

GC Series Geothermal Heat Pump Sizes 024, 036, 048, 060, 072

Installation Instructions

NOTE: Read the entire instruction manual before starting the installation.


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SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and current editions of the National Electrical Code (NEC) NFPA 70. In Canada, refer to current editions of the Canadian electrical code CSA 22.1.

Recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand these signal words; DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **would** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.

WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could result in personal injury or equipment damage.

Puron® refrigerant systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on Puron® refrigerant equipment.

WARNING



EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury, and/or property damage.

Never use air or gases containing oxygen for leak testing or operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to an explosion.

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 and gloves when handling parts.

CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in equipment damage and/or improper equipment operation.

It is extremely important to take the proper precautions to insure that the heat pump unit is installed in the proper location and that measures have been taken to prevent rupturing the water coil due to freezing conditions.

Frozen water coils are not covered under the limited product warranty.

INTRODUCTION

GC units are designed to be installed with a communicating User Interface. The unit will provide airflow at a rate commanded by the User Interface. The unit will provide airflow at a rate commanded by the User Interface. The nominal airflow/ton rate is 350 CFM/ton. The User Interface will modify the commanded airflow under certain operating modes. Refer to the User Interface literature for further system control details. This unit will not respond to commands from a common thermostat except under certain emergency situations explained in this document. The instructions contained herein provide guidance to successfully install the blower.

These units are designed specifically for Puron® (R-410A) refrigerant and must only be used with Puron® refrigerant.

These units are designed to meet low air leak requirements currently in effect. Because of this, units need special attention in the condensate pan and drain connection area and when brazing tubing.

Factory-authorized, field-installed electric heater packages are available in 5 through 20 kW. See Product Data for available accessory kits.

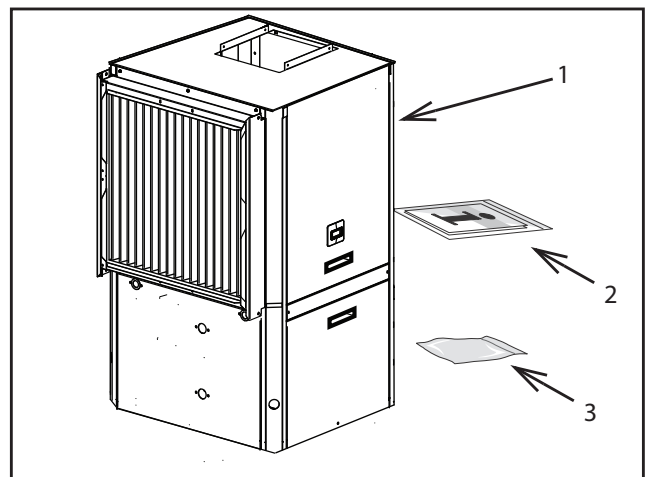


Fig. 1 - Standard Package

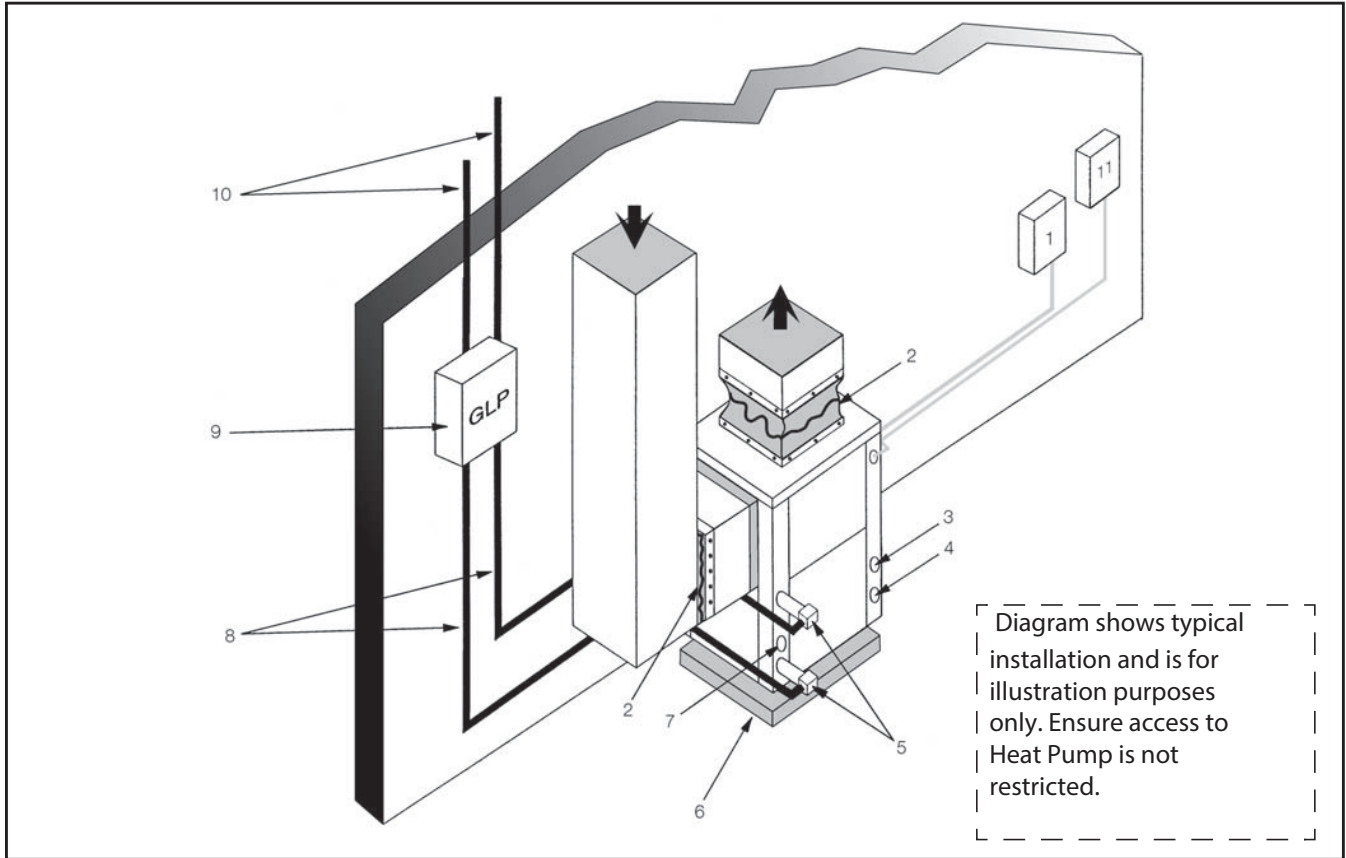
1. GC Series Water-To Air Heat Pump
2. Installation and Owner's Manual
3. Hanging Bracket Kit (HZ unit only)

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APPLICATION CONSIDERATIONS

Geothermal Systems

Closed loop and pond applications require specialized design knowledge. No attempt at these installations should be made unless the dealer has received specialized training. Anti-freeze solutions are utilized when low evaporating conditions are expected to occur. Refer to the Flow Center installation manuals for more specific instructions.



- (1) Line Voltage Disconnect (unit)
- (2) Flex Duct Connection
- (3) Low Voltage Control Connection
- (4) Line Voltage Connection
- (5) P/T Ports
- (6) Vibration Pad
- (7) Condensate Drain Connection
- (8) Ground Loop Connection Kit
- (9) Ground Loop Pumping Package
- (10) Polyethylene with Insulation
- (11) Line Voltage Disconnect (electric heater)

Fig. 2 - Example Geothermal System Setup

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Well Water Systems

IMPORTANT: Table 1 must be consulted for water quality requirements when using open loop systems. A water sample must be obtained and tested, with the results compared to the table. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH is <7.5 and the calcium hardness is <100 ppm, the potential for scaling is low. For numbers out of the range listed, a monitoring plan must be implemented due to probable scaling.

Other potential issues such as iron fouling, corrosion, erosion and clogging must be considered. Careful attention to water conditions must be exercised when considering a well water application.

Failure to perform water testing and/or applying a geothermal heat pump to a water supply that does not fall within the accepted quality parameters will be considered a mis-application of the unit and resulting heat exchanger failures will not be covered under warranty. Where a geothermal system will be used with adverse water conditions, a suitable plate-frame heat exchanger **MUST** be used to isolate the well water from the geothermal unit.

Proper testing is required to assure the well water quality is suitable for use with water source equipment.

In conditions anticipating moderate scale formation or in brackish water, a cupronickel heat exchanger is recommended. Copper is adequate for ground water that is not high in mineral content.

In well water applications, water pressure must always be maintained in the heat exchanger. This can be accomplished with either a control valve installed in the discharge line or a bladder type expansion tank.

When using a single water well to supply both domestic water and the heat pump, care must be taken to insure that the well can provide sufficient flow for both.

In well water applications, a slow closing solenoid valve must be used to prevent water hammer (hammering or stuttering sound in the pipeline). Water Solenoid valves should be connected across Y1 and C1 on the thermostat interface board for all. Make sure that the VA draw of the valve does not exceed the contact rating of the thermostat. (See Fig. 7) A flow regulator valve should be installed down stream from the water solenoid valve.

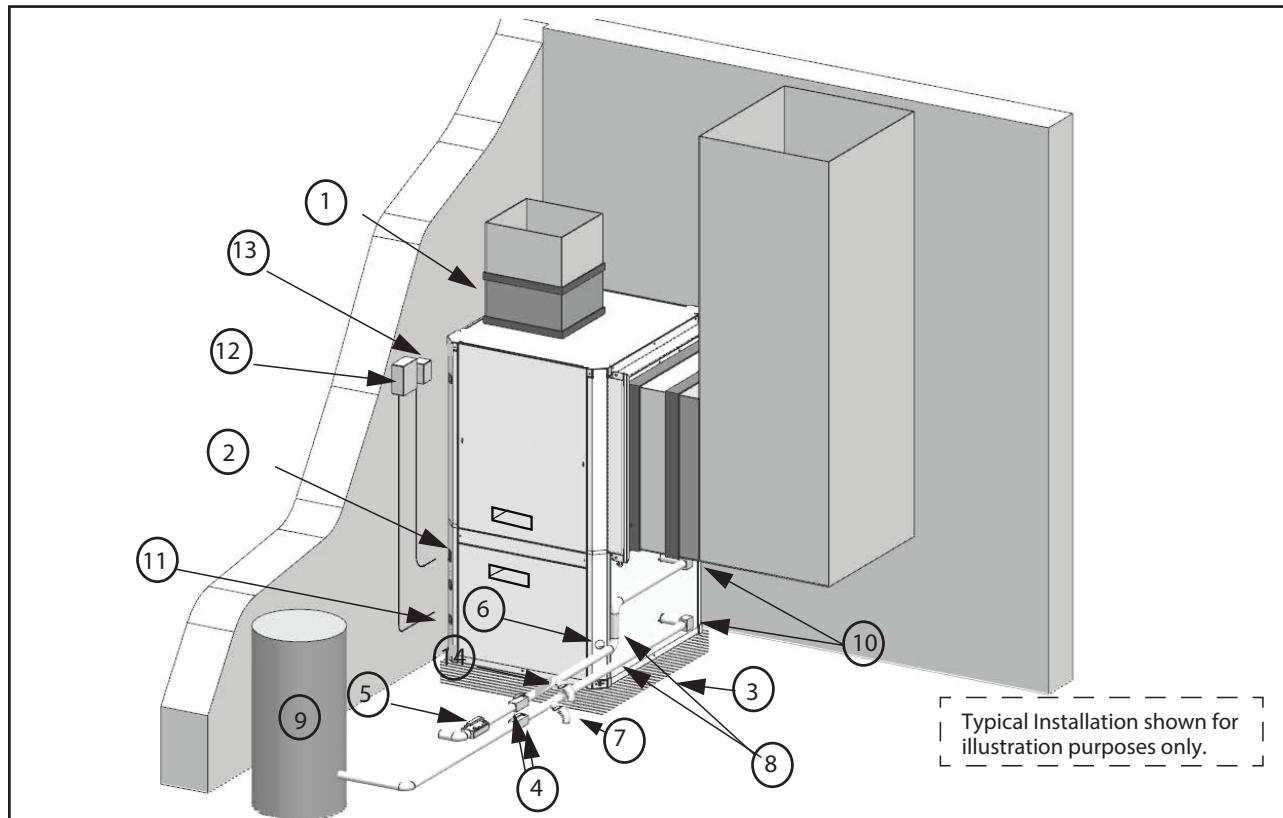


CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Discharge air configuration change is not possible on Heat Pumps equipped with Electric Heat Option.



- | | |
|------------------------------------|--|
| (1) Flex Duct Connection | (8) Hose Kits (optional) |
| (2) Low Voltage Control Connection | (9) Pressure Tank (optional) |
| (3) Vibration Pad | (10) P/T Ports (optional) |
| (4) Ball Valves | (11) Line Voltage Connection |
| (5) Solenoid Valve Slow Closing | (12) Electric Heater Line Voltage Disconnect |
| (6) Condensate Drain Connection | (13) Unit Line Voltage Disconnect |
| (7) Drain Valves | (14) Flow Regulator |

Fig. 3 - Example Well Water System Setup

Table 1 – Water Quality Requirements for Open-Loop Geothermal Heat Pump System

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 150°F for direct use and HWG applications, and at 90°F 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 150°F HWG and Direct well, 84°F 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, O ₂ <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 ₂ S)	All	--	At H S>0.2 ppm, avoid use of copper and copper nickel piping or HXs. 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		
			50°F	75°F	100°F
	Copper	--	<20 ppm	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 re-injection) 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		

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

INSTALLATION RECOMMENDATIONS

The Water-to-Air Heat Pumps are designed to operate with entering fluid temperature between 20°F to 90°F in the heating mode and between 30°F to 120°F in the cooling mode.

NOTE: 50° minimum Entering Water Temperature (EWT) is recommended for well water applications with sufficient water flow to prevent freezing. Antifreeze solution is required for all closed loop applications or EWT less than 45°. Cooling Tower/Boiler and Geothermal applications should have sufficient antifreeze solution to protect against extreme conditions and equipment failure. Frozen water coils are not covered under warranty. Other equivalent methods of temperature control are acceptable.

Check Equipment and Job Site

Moving and Storage

If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean, dry area. Units must only be stored or moved in the normal upright position as indicated by the “UP” arrows on each carton at all times.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

If unit stacking is required for storage, stack units as follows:

Do not stack units larger than 6 tons!

Vertical units: less than 6 tons, no more than two high.

Horizontal units: less than 6 tons, no more than three high.

Inspect Equipment

Be certain to inspect all cartons or crates on each unit as received at the job site before signing the freight bill. Verify that all items have been received and that there are no visible damages; note any shortages or damages on all copies of the freight bill. In the event of damage or shortage, remember that the purchaser is responsible for filing the necessary claims with the carrier. Concealed damages not discovered until after removing the units from the packaging must be reported to the carrier within 24 hours of receipt.

Location / Clearance

Locate the unit in an indoor area that allows easy removal of the filter and access panels, and has enough room for service personnel to perform maintenance or repair. Provide sufficient room to make fluid, 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 face of unit's air coil. On horizontal units, allow adequate room below the unit for a condensate drain trap and do not locate the unit above supply piping.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

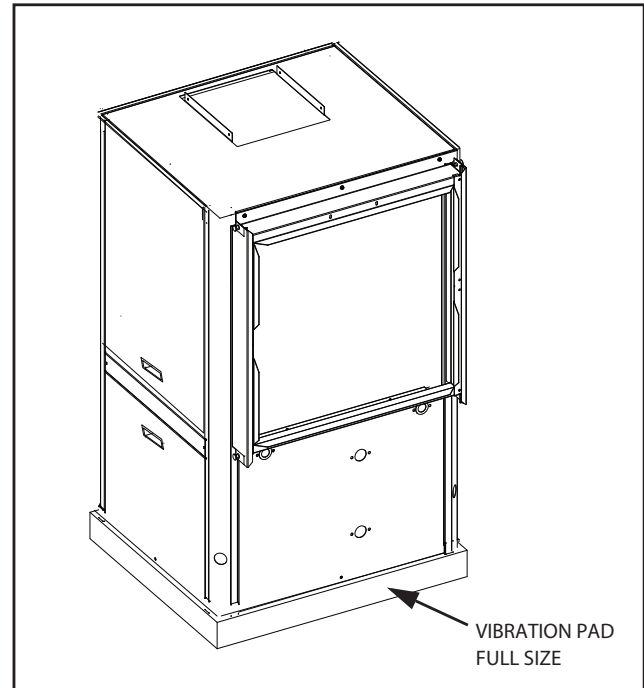
These units are not approved for outdoor installation; therefore, they must be installed inside the structure being conditioned. Do not locate in areas that are subject to freezing.

MOUNTING VERTICAL UNITS

Vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to minimize vibration transmission to the building structure. It is not necessary to anchor the unit to the floor. See Fig. 4.

NOTE: The condensate drain pan is internally sloped. There is no internal P-trap. An external trap is required.

NOTE: On VT and CF units, the condensate drain pan is internally sloped. There is no internal P-Trap.



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Fig. 4 - Vibration Absorbing Pad

MOUNTING HORIZONTAL UNITS

While horizontal units may be installed on any level surface strong enough to hold their weight, they are typically suspended above a ceiling by threaded rods. The manufacturer recommends these be attached to the unit corners by hanger bracket kits. The rods must be securely anchored to the ceiling. Refer to the hanging bracket assembly and installation instructions for details.

IMPORTANT: Horizontal units installed above the ceiling must conform to all local codes. An auxiliary drain pan, if required by code, should be at least four inches larger than the bottom of the heat pump.

Plumbing connected to the heat pump must not come in direct contact with joists, trusses, walls, etc. Some applications require an attic floor installation of the horizontal unit. In this case, the unit should be set in a full size secondary drain pan on top of a vibration absorbing mesh.

The Secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling.

The secondary drain pan is usually placed on a plywood base isolated from the ceiling joists by additional layers of vibration absorbing mesh.

In both cases, a 3/4" drain connected to this secondary pan should be run to an eave at a location that will be noticeable. If the unit is located in a crawl space, the bottom of the unit must be at least 4" above grade to prevent flooding of the electrical parts due to heavy rains.

NOTE: HZ unit condensate drain pan is NOT internally sloped.

IMPORTANT: Horizontal (HZ) units must be installed pitched toward the Condensate Drain Connection 1/8" per foot.

CONDENSATE DRAIN

IMPORTANT: This connection must be in conformance with local plumbing codes. A trap must be installed in the condensate line to insure free condensate flow. Units are NOT internally trapped or sloped for condensate drain.

IMPORTANT: Condensate piping must be pitched toward the drain 1/8" per foot.

NOTE: The condensate drain outlet on the cabinet is on a low point of the cabinet so additional height may need to be considered on unit base pad to allow for proper drain trap and slope.

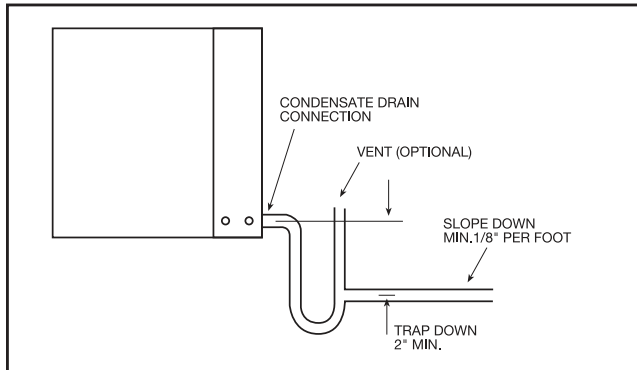


Fig. 5 - Condensate Drain

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A vertical air vent is sometimes required to avoid air pockets. The length of the trap depends on the amount of positive or negative pressure on the drain pan. A second trap must not be included.

Unit condensate drain connection may spin freely. Use backup wrench to hold fitting in place while connecting external piping.

DUCT SYSTEM

A supply air outlet collar and return air duct flange are provided on all units to facilitate duct connections.

NOTE: Supply air duct and return air duct flanges are shipped unfolded with unit.

Fold the duct flange outwards along the perforated line. Refer to unit Dimensional Drawings for physical dimensions of the collar and flange.

A flexible connector is recommended for supply and return air duct connections on metal duct systems. All metal ducting should be insulated with a minimum of one inch duct insulation to avoid heat loss or gain and prevent condensate from forming during the cooling operation.

Application of the unit to uninsulated duct work is not recommended as the unit's performance will be adversely affected.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in improper equipment operation.

Do not connect discharge ducts directly to the blower outlet.

The factory provided air filter must be removed when using a filter back return air grill. The factory filter should be left in place on a free return or standard ducted system.

If the unit will be installed in a new installation which includes new duct work, the installation should be designed using current ACCA procedures for duct sizing.

If the unit is to be connected to existing duct work, a check should be made to assure that the duct system has the capacity to handle the air required for the unit application.

If the duct system is too small, larger duct work should be installed. Check for existing leaks and repair.

The duct system and all diffusers should be sized to handle the designed air flow quietly. To maximize sound attenuation of the unit blower, the supply and return air plenums should be insulated. There should be no direct straight air path through the return air grille into the heat pump. The return air inlet to the heat pump must have at least one 90 degree turn away from the space return air grille. If air noise or excessive air flow are a problem, the blower speed can be changed to a lower speed to reduce air flow.

Air Ducts

Connect supply-air duct over outside of 3/4-in. flange provided on supply-air opening. Secure duct to flange with proper fasteners for type of duct used, and seal duct-to-unit joint.

Duct connection flanges are provided on unit air discharge connection.

Use flexible connectors between ductwork and unit to prevent transmission of vibration. When electric heater is installed, use heat resistant material for flexible connector between ductwork and unit at discharge connection. Ductwork passing through unconditioned space must be insulated and covered with vapor barrier.

Ductwork Acoustical Treatment

Metal duct systems that do not have a 90° elbow and 10 ft. of main duct to first branch takeoff may require internal acoustical insulation lining. As an alternative, fibrous ductwork may be used if constructed and installed in accordance with the latest edition of SMACNA construction standard on fibrous glass ducts. Both acoustical lining and fibrous ductwork shall comply with National Fire Protection Association Standards 90A or B as tested by UL Standard 181 for Class 1 air ducts.

PIPING

Supply and return piping must be as large as the unit connections on the heat pump (larger on long runs).

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in improper equipment operation.

Never use flexible hoses of a smaller inside diameter than that of the fluid connections on the unit.

GC units are supplied with either a copper or optional cupronickel condenser.

NOTE: Proper testing is recommended to assure the well water quality is suitable for use with water source equipment. When in doubt, use cupronickel. See Application Considerations notes on page 3.

In conditions anticipating moderate scale formation or in brackish water, a cupronickel heat exchanger is recommended.

Both the supply and discharge water lines will sweat if subjected to low water temperature. These lines should be insulated to prevent damage from condensation. All manual flow valves used in the system must be ball valves. Globe and gate valves must not be used due to high pressure drop and poor throttling characteristics.

⚠ CAUTION

EQUIPMENT DAMAGE AND/OR UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage and/or improper operation.

Never exceed the recommended water flow rates as serious damage or erosion of the water-to-refrigerant heat exchanger could occur.

Always check carefully for water leaks and repair appropriately. Units are equipped with female pipe thread fittings. Consult Unit Dimensional Drawings.

NOTE: Teflon tape sealer should be used when connecting water piping connections to the units to insure against leaks and possible heat exchanger fouling.

NOTE: The unit is shipped with water connection O-rings. A 10 pack of O-rings (part #4026) can be ordered through Replacement Components Division (RCD).

IMPORTANT: Do not over-tighten connections.

Flexible hoses should be used between the unit and the rigid system to avoid possible vibration. Ball valves should be installed in the supply and return lines for unit isolation. A flow regulator should be used to set flow rate.

CAUTION

EQUIPMENT DAMAGE AND/OR UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage and/or improper operation.

Do not apply additional controlled devices to the control circuit power supply without consulting the factory. Doing so may void equipment warranties.

PIPING AND PLUMBING INSTALLATION

Loop Pump Connections

Refer to the Flow Center installation manual for piping and wiring instructions.

Water Solenoid Valves

Open loop well water applications require a water solenoid valve. The purpose of the valve is to allow water to flow through the GHP only during operation.

For ground water/open loop installations, solenoid valves MVBR3F and MVBR4F are recommended due to its fast opening/slow closing timing feature (see Fig. 6). This valve will open in approximately 5 seconds. Solenoid valves that are slow opening are not recommended as water in the unit's coax may freeze during start-up of a heating call. A frozen coax is not covered under warranty. MVBR3 and MVBR4F valves are also slow closing to eliminate potential water hammer.

Information on the MVBR3F and MVBR4F valves is shown below.



Fig. 6 - Solenoid Valves

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Table 2 – Motorized Solenoid Valves

Part Number	Description
MVBR3F	Valve, motorized solenoid, forged brass 3/4" FPT, 24V
MVBR4F	Valve, motorized solenoid, forged brass 1" FPT, 24V

***Start up note** – The first time the water solenoid valve is operated, it may require 30 to 45 seconds to power open. This time is to charge an internal capacitor. After the initial “power up” the valve will open in 5 seconds. If the line voltage power has been turned off for service of the unit, the system will go through the same first time power up sequence.

The 24 VAC connections to the water solenoid valve should be made on the “C” and “W/Y” terminals. The power from the unit controls is identified as “C” and “Y1”. (See Fig. 7)

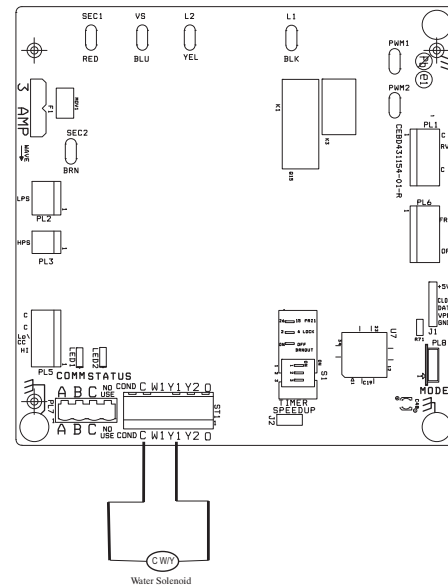


Fig. 7 - Water Solenoid Connections

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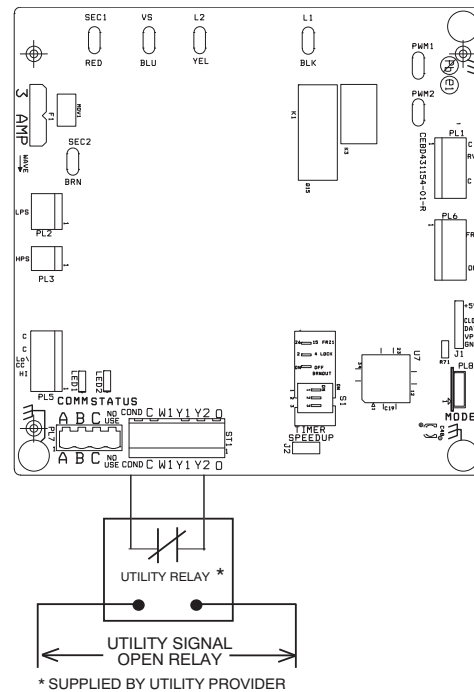


Fig. 8 - Utility Curtailment

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Flow Regulator Valve

A flow regulator valve should be used to set the flow rate through the heat pump. The lowest entering fluid temperature (EWT) expected should be used to determine the flow rate per ton. 1.5 GPM per ton is acceptable for 50°F (10°C) EWT or higher. 2 GPM per ton should be used if EWT is below 50°F (10°C). (See Fig. 9 and Table 3)



Fig. 9 - Flow Regulator

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Table 3 – Flow Regulator Valves

Part Number	Flow Regulator Valves
FR2	Valve, flow regulator, 3/4" FPT x 3/4" FPT, 2 GPM
FR3	Valve, flow regulator, 3/4" FPT x 3/4" FPT, 3 GPM
FR4	Valve, flow regulator, 3/4" FPT x 3/4" FPT, 4 GPM
FR5	Valve, flow regulator, 3/4" FPT x 3/4" FPT, 5 GPM
FR6	Valve, flow regulator, 3/4" FPT x 3/4" FPT, 6 GPM
FR7	Valve, flow regulator, 3/4" FPT x 3/4" FPT, 7 GPM

FACTORY INSTALLED OPTIONS

A number of factory installed options are available on the GC Series of Heat Pumps. The following details the purpose, function and components of each option.

Heat Recovery Package (HRP) (optional)

The heat recovery package is a factory installed option on GC series heat pumps. The HRP can be used to heat potable water during unit operation using waste heat from the compressor discharge gas. In some cases the HRP can provide most or all of the hot water requirements for a typical home.

The HRP consists of three major components:

1. Double wall, vented refrigerant to water heat exchanger
2. Circulating pump
3. Control circuit

The heat exchanger is rated for use with potable water and is acceptable for use as a domestic water heating device in most building codes.

The pump circulates water between the domestic hot water tank and HRP heat exchanger in the Heat Pump. The control circuit ensures that the HRP only operates when there is available heat from the compressor and when the water is within a safe temperature range of below 140°F. When the heat pump compressor operates, the HRP will monitor the temperature of the discharge gas from the compressor. Once discharge gas is hot enough to provide useful heat to the domestic water tank, the circulating pump will be enabled, drawing water from the tank, through the HRP heat exchanger and then depositing the heated water back into the tank.

If the water temperature reaches 140°F, the circulating pump is disabled to prevent over heating of the domestic water. The HRP is provided with an on/off switch in case the end user desires that the HRP be inactivated (typically during the winter months when space heating is most important).



CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

If heat recovery unit is installed in an area where freezing may occur, the unit must be drained during winter months to prevent heat exchanger damage. Heat exchanger ruptures that occur due to freezing will void the heat recovery package warranty along with the heat pump warranty.

NOTE: If factory installed HRP is not utilized in the field, it is recommended to disconnect the HRP switch.

Water Tank Preparation

1. Turn off electrical or fuel supply to the water heater.
2. Attach garden hose to water tank drain connection and run other end of hose out doors or to an open drain.
3. Close cold water inlet valve to water heater tank.
4. Drain tank by opening drain valve on the bottom of the tank, then open pressure relief valve or hot water faucet.
5. Once drained the tank should be flushed with cold water until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.
7. Install HR water piping.

HRP Water Piping

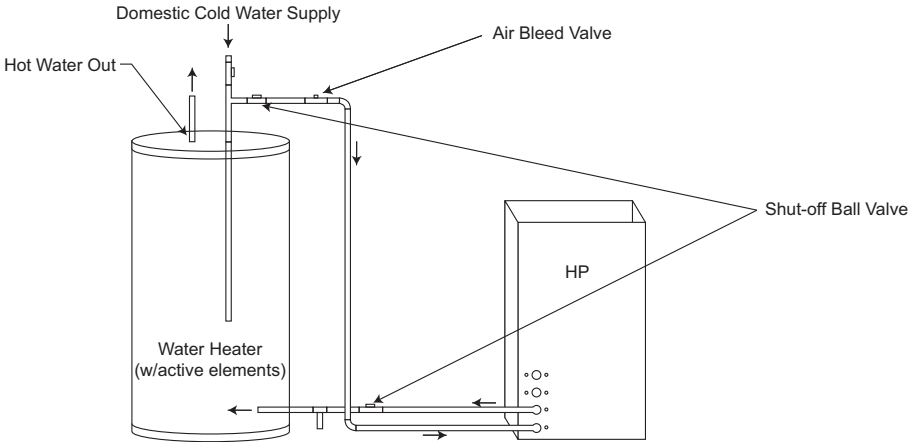
All hot water piping **MUST** be a minimum of 5/8" O.D. copper tube to a maximum distance of 15 feet. For distances beyond 15 feet, but not exceeding 60 feet, use 1/2" copper tube. Separately insulate all exposed surface of both connecting water lines with 3/8" wall closed cell insulation. Install isolation valves on supply and return to the heat recovery. (See Fig. 10)

Water Tank Refill

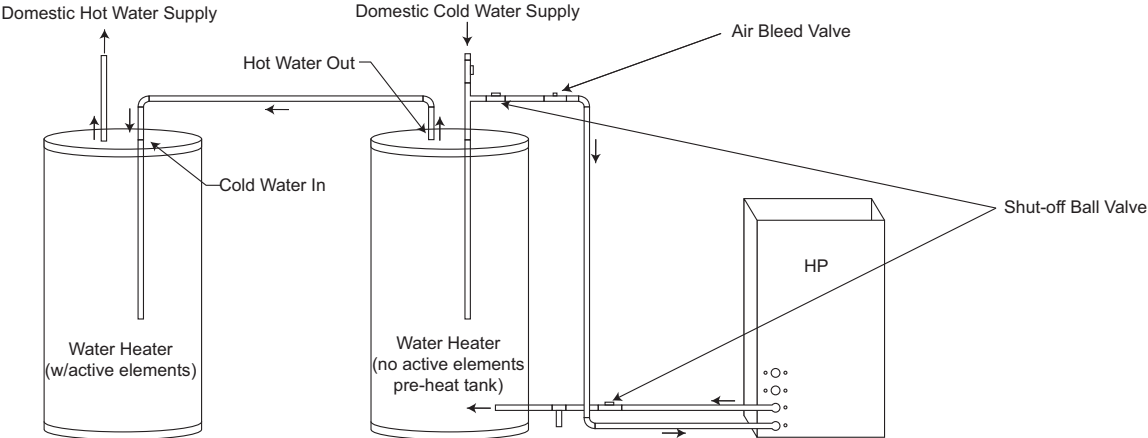
1. Open the cold water supply to the tank.
2. Open a hot water faucet to vent air from the system until water flows from the faucet, then close.
3. Depress the hot water tank pressure relief valve handle to ensure there is no air remaining in the tank.
4. Carefully inspect all plumbing for water leaks. Correct as required.
5. Using the air bleed valve, purge all air from water piping, allowing all air to bleed out until water appears at valve.
6. Before restoring the power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to ensure maximum utilization of heat available from the refrigeration system and to conserve the most energy. On tanks with thermostats and both upper and lower elements, the lower element should be turned down to 100°F, while the upper element should be adjusted to 120°F. Depending upon the specific needs of the customer, you may need to adjust the upper element differently. On tanks with a single thermostat, lower the thermostat setting to 120°F or the "LOW" position. After thermostat adjustments are completed, replace access cover and restore electrical or fuel supply to water heater.

IMPORTANT: Copper should be used for piping from HRP to domestic water tank(s). Use 5/8" (16mm) O.D. copper or larger. Refer to local codes for hot water piping. Insulate the water lines between the GHP and the water heater with a minimum of 3/8" (10mm) closed cell insulation.

One Tank System



Two Tank System (preferred)



Package unit shown. GC package unit arrangement similar with different water locations on unit.

Fig. 10 - HRP Water Piping

A150174

ELECTRICAL

Electrical Connections

WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing unit, always turn off all power to unit. There may be more than 1 disconnect switch. Turn off accessory heater power if applicable.

WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

If a disconnect switch is to be mounted on the unit, select a location where drill or fastener will not contact electrical or refrigerant components.

WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Field wires on the line side of the disconnect remain live, even when the pull-out is removed. Service and maintenance to incoming wiring can not be performed until the main disconnect switch (remote to the unit) is turned off.

NOTE: Before proceeding with electrical connections, make certain that supply voltage, frequency, and phase are as specified on unit rating plate. Be sure that electrical service provided by the utility is sufficient to handle the additional load imposed by this equipment. See unit wiring label for proper field high- and low-voltage wiring. Make all electrical connections in accordance with NEC and any local codes or ordinances that may apply. Use copper wire only. The unit must have a separate branch electric circuit with a field-supplied disconnect switch located within sight from and readily accessible from the unit.

24-V Control System Connections to Bus Com Harness

Field Connection

Use the field ABCD connector provided with the User Interface. Connect this plug to the factory wired female ABCD connector on the bus com harness (see Fig. 12). Use No. 18 AWG color-coded, insulated (35°C minimum) wires to make low-voltage connections between User Interface and unit. If User Interface is located more than 100 ft. from unit (as measured along the low-voltage wires), use No. 16 AWG color-coded, insulated (35°C minimum) wires or in accordance with local codes.

Connect low-voltage leads to User Interface and outdoor unit. (See Fig. 13.)

NOTE: Where local codes require User Interface wiring be routed through conduit or raceways, splices can be made inside blower unit. All wiring must be NEC Class I and must be separated from incoming power leads.

Low-Voltage Circuit Fusing and Reference

The low-voltage circuit is fused by a board-mounted 3-amp. automotive fuse placed in series with transformer SEC1 and R circuit. The C circuit of transformer circuit is referenced to chassis ground through a printed circuit run at SEC2 and metal PC board mounting eyelets. Check to be sure PC Board is mounted securely using both factory installed screws.

NOTE: Mis-wiring or shorting any of the low voltage connections may cause the low voltage fuse to open but will not damage the User Interface or ECM board. Simply rewire and replace fuse to correct fault.

Ground Connections

WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

The cabinet must have an uninterrupted or unbroken ground according to NEC, ANSI/NFPA 70 and local codes to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes. (See Ground/Conduit Note below.)

NOTE: Use UL listed conduit and conduit connector to connect supply wire(s) to unit and obtain proper grounding. If conduit connection uses reducing washers, a separate ground wire must be used. Grounding may also be accomplished by using grounding lug provided in control box. Use of dual or multiple supply circuits will require grounding of each circuit to ground lugs provided on unit and heaters.

Refer to electrical component box layout. See Fig. 11.

CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage and/or improper operation.

- Field wiring must comply with local and national electrical codes.
- Power to the unit must be within the operating voltage range indicated on the unit nameplate or on the performance data sheet.
- Operation of unit on improper line voltage or with excessive phase imbalance will be hazardous to the unit, constitutes abuse, and may void the warranty.

Properly sized fuses or HACR circuit breakers must be installed for branch circuit protection. See unit nameplate for maximum fuse or breaker size.

NOTE: Use copper wire only between disconnect switch and unit.

The unit is provided with a concentric knock-out for attaching common trade sizes of conduit, route power supply wiring through this opening.

Always connect the ground lead to the grounding lug provided in the control box and power leads to the line side of compressor contactor as indicated on the wiring diagrams.

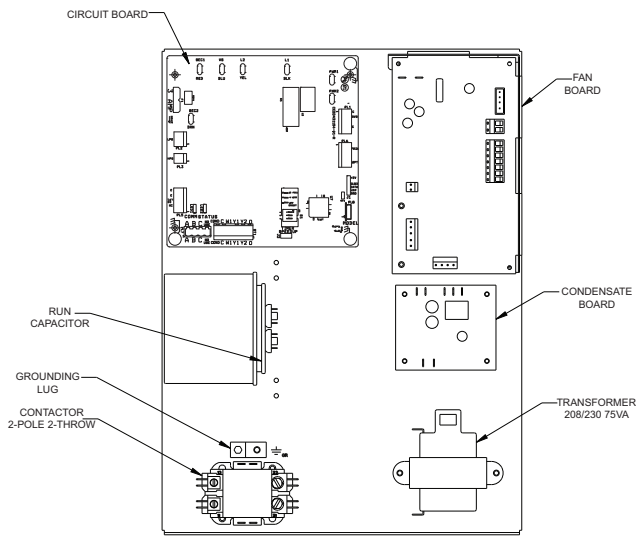


Fig. 11 - Electrical Component Box Layout

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ELECTRONIC THERMOSTAT INSTALLATION

Field Connections

This section is intended as a quick reference only and should not replace a complete review of thermostat Installation Instructions.

The GC unit can be installed as communicating with UI communicating thermostats only.

Communicating

User Interface (UI) is designed to self-program with the the GC unit when connected to the unit bus com harness ABCD connector (refer to Fig. 12) with the ABCD male adapter included with the unit in the literature packet shipped with the unit. 4 wires are needed as the bus com harness communicates between both unit boards and the UI when connected.

NOTE: Field wiring only needs to go to UPM and connector as the boards have factory wiring between them.

NOTE: It is advisable to run extra thermostat wire during installation in the event of faulty wires, etc.

Communicating System Tips:

- The GC units include an Outdoor Air Temperature (OAT) sensor in the literature packaging. Refer to Table 4 for thermostats that can incorporate this OAT and the thermostat instructions for wiring.
- The GC unit must be used with Wall Control version 13 or newer software for communicating connections.
- Energy tracking is not available for the geothermal products at this time for the Wall Control V13 software. However, future UI software versions will have this feature.
- Wi-Fi capability will be available with the Wi-Fi Wall Controls SYSTXCCITC01, SYSTXCCITW01, SYSTXBBECC01, SYSTXBBECCW01.
- To enter the Wall Control service mode hold the service cap in the main menu for about 10 seconds until it turns green then release.
- The last 10 system faults can be found in the service screens. Flash codes on the UPM board flash only an active code with series of short and long flashes on the amber LED. A code 37 will appear on the UPM LED as 3 short flashes followed by a pause then 7 long flashes followed by another pause and repeats this series. The Wall Control will display text on the screen for the last 10 events.
- Exit service screens by selecting "Done".

Table 4 – Recommended Thermostats

Carrier Systems:	Bryant Systems:
Infinity® Touch Wall Control	Evolution® Connex™ Wall Control
SYSTXCCITC01*	SYSTXBBECC01*
SYSTXCCITW01*	SYSTXBBECCW01*
SYSTXCCITN01*	SYSTXBBECCN01*
* Version 13 or newer software The GC unit is shipped with one OAT sensor in the literature package: TSTATXXSEN01-B Note: Any of the model numbers above may be followed by a revision letter such as "-A".	

Non-Communicating (Emergency Mode Only)

Temporary Emergency Electric Heat Mode in Event of UI Failure

In the event the system UI fails after initial UI install and there is a need for heat while a replaceable UI can be obtained, these steps can be followed with a non-communicating thermostat to provide emergency electric heat only temporarily.

The ECM board non-communicating stat connections can be wired with a non-communicating thermostat to provide emergency electric heat temporarily by connecting only C, W, G and R. **Disconnect the bus com harness ABCD connector to the ECM.** Do NOT wire the Y as the programming in the UPM will not allow cooling or heating mode.

System is not to be left in this configuration for an extended period, UI must be replaced as soon as possible.

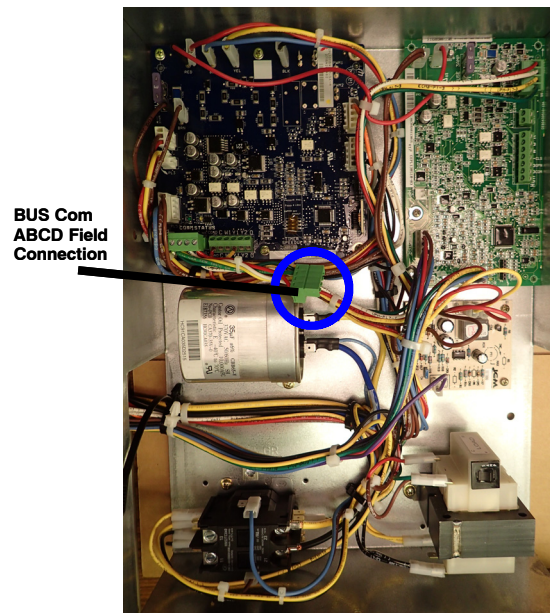


Fig. 12 - ABCD BUS COM Connection

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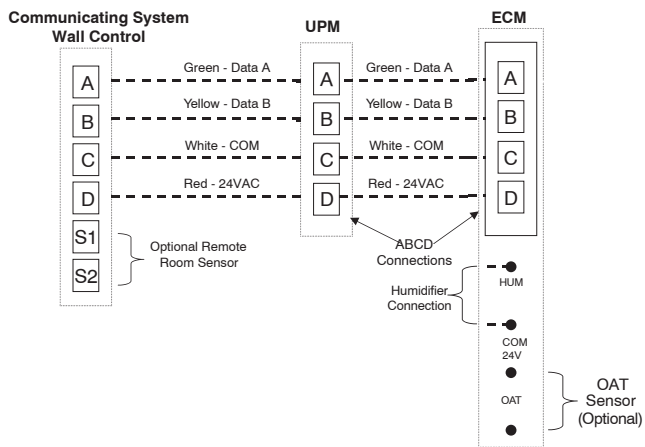


Fig. 13 - Universal Connection

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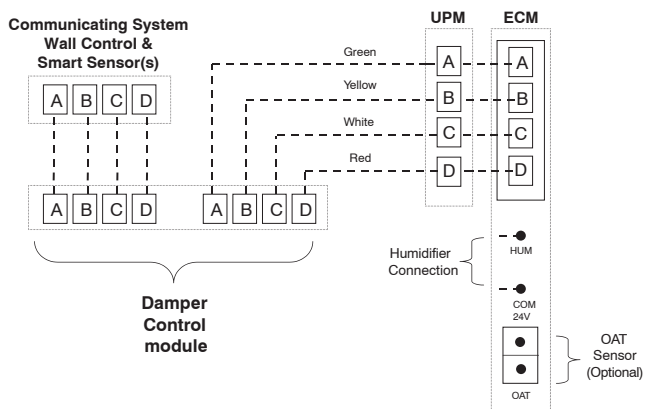


Fig. 14 - Zoning Connection for Geothermal Package Unit

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FIELD INSTALLED COMPONENTS

Electric Heaters

Electric heater kits are available for field install options only. The GC units can only use communicating electric heat kits. They are a one piece, easy to install design with a wiring harness that connects a 12-pin connector to a 12-pin mated connector from the blower motor harness in the motor compartment. The EH kit will slide easily into the electric heat collar on the top of the blower housing in all units except side discharge (due to space restrictions). In the event of side discharge unit, there is no electric heat available. Communicating duct heaters are a future consideration.

Main power wiring to the heater is separate to the compressor wiring in the motor compartment. The cabinet design allows for easy cabinet access for power cable routing via punch outs on the corner posts.

Refer to Table 5 for compatible heaters.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

Failure to follow the Installation Instructions for the Electric Heater Kits could result in equipment damage.

Table 5 – Auxiliary Electric Heaters

GHP Model	Aux. Heat Size Compatibility KWCEH –			
	0101B05 5Kw	0101B10 10 Kw	0101B15 15 Kw	0101B20 20 Kw
GC024	•	•	–	–
GC036	•	•	•	–
GC048	•	•	•	•
GC060	•	•	•	•
GC072	•	•	•	•

• = Heater Kit compatible / – = Heater Kit NOT compatible

IMPORTANT: 3rd party electric heaters may offer a design with 12-pin connection but they are not recommended and may not be recognized by the communicating controls.

Manufactured Housing

In manufactured housing applications, the Code of Federal Regulations, Title 24, Part 3280.714 requires that supplemental electric heat be locked out at outdoor temperatures above 40°F (4.4°C), except for a heat pump defrost cycle.

The User Interface with an outdoor air temperature sensor can be used to lockout supplemental heat above 40°F (4.4°C). Refer to User Interface Setup Instructions for how to set “Electric Heat Lockout” temperature.

To lock out the supplemental heat in the UI for systems with electric heat:

From MAIN screen:

1. Touch “menu”
2. Touch arrow-down
3. Touch service icon for 10 seconds until it turns green
4. Touch “setup”
5. Touch “heat source lockouts”

NOTE: Supplied outdoor air temperature sensor is field-install option. Connect to ECM board. See Fig. 24.

Outdoor Air Temperature Sensor (OAT)

An optional outdoor air temperature (OAT) sensor is provided in the literature package. Install the sensor outdoors, typically on the north side of the residence away from direct sunlight. Sensor package includes an adhesive holder for the sensor. See Fig 15 for wiring the sensor to the OAT plug on the fan coil or furnace unit control board. Do not connect to the optional remote sensor terminals (S1, S2) on the UI.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in improper operation.

The electric heat lock-out feature is included because it is required by statute for manufactured housing. This feature must not be enabled for geothermal closed loop installations except where required by law. When auxiliary heat is disabled, and the GHP does not satisfy the heating call, the GHP will continue to run, possibly non-stop for long periods of time. Longer run times on the GHP will reduce the loop temperature, lowering the capacity of the GHP. This in turn causes the GHP to continue to run in an attempt to satisfy the thermostat, which will further reduce the loop temperature. Operating the GHP (and loop) non-stop without the aid of auxiliary electric (when it’s needed) causes a negative “fly-wheel” effect. The extreme result could be freezing the loop fluid causing a unit lock-out which will require switching to emergency heat while the loop recovers (thaws).

Humidity control uses the OAT to adjust humidity target when the OAT drops into the cold range to prevent forming of condensation on windows. It also allows the UI to display outdoor air temperature.

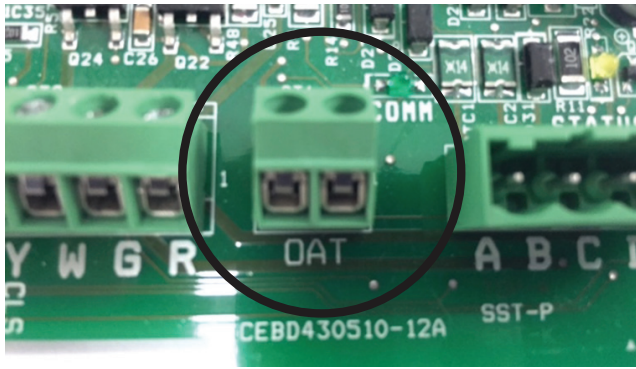


Fig. 15 - OAT Sensor Connection

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Outdoor Air Thermistor

A 2-screw terminal strip is provided for connection of an outdoor temperature thermistor. The installation of an outdoor temperature sensor using the ECM board terminals is optional. OAT input can be used to supply outdoor temperature data for system level functions and for temperature display on User Interface. If an OAT is added, it will be used for system level functions.

Using two wires of field-supplied thermostat wire cable, wire one lead of thermistor to one screw terminal and the other lead to remaining screw terminal; there is no polarity to be observed. It is strongly recommended that two wires be used to connect the thermistor to eliminate noise interference in temperature reading. If there are not two spare wires available in cable, one wire may be used to connect thermistor to OAT screw terminal 1 and the other lead of the thermistor can be wired to 24VAC COM (C) wire. OAT screw terminal 1 is terminal located closest to the ABCD system communications and is marked with a small number 1 next to the terminal strip.

NOTE: Mis-wiring OAT inputs will not cause damage to either ECM board or thermistor. If the thermistor is wired incorrectly, no reading will appear at User Interface. Re-wire thermistor correctly for normal operation.

Electronic Air Cleaner Connections

When using an electronic air cleaner, use airflow sensor part no. KEAAC0101AAA. The airflow sensor turns on electronic air cleaner when blower is operating.

Humidifier Connections

The ECM board terminal marked “HUM” is provided for low voltage (24VAC) control of a humidifier. No humidistat is required as User Interface monitors indoor humidity. When commanded to operate humidifier, the ECM board will energize the “HUM” output to turn humidifier on and de-energize HUM output to turn humidifier off. Wire “HUM” and “C” terminals directly to humidifier as shown in Fig. 9 or 10.

System Shutdown Accessories

The G thermostat terminal input can be configured through the User Interface to recognize accessories that will shut the system down in response to a malfunction. The ECM board can be

configured to recognize either Normally Open or Normally Closed (default) contact devices through the User Interface Set-Up screens. Wire the accessory device contacts in series with the R and G thermostat connections at the ECM board board. The User Interface will respond to the accessory device signal by ordering a shutdown of the system and will display SYSTEM MALFUNCTION on its screen. Refer to the User Interface Installation Instructions for more detail. See Fig. 16.

Generator

The ECM board G thermostat terminal input can be configured through the User Interface to recognize a Generator Normally Open dry-contact output to signal the system that a generator malfunction condition exists. Wire the generator output in series with the R and G thermostat connections at the ECM board. The User Interface will display GENERATOR MALFUNCTION when the G thermostat input is energized. This function requires the addition of a Generator Self Test Verifier (Part No. GSV200) which must be purchased separately. Visit www.GeneratorVerifier.com for details and ordering information. Refer to the User Interface Installation Instructions for more detail. See Fig. 16.

Ventilation Accessory

The G thermostat terminal input can be configured through the User Interface to recognize a Normally Open dry-contact output to signal the system that a Ventilation Accessory requires blower operation. Blower operation can be configured for Low, Med or High speed when the G terminal is energized. Wire the Accessory output in series with the R and G thermostat connections at the ECM board. Refer to the User Interface Installation Instructions for more detail. See Fig. 16.

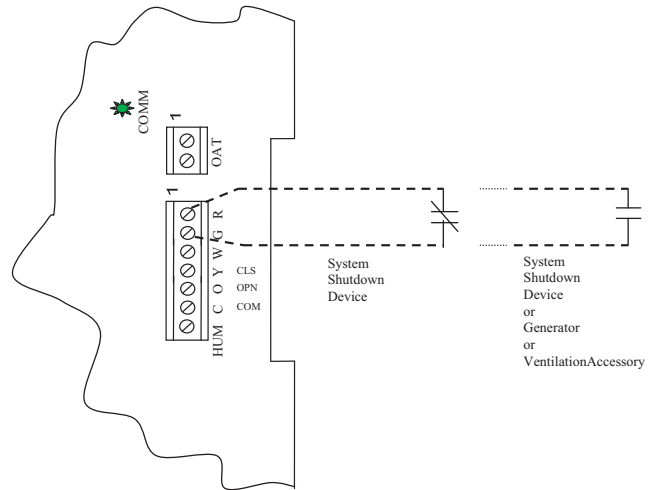


Fig. 16 - “G” Terminal Accessory Wiring

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Compressor Start Accessories

In the event of the rare occurrence of compressor starting issues such as dimming of the residential lights. Verify and correct voltage issues and add hard start components. Table 6 lists Hard Start components that are recommended in areas of poor power conditions.

Table 6 – Recommended Hard Start Kits

Unit Size	Compressor	Hard Start Kit	Start Cap	Start MFD	Start Cap Volts	Start Relay
GC024	ZPS20K5E –PFV	KSAHS2501AAA	HC95DE088	88 –108	330	HN61HB540
GC036	ZPS30K5E –PFV	KSAHS2501AAA	HC95DE088	88 –108	330	HN61HB540
GC048	ZPS40K5E –PFV	KSAHS2801AAA	HC95DE088	88 –108	330	HN61HB553
GC060	ZPS51K5E –PFV	KSAHS2801AAA	HC95DE088	88 –108	330	HN61HB553
GC072	ZPS60K5E –PFV	N/A	N/A	43	330	HN61HB553

TIMER SPEEDUP (TEST MODE)

Timer Speed Up allows the unit to bypass all start timings to below 10 seconds to allow the unit to run for testing purposes. This speed up will last one cycle until unit shuts down for the next start.

Start timings include:

- Anti-short cycle time (5 minutes)
- Random start-up

On a system with non-communicating control, Timer Speed Up can be initiated by manually shorting the 2-pin header labeled Timer Speed Up (see Fig 18) on the UPM board for at least 1 second but no more than 4 seconds then releasing.

On a system with a communicating control, from the main menu, enter the Service mode by holding the Service hat icon for approximately 10 seconds until it turns green. Enter the checkout screen. This allows an option to run 5 minutes low stage or 5 minutes high stage, each adjustable up to 120 minutes and stoppable at any time.

PRE START-UP CHECKLIST



CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

Equipment should never be used during construction due to likelihood of wall board dust accumulation in the air coil of the equipment which permanently affects the performance and may shorten the life of the equipment.



CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

Check with all code authorities on requirements involving condensate disposal/overflow protection criteria.

- Ensure the isolation valves are open and water control valves are wired.
- Loop/water piping is complete and flushed, (clean and purged of air).
- Verify loop water chemistry meets requirements on water chemistry table (reference table 1)
- Antifreeze is added if necessary
- Verify the HRP system is purged and connected completely, if applicable.
- Remove access panels to access applicable compartments.
- Verify sufficient space is available for accessing and servicing areas such as the blower and electric heat compartment and the compressor and electrical control box compartment.
- Verify all supply voltage is in accordance with unit nameplate.
- Verify all wiring is tight and secure.
- Verify system voltage is per the system rating.
- Check that the unit blower is free to rotate and wheel is secure to shaft.
- Verify the condensate drain pan is clear and drains with proper external trap and pipe pitch.
- Ensure the system air filters are installed.
- Ensure no wiring is pinched when panels are re-installed.
- Verify Loop pump wiring, if applicable, is in accordance with the pump installation instructions.
- Verify all system accessories and components are wired per applicable instructions and all wiring in accordance with NEC.

- UPM dip switch settings will be over-ridden by the UI. Settings should be configured in the User Interface during set up (see steps below in user interface quick set up).
- Ensure there are no wires pinched when panels are re-installed.
- Ensure all panels are in place before powering up the unit.

USER INTERFACE QUICK SET-UP

- Install only approved thermostats per the unit Product Data. Communicating geothermal units require UI software version 13 or later. Read and Understand the thermostat Installation Instructions, this start-up is not intended to replace the thermostat Installation Instructions.
 - Install each component per unit Installation Instruction. Wire each accordingly.
 - Enter the service and installation screens in the UI
- Upon powering up the system, the user interface installation will seek out the control boards in the unit and recognize the unit model and size and communicating electric heat, if installed.

Component search order:

- Indoor (ECM is the indoor if GC model)
 - Outdoor (UPM)
 - SAM if applicable
 - Zoning if applicable
 - Any non-com components via selectable screens.
- Run set up to select specific features desired such as UPM switch settings (brownout, lockout and freeze protection).

SYSTEM INITIAL POWER UP AND CHECKOUT



WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Ensure cabinet and electrical box are properly grounded

- From the UI main screen select menu. Then find and select the service cap icon. Touch and hold the icon for about 10 seconds until it turns hat green then release to enter the screen that provides these options:
 - Equipment summary
 - Installation
 - Setup
 - Checkout
- Select Installation to initialize equipment set up and follow screen prompts as necessary.
- Verify equipment summary is correct and complete by selecting equipment summary.
- Select Setup option to select system settings such as brownout protection, lock out settings and freeze protection. Set up air flow settings in the Setup option. Follow on screen prompts for airflow options.
- Airflow verification test can be achieved from the installation and service screen after full installation.

Cooling Airflows:

- Quiet: lowest airflow (~300CFM pr ton)
- Comfort: Default (varied on temp/humidity)
- Efficiency: (1 and 2) (fixed and no dehum)
- Max: (~400 CFM pr ton) (no dehum)

Heating Airflows:

- Comfort: Default (varied on temp/humidity)
- Efficiency: (1 and 2) (fixed and no dehum)
- Max: (~400 CFM pr ton) (no dehum)

Check out mode can now be accessed to check out cooling or heating modes for up to 120 minutes and can be stopped at any time.

- Verify low cool
- Verify high cool
- Verify low heat
- Verify high heat
- Verify Electric Heat Operation in emergency and auxiliary heat mode if applicable
- Conduct System Verification per the section below and the start-up checklist.
- Set up the thermostat for normal operation, set up customer preferences for programming
- Make sure company logo and contact info has been added to UI.
- Explain thermostat operation and maintenance to the homeowner.

SYSTEM VERIFICATION

- The unit is shipped with a Unit Start-up Checklist in the literature package. Complete the Start-up Checklist as you check the items below, and save it in the customer's file at your dealership.
- Allow the unit to operate for minimum of 5 minutes between system changes to stabilize before checking system performance.

Note: It is not recommended to access the refrigerant system at start up on package units. Access should only be necessary as last resort in troubleshooting to prevent unnecessary charge issues.
- Check the water flow and operating conditions. Reference Table 10.

Note: Tables typically show 3 GPM rates for each unit size. Rates are described from top to bottom listed as:

- Top listed GPM: minimum suggested for open loop.
- Middle listed GPM: minimum suggested for closed loop.
- Bottom listed GPM: Suggested rate for closed loop.

- Verify the unit is operating within 10% of the Heat of Extraction (HE)/Heat of Rejection (HR) published in the unit Product Data Performance tables. Access Product Data on HVAC Partners.
 - HE/HR= GPM x TD x Fluid Factor (500 for water, 485 for antifreeze).
 - Utilize Ht. Abs Btu/hr in heating mode for capacity.
 - Utilize Ht. Rej Btu/hr in cooling mode for capacity.

MAIN CONTROL BOARDS

The GC unit is designed as a package unit containing similar components as those found in a outdoor refrigeration split system and also those found in an indoor fan coil system. This unit has an electrical box (E-box) that contains both of the main control boards of this package unit and more. Refer to Fig. 11 for typical board locations in the E-box.

The unitary protection module (UPM) is the board that provides the system protection and compressor operation control (see Fig. 18).

The electronically commutated module (ECM) is the board that controls the blower motor (see Fig 24).

The electrical box is designed to allow servicing behind the box relatively easily to access reversing valve, etc. The 2-3 screws on the bottom of the electrical box could be removed and with wiring all out one side of the box carefully swing box in direction of the wiring bundle to allow access to components behind the box if necessary. Remember that all sides of the cabinet are accessible but in event the unit is placed where all sides make this difficult, removal of the box may help.

The transformer is a 75va transformer which should provide ample power for accessories. Size loads properly so they do not exceed capability of the transformer.

The transformer allows 208/230V selection with the factory default of 230V. The transformer has a 5amp circuit breaker internally built in for class 2 rating. See Fig. 17.

The circuit board has a 3 amp fuse that should identify any issues before the 5 amp circuit breaker trips. In an unlikely event of the transformer 5 amp circuit breaker tripping, it has a manual reset.

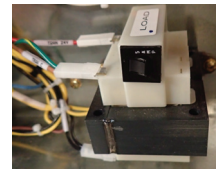
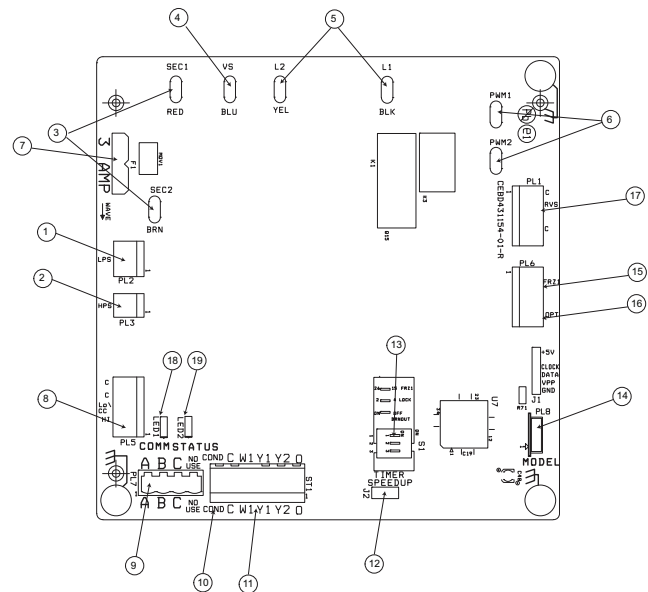


Fig. 17 - Transformer

UPM Board



1. **PL2 LPS** Low pressure switch
2. **PL3 HPS**: High pressure switch
3. **SEC1 and SEC2**: Transformer
4. **VS**: Start circuit high volt.
5. **L2 and L1**: Contactor and high voltage
6. **PWM1 and PWM2**: N/A
7. **F1**: 3 amp fuse
8. **PL5**: Compressor plug
9. **PL7**: ABCD comm. stat conn.
10. **COND**: Condensate overflow
11. **C W 1 Y 1 Y2 0**: Standard tstat connection
12. **J2 Speed Up Timer**: Test jumper
13. **S1**: DIP Switches
14. **PL8 Model**: Model plug conn.
15. **PL6 FRZ1**: Water coil freeze sensor
16. **PL6 OPT**: N/A
17. **PL1 RVS**: Reversing valve plug
18. **LED1 COMM**: Comm status light
19. **LED2 STATUS**: Status and fault code light

Fig. 18 - UPM Board

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The UPM Board includes the following features:

- LOW PRESSURE SWITCH:** The low pressure switch safety is designed to shut down the compressor in the event of loss of charge. Cut in 60 +/- 15 psig and cut out 40 +/- psig.
- HIGH PRESSURE SWITCH:** The high pressure switch safety is designed to shut down the compressor if it exceeds limits. Cut in 420 +/- 15 psig and cut out 600 +/- psig.
- ANTI-SHORT CYCLE TIMER:** 5 minute delay on break timer to prevent compressor short cycling.
- RANDOM START:** Each board has a unique random start delay ranging from 30 to 270 seconds on initial power up to reduce the chance of multiple unit simultaneously starting at the same time after power up or after a power interruption, thus avoiding creating large electrical spike.
- LOW PRESSURE BYPASS TIMER:** If the compressor is running and the low pressure switch opens, the board will keep the compressor ON for 120 seconds. After 2 minutes if the low pressure switch remains open, the board will shut down the compressor and enter a soft lockout. The compressor will not be energized until the low pressure switch closes and the anti-short cycle time delay expires. If the low pressure switch opens 2-4 times in 1 hour, the unit will enter a 4 hour lockout period.

Pressure Switch Protection: The geothermal unit is equipped with high- and low-pressure switches. If the control senses the opening of a high- or low-pressure switch, it will respond as follows:

1. De-energize the compressor contactor.
2. Display the appropriate fault code (see Table 12).
3. After a 15 minute delay, if there is a call for cooling or heating and LPS or HPS is reset, the compressor contactor is energized.
4. If the open switch closes anytime after the 15 minute delay, then resume operation with a call for cooling or heating.
5. If LPS or HPS trips 2-4 consecutive cycles per the dip switch lockout setting or UI setting (Communicating only), the unit operation is locked out for 4 hours.
6. In the event of a high-pressure switch trip or high-pressure lockout, check the refrigerant charge, and the coax coil (in cooling) for water issues, or indoor airflow in heating.
7. In the event of a low-pressure switch trip or low-pressure lockout, check the refrigerant charge and indoor airflow (cooling) and coax coil water pressure and flow in heating.

•**CONTROL FAULT:** If the geothermal unit control board has failed, the control will flash the appropriate fault code (see Table 12). The control board should be replaced.

•**UPM DIP SWITCH SETTINGS:** The UPM has 3 features controlled on the dip switch.

1. Freeze Protection Limit for the Freeze one water coil.
2. Lockout Settings (Soft Lockouts)
3. Brownout (High voltage protection)

DIP SWITCH		DIP Switch Position	
		ON	OFF (Default)
SW1	Freeze Protection Limit	15°F	26°F
SW2	Number of Trips to Lockout (HPS / LPS)	4	2
SW3	Brownout	Brownout Protection is Disabled	Brownout Protection is Active

•**WATER COIL FREEZE SENSOR:** The water coil is protected by a thermistor located between the condensing water coil (coax) and the thermal expansion valve (see Fig. 9).

The setting is default at 26°F (-3.33°C) but can be changed for units with ample anti-freeze to have a lower setting of 15°F (-9.44°C) with the dip switch selection or UI setting.

If the unit is employing an open loop system (no anti-freeze protection), the freeze limit trip for the UI will only allow selection of 26°F (-3.33°C) in order to shut down the unit at the appropriate leaving water temperature and protect the heat pump from freezing. If the refrigerant temperature drops below or remains at freezing limit trip for 30 seconds, the UPM will shut down the compressor and the board will flash fault code 86 (FRZ1 lockout). Fault code 86 will remain until the condition is corrected and also requires a manual reset low voltage circuit. After a manual reset and there is a call for heating, the unit will be re-energized automatically ONLY when the freeze sensor temperature is 7°F (-13.9°C) above setpoint (SW1).

Fault code 57 is FRZ1 sensor fault, which means the sensor is invalid, meaning the sensor could be open or faulty. If the sensor is invalid or out of the range (the range is from -50°F to 150°F (-45.6°C to 65.6°C), the compressor will be de-energized and display the freeze sensor fault code (57). When the sensor goes back into range, freeze sensor fault code will clear and the system will start up automatically if a demand exists.

For troubleshooting the Water Coil Freeze Sensor, refer to Table 12.

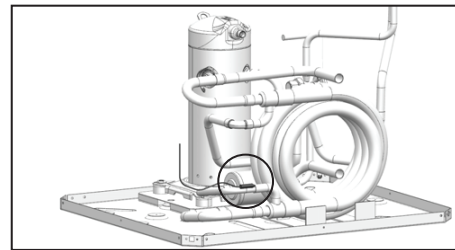


Fig. 19 - Freeze Protection Sensor Location

A14121

⚠ CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze1 set to the default 26°F (-3.33°C).

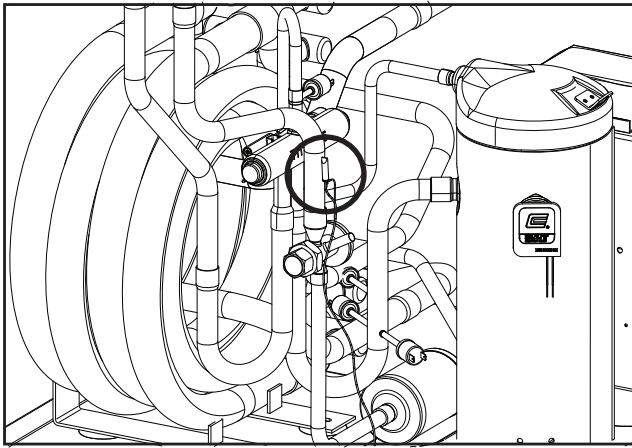
⚠ CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

Freeze sensor will not guard against the loss of water. A flow switch is recommended to prevent the unit from running if water flow is lost or reduced.

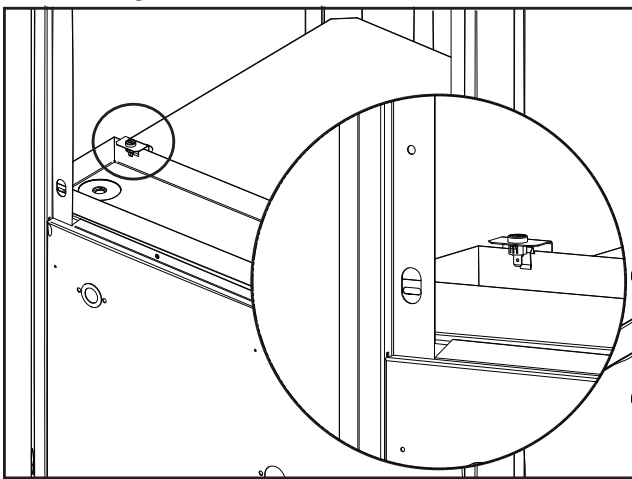
•Evaporator freeze protection sensor, mounted after the thermal expansion device and the evaporator, monitors refrigerant temperature between the evaporator coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 26°F. See Fig. 20.



A14122

Fig. 20 - Evaporator Freeze Protection Sensor Location

- The condensate overflow protection sensor is located in the drain pan of the unit and connected to the "COND" terminal on the UPM board. See Fig. 21.



A14123

Fig. 21 - Condensate Overflow Protection Sensor Location

- LOCKOUTS:** If system protection faults occur, the unit will shut down the compressor and fault codes will be shown on the UPM board and the UI screen.

There are two types of lockouts:

Soft lockouts - This is a selectable dipswitch position to allow 2 or 4 unit trips before going to hard lockout.

Hard lockouts - Will require a manual reset.

This applies to all unit trips unless otherwise noted. In order to exit the hard lockout early for servicing, the low voltage power to the unit would need to be reset and the fault conditions corrected. **NOTE:** The blower motor will remain active during a lockout condition.

- BROWNOUT PROTECTION:** The compressor will be shut down if the incoming voltage falls below 170 VAC for 4 seconds and fault code will display on UPM LED and wall control (if applicable). The compressor will remain off until the voltage is above 173 VAC for at least 4 seconds and the anti-short cycle timer times out.

Defeat the Brownout - The high voltage brownout feature can be defeated in the event of nuisance trips due to severe noisy power conditions. The UPM dip switch has brownout ON as default, to

defeat the brown out protection, the selection can be changed to OFF. All efforts should be exhausted to correct any electrical deficiencies before defeating this safety feature to eliminate possible equipment damage.

- COMPRESSOR VOLTAGE SENSING:** If there is no 230V at the compressor contactor(s) when the indoor unit is powered and cooling or heating demand exists, the appropriate fault code is displayed. Verify the disconnect is closed and 230V wiring is connected to the unit.
- 230V LINE (POWER DISCONNECT) DETECTION:** The control board input terminals labeled VS and L2 (see Fig. 18) are used to detect compressor voltage status and alert the user of potential problems. The control continuously monitors the high voltage on the run capacitor of the compressor motor. Voltage should be present any time the compressor contactor is energized and voltage should not be present when the contactor is de-energized.
- CONTACTOR SHORTED DETECTION:** If there is compressor voltage sensed when there is no demand for compressor operation, the contactor may be stuck closed or there may be a wiring error. The control will flash the appropriate fault code. If the control senses the compressor voltage after start-up and is then absent for 10 consecutive seconds while cooling or heating demand exists, the thermal protector is open. The control de-energizes the compressor contactor for 15 minutes. The control Status LED will flash the appropriate code shown in Table 12. After 15 minutes, with a call for low or high stage cooling or heating, the compressor contactor is energized. If the call for cooling or heating continues, the control will energize the compressor contactor every 15 minutes. If the thermal protector closes, (at the next 15 minute interval check) the unit will resume operation. If the thermal protector trips for three consecutive cycles, then unit operation is locked out for 4 hours and the appropriate fault code is displayed.
- NO 230V AT COMPRESSOR CONTACTOR:** If the compressor voltage is not sensed when the compressor should be starting, the appropriate contactor may be stuck open or there is a wiring error. The control will flash the appropriate fault code. Check the contactor and control box wiring. Refer to Table 7 and Fig. 22.

Table 7 – UPM Voltage Detection

UPM Voltage Detection	Fault Code
Brownout L1 and L2	46
Compressor voltage sensing VS and L1	74
230V line power disconnect detection on L1 and L2	47
Contactor shorted detection VS and L1	73
24V transformer Sec 1 and Sec 2	No faults

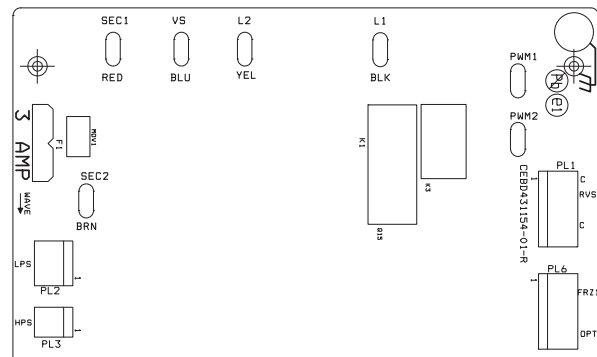


Fig. 22 - UPM Board L1, L2, VS, SEC 1 and SEC 2 Locations

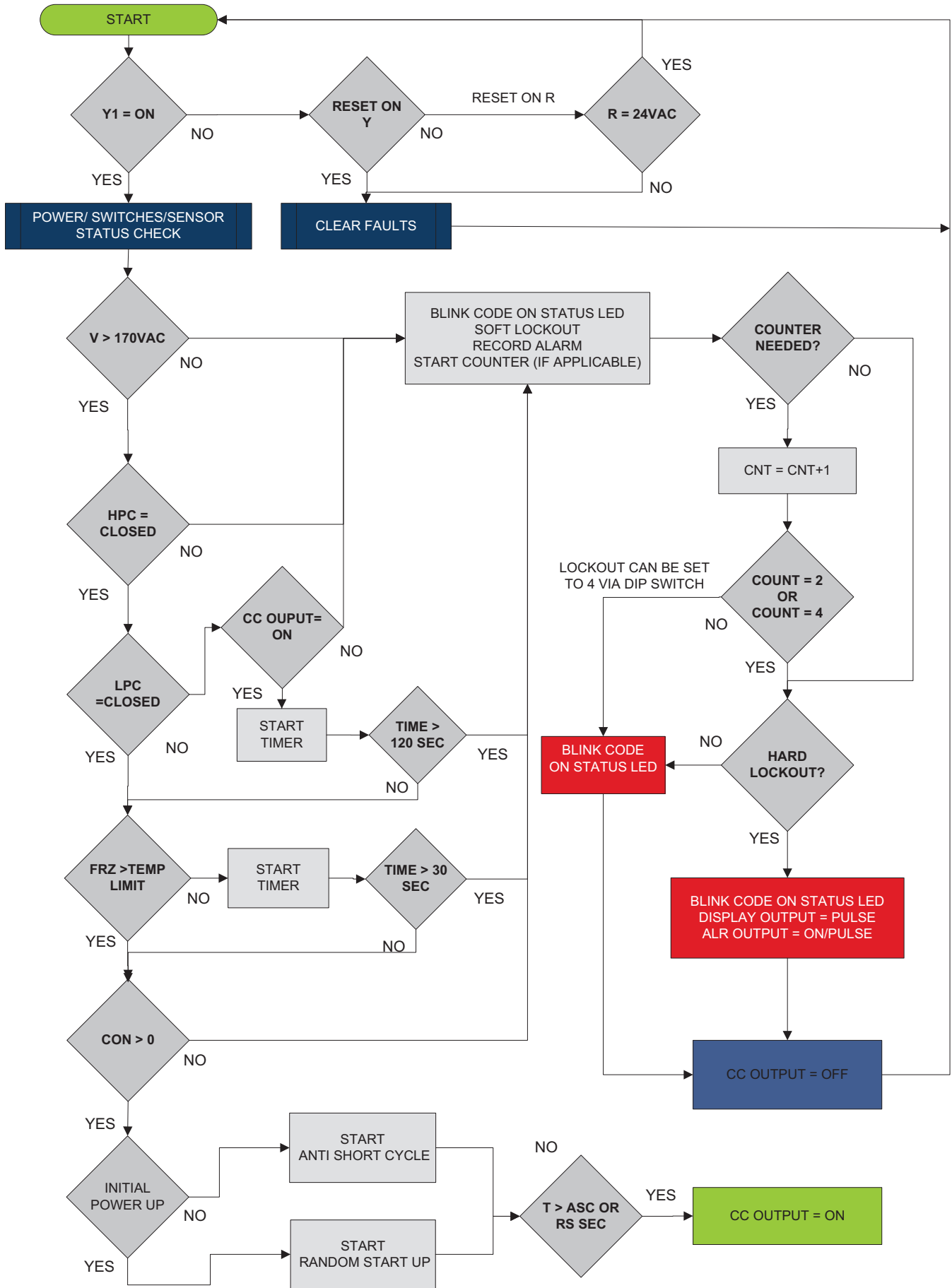
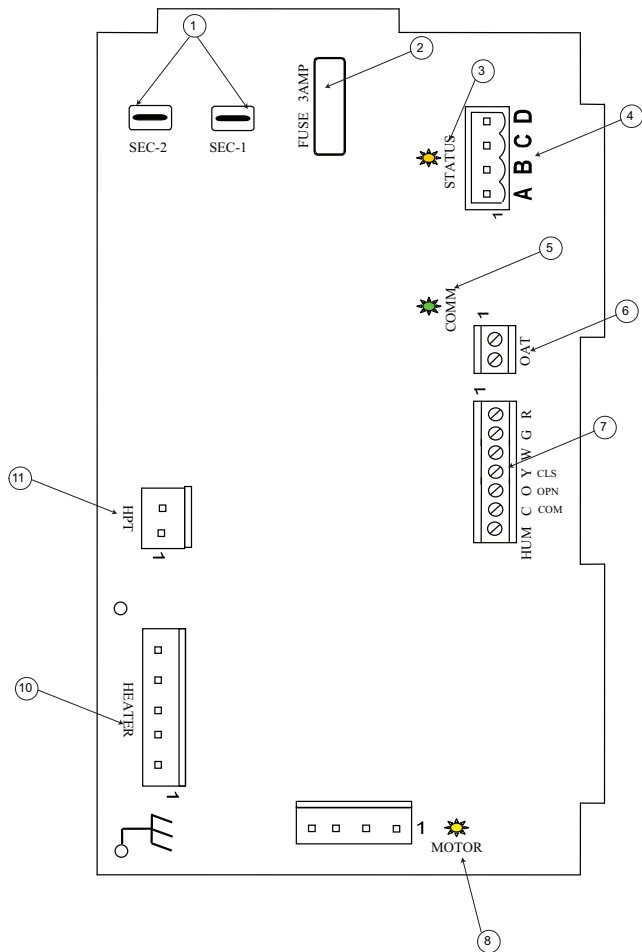


Fig. 23 - UPM Sequence of Operation (SOO) Flow Chart

A150171

ECM BOARD



A150556

- | | |
|---|---|
| (1) SEC 1 and SEC 2 | (7) Non-comm. t-stat emergency only connections |
| (2) Transformer Power | (8) Motor Power Indicator Light |
| (3) Status LED Light | (9) |
| (4) ABCD Communicating Thermostat Terminal Plug Connection. | (10) Heater Connection for Field Supply Electric Heat |
| (5) COMM Light | (11) HPT |
| (6) OAT - Outdoor Air Temp Sensor | |

Fig. 24 - Detail of ECM Printed Circuit Board Connections

NOTE: CFM LED indication is an approximation. Utilize conventional Test and Balance equipment for accurate airflow measurement.

- CFM count indicator (see Fig. 24, item 6) blinks to indicate approximate airflow in CFM and may flicker when the unit is off.
- Each blink of the LED represent approximately 100 CFM of air delivery so if the LED blinks 12 times, pauses, blinks 12 times, etc. the blower is delivering approximately 1200 CFM.
- An annual “checkup” is recommended by a qualified refrigeration mechanic.
- Recording the performance measurements of volts, amps, and water temperature differences (both heating and cooling) is recommended. This data should be compared to the information on the unit’s data plate and the data taken at the original start-up of the equipment.
- Periodic lockouts are commonly caused by water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur, call a mechanic immediately and have them check for the following:
 - Water flow problems
 - Water temperature problems

Unit capacity and water flow charts should be used for system checks. Refer to Table 8.

Using the Owner’s/User Manual furnished in outdoor unit, the installing technician should explain system operation to the consumer with particular emphasis on indoor fan coil operation sounds and filter maintenance.

ECM Sequence of Operation

The GC is designed for installation with a communicating User Interface. This blower will not respond to commands provided by a common thermostat except under certain emergency situations described in Blower Start Up and Troubleshooting section of this document.

The User Interface uses temperature; humidity and other data supplied from indoor and outdoor system components to control heating or cooling system for optimum comfort. The blower will be commanded by User Interface to supply airflow. The blower will operate at requested airflow for most modes.

The nominal requested airflow will be 350 cfm per ton of nominal cooling capacity as defined by outdoor unit size. Actual airflow request will be adjusted from nominal using indoor and outdoor temperature and indoor humidity data to optimize the system operation for occupant comfort and system efficiency. Refer to User Interface literature for further system control details.

Airflow during electric heater operation must be greater than a minimum level for safe operation. If User Interface instructs blower to turn on electric heat and the requested airflow is less than the minimum value required for safe operation of installed heater, the ECM board will override requested value with the value shown in Table 9, Blower Airflow Delivery Chart - Electric Heating Modes.

Table 8 – Operating Temperature and Pressures

Operating Temperatures and Pressures											
			COOLING				HEATING				
Model	Entering Water Temp. °F	Water Flow	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Rise °F	Air Temp Drop °F	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Drop	Air Temp Rise °F	
GC024 Part Load	30°	4					75-91	264-322	5-6	15-17	
		8					79-96	270-331	3-4	16-18	
	40°	4					88-107	277-339	6-7	17-20	
		8	115-140	175-214	8-9	19-23	92-112	284-348	4-5	18-21	
	50°	4	129-157	218-267	14-17	18-20	98-122	291-356	7-8	20-23	
		8	124-151	204-250	8-9	19-22	110-130	298-364	5-6	21-24	
	60°	4	134-163	249-305	13-16	17-20	112-136	304-372	8-10	22-26	
		8	128-156	233-287	8-9	18-21	117-143	312-381	6-7	23-28	
	70°	4	138-168	281-341	13-16	17-19	124-152	318-389	9-11	24-29	
		8	133-161	263-323	7-9	18-21	131-159	325-398	6-8	26-31	
	80°	4	143-174	317-388	13-16	16-19	136-166	331-405	11-13	27-32	
		8	137-167	297-366	7-9	17-20	143-174	339-415	7-9	28-33	
	90°	4	147-179	357-437	13-16	16-18	149-181	345-422	12-14	29-35	
		8	141-172	335-411	7-9	17-20	156-190	352-432	8-10	31-37	
	100°	4	151-185	402-492	13-15	15-18					
		8	146-177	378-459	7-9	16-19					
	GC024 Full Load	30°	4					76-92	242-297	3-4	13-14
			8					80-97	249-304	2-3	13-15
40°		4	125-151	180-221	14-18	19-22	89-108	255-312	4-5	15-17	
		8	120-146	169-207	8-10	20-23	93-113	261-320	3-3	16-18	
50°		4	134-163	211-258	14-18	18-21	106-118	267-327	5-6	17-19	
		8	129-157	198-242	8-10	19-23	110-126	274-335	3-4	18-21	
60°		4	139-169	241-295	14-17	18-21	113-138	280-342	6-7	19-22	
		8	134-163	227-278	8-10	19-22	119-145	287-351	4-5	20-23	
70°		4	144-175	272-333	14-17	17-20	126-155	292-358	7-8	21-24	
		8	138-168	255-313	8-10	18-21	133-162	300-367	5-6	22-26	
80°		4	148-181	307-375	14-17	17-19	138-168	305-373	8-9	23-27	
		8	143-174	288-353	8-10	18-21	145-177	312-382	5-6	24-29	
90°		4	153-186	346-423	14-17	16-19	151-184	317-388	8-10	25-29	
		8	147-179	325-398	8-9	17-20	158-193	325-398	6-7	26-31	
100°		4	158-191	389-477	13-16	16-18					
		8	152-185	366-448	8-9	17-20					

This chart shows approximate temperatures and pressures for a unit in good repair. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80° d.b./67° w.b. entering air temperature in cooling, 70° d.b. entering air temperature in heating. Heating data at entering fluid temperatures below 50° assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

Operating Temperatures and Pressures

		COOLING					HEATING				
Model	Entering Water Temp. °F	Water Flow	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Rise °F	Air Temp Drop °F	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Drop	Air Temp Rise °F	
GC036 Part Load	30°	4.5					73-89	266-325	5-6	15-18	
		9.0					77-94	272-333	3-4	16-19	
	40°	4.5	117-143	189-231	14-17	18-22	86-105	279-341	6-7	17-21	
		9.0	112-137	178-217	8-9	19-24	90-110	286-350	4-5	18-22	
	50°	4.5	126-154	221-270	14-17	18-21	105-125	293-358	7-8	20-24	
		9.0	121-148	207-253	8-9	19-23	109-130	300-366	5-6	21-25	
	60°	4.5	131-160	252-308	13-16	17-21	110-134	306-374	8-10	22-27	
		9.0	125-153	237-290	8-9	18-22	115-141	314-383	6-7	23-29	
	70°	4.5	135-165	284-347	13-16	17-20	122-150	320-391	9-11	24-30	
		9.0	130-158	266-326	7-9	18-22	129-157	327-400	6-8	26-32	
	80°	4.5	140-171	320-391	13-16	16-20	134-164	333-407	11-13	27-33	
		9.0	134-164	300-367	7-9	17-21	141-172	341-417	7-9	28-35	
	90°	4.5	144-176	360-440	13-16	16-19	147-179	347-424	12-14	29-36	
		9.0	138-169	338-414	7-9	17-21	154-188	355-434	8-10	31-38	
	100°	4.5	149-182	405-495	13-15	15-19					
		9.0	143-174	381-465	7-9	16-20					
	GC036 Full Load	30°	4.5					74-90	244-299	3-4	13-15
			9.0					78-95	251-306	2-3	13-16
40°		4.5	122-149	183-224	14-18	19-23	87-106	257-314	4-5	15-18	
		9.0	117-143	172-210	8-10	20-24	91-111	263-322	3-3	16-19	
50°		4.5	131-160	214-261	14-18	18-22	95-105	269-329	5-6	17-20	
		9.0	126-154	201-245	8-10	19-24	100-125	276-337	3-4	18-22	
60°		4.5	136-166	244-298	14-17	18-22	111-136	282-344	6-7	19-23	
		9.0	131-160	230-281	8-10	19-23	117-143	289-353	4-5	20-24	
70°		4.5	141-172	275-336	14-17	17-21	124-152	294-360	7-8	21-25	
		9.0	135-165	258-316	8-10	18-22	131-160	302-369	5-6	22-27	
80°		4.5	145-178	310-378	14-17	17-20	136-166	307-375	8-9	23-28	
		9.0	140-171	291-356	8-10	18-22	143-175	314-384	5-6	24-30	
90°		4.5	150-183	349-426	14-17	16-20	149-182	319-390	8-10	25-30	
		9.0	144-176	328-401	8-9	17-21	156-191	327-400	6-7	26-32	
100°		4.5	155-189	392-480	13-16	16-19					
		9.0	149-182	369-451	8-9	17-21					

This chart shows approximate temperatures and pressures for a unit in good repair. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80° d.b./67° w.b. entering air temperature in cooling, 70° d.b. entering air temperature in heating. Heating data at entering fluid temperatures below 50° assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

Operating Temperatures and Pressures

			COOLING				HEATING				
Model	Entering Water Temp. °F	Water Flow	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Rise °F	Air Temp Drop °F	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Drop	Air Temp Rise °F	
GC048 Part Load	30°	6.0					64-78	248-303	5-6	15-18	
		12.0					67-82	254-311	3-4	16-19	
	40°	6.0	109-134	183-224	18-22	19-23	75-91	261-319	6-8	17-21	
		12.0	105-128	172-210	10-12	20-25	79-96	267-327	4-5	18-23	
	50°	6.0	118-144	214-261	18-22	19-23	78-90	273-334	8-10	20-24	
		12.0	113-138	201-245	10-12	20-24	82-95	280-342	5-7	21-26	
	60°	6.0	122-149	244-298	17-21	18-22	96-117	286-349	9-11	22-27	
		12.0	117-143	230-281	10-12	19-24	101-123	293-358	6-8	24-29	
	70°	6.0	126-154	275-336	17-21	18-22	107-131	299-365	11-13	25-30	
		12.0	121-148	258-316	10-12	19-23	113-138	306-374	7-9	26-32	
	80°	6.0	130-159	310-378	17-21	17-21	117-143	311-380	12-15	27-33	
		12.0	132-153	291-356	10-12	18-22	123-151	319-390	8-10	29-35	
	90°	6.0	134-164	349-426	17-20	17-20	128-157	324-396	13-16	29-36	
		12.0	129-158	328-401	9-12	18-22	135-165	332-406	9-11	31-38	
	100°	6.0	139-170	392-480	16-20	16-20					
		12.0	133-163	369-451	9-11	17-21					
	GC048 Full Load	30°	6.0					71-87	277-339	6-7	15-19
			12.0					75-92	284-347	4-5	16-20
40°		6.0	118-144	194-237	21-25	19-23	84-102	291-356	7-9	18-22	
		12.0	113-138	182-223	12-14	20-24	88-108	299-365	5-6	19-23	
50°		6.0	127-155	226-276	21-25	18-22	92-110	305-373	9-11	20-25	
		12.0	122-149	213-260	12-14	19-24	98-120	313-383	6-7	21-26	
60°		6.0	131-160	259-316	21-25	18-22	108-132	320-391	10-13	23-28	
		12.0	126-154	243-297	12-14	19-23	113-138	328-400	7-9	24-29	
70°		6.0	136-166	291-355	20-25	17-21	120-147	334-408	12-15	25-31	
		12.0	130-159	273-334	12-14	18-22	126-154	342-418	8-10	27-32	
80°		6.0	140-171	328-401	20-24	17-20	131-161	348-425	14-17	27-34	
		12.0	135-165	308-377	11-14	18-22	138-169	356-436	9-11	29-36	
90°		6.0	145-177	369-451	20-24	16-20	144-176	362-442	15-18	30-37	
		12.0	139-170	347-424	11-14	17-21	151-185	371-453	10-12	32-39	
100°		6.0	149-183	415-508	19-24	16-19					
		12.0	143-175	391-477	11-14	17-21					

This chart shows approximate temperatures and pressures for a unit in good repair. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80° d.b./67° w.b. entering air temperature in cooling, 70° d.b. entering air temperature in heating. Heating data at entering fluid temperatures below 50° assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

Operating Temperatures and Pressures

		COOLING					HEATING				
Model	Entering Water Temp. °F	Water Flow	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Rise °F	Air Temp Drop °F	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Drop	Air Temp Rise °F	
GC060 Part Load	30°	7.0					68-84	256-313	5-7	19-23	
		14.0					73-89	261-319	4-5	20-25	
	40°	7.0	113-138	172-210	18-22	19-23	81-99	277-339	7-8	22-26	
		14.0	110-134	161-196	12-14	20-24	86-105	283-346	5-6	23-28	
	50°	7.0	116-142	206-252	17-21	19-23	93-114	299-365	8-9	24-29	
		14.0	112-137	193-236	12-14	19-24	99-121	305-373	6-7	25-31	
	60°	7.0	118-145	241-294	17-21	18-23	106-129	321-392	9-11	26-32	
		14.0	115-140	225-275	11-14	19-23	113-138	327-400	7-8	28-34	
	70°	7.0	121-148	275-336	17-21	18-22	118-145	342-418	10-12	29-35	
		14.0	117-143	257-314	11-14	19-23	126-154	349-427	8-9	30-37	
	80°	7.0	123-151	309-378	16-20	18-22	131-160	364-444	11-14	31-38	
		14.0	120-146	289-353	11-13	19-23	139-170	371-454	8-10	33-40	
	90°	7.0	126-154	344-420	16-20	18-22	143-175	385-471	12-15	33-41	
		14.0	122-149	321-392	11-13	18-22	152-186	393-480	9-11	35-43	
	100°	7.0	128-157	378-462	16-19	17-21					
		14.0	125-152	353-432	11-13	18-22					
	GC060 Full Load	30°	7.0					68-84	256-313	5-7	19-23
			14.0					73-89	261-319	4-5	20-25
40°		7.0	117-143	182-222	15-19	21-26	81-99	277-339	7-8	22-26	
		14.0	114-139	170-208	11-14	22-27	86-105	283-346	5-6	23-28	
50°		7.0	120-147	215-263	15-18	20-25	93-114	299-365	8-9	24-29	
		14.0	117-143	201-246	11-14	21-26	99-121	305-373	6-7	25-31	
60°		7.0	123-150	248-304	14-17	20-24	106-129	321-392	9-11	26-32	
		14.0	119-146	232-284	11-13	21-25	113-138	327-400	7-8	28-34	
70°		7.0	126-154	282-344	14-17	19-24	118-145	342-418	10-12	29-35	
		14.0	122-149	263-322	10-13	20-25	126-154	349-427	8-9	30-37	
80°		7.0	129-157	315-385	13-16	19-23	131-160	364-444	11-14	31-38	
		14.0	125-153	294-360	10-12	19-24	139-170	371-454	8-10	33-40	
90°		7.0	132-161	348-426	13-16	18-22	143-175	385-471	12-15	33-41	
		14.0	128-156	326-398	10-12	19-23	152-186	393-480	9-11	35-43	
100°		7.0	134-164	382-466	12-15	17-21					
		14.0	131-160	357-436	9-11	18-22					

This chart shows approximate temperatures and pressures for a unit in good repair. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80° d.b./67° w.b. entering air temperature in cooling, 70° d.b. entering air temperature in heating. Heating data at entering fluid temperatures below 50° assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

Operating Temperatures and Pressures

		COOLING					HEATING				
Model	Entering Water Temp. °F	Water Flow	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Rise °F	Air Temp Drop °F	Suction Pressure PSIG	Discharge Pressure PSIG	Water Temp Drop	Air Temp Rise °F	
GC072 Part Load	30°	9.0					71-87	259-316	5-7	19-23	
		18.0					76-92	264-322	4-5	20-25	
	40°	9.0	116-141	175-213	18-22	19-23	84-102	280-342	7-8	22-26	
		18.0	113-137	164-199	12-14	20-24	89-108	286-349	5-6	23-28	
	50°	9.0	119-145	209-255	17-21	19-23	96-117	302-368	8-9	24-29	
		18.0	115-140	196-239	12-14	19-24	102-124	308-376	6-7	25-31	
	60°	9.0	121-148	244-297	17-21	18-23	109-132	324-395	9-11	26-32	
		18.0	118-143	228-278	11-14	19-23	116-141	330-403	7-8	28-34	
	70°	9.0	124-151	278-339	17-21	18-22	121-148	345-421	10-12	29-35	
		18.0	120-146	260-317	11-14	19-23	129-157	352-430	8-9	30-37	
	80°	9.0	126-154	312-381	16-20	18-22	134-163	367-447	11-14	31-38	
		18.0	123-149	292-356	11-13	19-23	142-173	374-457	8-10	33-40	
	90°	9.0	129-157	347-423	16-20	18-22	146-178	388-474	12-15	33-41	
		18.0	125-152	324-395	11-13	18-22	155-189	396-483	9-11	35-43	
	100°	9.0	131-160	381-465	16-19	17-21					
		18.0	128-155	356-435	11-13	18-22					
	GC072 Full Load	30°	9.0					71-87	259-316	5-7	19-23
			18.0					76-92	264-322	4-5	20-25
40°		9.0	120-146	185-225	15-19	21-26	84-102	280-342	7-8	22-26	
		18.0	117-142	173-211	11-14	22-27	89-108	286-349	5-6	23-28	
50°		9.0	123-150	218-266	15-18	20-25	96-117	302-368	8-9	24-29	
		18.0	120-146	204-249	11-14	21-26	102-124	308-376	6-7	25-31	
60°		9.0	126-153	251-307	14-17	20-24	109-132	324-395	9-11	26-32	
		18.0	122-149	235-287	11-13	21-25	116-141	330-403	7-8	28-34	
70°		9.0	129-157	285-347	14-17	19-24	121-148	345-421	10-12	29-35	
		18.0	125-152	266-325	10-13	20-25	129-157	352-430	8-9	30-37	
80°		9.0	132-160	318-388	13-16	19-23	134-163	367-447	11-14	31-38	
		18.0	128-156	297-363	10-12	19-24	142-173	374-457	8-10	33-40	
90°		9.0	135-164	351-429	13-16	18-22	146-178	388-474	12-15	33-41	
		18.0	131-159	329-401	10-12	19-23	155-189	396-483	9-11	35-43	
100°		9.0	137-167	385-469	12-15	17-21					
		18.0	134-163	360-439	9-11	18-22					

This chart shows approximate temperatures and pressures for a unit in good repair. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80° d.b./67° w.b. entering air temperature in cooling, 70° d.b. entering air temperature in heating. Heating data at entering fluid temperatures below 50° assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

Table 9 – Blower Airflow Delivery Chart (CFM) — Electric Heating Models

MODEL	UNIT CAPACITY BTUH	ELECTRIC HEATER kW RANGE			
		5	10	15	20
GC024	EMERGENCY	825	825	–	–
	24,000	825	825	–	–
GC036	EMERGENCY	1100	1100	1100	–
	36,000	1100	1100	1100	–
GC048	EMERGENCY	1600	1600	1600	1600
	48,000	1600	1600	1600	1600
GC060	EMERGENCY	2000	2000	2000	2000
	60,000	2000	2000	2000	2000
GC072	EMERGENCY	2350	2350	2350	2350
	72,000	2350	2350	2350	2350

Note 1: Emergency – Air conditioner with electric heater application, or emergency heat.

Note 2: These airflows are minimum airflows as UL listed.

Note 3: Dashed entry indicates that the heater/blower/GC unit combination is not approved. Do not apply.

Table 10 – Water Side Pressure Drop PSIG

Model	GPM	Pressure Drop (PSI)								
		30°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F	110°F
GC024	3	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6
	4	1.4	1.3	1.3	1.3	1.2	1.2	1.1	1.0	1.0
	6	2.9	2.8	2.6	2.6	2.5	2.4	2.3	2.2	2.1
GC036	4.5	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.2	1.1
	6	2.7	2.6	2.4	2.2	2.2	2.1	2.0	2.0	1.9
	9	5.5	5.3	4.8	4.6	4.5	4.4	4.2	4.1	4.0
GC048	6	1.3	1.3	1.1	1.1	1.1	1.1	1.0	1.0	0.9
	8	2.2	2.1	1.9	1.8	1.8	1.7	1.7	1.6	1.6
	12	4.5	4.4	4.0	3.8	3.7	3.6	3.5	3.4	3.3
GC060	7.5	1.4	1.3	1.2	1.2	1.1	1.1	1.1	1.0	1.0
	10	2.3	2.2	2.0	2.0	1.9	1.8	1.8	1.7	1.7
	15	4.8	4.7	4.2	4.1	3.9	3.8	3.7	3.6	3.5
GC072	9	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.8
	12	1.7	1.7	1.5	1.5	1.4	1.4	1.3	1.3	1.3
	18	3.6	3.5	3.2	3.1	3.0	2.9	2.8	2.7	2.6

This chart shows approximate temperatures and pressures for a unit in good repair. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80°F d.b./67°F w.b. entering air temperature in cooling, 70°F d.b. entering air temperature in heating. Heating data at entering fluid temperatures below 50°F assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

Initial Start-Up of HRP System



CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

Make sure all valves in heat recovery water piping system are open. NEVER OPERATE HR PUMP DRY.

1. Turn on the heat pump. The HR pump should not run if the compressor is not running.
2. Turn HR switch to the "ON" position. The pump will operate if entering water temperature to HR is below 120°F.
3. The temperature difference between the water entering and leaving the heat recovery should be 5°F to 15°F.
4. Allow the unit to operate for 20 to 30 minutes to ensure it is functioning properly. The pump should shut off when the water temperature entering the heat recovery reaches 120°F.

HRP Troubleshooting

The HR pump will be enabled when compressor discharge temperature is 120°F (48.9°C) or above.

The circulating pump will be disabled if water temperature reaches 140°F (60°C) or amperage exceeds 0.4 amps.

HRP Troubleshooting		
Problem	Possible Cause	Checks and Corrections
NO FLOW LOW FLOW	No Power	Check power supply
	On/Off Switch Position	Set switch to "ON" position
	Compressor Contactor	Engage heat pump contactor
	Broken or loose wires	Repair or tighten wires
	Air Lock	Purge air from piping system
	Stuck pump shaft/impeller	Remove pump cartridge and clean
	Defective pump	Replace pump
	Kinked or under sized water piping	Repair kink and check for proper line size
HIGH WATER TEMPERATURE	Water temp limit closed	Stuck limit switch Sensor not attached securely to line
LOW HEAT OUTPUT	Scaled or fouled heat exchanger	Clean heat exchanger

SYSTEM FUNCTIONS AND SEQUENCE OF OPERATION

GC units are designed for communicating-only controls.

Communicating Sequence: The UPM board controls all functions. See Fig. 23.

Communication and Status Function Lights

A green LED (COMM light) on the UPM (see Fig. 18) indicates successful communication with the other system products. The green LED will remain OFF until communication is established. Once a valid command is received, the green LED will turn ON continuously. If no communication is received within 2 minutes, the LED will be turned OFF until the next valid communication.

Amber Status Light - An amber colored STATUS light is used to display the operation mode and fault codes as specified in the troubleshooting section. See Table 12 for codes and definitions. **NOTE:** Only one code will be displayed on the UPM board (the most recent, with the highest priority).

Time Delays

Unit time delays include:

- Five minute time delay to start cooling or heating operation when there is a call from the thermostat or user interface. To bypass this feature, momentarily short and release Timer Speed-Up pins.
- Five minute compressor re-cycle delay on return from a brown-out condition.
- Two minute time delay to return to standby operation from last valid communication (with UI only).
- There is no delay between staging from low to high and from high to low capacity. The compressor will change from low to high and from high to low capacity "on the fly" to meet the demand.

Compressor Operation

The basic scroll design has been modified with the addition of an internal unloading mechanism that opens a by-pass port in the first compression pocket, effectively reducing the displacement of the scroll. The opening and closing of the by-pass port is controlled by an internal electrically operated solenoid.

The modulated scroll uses a single step of unloading to go from full capacity to approximately 67% capacity. A single speed, high efficiency motor continues to run while the scroll modulates between the two capacity steps. Modulation is achieved by venting a portion of the gas in the first suction pocket back to the low side of the compressor, thereby reducing the effective displacement of the compressor.

Full capacity is achieved by blocking these vents, thus increasing the displacement to 100%. A DC solenoid in the compressor controlled by a rectified 24 volt AC signal in the external solenoid plug moves the slider ring that covers and uncovers these vents.

The vent covers are arranged in such a manner that the compressor operates at approximately 67% capacity when the solenoid is not energized and 100% capacity when the solenoid is energized. The loading and unloading of the two step scroll is done "on the fly" without shutting off the motor between steps.

NOTE: 67% compressor capacity translates to approximately 75% cooling or heating capacity at the indoor coil. The compressor will always start unloaded and stay unloaded for five seconds even when the thermostat is calling for high stage capacity.

Troubleshooting units for proper switching between low & high stages

Check the suction pressures at the service valves. Suction pressure should be reduced by 3-10% when switching from low to high capacity.

Compressor current should increase 20 to 45% when switching from low to high stage. The compressor solenoid when energized in high stage, should measure 24VAC across pin numbers PL5-2 HI and PL5-5 C. When the compressor is operating in low stage, the 24V DC compressor solenoid coil is de-energized. When the compressor is operating in high stage, the 24V DC solenoid coil is energized.

The solenoid plug harness that is connected to the compressor has an internal rectifier that converts the 24V AC signal to 24V DC.

DO NOT INSTALL A PLUG WITHOUT AN INTERNAL RECTIFIER.

Unloader Test Procedure

The unloader is the compressor internal mechanism, controlled by the DC solenoid, that modulates between high and low stage. If it is suspected that the unloader is not working, the following methods may be used to verify operation.

1. Operate the system and measure compressor amperage. Cycle the unloader on and off at 30 second plus intervals at the User Interface (from low to high stage and back to low stage). Wait 5 seconds after staging to high before taking a reading. The compressor amperage should go up or down at least 20 percent.
2. If the expected result is not achieved, remove the solenoid plug from the compressor and with the unit running and the User Interface or thermostat calling for high stage, test the voltage output at the plug with a DC voltmeter. The reading should be 24 volts DC.
3. If the correct DC voltage is at the control circuit molded plug, measure the compressor unloader coil resistance. The resistance should be approximately 330 or 1640 ohms depending on unloader coil supplier. If the coil resistance is infinite or is grounded, the compressor must be replaced.

Two Stage Compressor

The two stage compressor contains motor windings that provide 2-pole (3500 RPM) operation.

Compressor Internal Pressure Relief

The compressor is protected by an internal pressure relief (IPR) which relieves discharge gas into the compressor shell when differential between suction and discharge pressure exceeds 550-625 psi. The compressor is also protected by an internal overload attached to motor windings.

Compressor Control Contactor

The contactor has a 24volt coil. The electronic control board controls the operation of the contactor.

Troubleshoot Compressor

If the compressor fails to operate, Table 11 can be used to verify if there is any damage to the compressor windings causing system malfunction.

Table 11 – Winding Resistance

Compressor Ohms		
Model	Start Winding	Run Winding
GC024	1.64	1.3
GC036	1.52	0.88
GC048	1.86	0.52
GC060	1.63	0.39
GC072	1.85	0.34
Tolerance +/- 7%. All resistance values must be measured with compressor at room temperature.		

TROUBLESHOOTING

IMPORTANT: The following Troubleshooting tables are designed to help identify possible causes and solutions for problems. There could be more than one cause/solution to a problem that can be applied. Check each cause and adopt "process of elimination" and/or verification of each before making a conclusion.

Tables 12 and 13 show the status codes flashed by the amber status light. The codes are flashed by a series of short and long flashes of the status light. The short flashes indicate the first digit in the status code followed by long flashes indicating the second digit of

the error code. The short flash is 0.25 seconds on and the long flash is 1.0 seconds on. Time between flashes is 0.25 seconds. Time between short flash and first long flash is 1.0 seconds. Time between code repeating is 2.5 seconds with LED off.

Table 12 – UPM Fault Code Table

OPERATION	FAULT	FLASH CODE	POSSIBLE CAUSE AND ACTION
Standby	18–30 VAC power is present	ON, no flash	Normal Operation
Low Stage		1, pause	Normal Operation
High Stage		2, pause	Normal Operation
Brownout Protection is Disabled		5, pause	User made selection, see instructions for details
Brownout Protection is Active		6, pause	Default, user can disable see instructions for details
	System Communication Failure	16	Communication with User Interface lost. Check wiring to and from User Interface
	Invalid Model Plug	25	Control does not detect a model plug or detects an invalid model plug. Unit will not operate without correct model plug.
	High Pressure Switch	31*	High Pressure Switch Trip. Check Refrigerant Charge, Water Flow and Temperature too high in cooling, and airflow restrictions in heating.
	Low Pressure Switch	32*	Low Pressure Switch Trip. Check Refrigerant Charge, TXV operation and airflow restrictions.
	Internal Board Failure	45	UPM board has failed. Replace Board and transfer model plug to replacement board.
	Brownout on 230V	46	Line voltage <170V for at least 4 seconds. Compressor and blower not allowed until voltage >173V. Verify line voltage. This feature can be disabled, see instructions for details.
	No 230V to unit	47	There is no 230V at the contactor when indoor unit is powered and cooling/heating demand exists. Verify the disconnect is closed and 230V wiring is connected to the unit.
	Freeze Sensor Fault	57	Freeze sensor is invalid or out of range.. Check for open sensor, wire disconnected, sensor not connected properly or abnormal sensor temp ranges.
	Compressor Thermal Cutout in Low Stage	71*	Compressor operation detected then disappears while low stage demand exist. Possible causes are internal compressor overload trip or start relay and capacitor held in circuit too long (if installed).
	Compressor Thermal Cutout in High Stage	72*	Compressor operation detected then disappears while high stage demand exist. Possible causes are internal compressor overload trip or start relay and capacitor held in circuit too long (if installed).
	Voltage at Standby (contactor shorted)	73	Compressor voltage sensed when no demand for compressor operation exists. Contactor may be stuck closed or there is a wiring error.
	No Voltage to Compressor (No voltage at start-up)	74	Compressor voltage not sensed when compressor should be starting. Contactor may be stuck open or there may be a wiring error.
	Thermal Lockout in Low Stage for 4 Hours	81	Thermal cutout occurs in 3 consecutive low/high stage cycles. Low stage locked out for 4 hours or until 24V power recycled.
	Thermal Lockout in High Stage for 4 Hours	82	Thermal cutout occurs in 3 consecutive high/low stage cycles. High stage locked out for 4 hours or until 24V power recycled.
	Low Pressure Lockout	83	Low Pressure Switch (LPS) trips 2 or 4 times in an hour. Unit operation is locked out for 4 hours or until 24V power recycled.
	High Pressure Lockout	84	High Pressure Switch (HPS) trips 2 or 4 times in an hour. Unit operation is locked out for 4 hours or until 24V power recycled.
	Condensate Overflow	85	Water in the condensate pan exceeds certain level. The compressor is re-energized when water issue clears.
	Freeze Sensor Lockout	86	Refrigerant temperature drops below or remains at freeze limit trip for 30 seconds, the unit enters into a permanent lockout and needs a manual reset. Water coil freeze sensor below limit, verify proper loop water temp and pressures. Verify sensor accuracy using tables in instructions and verifying it is properly attached to coil. Verify antifreeze quantity if applicable and the freeze protection limit dip switch settings appropriate on the UPM board.

*Sequence: Compressor contactor is de-energized. If demand still exists, control will energize compressor contactor after 15 minute delay. If fault is cleared, unit will resume operation. If fault exists, blower shuts off, and error code continues to flash. Control will attempt re-start every 15 minutes. Cycling low voltage defeats the 15 minute delay.

Table 13 – ECM Fault Code Table

OPERATION	FAULT	FLASH CODE	POSSIBLE CAUSE AND ACTION
Standby	--	Continuously on	
	No Low Voltage or Control Failed	Continuously off	
	System Communication Fault	16	System communications are not successful for a period exceeding two minutes. Check system wiring to be sure the User Interface is powered and connections are made A to A, B to B, etc. and wiring is not shorted.
	Invalid Model/Motor Selection	25	Motor size and fan coil size do not match. Motor must be replaced with proper size motor. When a replacement ECM control is installed, enter correct model size from a list of valid sizes in UI.
	Invalid Heater Size	26	No resistor is found or heater resistor value read is invalid. - Check wiring harness connections. - Check for a resistance value greater than 5000 ohms. - Check for proper wiring of resistor assembly. - Make sure heater size installed is an approved size for outdoor unit and fan coil sizes installed.
	Invalid Outdoor Unit Size	27	Outdoor unit size is invalid. Check communications wiring to be sure User Interface has established communications with outdoor unit or select proper size from valid size list provided at User Interface.
	Heater output not sensed when energized	36	ECM control energizes either heater stage and does not detect the 24--Vac signal on output. Check for 24VAC on heater stage outputs. Fan coil control or sensing circuit may be bad.
	Heater output sensed On when not energized	37	ECM control detects a 24--Vac signal on either heater stage output and it is not supplying signal. - Stop all system operations at User Interface and check heater stage 24--Vac outputs. - Disconnect electric heater at plug/receptacle 2 and check heater wiring for faults.
	Blower Motor Fault	41	Motor does not run: - Check to be sure that the blower wheel is not rubbing the housing. - Check motor to be sure that the motor shaft is not seized. - Check motor windings.
	Motor Communication Fault	44	Motor does not communicate with ECM control. - Check the motor wiring harness for proper connection to control and motor receptacles. - Check motor wiring harness to be sure all wiring complies with wiring diagram description - Check 12--Vdc low--voltage supply to motor at Pins 1 (+) and 2 (-) of motor header connection to fan coil control.
	Control Board Fault	45	ECM control has failed internal start--up tests and must be replaced.
	Brown Out Condition	46	The secondary voltage of the transformer falls below 15VAC for a period exceeding four seconds. The brownout condition is cleared when secondary voltage rises above 17VAC.
	Heat Pump Temperature Sensor Fault	52	HPT sensor is shorted or open. Check for faults in wiring connecting sensor to HPT terminal. Check resistance of thermistor for a short or open condition.
	Outdoor Air Temperature Sensor Fault	53	OAT sensor is shorted or open. Check for faults in wiring connecting sensor to OAT terminal. Check resistance of thermistor for a short or open condition.

ECM BOARD TROUBLESHOOTING

LED Description:

LEDs built into ECM board provide installer or service person information concerning operation and/or fault condition of the ECM board and ECM motor. This information is also available at system user interface in text with basic troubleshooting instructions. Careful use of information displayed will reduce the need for extensive manual troubleshooting.

The amber LED located at bottom center of control adjacent to motor harness plug is motor status LED and it is labeled MOTOR. A second amber LED located in upper right center of control adjacent to System Communications connector (A,B,C,D) is the System Status LED and it is labeled STATUS. The green LED labeled COMM is also located adjacent to System Communications connector, below STATUS LED, and is used as an indicator of system communications status. Status Codes will be displayed on the STATUS LED using the following protocol:

1. The number of short flashes indicates first digit of code.
2. The number of long flashes indicates second digit of code.
3. A short flash is 0.25 seconds on. A long flash is 1 second on.
4. The time between flashes is 0.25 seconds.
5. The time between last short flash and first long flash is 1 second.
6. The LED will be off for 2.5 seconds before repeating code.

ECM Blower Start-Up and Troubleshooting

NOTE: Always check high and low voltage supply to the GC components. Check the integrity of the plug receptacle connections and blower wiring harness prior to assuming a component failure.

Emergency Heating and Cooling Modes

ECM board can provide **emergency** heating or cooling using a common heat/cool thermostat in the event that there are no system communications, fault is in User Interface and no replacement is immediately available.

To activate these modes, the thermostat and outdoor unit must be wired as a common heating/cooling system to ECM board RGWYOC terminals.

NOTE: These emergency modes do not provide the level of comfort and efficiency expected by the consumer and should only be activated when User Interface cannot be replaced immediately.

ECM Board Start-Up and System Communications Troubleshooting

On power up, green COMM LED will be turned off until successful system communications are established (this should happen within 10 seconds). Once communications with user interface are successful, COMM LED will be lit and held on. At the same time, amber STATUS LED will be lit and held continuously on until a request for operating mode is received. The STATUS LED will be on any time blower is in idle mode. If, at any time, communications are not successful for a period exceeding 2 minutes, ECM board will display **Status Code 16, System Communication Fault**, on amber STATUS LED. No further blower troubleshooting information will be available at user interface until communications are re-established.

If COMM LED does not light within proper time period and Status Code is not displayed:

1. Check system transformer high and low voltage to be sure the system is powered.
2. Check fuse on ECM board to be sure it is not blown. If fuse is open, check system wiring before replacing it to be sure a short does not cause a failure of replacement fuse.

If COMM LED does not light within proper time period and Status Code is displayed:

Check system wiring to be sure user interface is powered and connections are made A to A, B to B, etc. and wiring is not shorted. Mis-wiring or shorting of the ABCD communications wiring will not allow successful communications.

NOTE: Shorting or mis-wiring low voltage system wiring **will not** cause damage to ECM board or user interface but may cause low voltage fuse to open.

ECM Board Status (Fault) Codes

Blower faults indicated by flashing codes on the amber system STATUS LED can be resolved using troubleshooting information provided below. Codes are listed in order of their priority, highest to lowest. Though multiple faults can exist at any time, only the highest priority code will be displayed on STATUS LED. Clearing the indicated fault when multiple faults exist will cause the next highest priority Status Code to be flashed. All existing faults, as well as a fault history, can be viewed at user interface.

STATUS CODE 45, CONTROL BOARD TEST FAULT:

ECM board has failed internal start-up tests and must be replaced. No other service procedure will correct.

STATUS CODE 37, HEATER OUTPUT SENSED "ON" WHEN NOT ENERGIZED:

ECM board is provided with circuitry to detect presence of a 24VAC signal on Electric Heater stage 1 and stage 2 outputs. If ECM board detects a 24VAC signal on either heater stage output and it is not supplying signal, Status Code 37 will be displayed on STATUS LED. ECM board will turn off output and command blower motor to supply an airflow determined to be safe for current operation mode with electric heaters energized.

To find the fault:

1. Stop all system operations at User Interface and check heater stage 24VAC outputs.
2. Disconnect electric heater at plug/receptacle 2 and check heater wiring for faults. See Status Code 37 for more information.

STATUS CODE 44, MOTOR COMMUNICATION FAULT:

The MOTOR LED is connected to the blower motor communication line and works with the ECM board microprocessor and STATUS LED to provide blower operation and troubleshooting information. When motor is commanded to operate, the MOTOR LED will be turned on and will flash each time instructions are sent to the motor.

When the motor is commanded to stop, the MOTOR LED will be turned off. The MOTOR LED will not flash to indicate communications when it is turned off.

ECM board is constantly communicating with the motor, even when the motor and MOTOR LED are off. If motor does not acknowledge receipt of communications, the control will display Status Code 44 on STATUS LED and continue to try to communicate with the motor. If motor acknowledges communication, Status Code will be cleared.

If MOTOR LED is lit and flashing and motor does not run:

1. Check the STATUS LED. If STATUS LED is indicating a Status 44 code, check the motor wiring harness for proper connection to control and motor receptacles.
2. Check motor wiring harness to be sure all wiring complies with wiring diagram description, makes a complete circuit from connector to connector and is not shorted.
3. Check 12 Vdc low voltage supply to motor at pins 1 (+) and 2 (-) of motor header connection to ECM board.

If all checks are normal, ECM board is good and Control Module on motor may need replacement. Check motor and Motor Control Module following the instructions in Section C. ECM Motor Troubleshooting.

Shorted or mis-wiring of the low voltage motor harness wiring will not cause damage to ECM board or to motor Control Module.

If the MOTOR LED is off, STATUS LED is indicating a Status Code 44 and motor is running:

Disconnect the motor harness at the ECM board. If motor continues to run, ECM board is good and Control Module on motor may need replacement.

STATUS CODE 25, INVALID MOTOR / MODEL SELECTION:

On initial start-up, ECM board shall poll motor for its size data and check blower size data stored in ECM board memory.

1. If motor size or ECM board data doesn't match, Status Code 25 will be displayed on STATUS LED.
2. If model size data is missing (as is the case when a replacement ECM board is installed), system User Interface will prompt installer to enter correct model size from a list of valid sizes.
3. If motor size is incorrect for model size, motor must be replaced with proper size motor. **ECM board will not respond to operation requests until this fault condition is resolved.**

STATUS CODE 27, INVALID OUTDOOR UNIT SIZE:

On initial power-up, ECM board will write into memory UPM information as provided by User Interface in a fully communicating system.

1. If UPM board data is invalid, Status Code 27 will be displayed on STATUS LED.
2. User Interface will prompt the installer to choose system size from a list of valid sizes for application with blower.
3. Check communications wiring to be sure User Interface has established communications with outdoor unit or select proper size from valid size list provided at User Interface.
4. Check motor and motor Control Module following the instructions in Section C. ECM Motor Troubleshooting.

STATUS CODE 26, INVALID HEATER SIZE:

On initial power-up, ECM board will write into memory electric heater size as read from heater. The heater is provided with Identifier Resistor (IDR). Heater size must be valid for combination of indoor and outdoor components installed. ECM board will read IDR value connected to pins 5 and 8 of heater harness connector. If no resistor is found, system User Interface will prompt installer to verify that no heater is installed. Verifying that this is correct will establish that blower is operating without an electric heater accessory. Upon choosing negative option, installer will be prompted to select heater size installed from a list of valid heater sizes for blower and UPM data size installed. If heater ID resistor value read is invalid, Status Code 26 will be displayed on STATUS LED. If heater installed is equipped with a resistor connected to pins 5 and 8 of heater harness connector and Status Code 26 is displayed on STATUS LED:

1. Check wiring harness connections to be sure connections are secure.
2. If symptoms persist, disconnect wiring harness at ECM board heater header and check for a resistance value greater than 5000 ohms.
3. Check for proper wiring of resistor assembly.
4. Make sure heater size installed is an approved size for outdoor unit and blower sizes installed.

NOTE: ECM board will not operate electric heater until this Status Code is resolved. If the heater size is set through the User Interface, the heater will be operated as a single stage heater. If staging is desired, the IDR value must be read in by the ECM board.

STATUS CODE 36, HEATER OUTPUT NOT SENSED WHEN ENERGIZED:

ECM board is provided with circuitry to detect presence of a 24VAC signal on Electric Heater stage 1 and stage 2 outputs. If ECM board energizes either heater stage and does not detect the 24VAC signal on output, Status Code 36 will be displayed on the STATUS LED ECM board will continue to energize heater output(s) and adjust blower operation to a safe airflow level for energized electric heat stage(s).

To find the fault:

Check for 24VAC on heater stage outputs. ECM board or sensing circuit may be bad.

NOTE: It may be useful as an electric heater troubleshooting procedure to disconnect the system communications to force Status Code 16 enabling of emergency heat mode. It is difficult to know which heater output is energized or not energized in normal operation. When blower is operated in emergency heat mode using electric heaters, both outputs are energized and de-energized together. Terminal strip inputs to control can then be connected R to W to turn on both electric heat outputs. Heater output sensing circuits can then be checked to resolve Status Code 36 or 37 problems.

STATUS CODE 41, BLOWER MOTOR FAULT:

If MOTOR LED is lit and flashing and motor does not run:

1. Check STATUS LED. If STATUS LED is indicating Status Code 41, motor control has detected that the motor will not come up to speed within 30 seconds of being commanded to run or that the motor has been slowed to below 250 rpm for more than 10 seconds after coming up to speed. Motor wiring harness and ECM board are operating properly, do not replace.
2. Check to be sure that the blower wheel is not rubbing the housing.
3. Check motor to be sure that the motor shaft is not seized (motor Control Module must be removed and electronics disconnected from windings to perform this check properly).
4. Check motor windings section following instructions in Section C. ECM Motor Troubleshooting.

If all these checks are normal, the motor Control Module may need replacement.

STATUS CODE 16, SYSTEM COMMUNICATION FAULT:

On initial power-up and at any time system communications are not successful for a period exceeding 2 minutes following successful communications, the ECM board will only allow emergency heating or cooling operation using a common thermostat, wired to both UPM and ECM boards non-communicating thermostat connections RGWYO and will display Status code 16 on the amber STATUS LED (see Emergency Heating and Cooling Modes). No further blower troubleshooting information will be available at the User Interface until communications are reestablished.

Check system wiring to be sure the User Interface is powered and connections are made A to A, B to B, etc. and wiring is not shorted. Mis-wiring or shorting of the ABCD communications wiring will not allow successful communications. Correcting wiring faults will clear the code and reestablish communications.

Shorting or mis-wiring the low voltage system wiring will not cause damage to ECM board or to User Interface but may cause the low voltage fuse to open.

STATUS CODE 46, BROWNOUT CONDITION:

If the secondary voltage of the transformer falls below 15VAC for a period exceeding 4 seconds, Status Code 46 will be displayed on STATUS LED. If system includes a non-communicating outdoor air conditioner or heat pump, the User Interface will command the blower to turn off Y output controlling compressor.

When secondary voltage rises above 17VAC for more than 4 seconds, the brownout condition is cleared and normal system operation will resume subject to any minimum compressor off delay function which may be in effect. Brownout does not affect blower or electric heater operation.

STATUS CODE 53, OUTDOOR AIR TEMPERATURE SENSOR FAULT:

If an OAT sensor is found at power-up, input is constantly checked to be within a valid temperature range. If sensor is found to be open or shorted at any time after initial validation, Status Code 53 will be displayed at amber STATUS LED.

Check for faults in wiring connecting sensor to OAT terminals. Using an Ohmmeter, check resistance of thermistor for a short or open condition. If thermistor is shorted or open, replace it to return the system to normal operation. If fault is in the wiring connections, correcting the fault will clear the code and return the system to normal operation.

NOTE: If fault condition is an open thermistor or a wiring problem that appears to be an open thermistor and the power to the ECM board is cycled off, the fault code will be cleared on the next power-up but the fault will remain and system operation will not be as expected. This is because on power-up, the ECM board cannot discern the difference between an open sensor or if a sensor is not installed.

ECM MOTOR TROUBLESHOOTING

The ECM motor used in this product consists of two parts: the Control Module and the motor winding section. Do not assume motor or module is defective if it will not start. Use the designed-in LED information aids and follow troubleshooting steps described below before replacing motor Control Module or entire motor. Motor Control Module is available as a replacement part.

VERIFY MOTOR WINDING SECTION:

▲ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or possible equipment damage.

After disconnecting power from the ECM motor, wait at least 5 minutes before removing the control section. Internal capacitors require time to discharge.

Before proceeding to replace a motor Control Module:

1. Check motor winding section to be sure it is functional.
2. Remove motor Control Module section and unplug winding plug. Motor shaft should turn freely, resistance between any two motor leads should be similar and resistance between any motor lead and unpainted motor end should exceed 100,000 ohms.
3. Failing any of these tests, entire ECM motor must be replaced.
4. Passing all of the tests, motor Control Module alone can be replaced.

MOTOR TURNS SLOWLY:

1. Low static pressure loading of blower while access panel is removed will cause blower to run slowly. Particularly at low airflow requests. This is normal, do not assume a fault exists.
2. Recheck airflow and system static pressure using user interface service screens with access panel in place.

NOTE: Blower motor faults will not cause a lockout of blower operation. ECM board will attempt to run the blower motor as long as user interface maintains a demand for airflow. ECM board will not operate electric heaters while a fault condition exists. The ECM board communicates with the motor at least once every 5 seconds, even when the motor is idle. If, during operation, the ECM board does not communicate with the motor for more than 25 seconds, the motor will shut itself down and wait for communications to be reestablished.

•Using Motor LED in Troubleshooting

The MOTOR LED is connected to the blower motor communication line and works with the ECM board microprocessor and the STATUS LED to provide blower operation and troubleshooting information. When the motor is commanded to operate, the MOTOR LED will be turned on and will flash each time instructions are sent to the motor. When the motor is commanded to stop, the MOTOR LED will be turned off.

If the MOTOR LED is lit, flashing and the motor is running or if the MOTOR LED is off and the motor is stopped, operation is normal and no motor fault exists.

If the MOTOR LED is lit, flashing and the motor does not run, or if the MOTOR LED is off and the motor is running, check the STATUS LED for the Status Code. Refer to the troubleshooting instructions for the indicated Status Code in Section E, blower Troubleshooting.

Systems Communication Failure

If communication with the compressor control is lost with the Communicating System Wall Control, the control will flash the appropriate fault code (see Table 12) to the rest of the communicating system, including the wall control and the indoor geothermal unit.

Model Plug

Each control board contains a model plug. The model plug is used to identify the type and size of unit to the control.

The correct model plug must be installed for the system to operate properly (see Table 14).

Table 14 – Model Plug Information

Model Number	Model Plug Number	PINS 1–4	PINS 2–3
GC024	HK70EZ006	5.1K	51K
GC036	HK70EZ007	5.1K	62K
GC048	HK70EZ008	5.1K	75K
GC060	HK70EZ009	5.1K	91K
GC072	HK70EZ010	5.1K	120K

On new units, the model and serial numbers are input into the board's memory at the factory. If a model plug is lost or missing at initial installation, the unit will operate according to the information input at the factory and the appropriate error code will flash temporarily.

NOTE: RCD replacement boards contain no model and serial information. If the factory control board fails, the model plug must be transferred from the original board to the replacement board for the unit to operate.

NOTE: The model plug takes priority over factory model information input at the factory. If the model plug is removed after initial power up, the unit will operate according to the last valid model plug installed, and flash the appropriate fault code temporarily.

Troubleshooting the Model Plug

If the unit is being identified incorrectly by model or size, verify the plug resistance per Table 14. If resistance value verifies the plug is good, ensure the plug is dry and condensate free.

NOTE: Dielectric grease (field supplied) can be used on model plug pins if condensate has been noted after drying the plug.

Service Tool

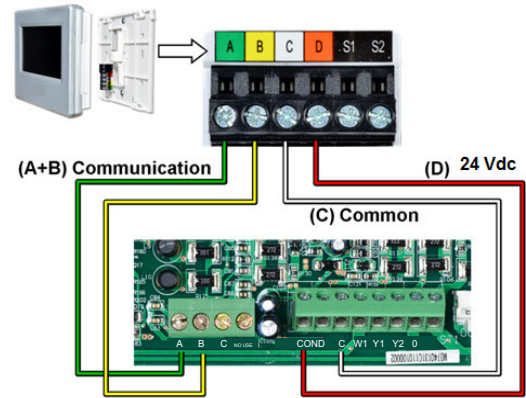


Fig. 25 – Service Tool Connection

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When working on the outdoor unit of a package system, the technician would usually need to repeatedly walk between the indoor wall control and the unit outside. To save time, the communicating controls offer a service tool feature.

By wiring the service tool into the UPM board, the technician can have a wall control capable of running the system right at the outdoor unit.

To use a service tool, connect the A and B communication bus wires from this second communicating control to the terminals marked A and B on the terminal strip located in the bottom left corner of the UPM board (see Fig. 25). But instead of connecting the wires on the service tool to the terminals marked C and D, connect the C and D wires from the service tool to the 24V and C on ST1 as shown in Fig. 25.

When the service tool is connected and powered up, the communicating controls inside the home will "go to sleep" and let the service tool take control of the system. In this manner, the service technician can run the diagnostic checkouts right at the outdoor unit using the service tool.

After the checkouts are completed and it is no longer necessary to use the service tool, remove it from the communicating controls and the indoor communicating controls will regain control in about two minutes.

⚠ CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

Connect 24 across COND and COMMON on ST1 thermostat connections. Ensure condensate overflow wires remain connected for proper protection.

Table 15 – 10K Temperature Sensor Resistance Table

°C	°F	OHM	°C	°F	OHM	°C	°F	OHM	°C	°F	OHM
-55	-67	963,800	-9	16	52,410	37	99	6,015	83	181	1,141
-54	-65	895,300	-8	18	49,660	38	100	5,774	84	183	1,105
-53	-63	832,100	-7	19	47,070	39	102	5,545	85	185	1,071
-52	-62	776,800	-6	21	44,630	40	104	5,326	86	187	1,038
-51	-60	719,900	-5	23	42,330	41	106	5,116	87	189	1,006
-50	-58	670,200	-4	25	40,160	42	108	4,916	88	190	975
-49	-56	624,200	-3	27	38,120	43	109	4,725	89	192	945
-48	-54	581,600	-2	28	36,190	44	111	4,542	90	194	916
-47	-53	542,200	-1	30	34,370	45	113	4,368	91	196	889
-46	-51	505,800	0	32	32,650	46	115	4,201	92	198	862
-45	-49	472,000	1	34	31,030	47	117	4,041	93	199	836
-44	-47	440,700	2	36	29,500	48	118	3,888	94	201	811
-43	-45	411,600	3	37	28,050	49	120	3,742	95	203	787
-42	-44	384,700	4	39	26,690	50	122	3,602	96	205	764
-41	-42	359,700	5	41	24,400	51	124	3,468	97	207	741
-40	-40	336,500	6	43	24,170	52	126	3,339	98	208	720
-39	-38	314,900	7	45	23,020	53	127	3,216	99	210	699
-38	-36	294,900	8	46	21,920	54	129	3,099	100	212	679
-37	-35	276,200	9	48	20,890	55	131	2,986	101	214	659
-36	-33	258,800	10	50	19,900	56	133	2,878	102	216	640
-35	-31	242,700	11	52	18,970	57	135	2,774	103	217	622
-34	-29	227,600	12	54	18,090	58	136	2,674	104	219	604
-33	-27	213,600	13	55	17,260	59	138	2,579	105	221	587
-32	-26	200,500	14	57	16,470	60	140	2,488	106	223	571
-31	-24	188,300	15	59	15,710	61	142	2,400	107	225	555
-30	-22	177,000	16	61	15,000	62	144	2,316	108	226	539
-29	-20	166,400	17	63	14,330	63	145	2,235	109	228	525
-28	-18	156,400	18	64	13,380	64	147	2,157	110	230	510
-27	-17	147,200	19	66	13,070	65	149	2,083	111	232	496
-26	-15	138,500	20	68	12,490	66	151	2,011	112	234	483
-25	-13	130,400	21	70	11,940	67	153	1,942	113	235	470
-24	-11	122,800	22	72	11,420	68	154	1,876	114	237	457
-23	-9	115,800	23	73	10,920	69	156	1,813	115	239	445
-22	-8	109,100	24	75	10,450	70	158	1,752	116	241	433
-21	-6	102,900	25	77	10,000	71	160	1,693	117	243	422
-20	-4	97,080	26	79	9,573	72	162	1,637	118	244	411
-19	-2	91,620	27	81	9,166	73	163	1,583	119	246	400
-18	0	86,500	28	82	8,778	74	165	1,531	120	248	389
-17	1	81,700	29	84	8,409	75	167	1,480	121	250	379
-16	3	77,190	30	86	8,057	76	169	1,432	122	252	370
-15	5	72,960	31	88	7,722	77	171	1,386	123	253	360
-14	7	68,980	32	90	7,402	78	172	1,341	124	255	351
-13	9	65,250	33	91	7,098	79	174	1,298	125	257	342
-12	10	61,740	34	93	6,808	80	176	1,256	126	259	333
-11	12	58,440	35	95	6,531	81	178	1,216	127	261	325
-10	14	55,330	36	97	6,267	82	180	1,178	128	262	317

MAINTENANCE

- An annual “checkup” is recommended by a qualified refrigeration mechanic.
- Recording the performance measurements of volts, amps, and water temperature differences (both heating and cooling) is recommended. This data should be compared to the information on the unit’s data plate and the data taken at the original start-up of the equipment.
- Periodic lockouts are commonly caused by water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur, call a mechanic immediately and have them check for the following:
 - Water flow problems
 - Water temperature problemsUnit capacity and water flow charts should be used for system checks. Refer to Table 11.
Using the Owner’s/User Manual furnished in outdoor unit, the installing technician should explain system operation to the consumer with particular emphasis on indoor fan coil operation sounds and filter maintenance.