

Geothermal/Water Source Heat Pump Installer's Guide

- R-410A Refrigerant
- 2 - 6 Tons

*1GC (First letter may be A or T)

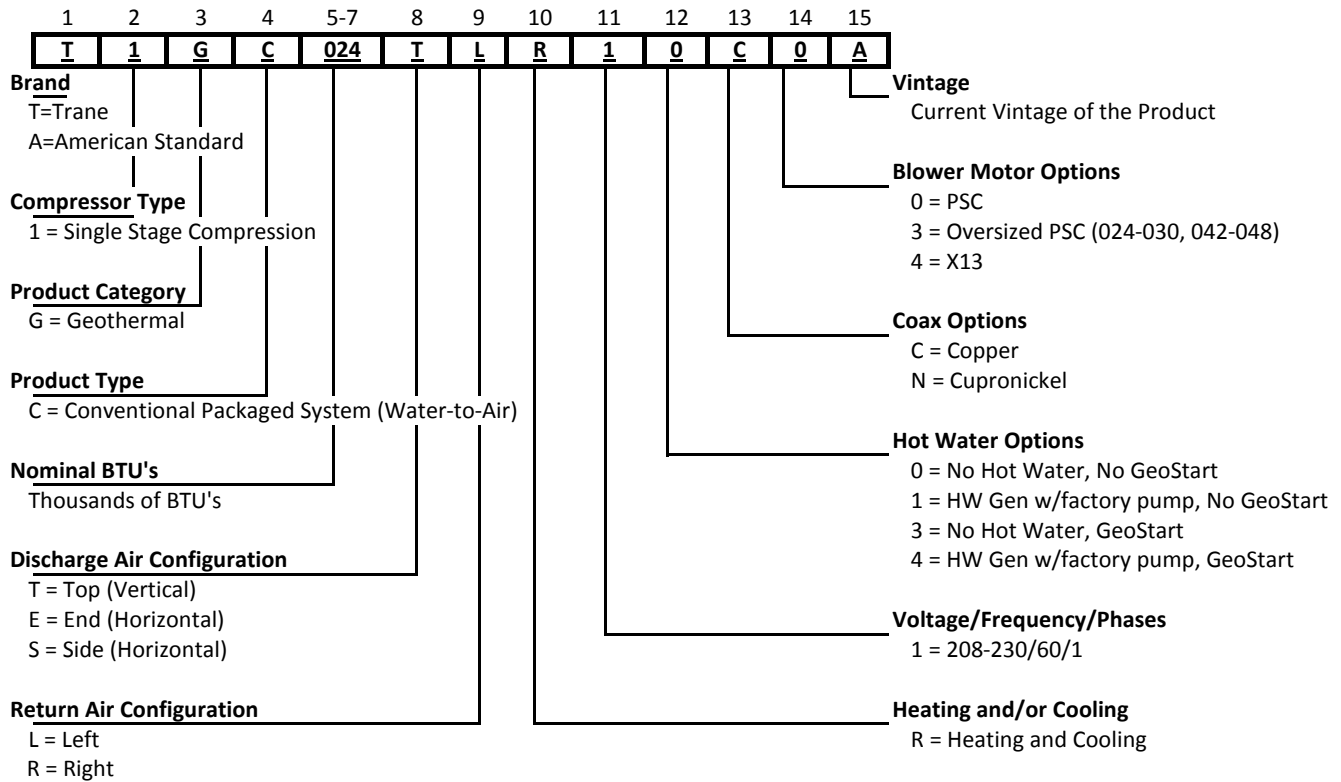


18-GL03D1-2

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Model Nomenclature



General Installation Information

Safety Considerations



WARNING: Before performing service or maintenance operations on a system, turn off main power switches to the indoor unit. If applicable, turn off the accessory heater power switch. Electrical shock could cause personal injury.

Installing and servicing heating and air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair or service heating and air conditioning equipment. Untrained personnel can perform the basic maintenance functions of cleaning coils and cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing operations and have a fire extinguisher available.

Moving and Storage

Move units in the normal "up" orientation. Horizontal units may be moved and stored per the information on the packaging. Do not stack more than three units in total height. Vertical units may be stored one upon another to a maximum height of two units. Do not attempt to move units while stacked. When the equipment is received, all items should be carefully checked against the bill of lading to be sure all crates and cartons have been received. Examine units for shipping damage, removing the units from the packaging if necessary. Units in question should also be internally inspected. If any damage is noted, the carrier should make the proper notation on the delivery receipt, acknowledging the damage.

Unit Location

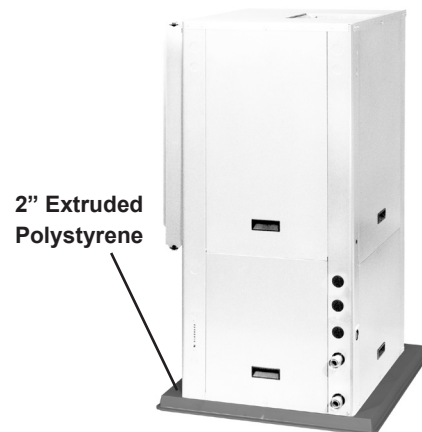
Locate the unit in an indoor area that allows for easy removal of the filter and access panels. Location should have enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water, electrical and duct connection(s). If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. On horizontal units, allow adequate room below the unit for a condensate drain trap and do not locate the unit above supply piping. **Care should be taken when units are located in unconditioned spaces to prevent damage from frozen water lines and excessive heat that could damage electrical components.**

Installing Vertical Units

Prior to setting the unit in place, remove and discard the compressor hold down shipping bolt located at the front of the compressor mounting bracket.

Vertical units are available in left or right air return configurations. Top air discharge vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to provide isolation between the unit and the floor. It is not necessary to anchor the unit to the floor.

Vertical Unit Mounting



General Installation Information cont.

Installing Horizontal Units

Remove and discard the compressor hold down shipping bolt located at the front of the compressor mounting bracket prior to setting the unit in place. Horizontal units are available with side or end discharge. Horizontal units are normally suspended from a ceiling by four or six 3/8-inch diameter threaded rods. The rods are usually attached to the unit by hanger bracket kits furnished with each unit.

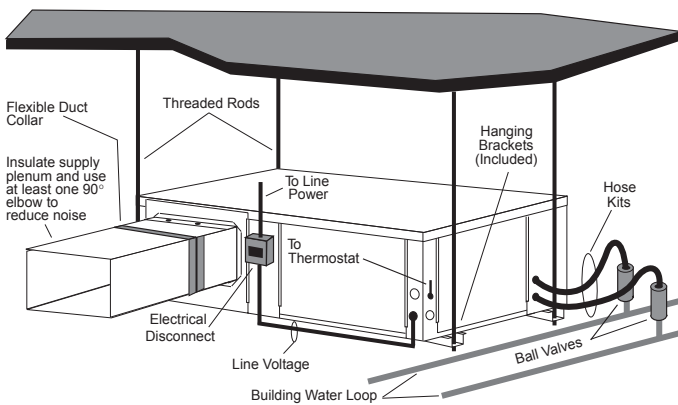
Lay out the threaded rods per the Hanger Dimensions table. Assemble the hangers to the unit as shown on page 7. Securely tighten the brackets to the unit using the weld nuts located on the underside of the bottom panel. When attaching the hanger rods to the bracket, a double nut is required since vibration could loosen a single nut. To allow filter access, one bracket on the filter side should be installed 180° from the position shown in the figure on page 7. The unit should be pitched approximately 1/4-inch towards the drain in both directions to facilitate the removal of condensate. Use only the bolts provided in the kit to attach hanger brackets. The use of longer bolts could damage internal parts.

Some residential applications require the installation of horizontal units on an attic floor. In this case, the unit should be set in a full size secondary drain pan on top of a vibration absorbing pad. 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 material.



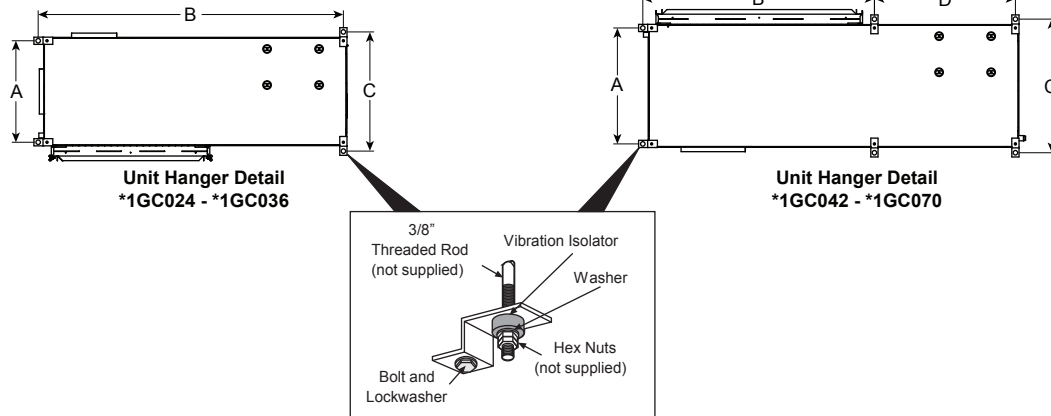
CAUTION: Do not use rods smaller than 3/8-inch diameter since they may not be strong enough to support the unit. The rods must be securely anchored to the ceiling.

Horizontal Unit Mounting



General Installation Information cont.

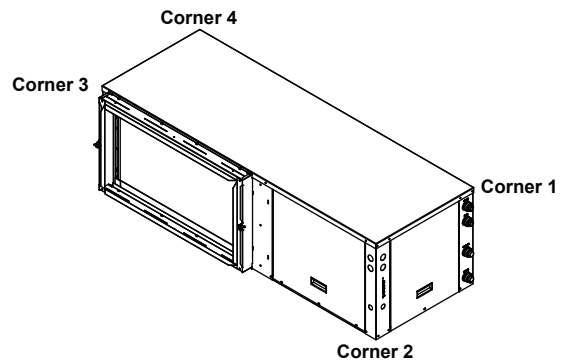
Unit Hanger Dimensions



Horizontal Models	Unit Hanger Dimensions				
		A	B	C	D
024-036	in.	21.1	63.4	24.8	-
	cm.	53.6	161.0	63.0	-
042-048	in.	24.1	43.1	27.8	29.3
	cm.	61.2	109.5	70.6	74.4
060	in.	24.1	48.1	27.8	29.3
	cm.	61.2	122.2	70.6	74.4
070	in.	24.1	53.1	27.8	29.3
	cm.	61.2	134.9	70.6	74.4

Corner Weight Locations

Model	Horizontal Corner Weights					
		Post #1	Post #2	Post #3	Post #4	Total
024	lb	35	119	81	33	268
	kg	[16]	[54]	[37]	[15]	[122]
030	lb	38	122	86	33	279
	kg	[17]	[55]	[39]	[15]	[127]
036	lb	40	124	88	35	287
	kg	[18]	[56]	[40]	[16]	[130]
042	lb	63	147	87	52	349
	kg	[29]	[67]	[39]	[24]	[158]
048	lb	64	152	89	53	358
	kg	[29]	[69]	[40]	[24]	[162]
060	lb	93	156	81	73	403
	kg	[42]	[71]	[37]	[33]	[183]
070	lb	143	137	124	34	438
	kg	[65]	[62]	[56]	[15]	[199]



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General Installation Information cont.

Duct System

An air outlet collar is provided on vertical top air discharge units and all horizontal units to facilitate a duct connection. A flexible connector is recommended for discharge and return air duct connections on metal duct systems. Uninsulated duct should be insulated with a minimum of 1-inch duct insulation. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended as the unit's performance will be adversely affected.

If the unit is connected to existing ductwork, check the duct system to ensure that it has the capacity to accommodate the air required for the unit application. If the duct is too small, as in the replacement of heating only systems, larger ductwork should be installed. All existing ductwork should be checked for leaks and repaired if necessary.

The duct system should be sized to handle the design airflow quietly and efficiently. To maximize sound attenuation of the unit blower, the supply and return plenums should include an internal duct liner of fiberglass or constructed of ductboard for the first few feet. On systems employing a sheet metal duct system, canvas connectors should be used between the unit and the ductwork. If air noise or excessive airflow is a problem, the blower speed can be changed.

Water Piping

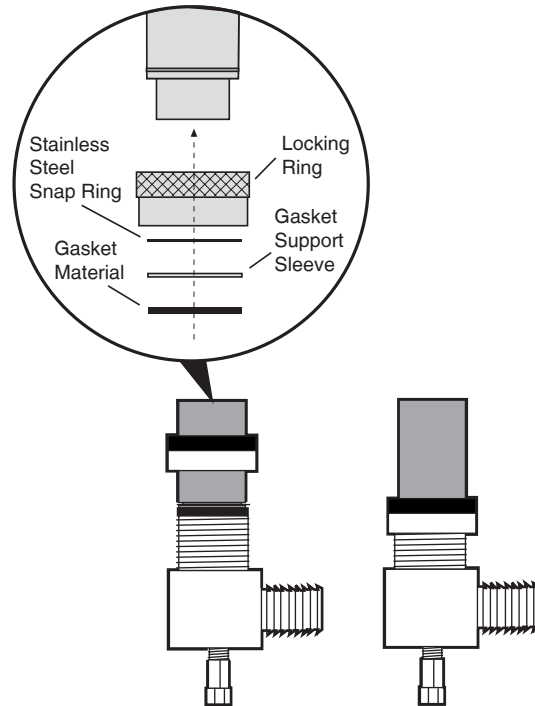
The proper water flow must be provided to each unit whenever the unit operates. To assure proper flow, use pressure/temperature ports to determine the flow rate. These ports should be located at the supply and return water connections on the unit. The proper flow rate cannot be accurately set without measuring the water pressure drop through the refrigerant-to-water heat exchanger.

All source water connections on residential units are swivel piping fittings (see Swivel Connections figure) that accept a 1-inch male pipe thread (MPT). The swivel connector has a rubber gasket seal similar to a rubber hose gasket, which when mated to the flush end of any 1-inch threaded pipe provides a leak-free seal without the need for thread sealing tape or compound. Check to ensure that the rubber seal is in the swivel connector prior to attempting any connection. The rubber seals are shipped attached to the waterline. To make the connection to a ground loop system, mate the brass connector (supplied in CK4L connector kit) against the rubber gasket in the swivel connector and thread the female locking ring onto the pipe threads, while maintaining the brass connector in the desired direction. Tighten the connectors by hand, then gently snug the fitting with pliers to provide a leak-proof joint. When connecting to an open loop (ground water) system, thread any 1-inch MPT fitting (SCH80 PVC or copper) into the swivel

connector and tighten in the same manner as noted above. The open and closed loop piping system should include pressure/temperature taps for serviceability.

Never use flexible hoses smaller than 1-inch inside diameter on the unit. Limit hose length to 10 feet per connection. Check carefully for water leaks.

Swivel Connections



Water Quality

In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, a closed loop system is recommended. The heat exchanger coils in ground water systems may, over a period of time, lose heat exchange capabilities due to a buildup of mineral deposits inside. These can be cleaned, but only by a qualified service mechanic, as special solutions and pumping equipment are required. Hot water generator coils can likewise become scaled and possibly plugged.

In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional flushing.

Units with cupronickel heat exchangers are recommended for open loop applications due to the increased resistance to build-up and corrosion, along with reduced wear caused by acid cleaning. Failure to adhere to the guidelines in the water quality table could result in loss of warranty.

Material		Copper	90/10 Cupro-Nickel	316 Stainless Steel
pH	Acidity/Alkalinity	7 - 9	7 - 9	7 - 9
Scaling	Calcium and Magnesium Carbonate	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm
Corrosion	Hydrogen Sulfide	Less than .5 ppm (rotten egg smell appears at 0.5 PPM)	10 - 50 ppm	Less than 1 ppm
	Sulfates	Less than 125 ppm	Less than 125 ppm	Less than 200 ppm
	Chlorine	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Chlorides	Less than 20 ppm	Less than 125 ppm	Less than 300 ppm
	Carbon Dioxide	Less than 50 ppm	10 - 50 ppm	10 - 50 ppm
	Ammonia	Less than 2 ppm	Less than 2 ppm	Less than 20 ppm
	Ammonia Chloride	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Ammonia Nitrate	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Ammonia Hydroxide	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Ammonia Sulfate	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Total Dissolved Solids (TDS)	Less than 1000 ppm	1000-1500 ppm	1000-1500 ppm
	LSI Index	*0.5 to .05	*0.5 to .05	*0.5 to .05
Iron Fouling	Iron, Fe ²⁺ (Ferrous) Bacterial Iron Potential	< .2ppm	< .2 ppm	< .2 ppm
(Biological Growth)	Iron Oxide	Less than 1 ppm. Above this level deposition will occur.	Less than 1 ppm. Above this level deposition will occur.	Less than 1 ppm. Above this level deposition will occur.
Erosion	Suspended Solids	Less than 10 ppm and filtered for max of 600 micron size	Less than 10 ppm and filtered for max of 600 micron size	Less than 10 ppm and filtered for max of 600 micron size
	Threshold Velocity (Fresh Water)	< 6 ft/sec	< 6 ft/sec	< 6 ft/sec

Note:
Grains = PPM divided by 17
mg/l is equivalent to PPM

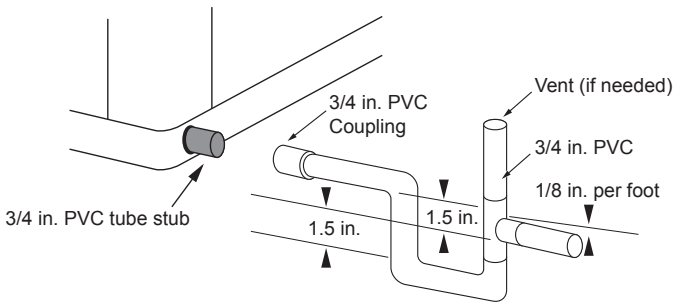
Freeze Detection

Set SW1-2 on the printed circuit board for applications using a closed loop antifreeze solution to "LOOP" (15°F) [-9.4°C]. On applications using an open loop/ground water system (or closed loop no antifreeze), set this dip switch to "WELL" (30°F) [-1.1°C], the factory default setting. (Refer to the Dip Switch Field Selection table).

Condensate Drain

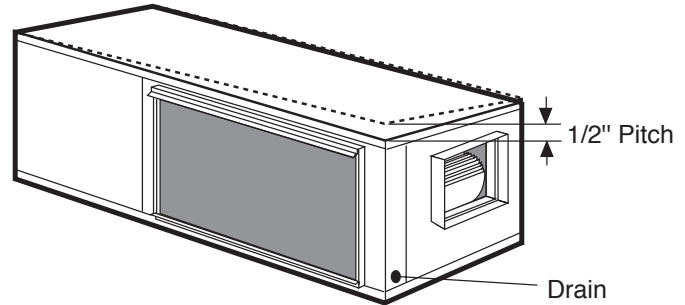
On vertical units, the internal condensate drain assembly consists of a drain tube which is connected to the drain pan, a 3/4 in. PVC female adapter and a flexible connecting hose. The female adapter may exit either the front or the side of the cabinet. The adapter should be glued to the field-installed PVC condensate piping. On vertical units, a condensate hose is inside all cabinets as a trapping loop; therefore, an external trap is not necessary.

Horizontal Drain Connection (Composite Drain Pan)



On horizontal units, a PVC stub is provided for condensate drain piping connection. An external trap is required (see below). If a vent is necessary, an open stand pipe may be applied to a tee in the field-installed condensate piping.

Unit Pitch for Drain



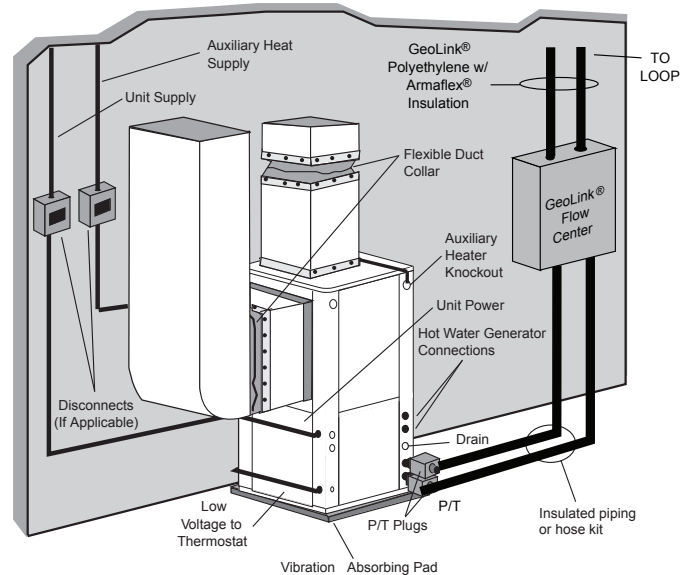
Closed Loop Ground Source Systems

NOTE: For closed loop systems with antifreeze protection, set SW1-2 to the "loop" position.

Once piping is completed between the unit, pumps and the ground loop, final purging and charging of the loop is required. A flush cart (or a 1.5 HP pump minimum) is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop itself. Antifreeze solution is used in most areas to prevent freezing. Flush the system adequately to remove as much air as possible then pressurize the loop to a static pressure of 40-50 PSI (summer) or 50-75 PSI (winter). This is normally adequate for good system operation. Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the cooling season. This fluctuation is normal and should be considered when initially charging the system.

After pressurization, be sure to turn the venting (burping) screw in the center of the pump two (2) turns open (water will drip out), wait until all air is purged from the pump, then tighten the plug. Ensure that the loop pumps provide adequate flow through the unit(s) by checking the pressure drop across the heat exchanger and comparing it to the unit capacity data in the specification catalog. 2.5 to 3 GPM of flow per ton of cooling capacity is recommended in earth loop applications.

Closed Loop Ground Source Application



NOTE: Additional information can be found in Flow Center installation manual and Flush Cart manual.

Open Loop Ground Water Systems

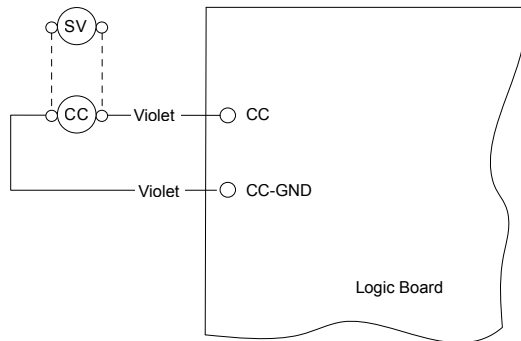
Typical open loop piping is shown below. Always maintain water pressure in the heat exchanger by placing water control valves at the outlet of the unit to prevent mineral precipitation. Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. Insure proper water flow through the unit by checking pressure drop across the heat exchanger and comparing it to the figures in unit capacity data tables in the specification catalog. 1.5-2 GPM of flow per ton of cooling capacity is recommended in open loop applications.

Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways, depending on local codes, i.e. recharge well, storm sewer, drain field, adjacent stream or pond, etc. Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning departments to assure compliance in your area.

NOTE: For open loop/groundwater systems or systems that do not contain an antifreeze solution, set SW1-Switch #2 to the "WELL" position. Slow opening/closing solenoid valves (type VM) are recommended to eliminate water hammer.

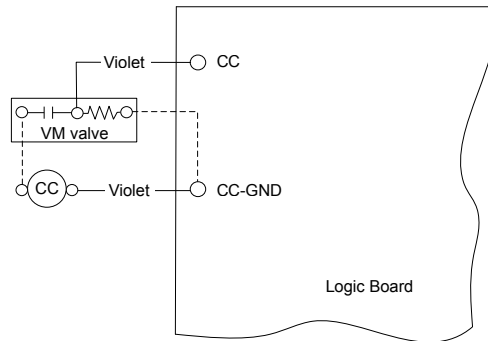
Open Loop Solenoid Valve Connection Option

Typical quick operating external 24V water solenoid valve (type PPV100 or BPV100) wiring.

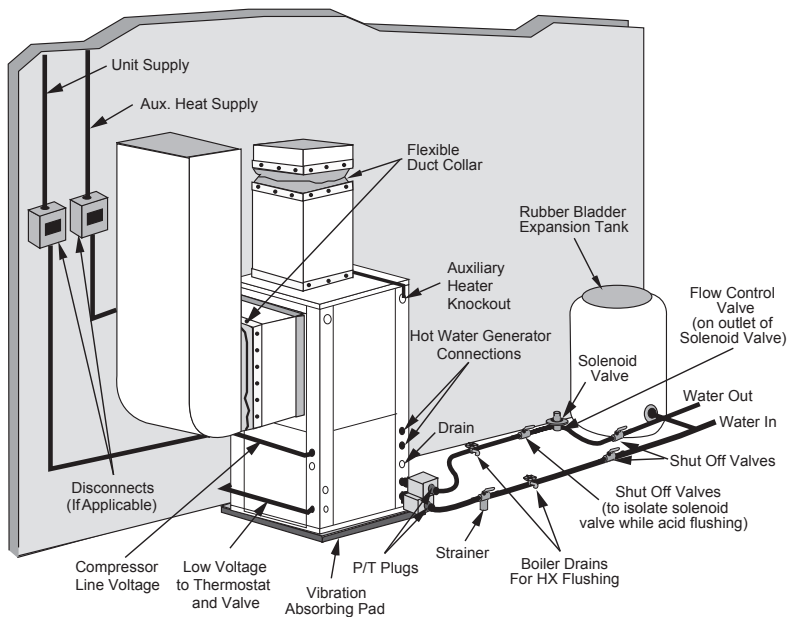


Open Loop Solenoid Valve Connection Option

Typical slow operating external 24V water solenoid valve (type VM) wiring and one (1) quick operating valve.



Open System - Groundwater Application



Hot Water Generator Connections

The heat reclaiming hot water generator coil is vented double-wall copper construction and is suitable for potable water.

To maximize the benefits of the hot water generator a minimum 50-gallon water heater is recommended. For higher demand applications, use an 80-gallon water heater or two 50-gallon water heaters connected in a series as shown below. Electric water heaters are recommended. Make sure all local electrical and plumbing codes are met for installing a hot water generator. Residential units with hot water generators contain an internal circulator and fittings. A water softener is recommended with hard water (greater than 10 grains or 170 total hardness). Once air has been purged from the water piping circuit, connect the blue wire from the hot water generator pump to T1 on the contactor (unit ships with this wire disconnected). The hot water generator pump will not operate until this wire is connected to the contactor.

Water Tank Preparation

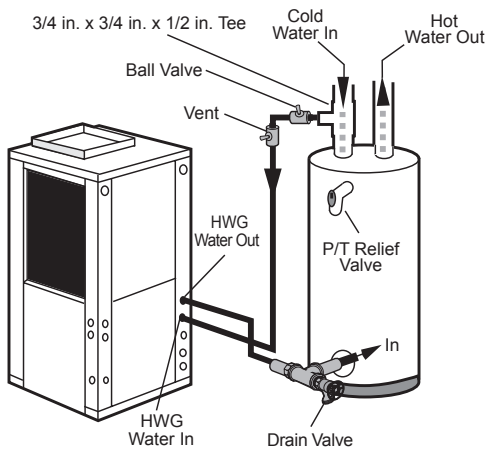
To install a unit with a hot water generator, follow these installation guidelines.

1. Turn off the power to the water heater.
2. Attach a water hose to the water tank drain connection and run the other end of the hose to an open drain or outdoors.
3. Close the cold water inlet valve to the water heater tank.
4. Drain the tank by opening the valve on the bottom of the tank, then open the pressure relief valve or hot water faucet.
5. Flush the tank by opening the cold water inlet valve to the water heater to free the tank of sediments. Close when draining water is clear.
6. Disconnect the garden hose and remove the drain valve from the water heater.
7. Refer to Plumbing Installation and Hot Water Generator Startup.

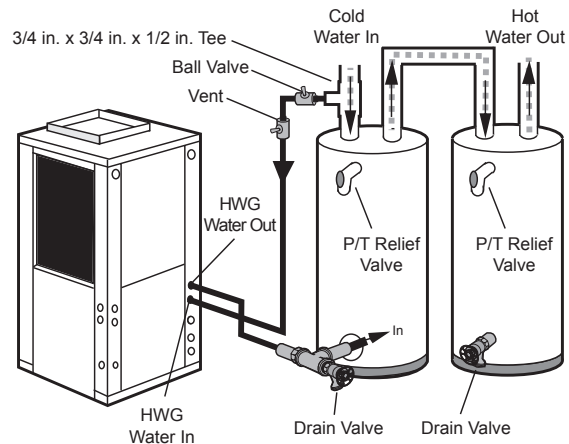


CAUTION: Elements will burn out if energized dry.

Typical Hot Water Generator Installation



Hot Water Generator Installation In Preheat Tank



NOTE: This configuration maximizes hot water generator capability.

Hot Water Generator Connections cont.

Plumbing Installation

1. Inspect the dip tube in the water heater cold inlet for a check valve. If a check valve is present it must be removed or damage to the hot water generator circulator will occur.
2. Remove drain valve and fitting.
3. Thread the 3/4-inch NPT x 3-1/2-inch brass nipple into the water heater drain port.
4. Attach the center port of the 3/4-inch FPT tee to the opposite end of the brass nipple.
5. Attach the 1/2-inch copper to 3/4-inch NPT adaptor to the side of the tee closest to the unit.
6. Install the drain valve on the tee opposite the adaptor.
7. Run interconnecting tubing from the tee to DHW water out.
8. Cut the cold water "IN" line going to the water heater.
9. Insert the reducing solder tee in line with cold water "IN" line as shown.
10. Run interconnecting copper tubing between the unit DHW water "IN" and the tee (1/2-inch nominal). The recommended maximum distance is 50 feet.
11. To prevent air entrapment in the system, install a vent coupling at the highest point of the interconnecting lines.
12. Insulate all exposed surfaces of both connecting water lines with 3/8-inch wall closed cell insulation.

NOTE: All plumbing and piping connections must comply with local plumbing codes.

Hot Water Generator Startup

1. Make sure the power is off to the heat pump. Connect the blue wire from the hot water generator pump to T1 on the contactor (unit ships with this wire disconnected). The hot water generator pump will not operate until this wire is connected to the contactor.
2. Close the drain valve to the water heater.
3. Open the cold water supply to the tank.
4. Open a hot water faucet in the building to bleed air from the system. Close when full.
5. Open the pressure relief valve to bleed any remaining air from the tank, then close.
6. If so equipped, turn the venting (burping) screw in the center of the pump two (2) turns open (water will drip out), wait until all air is purged from the pump, then tighten the plug. Use vent couplings to bleed air from the lines.
7. Carefully inspect all plumbing for water leaks and correct as required.
8. Before restoring electrical supply to the water heater, adjust the temperature setting on the tank.
 - On tanks with both upper and lower elements, the lower element should be turned down to the lowest setting, approximately 100°F. The upper element should be adjusted to 120°F to 130°F. Depending upon the specific needs of the customer, you may want to adjust the upper element differently.
 - On tanks with a single element, lower the thermostat setting to 120°F.
9. After the thermostat(s) is adjusted, replace the access cover and restore electrical supply to the water heater.
10. Make sure that any valves in the hot water generator circuit are open.
11. Turn on the unit to heating.
12. The DHW pump should be running. When the pump is first started, turn the venting (burping) screw (if equipped) in the center of the pump two (2) turns open until water dribbles out, then replace. Allow the pump to run for at least five minutes to ensure that water has filled the circulator properly.
13. The temperature difference between the water entering and leaving the hot water generator should be 5°F to 15°F. The water flow should be approximately 0.4 GPM per ton of nominal cooling.
14. Allow the unit to heat water for 15 to 20 minutes to be sure operation is normal.



CAUTION: Never operate the DHW circulating pump while dry. If the unit is placed in operation before the hot water generator piping is connected, be sure that the pump wires are disconnected from the contactor.

Electrical Connections

General

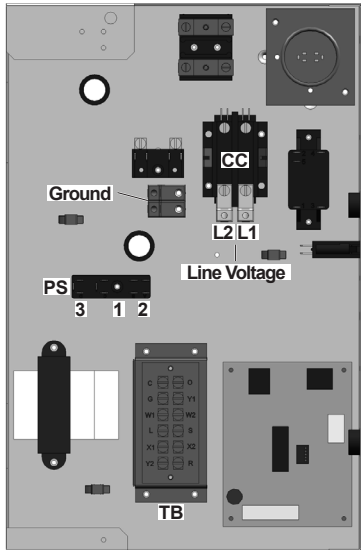
Be sure the available power is the same voltage and phase as that shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

Unit Power Connection

Connect the incoming line voltage wires to L1 and L2 of the contactor as shown below for single-phase unit. Consult the unit's Electrical Data for correct fuse sizes.

Open lower front access panel. Insert power wires through knockouts on lower left side of cabinet. Route wires through left side of control box and connect to contactor and ground. Close lower front access panel before unit start-up.

Line Voltage 208-230/60/1 Control Box



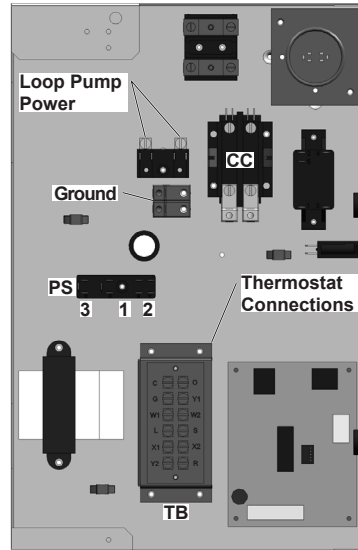
208 Volt Operation

All *1GC Series 208/230 units are factory wired for 230 volt operation. For 208 volt operation, the red and blue transformer wires must be switched on terminal strip PS.

Pump Wiring

See Pump Wiring figure below for electrical connections from control box to pumps.

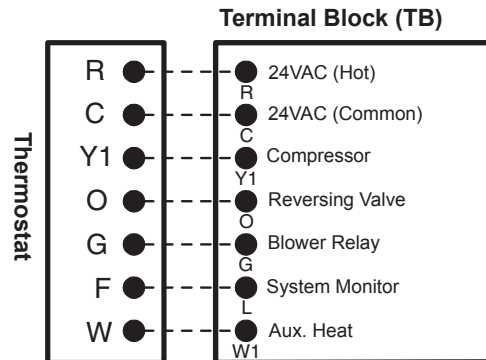
Pump Wiring 208-230/60/1



Electronic Thermostat Installation

Position the thermostat subbase against the wall so that it is level and the thermostat wires protrude through the middle of the subbase. Mark the position of the subbase mounting holes and drill holes with a 3/16-inch bit. Install supplied anchors and secure base to the wall. Thermostat wire must be 8-conductor, 18-AWG wire. Strip the wires back 1/4-inch (longer strip lengths may cause shorts) and insert the thermostat wires into the connector as shown. Tighten the screws to insure secure connections. The thermostat has the same type connectors, requiring the same wiring. See instructions enclosed in the thermostat for detailed installation and operation information.

Thermostat Wiring



Antifreeze Corrections

Catalog performance can be corrected for antifreeze use. Please use the following table and note the example given.

Antifreeze Correction Example

Antifreeze solution is Propylene Glycol 20% by weight. Determine the corrected heating and cooling performance at 30°F and 90°F respectively as well as pressure drop at 30°F for a *1GC024-PSC.

The corrected cooling capacity at 90°F would be:
 $24,500 \text{ MBtuh} \times 0.969 = 23,741 \text{ MBtuh}$

The corrected heating capacity at 30°F would be:
 $19,000 \text{ MBtuh} \times 0.913 = 17,347 \text{ MBtuh}$

The corrected pressure drop at 30°F and 6 GPM would be:
 $10.5 \text{ feet of head} \times 1.270 = 13.34 \text{ feet of head}$

(*First letter may be A or T)

Antifreeze Type	Antifreeze % by wt	Cooling Capacity	Heating Capacity	Pressure Drop
EWT - degF [DegC]		90 [32.2]	30 [-1.1]	30 [-1.1]
Water	0	1.000	1.000	1.000
Ethylene Glycol	10	0.991	0.973	1.075
	20	0.979	0.943	1.163
	30	0.965	0.917	1.225
	40	0.955	0.890	1.324
	50	0.943	0.865	1.419
Propylene Glycol	10	0.981	0.958	1.130
	20	0.969	0.913	1.270
	30	0.950	0.854	1.433
	40	0.937	0.813	1.614
	50	0.922	0.770	1.816
Ethanol	10	0.991	0.927	1.242
	20	0.972	0.887	1.343
	30	0.947	0.856	1.383
	40	0.930	0.815	1.523
	50	0.911	0.779	1.639
Methanol	10	0.986	0.957	1.127
	20	0.970	0.924	1.197
	30	0.951	0.895	1.235
	40	0.936	0.863	1.323
	50	0.920	0.833	1.399

Warning: Gray area represents antifreeze concentrations greater than 35% by weight and should be avoided due to the extreme performance penalty they represent.

Auxiliary Heat Ratings

Model	KW			BTU/HR		Min	*1GC Series Compatibility		
	208V	230V	Stages	208V	230V	CFM	024 - 036	042	048 - 070
EAM(H)5	3.6	4.8	1	12,300	16,300	450	•		
EAM(H)8	5.7	7.6	1	19,400	25,900	550	•		
EAM(H)10	7.2	9.6	1	24,600	32,700	650	•		
EAL(H)10	7.2	9.6	1	24,600	32,700	1100		•	•
EAL(H)15	10.8	14.4	1	36,900	49,100	1250		•	•
EAL(H)20	14.4	19.2	1	49,200	65,500	1500			•

9/18/09

Model	Supply Circuit	Heater Amps		Min Circuit Amp		Max Fuse (USA)		Max Fuse (CAN)		Max CKT BRK	
		208 V	240 V	208 V	240 V	208 V	240 V	208 V	240 V	208 V	240 V
EAM(H)5	Single	17.3	20	26.7	30	30	30	30	30	30	30
EAM(H)8	Single	27.5	31.7	39.3	44.6	40	45	40	45	40	50
EAM(H)10	Single	34.7	40	48.3	55	50	60	50	60	50	60
EAL(H)10	Single	34.7	40	53.3	60	60	60	60	60	60	60
EAL(H)15	Single	52.0	60	75	85	80	90	80	90	70	100
	L1/L2	34.7	40	53.3	60	60	60	60	60	60	60
	L3/L4	17.3	20	21.7	25	25	25	25	25	20	30
EAL(H)20	Single	69.3	80	96.7	110	100	110	100	110	100	100
	L1/L2	34.7	40	53.3	60	60	60	60	60	60	60
	L3/L4	34.7	40	43.3	50	45	50	45	50	40	50

All heaters rated single phase 60 cycle and include unit blower load.
 All fuses type "D" time delay (or HACR circuit breaker in USA)
 Wire length based on one-way measurement with 2% voltage drop
 Wire size based on 60°C (*90°C) copper conductor
 "H" is used in part numbers for horizontal units

9/18/09

Electrical Data

PSC Motor

Model	Compressor Model No.	Rated Voltage	Voltage Min/Max	Compressor				HWG Pump FLA	Ext Loop FLA	Blower Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR
				MCC	RLA	LRA	LRA**						
024	ZP20K5E-PFV	208-230/60/1	187/253	21.0	13.5	58.3	21.0	0.4	5.4	1.2	20.5	23.9	35
024*	ZP20K5E-PFV	208-230/60/1	187/253	21.0	13.5	58.3	21.0	0.4	5.4	1.5	20.8	24.2	35
030	ZP25K5E-PFV	208-230/60/1	187/253	22.0	14.1	73.0	26.0	0.4	5.4	1.5	21.4	24.9	35
030*	ZP25K5E-PFV	208-230/60/1	187/253	22.0	14.1	73.0	26.0	0.4	5.4	2.2	22.1	25.6	35
036	HRH029U1LP6	208-230/60/1	187/253	27.0	17.3	96.7	34.0	0.4	5.4	2.2	25.3	29.6	45
042	HRH034U1LP6	208-230/60/1	187/253	31.0	20.0	115.0	41.0	0.4	5.4	3.5	29.3	34.3	50
042*	HRH034U1LP6	208-230/60/1	187/253	31.0	20.0	115.0	41.0	0.4	5.4	4.6	30.4	35.4	50
048	HRH040U1LP6	208-230/60/1	187/253	32.0	21.0	115.0	41.0	0.4	5.4	3.5	30.3	35.6	50
048*	HRH040U1LP6	208-230/60/1	187/253	32.0	21.0	115.0	41.0	0.4	5.4	4.6	31.4	36.7	50
060	HRH051U1LP6	208-230/60/1	187/253	41.0	26.3	150.0	53.0	0.4	5.4	5.9	38.0	44.6	70
070	HRH056U1LP6	208-230/60/1	187/253	47.0	30.1	145.0	51.0	0.4	5.4	5.9	41.8	49.3	70

HACR circuit breaker in USA only

1/12/10

* With optional high-static PSC motor

** With optional GeoStart™, only available on 208-230/60/1

NOTE: High-static option not available on 036, 060, and 070 model sizes.

X13 ECM Motor

Model	Compressor Model No.	Rated Voltage	Voltage Min/Max	Compressor				HWG Pump FLA	Ext Loop FLA	Blower Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR
				MCC	RLA	LRA	LRA**						
024	ZP20K5E-PFV	208-230/60/1	187/253	21.0	13.5	58.3	21.0	0.4	5.4	4.1	23.4	26.8	40
030	ZP25K5E-PFV	208-230/60/1	187/253	22.0	14.1	73.0	26.0	0.4	5.4	4.1	24.0	27.5	40
036	HRH029U1LP6	208-230/60/1	187/253	27.0	17.3	96.7	34.0	0.4	5.4	4.1	27.2	31.5	45
042	HRH034U1LP6	208-230/60/1	187/253	31.0	20.0	115.0	41.0	0.4	5.4	7.6	33.4	38.4	50
048	HRH040U1LP6	208-230/60/1	187/253	32.0	21.0	115.0	41.0	0.4	5.4	7.6	34.4	39.7	60
060	HRH051U1LP6	208-230/60/1	187/253	41.0	26.3	150.0	53.0	0.4	5.4	7.6	39.7	46.3	70
070	HRH056U1LP6	208-230/60/1	187/253	47.0	30.1	145.0	51.0	0.4	5.4	7.6	43.5	51.0	80

HACR circuit breaker in USA only

10/20/09

** With optional GeoStart™, only available on 208-230/60/1

Blower Performance Data - PSC

Standard PSC Motor

Model	Blower Spd	Blower Size	Motor HP	Airflow (cfm) at External Static Pressure (in. wg)															
				0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.80	0.90	1.00
024	H	9 x 7	1/5	1065	1045	1030	1005	975	950	925	900	870	835	800	-	-	-	-	-
	M			880	865	850	830	815	795	775	750	725	700	670	-	-	-	-	-
	L			805	790	780	765	745	725	710	685	660	630	600	-	-	-	-	-
030	H	9 x 7	1/3	1120	1100	1070	1050	1040	1030	1020	1010	1000	980	830	-	-	-	-	-
	M			1020	1000	980	960	920	880	860	840	820	790	-	-	-	-	-	-
	L			860	850	840	830	810	800	780	760	740	710	-	-	-	-	-	-
036	H	9 x 7	1/2	1360	1340	1320	1290	1260	1220	1185	1130	1080	1045	1010	910	855	-	-	-
	M			1205	1190	1170	1145	1120	1085	1050	1015	980	940	900	845	-	-	-	-
	L			1070	1060	1050	1035	1020	995	970	940	910	875	840	780	-	-	-	-
042	H	10 x 10	1/2	1705	1685	1665	1645	1625	1595	1565	1530	1500	1450	1405	1260	1140	-	-	-
	M			1485	1475	1465	1445	1430	1410	1390	1350	1315	1260	1210	1110	1010	-	-	-
	L			1180	1165	1150	1135	1120	1090	1060	1030	1000	965	920	855	-	-	-	-
048	H	10 x 10	1/2	1930	1910	1885	1860	1830	1790	1750	1710	1665	1620	1580	1280	1235	-	-	-
	M			1580	1565	1550	1535	1525	1505	1485	1445	1410	1310	1215	1130	1030	-	-	-
	L			1180	1170	1160	1140	1120	1100	1080	1050	1020	970	930	875	-	-	-	-
060	H	11 x 10	1	2360	2330	2300	2270	2240	2215	2190	2160	2130	2095	2060	1985	1920	1855	-	-
	M			2165	2130	2095	2070	2050	2030	2010	1985	1965	1930	1900	1850	1775	1700	-	-
	L			1965	1940	1920	1900	1885	1870	1855	1825	1800	1780	1760	1720	1625	1530	-	-
070	H	11 x 10	1	2450	2435	2420	2395	2370	2340	2310	2280	2250	2225	2200	2040	2000	1950	-	-
	M			2215	2190	2170	2155	2140	2120	2095	2070	2045	2015	1990	1940	1875	1795	-	-
	L			2005	1990	1975	1960	1950	1940	1925	1910	1890	1865	1845	1780	1710	1565	-	-

11/13/09

Factory settings are in Bold

Air flow values are with dry coil and standard filter

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg, and 500 fpm by 0.16 in. wg.

Optional High Static PSC Motor

Model	Blower Spd	Blower Size	Motor HP	Airflow (cfm) at External Static Pressure (in. wg)															
				0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.80	0.90	1.00
024	H	9 x 7	1/3	1120	1100	1070	1050	1040	1030	1020	1010	1000	980	830	-	-	-	-	-
	M			1020	1000	980	960	920	880	860	840	820	790	-	-	-	-	-	-
	L			860	850	840	830	810	800	780	760	740	710	-	-	-	-	-	-
030	H	9 x 7	1/2	1340	1320	1300	1270	1240	1200	1160	1115	1070	1025	985	880	-	-	-	-
	M			1185	1175	1165	1130	1095	1065	1035	1000	965	920	880	795	-	-	-	-
	L			1050	1040	1030	1015	1000	980	960	925	895	855	815	-	-	-	-	-
042	H	10 x 10	3/4	2095	2080	2060	2020	1980	1950	1920	1880	1840	1780	1725	1550	1335	1120	-	-
	M			1960	1940	1920	1890	1865	1830	1800	1760	1725	1670	1620	1435	1300	-	-	-
	L			1800	1780	1760	1740	1725	1695	1670	1625	1585	1525	1465	1300	1200	-	-	-
048	H	10 x 10	3/4	2095	2080	2060	2020	1980	1950	1920	1880	1840	1780	1725	1550	1335	1120	-	-
	M			1960	1940	1920	1890	1865	1830	1800	1760	1725	1670	1620	1435	1300	-	-	-
	L			1800	1780	1760	1740	1725	1695	1670	1625	1585	1525	1465	1300	1200	-	-	-

11/4/09

Factory settings are in Bold

Air flow values are with dry coil and standard filter

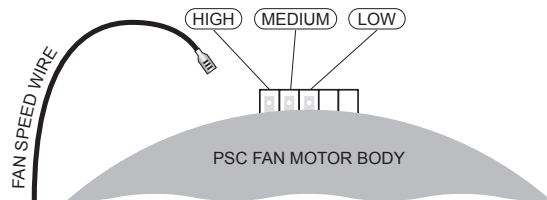
For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg, and 500 fpm by 0.16 in. wg.

Setting Blower Speed - PSC



CAUTION: Disconnect all power before performing this operation.



Blower Performance Data - X13 ECM

Model	Motor Spd	Motor Tap	Blower Size	Motor HP	Airflow (cfm) at External Static Pressure (in. wg)															
					0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.80	0.90	1.00
024	High	5	9 x 7	1/2	980	960	940	930	920	905	890	875	860	840	820	800	745	-	-	-
	Med High	4			890	878	865	845	825	813	800	785	770	753	735	710	665	-	-	-
	Med	3			830	815	800	788	775	755	735	723	710	690	670	640	600	-	-	-
	Med Low	2			780	760	740	703	665	653	640	620	600	585	570	-	-	-	-	-
	Low	1			625	593	560	535	510	495	480	455	430	410	390	-	-	-	-	-
030	High	5	9 x 7	1/2	1340	1310	1280	1240	1200	1170	1140	1095	1050	1015	980	900	800	-	-	-
	Med High	4			1130	1115	1100	1085	1070	1057	1044	1022	1000	970	940	870	780	-	-	-
	Med	3			1030	1005	980	965	950	935	920	900	880	870	860	830	750	-	-	-
	Med Low	2			960	945	930	915	900	885	870	855	840	825	810	790	740	-	-	-
	Low	1			790	765	740	725	710	690	670	660	650	630	610	580	500	-	-	-
036	High	5	9 x 7	1/2	1370	1345	1320	1285	1250	1220	1190	1158	1125	1085	1045	960	-	-	-	-
	Med High	4			1265	1253	1240	1220	1200	1175	1150	1120	1090	1053	1015	-	-	-	-	-
	Med	3			1160	1143	1125	1113	1100	1085	1070	1055	1040	1020	1000	-	-	-	-	-
	Med Low	2			1110	1095	1080	1065	1050	1038	1025	1008	990	980	970	-	-	-	-	-
	Low	1			825	803	780	770	760	740	720	705	690	670	650	-	-	-	-	-
042	High	5	11 x 10	1	1840	1825	1810	1790	1770	1745	1720	1700	1680	1660	1640	1600	1570	1530	1480	-
	Med High	4			1730	1713	1695	1670	1645	1623	1600	1575	1550	1535	1520	1480	1440	1390	1350	-
	Med	3			1630	1610	1590	1563	1535	1513	1490	1470	1450	1425	1400	1370	1330	1290	-	-
	Med Low	2			1550	1520	1490	1465	1440	1415	1390	1370	1350	1330	1310	1260	1220	1180	-	-
	Low	1			1380	1340	1300	1275	1250	1225	1200	1175	1150	1125	1100	1030	980	820	-	-
048	High	5	11 x 10	1	2060	2045	2030	2015	2000	1970	1940	1925	1910	1890	1870	1830	1800	1750	1740	-
	Med High	4			1880	1860	1840	1825	1810	1785	1760	1740	1720	1705	1690	1640	1610	1570	1535	-
	Med	3			1790	1770	1750	1730	1710	1685	1660	1640	1620	1600	1580	1550	1510	1460	-	-
	Med Low	2			1670	1650	1630	1605	1580	1555	1530	1510	1490	1470	1450	1410	1370	1340	-	-
	Low	1			1430	1405	1380	1353	1325	1303	1280	1255	1230	1210	1190	1130	1070	925	-	-
060	High	5	11 x 10	1	2400	2360	2330	2315	2300	2290	2285	2275	2265	2250	2230	2200	2165	2110	2080	2030
	Med High	4			2180	2160	2140	2130	2120	2105	2090	2075	2060	2045	2030	2000	1960	1930	1890	1850
	Med	3			2080	2050	2020	2010	2000	1985	1970	1955	1940	1925	1910	1870	1840	1800	1760	1720
	Med Low	2			1930	1920	1910	1893	1875	1863	1850	1833	1815	1798	1780	1740	1700	1660	1620	1590
	Low	1			1750	1735	1720	1698	1675	1658	1640	1620	1600	1583	1565	1525	1490	1450	1410	1350
070	High	5	11 x 10	1	2400	2360	2330	2315	2300	2290	2285	2275	2265	2250	2230	2200	2165	2110	2080	2030
	Med High	4			2180	2160	2140	2130	2120	2105	2090	2075	2060	2045	2030	2000	1960	1930	1890	1850
	Med	3			2080	2050	2020	2010	2000	1985	1970	1955	1940	1925	1910	1870	1840	1800	1760	1720
	Med Low	2			1930	1920	1910	1893	1875	1863	1850	1833	1815	1798	1780	1740	1700	1660	1620	1590
	Low	1			1750	1735	1720	1698	1675	1658	1640	1620	1600	1583	1565	1525	1490	1450	1410	1350

Factory settings are in Bold

11/13/09

Air flow values are with dry coil and standard filter

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12 in. wg, and 500 fpm by 0.16 in. wg.

ISO/AHRI rating point on the *1GC070 (*may be A or T) will require moving the red wire on the motor to high speed (tap 5) and disconnecting the tan wire from tap 5.

X13 ECM Constant Torque Motors

The X13 is a 'Constant Torque' ECM motor and delivers air flow similar to a PSC but operates as efficiently as an ECM Variable Speed Motor. Because it's an ECM Motor, the X13 can ramp slowly up or down like the ECM Variable Speed Motor. There are 5 possible speed taps available on the X13 motor with #1 being the lowest airflow and #5 being the highest airflow. These speed selections are preset at the time of manufacture and are easily changed in the field if necessary. The G, Y1 and W signals are wired to the motor at the factory. A gray wire is tied to the motor wire bundle for the Y2 signal and can be field connected to the motor if desired.

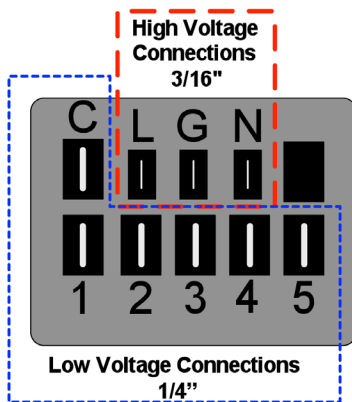
X13 Benefits:

- High efficiency
- Soft start
- 5 speeds with up to 4 speeds on-line
- Built in logic allows air flow to change with G, Y1, Y2 and W signals
- Super efficient low airflow continuous blower setting (G)

If more than one tap are energized at the same time, built in logic gives precedence to the highest tap number and allows air flow to change with G, Y1, Y2 and W signals. Each of those 5 speeds has a specific 'Torque' value programmed into the motor for each speed selection. As static pressure increases, airflow decreases resulting in less torque on the rotor. The motor responds only to changes in torque and adjusts its speed accordingly.

The X13 motor is powered by 208-230VAC but the motor speed is energized by 24VAC.

X13 ECM Motor Connections



Power Connection - 3/16 in. quick connects - Line 1 (orange wire) to L, Ground (green wire) to G, Line 2 (for 208V-230V units) to N (brown wire).

Signal Connection - 1/4 in. quick connects - Common to C, 24VAC to Taps #1-5.

Applying 24VAC power between any of the motor taps 1-5 (1/4 in. quick connects) and common will signal the motor to run and regulate torque at the programmed level. The tap input voltage must be in the range 12-33VAC. The X13 will have less variation over the operating static pressure range versus a PSC motor as well as a significant watts reduction due to the high motor efficiency.

Thermal protection - Motor is electronically protected.

Locked Rotor Amps - If motor speed decreases below a programmed stall speed, the motor will shut down and after a delay period, the control will attempt to restart the motor.

The X13 speed tap selections are as follows:

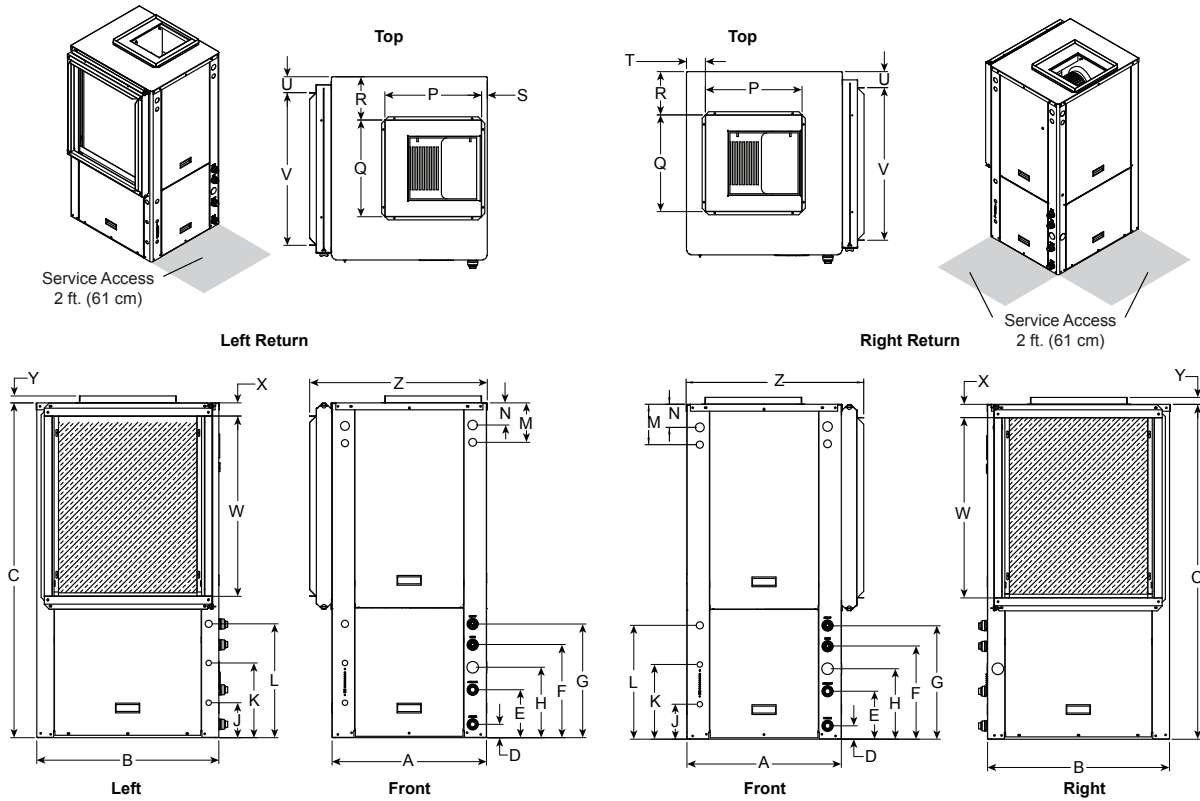
The blue wire should be placed on the speed tap desired for the (G) continuous blower setting – factory wired to Tap 1.

The red wire should be placed on the speed tap desired during compressor operation (Y1 signal) – factory wired to Tap 3 or 4.

The gray wire is not factory wired to the motor and is tied to the wire harness. It is field connected and can be used with 3ht/2cl thermostats or IntelliZone to deliver the required air flow for the Y2 signal.

The tan wire should be placed on the speed tap desired for auxiliary heat (W signal) – factory wired to Tap 5.

Vertical Dimensional Data



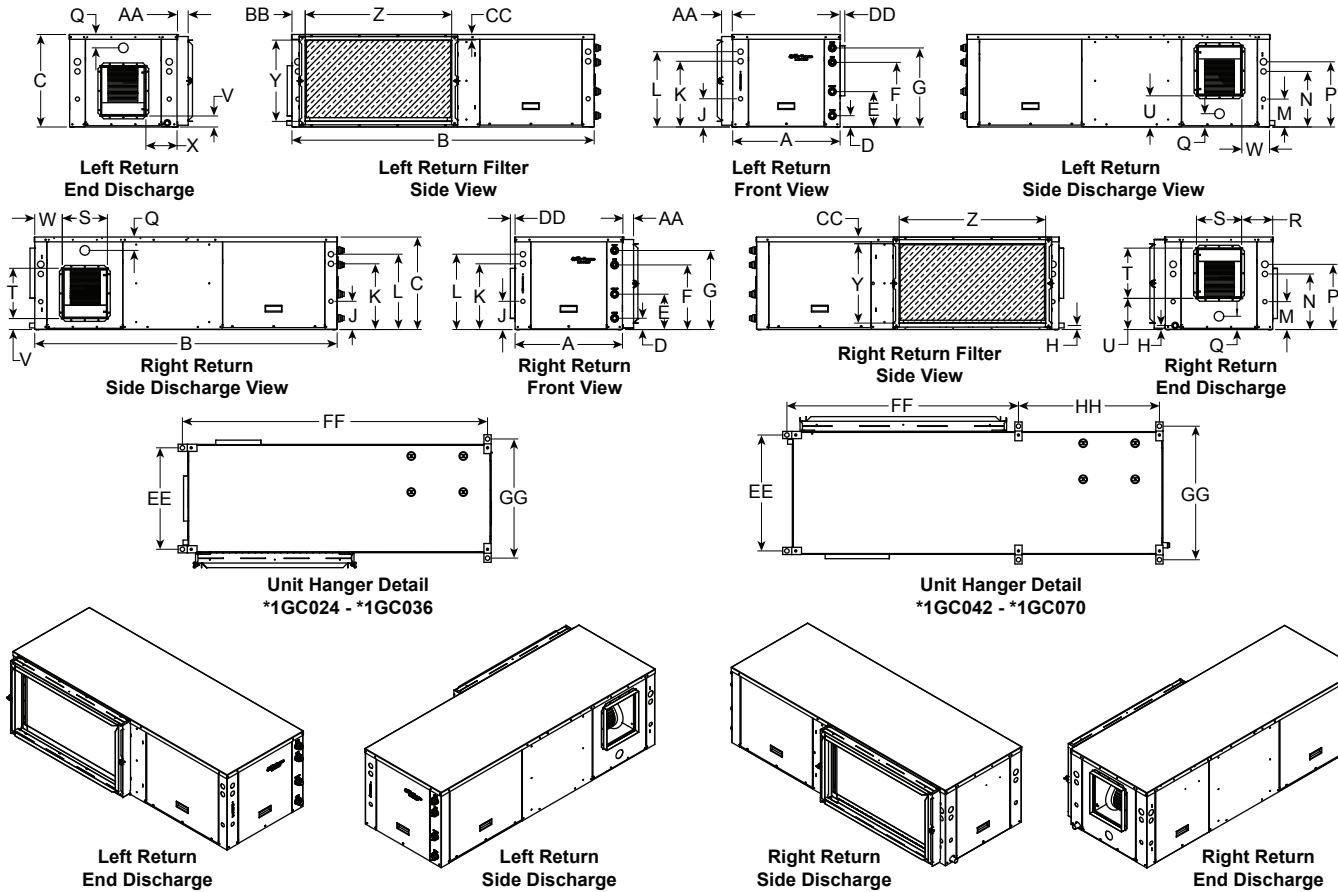
10/22/09

Vertical Topflow Model	Overall Cabinet			Water Connections							Electrical Connections					
	A Width	B Depth	C Height	D Loop In	E Loop Out	F HWG In	G HWG Out	H Condensate	Loop Water FPT	HWG Sweat (I.D)	J Low Voltage	K Ext Pump	L Power Supply	M	N	
024	in.	22.3	26.3	44.4	1.9	6.9	13.5	16.4	10.2	1"	1/2"	5.1	10.8	16.5	5.9	3.3
	cm.	56.6	66.8	112.8	4.8	17.5	34.3	41.7	25.9	Swivel	Female	13.0	27.4	41.9	15.0	8.4
030	in.	22.3	26.3	44.4	1.9	6.9	13.5	16.4	10.2	1"	1/2"	5.1	10.8	16.5	5.9	3.3
	cm.	56.6	66.8	112.8	4.8	17.5	34.3	41.7	25.9	Swivel	Female	13.0	27.4	41.9	15.0	8.4
036	in.	22.3	26.3	48.4	1.9	6.9	13.5	16.4	10.2	1"	1/2"	5.1	10.8	16.5	5.9	3.3
	cm.	56.6	66.8	122.9	4.8	17.5	34.3	41.7	25.9	Swivel	Female	13.0	27.4	41.9	15.0	8.4
042	in.	25.4	31.4	50.4	2.3	7.3	15.9	18.9	10.6	1"	1/2"	6.5	12.2	17.9	5.9	3.3
	cm.	64.5	79.8	128.0	5.8	18.5	40.4	48.0	26.9	Swivel	Female	16.5	31.0	45.5	15.0	8.4
048	in.	25.4	31.4	50.4	2.3	7.3	15.9	18.9	10.6	1"	1/2"	6.5	12.2	17.9	5.9	3.3
	cm.	64.5	79.8	128.0	5.8	18.5	40.4	48.0	26.9	Swivel	Female	16.5	31.0	45.5	15.0	8.4
060	in.	25.4	31.4	54.4	2.3	7.3	15.9	18.9	10.6	1"	1/2"	6.5	12.2	17.9	5.9	3.3
	cm.	64.5	79.8	138.2	5.8	18.5	40.4	48.0	26.9	Swivel	Female	16.5	31.0	45.5	15.0	8.4
070	in.	25.4	31.4	58.4	2.3	7.3	15.9	18.9	10.6	1"	1/2"	6.5	12.2	17.9	5.9	3.3
	cm.	64.5	79.8	148.3	5.8	18.5	40.4	48.0	26.9	Swivel	Female	16.5	31.0	45.5	15.0	8.4

Vertical Topflow Model	Discharge Connection - duct flange installed (±0.10 in)					Return Connection - using std deluxe filter rack (±0.10 in)						
	P Supply Width	Q Supply Depth	R	S	T	U	V Return Depth	W Return Height	X	Y	Z	
024	in.	14.0	14.0	6.2	0.8	2.7	2.3	22.0	22.0	2.0	1.0	25.7
	cm.	35.6	35.6	15.7	2.0	6.9	5.8	55.9	55.9	5.1	2.5	65.3
030	in.	14.0	14.0	6.2	0.8	2.7	2.3	22.0	22.0	2.0	1.0	25.7
	cm.	35.6	35.6	15.7	2.0	6.9	5.8	55.9	55.9	5.1	2.5	65.3
036	in.	14.0	14.0	6.2	0.8	2.7	2.3	22.1	26.1	2.0	1.0	25.7
	cm.	35.6	35.6	15.7	2.0	6.9	5.8	56.1	66.3	5.1	2.5	65.3
042	in.	18.0	18.0	6.9	1.1	3.8	1.7	28.1	26.0	2.0	1.0	28.7
	cm.	45.7	45.7	17.5	2.8	9.7	4.3	71.4	66.0	5.1	2.5	72.9
048	in.	18.0	18.0	6.9	1.1	3.8	1.7	28.1	26.0	2.0	1.0	28.7
	cm.	45.7	45.7	17.5	2.8	9.7	4.3	71.4	66.0	5.1	2.5	72.9
060	in.	18.0	18.0	6.9	1.1	3.8	1.7	28.1	30.0	2.0	1.0	28.7
	cm.	45.7	45.7	17.5	2.8	9.7	4.3	71.4	76.2	5.1	2.5	72.9
070	in.	18.0	18.0	6.9	1.1	3.8	1.7	28.1	34.0	2.0	1.0	28.7
	cm.	45.7	45.7	17.5	2.8	9.7	4.3	71.4	86.4	5.1	2.5	72.9

Condensate is 3/4 in. PVC female glue socket and is switchable from side to front
 Unit shipped with deluxe 1 in. (field adjustable to 2 in.) duct collar/filter rack extending from unit 3.25 in. and is suitable for duct connection.
 Discharge flange is field installed and extends 1 in. [25.4 mm] from cabinet

Horizontal Dimensional Data



10/29/09

Horizontal Models	Overall Cabinet			Water Connections					Electrical Knockouts									
	A	B	C	D	E	F	G	H	Loop Water FPT	HWG Sweat (I.D.)	J	K	L	M	N	P	Q	
	Width	Depth	Height*	Loop In	Loop Out	HWG In	HWG Out	Condensate			Low Voltage	Ext Pump	Power Supply	Low Voltage	Ext Pump	Power Supply	Elec. Heat	
024-036	in.	22.5	63.0	19.2	2.4	7.4	13.4	16.4	1.1	1"	1/2"	5.9	13.7	15.7	5.9	11.6	13.6	2.5
	cm.	57.2	160.0	48.8	6.1	18.8	34.0	41.7	2.8	Swivel	Female	15.0	34.8	39.9	15.0	29.5	34.5	6.4
042-048	in.	25.5	72.0	21.2	2.2	7.2	15.8	18.8	1.1	1"	1/2"	5.9	13.7	15.7	5.9	13.7	15.7	2.5
	cm.	64.8	182.9	53.8	5.6	18.3	40.1	47.8	2.8	Swivel	Female	15.0	34.8	39.9	15.0	34.8	39.9	6.4
060	in.	25.5	77.0	21.2	2.2	7.2	15.8	18.8	1.1	1"	1/2"	5.9	13.7	15.7	5.9	13.7	15.7	2.5
	cm.	64.8	195.6	53.8	5.6	18.3	40.1	47.8	2.8	Swivel	Female	15.0	34.8	39.9	15.0	34.8	39.9	6.4
070	in.	25.5	82.0	21.2	2.2	7.2	15.8	18.8	1.1	1"	1/2"	5.9	13.7	15.7	5.9	13.7	15.7	2.5
	cm.	64.8	208.3	53.8	5.6	18.3	40.1	47.8	2.8	Swivel	Female	15.0	34.8	39.9	15.0	34.8	39.9	6.4

Horizontal Models	Discharge Connection duct flange installed (±0.10 in.)							Return Connection using deluxe filter rack option (±0.10 in.)				Unit Hanger Dimensions				PVC Drain Size			
	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF		GG	HH	
		Supply Height	Supply Depth					Return Height	Return Depth										
024-036	in.	6.5	9.4	10.5	6.5	2.3	5.7	6.5	16.9	30.5	2.2	2.8	1.0	1.0	21.1	63.4	24.8	n/a	3/4
	cm.	16.5	23.9	26.7	16.5	5.8	14.5	16.5	42.9	77.5	5.6	7.1	2.5	2.5	53.6	161.0	63.0	n/a	1.9
042-048	in.	4.5	13.4	13.7	4.8	2.8	6.8	7.5	18.7	35.5	2.2	2.8	1.0	1.0	24.1	43.1	27.8	29.3	3/4
	cm.	11.4	34.0	34.8	12.2	7.1	17.3	19.1	47.5	90.2	5.6	7.1	2.5	2.5	61.2	109.5	70.6	74.4	1.9
060	in.	4.5	13.4	13.7	4.8	2.8	6.8	7.5	18.7	40.5	2.2	2.8	1.0	1.0	24.1	48.1	27.8	29.3	3/4
	cm.	11.4	34.0	34.8	12.2	7.1	17.3	19.1	47.5	102.9	5.6	7.1	2.5	2.5	61.2	122.2	70.6	74.4	1.9
070	in.	4.5	13.4	13.7	4.8	2.8	6.8	7.5	18.7	45.5	2.2	2.8	1.0	1.0	24.1	53.1	27.8	29.3	3/4
	cm.	11.4	34.0	34.8	12.2	7.1	17.3	19.1	47.5	115.6	5.6	7.1	2.5	2.5	61.2	134.9	70.6	74.4	1.9

Condensate is 3/4" PVC stub extends from cabinet approximately 1-1/2" [38.1 mm].

Unit is shipped with 1 in. filter. The deluxe duct collar/filter rack is field adjustable to accept a 2 in. filter. The duct collar/filter rack extends 3.2 in. from unit, and is suitable for duct connections.

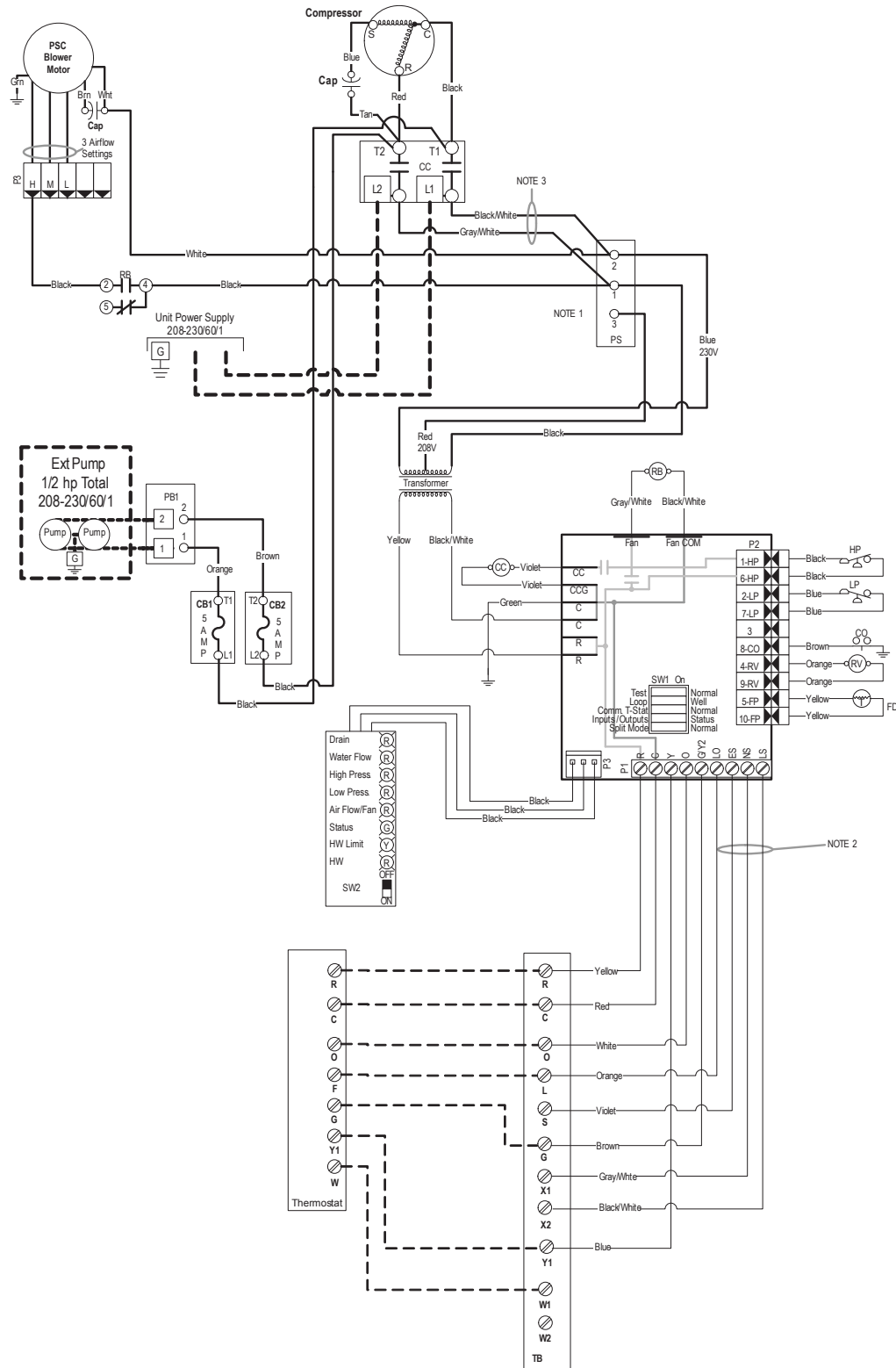
Discharge flange extends 1 in. [25.4 mm] from cabinet.

Physical Data

Model	024	030	036	042	048	060	070	
Compressor (1 each)	Single Speed Scroll							
Factory Charge R-410A, oz [kg] Vertical	52 [1.47]	56 [1.58]	60 [1.70]	74 [2.09]	84 [2.38]	100 [2.83]	104 [2.94]	
Factory Charge R-410A, oz [kg] Horizontal	52 [1.47]	56 [1.58]	60 [1.70]	74 [2.09]	84 [2.38]	100 [2.83]	104 [2.94]	
Blower Motor & Blower								
Blower Motor Type/Speeds	X13	X13 ECM - 5 Speeds						
	PSC	PSC - 3 Speeds						
Blower Motor - hp [W]	X13	1/2 [373]	1/2 [373]	1/2 [373]	1 [746]	1 [746]	1 [746]	
	PSC	1/5 [149]	1/3 [249]	1/2 [373]	1/2 [373]	1/2 [373]	1 [746]	
Optional - Oversized Blower Motor - hp [W]	X13	Not Available						
	PSC	1/3 [249]	1/2 [373]	Not Available	3/4 [560]	3/4 [560]	Not Available	Not Available
Blower Wheel Size (Dia x W), in. [mm]	X13	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]
	PSC	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	10 x 10 [254 x 254]	10 x 10 [254 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]
Coax and Water Piping								
Water Connections Size - Swivel - in [mm]	1 [25.4]	1 [25.4]	1 [25.4]	1 [25.4]	1 [25.4]	1 [25.4]	1 [25.4]	
HWG Connection Size - Female Sweat (I.D.) - in [mm]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	
Coax & Piping Water Volume - gal [l]	.4 [1.4]	0.7 [2.6]	.7 [2.6]	.7 [2.7]	1.0 [3.8]	1.3 [4.9]	1.6 [6.1]	
Vertical								
Air Coil Dimensions (H x W), in. [mm]	24 x 20 [610 x 542]	24 x 20 [610 x 542]	28 x 20 [711 x 542]	28 x 25 [711 x 635]	28 x 25 [711 x 635]	32 x 25 [813 x 635]	36 x 25 [914 x 635]	
Air Coil Total Face Area, ft ² [m ²]	3.3 [0.310]	3.3 [0.310]	3.9 [0.362]	4.9 [0.451]	4.9 [0.451]	5.6 [0.516]	6.3 [0.581]	
Air Coil Tube Size, in [mm]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	
Air Coil Number of rows	3	3	3	3	3	3	3	
Filter Standard - 1" [24mm] Pleated MERV8 Throwaway, in [mm]	24 x 24 [610 x 610]	24 x 24 [610 x 610]	28 x 24 [712 x 610]	28 x 30 [711 x 762]	28 x 30 [711 x 762]	32 x 30 [813 x 762]	36 x 30 [914 x 762]	
Weight - Operating, lb [kg]	258 [117]	273 [124]	308 [140]	333 [151]	360 [163]	421 [191]	435 [197]	
Weight - Packaged, lb [kg]	278 [126]	293 [133]	328 [149]	353 [160]	380 [172]	441 [200]	455 [206]	
Horizontal								
Air Coil Dimensions (H x W), in. [mm]	18 x 27 [457 x 686]	18 x 27 [457 x 686]	18 x 30 [457 x 762]	20 x 35 [508 x 889]	20 x 35 [508 x 889]	20 x 40 [508 x 1016]	20 x 45 [508 x 1143]	
Air Coil Total Face Area, ft ² [m ²]	3.4 [0.316]	3.4 [0.316]	3.9 [0.362]	4.9 [0.451]	4.9 [0.451]	5.6 [0.516]	6.3 [0.581]	
Air Coil Tube Size, in [mm]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	
Air Coil Number of rows	3	3	3	3	3	3	3	
Filter Standard - 1 in. [25mm] Pleated MERV8 Throwaway, in [mm]	1 - 18 x 32 [457 x 813]	1 - 18 x 32 [457 x 813]	1 - 18 x 32 [457 x 813]	1 - 20 x 37 [686 x 940]	1 - 20 x 37 [686 x 940]	1 - 20 x 20 [508 x 508] 1 - 20 x 22 [508 x 559]	1 - 20 x 25 [508 x 635] 1 - 20 x 22 [508 x 559]	
Weight - Operating, lb [kg]	268 [122]	279 [127]	287 [130]	349 [158]	358 [162]	403 [183]	438 [199]	
Weight - Packaged, lb [kg]	288 [131]	299 [136]	307 [139]	379 [172]	388 [176]	448 [203]	483 [219]	

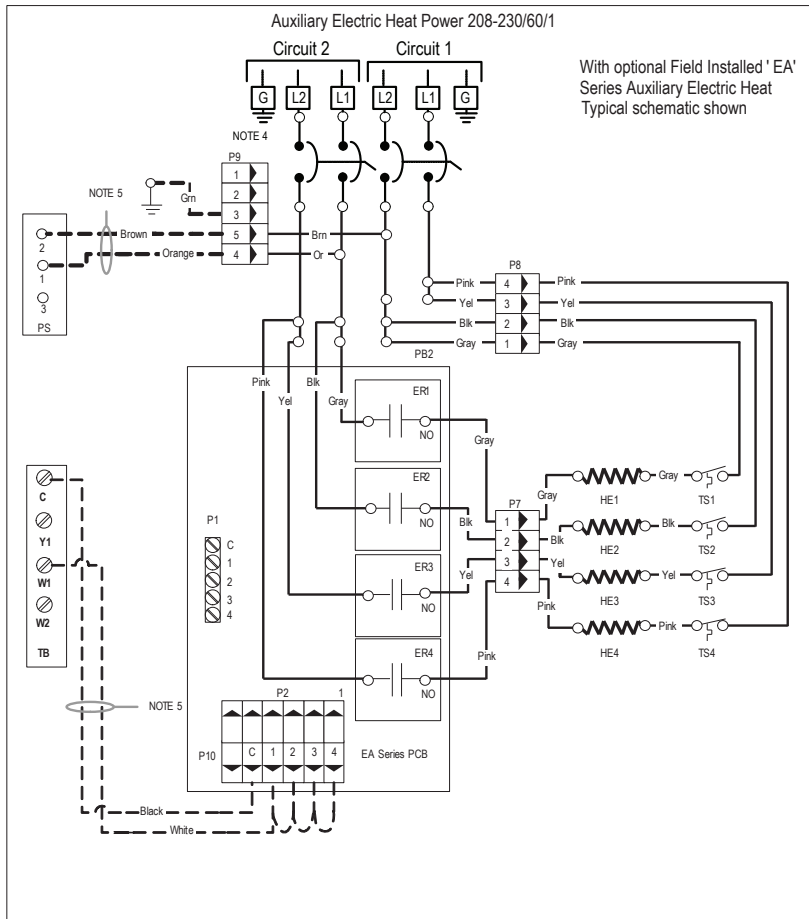
Wiring Schematics

208-230/60/1 PSC



Wiring Schematics cont.

208-230/60/1 PSC cont.



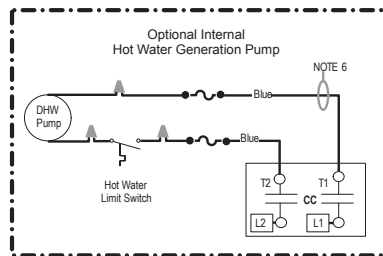
Event	Normal Mode	Test Mode
Power On Delay	5 minutes	15 seconds
Compressor On Delay	10 seconds	2 seconds
Compressor Minimum On Time	2 minutes	5 seconds
Compressor Short Cycle Delay	5 minutes	15 seconds
Blower Off Delay	30 seconds	5 seconds
Fault Recognition Delay - High Pressure	Less than 1 second	Less than 1 second
Start-Up Bypass - Low Pressure	2 minutes	0 seconds
Fault Recognition Delay - Low Pressure	30 seconds	30 seconds
Start-Up Bypass - Freeze Detection Limit	2 minutes	0 seconds
Fault Recognition Delay - Freeze Detection Limit	30 seconds	30 seconds
Fault Recognition Delay - Condensate Overflow	30 seconds	30 seconds

DIP Switch Number	Description	"OFF" Position	"ON" Position
SW1-1	Service Test Mode On the control, allows field selection of "NORMAL" or "TEST" operational modes. Test mode accelerates most timing functions. 16 times to allow faster troubleshooting. Test mode also allows viewing the "CURRENT" status of the fault inputs on the LED display.	Test Mode	Normal Speed Operation
SW1-2	Freeze Detection Setting This DIP switch allows field selection of low source water thermostat fault sensing for "WELL" water(30°F) or "LOOP" (15°F) for antifreeze protected earth loops.	"LOOP" (15°F)	"WELL" (30°F)
SW1-3	Not Available	N/A	Normal Operation
SW1-4	I/O Display Mode This DIP switch enables Input/Output Display or Status/Current Fault on LED Board. Refer to SW2 for operation and positioning.	Input/Output Display Mode	Status/Current Fault Display Mode
SW1-5	Not Available	N/A	Normal Operation
SW2	LED Display (On LED Board) This DIP switch enables Normal Status or Input display mode in the "OFF" position and Current Fault or Output display mode in the "ON" position.	Status or Inputs Display Mode	Current Fault or Output Display Mode

LED	SW1-4 On, SW2 Off	SW1-4 Off, SW2 On	SW1-4 Off, SW2 On
Drain	Drain Pan Overflow Lockout	Y	Compressor
Water Flow	Freeze Detection Lockout (Loop <= 15°F, Well <= 30°F)	G	Fan
High Press.	High Pressure Lockout	O	Reversing Valve
Low Press.	Low Pressure Lockout	ES	ES
Air Flow	Not Used	NS	NS
Status	Not Used	LS	LS
HW Limit	Not Used	Not Used	Not Used
HW	SW2 Status (Off-Down Position, On-Up Position)	SW2 = Off	SW2 = On

* Flashing Status Light Indicates the Board is Functioning Properly A Solid "On" Indicates a Board Malfunction.

Mode	Inputs	Fan	Comp	RV
Htg	Y	Auto	ON	OFF
Clg	Y, O	Auto	ON	ON
Fan Only	G/Y2	ON	OFF	OFF



Model	Vertical	Horizontal
024	Med	Med
030	Med	Med
036	High	High
042	Med	Med
048	High	High
060	Med	Med
070	High	High

- Notes :**
- 1 - Swap blue and red leads for 208V operation
 - 2 - Requires common connection or 24 VAC for activation
 - 3 - Wires are removed when Auxiliary Heat is installed.
 - 4 - Field supplied Square D part number QOU141100JBFAF (jumper bar assembly) should be used for single source power.
 - 5 - Wires are provided with the unit but not connected.
 - 6 - Wire not connected at factory, connect to T1 for HW pump operation.

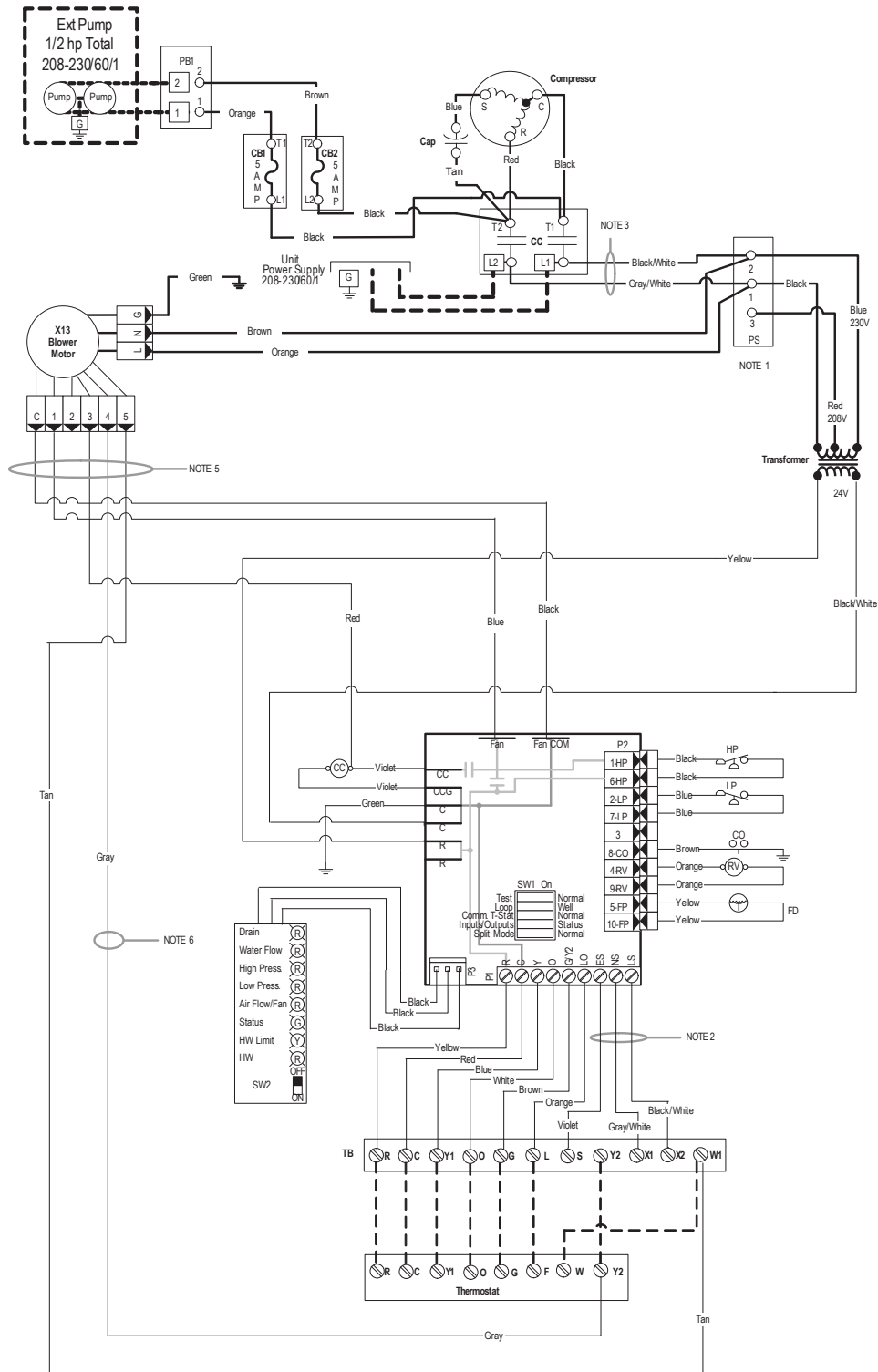
Legend

<ul style="list-style-type: none"> Factory Low Voltage Wiring Factory Line Voltage Wiring Field Low Voltage Wiring Field Line Voltage Wiring Optional Block DC Voltage PCB Traces Field Zone Sensor Wiring Internal Junction Quick Connect Terminal Field Wiring Lug Ground Relay Contacts- N.O., N.C. 	<ul style="list-style-type: none"> Thermistor Relay Coil Switch - Condensate Overflow Switch - High pressure Switch - Low pressure Polarized connector Capacitor Circuit Breaker Jumper Wire
--	--

CB - Circuit Breaker
 CC - Compressor Contactor
 CO - Condensate Overflow Sensor
 ES - Emergency Shutdown
 HP - High Pressure Switch
 LP - Low Pressure Switch
 FD - Freeze Detection Sensor
 RB - Blower Relay
 RV - Reversing Valve Coil

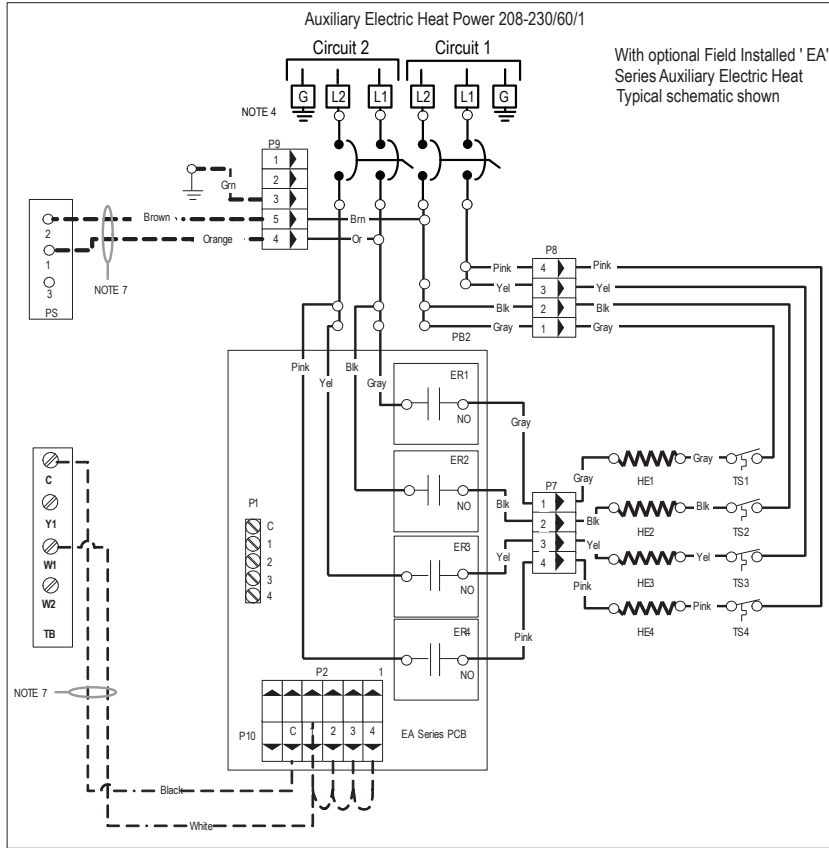
Wiring Schematics cont.

208-230/60/1 X13 ECM



Wiring Schematics cont.

208-230/60/1 X13 ECM cont.



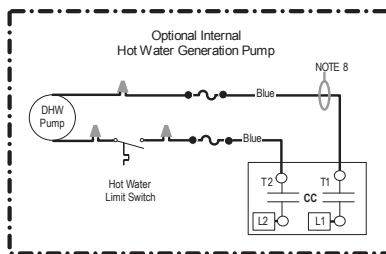
X13 MOTOR LOW VOLTAGE CONNECTIONS					
Model	TAP-1	TAP-2	TAP-3	TAP-4	TAP-5
024	BLUE			RED	TAN
030	BLUE			RED	TAN
036	BLUE			RED	TAN
042	BLUE		RED		TAN
048	BLUE		RED		TAN
060	BLUE		RED		TAN
070	BLUE		RED		TAN

WIRE COLOR	CALL	DESCRIPTION
BLUE	G	FAN
RED	Y1	1ST STAGE H/C
GRAY	Y2	2ND STAGE H/C
TAN	W	AUXILIARY HEAT

Factory Setup DIP Switches(SW1)				
DIP Switch Number	Description	"OFF" Position	"ON" Position	
SW1-1	Service Test Mode On the control allows field selection of "NORMAL" or "TEST" operational modes. Test mode accelerates most timing functions 16 times to allow faster troubleshooting. Test mode also allows viewing the "CURRENT" status of the fault inputs on the LED display.	Test Mode	Normal Speed Operation	
SW1-2	Freeze Detection Setting This DIP switch allows field selection of low source water thermostat fault sensing for "WELL" water (30°F) or "LOOP" (15°F) for antifreeze protected earth loops	"LOOP" (15°F)	"WELL" (30°F)	
SW1-3	Not Available	N/A	Normal Operation	
SW1-4	I/O Display Mode This DIP switch enables Input/Output Display or Status/Current Fault on LED Board. Refer to SW2 for operation and positioning	Input/Output Display Mode	Status/Current Fault Display Mode	
SW1-5	Not Available	N/A	Normal Operation	
SW2	LED Display (On LED Board) This DIP switch enables Normal Status or Input display mode in the "OFF" position and Status or Input display mode in the "ON" position.	Status or Input Display Mode	Current Fault or Output Display Mode	

Operational Logic Table				
Mode	Inputs	Fan	Comp	RV
Htg	Y	Auto	ON	OFF
Clg	Y, O	Auto	ON	ON
Fan Only	G/Y2	ON	OFF	OFF

- Notes:**
- 1 - Swap blue and red leads for 208V operation
 - 2 - Requires common connection or 24 VAC for activation
 - 3 - Wires are removed when Auxiliary Heat is installed.
 - 4 - Field supplied Square D part number QOU141100JBAF (jumper bar assembly) should be used for single source power.
 - 5 - Refer to the X13 Motor Low Voltage Connection Table.
 - 6 - Wire is provided with the unit but not connected to the X13 motor.
 - 7 - Wires are provided with the unit but not connected.
 - 8 - Wire not connected at factory, connect to T1 for HW pump operation.



Normal Mode Control Timing Table		
Event	Normal Mode	Test Mode
Power On Delay	5 minutes	15 seconds
Compressor On Delay	10 seconds	2 seconds
Compressor Minimum On Time	2 minutes	5 seconds
Compressor Short Cycle Delay	5 minutes	15 seconds
Blower Off Delay	30 seconds	5 seconds
Fault Recognition Delay - High Pressure	Less than 1 second	Less than 1 second
Start-Up Bypass - Low Pressure	2 minutes	0 seconds
Fault Recognition Delay - Low Pressure	30 seconds	30 seconds
Start-Up Bypass - Low Water Coil Limit	2 minutes	0 seconds
Fault Recognition Delay - Low Water Coil Limit	30 seconds	30 seconds
Fault Recognition Delay - Condensate Overflow	30 seconds	30 seconds

X13 MOTOR BLOWER TABLE						
MODEL	ESP	TAP-1 Low (cfm)	TAP-2 Med. Low (cfm)	TAP-3 Medium (cfm)	TAP-4 Med. Hi (cfm)	TAP-5 High (cfm)
024	0.3	480	670	740	800	890
030	0.3	680	870	920	1040	1140
036	0.3	720	1020	1070	1150	1190
042	0.5	1100	1310	1410	1520	1640
048	0.5	1190	1450	1580	1690	1870
060	0.5	1540	1750	1880	2010	2210
070	0.5	1560	1790	1900	2030	2230

LED Display Mode Table			
Status Display Mode			
LED	SW1-4 On, SW2 Off		
Drain	Drain Pan Overflow Lockout		
Water Flow	Freeze Detection (Loop <= 15°F, Well <= 30°F)		
High Press	High Pressure Lockout		
Low Press	Low Pressure Lockout		
Air Flow	Not Used		
Status	Microprocessor Malfunction*		
HW Limit	Not Used		
HW	SW2 Status(Off-Down Position, On-Up Position)		
Diagnostic Display Modes			
Current Fault Display Mode			
LED	SW1-4 On, SW2 On	SW1-4 Off, SW2 Off	SW1-4 Off, SW2 On
Drain	Drain Pan Overflow Lockout	Y	Compressor
Water Flow	Low Water Coil Limit Lockout	G	Fan
High Press	High Pressure Lockout	O	Reversing Valve
Low Press	Low Pressure Lockout	ES	ES
Air Flow	Not Used	NS	NS
Status	Not Used	LS	LS
HW Limit	Not Used	Not Used	Not Used
HW	SW2 = On	SW2 = Off	SW2 = On

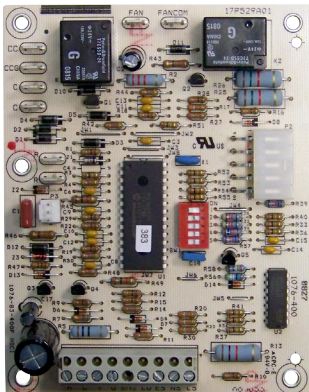
*Flashing Status Light Indicates the Board is Functioning Properly A Solid "On" Indicates a Board Malfunction

Legend

- Factory Low Voltage Wiring
- Factory Line Voltage Wiring
- Field Low Voltage Wiring
- Field Line Voltage Wiring
- Optional Block
- DC Voltage PCB Traces
- Field Zone Sensor Wiring
- Internal Junction
- Quick Connect Terminal
- L1 Field Wiring Lug
- Ground
- Relay Contacts - N.O., N.C.
- Thermistor
- Relay Coil
- Switch-Condensate Overflow
- Switch-High pressure
- Switch-Low pressure
- Polarized connector
- Capacitor
- Circuit Breaker
- Jumper Wire
- ES - Emergency Shutdown
- NS - Night Setback
- LS - Loadshed

Controls

Standard Microprocessor



Flexible Control Options

The standard control system is a microprocessor-based printed circuit board, (PCB), conveniently located in the unit control box for accessibility. The microprocessor control is specifically designed for geothermal water source heat pumps to integrate compressors and advanced features needed in geothermal water source heat pump applications. The microprocessor provides control of the entire unit as well as outputs for status modes, faults, and diagnostics. Low voltage thermostat terminal strips provide convenient field connections. LEDs are located in the corner post to assist the technician when servicing the unit.

Startup

The unit will not operate until all the inputs and safety controls are checked for normal conditions. At first powerup, a five minute delay is employed before the compressor is energized.

Component Sequencing Delays

Components are sequenced and delayed for optimum space conditioning performance.

Short Cycle Protection

The control allows a minimum on time of 2 minutes and a minimum off time of 4 minutes for short cycle protection.

Condensate Overflow Protection

The control board incorporates an impedance sensing liquid sensor at the top of the drain pan. Upon a continuous 30-second sensing of the condensate, compressor operation is suspended (see Fault Retry), and the condensate overflow lockout LED begins flashing.

Safety Controls

The control receives separate signals for a high pressure switch for safety, a low pressure switch to prevent loss of charge damage, and a low suction temperature thermistor for freeze sensing. Upon a continuous 30-second measurement of the fault (immediate

for high pressure), compressor operation is suspended, the appropriate lockout LED begins flashing. (Refer to the "Fault Retry" section).

Testing

The control allows service personnel to shorten most timing delays for faster diagnostics.

Fault Retry

All faults are retried twice before finally locking the unit out. An output signal is made available for a fault LED at the thermostat. The "Fault Retry" feature is designed to prevent nuisance service calls.

Diagnostics

The control board allows all inputs and outputs to be displayed on the LEDs for fast and simple control board diagnosis.

Emergency Shutdown

A grounded signal to common or connecting 24 VAC to the ES terminal places the controller into the emergency shutdown mode. The compressor and blower operation are suspended while in the emergency shutdown mode.

Heating Operation Heating (Y1)

The blower motor is started immediately after the "Y1" input is received, and the compressor is energized 10 seconds after the "Y1" input.

Heat, 2nd Stage (Y1, Y2) X13 ECM

When the gray wire is connected to the motor (Y2 is field connected) the blower speed will increase.

Heat, 3rd Stage (Y1, Y2, W) X13 ECM

When a "W" input is received the blower speed will increase and all stages of resistance heat will be energized along with the compressor operation.

Emergency Heat (W only)

The blower is started on high speed and all stages of resistance heat are energized.

Cooling Operation

In all cooling operations, the reversing valve directly tracks the "O" input. Thus, anytime the "O" input is present, the reversing valve will be energized.

Controls cont.

Cooling (Y1,O)

The blower motor is started immediately after the “Y1” input is received, and the compressor is energized 10 seconds after the “Y1” input.

Cool, 2nd Stage (Y1, Y2, 0)

When the gray wire is connected to the motor (Y2 is field connected) the blower speed will increase.

Blower (G only)

The blower motor is started immediately after the “G” input is received; and it will remain on for 30 seconds at the end of each heating or cooling cycle.

Lockout Conditions

During lockout mode, the appropriate unit and thermostat lockout LEDs will illuminate. The compressor, loop pump(s), and hot water generator pump outputs are de-energized. If the thermostat calls for heating, emergency heat operation will occur. All lockout modes can be reset at the thermostat after turning the unit off, and then on, which restores normal operation but keeps the unit lockout LED illuminated. Interruption of power to the unit will reset lockout without a waiting period and clear all lockout LEDs.

High Pressure

This lockout mode occurs when the normally closed safety switch is opened momentarily (set at 600 PSI).

Low Pressure

This lockout mode occurs when the normally closed low pressure switch is opened for 30 continuous seconds (set at 40 PSI).

Freeze Detection (Water Flow)

This lockout mode occurs when the freeze thermistor temperature is at or below the selected freeze detection point (well 30°F or loop 15°F) for 30 continuous seconds.

Condensate Overflow

This lockout mode occurs when the condensate overflow level has been reached for 30 continuous seconds.

DIP Switch Settings

Prior to powering unit, ensure that all DIP switches on SW1 are set properly according to the table below.

FACTORY SETUP DIP SWITCHES (SW1)				
Dip Switch Number		Description	"OFF" Position	"ON" Position
SW1-	1	Service Test Mode On the control, allows field selection of "NORMAL" or "TEST" operational modes, Test mode accelerates most timing functions 16 times to allow faster troubleshooting. Test mode also allows viewing the "CURRENT" status of the fault inputs on the LED display.	Test Mode	Normal Speed Operation
SW1-	2	Freeze Detection Setting This DIP switch allows field selection of low source water thermistor fault sensing for "WELL" water (30°F) or "LOOP" (15°F) for antifreeze protected earth loops.	"LOOP" (15°F)	"WELL" (30°F)
SW1-	3	Not Available	N/A	Normal Operation
SW1-	4	I/O Display Mode This DIP switch enables Input/Output Display or Status/Current Fault on LED Board. Refer to SW2 for operation and positioning.	Input/Output Display Mode	Status/Current Fault Display Mode
SW1-	5	Not Available	N/A	Normal Operation
SW2-		LED Display (On LED Board) This DIP switch enables Normal Status or Input display mode in the "OFF" position and Current Fault or Output display mode in the "ON" position.	Status or Inputs Display Mode	Current Fault or Output Display Mode

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Operation Logic Data Table

Mode	Inputs	Blower	Comp	RV
Htg	Y	Auto	ON	OFF
Clg	Y, O	Auto	ON	ON
Blower Only	G/Y2	ON	OFF	OFF

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Unit Startup

Before Powering Unit, Check the Following:

NOTE: Remove and discard the compressor shipping bolt located at the front of the compressor mounting bracket.

- High voltage is correct and matches nameplate.
- Fuses, breakers and wire size correct.
- Low voltage wiring complete.
- Piping completed and water system cleaned and flushed.
- Air is purged from closed loop system.
- Isolation valves are open, water control valves or loop pumps wired.
- Condensate line open and correctly pitched.
- Transformer switched to 208V if applicable.
- Dip switches are set correctly.
- Hot water generator pump wires are disconnected unless piping is completed and air has been purged.
- Blower rotates freely – foam shipping support has been removed.
- Blower speed correct.
- Air filter/cleaner is clean and in position.
- Service/access panels are in place.
- Return air temperature is between 50-80°F heating and 60-95°F cooling.
- Check air coil cleanliness to insure optimum performance. Clean as needed according to maintenance guidelines. To obtain maximum performance the air coil should be cleaned before startup. A 10-percent solution of dishwasher detergent and water is recommended for both sides of coil, a thorough water rinse should follow.

Startup Steps

NOTE: Complete the Equipment Start-Up/Commissioning Check Sheet during this procedure. Refer to thermostat operating instructions and complete the startup procedure.

1. Initiate a control signal to energize the blower motor. Check blower operation.
2. Initiate a control signal to place the unit in the cooling mode. Cooling setpoint must be set below room temperature.
3. Cooling will energize after a time delay.
4. Be sure that the compressor and water control valve or loop pump(s) are activated.
5. Verify that the water flow rate is correct by measuring the pressure drop through the heat exchanger using the P/T plugs and comparing to the pressure drop table.
6. Check the temperature of both the supply and discharge water (Refer to Unit Operating Parameters tables).
7. Check for an air temperature drop of 15°F to 25°F across the air coil, depending on the blower speed and entering water temperature.
8. Adjust the cooling setpoint above the room temperature and verify that the compressor and water valve or loop pumps deactivate.
9. Initiate a control signal to place the unit in the heating mode. Heating set point must be set above room temperature.
10. Heating will energize after a time delay.
11. Check the temperature of both the supply and discharge water (Refer to Unit Operating Parameters tables).
12. Check for an air temperature rise of 20°F to 35°F across the air coil, depending on the blower speed and entering water temperature.
13. If auxiliary electric heaters are installed, increase the heating setpoint until the electric heat banks are sequenced on. All stages of the auxiliary heater should be sequenced on when the thermostat is in the Emergency Heat mode. Check amperage of each element.
14. Adjust the heating setpoint below room temperature and verify that the compressor and water valve or loop pumps deactivate.
15. During all testing, check for excessive vibration, noise or water leaks. Correct or repair as required.
16. Set system to desired normal operating mode and set temperature to maintain desired comfort level.
17. Instruct the owner/operator in the proper operation of the thermostat and system maintenance.

NOTE: Be certain to fill out and forward all warranty registration papers.

Troubleshooting

Standard Microprocessor Controls

To check the unit control board for proper operation:

- 1) Disconnect thermostat wires at the control board.
- 2) Jumper the desired test input (Y1, W, O, or G) to the R terminal to simulate a thermostat signal.
- 3) If control functions properly:
 - Check for thermostat and field control wiring (use the diagnostic inputs mode).

- 4) If control responds improperly:
 - Ensure that component being controlled is functioning (compressor, blower, reversing valve, etc.).
 - Ensure that wiring from control to the component is functioning (refer to the LED Definition table below and use the diagnostic outputs mode).
 - If steps above check properly, replace unit control.

LED Definitions and Diagnostics

Microprocessor

Status Display Mode

LED	SW1-4 On, SW2 Off
Drain	Drain Pan Overflow Lockout
Water Flow	Freeze Detection (Loop <= 15°F, Well <= 30°F)
High Pressure	High Pressure Lockout
Low Pressure	Low Pressure Lockout
Air Flow	Not Used
Status	Micoprocessor Malfunction*
DHW Limit	Not Used
DHW	SW2 Status (On=Down Position, Off=Up Position)

Diagnostic Display Modes

	Current Fault Display Mode	Inputs Display Mode	Outputs Display Mode
LED	SW1-4 On, SW2 On	SW1-4 Off, SP2 Off	SW1-4 Off, SW2 On
Drain	Drain Pan Overflow Lockout	Y	Compressor
Water Flow	Freeze Detection Lockout	G	Blower
High Press.	High Pressure Lockout	O	Reversing Valve
Low Press.	Low Pressure Lockout	ES	ES
Air Flow	Not Used	NS	NS
Status	Not Used	LS	LS
DHW Limit	Not Used	Not Used	Not Used
DHW	SW2 = On	SW2 = Off	SW2 = On

* Flashing Status Light Indicates the Board is Functioning Properly.
A Solid "On" Indicates a Board Malfunction.

Refrigerant Systems

To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Compare the change in temperature on the air side as well as the water side to the Unit Operating Parameters tables. If the unit's performance is not within the ranges listed, and the airflow and water flow are known to be correct, gauges should then be installed and superheat and subcooling numbers calculated. If superheat and subcooling are

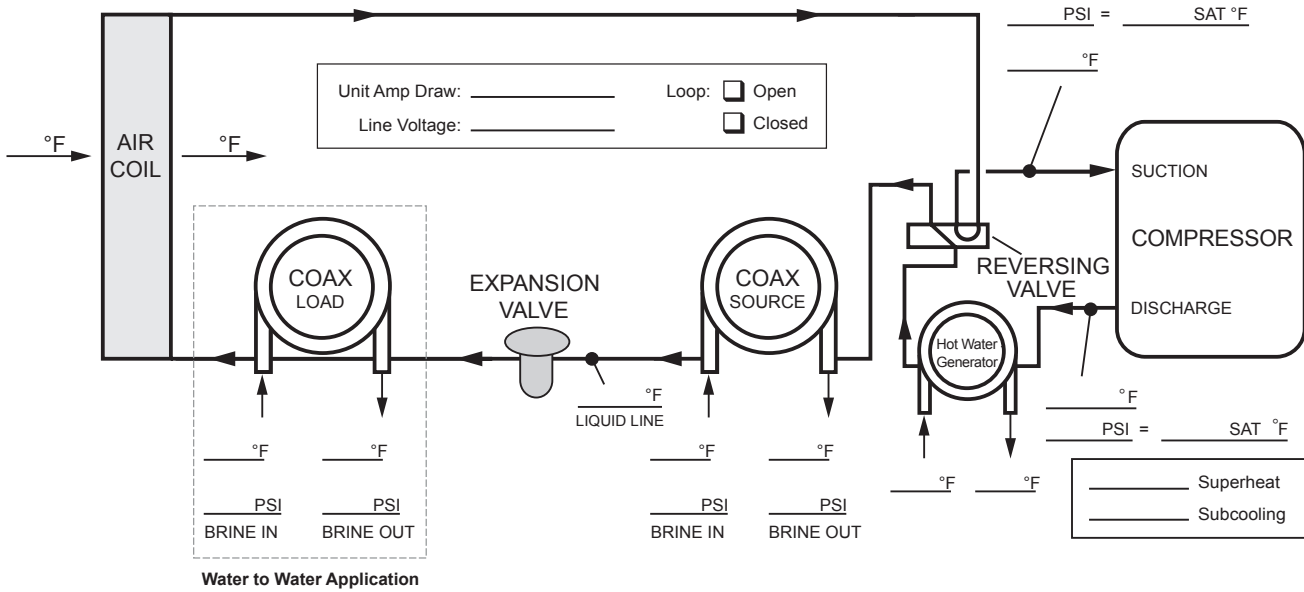
outside recommended ranges, an adjustment to the refrigerant charge may be necessary.

NOTE: Refrigerant tests must be made with hot water generator pump power disconnected. Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

DEALER: _____
 PHONE #: _____ DATE: _____
 PROBLEM: _____
 MODEL #: _____
 SERIAL #: _____

Startup/Troubleshooting Form

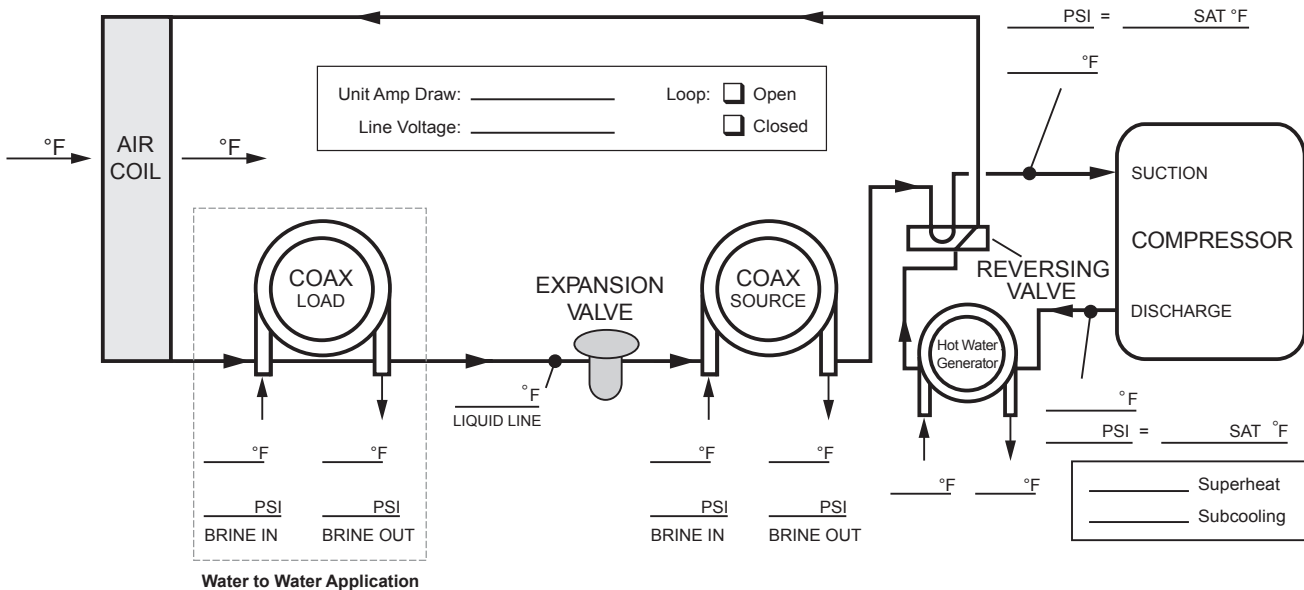
COOLING CYCLE ANALYSIS



Heat of Extraction/Rejection = GPM x 500 (485 for water/antifreeze) x ΔT

Note: DO NOT hook up pressure gauges unless there appears to be a performance problem.

HEATING CYCLE ANALYSIS



Operating Parameters

Entering Water Temp °F	Water Flow GPM/Ton	Cooling -- No Hot Water Generation					
		Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB
30	1.5	100-115	170-190	17 - 26	10 - 14	18 - 22	18 - 22
	3.0	95-110	150-170	20 - 29	7 - 11	8 - 10	18 - 22
50	1.5	133 - 148	205 - 225	17 - 26	10 - 14	18 - 22	18 - 22
	3.0	129 - 144	185 - 205	20 - 29	7 - 11	8 - 10	18 - 22
70	1.5	139 - 154	280 - 300	8 - 11	8 - 12	18 - 22	18 - 22
	3.0	137 - 152	250 - 270	9 - 12	7 - 11	8 - 10	18 - 22
90	1.5	143 - 158	360 - 380	8 - 11	9 - 13	18 - 22	16 - 20
	3.0	141 - 156	330 - 350	9 - 12	8 - 12	8 - 10	16 - 20
110	2.3	143 - 158	360 - 380	8 - 11	9 - 13	18 - 22	16 - 20
	3.0	141 - 156	440-460	9 - 12	8 - 12	8 - 10	16 - 20

Entering Water Temp °F	Water Flow GPM/Ton	Heating -- No Hot Water Generation					
		Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30	1.5	73 - 79	279 - 304	7 - 13	2 - 6	7 - 10	18 - 24
	3.0	79 - 85	285 - 310	8 - 14	2 - 6	3 - 6	20 - 26
50	1.5	103 - 109	308 - 333	8 - 12	4 - 8	8 - 11	20 - 26
	3.0	110 - 116	315 - 340	9 - 13	4 - 8	4 - 7	22 - 28
70	1.5	140 - 146	330 - 365	10 - 14	7 - 11	11 - 14	26 - 32
	3.0	146 - 153	340 - 375	10 - 14	7 - 11	7 - 10	28 - 34
90	1.5	170-177	425-460	14-18	12-16	8-11	42-50
	3.0	174-181	435-470	14-18	12-16	8-11	42-50
110	2.3						
	3.0						

NOTES: Cooling performance based on entering air temperatures of 80°F DB, 67°F WB.
 Heating performance based on entering air temperature of 70°F DB.

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Operating Limits

Operating Limits	Cooling		Heating	
	(°F)	(°C)	(°F)	(°C)
Air Limits				
Min. Ambient Air	45	7.2	45	7.2
Rated Ambient Air	80	26.7	70	21.1
Max. Ambient Air	100	37.8	85	29.4
Min. Entering Air	50	10.0	40	4.4
Rated Entering Air db/wb	80.6/66.2	27/19	68	20.0
Max. Entering Air db/wb	110/83	43/28.3	80	26.7
Water Limits				
Min. Entering Water	30	-1.1	20	-6.7
Normal Entering Water	50-110	10-43.3	30-70	-1.1
Max. Entering Water	120	48.9	90	32.2

NOTE: Minimum/maximum limits are only for start-up conditions, and are meant for bringing the space up to occupancy temperature. Units are not designed to operate at the minimum/maximum conditions on a regular basis. The operating limits are dependant upon three primary factors: 1) water temperature, 2) return air temperature, and 3) ambient temperature. When any of the factors are at the minimum or maximum levels, the other two factors must be at the normal level for proper and reliable unit operation.

Pressure Drop

Model	GPM	Pressure Drop (psi)				
		30°F	50°F	70°F	90°F	110°F
024	3.0	1.1	1.0	0.9	0.8	0.6
	4.5	2.4	2.2	2.1	2.0	1.9
	6.0	4.5	4.4	4.3	4.1	4.0
	8.0	6.7	6.6	6.5	6.3	6.2
030	4.0	0.9	0.8	0.7	0.6	0.5
	6.0	1.9	1.8	1.7	1.6	1.5
	8.0	3.7	3.6	3.5	3.4	3.3
	10.0	4.8	4.7	4.6	4.5	4.4
036	5.0	1.4	1.1	0.9	0.7	0.5
	7.0	2.5	2.3	2.1	1.8	1.6
	9.0	6.0	5.8	5.5	5.3	5.1
	12.0	6.6	6.4	6.2	6.0	5.7
042	5.0	1.5	1.2	0.9	0.5	0.4
	8.0	3.4	3.1	2.8	2.5	2.1
	11.0	7.9	7.5	7.2	6.9	6.6
	14.0	9.1	8.8	8.5	8.2	7.9
048	6.0	2.8	2.6	2.4	2.2	2.0
	9.0	6.5	6.3	6.0	5.8	5.5
	12.0	10.2	9.9	9.6	9.3	9.0
	16.0	12.9	12.6	12.2	11.8	11.4
060	9.0	4.1	3.8	3.6	3.4	3.1
	12.0	7.1	6.7	6.3	5.9	5.6
	15.0	9.6	9.2	8.9	8.6	8.3
	20.0	15.5	14.5	13.3	12.0	10.7
070	12.0	4.0	3.6	3.2	3.0	2.7
	15.0	6.4	6.0	5.6	5.2	4.8
	18.0	8.8	8.4	7.9	7.5	7.1
	24.0	13.6	13.2	12.6	12.0	11.5

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Compressor Resistance

Model	Run Winding	Start Winding
024	1.14 - 1.32	1.37 - 1.57
030	0.95 - 1.09	1.81 - 2.09
036	0.62 - 0.72	1.46 - 1.65
042	0.49 - 1.03	1.29 - 1.49
048	0.51 - 0.58	1.36 - 1.57
060	0.29 - 0.34	0.76 - 0.87
070	0.26 - 0.29	0.76 - 0.87

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Thermistor Resistance

Thermistor Temperature (°F)	Resistance
78.5	9230 - 10007 Ohms
77.5	9460 - 10032 Ohms
76.5	9690 - 10580 Ohms
75.5	9930 - 10840 Ohms
33.5	30490 - 32080 Ohms
32.5	31370 - 33010 Ohms
31.5	32270 - 33690 Ohms
30.5	33190 - 34940 Ohms
1.5	79110 - 83750 Ohms
0.5	81860 - 86460 Ohms
0.0	82960 - 87860 Ohms

Symptom	Head Pressure	Suction Pressure	Compressor Amp Draw	Superheat	Subcooling	Air Temp. Differential	Water Temp. Differential
Under Charged System (Possible Leak)	Low	Low	Low	High	Low	Low	Low
Over Charged System	High	High	High	Normal	High	Normal/Low	Normal
Low Air Flow Heating	High	High	High	High/Normal	Low	High	Low
Low Air Flow Cooling	Low	Low	Low	Low/Normal	High	High	Low
Low Water Flow Heating	Low/Normal	Low/Normal	Low	Low	High	Low	High
Low Water Flow Cooling	High	High	High	High	Low	Low	High
High Air Flow Heating	Low	Low	Low	Low	High	Low	Low
High Air Flow Cooling	Low	High	Normal	High	Low	Low	Normal
High Water Flow Heating	Normal	Low	Normal	High	Normal	Normal	Low
High Water Flow Cooling	Low	Low	Low	Low	High	Normal	Low
Low Indoor Air Temperature Heating	Low	Low	Low	Normal	High	Normal	Normal/High
Low Indoor Air Temperature Cooling	Low	Low	Low	Normal/Low	High	Low	Low
High Indoor Air Temperature Heating	High	High	High	Normal/High	Normal/Low	Low	Normal
High Indoor Air Temperature Cooling	High	High	High	High	Low	Low	High
Restricted TXV (Check Service Advisory)	High	Low	Normal/Low	High	High	Low	Low
Insufficient Compressor (Possible Bad Valves)	Low	High	Low	High	Normal/High	Low	Low
TXV - Bulb Loss of Charge	Low	Low	Low	High	High	Low	Low
Scaled Coaxial Heat Exchanger Heating	Low	Low	Low	Normal/Low	High	Low	Low
Scaled Coaxial Heat Exchanger Cooling	High	High	High	Normal/Low	Low	Low	Low
Restricted Filter Drier	Check temperature difference (delta T) across filter drier.						

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Reference Calculations

Heating Calculations:	Cooling Calculations:
$LWT = EWT - \frac{HE}{GPM \times 500}$	$LWT = EWT + \frac{HR}{GPM \times 500}$
$LAT = EAT + \frac{HC}{CFM \times 1.08}$	$LAT (DB) = EAT (DB) - \frac{SC}{CFM \times 1.08}$
$TH = HC + HWC$	$LC = TC - SC$
	$S/T = \frac{SC}{TC}$

Legend and Notes

ABBREVIATIONS AND DEFINITIONS:

- | | |
|--|---|
| CFM = airflow, cubic feet/minute | HE = total heat of extraction, MBTUH |
| EWT = entering water temperature, Fahrenheit | HWC = hot water generator capacity, MBTUH |
| GPM = water flow in gallons/minute | EER = Energy Efficient Ratio |
| WPD = water pressure drop, PSI and feet of water | = BTU output/Watt input |
| EAT = entering air temperature, Fahrenheit (dry bulb/wet bulb) | COP = Coefficient of Performance |
| HC = air heating capacity, MBTUH | = BTU output/BTU input |
| TC = total cooling capacity, MBTUH | LWT = leaving water temperature, °F |
| SC = sensible cooling capacity, MBTUH | LAT = leaving air temperature, °F |
| KW = total power unit input, kilowatts | TH = total heating capacity, MBTUH |
| HR = total heat of rejection, MBTUH | LC = latent cooling capacity, MBTUH |
| | S/T = sensible to total cooling ratio |

HE/HR Table

Model	GPM	Heat of Extraction				Heat of Rejection				
		30°F	50°F	70°F	90°F	30°F	50°F	70°F	90°F	110°F
024	3.0		14.7	19.4	23.6		28.2	27.8	26.2	
	4.5	10.7	15.6	20.5	24.8	26.2	28.3	27.9	26.1	24.3
	6.0	10.8	15.9	20.9	25.3	26.4	28.4	28.0	26.2	24.3
030	4.0		14.7	19.4	23.6		28.2	27.8	26.2	
	6.0	10.7	15.6	20.5	24.8	26.2	28.3	27.9	26.1	24.3
	8.0	10.8	15.9	20.9	25.3	26.4	28.4	28.0	26.2	24.3
036	5.0		23.8	31.3	37.6		41.2	42.4	40.6	
	7.0	17.7	24.9	32.6	39.2	34.7	41.1	42.3	40.5	37.8
	9.0	18.1	25.5	33.2	39.8	35.0	41.5	42.6	40.7	38.0
042	5.0		27.2	33.7	40.0		50.3	51.4	48.9	
	8.0	21.0	28.5	35.5	42.4	47.0	50.5	51.7	49.3	46.1
	11.0	21.4	29.3	36.6	43.9	47.3	50.8	51.9	49.4	46.1
048	6.0		35.1	43.9	51.2		60.7	60.7	57.3	
	9.0	26.8	36.7	46.3	54.3	56.3	60.9	61.0	57.6	54.0
	12.0	27.3	37.7	47.7	56.2	56.6	61.3	61.3	57.7	54.0
060	9.0		43.1	55.1	63.7		84.6	82.7	77.7	
	12.0	30.8	44.4	56.2	67.6	80.2	84.4	83.0	77.5	73.0
	15.0	31.8	45.3	58.6	68.5	80.8	84.7	82.6	77.7	73.1
070	12.0		51.4	65.6	76.5		92.7	91.1	84.3	
	15.0	37.2	52.7	68.4	81.2	83.4	92.8	91.0	84.0	77.9
	18.0	37.3	53.2	69.5	83.0	83.8	93.5	91.9	85.0	78.8

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Preventive Maintenance

Water Coil Maintenance

1. Keep all air out of the water. An open loop system should be checked to ensure that the well head is not allowing air to infiltrate the water line. Lines should always be airtight.
2. Keep the system under pressure at all times. It is recommended in open loop systems that the water control valve be placed in the discharge line to prevent loss of pressure during off cycles. Closed loop systems must have positive static pressure.

NOTE: On open loop systems, if the installation is in an area with a known high mineral content (125 PPM or greater) in the water, it is best to establish with the owner a periodic maintenance schedule so the coil can be checked regularly. Should periodic coil cleaning be necessary, use standard coil cleaning procedures which are compatible with either the cupronickel or copper water lines. Generally, the more water flowing through the unit the less chance for scaling.

Other Maintenance

Filters

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

Condensate Drain

In areas where airborne bacteria produce a slime in the drain pan, it may be necessary to treat chemically to minimize the problem. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect twice a year to avoid the possibility of overflow.

Blower Motors

Blower motors are equipped with sealed ball bearings and require no periodic oiling.

Hot Water Generator Coil

See Water Coil Maintenance section above.

Air Coil

The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum (with a brush attachment) clean. Care must be taken not to damage the aluminum fins while cleaning.



CAUTION: Fin edges are sharp.

Replacement Procedures

Obtaining Parts

When ordering service or replacement parts, refer to the model number and serial number of the unit as stamped on the serial plate attached to the unit. If replacement parts are required, mention the date of installation of the unit and the date of failure, along with an explanation of the malfunctions and a description of the replacement parts required.

In-Warranty Material Return

Material may not be returned except by permission of authorized warranty personnel. Contact your local distributor for warranty return authorization and assistance.

Service Parts

Part Description		Vertical							
		024	030	036	042	048	060	070	
Compressor	Compressor 208-230/60/1	34P624-01	34P583-01	34P625-01	34P621-01	34P623-01	34P613-01	34P616-01	
	Run Capacitor 208-230/60/1	16P002D19	16P002D20	16P002D21	16P002D36	16P002D23	16P002D25	16P002D24	
	Sound Jacket	92P504A05					92P519-02		
	Power Harness	11P781-01			11P781-03				
X13 ECM Motor & Blower	ECM Motor	14P515B01			14P516B01			14P517B01	
	X13 Motor 208-230/60/1	14S536-01	14S536-02	14S536-03	14S537-01	14S537-02	14S537-03		
	X13 Blower Housing	53P500B01			53P501B01				
	X13 Low Voltage Harness	11P811-02							
	X13 Power Harness	11P810-02							
Standard PSC Motor & Blower	PSC Motor 208-230/60/1	14P508B01	14P509B01	14P510B01	14P511B01	14P512B01	14P514B01		
	PSC Motor Capacitor	16P002D04			16P002D06			16P002D12	
	PSC Blower & Housing	53P500B01			53P517-01			53P501B01	
High Static PSC Motor & Blower Option	High Static PSC Motor 208-230/60/1	14P509B01	14P510B01	Not Available	14P513B01			Not Available	
	High Static PSC Motor Capacitor	16P002D04	16P002D06	Not Available	16P002D12			Not Available	
	High Static PSC Blower & Housing	53P512B01			Not Available	53P517-02			Not Available
Major Components	Air Coil (coated)	61S503C02		61S548-02	61S505C02		61S506C02	61S507C02	
	Coax (Copper)	62I572-01	62I566-01	62I568-01		62I573-01	62I574-01	62P543B01	
	TXV	33P605-16	33P605-02	33P605-02	33P605-10			33P608-10 33P605-13	
	Desuperheater	62I516-05			62I516-03				
	Desuperheater Pump	24P501A01							
	Reversing Valve	33P506-04			33P503-05			33P526-04	
	Filter Dryer	36P500B01					36P508B02		
Electrical Components	Contactors	13P004A03							
	Transformer 208-230/60/1	15P501B01							
	Pump Circuit Breaker - 250 vac/5 amp	19P583-01							
	Terminal Board - 12 position	12P528B01							
	3 Pole Power Block	12P503-10							
	2 Pole Screw Term. Block	12P500A01							
	3 Amp Fused Wire Lead - Blue	11P677A01							
	GeoStart Module (024 - 042)	IS060S							
	GeoStart Module (048 - 070)	IS060L							
	GeoStart Power Block	12P546-01							
	Status Light Board	17P503-02							
Status Light Board Wire Harness	11P783-01								
Microprocessor Board	17P529A01								
Sensors & Safeties	Freeze Protection Thermistor	12P505B01							
	Thermo Switch 130°F (for HWG)	13P073B04							
	High Pressure Switch Service Kit	SKHPE600							
	Low Pressure Switch Service Kit	SKLPE40							
Miscellaneous	1" Pleated MERV 8 Filter	59P503B27	59P503B27	59P503B05	59P503B28	59P503B28	59P503B21	59P503B04	
	2" Pleated MERV 13 Filter	59P511-17	59P511-17	59P511-04	59P511-08	59P511-08	59P511-07	59P511-06	

NOTE: Part numbers subject to change.

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Service Parts cont.

Part Description		Horizontal							
		024	030	036	042	048	060	070	
Compressor	Compressor 208-230/60/1	34P624-01	34P583-01	34P625-01	34P621-01	34P623-01	34P613-01	34P616-01	
	Run Capacitor 208-230/60/1	16P002D19	16P002D20	16P002D21	16P002D36	16P002D23	16P002D25	16P002D24	
	Sound Jacket	92P504A05					92P519-02		
	Power Harness	11P781-01			11P781-03				
X13 ECM Motor & Blower	X13 Motor 208-230/60/1	14S536-01	14S536-02	14S536-03	14S537-01	14S537-02	14S537-03		
	X13 Blower Housing	53P500B01			53P501B01				
	X13 Low Voltage Harness	11P811-02							
	X13 Power Harness	11P810-02							
Standard PSC Motor & Blower	PSC Motor 208-230/60/1	14P508B01	14P509B01	14P510B01	14P511B01	14P512B01	14P514B01		
	PSC Motor Capacitor	16P002D04		16P002D06			16P002D12		
	PSC Blower & Housing	53P500B01			53P517-01		53P501B01		
High Static PSC Motor & Blower Option	High Static PSC Motor 208-230/60/1	14P509B01	14P510B01	Not Available	14P513B01		Not Available		
	High Static PSC Motor Capacitor	16P002D04	16P002D06	Not Available	16P002D12		Not Available		
	High Static PSC Blower & Housing	53P512B01		Not Available	53P517-02		Not Available		
Major Components	Air Coil (coated)	61S509C02		61S510C02	61S511C02		61S512C02	61S513C02	
	Coax (Copper)	62I572-01	62I566-01	62I568-01	62I573-01		62I574-01	62P543B01	
	TXV	33P605-16	33P605-02	33P605-02	33P605-10		33P608-10	33P605-13	
	Desuperheater	62I516-05			62I516-03				
	Desuperheater Pump	24P501A01							
	Reversing Valve	33P506-04			33P503-05		33P526-04		
	Filter Dryer	36P500B01					36P508B02		
Electrical Components	Contactors	13P004A03							
	Transformer 208-230/60/1	15P501B01							
	Pump Circuit Breaker - 250 vac/5 amp	19P583-01							
	Terminal Board - 12 position	12P528B01							
	3 Pole Power Block	12P503-10							
	2 Pole Screw Term. Block	12P500A01							
	3 Amp Fused Wire Lead - Blue	11P677A01							
	GeoStart Module (024 - 042)	IS060S							
	GeoStart Module (048 - 070)	IS060L							
	GeoStart Power Block	12P546-01							
	Status Light Board	17P503-02							
	Status Light Board Wire Harness	11P783-01							
Microprocessor Board	17P529A01								
Sensors & Safeties	Freeze Protection Thermistor	12P505B01							
	Thermo Switch 130°F (for HWG)	13P073B04							
	High Pressure Switch Service Kit	SKHPE600							
	Low Pressure Switch Service Kit	SKLPE40							
Miscellaneous	1" Pleated MERV 8 Filter	59P503B23	59P503B23	59P503B23	59P503B08	59P503B08	59P503B02	59P503B24	
	2nd Filter if needed	Not Needed					59P503B24	59P503B03	

NOTE: Part numbers subject to change.

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