered for maximum 841 micron [0.84 mm, 20 mesh] size.	<10 ppm (<1 ppm "sandfree" for reinjection) of particles and a maximum velocity of 1.8 m/s. Filtered for maximum 841 micron 0.84 mm, 20 mesh] size. Any particulate that is not removed can potentially clog components.		

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Notes:
- Closed Recirculating system is identified by a closed pressurized piping system.
- Recirculating open wells should observe the open recirculating design considerations.
- NR - Application not recommended.
- "-" No design Maximum.

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 SET POINT 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

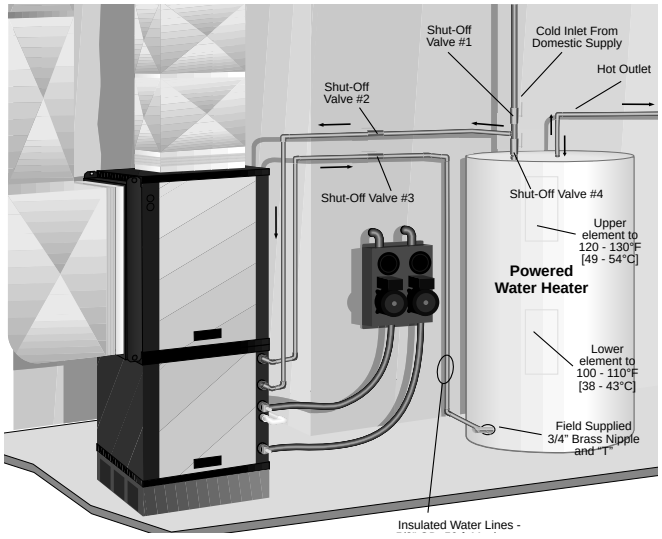
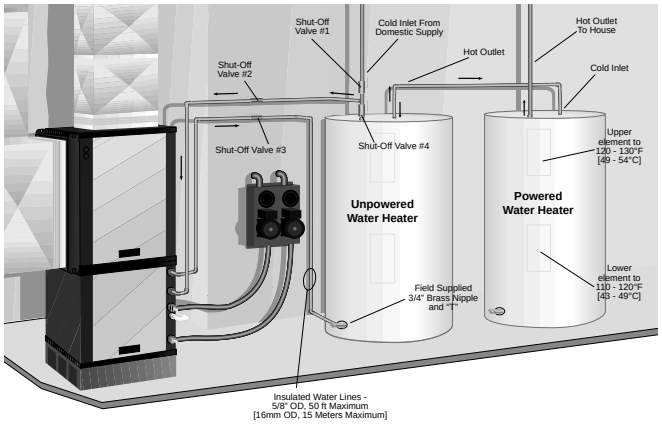


Figure 15: HWG Double Tank Installation



Hot Water Generator

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 AS FULL LOAD CONDITIONS CAN DRIVE HOT WATER TANK TEMPERATURES FAR ABOVE SAFE TEMPERATURE LEVELS IF SENSORS HAVE BEEN 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).

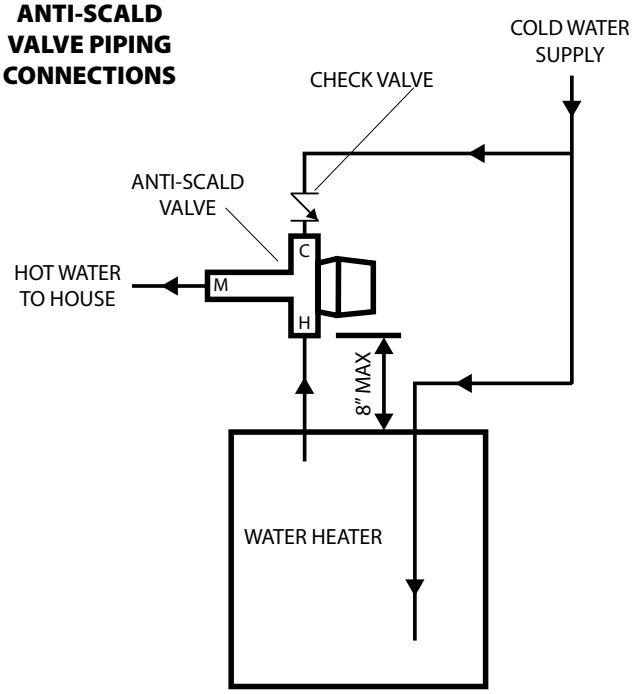
SW10 HWG PUMP TEST. When this switch is in the "ON" position, the HWG pump is forced to operate even if there is no call for the HWG. This mode may be beneficial to assist in purging the system of air during Initial start up. When SW10 is in the "OFF" position, the HWG will operate normally. This switch 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

⚠ WARNING! ⚠

WARNING! USING A 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



125°F. This switch Is shipped from the factory in the "OFF" (125°F) position.

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 (>160ºF)	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

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. [15 m] one way.

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.

HWG Water Piping Size 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.

Electrical - Line Voltage

⚠ 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: RPV V/H/D Series Electrical Data

RPV V/H/D											
Model	Compressor			HWG Pump FLA	Ext Loop Pump FLA	Fan Motor FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR	Supply Wire	
	RLA	LRA	Qty							Min AWG	Max Ft (m)
025	10.3	52.0	1	0.40	4.0	4.3	19.0	21.6	30	10	86 (26.2)
036	16.7	82.0	1	0.40	4.0	4.3	25.4	29.6	45	10	63 (19.1)
048	21.2	96.0	1	0.40	4.0	7.0	32.6	37.9	50	8	78 (23.8)
062	25.6	118.0	1	0.40	4.0	7.0	37.0	43.4	60	6	108 (32.9)
069	27.2	150.0	1	0.40	4.0	7.0	38.6	45.4	70	66	103 (31.4)

Rated Voltage of 208-230/60/1
HACR circuit breaker in USA only
Wire length based on one way measurement with 2% voltage drop

Min/Max Voltage of 197/254
All fuses Class RK-5
Wire size based on 60°C copper conductor and Minimum Circuit Ampacity.

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.

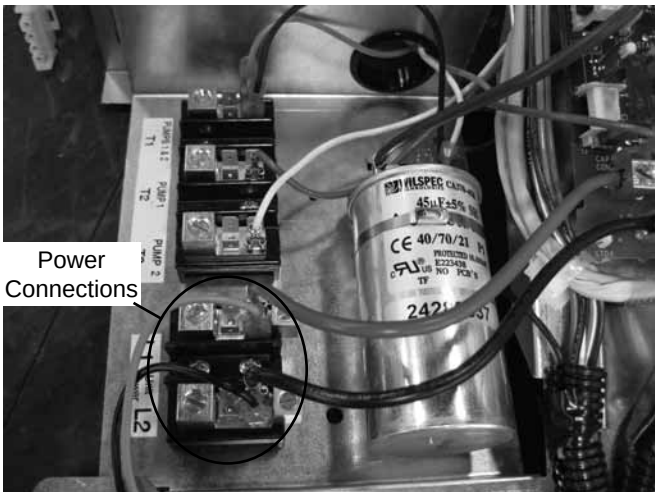
All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

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.

Power Connection
Line voltage connection is made by connecting the incoming line voltage wires to the power distribution block as shown in Figure 16. Consult Table for correct fuse size.

208 Volt Operation
All residential 208-230 Volt units are factory wired for 230 Volt operation. The transformer may be switched to the 208V tap as illustrated on the wiring diagram by switching the red (208V) and the orange (230V) wires at the power distribution block.

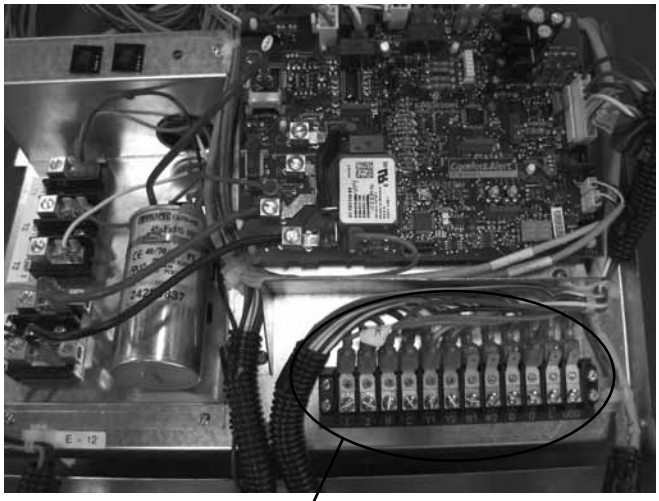
Figure 16: Line Voltage Connections



Electrical - Low Voltage Wiring

Thermostat Connections
The thermostat should be wired to the thermostat terminal block provided, as shown in Figure 17. See “Electrical – Thermostat” for specific terminal connections.

Figure 17: Low Voltage Wiring

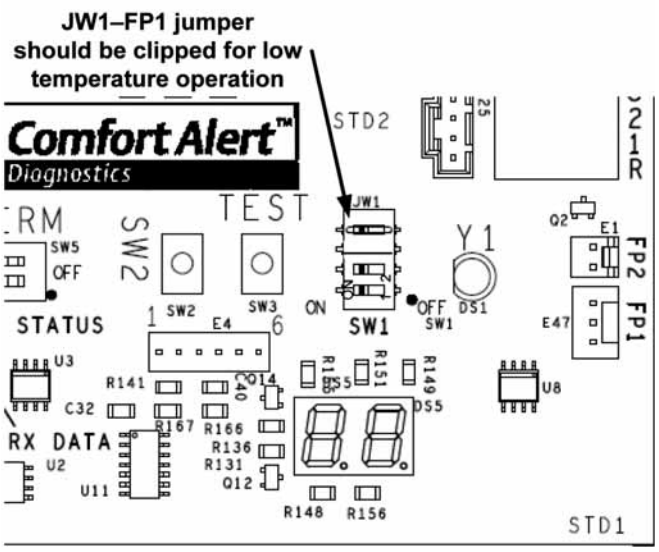


Condensate Overflow Switch
The condensate overflow switch is wired in place of, or in series with the return air sensor when using a Comfort Control² thermostat. The condensate overflow switch is wired in series with the Y1 thermostat connection when using a 24 VAC thermostat.

Low Water Temperature Cutout Selection
The ICC control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW1, which changes the sensing temperature associated with thermistor FP1. Note that the FP1 thermistor is located on the refrigerant line between the coaxial heat exchanger and expansion device (TXV). Therefore, FP1 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 FP1 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 JW1 should be clipped as shown in Figure 18 to change the setting to 10°F [-12.2°C] refrigerant temperature, a more suitable temperature when using an antifreeze solution. All residential units include water/refrigerant circuit insulation to prevent internal condensation, which is required when operating with entering water temperatures below 59°F [15°C].

Figure 18: FP1 Limit Setting



Electrical - Low Voltage Wiring

Figure 19: Two-Stage Piping

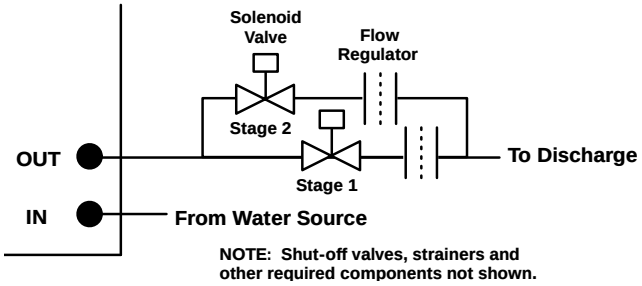
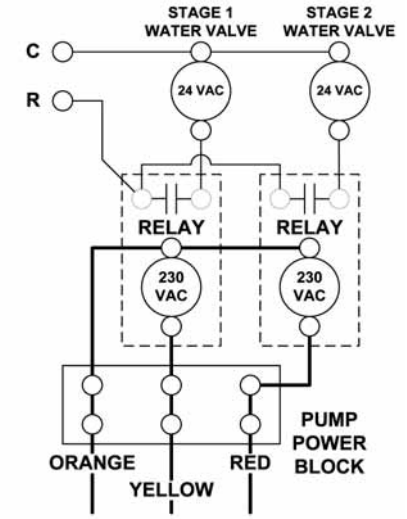


Figure 20: Typical Water Valve Wiring



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.

RPV units should be designed with two parallel valves for ground water applications to limit water use during first stage operation. For example, at 1.5 gpm/ton [2.0 l/m per kW], a RPV 048 unit requires 6 gpm [23 l/m] for full load (2nd stage) operation, but only 4 gpm [15 l/m] during 1st stage operation. Since the unit will operate on first stage 80-90% of the time, significant water savings can be realized by using two parallel solenoid valves with two flow regulators. In the example above, stage one solenoid would be installed with a 4 gpm [15 l/m] flow regulator on the outlet, while stage two would utilize a 2 gpm [8 l/m] flow regulator. When stage one is operating, the second solenoid valve will be closed. When stage two is operating, both valves will be open, allowing full load flow rate. Figure 19 illustrates piping for two-stage solenoid valves. NOTE: when EWT is below 50ºF [10ºC], a minimum of 2 gpm per ton [2.6 l/m per kW] is required.

Figure 20 shows typical wiring for 24 VAC external solenoid valves. Figures 21 and 22 illustrate typical wiring utilizing slow closing water control valves. When standard water solenoid valves are used, dipswitch SW1-2 on the ICC control should be in the ON position. When a slow closing water control valve is used, dipswitch SW1-2 on the ICC control must be placed in the OFF position. See Figure 23 for the position of dipswitch SW1-2 on the ICC control.

Figure 21: AMV Valve Wiring

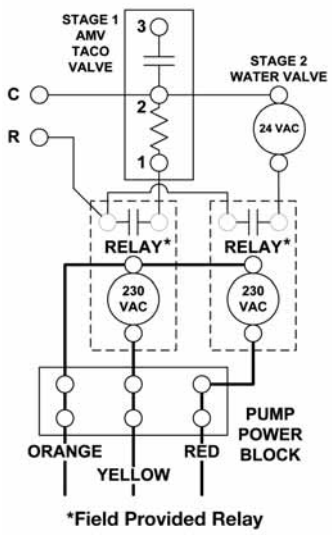
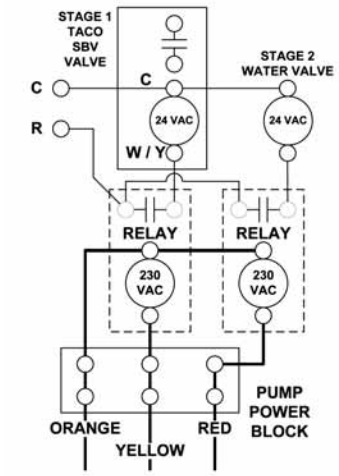


Figure 22: Taco SBV Valve Wiring



Electrical - Thermostat Wiring

⚠ CAUTION! ⚠

CAUTION! Many units installed with a factory or field supplied manual or electric shut-off valve. **DAMAGE WILL OCCUR** if shut-off valve is **closed** during unit operation. A high pressure switch must be installed on the heat pump side of any field provided shut-off valves and connected to the heat pump controls in series with the built-in refrigerant circuit high pressure switch to disable compressor operation if water pressure exceeds pressure switch setting. The field installed high pressure switch shall have a cut-out pressure of 300 psig and a cut-in pressure of 250 psig. This pressure switch can be ordered with a 1/4" internal flare connection as part number 39B0005N02.

⚠ CAUTION! ⚠

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

Thermostats

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 exterior walls. The wire access hole behind the thermostat may in certain cases need to be sealed to prevent erroneous temperature measurement. Thermostat wire should be 18 AWG wire. Wire the appropriate thermostat as shown in Figures 24–27 to the low voltage terminal block.

Important: when using a Comfort Control^2 thermostat, do not make any connections to the 24VAC thermostat connections. If any connections are made to the Y1, Y2, O, W1, W2, G, or ODD terminals, the Comfort Control^2 system will assume the control is being used with a 24VAC thermostat and will IGNORE ANY COMMUNICATIONS USING DATA WIRE 1 AND DATA WIRE 2.

Figure 23: Water Valve Operation Selection

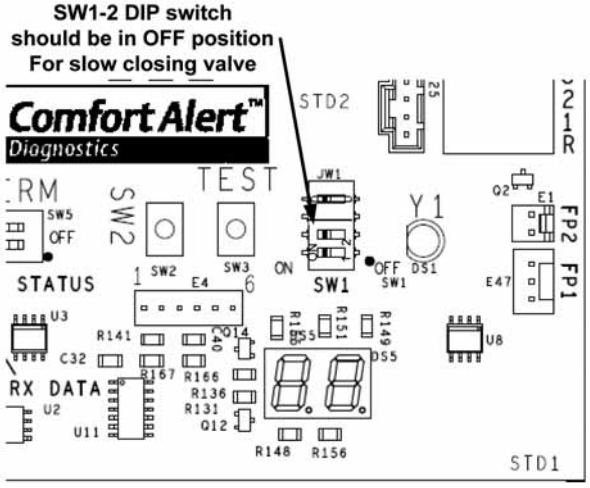


Figure 24: Comfort Control^2 Thermostat

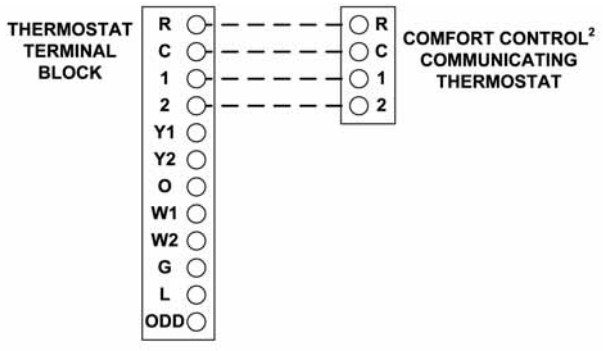


Figure 25: Typical Thermostat

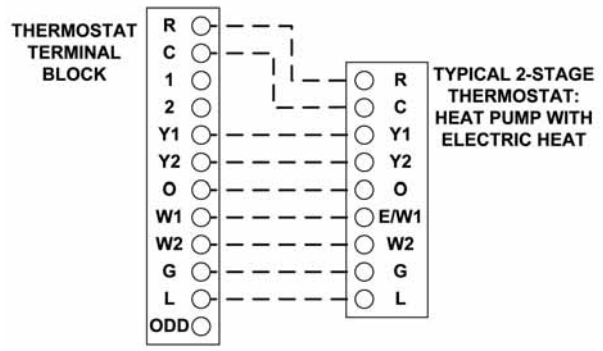


Figure 26: Two-Stage Thermostat with Dehumidification

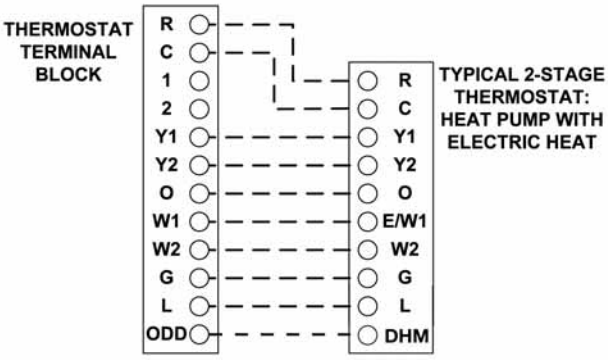
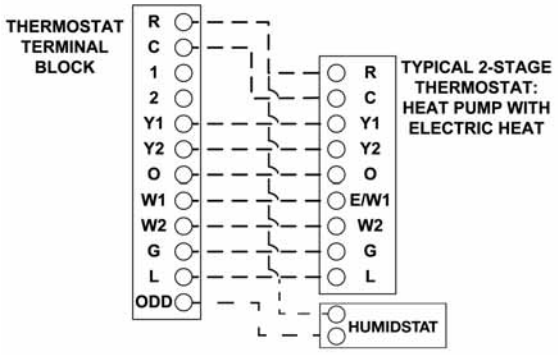


Figure 27: Two-Stage Thermostat with Humidistat for Dehumidification



ECM Blower Control

The ECM fan is controlled by the blower control board that converts thermostat signals and CFM settings into signals used by the ECM motor.

Comfort Control² Airflow Settings
When using a Comfort Control² thermostat, the dipswitches on the blower control board will have no affect on the airflow.

Cooling Airflow Settings. The Comfort Control² system sets the cooling airflow for optimum performance and comfort based on the unit size. Refer to Table 5 for the cooling operation airflows.

Cooling Airflow Adjustment. The Comfort Control² system allows the user to tweak the cooling airflow +/- 15% to suit the installation. When using the Comfort Control² system, the airflow can only be adjusted using the Comfort Control² thermostat. To adjust the cooling airflow, go to the airflow adjustment menu and select the desired adjustment.

Cooling Mode Dehumidification. The Comfort Control² system controls are shipped with "On Demand Dehumidification" (ODD) turned OFF. On Demand Dehumidification may be activated from the Comfort Control² thermostat, when the thermostat has an on-board humidity sensor.

Heating Airflow Settings. The Comfort Control² system sets the heating airflow for optimum performance and comfort based on the unit size. Refer to Table 5 for the heating operation airflows.

Heating Airflow Adjustment. The Comfort Control² system allows the user to tweak the heating airflow +/- 15% to suit the installation. When using the Comfort Control² system, the airflow can only be adjusted using the Comfort Control² thermostat. To adjust the heating airflow, go to the airflow adjustment menu and select the desired adjustment.

Auxiliary Heat Airflow Settings. The Comfort Control² system sets the auxiliary heat airflow to provide adequate airflow based on the unit size. Refer to Table 5 for the auxiliary heat operation airflows. Airflow levels for auxiliary heat are fixed and cannot be field adjusted.

Constant Fan Airflow Settings. The Comfort Control² system sets the nominal constant fan airflow based on the unit size. Refer to Table 5 for the nominal constant fan operation airflows.

Constant Fan Airflow Adjustment. The Comfort Control² system allows the user to tweak the constant fan airflow +/- 50% to suit the installation. When using the Comfort Control² system, the airflow can only be adjusted using the Comfort Control² thermostat. To adjust the constant fan airflow, go to the constant fan adjustment menu and select the desired adjustment.

Airflow Delay Profile. The Comfort Control² system uses factory configured blower on and off delays to increase energy efficiency and comfort. The airflow delay profiles for heating and cooling operation are shown in Table 5.

24VAC Thermostat Airflow Settings
When using a 24 VAC thermostat, the dipswitches on the blower control board select the heating, cooling, and constant fan operation airflows.

Cooling Airflow Settings. The cooling operation airflow setting is determined by the positions of dipswitches 1 and 2 on the blower control board when using a 24VAC thermostat. Refer to Table 5 for the tap setting associated with each dipswitch setting, and to the ECM Blower Performance Data on page 26 for the associated airflows.

Heating Airflow Settings. The heating operation airflow setting is determined by the positions of dipswitches 3 and 4 on the blower control board when using a 24VAC thermostat. Refer to Table 5 for the tap setting associated with each dipswitch setting, and to the ECM Blower Performance Data on page 26 for the associated airflows.

Airflow Adjustment. The cooling and heating airflow settings may be adjusted +/- 15% to suit the installation. The airflow levels are adjusted by the positions of dipswitches 5 and 6 on the blower control board when using a 24VAC thermostat. Refer to Table 5 for the airflow adjustment setting associated with each dipswitch setting.

Auxiliary Heat Airflow Settings. The auxiliary heat airflow is fixed based on the size of the heat pump to provide adequate airflow. Refer to the ECM Blower Performance Data on page 26 for the auxiliary heat airflows.

Constant Fan Airflow Settings. The constant fan operation airflow setting is determined by the positions of dipswitches 1 and 2 on the blower control board when using a 24VAC thermostat. Refer to Table 5 for the tap setting associated with each dipswitch setting, and to the ECM Blower Performance Data on page 26 for the associated airflows.

Cooling Mode Dehumidification. The heat pump is shipped with the "On Demand Dehumidification" (ODD) turned OFF. On Demand Dehumidification is used in conjunction with a traditional 24VAC thermostat equipped with an on-board humidity sensor. ODD operation is activated by setting dipswitch 7 on the blower control board to the ON position. ODD operation is controlled by the indoor humidity sensor at the thermostat. The heat pump is programmed to provide maximum efficiency and optimum humidity removal. When high humidity is detected, the cooling airflow is reduced. Refer to Table 5 for the cooling airflow reduction for each unit size. Operation for ODD is:

Normal Humidity (humidity BELOW the dehumidification setpoint): Thermostat will apply a 24VAC signal to the ODD terminal, and the blower will operate at the normal

airflow for cooling operation.

High Humidity (humidity ABOVE the dehumidification setpoint): Thermostat will apply no signal to the ODD terminal, and the blower will operate at reduced airflows for cooling operation.

Table 5: ECM Airflow and Tap Settings

Comfort Control² Airflow Settings

Model	Cooling Mode		Dehumid Mode		Heating Mode		Fan	Aux Heat
	Stg 1	Stg 2	Stg 1	Stg 2	Stg 1	Stg 2		
025	730	850	570	660	820	950	700	990
036	1000	1250	780	975	1000	1250	825	1400
048	1300	1550	1010	1200	1390	1650	1050	1700
062	1480	1825	1150	1420	1660	2050	1250	2100
069	1480	1950	1150	1520	1660	2100	1250	2300

Cooling Settings

Tap Setting	DIP Switch S1	DIP Switch S2
1	ON	ON
2	OFF	ON
3	ON	OFF
4	OFF	OFF

Heating Settings

Tap Setting	DIP Switch S3	DIP Switch S4
1	ON	ON
2	OFF	ON
3	ON	OFF
4	OFF	OFF

Adjustment Settings

Tap Setting	DIP Switch S5	DIP Switch S6
Normal	OFF	OFF
+ 15%	ON	OFF
- 15%	OFF	ON
Nomal	ON	ON

ODD Adjustment

Model	Airflow
025	78%
036	78%
048	78%
062	78%
069	78%

Comfort Control² CONTROL WIRING

The *Comfort Control²* requires four (4) control wires for unit operation:

R - 24VAC
C - 24VAC common
1 - Data wire 1
2 - Data wire 2

Wiring sizing for *Comfort Control²* is identical to systems using low voltage 24V wires.

Note: *Comfort Control²* requires a minimum 18 AWG.

IMPORTANT: When using *Comfort Control²*, do not make any connections to the 24VAC thermostat wires. If any connections are made to the G, W1, W2, Y1, Y2, B or ODD wires, the *Comfort Control²* control will assume the control is being used with a traditional thermostat and will IGNORE ANY COMMUNICATIONS USING DATA WIRE 1 AND DATA WIRE 2.

Installation Verification

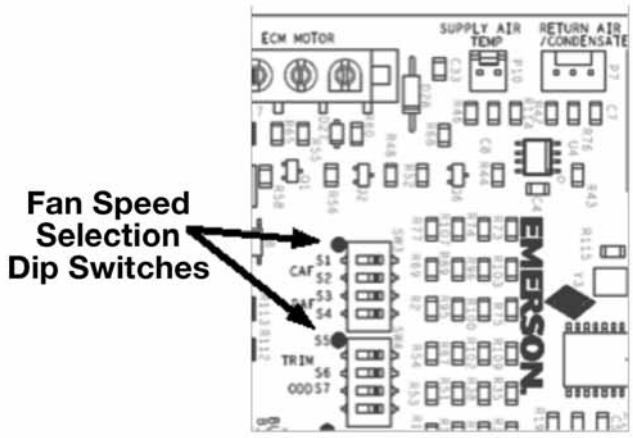
- Term and bias dip switches should be on.
- 24 VAC power on R&C must be present at the control for the air handler to operate, reference Figure 9.
- Line voltage must be present at the control for indoor blower operation.
- The RX Data LED will flash green in normal operation. A flashing green light indicates 24VAC is present and the data wires 1 and 2 are wired properly.

IMPORTANT: If the RX DATA LED is solid green, data wire 1 and data wire 2 are not properly connected. Typically, the connections are switched, i.e. data wire 1 is wired to the data wire 2 connection and data wire 2 is wired to the data wire 1 connection. Verify wiring and correct the polarity at the two data wires.

IMPORTANT: Diagnostic port is for the diagnostic tool only. Do not attempt to connect components using a telephone cord. Damage will occur.

IMPORTANT: Diagnostic port is not a phone jack. Connecting to a telephone or telephone system will result in damage.

Figure 28: ECM Blower Settings



USING THE ON-BOARD LED TO DETERMINE BLOWER CFM

The CFM LED indicates blower output by flashing one (1) flash for every 100 CFM of airflow. The LED will pause 1/10 second between each flash.

RPV Series ECM Blower Performance Data

Airflow in CFM with wet coil and clean air filter

Model	Max ESP (in. wg)	Fan Motor (hp)	Tap Setting	Cooling Mode			Dehumid Mode			Heating Mode			Residential Units Only: AUX CFM	Residential Units Only: Aux/ Emerg Mode
				Stg 1	Stg 2	Fan	Stg 1	Stg 2	Fan	Stg 1	Stg 2	Fan		
025	0.50	1/2	4	810	950	400	630	740	400	920	1060	400	4	950
	0.50	1/2	3	725	850	360	560	660	360	825	950	360	3	950
	0.50	1/2	2	620	730	310	490	570	310	710	820	310	2	950
	0.50	1/2	1	520	610	260				600	690	260	1	950
036	0.50	1/2	4	1120	1400	560	870	1090	560	1120	1400	560	4	1350
	0.50	1/2	3	1000	1250	500	780	980	500	1000	1250	500	3	1350
	0.50	1/2	2	860	1080	430	670	840	430	860	1080	430	2	1350
	0.50	1/2	1	730	900	365				730	900	365	1	1350
048	0.75	1	4	1460	1730	730	1140	1350	720	1560	1850	730	4	1660
	0.75	1	3	1300	1550	650	1020	1210	650	1400	1650	650	3	1660
	0.75	1	2	1120	1330	560	870	1040	560	1200	1430	560	2	1660
	0.75	1	1	940	1120	470				1010	1200	470	1	1660
062	0.75	1	4	1670	2050	835	1300	1600	835	1860	2280	835	4	2040
	0.75	1	3	1500	1825	750	1160	1430	750	1650	2050	750	3	2040
	0.75	1	2	1280	1580	640	1000	1230	640	1430	1750	640	2	2040
	0.75	1	1	1080	1320	540				1200	1470	540	1	2040
069	0.75	1	4	1620	2190	810	1270	1650	810	1690	2230	810	4	2100
	0.75	1	3	1500	1950	750	1170	1520	750	1600	2100	750	3	2100
	0.75	1	2	1400	1830	700	1100	1420	700	1400	1850	700	2	2100
	0.75	1	1	1320	1700	660				1240	1620	660	1	2100

Factory shipped on Tap Setting 2
Airflow is controlled within +/- 5% up to Max ESP shown with wet coil and standard 1" fiberglass filter
Do not select Dehumidification mode if HP CFM is on setting 1
All units ARI/ISO/ASHRAE 13256-1 rated HP (Cooling) Delay (Heating) CFM Setting 3

Note: See the ECM Blower Control section for information on setting taps.

ICC and Blower Controls

ICC Control Description

Dual 7-Segment LED
Displays status and diagnostic codes, for normal operation and fault recall.

Red LED (Y1)
Displays the status of the Y1 thermostat input.
Caution: UNIT MAY START SUDDENLY AND WITHOUT WARNING. Solid red light indicates a thermostat call for operation is present at the ICC control. The ICC control will attempt to start the unit after the short cycle timer expires if the control is not locked out.

Green LED (COMM STATUS)
The COMM STATUS LED will flash green in normal operation. A flashing green light indicates 24VAC is present and the data wires 1 and 2 are wired properly.
Important: If the COMM STATUS LED is solid green, data wire 1 and data wire 2 are not properly connected. Typically the connections are switched. Verify wiring and correct the polarity at the two wires.

Compressor Control (K2)
Sealed single pole compressor relay switch with optical feedback feature (arc detection).

Low Voltage Fuse
If necessary replace with 3 A automotive ATC style blade fuse.

Low Pressure Control (LPC Input)
Low pressure control is automatically resetting factory installed device.

High Pressure Control (HPC Input)
High pressure control is automatically resetting factory installed device.

Water Coil Low Temperature (FP1)
Low water coil temperature protection control is a factory installed temperature sensor.

Air Coil Low Temperature (FP2)
Low air coil temperature protection control is a factory installed temperature sensor.

TEST and SW2 Buttons
The TEST and SW2 buttons are used to enter the Test and Fault Recall modes.

Test Mode: Test mode allows the service technician to check the operation of the control system in a timely manner. The Test mode is activated by pressing the TEST button for 1 second, and will reset any active ICC lockout, reset the anti-short cycle timer, and activate the compressor output without a command for unit operation.

If the Test mode is initiated with no command for operation present, and the ICC control will do the following:
1) A steady “t” appears on the ICC diagnostic display.
2) The compressor and low speed pump outputs will be activated.
3) The compressor and pump outputs will turn off after 5 seconds.

Note: If a command for unit operation is present at the end of the Test mode, the unit will continue to operate.

If the Test mode is initiated with a command for operation present, and the ICC control will do the following:
1) A “t” is displayed momentarily on the ICC diagnostic display.
2) The compressor and low speed pump outputs will be activated.
3) The ICC diagnostic display will change to “c”, “C”, “h”, or “H” to show the current command for unit operation.

Fault Recall Mode: The Fault Recall mode is activated by pressing both the TEST and SW2 buttons for 1 second

If the Fault Recall mode is initiated, the ICC control will do the following:
1) When entering and exiting the Fault Recall mode, the top and bottom right hand segments of the dual 7-segment LEDs will illuminate.
2) When entering the Fault Recall mode, the ICC will automatically scroll through the stored faults on the dual 7-segment LEDs.
3) Each stored fault is displayed on time with the top right hand segment of the dual 7-segment display activated between fault codes.
4) Each fault is displayed with the most recent fault displayed first.
5) A maximum of six individual faults can be stored.
6) A maximum of three consecutive identical faults may be stored.
7) A “0” will be displayed when no faults are stored in memory.
8) The ICC will automatically exit the Fault Recall mode after displaying stored faults.

Clear Fault History: The stored fault history may be cleared by pressing both the TEST and SW2 buttons for 5 seconds. The top and bottom right hand segments of the dual 7-segment LEDs will flash to indicate the fault history has been cleared.

ICC Control DIP Switches
Note: In the following field configuration options, DIP switches should only be changed when power is removed from the ICC control.
DIP switch SW1–1: Factory Setting – Normal position is “On”. Do not change this selection unless instructed to do so by the factory.
DIP switch SW1–2: Slow Opening Water Valve – Provides the selection of the pump (water valve) operation.
On = Normal operation. Off = Slow opening water valve.

ICC and Blower Controls

Field Configuration Jumper
Note: The JW1 field configuration jumper should be clipped ONLY when power is removed from the ICC control.

Water Coil Low Temperature Limit Setting: Jumper 1 (JW1) provides field selection of the temperature limit setting for FP1 of 30ºF or 10ºF [-1ºC or -12ºC] (refrigerant temperature). Not Clipped = 30ºF [-1ºC]. Clipped = 10ºF [-12ºC].

Diagnostic Port
The diagnostic port E25 is for a diagnostic tool only. Do not attempt to connect other components or use a telephone cord. Damage will occur.

Memory Card
The memory card stores all of the unit configuration data, referred to as shared data. The shared data is the information required for proper unit operation.

NOTE: The memory card for the unit has specific shared data for this unit. The memory card is attached to the control box with a tether.

Blower Control Description

Red LED (CFM)
The CFM LED indicates the blower output by flashing one (1) flash for every 100 CFM of airflow. The LED will pause for 1/10 second between each flash.

Green LED (RX DATA)
The RX DATA LED will flash green in normal operation. A flashing green light indicates 24VAC is present and the data wires 1 and 2 are wired properly.
Important: If the RX DATA LED is solid green, data wire 1 and data wire 2 are not properly connected. Typically the connections are switched. Verify wiring and correct the polarity at the two wires.

Low Voltage Fuse
If necessary replace with 3 A automotive ATC style blade fuse

Supply Air Temperature
The supply air temperature sensor is an optional field installed temperature sensor

Return Air Temperature
The return air temperature sensor is an optional field installed temperature sensor

Condensate Overflow
The condensate overflow is an optional field installed normally closed float switch.
Note: The condensate overflow switch is wired in place of, or in series with the return air sensor when using a Comfort Control^2 thermostat. The condensate overflow switch is wired in series with the Y1 thermostat connection when using a 24 VAC thermostat.

Blower Control DIP Switches
See ECM Blower Control for Blower Control DIP switch definitions.

Diagnostic Port
The diagnostic port is for a diagnostic tool only. Do not attempt to connect other components or use a telephone cord. Damage will occur.

Memory Card
The memory card stores all of the unit configuration data, referred to as shared data. The shared data is the information required for proper unit operation.

NOTE: The memory card for the unit has specific shared data for this unit. The memory card is attached to the control box with a tether.

Normal Control System Operation

Installation Verification:
24VAC power on R & C must be present at the ICC control and the Blower control for the system to operate properly.

Line voltage must be present for the compressor, blower, and pumps to operate properly.

The ICC control displays a “0” for standby mode. Standby mode indicates line voltage and 24VAC are present at the ICC, and there is not a command for unit operation from the serial communicating thermostat.

Zero (0) displayed indicates the unit is in standby

Command for Compressor Operation (Y1 LED)
If a command for compressor operation is received by the ICC (first stage/second stage cooling or first stage/second stage heating), the LED will illuminate.
The ICC has an on/off pump delay of one (1) second for each stage of heating or cooling.
The Blower control has an on/off indoor blower delay for heating and cooling.
The ICC ignores the low pressure control for the first 120 seconds of compressor operation.
The ICC ignores the low temperature protection temperatures for the first 120 seconds of compressor operation.
The dual 7-segment LED displays four (4) operational status codes:

1) First Stage Cooling Operation – When the ICC receives a command for first stage cooling operation, a lower case “c” is displayed on the dual 7-segment LED.

Lower case “c” indicates first stage cooling operation.

ICC and Blower Controls

2) Second Stage Cooling Operation – When the ICC receives a command for second stage cooling operation, an upper case “C” is displayed on the dual 7-segment LED.

Upper case “C” indicates second stage cooling operation.

3) First Stage Heating Operation – When the ICC receives a command for first stage heating operation, a lower case “h” is displayed on the dual 7-segment LED.

Lower case “h” indicates first stage heating operation.

4) Second Stage Heating Operation – When the ICC receives a command for second stage heating operation, an upper case “H” is displayed on the dual 7-segment LED.

Upper case “H” indicates second stage heating operation.

5-Minute Anti-Short Cycle Timer
The ICC has a built in 5-minute time delay between compressor operations to protect the compressor against short cycling. The dual 7-segment LEDs will flash “c”, “C”, “h”, or “H” while the short cycle timer is active and a command for unit operation is received.

Flashing lower case “c” indicates a command for first stage cooling has been received.

Flashing upper case “C” indicates a command for second stage cooling has been received.

Flashing lower case “h” indicates a command for first stage heating has been received.

Flashing upper case “H” indicates a command for second stage heating has been received.

The 5-minute time delay can be bypasses when a command for compressor operation is present by pressing the TEST button for 1 second and releasing. The compressor will begin operation and the dual 7-segment will stop flashing.

30 Second Minimum Run Timer
The ICC has a built in 30 second minimum unit run time. If a command for compressor operation is received by the ICC and the command is removed, the compressor will continue to operate for 30 seconds. The dual 7-segment LEDs will flash “c”, “C”, “h”, or “H” while the minimum run timer is active.

1 Second Compressor/Pump Delay
The ICC starts/stops the pump output one (1) second after the start/stop of the compressor upon a command for compressor operation to minimize current inrush and/or voltage drop.

Safety Feature Operation

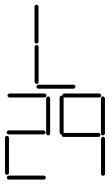
Active Compressor Protection Modes
The ICC actively protects the system from harmful operation during a fault condition
When the ICC detects a condition that could damage the system, the ICC will enter active protection mode and lockout compressor operation
The condition causing active protection must be resolved before the ICC will restart the system
There are eight (8) active protection modes:
1) Low Pressure Control Lockout
The ICC will display a flashing “L” followed by a flashing “21” when a low-pressure lockout occurs.

Active Protection – Code L21 – Open Low Pressure Control

If the LPC opens for thirty (30) continuous seconds, three (3) times during the same command for compressor operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “21”.

IMPORTANT: This mode of active protection must be manually reset.

2) High Pressure Control Lockout
The ICC will display a flashing “L” followed by a flashing “29” when a high-pressure lockout occurs.



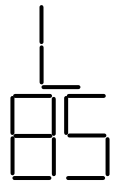
ICC and Blower Controls

Active Protection – Code L29 – Open High Pressure Control

If the HPC opens three (3) times during the same command for compressor operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “29”.

IMPORTANT: This mode of active protection must be manually reset.

3) Low Water Coil Temperature Lockout
The ICC will display a flashing “L” followed by a flashing “85” when a low water coil temperature lockout occurs.

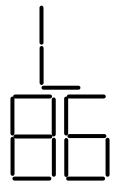


Active Protection – Code L85 – Low Water Coil Temperature

If the Water Coil Temperature sensor (FP1) measures a temperature below the currently selected setpoint (JW1) for thirty (30) continuous seconds during compressor operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “85”.

IMPORTANT: This mode of active protection must be manually reset.

4) Low Air Coil Temperature Lockout
The ICC will display a flashing “L” followed by a flashing “86” when a low air coil temperature lockout occurs.

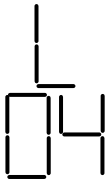


Active Protection – Code L86 – Low Air Coil Temperature

If the Air Coil Temperature sensor (FP2) measures a temperature below 30ºF [-1ºC] for thirty (30) continuous seconds during compressor operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “86”.

IMPORTANT: This mode of active protection must be manually reset.

5) Compressor Locked Rotor Lockout
The ICC will display a flashing “L” followed by a flashing “04” when a compressor locked rotor condition occurs.



Active Protection – Code L4 – Compressor Locked Rotor

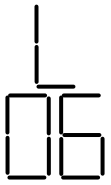
If the ICC detects the compressor has run less than 15 seconds for four (4) consecutive starts during the same command for unit operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “04”.

IMPORTANT: This mode of active protection must be manually reset.

6) Compressor Protector Trip
If the ICC detects a compressor protector trip it will display a “P”. If the protector doesn’t reset within 4 hours, the ICC display will change to “5”.

Compressor Protector – Code P – Protector Trip

7) Open Compressor Start Circuit Lockout
The ICC will display a flashing “L” followed by a flashing “06” when a compressor open start circuit condition occurs.

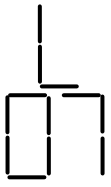


Active Protection – Code L6 – Compressor Open Start Circuit

If the ICC detects current in the run circuit without current present in the start circuit, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “06”.

IMPORTANT: This mode of active protection must be manually reset.

8) Open Compressor Run Circuit Lockout
The ICC will display a flashing “L” followed by a flashing “07” when a compressor open run circuit condition occurs.



ICC and Blower Controls

Active Protection – Code L7 – Compressor Open Run Circuit

If the ICC detects current in the start circuit without current present in the run circuit, the ICC will lockout the compressor to keep it from continuing to operate and flash a "L" on the dual 7-segment LEDs followed by a "07".

IMPORTANT: This mode of active protection must be manually reset.

Exiting Active Compressor Protection Lockout
There are three methods to reset the ICC after an active protection lockout:

1) Cycle the line voltage to the unit
2) Cycle 24VAC to the ICC (remove the R or C connection to the ICC)
3) Push the TEST button down with an insulated probe for one (1) second and release

Note: The ICC will attempt to start the unit when the TEST button is pressed and released

Note: The preferred method of resetting the ICC is to push the TEST button down for one (1) second.

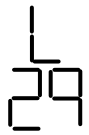
Optional Condensate Overflow Protection
An optional condensate overflow protection float switch may be connected to the Blower control when using the Comfort Control^2 system.
If the optional float switch is open for thirty (30) consecutive seconds during compressor operation, the ICC will shut down the compressor to keep it from continuing to operate, until the float switch has been closed for thirty (30) consecutive seconds. The dual 7-segment LEDs will flash "c", "C", "h", or "H" while the compressor is shut down due to condensate overflow protection.

ICC Control Diagnostic Codes
The description of ICC diagnostic codes displayed on the dual 7-segment LEDs are provided below:

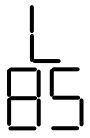
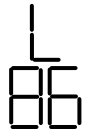
Dual 7 - Segment LEDs Display Code	Diagnostic Description	Status/Possible Cause – Troubleshooting Information
0	0 – Standby No command for operation	Normal Operation
c	c – First Stage Cooling Unit has received a command for first stage cooling	Normal Operation
c Flashing	c – Anti-short cycle timer (5 minutes) or Minimum run timer (30 seconds) active	• The unit has received a command for first stage cooling during an active anti-short cycle timer or minimum run timer • Wait until unit timer has expired or press the TEST button to defeat short cycle delay
C	C – Second Stage Cooling Unit has received a command for second stage cooling	Normal Operation
C Flashing	C – Anti-short cycle timer (5 minutes) or Minimum run timer (30 seconds) active	• The unit has received a command for second stage cooling during an active anti-short cycle timer or minimum run timer • Wait until unit timer has expired or press the TEST button to defeat short cycle delay
h	h – First Stage Heating Unit has received a command for first stage heating	Normal Operation
h Flashing	h – Anti-short cycle timer (5 minutes) or Minimum run timer (30 seconds) active	• The unit has received a command for first stage heating during an active anti-short cycle timer or minimum run timer • Wait until unit timer has expired or press the TEST button to defeat short cycle delay
H	H – Second Stage Heating Unit has received a command for second stage heating	Normal Operation
H Flashing	H – Anti-short cycle timer (5 minutes) or Minimum run timer (30 seconds) active	• The unit has received a command for second stage heating during an active anti-short cycle timer or minimum run timer • Wait until unit timer has expired or press the TEST button to defeat short cycle delay
t	t – Test Mode	The ICC is in the TEST mode
P	P – Protector Trip A command for compressor operation is present but no current is measured to the compressor	• Motor protector open
01	01 – Long Run Time (Compressor) The compressor has continuously run for more than 18 hours	• Low refrigerant charge • Air ducts have substantial leakage • Dirty air filter or air coil
02	02 – High Side Fault Compressor limit has opened four (4) times within a call for operation	• Dirty air filter or air coil • Blower is not running • Liquid line restriction • Excessive refrigerant charge

ICC and Blower Controls

Dual 7 - Segment LEDs Display Code	Diagnostic Description	Status/Possible Cause – Troubleshooting Information
	03 – Short Cycling the ICC detects the run time for the past four (4) compressor cycles is less than three (3) minutes each	• Check thermostat wire connections • Check thermostat location in zone (too close to discharge grill)
	L4 – Locked Rotor The ICC detects four (4) consecutive protector trips have occurred and the average run time for each trip is less than 15 seconds	• Bad run capacitor • Low line voltage • Excessive refrigerant in compressor • Seized bearings in compressor
	05 – Open Run Circuit (Compressor will not run) The ICC has had a protector trip for more than 4 hours	• Check for damaged, miswired, or wrong run capacitor • Check for broken wires, loose connectors, or miswired compressor • Check compressor windings for continuity • Check for open compressor internal protector
	06 – Compressor Open Start Circuit The ICC detects current in the Run circuit but not in the Start circuit of the compressor	• Check for damaged, miswired, or wrong run capacitor • Check for broken wires, loose connectors, or miswired compressor • Check compressor windings for continuity
	L6 – Compressor Open Start Circuit The ICC detects current in the Run circuit but not in the Start circuit of the compressor four (4) times in one compressor call	• Check for damaged, miswired, or wrong run capacitor • Check for broken wires, loose connectors, or miswired compressor • Check compressor windings for continuity
	07 – Compressor Open Run Circuit The ICC detects current in the Start circuit but not the Run circuit of the compressor	• Check for damaged, miswired, or wrong run capacitor • Check for broken wires, loose connectors, or miswired compressor • Check compressor windings for continuity
	L7 – Compressor Open Run Circuit The ICC detects current in the Start circuit but not the Run circuit of the compressor four (4) times in one compressor call	• Check for damaged, miswired, or wrong run capacitor • Check for broken wires, loose connectors, or miswired compressor • Check compressor windings for continuity
	09 – Low Secondary Voltage The secondary voltage at R and C is below 18VAC	• Control transformer overloaded • Low line voltage

Dual 7 - Segment LEDs Display Code	Diagnostic Description	Status/Possible Cause – Troubleshooting Information
	21 – Low Pressure Control Open The ICC detects the LPC is open. Note: The low pressure control is ignored for the first 120 seconds of compressor operation	• Unit has low refrigerant charge • Air coil is frozen • Dirty air filter or air coil • Blower is not running • Expansion valve is not operating properly
 Flashing	L21 – Active Protection Low Pressure Control Trip	LPC has opened 3 times in the same compressor operation, the ICC has locked out the compressor to protect it. ICC alternately flashes L and 21
	27 – Low Line Voltage or No Line Voltage Fault	• Check incoming line voltage to the disconnect and unit • Check wiring connections
	28 – High Line Voltage Fault	• Check line voltage
	29 – High Pressure Control Open The ICC detects the HPC is open	• Dirty air filter or air coil • Blower is not running • Liquid line restriction • Excessive Refrigerant charge
 Flashing	L29 – Active Protection High Pressure Control Trip	HPC has opened 3 times in the same compressor operation, the ICC has locked out the compressor to protect it. ICC alternately flashes L and 29
	30 – Fuse Open The ICC detects the on-board fuse is open	• The 3-amp fuse on the ICC is open • Low voltage wiring at R and C is damaged or miswired
	80 - Low Air Flow The ICC detects that the blower is not providing the minimum airflow requirements	• Wrong blower motor configuration
	85 – Low Water Coil Temperature The ICC detects the water coil temperature below the selected setpoint	• Low water flow • Water pump not running

ICC and Blower Controls

Dual 7 - Segment LEDs Display Code	Diagnostic Description	Status/Possible Cause – Troubleshooting Information
	L85 – Active Protection Low Water Coil Temperature Trip	The water coil temperature has been detected below the selected setpoint, the ICC has locked out the compressor to protect it. ICC alternately flashes L and 85
	86 – Low Air Coil Temperature The ICC detects the air coil temperature below the setpoint	• Low airflow • Dirty air filter or air coil •Blower is not running
 Flashing	L86 – Active Protection Low Air Coil Temperature Trip	The air coil temperature has been detected below the setpoint, the ICC has locked out the compressor to protect it. ICC alternately flashes L and 86
	93 – Internal Control Fault The control is not functioning properly	• Check control for proper system operation • Replace control
	d1 – No Shared Data The control board does not have shared data	• Replace memory card with correct system information
	d3 – Airflow CFM Mismatch The blower cannot supply the required airflow for proper system operation	• Misapplied/wrong blower – replace with properly sized blower
	d4 – Memory Card Invalid for Device The memory card is missing or the data in the memory card does not match the data in the control	• Check memory card to ensure it matches device • Check if memory card is present
	d8 – Old Shared Data System data is obsolete	• If system will not operate, order new memory card to update system information

Blower Control Diagnostic Codes

Descriptions of Comfort Control[2] Blower control diagnostic codes are provided below. These codes can be displayed at the thermostat when the system is wired for Comfort Control[2] serial communications only.

Dual 7 - Segment LEDs Display Code	Diagnostic Description	Status/Possible Cause – Troubleshooting Information
	d1 – No Shared Data The control board does not have shared data	• Replace memory card with correct system information
	d3 – Airflow CFM Mismatch The blower cannot supply the required airflow for proper system operation	• Misapplied/wrong blower – replace with properly sized blower
	d4 – Memory Card Invalid for Device The memory card is missing or the data in the memory card does not match the data in the control	• Check memory card to ensure it matches device • Check if memory card is present
	d5 – Card Hardware Conflict The motor horsepower is not correct for the blower	• Replace blower motor with correct horsepower motor • Replace memory card with the correct system information
	d6 – Blower Horsepower Conflict The horsepower data in the memory card does not match the motor horsepower	• Replace blower motor with correct horsepower motor • Replace memory card with the correct system information. Check memory card to ensure it matches device
	d7 – Blower Manufacturer Conflict The system does not have any data on the installed motor	• Replace memory card with correct system information
	d8 – Old Shared Data System data is obsolete	• If system will not operate, order new memory card to update system information
	25 – Condensate Overflow Fault The system has detected the condensate overflow float switch open	• Check for blocked condensate drain • Check condensate flow switch
	60 – Blower Fault Running The ECM motor is running but has a fault	• Test the ECM for proper operation

ICC and Blower Controls

Dual 7 - Segment LEDs Display Code	Diagnostic Description	Status/Possible Cause – Troubleshooting Information
	61 – Blower Fault – Not Running The ECM motor is not operating	• Make sure the ECM motor wiring harness is plugged into the ECM motor and control board • Test the ECM motor for proper operation
	68 – ECM No Signal The ECM motor is not communicating to the blower control	• Make sure the ECM motor wiring harness is plugged into the ECM motor and control board • Test the ECM motor for proper operation using a service tool
	81 – Return Air Sensor Out of Range The resistance of the sensor is out of range for normal operation	• Make sure the sensor is plugged into the blower control board • Check the resistance of the sensor. Replace if it is out of tolerance
	82 – Supply Air Sensor Out of Range The resistance of the sensor is out of range for normal operation	• Make sure the sensor is plugged into the blower control board • Check the resistance of the sensor. Replace if it is out of tolerance
	93 – Internal Control Fault The control is not functioning properly	• Check control for proper system operation • Replace control

ICC and Blower Controls

Figure 29: ICC Control Board

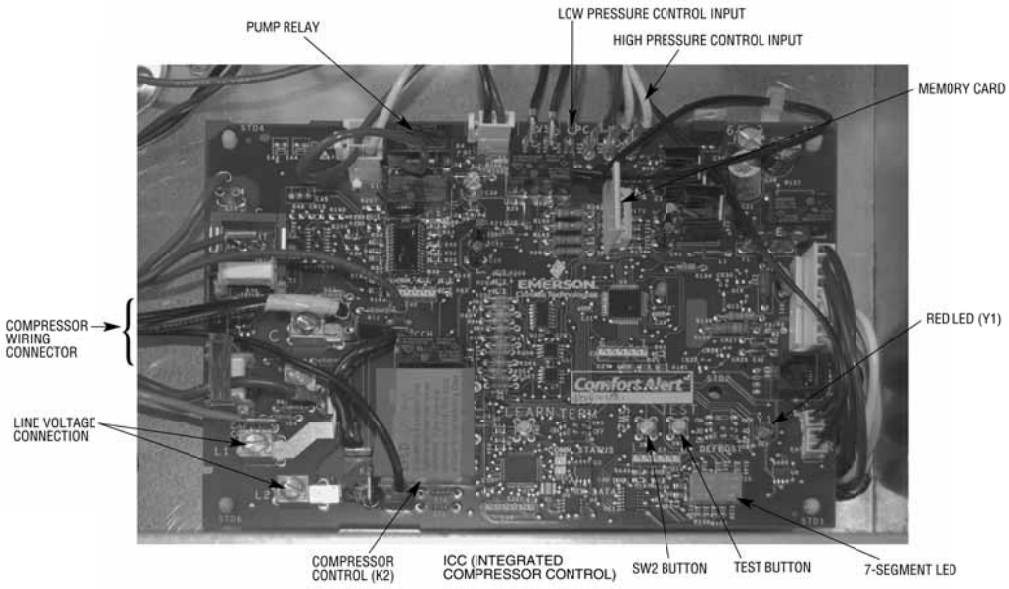


Figure 30: Blower Control Board

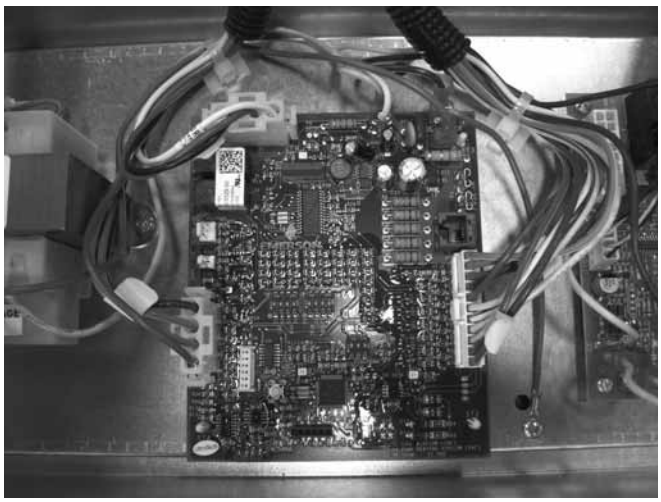


Table 6: Unit Operation

Comfort Control[2] System Demand	24 VAC Thermostat Signals	System Operation
Fan Only	G	Constant Fan
Stage 1 Heating	Y1, G	1st Stage Compressor & Fan, 1st Stage Pump
Stage 2 Heating	Y1, Y2, G	2nd Stage Compressor & Fan, 1st & 2nd Stage Pumps
Stage 3 Heating	Y1, Y2, W1 (W2), G	2nd Stage Compressor & Fan, 1st & 2nd Stage Pumps, Auxiliary Heat
Emergency Heat	W1 (W2), G	Fan & Auxiliary Heat
Stage 1 Cooling	Y1, O, G	1st Stage Compressor & Fan, 1st Stage Pump, Reversing Valve
Stage 2 Cooling	Y1, Y2, O G	2nd Stage Compresor & Fan, 1st & 2nd Stage Pumps, Reversing Valve

Table 7: Nominal resistance at various temperatures

Temp (°C)	Temp (°F)	Resistance (kOhm)	Temp (°C)	Temp (°F)	Resistance (kOhm)
-17.8	0.0	85.41	55	131.0	2.99
-17.5	0.5	84.16	56	132.8	2.88
-16.9	1.5	81.43	57	134.6	2.77
-12	10.4	61.70	58	136.4	2.67
-11	12.2	58.40	59	138.2	2.58
-10	14.0	55.30	60	140.0	2.49
-9	15.8	52.40	61	141.8	2.40
-8	17.6	49.60	62	143.6	2.32
-7	19.4	47.00	63	145.4	2.23
-6	21.2	44.60	64	147.2	2.16
-5	23.0	42.30	65	149.0	2.08
-4	24.8	40.10	66	150.8	2.01
-3	26.6	38.10	67	152.6	1.94
-2	28.4	36.10	68	154.4	1.88
-1	30.2	34.30	69	156.2	1.81
0	32.0	32.60	70	158.0	1.75
1	33.8	31.00	71	159.8	1.69
2	35.6	29.40	72	161.6	1.64
3	37.4	28.00	73	163.4	1.58
4	39.2	26.60	74	165.2	1.53
5	41.0	25.30	75	167.0	1.48
6	42.8	24.10	76	168.8	1.43
7	44.6	23.00	77	170.6	1.38
8	46.4	21.90	78	172.4	1.34
9	48.2	20.80	79	174.2	1.30
10	50.0	19.90	80	176.0	1.26
11	51.8	18.97	81	177.8	1.22
12	53.6	18.09	82	179.6	1.18
13	55.4	17.25	83	181.4	1.14
14	57.2	16.46	84	183.2	1.10
15	59.0	15.71	85	185.0	1.07
16	60.8	15.00	86	186.8	1.04
17	62.6	14.32	87	188.6	1.00
18	64.4	13.68	88	190.4	0.97
19	66.2	13.07	89	192.2	0.94
20	68.0	12.49	90	194.0	0.92
21	69.8	11.94	91	195.8	0.89
22	71.6	11.42	92	197.6	0.86
23	73.4	10.92	93	199.4	0.84
24	75.2	10.45	94	201.2	0.81
25	77.0	10.00	95	203.0	0.79
26	78.8	9.57	96	204.8	0.76
27	80.6	9.17	97	206.6	0.74
28	82.4	8.78	98	208.4	0.72
29	84.2	8.41	99	210.2	0.70
30	86.0	8.06	100	212.0	0.68
31	87.8	7.72	101	213.8	0.66
32	89.6	7.40	102	215.6	0.64
33	91.4	7.10	103	217.4	0.62
34	93.2	6.81	104	219.2	0.60
35	95.0	6.53	105	221.0	0.59
36	96.8	6.27	106	222.8	0.57
37	98.6	6.02	107	224.6	0.56
38	100.4	5.78	108	226.4	0.54
39	102.2	5.55	109	228.2	0.53
40	104.0	5.33	110	230.0	0.51
41	105.8	5.12	111	231.8	0.50
42	107.6	4.92	112	233.6	0.48
43	109.4	4.73	113	235.4	0.47
44	111.2	4.54	114	237.2	0.46
45	113.0	4.37	115	239.0	0.45
46	114.8	4.20	116	240.8	0.43
47	116.6	4.04	117	242.6	0.42
48	118.4	3.89	118	244.4	0.41
49	120.2	3.74	119	246.2	0.40
50	122.0	3.60	120	248.0	0.39
51	123.8	3.47	121	249.8	0.38
52	125.6	3.34	122	251.6	0.37
53	127.4	3.22	123	253.4	0.36
54	129.2	3.10			

Unit Commissioning And Operating Conditions

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 insure 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 appropriate operating conditions.

Table 8a: Building Operating Limits

Operating Limits	RPV V/H/D	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	110ºF [43ºC]	85ºF [29ºC]
Min. entering air, DB/WB	60/45ºF [16/7ºC]	40ºF [4.4ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	100/75ºF [38/24ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

Commissioning Conditions
Consult Table 8b for appropriate commissioning conditions. Commissioning conditions vary and are based upon the following notes:

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

Table 8b: Building Commissioning Limits

Commissioning Limits	RPV V/H/D	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	110ºF [43ºC]	85ºF [29ºC]
Min. entering air, DB/WB	50ºF [10ºC]	40ºF [4.5ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	110/83ºF [43/28ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

Unit Starting and Operating Conditions

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 ICC 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 disabled 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 ICC 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 - JW1).
- ❑ Miscellaneous: Note any questionable aspects of the installation.

⚠ CAUTION! ⚠

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

⚠ CAUTION! ⚠

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

Unit Start-up Procedure

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 8. 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 ICC control board. 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 Table 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 10a. Check the temperature of both

Unit Start-Up Procedure

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 Table 10b. 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 Table 9.

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.

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 10a. 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 Table 10b. 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 ICC and blower controls 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.

Unit Operating Conditions

Table 9: RPV V/H/D Coax Water Pressure Drop

Model	GPM	Pressure Drop (psi)				
		30°F	50°F	70°F	90°F	100°F
025	3.5	1.2	1.0	0.9	0.8	0.8
	4.0	1.5	1.3	1.1	1.0	1.0
	5.8	2.9	2.4	2.1	1.9	1.8
	6.0	3.1	2.6	2.3	2.1	2.0
	7.0	4.1	3.4	3.0	2.7	2.6
	8.0	5.1	4.3	3.8	3.4	3.2
036	4.0	1.2	1.0	0.8	0.7	0.6
	4.5	1.7	1.3	1.1	0.9	0.8
	6.0	2.6	2.5	2.3	2.1	2.0
	6.8	3.3	3.1	2.9	2.7	2.6
	8.0	4.5	4.2	4.0	3.7	3.6
	9.0	5.7	5.2	4.8	4.4	4.2
048	5.5	1.1	0.9	0.8	0.7	0.7
	6.0	1.3	1.1	0.9	0.9	0.8
	8.3	2.3	2.1	2.0	1.8	1.8
	9.0	2.7	2.5	2.3	2.2	2.1
	11.0	3.9	3.6	3.3	3.1	3.0
	12.0	4.6	4.2	3.8	3.5	3.3
062	7.0	0.5	0.3	0.2	0.1	0.1
	7.5	0.6	0.4	0.3	0.2	0.1
	10.5	1.9	1.8	1.7	1.5	1.5
	11.3	2.3	2.1	2.0	1.9	1.8
	14.0	3.9	3.6	3.3	3.0	2.8
	15.0	4.8	4.3	3.9	3.5	3.3
069	7.5	1.7	1.5	1.3	1.3	1.2
	8.5	2.2	1.9	1.7	1.6	1.5
	11.3	3.9	3.4	3.0	2.8	2.7
	12.8	5.0	4.3	3.9	3.6	3.4
	15.0	6.9	6.0	5.4	5.0	4.8
	17.0	8.9	7.7	6.9	6.5	6.1

Table 10a: Water Temperature Change Through Heat Exchanger

Water Flow, gpm (l/m)	**Rise, Cooling** °F (°C)	**Drop, Heating** °F (°C)
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton (3.9 l/m per kw)	9 - 12 (5 - 6.7)	4 - 8 (2.2 - 4.4)
For Open Loop: Ground Water Systems at 1.5 gpm per ton (2.0 l/m per kw)	20 - 26 (11.1 - 14.4)	10 - 17 (5.6 - 9.4)

Antifreeze Correction Table

Antifreeze Type	**Antifreeze %**	**Cooling**			**Heating**		**WPD Corr. Fct. EWT 30°F**
		EWT 90°F			**EWT 30°F**		
		Total Cap	**Sens Cap**	**Power**	**Htg Cap**	**Power**	
Water	0	1.000	1.000	1.000	1.000	1.000	1.000
Propylene Glycol	5	0.995	0.995	1.003	0.989	0.997	1.070
	15	0.986	0.986	1.009	0.968	0.990	1.210
	25	0.978	0.978	1.014	0.947	0.983	1.360
Methanol	5	0.997	0.997	1.002	0.989	0.997	1.070
	15	0.990	0.990	1.007	0.968	0.990	1.160
	25	0.982	0.982	1.012	0.949	0.984	1.220
Ethanol	5	0.998	0.998	1.002	0.981	0.994	1.140
	15	0.994	0.994	1.005	0.944	0.983	1.300
	25	0.986	0.986	1.009	0.917	0.974	1.360
Ethylene Glycol	5	0.998	0.998	1.002	0.993	0.998	1.040
	15	0.994	0.994	1.004	0.980	0.994	1.120
	25	0.988	0.988	1.008	0.966	0.990	1.200

Table 10b: RPV V/H/D Heat of Rejection/Heat of Extraction

Model	Stage	GPM	CFM	**Cooling EAT = 80/67°F** Heat of Rejection (in mbtu/h)					**Heating EAT = 70°F** Heat of Extraction (in mbtu/h)			
				30°F	50°F	70°F	90°F	100°F	30°F	50°F	70°F	90°F
025	1	3.5	725 Clg 825 Htg	24.4	25.6	24.3	22.6	21.7	10.3	14.8	18.8	22.6
		5.8		24.7	25.6	24.8	22.9	22.0	10.9	15.5	19.6	23.6
		7.0		24.7	25.6	24.9	23.1	22.1	11.1	15.7	19.9	23.9
	2	4.0	850 Clg 950 Htg	34.3	34.0	32.3	30.2	29.2	13.2	19.4	24.4	28.8
		6.0		34.4	34.3	32.8	30.7	29.7	14.0	20.3	25.4	29.9
		8.0		34.5	34.4	33.1	31.0	29.9	14.4	20.8	25.9	30.4
036	1	4.0	1000	33.5	34.8	33.3	31.2	30.4	14.4	20.0	25.9	32.3
		6.0		33.6	34.9	33.8	31.7	30.8	15.1	21.0	27.4	34.2
		8.0		33.8	35.0	34.1	32.0	31.0	15.5	21.5	28.1	35.3
	2	4.5	1250	49.6	48.7	46.6	44.2	43.2	20.9	28.3	36.0	44.0
		6.8		49.4	49.2	47.4	45.0	43.8	22.1	30.0	38.2	46.9
		9.0		49.4	49.4	47.8	45.4	44.2	22.8	30.9	39.5	48.5
048	1	5.5	1300 Clg 1400 Htg	43.2	46.5	45.4	42.3	40.7	18.9	27.2	36.4	45.3
		8.3		43.2	46.6	46.1	43.2	41.5	19.8	28.8	38.6	47.6
		11.0		43.3	46.7	46.4	43.6	41.9	20.3	29.6	39.7	48.8
	2	6.0	1550 Clg 1650 Htg	65.0	64.7	61.6	57.4	55.4	25.7	35.8	46.6	57.7
		9.0		65.0	65.4	62.8	58.8	56.6	27.2	38.0	49.7	61.6
		12.0		65.1	65.5	63.4	59.5	57.3	28.0	39.3	51.4	63.6
062	1	7.0	1500 Clg 1650 Htg	55.0	59.2	56.5	52.6	50.9	22.9	32.1	41.7	51.0
		10.5		55.98	59.3	57.5	53.6	51.7	23.9	33.6	43.7	53.2
		14.5		57.4	59.4	57.9	54.1	52.1	24.4	34.4	44.8	54.3
	2	7.5	1825 Clg 2050 Htg	77.2	80.9	78.5	74.6	72.6	32.6	43.8	55.6	68.1
		11.3		77.8	81.0	79.6	75.9	73.9	33.1	46.2	58.8	72.4
		15.0		78.9	81.1	80.1	76.6	74.6	35.2	47.5	60.6	74.8
069	1	7.5	1500 Clg 1600 Htg	66.2	70.5	67.5	63.3	61.5	24.6	36.9	50.3	63.1
		11.3		66.7	70.6	68.7	64.5	62.5	25.9	39.2	53.5	66.4
		15.0		67.5	70.7	69.2	65.2	63.0	26.6	40.5	55.3	68.1
	2	8.5	1950 Clg 2100 Htg	86.0	93.7	89.1	83.3	80.9	33.7	49.1	66.1	81.8
		12.8		86.1	93.8	90.8	85.2	82.3	35.7	52.7	70.7	86.3
		17.0		86.3	93.9	91.4	86.3	83.2	36.8	54.6	73.2	88.4

Unit Operating Conditions

Table 11: RPV V/H/D Series Typical Unit Operating Pressures and Temperatures

025		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	Subcool-ing	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcool-ing	Water Temp Drop °F	Air Temp Rise °F DB
30	1.5 2.25 3	118-128 118-128 118-128	159-179 146-166 132-152	25-30 25-30 25-30	9-14 7-12 7-12	16.7-18.7 12.3-14.3 7.9-9.9	19-25 20-26 20-26	72-83 75-85 78-88	273-293 275-295 277-297	6-11 6-11 6-11	3-8 3-8 3-8	5.9-7.9 4.2-6.2 2.7-4.7	16-22 17-23 18-24
50	1.5 2.25 3	128-138 128-138 128-138	186-206 172-192 158-178	18-23 18-23 18-23	8-13 6-11 6-11	16.3-18.3 12.1-14.1 7.8-9.8	19-25 20-26 20-26	102-112 106-116 110-120	302-322 303-323 305-325	8-12 8-12 8-12	6-11 6-11 6-11	8.9-10.9 6.7-8.7 4.5-6.5	22-28 23-29 23-29
70	1.5 2.25 3	136-146 136-146 136-146	281-301 267-287 253-273	7-12 7-12 7-12	7-12 5-10 4-9	15.7-17.7 11.6-13.6 7.6-9.6	19-25 19-25 19-25	128-138 134-144 141-151	330-350 332-352 334-354	10-15 10-15 10-15	8-13 8-13 8-13	11.3-13.3 8.5-10.5 5.8-7.8	27-34 28-35 28-35
90	1.5 2.25 3	139-149 139-149 139-149	368-388 354-374 340-360	6-11 6-11 6-11	7-12 5-10 5-10	14.9-16.9 11-13 7.2-9.2	18-24 18-24 18-24	162-172 166-176 171-181	367-387 372-392 377-397	14-19 15-20 17-22	10-15 10-15 10-15	14.4-16.4 10.8-12.8 7.1-9.1	33-41 34-42 34-42
110	1.5 2.25 3	143-153 143-153 143-153	465-485 450-470 433-453	6-11 6-11 6-11	7-12 5-10 5-10	13.9-15.9 10.2-12.2 6.5-8.5	17-23 17-23 17-23						

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 2.25 3	120-130 119-129 119-129	156-176 148-168 138-158	25-30 25-30 25-30	9-14 8-13 8-13	22.1-24.1 16.8-18.8 10.5-12.5	18-24 19-25 19-25	69-79 73-83 76-86	293-313 297-317 300-320	7-12 7-12 7-12	14-19 14-19 14-19	8.9-10.9 6.7-8.7 4.5-6.5	17-23 18-24 19-25
50	1.5 2.25 3	129-139 128-138 128-138	225-245 211-231 197-217	15-20 15-20 15-20	10-15 9-14 9-14	21.9-23.9 16.1-18.1 10.3-12.3	18-24 19-25 19-25	96-106 100-110 105-115	322-342 326-346 331-351	10-15 10-15 10-15	17-22 17-22 17-22	12.2-14.2 9.3-11.3 6.4-8.4	23-29 24-30 24-30
70	1.5 2.25 3	136-146 135-145 135-145	302-322 283-303 265-285	9-14 9-14 9-14	13-18 12-17 12-17	21.5-23.5 15.8-17.8 10-12	18-24 19-25 19-25	123-133 129-139 135-145	352-372 358-378 364-384	11-16 11-16 11-16	19-24 19-24 19-24	15-17 11.6-13.6 8.2-10.2	28-35 29-36 30-37
90	1.5 2.25 3	140-150 140-150 140-150	390-410 369-389 349-369	7-12 8-13 8-13	13-18 8-13 8-13	20.5-22.5 14.9-16.9 9.3-11.3	17-23 17-23 17-23	157-167 169-179 181-191	390-410 399-419 408-428	13-18 13-18 14-19	18-23 16.5-21.5 15-20	21-23 15.5-17.5 10.5-12.5	36-44 37-45 39-47
110	1.5 2.25 3	145-155 145-155 145-155	488-508 467-487 447-467	7-12 8-13 8-13	13-18 8-13 8-13	19-21 14-16 9-11	17-23 17-23 17-23						

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 2.25 3	112-122 111-121 111-121	187-207 167-187 147-167	22-27 22-27 23-28	14-19 12-17 11-16	20.7-22.7 15.5-17.5 10.2-12.2	18-24 18-24 18-24	66-76 69-79 72-82	286-306 289-309 292-312	7-12 7-12 7-12	8-13 9-14 9-14	8-10 6-8 4-6	18-24 19-25 19-25
50	1.5 2.25 3	125-135 123-133 122-132	242-262 224-244 205-225	13-18 13-18 14-19	10-15 9-14 7-12	20.9-22.9 15.6-17.6 10.2-12.2	19-25 19-25 19-25	93-103 98-108 103-113	314-334 320-340 326-346	8-13 8-13 8-13	10-15 10-15 10-15	11.5-13.5 8.7-10.7 5.9-7.9	23-29 24-30 25-31
70	1.5 2.25 3	133-143 132-142 131-141	310-330 290-310 270-290	8-13 8-13 9-14	8-13 7-12 5-10	20.5-22.5 15.2-17.2 9.9-11.9	19-25 19-25 19-25	123-133 130-140 137-147	344-364 354-374 361-381	9-14 9-14 9-14	9-14 9-14 9-14	15-17 11.5-13.5 7.9-9.9	28-35 29-36 30-37
90	1.5 2.25 3	138-148 137-147 136-146	396-416 374-394 352-372	7-12 7-12 7-12	7-12 6-11 4-9	19.2-21.2 14.3-16.3 9.3-11.3	18-24 18-24 18-24	165-175 175-185 185-195	390-410 401-421 413-433	13-18 15-20 17-22	8-13 8-13 8-13	19.6-21.6 15-17 10.3-12.3	37-45 38-46 39-47
110	1.5 2.25 3	144-154 143-153 142-152	497-517 472-492 447-467	7-12 7-12 7-12	5-10 4-9 3-8	18-20 13.3-15.3 8.5-10.5	17-23 17-23 17-23						

Unit Operating Conditions

Table 11: RPV V/H/D Series Typical Unit Operating Pressures and Temperatures: Continued

062		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	Subcool-ing	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcool-ing	Water Temp Drop °F	Air Temp Rise °F DB
30	1.5 2.25 3	117-127 116-126 115-125	170-190 143-163 135-155	27-32 28-33 29-34	15-20 13-18 12-17	18.2-20.2 12.6-14.6 7-9	17-23 17-23 17-23	66-76 69-79 72-82	282-302 285-305 289-309	10-16 10-16 10-16	9-14 9-14 10-15	8-10 6-8 4-6	19-25 19-25 20-26
50	1.5 2.25 3	128-138 126-136 125-135	238-258 222-242 205-225	16-21 21-26 26-31	14-19 13-18 12-17	20.5-22.5 14.9-16.9 9.2-11.2	21-27 21-27 21-27	90-100 95-105 99-109	310-330 313-333 316-336	11-17 11-17 11-17	12-17 12-17 12-17	11.3-13.3 8.5-10.5 5.7-7.7	24-30 25-31 26-32
70	1.5 2.25 3	135-145 134-144 133-143	315-335 296-316 276-296	10-15 12-17 15-20	14-19 13-18 11-16	21-23 15.5-17.5 10-12	22-28 22-28 22-28	115-125 120-130 126-136	337-357 341-361 345-365	12-18 12-18 12-18	14-19 14-19 15-20	14-16 10.6-12.6 7.3-9.3	28-35 29-36 30-37
90	1.5 2.25 3	139-149 138-148 138-148	408-428 386-406 364-384	10-15 10-15 10-15	15-20 13-18 11-16	20.1-22.1 14.8-16.8 9.5-11.5	21-27 21-27 21-27	157-167 161-171 166-176	390-410 394-414 398-418	15-20 15-20 15-20	14-19 14-19 15-20	18.2-20.2 13.9-15.9 9.6-11.6	37-45 38-46 39-47
110	1.5 2.25 3	144-154 143-153 142-152	515-535 493-513 469-489	8-13 8-13 8-13	14-19 13-18 12-17	19-21 14-16 9-11	20-26 20-26 20-26						

069		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	Subcool-ing	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcool-ing	Water Temp Drop °F	Air Temp Rise °F DB
30	1.5 2.25 3	119-129 117-127 115-125	155-175 150-170 144-164	25-30 25-30 28-32	17-22 17-22 17-22	18-20 13.2-15.2 8.4-9.4	21-27 21-27 22-28	61-71 65-75 68-78	292-312 296-316 300-320	11-16 11-16 10-15	13-18 14-19 15-20	7.2-9.2 5.4-7.4 3.5-5.5	19-25 20-26 21-27
50	1.5 2.25 3	131-141 130-140 129-139	210-230 205-225 200-220	10-15 11-16 13-18	12-17 12-17 12-17	18.5-20.5 14-16 9.5-11.5	22-28 23-29 24-30	89-99 98-108 106-116	327-347 337-357 348-368	10-15 10-15 10-15	19-24 14-19 9-14	10.9-12.9 8.3-10.3 5.7-7.7	26-32 28-34 30-36
70	1.5 2.25 3	135-145 131-141 128-138	300-320 295-315 290-310	10-15 11-16 13-18	15-20 14-19 14-19	17.6-19.6 13.8-15.8 10-12	23-29 23-29 23-29	119-129 132-142 144-154	365-385 380-400 395-415	10-15 10-15 10-15	21-26 16-21 11-16	14.7-16.7 11.3-13.3 7.9-9.9	33-39 36-42 38-44
90	1.5 2.25 3	139-149 137-147 135-145	390-410 370-390 350-370	10-15 10-15 10-15	16-21 14-19 13-18	16.7-18.7 12.6-14.6 8.5-10.5	22-28 22-28 22-28	162-172 172-182 182-192	418-438 430-450 444-464	10-15 10-15 11-16	19-24 19-24 19-24	19.4-21.4 14.7-16.7 10.1-12.1	43-49 45-51 47-53
110	1.5 2.25 3	145-155 145-155 144-154	490-510 470-490 452-472	10-15 10-15 9-14	16-21 14-19 13-18	15.9-17.9 11.7-13.7 7.4-9	20-27 20-27 20-27						

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 "ICC Blower Control System Troubleshooting Process Flowchart" or "Functional Troubleshooting Chart."

ICC / Blower Control System
The ICC and Blower controls provide status and diagnostic information that greatly enhances the ability to quickly diagnose system faults.

NOTE In diagnosing common faults in the system develop a logical thought pattern as used by experienced technicians. The charts which follow are not intended to be an answer to all problems but only to guide the technician's troubleshooting.

Comfort Control^2 System Startup
If the communications wires are wired backwards at any point the green LED (COMM STATUS) will always be on. If this happens check the wires at each point to ensure they are not reversed

Once all devices are connected power up the line and low voltage system. When all devices are powered the thermostat should detect the ICC and Blower control within 45 seconds. Each control has a set of bias dipswitches set at a factory default to the ON position. These dipswitches are for future use. DO NOT CHANGE THESE DIPSWITCHES.

Once the system is powered the airflow settings will be configured for all devices. The ICC will send information to configure airflow to the Blower control. If the Blower control is incapable of supplying the required airflow a d3 fault will be displayed on the thermostat and ICC.

All devices have a LEARN button. This button is for future use and has no function at this time.

All airflow adjustments are made at the thermostat. Items that can be changed are Airflow trim adjustment, Dehumidification Setpoint, and mode of operation. The thermostat also has a wide range of fault and history information.

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 7. An ice bath can be used to check calibration of the thermistor.

ICC/Blower Control System Troubleshooting Flowchart/ Functional Troubleshooting Chart
The "ICC/Blower Control System Troubleshooting Flowchart" is a quick overview of how to start diagnosing a suspected problem, using the fault recognition features of the ICC control board. The "Functional Troubleshooting Chart" on the following page is a more comprehensive method for identifying a number of malfunctions that may occur, and is not limited to just the ICC and Blower controls.

⚠ 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.

Comfort Control^2 System Board Replacement
Verification of a Comfort Control^2 failure is required before replacement.

Each control board in the Comfort Control^2 System needs information specific to the unit the control is installed in. This information is called shared data because it is distributed (shared) on the HVAC network. The shared data for a unit contains information that allows the unit to operate correctly.

When a control board requires replacement, it is important that the replacement control gets the shared data from the old control. The primary way the replacement control gets this information is by the memory card that is installed in the old control. Remove the memory card from the old control, but leave it attached to the unit by the plastic tether, replace the control and reinstall the memory card on the new control. Never remove the memory card from the unit or cut the tether of a memory card as it is the most effective way to transfer the shared data. The unit will operate without a memory card, but a D3 error will be displayed on the ICC 7-segment LEDs.

The memory card from a different unit should never be used.

Figure 31: ICC Control Replacement

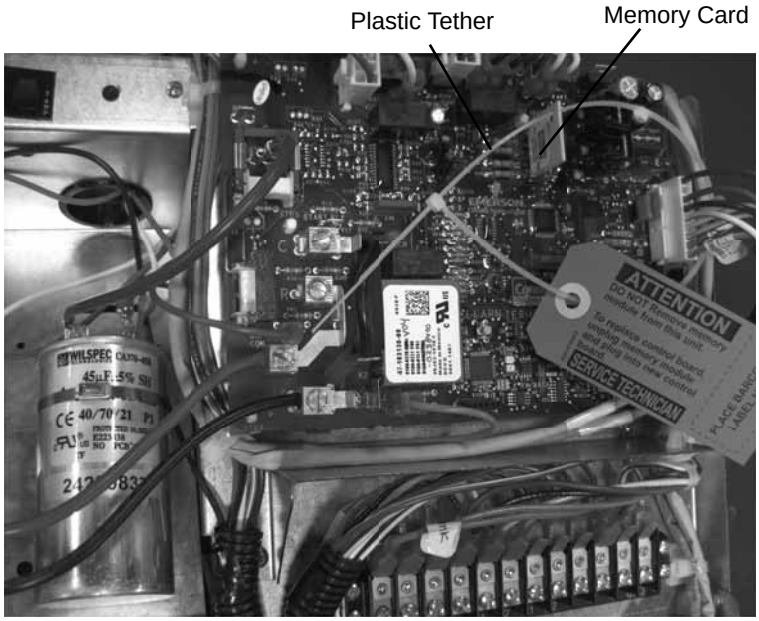
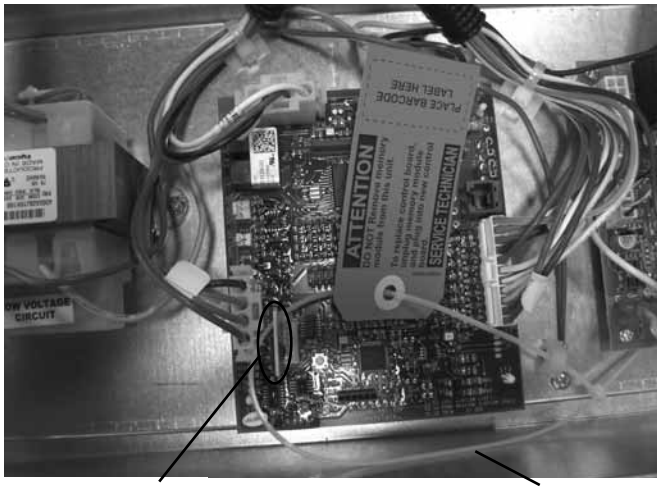


Figure 32: Blower Control Replacement



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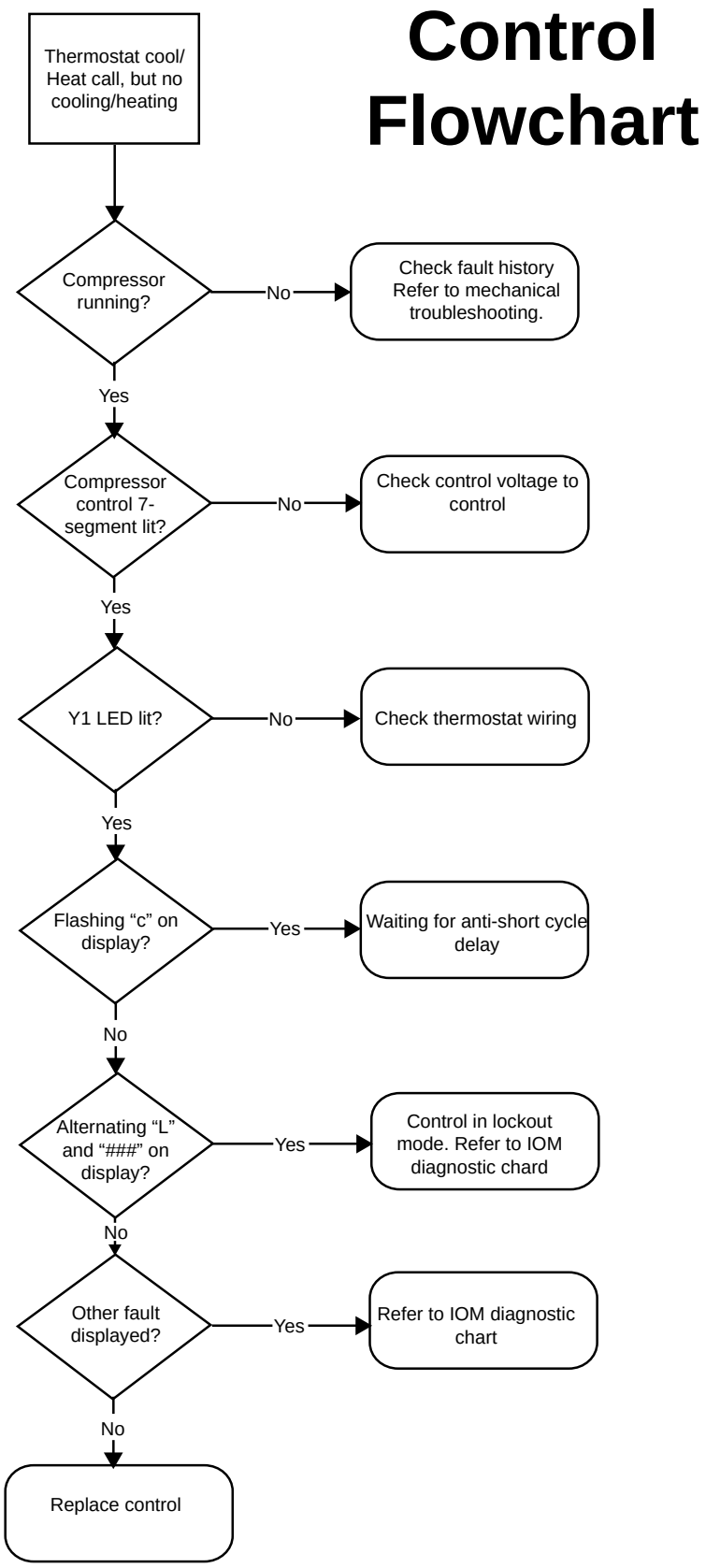
ICC/Blower Control System Troubleshooting Chart



Functional Troubleshooting

Fault	Htg	Clg	Possible Cause	Solution
Main power Problems **Fault Code 27**	X	X	Low or no line voltage	Check Line Voltage circuit breaker and disconnect
				Check for line voltage between L1 and L2 on the control board
HP Fault-Code 29 High pressure		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting
				Check water flow adjust to proper flow rate
		X	Water Temperature out of range in cooling	Bring water temp within design parameters
	X		Reduced or no Air flow in heating	Check for dirty air filter and clean or replace
				Check fan motor operation and airflow restrictions
				Dirty Air Coil- construction dust etc.
				Too high of external static. Check static vs blower table
	X		Air Temperature out of range in heating	Bring return air temp within design parameters
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table
	X	X	Bad HP Switch	Check switch continuity and operation. Replace
LP/LOC Fault-Code 21	X	X	Insufficient charge	Check for refrigerant leaks
Low Pressure/Loss of Charge	X		Compressor pump down at start-up	Check charge and start-up water flow
FP1 Fault - Code 85 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 anti-freeze level	Check antifreeze density with hydrometer
	X		Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Clip JW1 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
FP2 fault - Code 86 Air Coil low temperature limit		X	Reduced or no Air flow in cooling	Check for dirty air filter and clean or replace
				Check fan motor operation and airflow restrictions
				Too high of external static. Check static vs blower table
		X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters
		X	Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Normal airside applications will require 30°F [-1°C] only
	X	X	Bad thermistor	Check temp and impedance correlation per chart
Condensate Fault-Code 25	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
Under Voltage- Code 09 (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
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	Insure 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.

Functional Troubleshooting

Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	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 ICC board.
				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	Thermostat wiring	Put thermostat in cooling mode. Check for 24VAC on O (check between C and O); check for 24VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, thermostat may be bad or wired incorrectly.

Performance Troubleshooting

Performance Troubleshooting	**Htg**	**Clg**	**Possible Cause**	**Solution**
Insufficient capacity/	X	X	Dirty Filter	Replace or clean
Not cooling or heating	X		Reduced or no Air flow	Check for dirty air filter and clean or replace
properly			in heating	Check fan motor operation and airflow restrictions
				Too high of external static. Check static vs blower table
		X	Reduced or no Air flow	Check for dirty air filter and clean or replace
			in cooling	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 clg load and heat pump capacity
	X	X	Scaling in water heat exchanger	Perform Scaling check and clean if necessary
	X	X	Inlet Water too Hot or Cold	Check load, loop sizing, loop backfill, ground moisture.
High Head Pressure	X		Reduced or no Air flow	Check for dirty air filter and clean or replace
			in heating	Check fan motor operation and airflow restrictions
				Too high of external static. Check static vs blower table
		X	Reduced or no water flow	Check pump operation or valve operation/setting
			in cooling	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 temp within design parameters
		X	Scaling in water heat exchanger	Perform Scaling check and clean if necessary
	X	X	Unit Overcharged	Check superheat and subcooling. Reweigh in charge
	X	X	Non-condensables insystem	Vacuum system and reweigh in charge
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
Low Suction Pressure	X		Reduced water flow	Check pump operation or water valve operation/setting
			in heating	Plugged strainer or filter. Clean or replace.
				Check water flow adjust to proper flow rate
	X		Water Temperature out of range	Bring water temp within design parameters
		X	Reduced Air flow	Check for dirty air filter and clean or replace
			in cooling	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	X	Insufficient charge	Check for refrigerant leaks
Low discharge air temperature in heating	X		Too high of air flow	Check fan motor speed selection and airflow chart
	X		Poor Performance	See 'Insufficient Capacity'
High humidity		X	Too high of air flow	Check fan motor speed selection and airflow chart
		X	Unit oversized	Recheck loads & sizing check sensible clg load and heat pump capacity

Troubleshooting Form

Packaged Unit Refrigeration Schematic

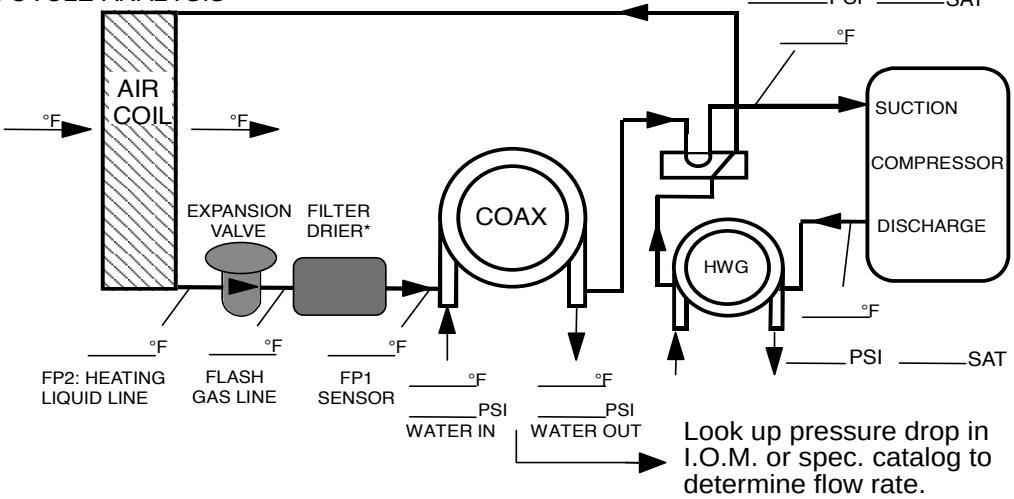
Date: _____

Customer: _____ Antifreeze: _____

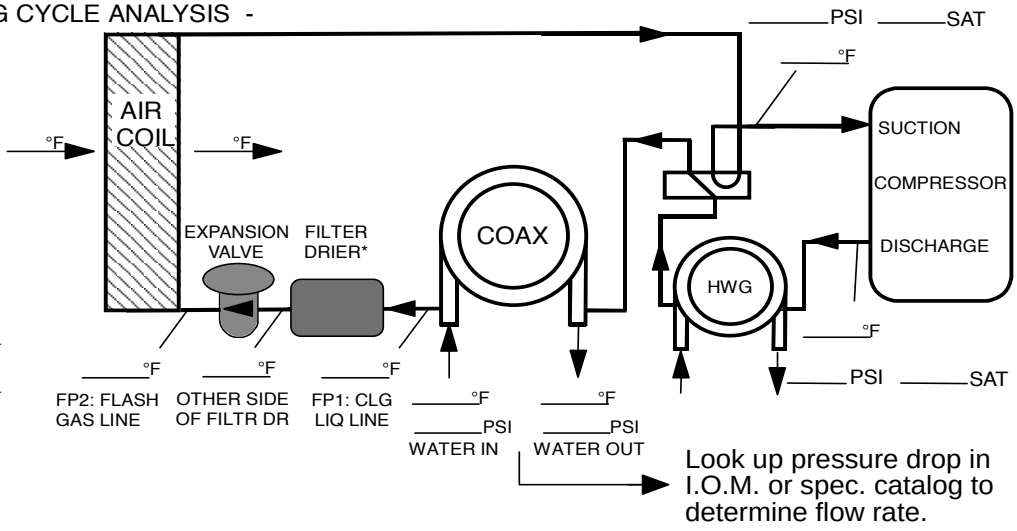
Model#: _____ Serial#: _____ Loop type: _____

Complaint: _____

HEATING CYCLE ANALYSIS -



COOLING CYCLE ANALYSIS -



Refrigerant Type:

HFC-410A

Voltage: _____

Comp Amps: _____

Total Amps: _____

Heat of Extraction (Absorption) or Heat of Rejection =

_____ flow rate (gpm) x _____ temp.diff. (deg. F) x _____ fluid factor† = _____ (Btu/hr)

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

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

† Use 500 for water, 485 for antifreeze.

Rev. 12/08

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/LIMITATION OF REMEDIES AND LIABILITY FOR RESIDENTIAL RPV GEOTHERMAL PRODUCTS WITH LABOR ALLOWANCE

It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Climate Master, Inc., a Delaware corporation, ("Manufacturer") or its representatives, relating to any of Manufacturer's products, whether oral, written or contained in any sales literature, catalog or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely Manufacturer's opinion or commendation of Manufacturer's products. Except to the extent specifically set forth herein, any statements made by Rheem Sales Company, Inc., Rheem Manufacturing Company or their affiliates or representatives ("Rheem"), relating to any of Manufacturer's products, whether oral, written or contained in any sales literature, catalog or agreement are not express warranties of Manufacturer and are not binding on Manufacturer. EXCEPT AS SPECIFICALLY SET FORTH HEREIN, THERE IS NO EXPRESS OR IMPLIED WARRANTY AS TO ANY OF MANUFACTURER'S PRODUCTS. MANUFACTURER MAKES NO WARRANTY AGAINST LATENT DEFECTS. MANUFACTURER MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE. RHEEM SALES COMPANY, INC., RHEEM MANUFACTURING COMPANY AND THEIR AFFILIATES DO NOT MANUFACTURE ANY OF THE PRODUCTS COVERED BY THIS WARRANTY AND THEY DO NOT OFFER, AND SHALL NOT BE LIABLE FOR, ANY WARRANTY WHATSOEVER IN CONNECTION WITH THE PRODUCTS COVERED BY THIS WARRANTY. CLIMATE MASTER, INC. IS THE MANUFACTURER OR SUPPLIER OF THE PRODUCTS COVERED BY THIS WARRANTY AND IS THE ONLY ENTITY THAT OFFERS ANY WARRANTY IN CONNECTION WITH SUCH PRODUCTS, WHICH LIMITED WARRANTY IS SET FORTH IN ITS ENTIRETY HEREIN.

GRANT OF LIMITED EXPRESS WARRANTY

Manufacturer warrants its following residential geothermal products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows: (1) Geothermal air conditioning, heating and/or heat pump units built or sold by Manufacturer that are branded as "Rheem" or "Ruud" ("RPV Geothermal Units") for ten (10) years from the Warranty Inception Date (as defined below); (2)Auxiliary electric heaters and geothermal pumping modules built or sold by Manufacturer, when installed with RPV Geothermal Units, for ten (10) years from the Warranty Inception Date (as defined below); (3) Sealed refrigerant circuit components of RPV Geothermal Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for ten (10) years from the Warranty Inception Date (as defined below); and (4) other accessories and parts built or sold by Manufacturer which are not supplied under warranty for one (1) year from the date of shipment from Manufacturer. The "Warranty Inception Date" shall be the date of original unit installation, or six (6) months from date of unit shipment from Manufacturer, whichever comes first.

This Limited Express Warranty shall cover the labor incurred by Manufacturer authorized service personnel in connection with the installation of a new or repaired warranty part that is covered by this Limited Express Warranty only to the extent specifically set forth in the then existing labor allowance schedule provided by Manufacturer's Warranty Department and only as follows: (1) Manufacturer Units for two (2) years from the Warranty Inception Date; (2) Auxiliary electric heaters and geothermal pumping modules built or sold by Manufacturer, when installed with Manufacturer Units, for two (2) years from the Warranty Inception Date; and (3) Sealed refrigerant circuit components of Manufacturer Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for five (5) years from the Warranty Inception Date. Actual Labor costs are not covered by this Limited Express Warranty to the extent they exceed the amount allowed under said allowance schedule, they are not specifically provided for in said allowance schedule, they are not the result of work performed by Manufacturer authorized service personnel, they are incurred in connection with a part not covered by this Limited Express Warranty, or they are incurred more than the time periods set forth in this paragraph after the Warranty Inception Date.

To make a claim under this warranty, parts must be returned to Manufacturer in Oklahoma City, Oklahoma, freight prepaid, no later than ninety (90) days after the date of the failure of the part; if Manufacturer determines the part to be defective and within Manufacturer's Limited Express Warranty, Manufacturer shall, when such part has been either replaced or repaired, return such to a factory recognized distributor, dealer or service organization, F.O.B. Manufacturer, Oklahoma City, Oklahoma, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

This 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 Manufacturer, regardless of the cause of the failure of such portion or component; (4) Products on which the unit identification tags or labels have been removed or defaced; (5) Products on which payment to Manufacturer, or to the owner's seller or installing contractor, is in default; (6) Products subjected to improper or inadequate installation, maintenance, repair, wiring or voltage conditions; (7) Products subjected to accident, misuse, negligence, abuse, fire, flood, 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; (8) Mold, fungus or bacteria damages; (9) Corrosion or abrasion of the product; (10) Products supplied by others; (11) Products which have been operated in a manner contrary to Manufacturer's printed instructions; (12) Products which have insufficient performance as a result of improper system design or improper application, installation, or use of Manufacturer's products; or (13) Electricity or fuel costs, or any increases or unrealized savings in same, for any reason whatsoever.

This Limited Express Warranty provides the limited labor coverage set for the above. Otherwise, Manufacturer 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 a defective part covered by Manufacturer's Limited Express Warranty; (2) The costs of labor, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part; (3) Transportation costs of the defective part from the installation site to Manufacturer, or of the return of that part if not covered by Manufacturer's Limited Express Warranty; or (4) The costs of normal maintenance.

This Limited Express Warranty applies to Manufacturer Residential Class products ordered from Manufacturer on or after June 7, 2010 (this would generally include Manufacturer Units with serial numbers beginning with "RN322" and higher), and is not retroactive to an y products ordered from Manufacturer prior to June 7, 2010 (this would generally include Manufacturer Units with serial numbers beginning with "RN321" and lower). If you are unsure if this Limited Express Warranty applies to the product you have purchased, contact Manufacturer at the phone number or address reflected below.

Limitation: This Limited Express Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without limitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Warranty.

LIMITATION OF REMEDIES

In the event of a breach of the Limited Express Warranty, Manufacturer will only be obligated at Manufacturer's option to repair the failed 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 Manufacturer's factory in Oklahoma City, Oklahoma of each defect, malfunction or other failure, and a reasonable number of attempts by Manufacturer to correct the defect, malfunction or other failure, and the remedy fails of its essential purpose, Manufacturer shall refund the purchase price paid to Manufacturer in exchange for the return of the sold good(s). Said refund shall be the maximum liability of Manufacturer. THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR PURCHASER AGAINST MANUFACTURER FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR MANUFACTURER'S NEGLIGENCE OR IN STRICT LIABILITY.

LIMITATION OF LIABILITY

Manufacturer shall have no liability for any damages if Manufacturer'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 Manufacturer. MANUFACTURER EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR MANUFACTURER'S NEGLIGENCE OR AS STRICT LIABILITY.

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 Manufacturer 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 limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. 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.

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

Rev.: May 21, 2010
Part No.: RH015

Optional Warranty

CLIMATE MASTER, INC.

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Manufacturer warrants its following residential geothermal products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows: (1) Geothermal air conditioning, heating and/or heat pump units built or sold by Manufacturer that are branded as "Rheem" or "Ruud" ("RPV Geothermal Units") for ten (10) years from the Warranty Inception Date (as defined below); (2)Auxiliary electric heaters and geothermal pumping modules built or sold by Manufacturer, when installed with RPV Geothermal Units, for ten (10) years from the Warranty Inception Date (as defined below); (3) Sealed refrigerant circuit components of RPV Geothermal Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for ten (10) years from the Warranty Inception Date (as defined below); and (4) other accessories and parts built or sold by Manufacturer which are not supplied under warranty for one (1) year from the date of shipment from Manufacturer. The "Warranty Inception Date" shall be the date of original unit installation, or six (6) months from date of unit shipment from Manufacturer, whichever comes first.

To make a claim under this warranty, parts must be returned to Manufacturer in Oklahoma City, Oklahoma, freight prepaid, no later than ninety (90) days after the date of the failure of the part; if Manufacturer determines the part to be defective and within Manufacturer's Limited Express Warranty, Manufacturer shall, when such part has been either replaced or repaired, return such to a factory recognized distributor, dealer or service organization, F.O.B. Manufacturer, Oklahoma City, Oklahoma, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

This Limited Express Warranty shall cover the labor incurred by Manufacturer authorized service personnel in connection with the installation of a new or repaired warranty part that is covered by this Limited Express Warranty only to the extent specifically set forth in the then existing labor allowance schedule provided by Manufacturer's Warranty Department and only as follows: (1) Manufacturer Units for ten (10) years from the Warranty Inception Date; (2) Auxiliary electric heaters and geothermal pumping modules built or sold by Manufacturer, when installed with Manufacturer Units, for ten (10) years from the Warranty Inception Date; and (3) Sealed refrigerant circuit components of Manufacturer Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for ten (10) years from the Warranty Inception Date. Actual Labor costs are not covered by this Limited Express Warranty to the extent they exceed the amount allowed under said allowance schedule, they are not specifically provided for in said allowance schedule, they are not the result of work performed by Manufacturer authorized service personnel, they are incurred in connection with a part not covered by this Limited Express Warranty, or they are incurred more than the time periods set forth in this paragraph after the Warranty Inception Date.

This 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 Manufacturer, regardless of the cause of the failure of such portion or component; (4) Products on which the unit identification tags or labels have been removed or defaced; (5) Products on which payment to Manufacturer, or to the owner's seller or installing contractor, is in default; (6) Products subjected to improper or inadequate installation, maintenance, repair, wiring or voltage conditions; (7) Products subjected to accident, misuse, negligence, abuse, fire, flood, 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; (8) Mold, fungus or bacteria damages; (9) Corrosion or abrasion of the product; (10) Products supplied by others; (11) Products which have been operated in a manner contrary to Manufacturer's printed instructions; (12) Products which have insufficient performance as a result of improper system design or improper application, installation, or use of Manufacturer's products; or (13) Electricity or fuel costs, or any increases or unrealized savings in same, for any reason whatsoever.

This Limited Express Warranty provides the limited labor coverage set forth above. Otherwise, Manufacturer 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 a defective part covered by Manufacturer's Limited Express Warranty; (2) The costs of labor, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part; (3) Transportation costs of the defective part from the installation site to Manufacturer, or of the return of that part if not covered by Manufacturer's Limited Express Warranty; or (4) The costs of normal maintenance.

This Limited Express Warranty applies to Manufacturer Residential Class products ordered from Manufacturer on or after June 7, 2010 (this would generally include Manufacturer Units with serial numbers beginning with "RN322" and higher), and is not retroactive to any products ordered from Manufacturer prior to June 7, 2010 (this would generally include Manufacturer Units with serial numbers beginning with "RN321" and lower). If you are unsure if this Limited Express Warranty applies to the product you have purchased, contact Manufacturer at the phone number or address reflected below.

MANUFACTURER'S LIABILITY UNDER THE TERMS OF THIS LIMITED WARRANTY SHALL APPLY ONLY TO THE MANUFACTURER'S UNIT BEARING THE MODEL AND SERIAL NUMBERS STATED ON THE REVERSE SIDE AND MANUFACTURER SHALL NOT, IN ANY EVENT, BE LIABLE UNDER THE TERMS OF THIS LIMITED WARRANTY UNLESS THIS WARRANTY CERTIFICATE HAS BEEN VALIDATED BY MANUFACTURER IN THE SPACE PROVIDED ON THE REVERSE SIDE.

Limitation: This Limited Express Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without limitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Warranty.

LIMITATION OF REMEDIES

In the event of a breach of the Limited Express Warranty, Manufacturer will only be obligated at Manufacturer's option to repair the failed 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 Manufacturer's factory in Oklahoma City, Oklahoma of each defect, malfunction or other failure, and a reasonable number of attempts by Manufacturer to correct the defect, malfunction or other failure, and the remedy fails of its essential purpose, Manufacturer shall refund the purchase price paid to Manufacturer in exchange for the return of the sold good(s). Said refund shall be the maximum liability of Manufacturer. THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR PURCHASER AGAINST MANUFACTURER FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR MANUFACTURER'S NEGLIGENCE OR IN STRICT LIABILITY.

LIMITATION OF LIABILITY

Manufacturer shall have no liability for any damages if Manufacturer'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 Manufacturer. MANUFACTURER EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR MANUFACTURER'S NEGLIGENCE OR AS STRICT LIABILITY.

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 Manufacturer 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 limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. 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.

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

Rev.: May 21, 2010
Part No.: RH016

Revision History

Date	Page #	Description
10 March, 11	16	HWG Piping Drawings Revised
29 July, 10	4	Compressor isolation upgrade from Springs to grommets
7 May, 10	53-54	Updated Warranties
3 May, 10	16	HWG Piping Drawings Revised
12 Oct., 09	All	First Published

ISO 9001:2000 Certified

ENERGY STAR PARTNER

97B0077N01

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The Manufacturer works continually to improve its products. As a result, the design and specifications of each product at the time for order may be changed without notice and may not be as described herein. Please contact the Manufacturer's Customer Service Department at 1-405-357-0409 for specific information on the current design and specifications. Statements and other information contained herein are not express warranties and do not form the basis of any bargain between the parties, but are merely Manufacturer's opinion or commendation of its products.

The management system governing the manufacture of Manufacturer's products is ISO 9001:2000 certified.