GW Series
Water-to-Water Geothermal Heat Pump
Sizes 024, 036, 048, 060, 072, 120

Installation Instructions

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

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Information in these installation instructions pertains only to GW series units.

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

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.

⚠ 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.

⚠ 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.

INSTALLATION RECOMMENDATIONS

The GW Water-to-Water Heat Pump is Underwriters Laboratories (UL) and (cUL) listed for safety. The water-to-water heat pumps are designed to operate with entering fluid temperature between 25°F to 110°F.

Safety devices are built into each unit to provide the maximum system protection possible when properly installed and maintained.

IMPORTANT: 50° Min. EWT (entering water temperature) for well water applications with sufficient water flow to prevent freezing. Antifreeze solution is required for all closed loop applications. Earth Coupled (Geothermal) applications should have sufficient antifreeze solution to protect against extreme conditions and equipment failure. **Frozen water coils are not covered under warranty**.

IMPORTANT: This product should not be used for temporarily heating or cooling during construction. Doing so may effect the unit's warranty.

⚠ 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.

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. Horizontals 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 space. 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.

⚠ 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.

APPLICATION CONSIDERATIONS

Typical Load Side Applications

There are many load side applications for which the water-to-water heat pump/ liquid chiller is ideally suited.

Some typical uses are as follows:

Hydronic baseboard heating, hydronic in-slab floor heating, forced air fan coil heating or cooling, ice and snow melting, heating potable water, (when allowed by code) heating swimming pool and spa*, process fluid heating or cooling.

When specifying load side fluid volume it is important to consider the heat pump output capacities and flow rates. Insufficient load side fluid volume may cause unstable heat pump operation (short cycling). Pressure/temperature ports should be used to set flow rates.

*A water-to-water series Heat Pump/Liquid Chiller can be utilized for direct pool/spa heating without a secondary heat exchanger. In this application cupronickel heat exchangers must be used. Automatic chemical feeders must never be installed upstream of the unit. An external bypass should be installed to avoid over-flowing the heat exchanger to prevent coil erosion. The pool pH levels and chemical balances must be maintained to avoid possible heat exchanger damage.

Earth Coupled (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 entering loop temperatures drop below 50°F or where piping will be routed through areas subject to freezing. A flow rate between 2.5 to 3.0 gpm per nominal ton of cooling is recommended for this application. See Flow Center Curve for sizing information. Refer to the Flow Center installation manuals for more specific instructions.

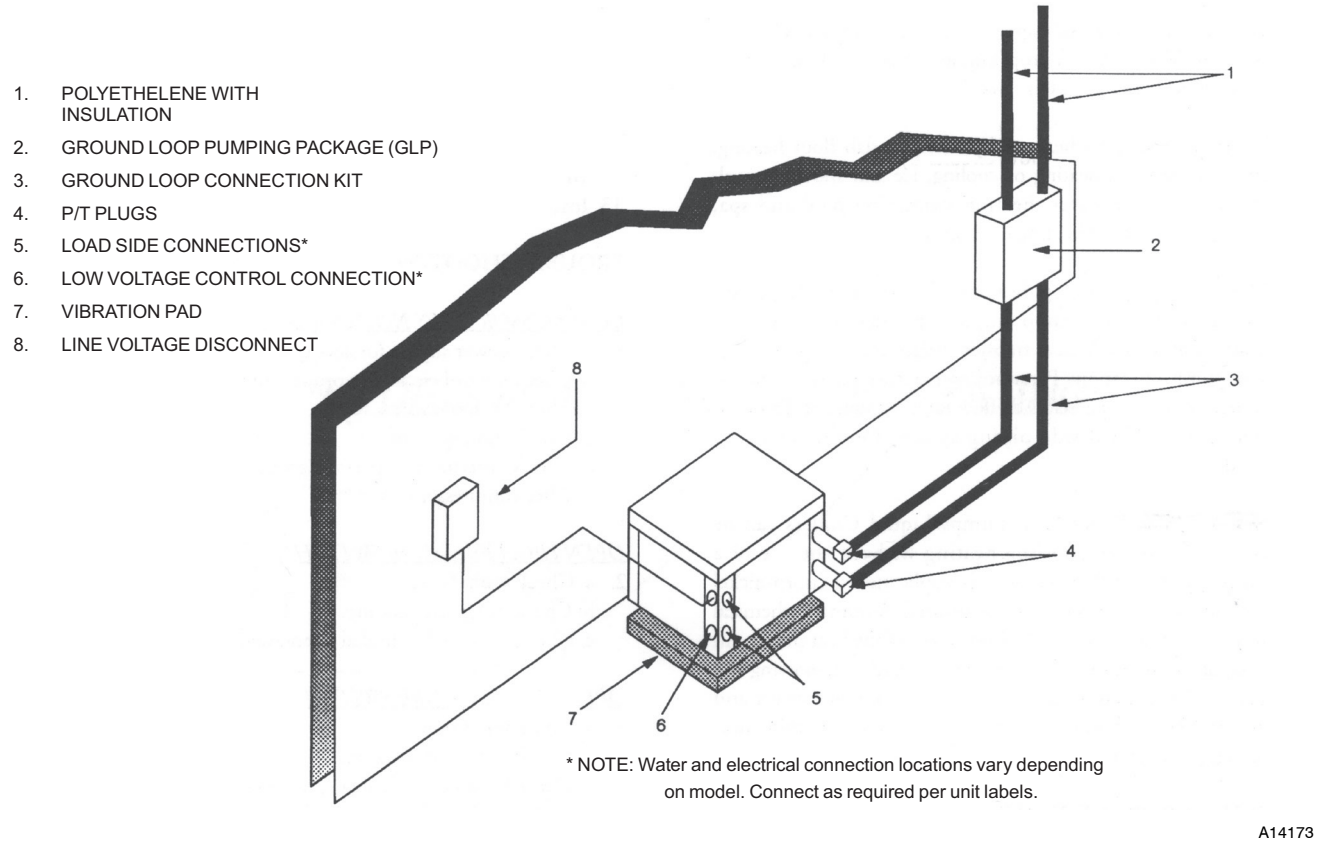


Fig. 1 - Earth Coupled Application

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 l<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.

⚠ CAUTION

UNIT OPERATION HAZARD

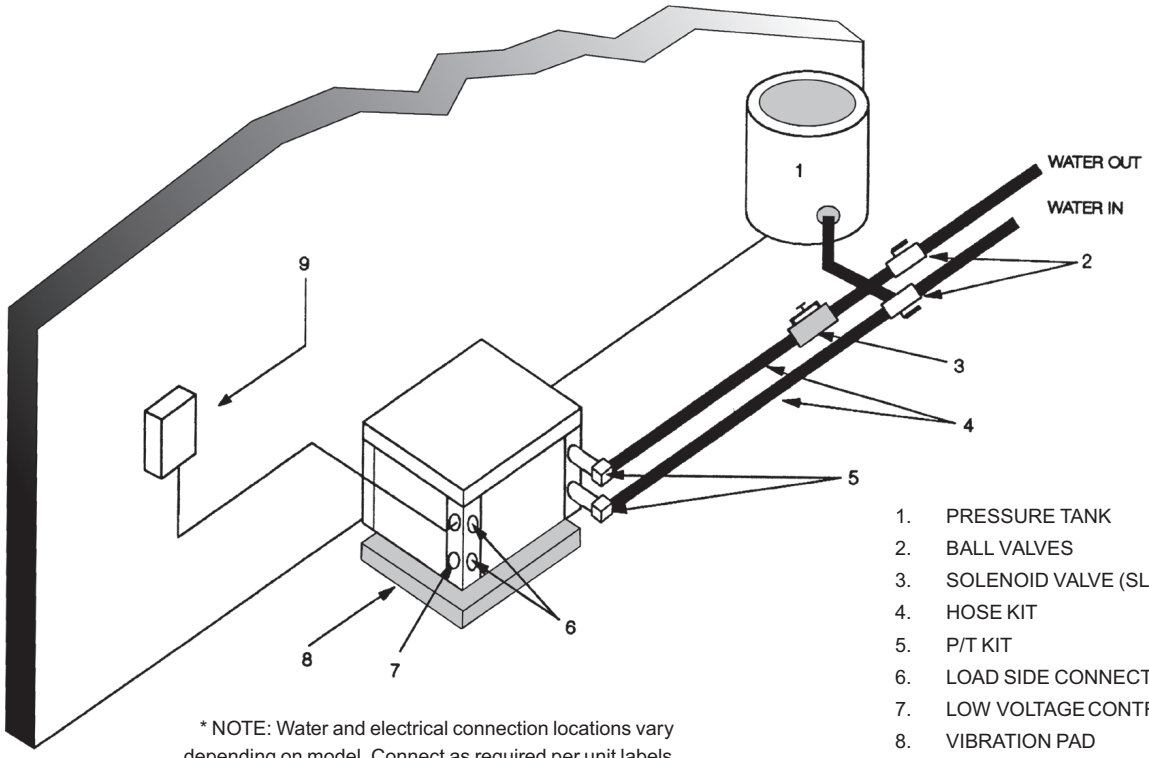
Failure to follow this caution may result in equipment damage or improper operation.

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

Water quantity should be plentiful, between 1.5 and 3.0 gpm per ton of cooling, and of good quality. To avoid the possibility of freezing in the heating mode, the well water should be above 50°F.

Water pressure must always be maintained in the heat exchanger by placing a water control valve on the outlet of the water-to-water unit. A bladder type expansion tank may be used to maintain pressure on the system. All solenoid valves should be slow closing to avoid water hammer.

The discharge water from the water-to-water unit is not contaminated in any manner and can be disposed of in various ways depending on the local codes (i.e. discharge well, dry well, storm sewer, drain field, stream, pond, etc.) Pilot operated or slow closing valves are recommended to reduce water hammering.



* NOTE: Water and electrical connection locations vary depending on model. Connect as required per unit labels.

1. PRESSURE TANK
2. BALL VALVES
3. SOLENOID VALVE (SLOW CLOSING)
4. HOSE KIT
5. P/T KIT
6. LOAD SIDE CONNECTIONS*
7. LOW VOLTAGE CONTROL CONNECTION*
8. VIBRATION PAD
9. LINE VOLTAGE DISCONNECT

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Fig. 2 - Well Water Application

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, O2<5 ppm check for iron bacteria		
Iron Fouling	All	--	<0.5 ppm of Oxygen Above this level deposition will occur		
Corrosion Prevention					
pH	All	6 - 8.5 Monitor/treat as needed	6 - 8.5 Minimize steel pipe below 7 and no open tanks with pH <8		
Hydrogen Sulfide (H_2S)	All	--	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

The Water-to-Water series unit 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. 3.

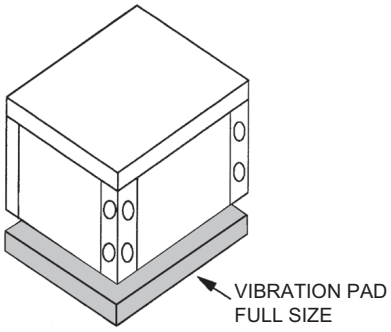


Fig. 3 - Vibration Absorbing Pad

If the unit is installed on a floor over a crawl space, it should not rest on long, unsupported floor joists. Vibrations may be created in the joists with the crawl space acting as an amplifier box resulting in undesirable noise. A drain pan is recommended where water released during start-up or maintenance could cause damage below the unit.

In both cases, a 3/4" drain connected to this secondary pan should be run to a suitable location. 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.

MINIMAL SYSTEM VOLUME

The manufacturer recommends that the total fluid volume in the system be not less than 6 gallons per nominal ton of cooling capacity on both the load and source sides.

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.

GW units are supplied with either a copper or optional cupronickel condenser. Copper is adequate for ground water that is not high in mineral content.

NOTE: Proper testing is recommended to assure the well water quality is suitable for use with water source equipment. When in doubt, use cupronickel.

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.

Improper heat exchanger water flow due to piping, valve arrangement or improper pump operation is hazardous to the unit and constitutes abuse which will void the heat exchanger and compressor warranty.

Always check carefully for water leaks and repair appropriately. Units are equipped with female pipe thread fittings. Consult Product Data for sizes.

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

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 and unit water flow balancing.

No unit should be connected to the supply or return piping until the water system has been completely cleaned and flushed to remove any dirt, piping chips or other foreign material. Supply and return hoses should be connected together during this process to ensure the entire system is properly flushed. After the cleaning and flushing has taken place the unit may be connected to the water loop and should have all valves wide open. **Do not over-tighten connections.**

ELECTRICAL

⚠ 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.

⚠ CAUTION

UNIT OPERATION HAZARD

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

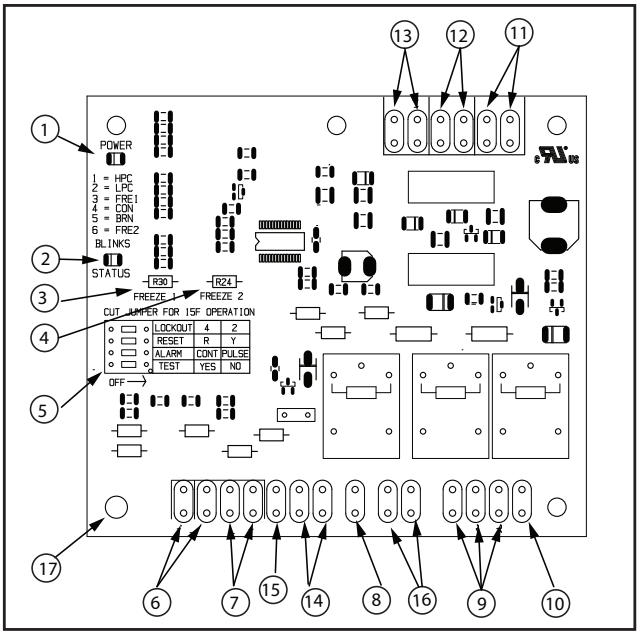
- Field wiring must comply with local and national electrical codes.
- Power to the unit must be within the operating voltage range indicated on the unit nameplate.
- On three-phase units, phases must be balanced within 2%.
- Operation of unit on improper line voltage or with excessive phase imbalance 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.

The unit is provided with a concentric knock-out for attaching common trade sizes of conduit, route power supply wiring through this opening. Flexible wiring and conduit should be used to isolate vibration and noise from the building structure.

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.

SAFETY DEVICES AND UPM CONTROLLER



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(1) Board Power Indicator
(2) UPM Status LED Indicator
(3) Water Coil Freeze Protection Temperature Selection [R30]
(4) Air Coil Freeze Protection Temperature Selection
(5) UPM Board Settings
(6) Water Coil Freeze Connection
(7) Air Coil Freeze Connection
(8) LCD Unit Display Connection
(9) 24VAC Power Input
(10) Compressor Contact Output
(11) High Pressure Switch Connection
(12) Call for Compressor Y1
(13) Low Pressure Switch Connection
(14) 24VAC Power Common
(15) Condensate Overflow Sensor
(16) Dry Contact
(17) UPM Ground Standoff

Fig. 4 - Unit Protection Module (UPM)

Each unit is factory provided with a Unit Protection Module (UPM) that controls the compressor operation and monitors the safety controls that protect the unit (see Fig. 4).

NOTE: UPM Board Dry Contacts are normally open (NO)

The UPM Board includes the following features:

- **LOW PRESSURE SWITCH**: The low pressure switch safety is designed to shut down the compressor in th 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.
- **LOW PRESSURE BYPASS TIMER**: If the compressor is running and the low pressure switch opens, the controller will keep the compressor ON for 120 seconds. After 2 minutes if the low pressure switch remains open, the controllers 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 hard lockout. In order to exit hard lockout power to the unit would need to be reset.
- **ANTI-SHORT CYCLE TIMER**: 5 minute delay on break timer to prevent compressor short cycling.
- **RANDOM START**: Each controller has an unique random start delay ranging from 270 to 300 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.
- **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

- **FREEZE SENSOR**: The water coil is protected by a thermistor located between the condensing water coil (coax) and the thermal expansion valve (see Fig.5).
  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.

⚠ 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.

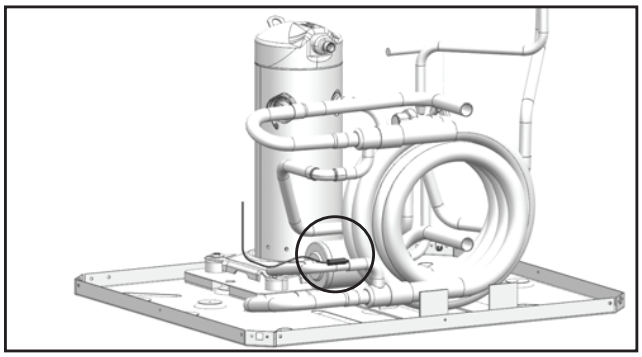

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Fig. 5 - Freeze Protection Sensor Location

⚠ 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. 6.

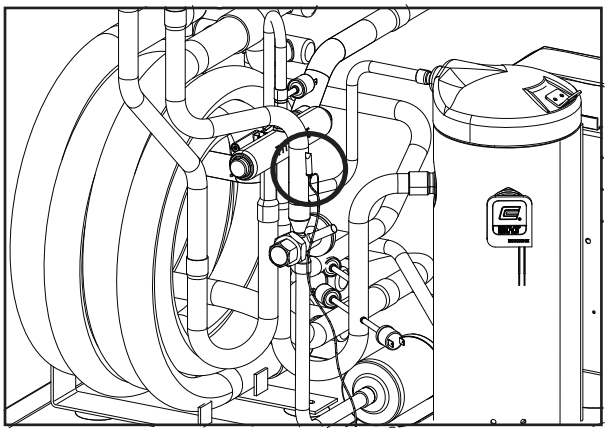

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Fig. 6 - Evaporator Freeze Protection Sensor Location

- **CONDENSATE OVERFLOW PROTECTION SENSOR:** Located in the drain pan of the unit and connected to the "COND" terminal on the UPM board. See Fig. 7.

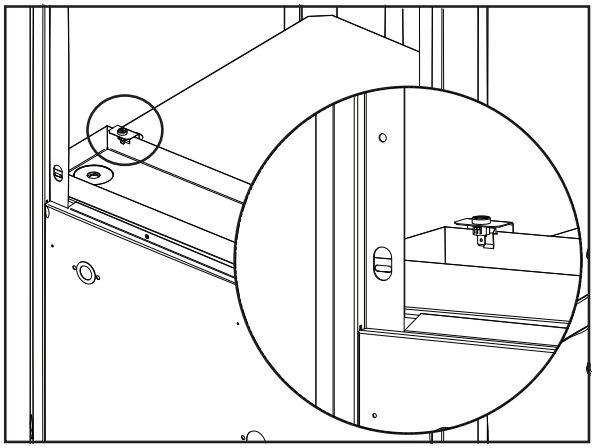

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Fig. 7 - Condensate Overflow Protection Sensor Location

- **BROWNOUT / SURGE / POWER INTERRUPTION PROTECTION**: The brownout protection in the UPM board will shut does the compressor if the incoming power falls below 18 VAC. The compressor will remain OFF until the voltage is above 18 VAC and ANTI-SHORT CYCLE TIMER (300 seconds) times out. The unit will not go into a hard lockout.
- **MALFUNCTION OUTPUT**: Alarm output is Normally Open (NO) dry contact. If pulse is selected the alarm output will be pulsed. The fault output will depend on the dip switch setting for "ALARM". If it is set to "CONST", a constant signal will be produced to indicate a fault has occurred and the unit requires inspection to determine the type of fault. If it is set to "PULSE", a pulse signal is produced and a fault code is detected by a remote device indicating the fault. See L.E.D Fault Indication below for blink code explanation. The remote device must have a malfunction detection capability when the UPM board is set to "PULSE".

NOTE: If 24 VAC output is needed, R must be wired to ALR-COM terminal; 24 VAC will be available o the ALR-OUT terminal when the unit is in the alarm condition.

UPM Board LED Indications		
Indication Color	**Blinks**	**Description**
GREEN	Solid	18-30 VAC Power is present
RED	1	High pressure lockout
RED	2	Low pressure lockout
RED	3	Freeze sensor lockout
RED	4	Condensate overflow
RED	5	Brownout
RED	6	Evaporator Freeze condition

- **TEST DIP SWITCH**: A test dip switch is provided to reduce all time delays settings to 10 seconds during troubleshooting or verification of unit operation.

⚠ CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

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

Operation of unit in test mode can lead to accelerated wear and premature failure of components. The "TEST" switch must be set back to "NO" after troubleshooting/ servicing.

- **INTELLIGENT RESET**: If a fault condition is initiated, the 5 minute delay on break time period is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition still exists or occurs 2 or 4 times (depending on 2 or 4 setting for Lockout dip switch) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset.
  A single condensate overflow fault will cause the unit to go into a hard lockout immediately, and will require a manual lockout reset.
- **LOCKOUT RESET**: A hard lockout can be reset by turning the unit thermostat off and then back on when the "RESET" dip switch is set to "Y" or by shutting off unit power at the circuit breaker when the "RESET" dip switch is set to "R".

NOTES: The blower motor will remain active during a lockout condition.

UPM Board Factory Default Settings	
TEMP	26°F
LOCKOUT	2
RESET	Y
ALARM	PULSE
TEST	NO

UPM DIP SWITCH DEFAULT POSITION			
	lockout	4	2
	reset	R	Y
	alarm	Cont	pulse
	test	yes	no

- **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 2 and Fig. 8.

Table 2 – 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

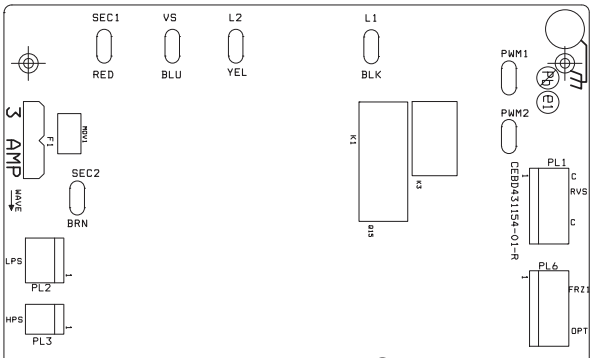


Fig. 8 - UPM Board
L1, L2, VS, SEC 1 and SEC 2 Locations

SEQUENCE OF OPERATION

Cooling Mode

Energizing the “O” terminal energizes the unit reversing valve thus placing the unit into cooling mode. The fan motor starts when the “G” terminal is energized.

When the thermostat calls for cooling (Y), the loop pump or solenoid valve, if present, is energized and compressor will start. Once the thermostat is satisfied, the compressor shuts down accordingly and the fan ramps down to either FAN ONLY mode or OFF over a span of 30 seconds (ECM Motors).

NOTE: A fault condition initiating a lockout will de-energize the compressor.

Heating Mode

Heating operates in the same manner as cooling, but with the reversing valve de-energized. The compressor will run until the desired setpoint temperature on the thermostat is achieved.

Once the thermostat is satisfied, the compressor shuts down and the fan ramps down in either FAN ONLY mode or turns off over a span of 30 seconds.

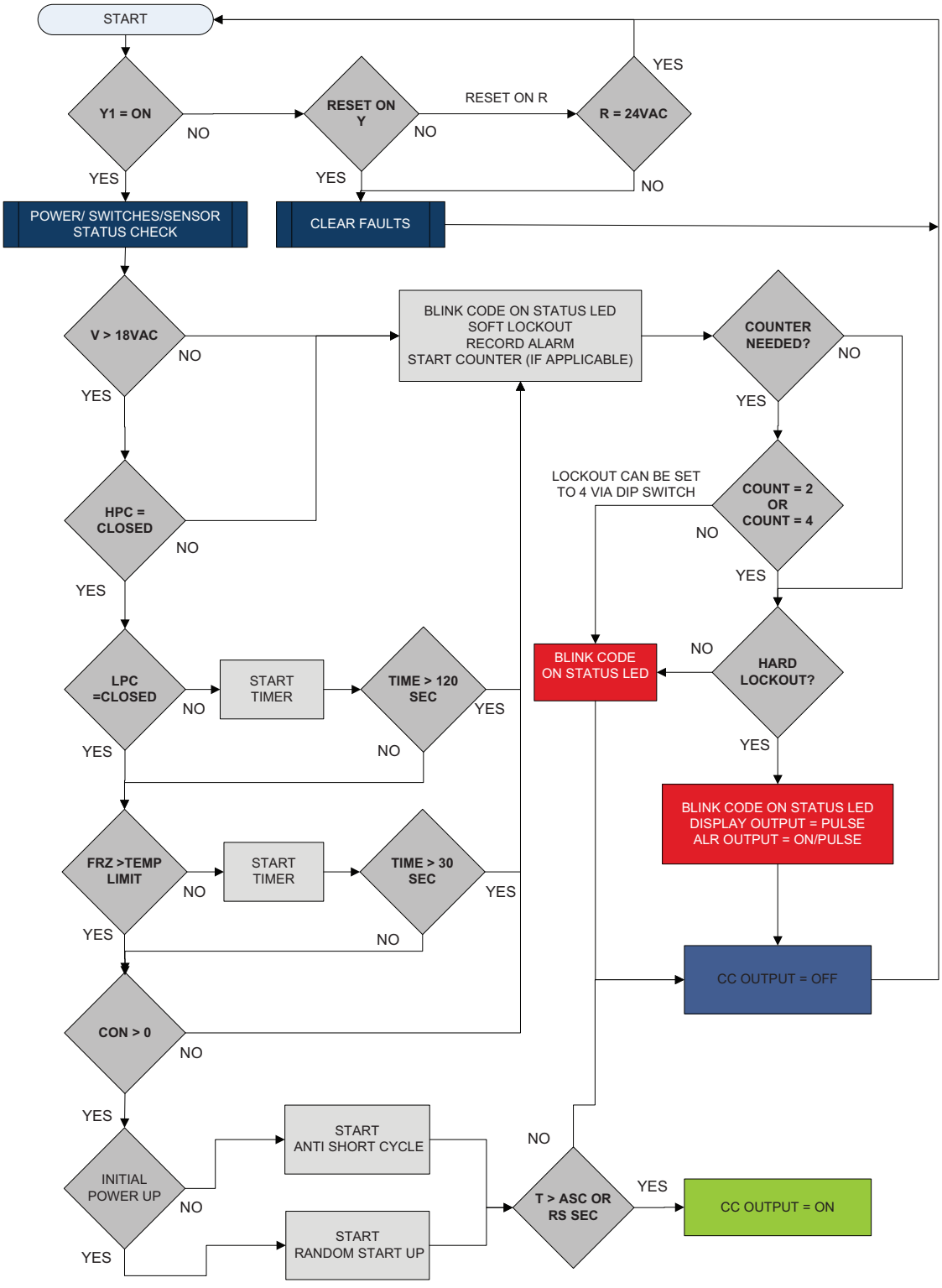


Fig. 9 - UPM Sequence of Operation (SOO) Flow Chart

FACTORY INSTALLED OPTIONS

Heat Recovery Package (HRP)

The Heat Recovery package is a factory mounted option. It consists of a forced pumped unit that employs a circulating pump to move water through a double wall/ vented heat exchanger and returns the heated water to the water tank. The water is heated by superheated refrigerant discharge gas from the compressor. This waste heat of the cooling mode, captured by the heat recovery, increases the capacity and efficiency of the heat pump unit. If the air temperature is uncomfortable coming from the air vents in heating mode the heat recovery may need to be turned off. In heating mode, the heat recovery captures heat that would normally be used for space heating.

⚠ 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.

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

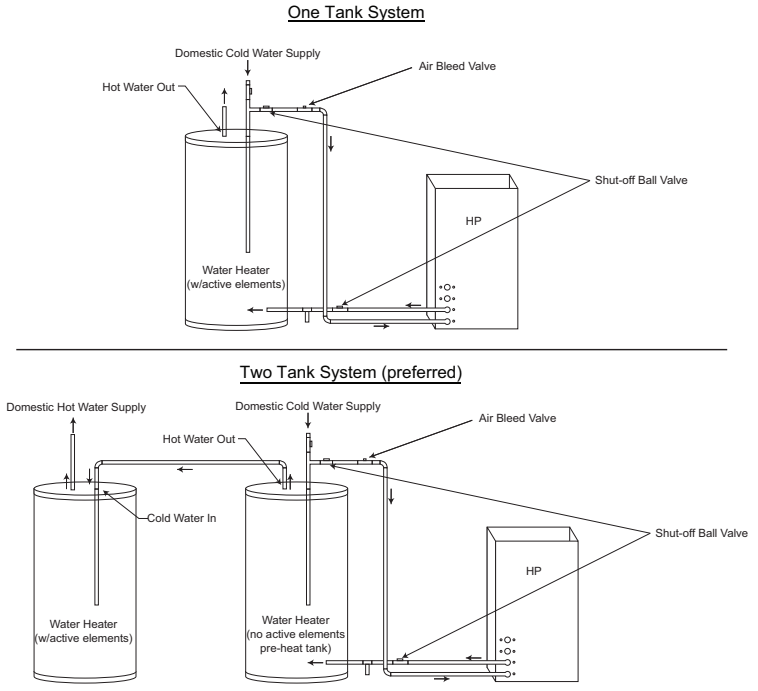
All hot water piping MUST be a minimum of 3/8” O.D. copper tube to a maximum distance of 15 feet. For distances beyond 15 feet, but not exceeding 60 feet, use 1/2” copper tube. Separately insulate all exposed surface of both connecting water lines with 3/8” wall closed cell insulation. Install isolation 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. Purge all air from HRP by depressing the Schrader valve on the HR unit. Allow all air to bleed out until water appears at the valve.

IMPORTANT: All piping from HRP to domestic water tank must be copper or any metal of stronger alloy.

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.
7. After thermostat adjustments are completed, replace access cover and restore electrical or fuel supply to water heater.



Package unit shown. GW unit arrangement similar with different water locations on unit.

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Fig. 10 - HRP Water Piping

HRP Initial Start-Up

⚠ 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

FACTORY INSTALLED OPTIONS (CONT)

Smart Start Assist

The Smart Start Assist (SSA) is designed to reduce the in-rush draw during single-phase scroll start-up. The kit contains two main parts (shown in Fig. 11), the mounting plate and the SSA component. The kit is installed on top of the unit's electrical box.

The SSA reduces compressor starting currents, limiting the peak energy demand. SSA has a dedicated algorithm and built-in current limit settings specifically for scroll compressor starting. The designed soft start algorithm slowly ramps the in-rush current which results in the elimination of light flickering, reduction in voltage disturbances and increased compressor lifetime. The SSA can lock out the unit and incorporates its own 5 min. time delay, Refer to Fig. 12, Mode of Operation. This 5 minute anti-cycle delay that could possibly hold unit off even if the UPM test switch is activated in attempt to override the UPM 5 min delay. De-energizing the SSA is the only way to override its built in time delay (refer to unit wiring diagram).

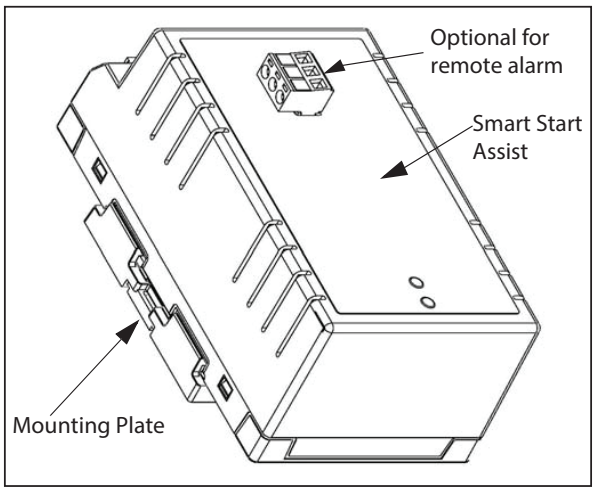

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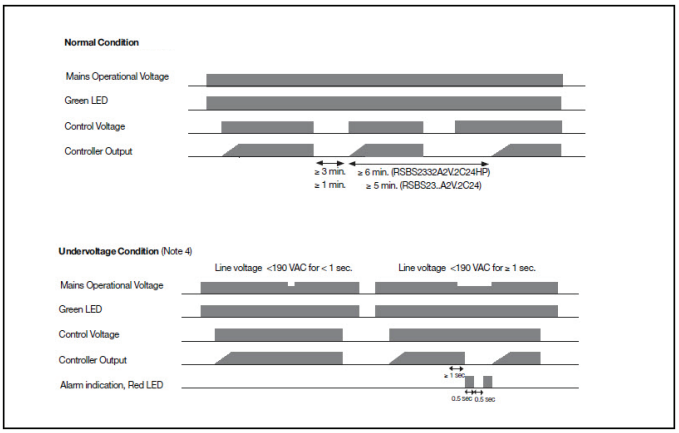
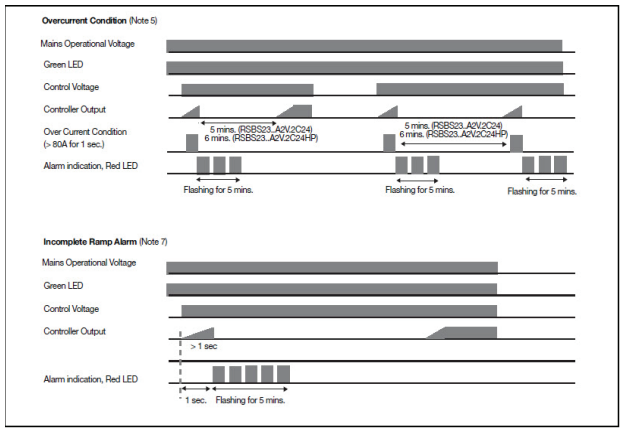
Fig. 11 - Smart Start Assist





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1. The Smart Start Assist has 2 indication LEDs on board. The green LED indicates the status fo the on-board power supply while the red LED indicates an alarm condition or the recovery time between starts[1]
2. Once the mains voltage is present, the green LED will be fully ON. In case the mains voltage is less than the stated pickup voltage alarm value, the green LED will be flashing. In case the mains voltage is higher than the stated pickup voltage and the green LED is flashing, this may indicate that the on-board power supply is faulty. (Power Supply Alarm)
3. Upon closing K1, the Smart Start Assist will start ramping for duration of <1 second provided that the minimum time from stop to start is respected. When opening the K1, the Smart Start Assist will stop without any ramp down.
4. In case of an under-voltage, the Smart Start Assist will shut down and the red LED will flash 2 times as long as the under-voltage is present. Once the mains voltage is restored, the red LED will continue flashing for 5 minutes (6 minutes for HP versions). Following these 5 minutes, the Smart Start Assist will start ramping function in the case k1 is closed. The device can be reset at any time by removing power on L1-N connection. When the power is reapplied, the soft starter will start ramping up as soon as K1 is closed provided that the minimum time between starts and the minimum time from stop to start are respected.
5. If an over-current (>80A for 1 second) is sensed, the Smart Start Assist will shut down and the red LED will flash 3 times indicating an over-current situation. This continues for 5 minutes. In the case that the over-current is still present at the second attempt, user intervention is required to meet the controller by cycling power for the device to operate again as this implies that there are problems in the system.
6. A detection circuitry provides protection in case of a faulty starting capacitor EMR. In such a situation, the red LED will flash 4 times for 5 minutes. Smart Start Assist will check the status of the starting capacitor EMR before attempting a ramping function (in the case K1 is closed). If, at the second attempt, the starting capacitor EMR is found to be faulty, user intervention is required to reset the controller by cycle power for the device.
7. In the case of incomplete ramping of the soft starter, the red LED will flash 5 times. The flashing will be indicated by the red LED for 5 minutes. If, after the second attempt, there is another incomplete ramp alarm, user intervention is required to reset the controller.
8. During recovery from under-voltage, over-current and incomplete ramp alarms, the red LED will flash twice the normal flashing frequency using the same number of flashes. The figure shows the flashing in case of a recovery from an under-voltage alarm.
9. During the recovery time between starts, the Smart Start Assist will be continuously ON until the necessary recovery time elapses[1]
10. If supply on Smart Start Assist is removed before the recovery period has elapsed, when supply is restored, the delay will continue until the remaining recovery time from the last start/stop (before supply removal) is over. Following this, another start may be attempted. If supply is removed during alarm recovery (red LED flashing), when supply is restored, the alarm will be rest and the Smart Start Assist will only wait for the respective delays between starts and/or stop to start to elapse before attempting another start (assuming K1 is closed).

[1] - Applicable to HP versions only

Manual resets may be necessary if consecutive flash codes:
- 2 - Over current
- 4 - Relay Protection
- 5 - Incomplete Ramp

Fig. 12 - Mode of Operation

SYSTEM CHECKOUT

After completing the installation, and before energizing the unit, the following system checks should be made:

1. Verify that the supply voltage to the heat pump is in accordance with the nameplate ratings.
2. Make sure that all electrical connections are tight and secure.
3. Check the electrical fusing and wiring for the correct size.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

Ensure cabinet and electrical box are properly grounded

4. Verify that the low voltage wiring between the thermostat and the unit is correct.
5. Verify that the water piping is complete and correct.
6. Check that the water flow is correct, and adjust if necessary.
7. Check the blower for free rotation, and that it is secured to the shaft.
8. Verify that vibration isolation has been provided.
9. Verify that the unit is serviceable. Be certain that all access panels are secured in place.

Considerations:

- Always check incoming line voltage power supply and secondary control voltage for adequacy. Transformer primaries are dual tapped for 208 and 230 volts. Connect the appropriate tap to ensure a minimum of 18 volts secondary control voltage. 24 volts is ideal for best operation.
- The following guidelines are recommended for wiring between a thermostat and the unit: 18 GA up to 60 ft (18.3m), 16 GA up to 100 ft (30.5m) and 14 GA up to 140 ft (42.7m)

⚠ 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.

⚠ 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.

UNIT START-UP

NOTE: A unit Start-Up checklist is included in the unit packet. Complete the Checklist and place it in the customer file at your dealership.

1. Open all water valves to the full open position.
2. Turn on line power to the heat pump.
3. Set the mode on the system control to "HEAT". Adjust the aquastat to its lowest setting.
4. Slowly increase the aquastat set temperature until the compressor turns on.
5. After a few minutes, check for warm delivery temperature on the load side piping exiting the unit.
6. Verify water flow.
7. Check for leaks.
8. Check for excessive noise and vibration.
9. Check the temperature of EWT and LWT. Compare to tables in Product Data sheets to confirm unit is meeting heating specification. If unit is not achieving performance listed, check refrigerant pressures and compare them to table on page 15 before proceeding.
10. Once heating performance is verified, place system control to "COOL" mode. Adjust aquastat to its highest setting.
11. Slowly decrease the aquastat setting until the compressor turns on.
12. After a few minutes, check for cool delivery temperature on the load side piping exiting the unit.
13. Check the temperature of EWT and LWT. Compare to tables in Product Data sheets to confirm unit is meeting cooling specification. If unit is not achieving performance listed, check refrigerant pressures and compare them to table on page 15 before proceeding.
14. If unit fails to operate properly, refer to the Troubleshooting section beginning on page 16.
15. Once proper cooling and heating performance has been confirmed, adjust control to desired setting.

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 startup 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.

CHILLER MODE

Cooling Mode Operating Pressures (PSIG) (R–410A units – full load)						
Entering Fluid Temp ° F	Entering Source Condenser Temperature ° F					
	75° F		85° F		95° F	
	Suction Pressure	Discharge Pressure	Suction Pressure	Discharge Pressure	Suction Pressure	Discharge Pressure
65	99–116	290–320	107–123	325–358	107–123	370–400
55	91–107	265–311	91–107	303–350	99–116	370–400
45	76–91	265–311	76–91	295–345	83–99	358–390

BOILER MODE

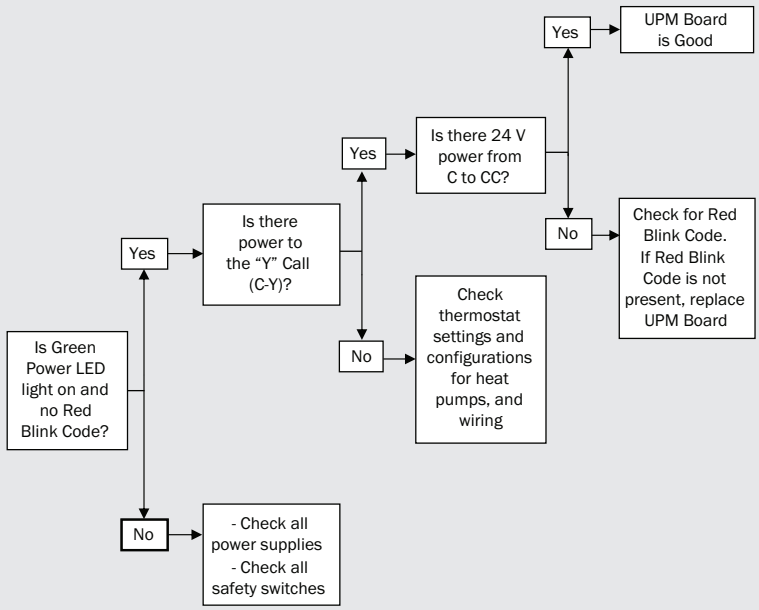
Heating Mode operating Pressures (PSIG) (R–410A units – full load)			
Entering Load ° F	Entering Source	Suction Pressure	Discharge Pressure
70	40	68–83	255–290
	60	99–116	270–305
	80	130–145	290–325
90	40	76–91	350–380
	60	99–116	358–390
	80	130–165	370–400
110	40	76–91	455–480
	60	99–116	470–500
	80	139–165	480–575

NOTE: Ratings are based on water flow rates stated in specification sheets. 2.4 GPM/ton on evaporator side and 10° F ΔT on condenser side when in the chiller mode. Boiler mode conditions are 2.4 GPM/ton on the source side and 10° F ΔT on load side. Values are typical and may vary between models.

TROUBLESHOOTING

Problem	Possible Cause	C hecks and Corrections
Compressor does not operate	Power Supply Off	Apply power, close disconnect
	Blown Fuse	Replace fuse or reset circuit breaker. Check for correct fuses
	Broken or loose wires	Replace or tighten the wires. Check for loose or broken wires at compressor, capacitor, or contactor.
	Voltage supply low	If voltage is below minimum voltage specified on unit data plate, contact local power company.
	Controller	Set controller to “COOL” and lowest temperature setting, the unit should run in the cooling mode (reversing valve energized). Set unit to “HEAT” and the highest temperature setting, the unit should run in the heating mode. If the compressor does not run in all cases, the controller could be miswired or faulty.To ensure miswired or faulty thermostat verify 24 volts is available on the unit section low voltage terminal strip between “R” and “C”, “Y” and “C”, and “O” and “C”. Replace the controller if defective.
	Safety controls	Reset the controller to “OFF”. After a few minutes turn to “COOL” or “HEAT”. If the compressor runs, unit was off on one of the safety con trols. (See problem for possible causes)
	Compressor overload open	If the compressor is cool and the overload will not reset, replace com pressor.
	Compressor motor grounded	Internal winding grounded to the compressor shell. Replace compressor burnout, install suction filter dryer.
	Compressor windings open	After compressor has cooled, check continuity of the compressor windings. If the windings are open, replace the compressor.
Unit off on high pressure switch	Discharge pressure too high	In “COOLING” mode: SOURCE COIL - Lack of or inadequate water flow. Entering water temperature too warm. Scaled or plugged condenser. In “HEATING” mode: LOAD COIL - Lack of or inadequate water flow. Entering water temperature too warm. Scaled or plugged load coil.
	Refrigerant charge	The unit is overcharged with refrigerant. Reclaim refrigerant, evacuate and recharge with factory recommended charge.
	High pressure switch	Check for defective or improperly calibrated high pressure switch.
Unit off on low pressure switch	Suction pressure too low	In “COOLING” mode: LOAD COIL - Lack of or inadequate fluid flow. Entering water temperature too cold. Scaled or plugged load coil. In “HEATING” mode: SOURCE COIL - Lack of or inadequate fluid flow. Entering water temperature too cold. Scaled or plugged source coil.
	Refrigerant charge	The unit is low on refrigerant. Check for refrigerant leak, repair, evacu - ate and recharge with factory recommended charge.
	Low pressure switch	Check for defective or improperly calibrated low-pressure switch.

TROUBLESHOOTING (CONT.)

Unit short cycles	Unit oversized	Recalculate heating and or cooling loads.
	Wiring and controls	Loose connections in the wiring or a defective compressor contactor.
	Fluid Volume	Inadequate load side fluid volume.
Insufficient cooling or heating	Unit undersized	Recalculate heating and or cooling loads. If excessive, possibly adding insulation and shading will rectify the problem. Unit may be short of refrigerant.
	Refrigerant charge	Unit may be short on refrigerant charge.
	Compressor	Check for defective compressor. If discharge is too low and suction pressure is too high, compressor is not pumping properly. Replace compressor.
	Reversing valve	Defective reversing valve creating bypass of refrigerant from discharge to suction side of compressor. Replace reversing valve.
	Operating pres sures	Compare unit operating pressures to the pressure / temperature chart for the unit.
	TXV	Check TXV for possible restriction or defect. Replace if necessary
	Moisture, noncon densables	The refrigerant system may be contaminated with moisture or noncon densables. Reclaim refrigerant, evacuate and recharge with factory recommended charge. Note: a liquid line dryer may be required
UPM board trouble shooting	Compressor will not run, no fault blink code	

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