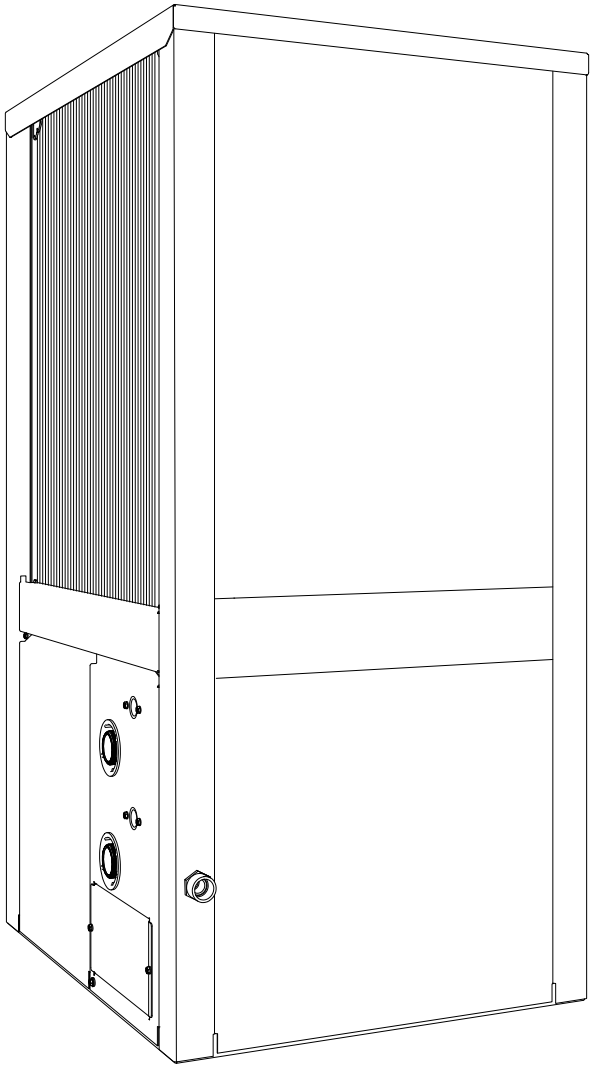
ENERTECH
ENERGY + TECHNOLOGY

Installation & Operations Manual

YT MODELS PACKAGED WATER-TO-AIR MULTI-POSITIONAL HEAT PUMPS



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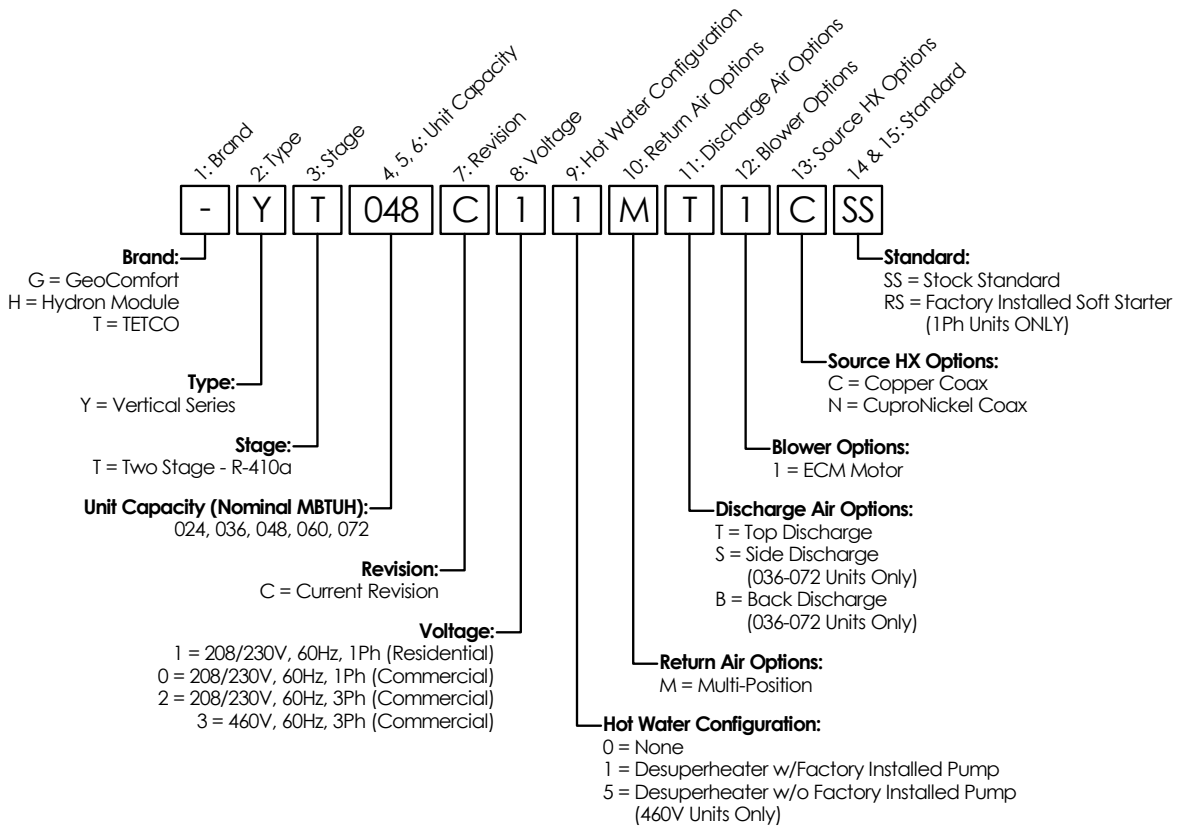
Section 1: Model Nomenclature

Nomenclature Decoder



⚠ NOTICE ⚠

PRIOR TO OPERATING THE UNIT, REMOVE AND DISCARD THE BLOWER MOTOR ARMATURE SUPPORT BRACKET LOCATED ON THE BACK OF THE BLOWER. IF APPLICABLE, REMOVE AND DISCARD THE BLOWER SHIPPING BRACKET LOCATED ON THE BOTTOM OR SIDE OF THE BLOWER HOUSING.

FAILURE TO REMOVE THESES BRACKETS COULD RESULT IN NOISY OPERATION AND EQUIPMENT DAMAGE.

⚠ CAUTION ⚠

ALL GEOTHERMAL EQUIPMENT UNLESS SPECIFIED "OUTDOOR" IS DESIGNED FOR INDOOR INSTALLATION ONLY. DO NOT INSTALL OR STORE UNIT IN A CORROSIVE ENVIRONMENT OR IN A LOCATION WHERE TEMPERATURE AND HUMIDITY ARE SUBJECT TO EXTREMES.
USE OF EQUIPMENT NOT CERTIFIED AND MARKED FOR OUTDOOR APPLICATION WILL VOID ALL WARRANTIES.

⚠ WARNING ⚠

FAILURE TO FOLLOW THIS CAUTION MAY RESULT IN PERSONAL INJURY. USE CARE AND WEAR APPROPRIATE PROTECTIVE CLOTHING, SAFETY GLASSES AND PROTECTIVE GLOVES WHEN SERVICING UNIT AND HANDLING PARTS.

⚠ CAUTION ⚠

BEFORE DRILLING OR DRIVING ANY SCREWS INTO CABINET, CHECK TO BE SURE THE SCREW WILL NOT HIT ANY INTERNAL PARTS OR REFRIGERANT LINES.

Introduction

This geothermal heat pump provides heating and cooling as well as optional domestic water heating capability. Engineering and quality control is built into every geothermal unit. Good performance depends on proper application and correct installation. All YT Models do not have more than 2% air leakage

Notices, Cautions, Warnings, & Dangers

"NOTICE" Notification of installation, operation or maintenance information which is important, but which is NOT hazard-related.

"CAUTION" Indicates a potentially hazardous situation or an unsafe practice which, if not avoided, COULD result in minor or moderate injury or product or property damage.

"WARNING" Indicates potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

"DANGER" Indicates an immediate hazardous situation which, if not avoided, WILL result in death or serious injury.

Inspection

Upon receipt of any geothermal equipment, carefully check the shipment against the packing slip and the freight company bill of lading. Verify that all units and packages have been received. Inspect the packaging of each package and each unit for damages. Insure that the carrier makes proper notation of any and all damages or shortage on all bill of lading papers. Concealed damage should be reported to the freight company within 5 days. If not filed within 5 days the freight company can deny all claims.

Note: Notify Enertech Global's shipping department of all damages within 5 days. It is the responsibility of the purchaser to file all necessary claims with the freight company.

Un-packaging

Enertech units are mounted to wooden pallets for easy handling during shipment and installation. Units are protected during shipment with durable cardboard corner posts, top and air coil panels. Shrink wrap is applied covering the entire unit and attachment to the pallet.

Upon receipt of the unit carefully remove the shrink wrap. Using a box cutter slit the shrink wrap on the cardboard top and corner posts. Use caution to not damaged the finished surface of the unit. Keep all cardboard or other packaging material for safe storage and transport to the job site prior to installation.

Remove the front compressor section service panel to locate technical documents; manuals, bulletins or instructions and accessory items; HWG piping kits, supply/return duct flange kits or condensate tubing kits prior to installation.

Section 2: Installation Introduction

Unit Protection

Protect units from damage and contamination due to plastering (spraying), painting and all other foreign materials that may be used at the job site. Keep all units covered on the job site with either the original packaging or equivalent protective covering. Cap or recap unit connections and all piping until unit is installed. Precautions must be taken to avoid physical damage and contamination which may prevent proper start-up and may result in costly equipment repair.

Storage

All geothermal units should be stored inside in the original packaging in a clean, dry location. Units should be stored in an upright position at all times. Units should not be stacked unless specially Noted on the packaging.

Removal and Disposal

Geothermal units removed from service should have all components, oils, antifreeze and refrigerants properly disposed of according to all local and national environmental recycling codes, regulations, standards and rules.

Pre-Installation

Special care should be taken in locating the geothermal unit. Installation location chosen should include adequate service clearance around the unit. All vertical units should be placed on a formed plastic air pad, or a high density, closed cell polyethylene pad slightly larger than the base of the unit. Flex connectors should also be installed in between the ductwork and the unit. All units should be located in an indoor area where the ambient temperature will remain above 55°F and should be located in a way that piping and ductwork or other permanently installed fixtures do not have to be removed for servicing and filter replacement.

Pre-Installation Steps:

1. Compare the electrical data on the unit nameplate with packing slip and ordering information to verify that the correct unit has been shipped.
2. Remove any packaging used to support or hold the blower during shipping. Remove and discard the blower support bracket (if equipped) and motor armature shaft shipping bracket from the rear of the blower.
3. Remove and discard the air coil protective shipping cover (if equipped).
4. Inspect all electrical connections and wires. Connections must be clean and tight at the terminals, and wires should not touch any sharp edges or copper pipe.
5. Verify that all refrigerant tubing is free of dents and kinks. Refrigerant tubing should not be touching other unit components.
6. Before unit start-up, read all manuals and become familiar with unit components and operation. Thoroughly check the unit before operating.
7. Determine discharge and return air patterns prior to unit assembly and installation

⚠ CAUTION ⚠

DO NOT OPERATE THE GEOTHERMAL HEAT PUMP UNIT DURING BUILDING CONSTRUCTION PHASE.

Components

Master Contactor: Energizes Compressor and optional Hydronic Pump and/or Desuperheater package.

Logic Board: Logic Board operates the compressor and protects unit by locking out when safety switches are engaged. It also provides fault indicator(s).

Terminal Strip: Provides connection to the thermostat or other accessories to the low voltage circuit.

Transformer: Converts incoming (source) voltage to 24V AC.

Low Voltage Breaker: Attached directly to transformer, protects the transformer and low voltage circuit.

Reversing Valve: Controls the cycle of the refrigerant system (heating or cooling). Energized in cooling mode.

High Pressure Switch: Protects the refrigerant system from high refrigerant pressure, by locking unit out if pressure exceeds setting.

Low Pressure Switch: Protects the refrigerant system from low suction pressure, if suction pressure falls below setting.

Electric Heater: Provides auxiliary heat during cold temperatures and provides electric backup if unit malfunctions.

Blower Motor (ECM): ECM (Electronically Commutated Motor) for variable fan speeds.

Compressor (Copeland Scroll): Pumps refrigerant through the heat exchangers and pressurizes the refrigerant, which increases the temperature of the refrigerant.

Section 3: Installation Considerations

Consumer Instructions

Dealer should instruct the consumer in proper operation, maintenance, filter replacements, thermostat and indicator lights. Also provide the consumer with the manufacturer's Owner's Manual for the equipment being installed.

Enertech Global D-I-Y Policy: Enertech Global's geothermal heat pumps and system installations may include electrical, refrigerant and/or water connections. Federal, state and local codes and regulations apply to various aspects of the installation. Improperly installed equipment can lead to equipment failure and health/safety concerns. For these reasons, only qualified technicians should install a Enertech Global built geothermal system.

Because of the importance of proper installation, Enertech Global does not sell equipment direct to homeowners. Internet websites and HVAC outlets may allow for purchases directly by homeowners and do-it-yourselfers, but Enertech Global offers no warranty on equipment that is purchased via the internet or installed by persons without proper training.

Enertech Global has set forth this policy to ensure installations of Enertech Global geothermal systems are done safely and properly. The use of well-trained, qualified technicians helps ensure that your system provides many years of comfort and savings.

Equipment Installation: Special care should be taken in locating the unit. All vertical units should be placed on a vibration absorbing pad (air pad) slightly larger than the base of the unit. Flex connectors should also be installed in between the ductwork and the unit. All units should be located in an indoor area were the ambient temperature will remain above 55°F and should be located in a way that piping and ductwork or other permanently installed fixtures do not have to be removed for servicing and filter replacement.

Electrical: All wiring, line and low voltage, should comply with the manufacturer's recommendations, The National Electrical Code, and all local codes and ordinances.

Thermostat: Thermostats should be installed approximately 54 inches off the floor on an inside wall in the return air pattern and where they are not in direct sunlight at anytime.

Loop Pumping Modules: Must be wired to the heat pump's electric control box. A special entrance knockout is provided below the thermostat entrance knockout. A pump module connection block, connected to the master contactor, and circuit breaker is provided to connect the Pump Module wiring.

Desuperheater Package: Water heating is standard on all residential units (units may be ordered without). It uses excess heat, during both heating and cooling cycles, to provide hot water for domestic needs. A double wall desuperheater exchanger (coil) located between the compressor and the reversing valve, extracts superheated vapor to heat domestic water; while satisfying its heating and cooling needs. The water circulation pump comes pre-mounted in all residential units, but must be electrically connected to the master contactor. Leaving it unconnected ensures that the pump is not run without a water supply.
The Desuperheater package can make up to 60% (depending on heat pump usage) of most domestic water needs, but a water heater is still recommended.

Desuperheater Piping: All copper tubes & fittings should be 5/8" O.D (1/2" nom) minimum with a maximum of 50ft separation. Piping should be insulated with 3/8" wall closed cell insulation.

Note: Copper is the only approved material for desuperheater piping.

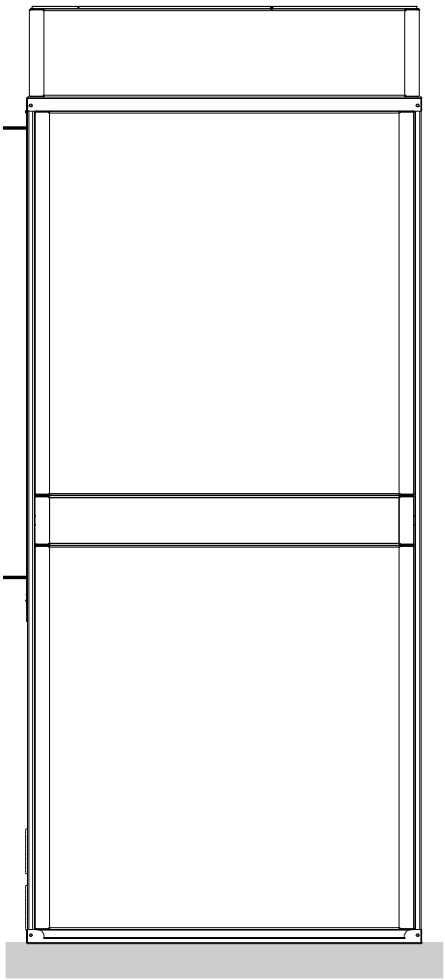
UV Light Usage: The use of a UV light in the unit return air plenum should be such that the light does not have a direct line of sight to the air coil of the unit. UV lights could cause internal wiring, foam insulation, or other components to deteriorate. It would be better to place the UV light in the supply air plenum, or ductwork. This also helps keep the light cleaner. Additionally, if a humidifier is installed and in line of the sight of the UV light, consult the humidifier install manual for indication of whether the light will deteriorate any parts of the humidifier (like the pad).

Section 3: Installation Considerations

Unit Placement

When installing a geothermal heating and cooling unit, there are several items the installer should consider before placing the equipment.

1. Service Access and Installation Space. Is there enough space for service access? A general rule of thumb is at least 2 to 2 1/2 feet on the front and air coil sides depending on return ductwork size.
2. Unit Air Pad. All vertical geothermal heating and cooling equipment should be placed on either a formed plastic air pad, or a high density, closed cell polyethylene pad. This helps eliminate vibration noise that could be transmitted through the floor. **The use of corner pads alone is not recommended.**
3. The installer has verified that all applicable wiring, ductwork, piping, and accessories are correct and on the job site.
4. Determine left or right side return air pattern prior to unit assembly and installation



Equipment Pad
2" Polyethylene Foam

Duct Work

All new ductwork shall be designed as outlined in Sheet Metal and Air Conditioning Contractors National Association (SMACNA) or Air Conditioning Contractors of America (ACCA) or American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) handbooks. All YT Models do not have more than 2% air leakage

All supply/return plenums should be isolated from the unit by a flexible connector (canvas) or equivalent to prevent transfer of vibration noise to the ductwork. The flex connector should be designed so as not to restrict airflow. Turning vanes should be used on any transition with airflow over 500 CFM. **All metal ductwork should be insulated on the inside** to prevent heat loss/gain, condensation and to absorb air noise. If the unit is being installed with existing ductwork, the ductwork must be designed to handle the air volume required by the unit being installed. When running a cooling or heating load on a building, size ductwork accordingly to the building design load and heat pump CFM.

Industry Standard: When sizing ductwork use 400 CFM per Ton.

As a general rule, maximum recommended face velocity for a supply outlet used in a residential application is 750 FPM. Maximum recommended return grille velocity is 600 FPM. Systems with higher velocity, are likely to have noise problems.

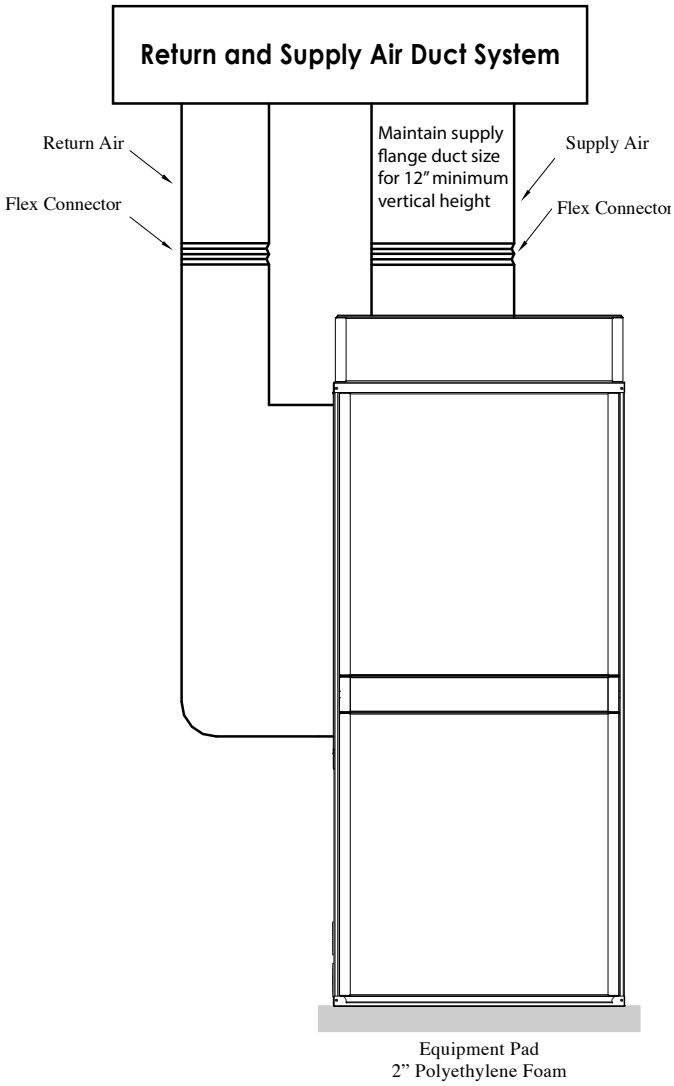
In buildings where ceilings are 8 feet or more, at least 50 percent of the return air should be taken back to the heat pump from the ceiling or high sidewall location and not more than 50 percent from the floor or low sidewall location.

Table 1: Maximum Air Velocities

Location	Supply	Return
Main Ducts	900 FPM	600 FPM
Branch Ducts	700 FPM	600 FPM
Grills, Registers, Diffusers	750 FPM	600 FPM

Section 3: Installation Considerations

Typical Supply and Return Ductwork Connections



Unit Physical Data

Dual Capacity Vertical					
Model Number	**024**	**036**	**048**	**060**	**072**
Fan Wheel (in.)	10 x 8	11 x 10	11 x 10	11 x 10	11 x 10
Fan Motor ECM (HP)	3/4	3/4	3/4	1	1
Refrigerant Charge (oz.)	56	76	87	94	94
Air Coil	**024**	**036**	**048**	**060**	**072**
Face Area (Sq. Ft.)	3.51	4.76	4.76	5.65	5.65
Dimensions (in.)	25.5 x 19.8 x 1	28.9 x 23.7 x 1.26		32.8 x 24.8 x 1.26	
Number of Rows	N/A - Micro-Channel Coil				
Unit Weight lbs (shipping)	300	415	450	475	480

Notes:

Source water loop - residential models use 1" double o-ring fittings, commercial models use 1" FPT fittings.

All measurements are in inches.

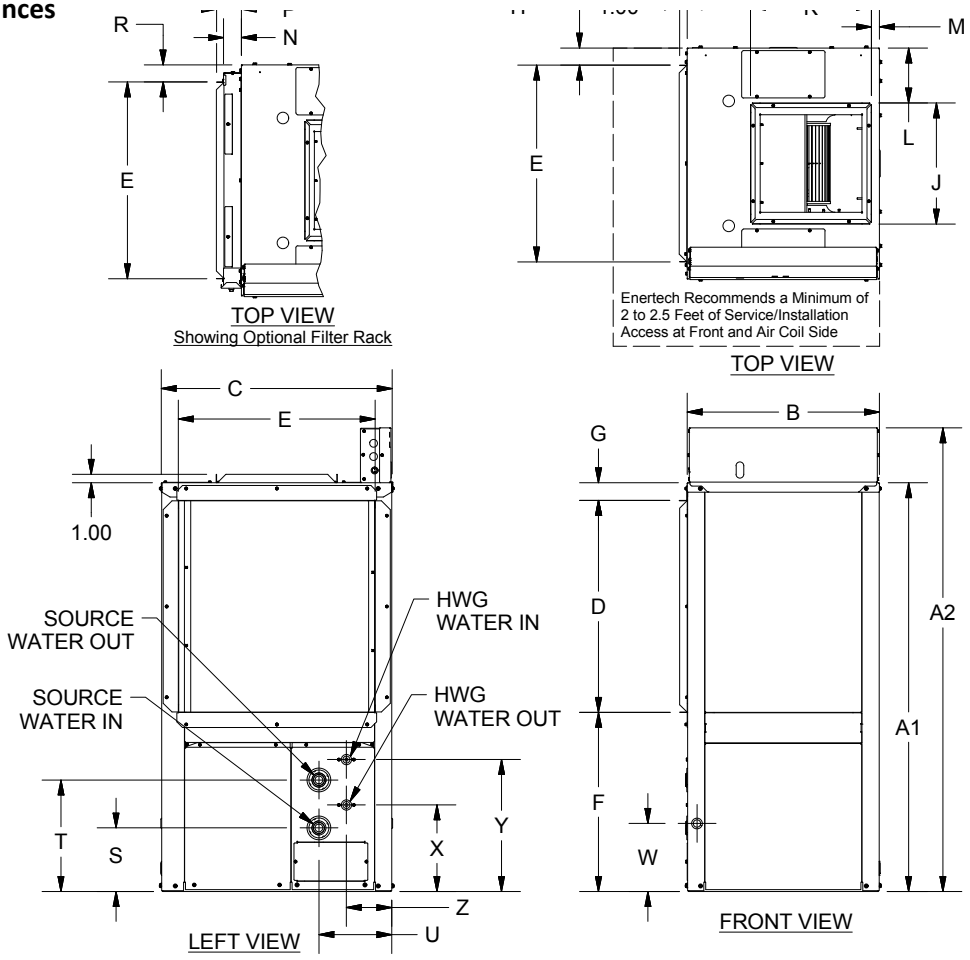
All Desuperheater connections are 3/4" FPT.

Electrical connections are 1" for high voltage, 1/2" for low voltage

* Width excludes field installed factory supplied flanges.

Section 4: Unit Data Information

Installation Clearances



Unit Dimensional Data

Model	Without Control Box			With Control Box	Return Air Flange					Supply Air Flange				Optional Filter Rack		
	A1	*B	C	A2	D	E	F	G	H	J	K	L	M	N	P	R
024	46.0	23.0	26.5	53.25	25.0	20.0	19.1	1.92	3.63	11.62	12.5	7.44	1.05	2.34	3.00	3.63
036-048	54.0	25.4	30.5	61.2	28.0	26.0	23.7	2.34	2.25	16.0	16.0	7.26	1.60	2.34	3.29	2.25
060-072	58.4	25.4	30.5	65.6	32.0	26.0	24.0	2.34	2.25	16.0	16.0	7.26	1.60	2.34	3.29	2.25

	Residential Double O-Ring Models						
Model	Source Water			Drain Ht.	HWG Water		
	S	T	U	W	X	Y	Z
024	8.28	13.63	9.63	9.0	10.31	14.75	6.00
036-048	8.41	13.41	9.63	9.0	11.44	17.44	6.00
060-072	7.03	12.03	9.63	12.2	14.63	17.88	6.00

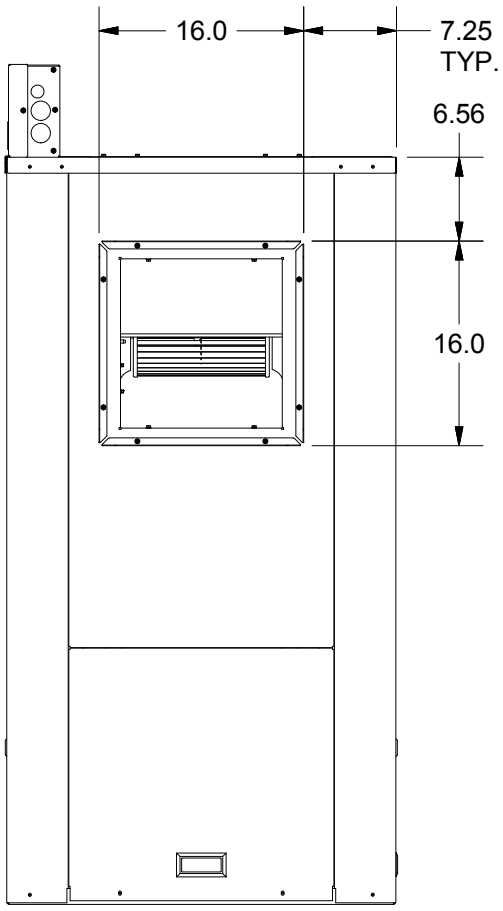
	Commercial 1" FPT Models						
Model	Source Water			Drain Ht.	HWG Water		
	S	T	U	W	X	Y	Z
024	8.28	13.63	9.63	9.0	10.31	14.75	6.00
036-048	8.41	14.73	9.63	9.0	11.44	17.44	6.00
060-072	5.56	12.21	9.63	12.2	14.63	17.88	6.00

Notes:
Source water loop - residential models use 1" double o-ring fittings, commercial models use 1" FPT fittings.
All measurements are in inches.
All Desuperheater (HWG) connections are 3/4" FPT fittings.
Electrical connect. are 1" for high voltage, 1/2" for low voltage.
*B (Unit Width) excludes field installed factory supplied flanges.

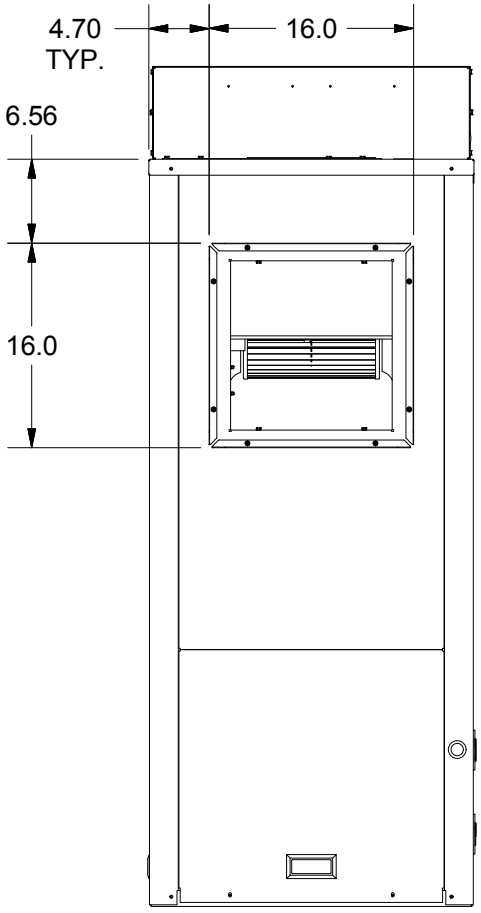
Section 4: Unit Data Information

Side and Back Discharge Dimensional Data

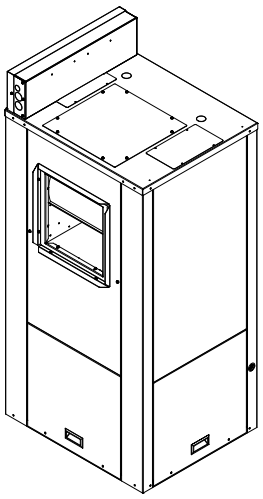
CONFIGURED AS
SIDE DISCHARGE



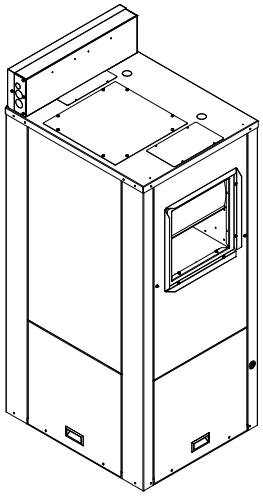
CONFIGURED AS
BACK DISCHARGE



Note:
Side and Back Discharge configurations are only available in 036 through 072 models.



SIDE DISCHARGE



BACK DISCHARGE

Section 4: Unit Data Information

Unit Electrical Data

Model	Voltage Code/ HWG Option	60 Hz Power		Compressor		Fan Motor FLA	HWG Pump FLA	Ext. Loop Pump FLA	Total Unit FLA	Min Circuit AMPS	Max Brkr HACR
		Volts	Phase	LRA	RLA						
YT024	00	208/230	1	58.3	11.7	5.2	0.0	0.0	16.9	19.8	30
	01	208/230	1	58.3	11.7	5.2	0.5	0.0	17.4	20.3	30
	10	208/230	1	58.3	11.7	5.2	0.0	4.0	20.9	23.8	35
	11	208/230	1	58.3	11.7	5.2	0.5	4.0	21.4	24.3	35
	20	208/230	3	55.4	6.5	5.2	0.0	0.0	11.7	13.3	20
	21	208/230	3	55.4	6.5	5.2	0.5	0.0	12.2	13.8	20
	30/35	460	3	28.0	3.5	4.7	0.0	0.0	8.2	9.4	15
YT036	00	208/230	1	83.0	15.6	5.2	0.0	0.0	20.8	24.7	40
	01	208/230	1	83.0	15.6	5.2	0.5	0.0	21.3	25.2	40
	10	208/230	1	83.0	15.6	5.2	0.0	4.0	24.8	28.7	40
	11	208/230	1	83.0	15.6	5.2	0.5	4.0	25.3	29.2	45
	20	208/230	3	73.0	11.6	5.2	0.0	0.0	16.8	19.7	30
	21	208/230	3	73.0	11.6	5.2	0.5	0.0	17.3	20.2	30
	30/35	460	3	38.0	5.7	4.7	0.0	0.0	10.4	11.8	15
YT048	00	208/230	1	104.0	21.2	5.2	0.0	0.0	26.4	31.7	50
	01	208/230	1	104.0	21.2	5.2	0.5	0.0	26.9	32.2	50
	10	208/230	1	104.0	21.2	5.2	0.0	5.5	31.9	37.2	50
	11	208/230	1	104.0	21.2	5.2	0.5	5.5	32.4	37.7	50
	20	208/230	3	83.1	14.0	5.2	0.0	0.0	19.2	22.7	35
	21	208/230	3	83.1	14.0	5.2	0.5	0.0	19.7	23.2	35
	30/35	460	3	41.0	6.4	4.7	0.0	0.0	11.1	12.7	15
YT060	00	208/230	1	152.9	27.1	6.9	0.0	0.0	34.0	40.8	60
	01	208/230	1	152.9	27.1	6.9	0.5	0.0	34.5	41.3	60
	10	208/230	1	152.9	27.1	6.9	0.0	5.5	39.5	46.3	70
	11	208/230	1	152.9	27.1	6.9	0.5	5.5	40.0	46.8	70
	20	208/230	3	110.0	16.5	6.9	0.0	0.0	23.4	27.5	40
	21	208/230	3	110.0	16.5	6.9	0.5	0.0	23.9	28.0	45
	30/35	460	3	52.0	7.2	6.0	0.0	0.0	13.2	15.0	20
YT072	00	208/230	1	179.2	29.7	6.9	0.0	0.0	36.6	44.0	70
	01	208/230	1	179.2	29.7	6.9	0.5	0.0	37.1	44.5	70
	10	208/230	1	179.2	29.7	6.9	0.0	5.5	42.1	49.5	70
	11	208/230	1	179.2	29.7	6.9	0.5	5.5	42.6	50.0	80
	20	208/230	3	136.0	17.6	6.9	0.0	0.0	24.5	28.9	45
	21	208/230	3	136.0	17.6	6.9	0.5	0.0	25.0	29.4	45
	30/35	460	3	66.1	8.5	6.0	0.0	0.0	14.5	16.6	25

Notes:

1. All line and low voltage wiring must adhere to the National Electrical Code and local codes, whichever is the most stringent.
2. In determining the correct supply wire size and maximum length, reference NFPA 70, Section 310. If the calculation is close to the maximum allowable ampacity of a particular wire size, use the next size up. This will ensure that no adverse effects occur, such as light dimming and/or shortened compressor life.
3. Min/Max Voltage: 208/230/60 = 187-252, 460/60 = 432-502
4. See Wiring Diagrams for proper 460V power.

*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 048-072 and two pumps for 024-036.

Section 4: Unit Data Information

ECM Fan Performance - Two-Stage Compressor Units

*YT Series ECM Blower Performance Data: Two-Stage Compressor Units																		
Model	Max ESP in. w.c.[2]	Program[3]	Heating Mode		Cooling Mode		Dehumidification Mode		Fan Only	AUX/ EMG Heat	DIP Switch Settings							
			1st	2nd	1st	2nd	1st	2nd			S1	S2	S3	S4	S5	S6	S7	S8
024	1.4	A	790	1100	780	1040	670	880	520	1230	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		B	**780**	**1010**	**770**	**1030**	**650**	**840**	**450**	**1190**	**ON**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**
		C	670	900	670	890	510	760	420	1130	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
		D	640	840	650	840	480	710	410	1100	ON	ON	OFF	OFF	ON	ON	OFF	OFF
036	1.1	A	1250	1520	1230	1560	1070	1330	760	1760	ON	OFF	ON	OFF	ON	OFF	OFF	OFF
		B	**1130**	**1380**	**1130**	**1420**	**970**	**1210**	**690**	**1480**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
		C	1030	1240	1010	1280	870	1080	620	1310	ON	OFF	OFF	ON	ON	OFF	OFF	OFF
		D	930	1130	930	1170	800	990	500	1210	ON	ON	OFF	OFF	ON	ON	OFF	OFF
048	1.1	A	1570	1970	1680	1880	1440	1590	930	2020	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
		B	**1420**	**1790**	**1530**	**1710**	**1310**	**1440**	**850**	**1880**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
		C	1280	1600	1380	1540	1180	1290	770	1690	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
		D	1090	1370	1280	1420	1090	1200	690	1500	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
060	1.2	A	1870	2160	1800	2170	1500	1825	1050	2380	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
		B	**1680**	**1960**	**1610**	**1960**	**1370**	**1660**	**950**	**2170**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
		C	1500	1750	1450	1770	1230	1490	850	1950	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
		D	1220	1440	1300	1580			740	1690	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
072	1.2	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		B	**1870**	**2160**	**1800**	**2170**	**1500**	**1830**	**1050**	**2390**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
		C	1680	1960	1610	1960			950	2180	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		D	1500	1750	1450	1770			850	1960	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF

Notes:

1. Program **B (Bold Type)** is factory settings and rated CFM. CFM is controlled within 5% up to the Max ESP.
2. Max ESP includes allowance for wet coil and NO FILTER
3. Power must be off to the unit for at least 3 seconds before the ECM motor will recognize a program change.
4. Max ESP for *YT024 models with internal electric heat is 0.5"; for *YT036 and *YT048 it is 0.6"; for *YT060 and *YT072 it is 0.7". Exceeding the Max ESP may result in nuisance trips of the electric heat. Thermal limits are rated at 100,000 cycles.
5. *YT060 models with 10kW internal electric heat cannot be set on the 'D' program.

***YT Series Dehumidification Mode Options**

DIP Switch		Mode	Operation
S9	S10		
ON	OFF	Normal	Dehumidification mode disabled (Normal Htg/Clg CFM)-- Factory setting.
OFF	ON	ODD	On Demand Dehumidification mode (humidistat input at terminal ODD)-- Humidistat required.
OFF	OFF	Constant Dehum	Constant Dehumidification mode (always uses dehum CFM for cooling and normal CFM for heating)--No humidistat required.
ON	ON	Not Used	Not an applicable selection.

Notes:

1. To enter dehumidification mode, ODD input should be 0 VAC; for normal cooling CFM, ODD input should be 24 VAC.
2. Heating CFM is not affected by dehumidification mode. When in dehumidification mode, cooling CFM is 85% of normal CFM.

Section 4: Unit Data Information

Filter Performance

The blower performance data in the ECM Blower Performance table is WITHOUT FILTER. To determine the approximate blower performance WITH FILTER apply the filter pressure drop value for the filter being used or calculate the pressure drop as follows:

Below is typical filter performance data and should only be used as a guideline. Actual performance may vary between manufacturers.

	Return Size		
Model	Height (in.)	Width (in.)	Area (ft^2)
024	26	21	3.8
036	28	26	5.1
048			
060	32	26	5.8
072			
Filter Type	Thickness (in.)	Rated Velocity (fpm)	Initial Resistance (in. w.c.)
MERV 8	1	300	0.21
MERV 11	2	500	0.24
MERV 13	3	500	0.43

To calculate filter pressure drop:

$$Filter\ \Delta P_s = \left[\frac{\left[\frac{CFM}{Area}\right]}{Rated\ Velocity}\right] X\ Initial\ Resistance$$

Applying Filter Pressure Drop to Determine Total ESP

To determine the Total ESP of a unit with the filter in place, follow the steps below:

1. Select the filter type and determine Rated Velocity and Initial Resistance
2. For the model being considered determine Max ESP, CFM and Return Area
3. Determine Filter pressure drop (ΔPs) using the equation above
4. Measure (or calculate) the ESP without filter in place
5. Calculate Total ESP = Measured ESP + Filter Pressure Drop
6. Total ESP should be less than or equal to Max ESP

Example: For an YT060 at an air flow of 1960 CFM calculate the filter pressure drop with a 2" MERV 11 filter and determine Total ESP and compare to Max ESP.

CFM = 1960
Area = 5.8 ft2
Rated Velocity = 500 fpm
Initial Resistance = 0.24 in.w.c.
Measured ESP without filter = 0.53

1. 1960 CFM ÷ 5.8 ft2 = 338 fpm
2. 338 fpm ÷ 500 fpm = 0.676
3. 0.676 x 0.24 in.w.c. = 0.16 in.w.c. = Filter Pressure Drop
4. Total ESP is 0.53 + 0.16 = 0.69 in.w.c. which is less than the 1.2 in.w.c. Max ESP

Example: For an YT036 at an air flow of 1420 CFM calculate the filter pressure drop with a 2" MERV 13 filter and determine Total ESP and compare to Max ESP.

CFM = 1420
Area = 5.1 ft2
Rated Velocity = 500 fpm
Initial Resistance = 0.43 in.w.c.
Measured ESP without filter = 0.53

1. 1420 CFM ÷ 5.1 ft2 = 278 fpm
2. 278 fpm ÷ 500 fpm = 0.556
3. 0.556 x 0.43 in.w.c. = 0.24 in.w.c. = Filter Pressure Drop
4. Total ESP is 0.36 + 0.24 = 0.6 in.w.c. which is less than the 1.1 in.w.c. Max ESP

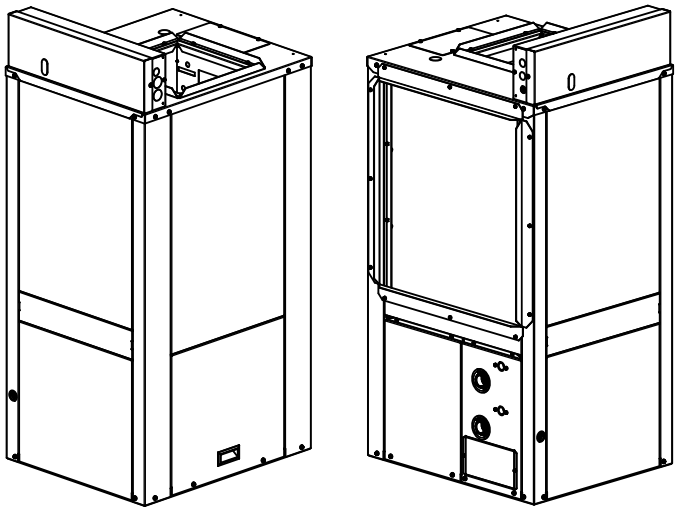
Section 5: General Unit Assembly

Pre-Installation Checklist

Before you fully install the geothermal equipment, it is recommended you go through this quick checklist before placing the equipment.

- ☐ Fully inspect the unit after unpacking.
- ☐ Open both the air handler section and compressor section and remove any packaging material or documentation included in the unit.
- ☐ Maintain the installation instructions included with any kits for installation during unit assembly.
- ☐ Remove and discard any blower housing supports and the motor armature shaft shipping bracket from the rear of the blower.
- ☐ Remove and discard the blower housing bottom M shaped shipping bracket
- ☐ Locate and review the Equipment Start-Up Procedures and Forms from this manual and have it available as the unit installation proceeds.
- ☐ Clean the air coil with soap and water solution to remove any oil or dirt.

Field Selectable Return Air Pattern



This unit is a field selectable return air unit. The unit will come already set up for a left hand return. The source and hot water generator connections are on the air coil side of the unit, under the air coil itself. These connections are easier to facilitate if done prior to the fitting of the return air drop. The condensate drain is field selectable and will be discussed in the "CONDENSATE DRAIN TUBE INSTALLATION" section later in this document.

If the unit needs to be changed to a right hand return configuration, please complete the following:

1. Using a flat blade, remove the front center insert panel. Place the flat blade in the gap on one side and gently pull out. (Refer to the picture in step 2 of the following Control Box Installation section).
2. Remove the lower then the upper front doors. (Use caution to support the doors as the screws are removed to avoid dropping the panels).
3. Once the doors are removed, the plate behind the center insert panel (same color as the unit) will be exposed. This will need to be removed, so it can be placed on the back side of the unit for panel attachment in the right hand return configuration.
4. Remove the rear bottom and top doors.
5. At this point the front and rear doors should be completely removed from the unit.
6. Take the panel that was removed from behind the front center insert panel, and re-install it in the same location in the back side of the unit. There should be a total of (5) screws.
7. Remove all shipping brackets. Proceed to the **"CONTROL BOX INSTALLATION"** section, unless the unit has a factory installed soft start module. If the unit has a factory installed soft start module, it will need to be moved from the front right corner to the back right corner of the unit, so proceed to the "SOFT START CONVERSION - RIGHT HAND RETURN- " section.

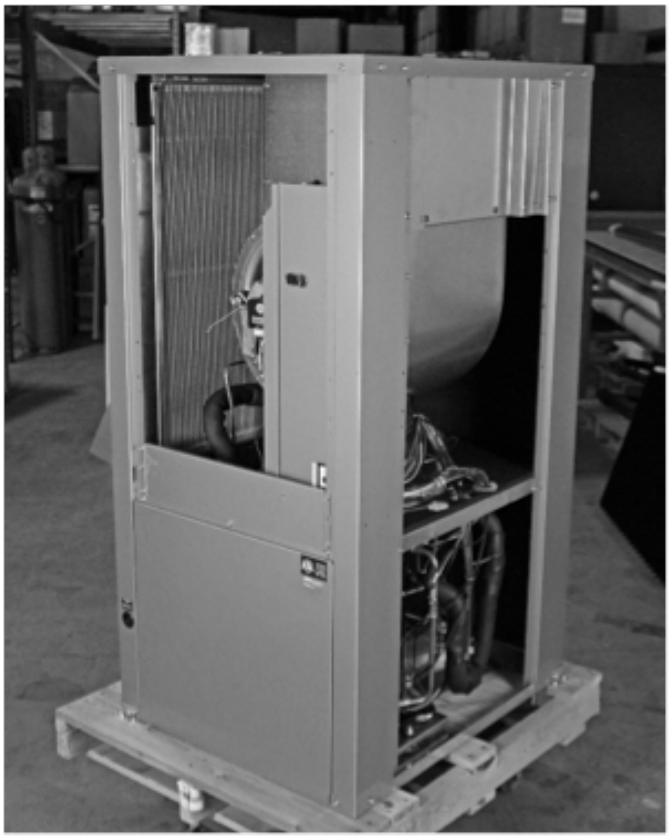
Section 5: General Unit Assembly

Control Box Installation

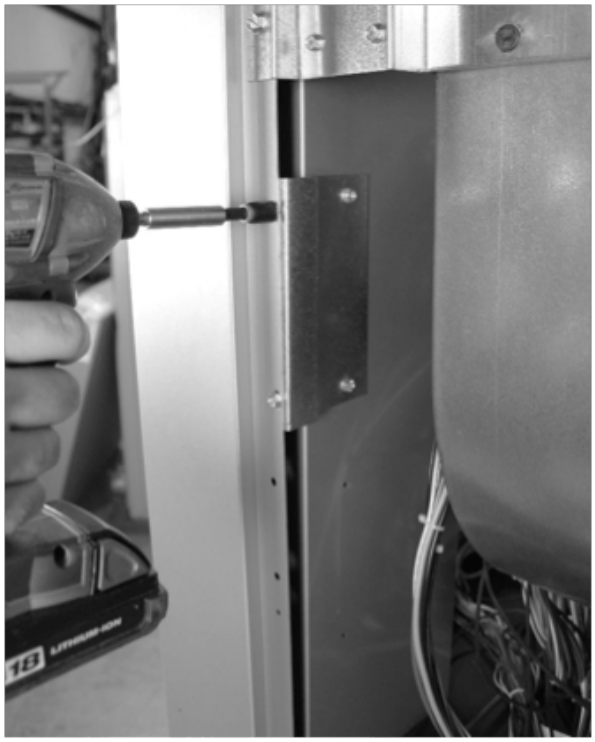
1. This unit should look similar to what is shown below after removing all cardboard and plastic wrap on unit and in front of the air coil.

2. Remove the center insert panel on the front of the unit by inserting a flat blade in the gap on one side and gently prying open as shown in the picture below.

3. Remove the outer doors from the unit. Units are shipped with the control box in the unit air handler section.

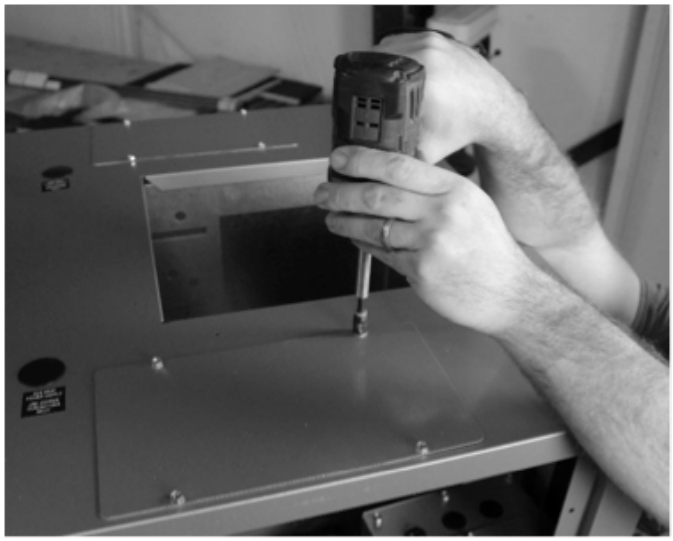


4. Viewing the right side of the unit, remove the control box shipping bracket from the unit and from the control box. This will require the removal of 4 screws.

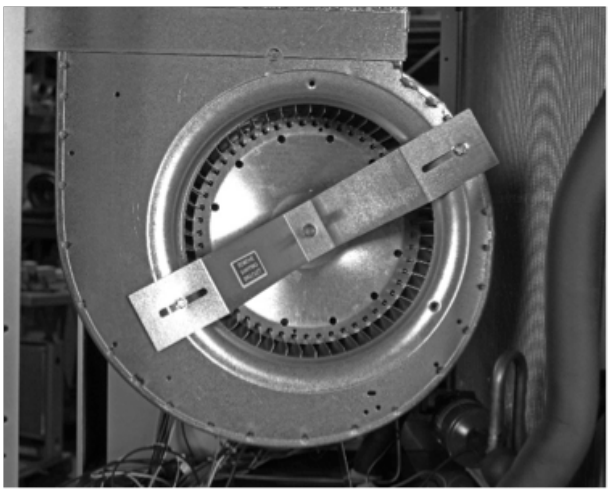


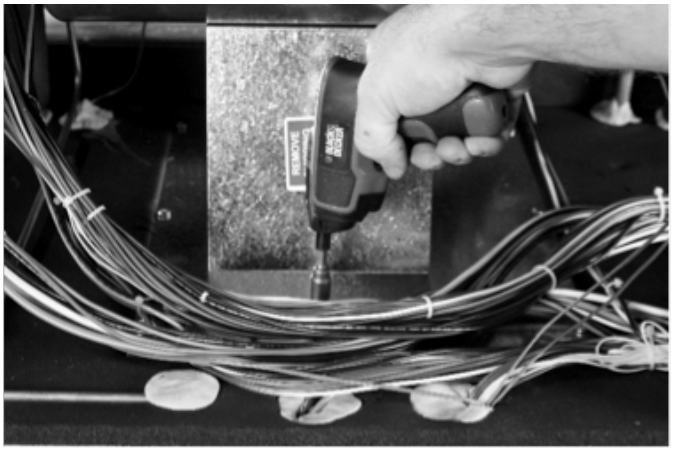
5. Remove bracket from the control box and discard.

6. Mounting the control box requires removal of the selected (left or right return) top cover access filler plate. Make sure to keep the (4) screws for future use.



7. Remove the blower motor/blower wheel bracket and the blower housing bracket at this time. Remove both brackets with (2) screws from each bracket. Once removed discard.





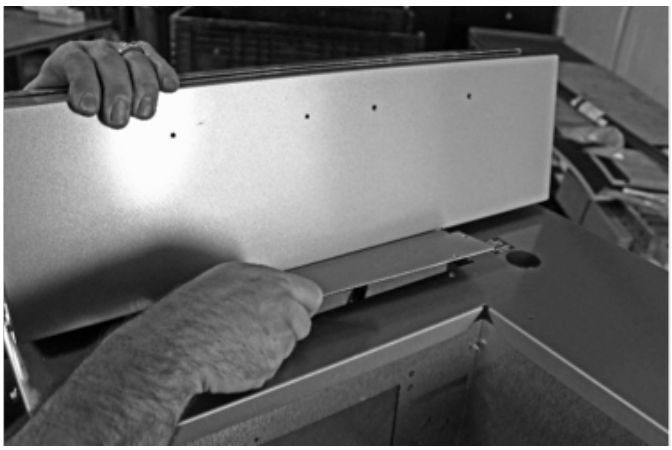
8. Pass the control box asm. up through the opening in the top cover.

Section 5: General Unit Assembly

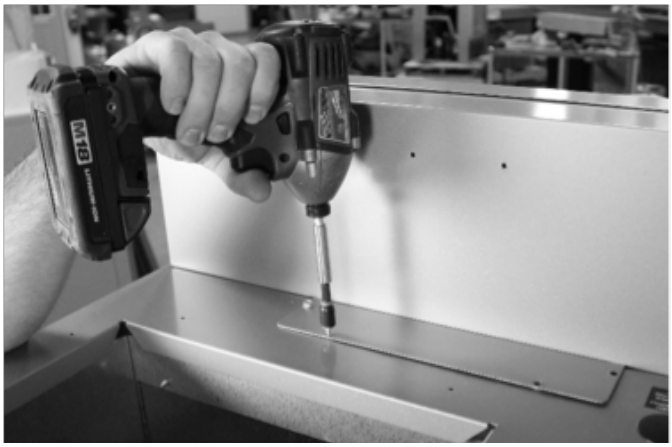
9. The front edge of the control box asm. should hang over the front edge of the top cover as shown below.

10. Locate and then open the small filler plate kit found in the bottom of the unit.

11. Slide the small filler plate into the slot at the bottom rear of the control box asm. This plate will cover and insulate the remainder of the access opening of the control box asm.

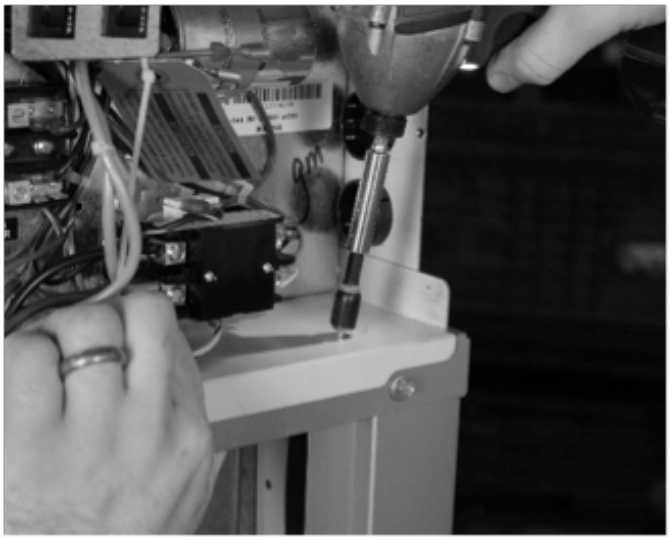


12. Assemble the small filler plate using the (4) screws provided.

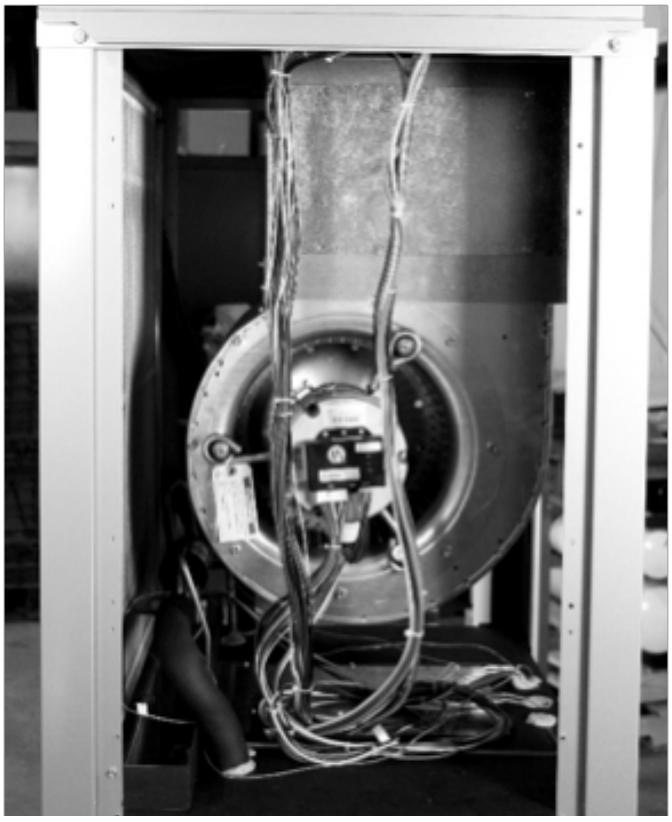


13. Remove the control front from the control box asm. by removing two screws (1 on each side). Be sure to keep these two screws as they will be used when the control front is assembled back onto the control box asm.

14. Assemble the control box asm to the top of the unit by aligning the screw holes in the control box asm to the top cover, insert and start screws. Align, insert, and tighten these (3) screws.



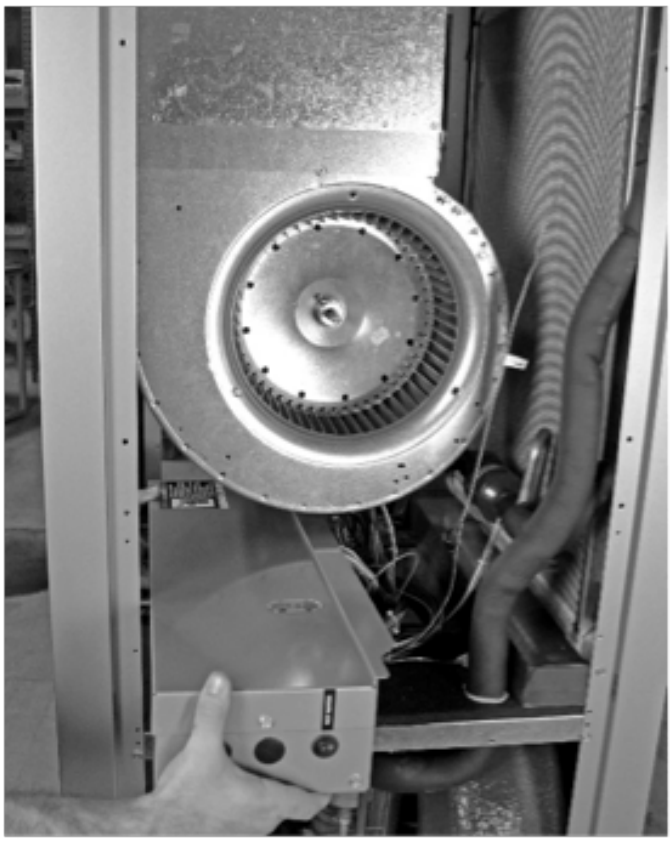
15. Confirm that the position of the unit wiring in the air handler section is well placed and does not come into contact with the blower wheel/motor or any sharp edges. Leave the wiring bundle as two separate bundles as shown below. If the wiring needs additional bundling, use the extra plastic tie straps provided.



16. If this is a left hand return unit move to Step 19. If this is a right hand return unit, relocate the control box asm to the other side of the unit as shown in the next few steps. Then assemble the control box asm. to the top of the unit using the previous steps shown above. Start by removing the front plate behind the center insert panel.

Section 5: General Unit Assembly

17. Move the control box asm. into place by sliding it under the blower housing to what will become the front of the unit when configured as a right hand return unit.



18. Once the control box asm. has been relocated under the blower housing to what is now the front of the unit as a right hand return, assemble it through the opening in the top cover and onto the top of the unit per the previous steps 8 through 14.
19. Be sure to reassemble the front plate (behind the center insert panel) to the new front of the unit if this is a right hand return unit. If it is a left hand return unit, this front plate was not previously removed.

While panels are still removed continue unit assembly by proceeding to the instructions for **Condensate Drain Tube Installation or Soft Start Conversion, Right Hand Return** sections on the immediately following pages.

If no further assembly is required reassemble all panels, the control box cover, and doors that were removed from the unit before unit startup. The door with the logo will be the top front door and the bottom door without a handle will be the bottom front door. You have how completed the control box installation.

Section 5: General Unit Assembly

Condensate Drain Tube Installation

The flexible tube condensate drain allows field selectable installation. Installation requires removal of access panels/ doors.

To install the drain tube assembly:

1. Looking at the front and rear coil side of the unit you will notice the “Condensate Drain” labels and plastic black plugs. Decide which direction that you want your unit to drain, front or rear, and remove the corresponding black plug.
2. Remove the lower access panel on the side of the condensate exit. If this panel is on the “front” of the unit that incorporates the bellyband, the bellyband will need to be removed before the lower access panel can be removed.

   Note: Do not pry on the “bellyband” panel that runs across the front of the unit covering the front top and lower access panel screws.
3. Insert a non-marring blade (1/4” to 1/2” wide) into the small indent on the right or left side of the band and apply slight outward pressure to release the latch tab. Use caution to not over bend the metal or latch during removal. Should the latch tab become over bent go ahead and return it to its original position.
4. Remove the access panel on the coil side that covers the coax area. Once this coax panel is removed look inside, near the top right hand corner where the panel was assembled. There you will find the bottom drain tube exiting the drain pan.
5. On the drain pan tube you will find a plastic plug, remove the plug from the tube.

   Note: this plug must be totally removed from the unit, otherwise the condensate will not drain from the unit.
6. Working on the end of the unit that you want the condensate to exit (the plastic fitting end), complete the following:
7. Locate the Drain Kit packaged in a plastic bag in the bottom of your unit.
8. Open the bag and attach the clear vinyl tube to the barb adapter, apply plastic squeeze clamp over the tubing/barb adapter, tightening the clamp with pliers.
9. The length of the vinyl tubing is already precut to the proper length.
10. To check the routing of the drain, fit the vinyl tube asm from the inside of the corner post hole to the drain, noting any obstacles that you need to route around.
11. While working on the inside of the unit, fit the gasket and barb/vinyl tube asm up to the inside if the corner post. At this point assemble the 3/4” S x 3/4” Mips Male Adapter through the hole in the corner, through the gasket, and thread into the female barb fitting. Hand tighten only. If using a 1” P-trap you must supply and install a 1” S x 3/4” Mips adapter.
12. At this point go ahead and route the vinyl tubing up to the drain pan tube, making sure to not leave any internal traps along the way.
13. If needed wet the inside of the vinyl tube so it will assemble easier to the drain pan drain.
14. Push the end of the vinyl tube over the drain pan tube.
15. Take a second look to make sure everything is in place and that there are no internal condensate traps. If all is ok, assemble the plastic squeeze clamp over the vinyl tube/ drain pan tube.
16. The condensate drain tube installation has been completed. We are now ready to work on the drain outside of the unit.
17. Connect the exterior condensate drain piping to the male adapter as described in the Unit Piping Installation section.
18. Once completed, reassemble all access panels to the unit.

Return Duct Flange Kit Installation

Install the flanges per the instructions, part # 20D200-01NN, provided in the kit package shipped inside the unit.

Optional Filter Rack Kit Installation

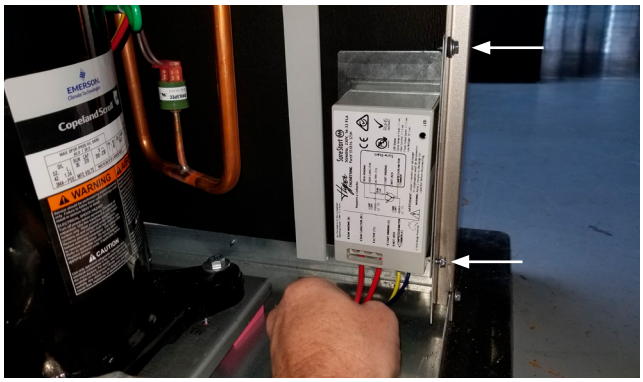
Installation of the optional and sold separately accessory filter rack is described in the installation instructions provided with that item. Maintenance and filter change instructions are included in the owners manual shipped with every unit.

Section 5: General Unit Assembly

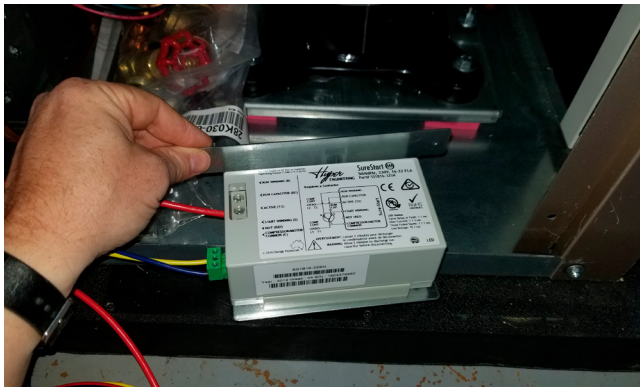
Soft Start Conversion, Right Hand Return

Note: Step 1-6 may not be necessary depending on unit size. Move unit control box first, then verify wiring harness length to determine if Hyper Engineering Soft Start needs to be relocated.

1. With the front, rear, and right side doors removed, remove the (2) screws holding the soft start bracket and module to the lower right front corner of the unit.



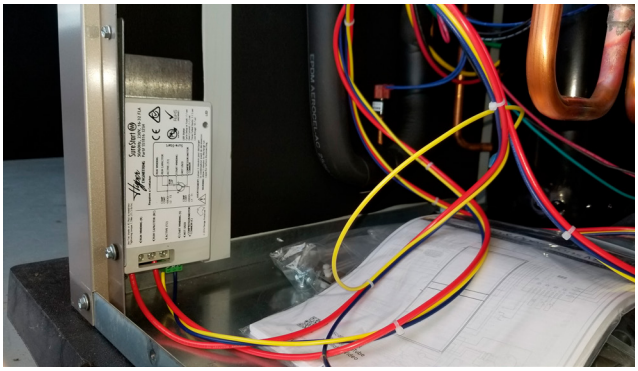
2. Take the bracket, with the soft start module and wiring, and route it out the right side of the unit, around the compressor, and then back into the rear side of the unit. See picture below.



3. At this point, the bracket, with the soft start module and wiring, should be sitting loose in the rear, bottom side of the unit.

4. Take a flat blade screwdriver, and pop the module (with the wiring connected) out of the plastic clip that is mounted to the sheet metal bracket shown in the picture below.

5. Use the (2) screws that were removed in the front, to attach the bracket to the rear, lower right corner. Holes already exist for this installation.
6. Clip the module back into the plastic clip that is mounted on the metal bracket, making sure that the wiring is pointed downward. See picture below.
7. Refer to Section 11 “Soft Start Controls” for Soft Start Wiring Diagram, basic operation, specifications, and LED Codes.



Section 6: Unit Piping Installation

Water Quality

The quality of the water used in geothermal systems is very important. In closed loop systems the dilution water (water mixed with antifreeze) must be of high quality to ensure adequate corrosion protection. Water of poor quality contains ions that make the fluid "hard" and corrosive. Calcium and magnesium hardness ions build up as scale on the walls of the system and reduce heat transfer. These ions may also react with the corrosion inhibitors in glycol based heat transfer fluids, causing them to precipitate out of solution and rendering the inhibitors ineffective in protecting against corrosion. In addition, high concentrations of corrosive ions, such as chloride and sulfate, will eat through any protective layer that the corrosion inhibitors form on the walls of the system.

Ideally, de-ionized water should be used for dilution with antifreeze solutions since de-ionizing removes both corrosive and hardness ions. Distilled water and zeolite softened water are also acceptable. Softened water, although free of hardness ions, may actually have increased concentrations of corrosive ions and, therefore, must be avoided.

It is recommended that dilution water contain less than 100 PPM calcium carbonate or less than 25 PPM calcium plus magnesium ions; and less than 25 PPM chloride or sulfate ions.

In an open loop system the water quality is of no less importance. Due to the inherent variation of the supply water, it should be tested prior to making the decision to use an open loop system. Scaling of the heat exchanger and corrosion of the internal parts are two of the potential problems. The Department of Natural Resources or your local municipality can direct you to the proper testing agency. Please see Table 2 for guidelines.

Note: Failure to adhere to the water quality guidelines may result in loss of warranty.

Once the system has been flushed and filled, Enertech recommends the use of Fernox F1 (Enertech P/N: F-57880) water treatment products in order to keep the system clean and running smooth for years to come.

Table 2: Water Quality

Potential	Problem Chemical(s) or Condition	Range for Copper Heat Exchangers	Range for Cupro-Nickel Heat Exchangers	Range for Stainless Steel BPHE
Scaling	Calcium & Magnesium	Less than 350 ppm	Less than 350 ppm	Less than 0.1 ppm
	pH Range	7 - 9	7 - 9	7 - 9
Corrosion	Total Dissolved Solids	Less than 1000 ppm	Less than 1500 ppm	No rigid setpoint
	Ammonia, Ammonium Hydroxide	Less than 0.5 ppm	Less than 0.5 ppm	No Limit
	Ammonium Chloride, Ammonium	Less than 0.5 ppm	Less than 0.5 ppm	Less than 2-20 ppm
	Calcium Chloride / Sodium	Less than 125 ppm	Less than 125 ppm	Not Allowed
	Chlorine	Less than 0.5 ppm	Less than 0.5 ppm	Not Allowed
	Hydrogen Sulfide	None Allowed	None Allowed	Less than 0.05 ppm
Biological	Iron Bacteria	None Allowed	None Allowed	Not Allowed
	Iron Oxide	Less than 1 ppm	Less than 1 ppm	Less than 0.2 ppm
Erosion	Suspended Solids	Less than 10 ppm	Less than 10 ppm	16-20 mesh strainer recommended
	Water Velocity	Less than 8ft/s	Less than 12 ft/s	Less than 5.5 m/s in the port

1. Hardness in ppm is equivalent to hardness in mg/l.Notes
2. Grains/gallon = ppm divided by 17.1.
3. Unit internal heat exchangers are not recommended for pool applications or water outside the range of the table. Secondary heat exchangers are required for pool or other applications not meeting the requirements shown above.
4. Saltwater applications (approx. 25,000 ppm) require secondary heat exchangers due to copper piping between the heat exchanger.
5. Filter for maximum of 600 micron size.

Section 6: Unit Piping Installation

Interior Piping

All interior piping must be sized for proper flow rates and pressure loss. Insulation should be used on all inside piping when minimum loop temperatures are expected to be less than 50°F. Use the table below for insulation sizes with different pipe sizes. All pipe insulation should be a closed cell and have a minimum wall thickness of 3/8". All piping insulation should be glued and sealed to prevent condensation and dripping. Interior piping may consist of the following materials: HDPE, copper, brass, or rubber hose (hose kit only). **PVC is not allowed on pressurized systems.**

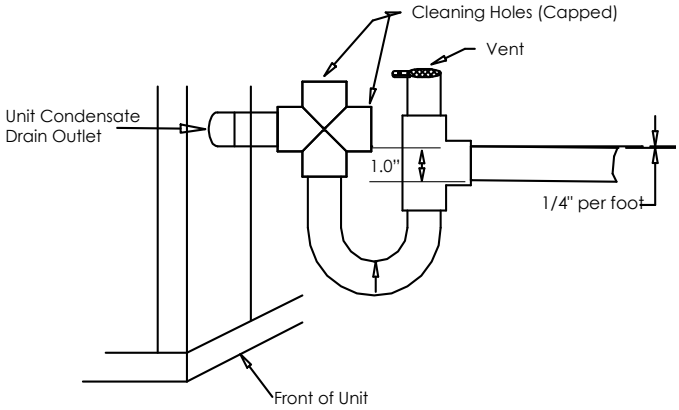
Table 3: Pipe Insulation

Piping Material	Insulation Description
1" IPS Hose	1-3/8" ID - 3/8" Wall
1" IPS PE	1-1/4" ID - 3/8" Wall
1-1/4" IPS PE	1-5/8" ID - 3/8" Wall
2" IPS PD	2-1/8" ID - 3/8" Wall

Condensation Drain Connection

Connect the EZ-Trap to the 3/4" equipment condensate drain connection as shown in figure 9a. The condensate line must be trapped a minimum of 1.0" as shown in the diagram. The condensate line should be pitched away from the unit a minimum of 1/4" per foot. The condensate line from the unit drain connection to the P-trap should be sloped downward. For more information on installing EZ-Trap, see installation sheet that comes with the EZ-Trap Kit. Always install the air vent after the trap.

Figure 9a: Typical Condensation Drain Connection



Note: Connect the drain through the trap to the condensation drain system in conformance to local plumbing codes.

Part Number Description
ACDT1A - EZ-Trap ¾" Kit
ACDT2A - EZ-Trap 1" Kit (customer must provide a 1" S x 3/4" Mips adapter)

Typical Pressurized Flow Center Installation

The flow centers are insulated and contain all flushing and circulation connections for residential and light commercial earth loops that require a flow rate of no more than 20 gpm. 1-1/4" fusion x 1" double o-ring fittings (AGA6PES) are furnished with the double o-ring flow centers for HDPE loop connections. Various fittings are available for the double o-ring flow centers for different connections. See figure 6 for connection options. A typical installation will require the use of a hose kit. Matching hose kits come with double o-ring adapters to transition to 1" hose connection.

Note: Threaded flow centers all have 1" FPT connections. Matching hose kits come with the AGBA55 adapter needed to transition from 1" FPT to 1" hose.

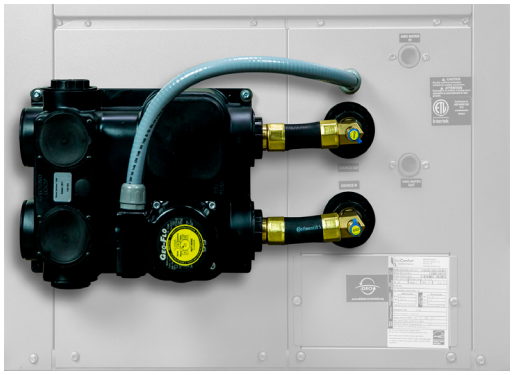
Flushing & Charging a Pressurized Flow Center

Once piping is completed between the unit, flow center, and the earth loop, final purging and charging of the system is needed. A flush cart (at least a minimum of 1.5 hp pump motor or larger) is needed to achieve adequate flow velocity (2 fps in all piping) in the loop to purge air and debris from the loop piping (unless the header manifold is located inside and has isolation valves). All air and debris must be removed from the system before operation or pump failure could result. The flush ports located on the flow center are access to the piping system for the flush cart. See figure 7 for connection details.

The 3-way valves on the flow center include direction indicators on the valves which determine the flow path (see figure 8). A 3/8" socket drive is required to operate the 3-way valves. The valves will turn in either direction, 360 degrees. Make sure during this process that the valves are in the same position so that air does not become trapped in the system.

Section 6: Unit Piping Installation

Figure 6: Typical Single Unit Piping Connection (Pressurized Flow Center)



"Plug n Play" Pressurized Flow Center
Composite Cabinet/Brass Valve - UPS26-99-230V w/hose kit
Enertech Part Number: AGFC1G (single pump, shown above) or AGFC2G (two-pump)

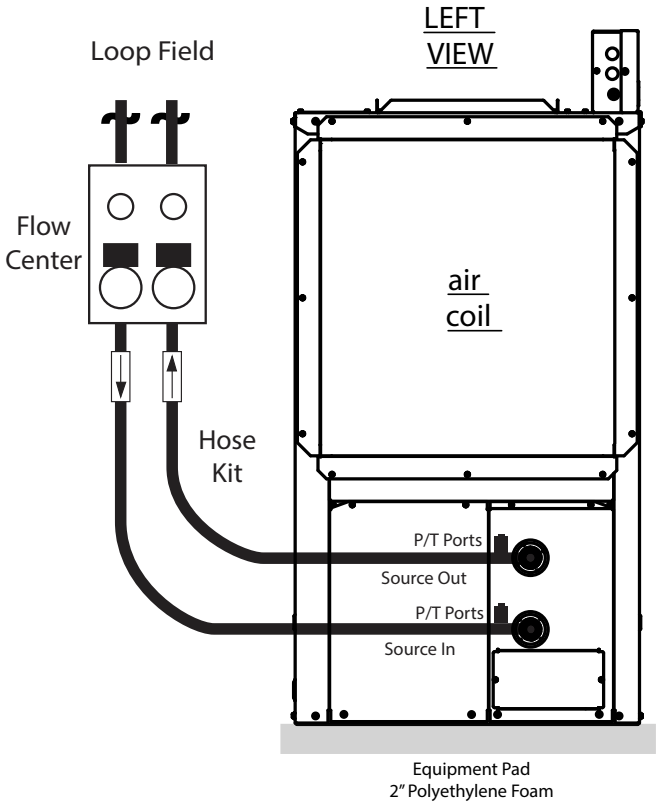
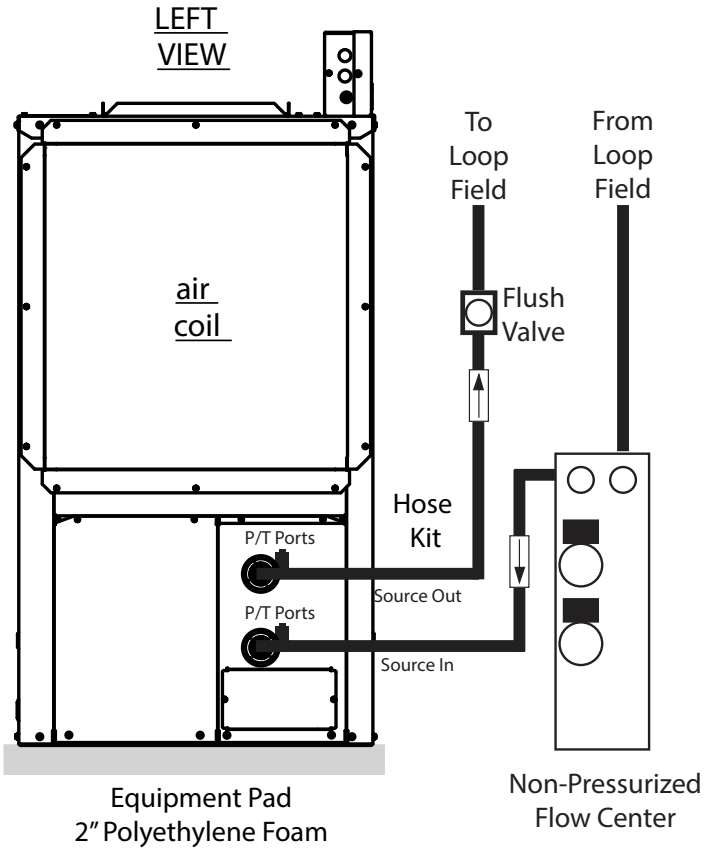


Figure 7: Typical Single Unit Piping Connection (Non-Pressurized Flow Center)



Section 6: Unit Piping Installation

Pressurized Flow Center and Pump Mounting

The flow center can be mounted with the flow paths either vertical or horizontal (see Figure 4). However, the flow center cannot be mounted on its back, upside down, or at an angle, as premature pump failure will occur when the pump shaft is not in the horizontal position.

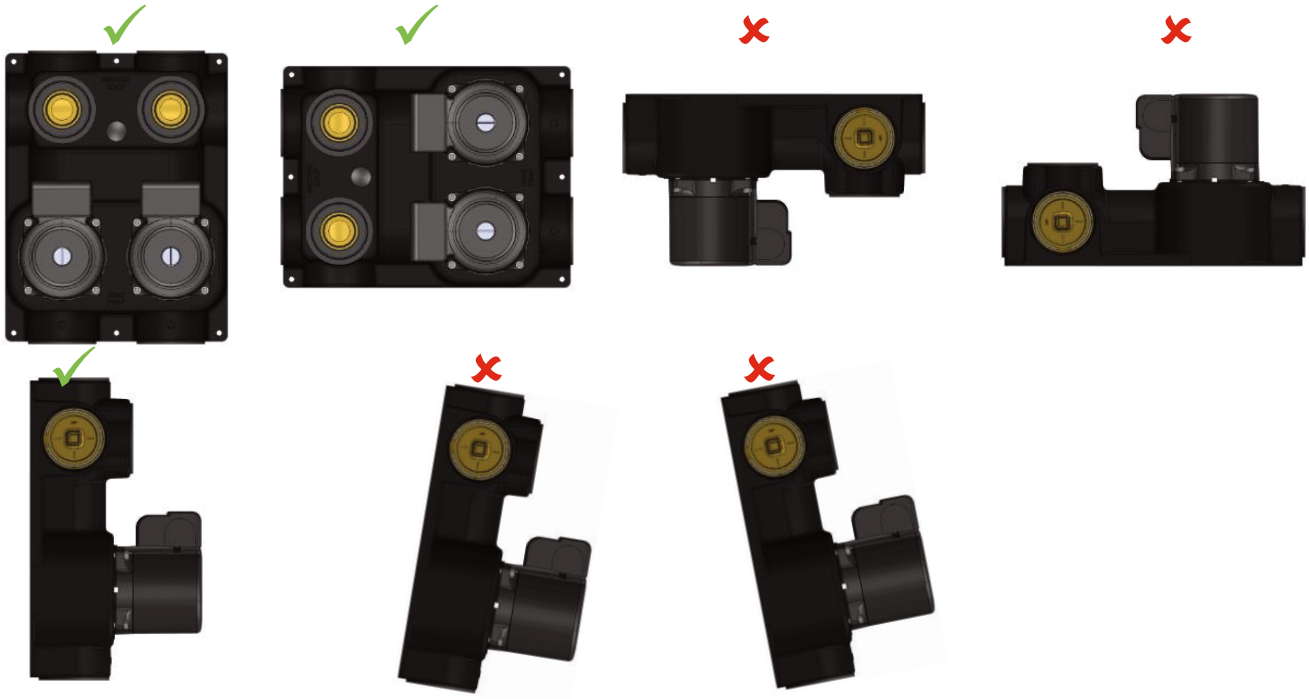


Figure 4: Acceptable mounting positions for Flo-Link and GPM series flow centers

Equally important to pump longevity is terminal box orientation. See Figure 5, 6, and 7 for proper control box orientation. The pump terminal box must be located in a position to avoid condensation running into the control box, and also to take advantage of the “weep holes” designed to drain any condensation that may have formed (Figure 6). “Weep holes” are located on three sides of the pump.

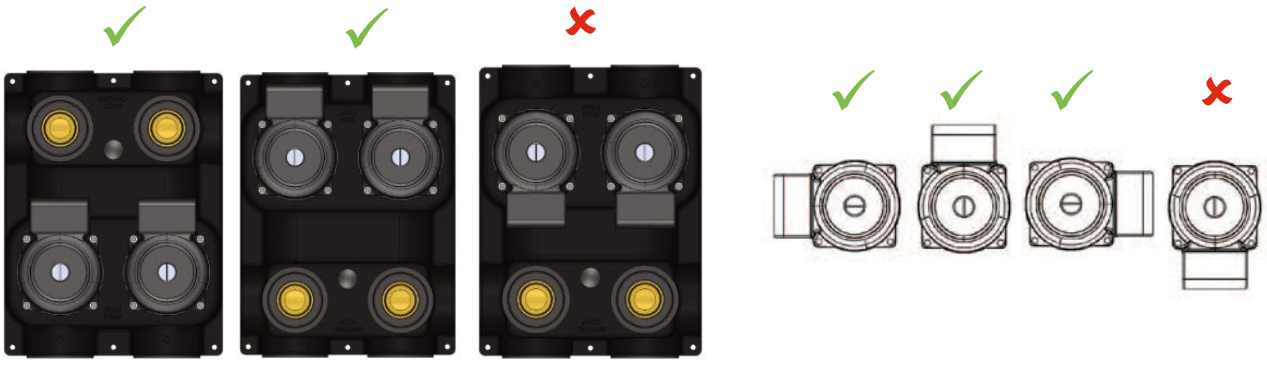


Figure 5: Acceptable terminal box locations for UPS26-99, UP26-99, and UP26-116 pumps.

Section 6: Unit Piping Installation

Flush Cart Design

The Enertech Manufacturing flush cart has been designed to effectively and efficiently flush the earth loop and to facilitate injecting and mixing of the antifreeze. The single most important element in flow center reliability is the ability to remove all the air and debris from the loop and to provide the proper working pressure.

Removing Debris During Flushing

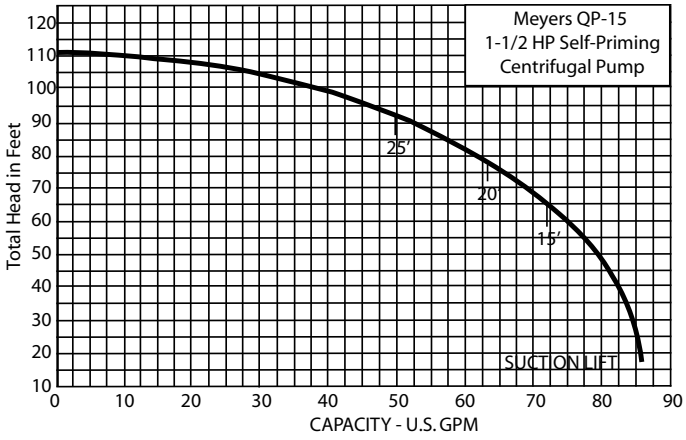
Most flow center or pump failures are a result of poor water quality or debris. Debris entering the loop during fusion and installation can cause noise and premature pump failure. Enertech recommends a double flush filtering method during purging. When purging, use a 100 micron bag filter until air bubbles are removed. Remove the 100 micron bag, replace it with a 1 micron bag and restart the flushing.

Features of the flush cart:

Cylinder: HDPE, SDR15.5, 10” dia. (10 Gallons)
Pump: Myers High Head QP15, 1.5hp, 115V
Hose connections: Cam Lock quick connects - 1-1/2” hoses
Hand Truck: 600lb rating with pneumatic tires
Wiring: Liquid Tight metal on/off switch
Tubing: SDR11 HDPE
Connections: 2 - 3/4” connections for antifreeze and discharge
Drain: one on the pump and the tank

Figure 9: Enertech Flush Cart

Figure 10: Flush Cart Pump Curve



Step 1: Flushing the Earth Loop

- Connect flush cart hoses to flow center flush ports using proper adapters #AGAFP.
- Connect water supply to hose connection on return line of flush cart.
- Turn both 3-way valves on flow center to flush ports and loop position.
- Turn on water supply (make sure water is of proper quality).
- As the reservoir fills up, turn the pump on and off, sucking the water level down. Do not allow the water level to drop below intake fitting to the pump.
- Once the water level remains above the water outlet in the reservoir leave the pump running continuously.
- Once the water level stays above the “T” in the reservoir, turn off the water supply (this also allows observation of air bubbles).
- Run the pump for a minimum of 2 hours for proper flushing and purging (depending on system size it may take longer).
- “Dead head” the pump every so often and watch the water level in the reservoir. Once all the air is removed there should not be more than a 1” to 2” drop in water level in the reservoir. If there is more than a 2” drop, air is still trapped in the system. This is the only way to tell if air is still trapped in the system.
- To dead head the pump, shut off the return side ball valve on the flush cart. This will provide a surge in pressure to the system piping, helping to get the air bubbles moving. Do not reverse flow during flushing.

Section 6: Unit Piping Installation

Figure 7: Flush Cart Connections

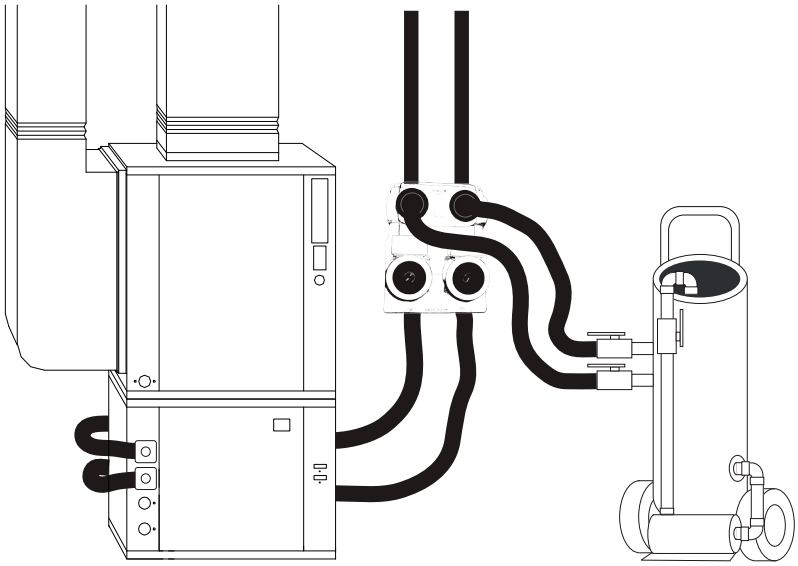
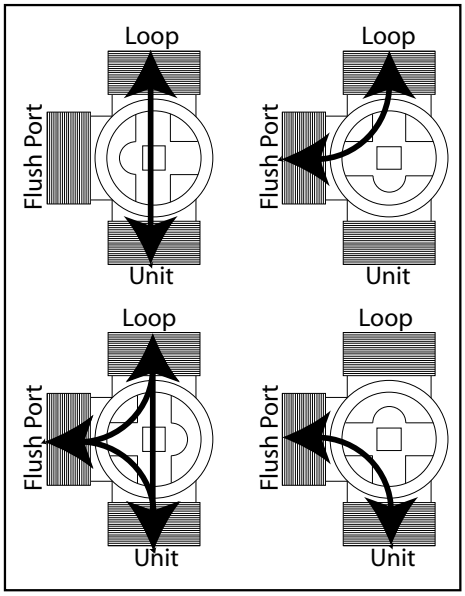


Figure 8: Flow Center 3-Way Valves



Water Quality: Even on a closed loop system water quality is an issue. The system needs to be filled with clean water. If the water on site has high iron content, high hardness, or the PH is out of balance, premature pump failure may result. Depending upon water quality, it may need to be brought in from off site.

Step 2: Flushing the Unit

1. Turn off the pump on the flush cart.
2. Turn both 3-way valves to the unit and flush port position.
3. Turn the pump back on. It may be necessary to turn the water supply back on to keep the water level in the reservoir above the return tee.
4. This should only take 5 to 10 minutes to purge the unit.
5. Once this is done, the entire system is now full of water, and the flush cart pump may be turned off.

Step 3: Adding Antifreeze by Displacement

If the antifreeze was not added when the loop was being filled, it will be necessary to follow the next few steps.

1. Turn both 3-way "Ts" back to the original position for flushing the loop only.
2. Close the return side ball valve on the flush cart.
3. Connect hose to the return side discharge line and run it to a drain. Open the ball valve on discharge line on flush cart.
4. Turn pump on until water level is sucked down just above the water outlet in the reservoir, and turn pump off. Be sure not to suck air back into the system.
5. Fill the reservoir back up with the antifreeze.
6. Repeat steps 5 and 6 until all the antifreeze is in the system and reservoir.
7. Turn the discharge line ball valve off at the flush cart. Turn the return line ball valve back to the on position.
8. It may be necessary to add some water into the reservoir to keep the water level above the return tee so that the solution does not foam.
9. The system must be run for 3 to 4 hours to mix the antifreeze and water in the reservoir. The fluid will not mix inside the loop.
10. Check the antifreeze level every so often to insure that the proper amount was added to the system (see antifreeze charging section).

Step 4: Final Pressurization of System

Once all of the air and debris has been removed, and the antifreeze has been added and mixed, the system is ready for final pressurization.

1. Turn one of the 3-way valves so that it is open to all 3 ports, the unit, loop, and flush port. Turn the other valve so it is only open to the loop and flush port (pressure is also applied to the hose kit in this arrangement).
2. Turn the flush cart pump on and allow the system to start circulating.
3. With the pump running, turn the return line ball valve to the off position on the flush cart, "dead heading" the pump.
4. There should be a maximum of 1" to 2" inches of drop in the water level in the reservoir. This only takes about 3-5 seconds.
5. Next, turn the supply line ball valve to the off position on the flush cart (isolates the flow center from the flush cart).
6. Now that the system is isolated from the reservoir the pump can be turned off. Do not open the main flush cart ball valves yet.
7. Connect the water supply back to the discharge line hose connection, and open the ball valve. Turn on the water supply and leave it on for 20 to 30 minutes. This will stretch the pipe properly to insure that the system will not have a "flat" loop during cooling operation.
8. Once the loop is pressured (recommended pressure on initial start up is 50 to 70 psi), turn the water supply off. Turn off the discharge line ball valve, and disconnect the water supply. Maximum pressure should never exceed 100 psi under any circumstance!
9. Turn the 3-way valves on the flow center back to the normal operation mode, which closes the flush port connections.
10. Open the ball valves on the flush cart to relieve pressure on the hoses. Disconnect the hoses from the flow center.

Note: Pressurized flow centers and Grundfos UP series pumps need a minimum of 3psi on the suction side of the pump to operate. Maximum operating pressure is 100 psi.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the summer months. In the cooling mode the heat pump is rejecting heat, which relaxes the pipe. This fluctuation is normal and needs to be considered when charging and pressuring the system initially. Typical operating pressures of an earth loop are 15 to 50 psi.

Note: Burping pump(s): On flow center initial start up, the pumps must be bled of air. Start the system and remove the bleed screw from the back side of the pump(s). This allows any trapped air to bleed out. It also floods the pump shaft, and keeps the pump(s) cool. Failure to do this could result in premature pump failure.

Typical Non-Pressurized Flow Center Installation

Standing column flow centers are designed to operate with no static pressure on the earth loop. The design is such that the column of water in the flow center is enough pressure to prime the pumps for proper system operation and pump reliability. The flow center does have a cap/seal, so it is still a closed system, where the fluid will not evaporate. If the earth loop header is external, the loop system will still need to be flushed with a purge cart. The non-pressurized flow center needs to be isolated from the flush cart during flushing because the flow center is not designed to handle pressure. Since this is a non-pressurized system, the interior piping can incorporate all the above-mentioned pipe material options (see interior piping), including PVC. The flow center can be mounted to the wall with the included bracket or mounted on the floor as long as it is properly supported.

Flushing the Interior Piping (Non-Pressurized)

Do not use the flush cart to purge the interior piping and flow center in a non-pressurized system. Once the loop has been flushed the ball valves may be opened above the flush ports. Take a garden hose from the flush port connected to the water out to the loop pipe, and run the other end of the hose into the top of the canister. Fill the canister with water and turn the pumps on. Continue to fill the canister until the water level stays above the dip tube. Once filling is complete, remove the hose and close the flush port. Turn the system on. Any air that may still be in the system will burp itself out of the top of the canister. Leave the top open for the first 1/2 hour of run time to ensure that all of the air is bled out. Tighten the cap on the flow center to complete the flushing and filling procedure (hand tighten only -- do not use a wrench).

Section 6: Unit Piping Installation

Antifreeze Overview

In areas where minimum entering source temperatures drop below 40°F, or where piping will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze. However, local and state/provincial codes supersede any instructions in this document. In addition, the system needs antifreeze to protect the braze plate heat exchanger from freezing and rupturing. Freeze protection should be maintained to 15°F below the lowest expected entering loop temperature. For example, if 30°F is the minimum expected entering loop temperature, the leaving source temperature could be 22 to 25°F. Freeze protection should be set at 15°F (30-15 = 15°F). To determine antifreeze requirements, calculate how much volume the system holds. Then, calculate how much antifreeze will be needed by determining the percentage of antifreeze required for proper freeze protection. **See Tables 3a and 3b for volumes and percentages.** The freeze protection should be checked during installation using the proper hydrometer to measure the specific gravity and freeze protection level of the solution.

Antifreeze Characteristics

Selection of the antifreeze solution for closed loop systems require the consideration of many important factors, which have long-term implications on the performance and life of the equipment. Each area of concern leads to a different "best choice" of antifreeze. **There is no "perfect" antifreeze.** Some of the factors to consider are as follows (Brine = antifreeze solution including water):

Safety: The toxicity and flammability of the brine (especially in a pure form).

Cost: Prices vary widely.

Thermal Performance: The heat transfer and viscosity effect of the brine.

Corrosiveness: The brine must be compatible with the system materials.

Stability: Will the brine require periodic change out or maintenance?

Convenience: Is the antifreeze available and easy to transport and install?

Codes: Will the brine meet local and state/provincial codes?

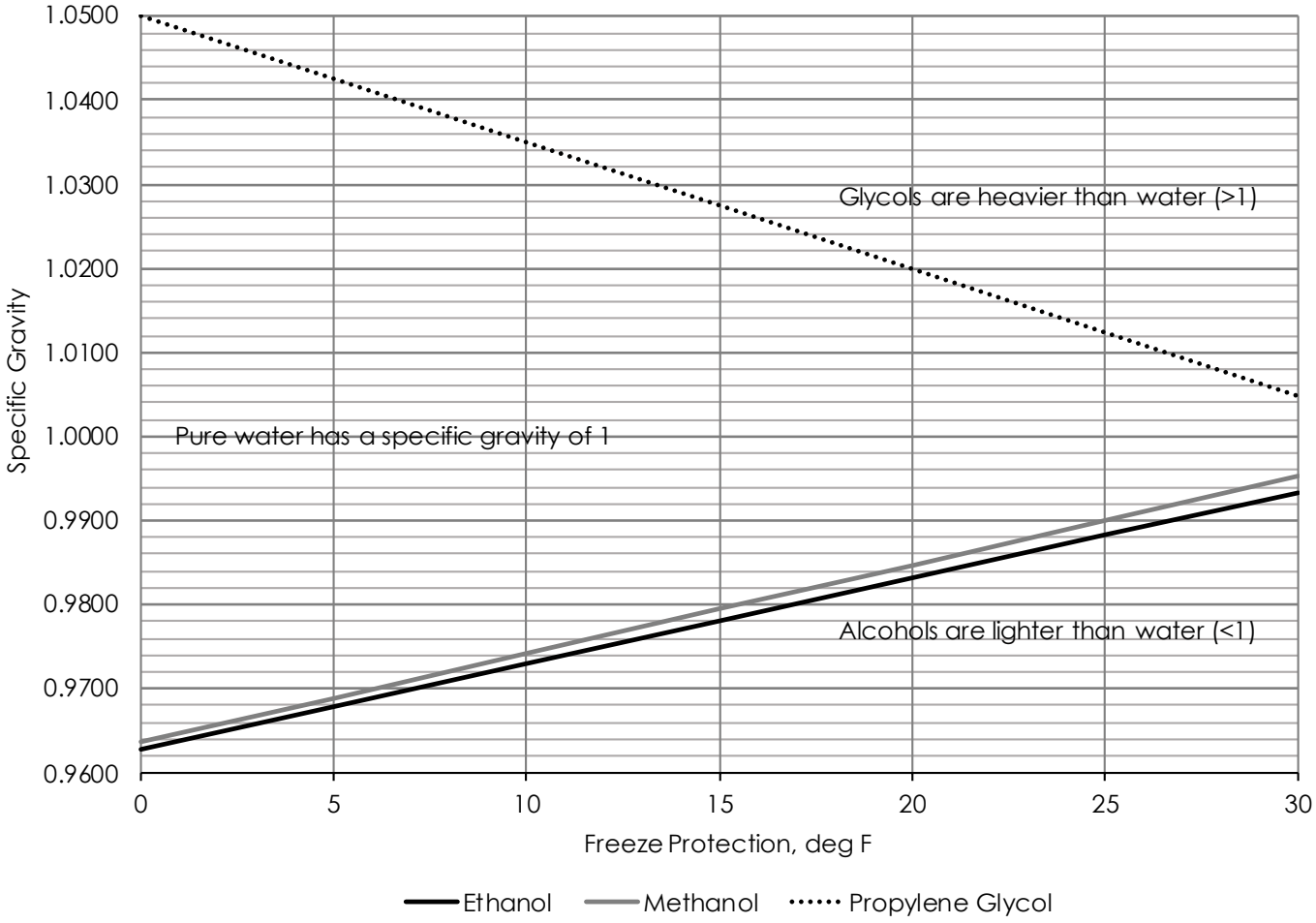
The following are some general observations about the types of brines presently being used:

Methanol: Wood grain alcohol that is considered toxic in pure form. It has good heat transfer, low viscosity, is non-corrosive, and is mid to low price. The biggest down side is that it is flammable in concentrations greater than 25%.

Ethanol: Grain alcohol, which by the ATF (Alcohol, Tobacco, Firearms) department of the U.S. government, is required to be denatured and rendered unfit to drink. It has good heat transfer, mid to high price, is non-corrosive, non-toxic even in its pure form, and has medium viscosity. It also is flammable with concentrations greater than 25%. Note that the brand of ethanol is very important. Make sure it has been formulated for the geothermal industry. Some of the denaturants are not compatible with HDPE pipe (for example, solutions denatured with gasoline).

Propylene Glycol: Non-toxic, non-corrosive, mid to high price, poor heat transfer in high concentrations, and potential for high viscosity when cold (in high concentrations). It has also been known to form a "slime-type" coating inside the pipe when inhibitors are not used. Do not use food grade glycol, since it does not include inhibitors. A 25% to 30% brine solution is a minimum concentration for required inhibitors, depending upon brand of glycol. If using a lower concentration (e.g. 20% provides 19°F freeze protection), additional inhibitors must be added. Note that some states/provinces have toxicity requirements that must be verified based upon the chemical composition of the inhibitors.

Figure #7: Antifreeze Specific Gravity



Notes:

1. Consult with your representative or distributor if you have any questions regarding antifreeze selection or use.
2. Some antifreeze suppliers and manufacturers recommend the use of either de-ionized or distilled water with their products. Some brands are designed to work with tap water. Consult the antifreeze manufacturer's technical data.

⚠ CAUTION ⚠

Use extreme care when opening, pouring, and mixing flammable antifreeze solutions. Remote flames or electrical sparks can ignite undiluted antifreezes and vapors. Use only in a well ventilated area. Do not smoke when handling flammable solutions. Failure to observe safety precautions may result in fire, injury, or death. Never work with 100% alcohol solutions.

Section 6: Unit Piping Installation

Antifreeze Charging

Calculate the total amount of pipe in the system and use **(Table #3a)** to calculate the amount of volume for each specific section of the system. Add the entire volume together, and multiply that volume by the proper antifreeze percentage needed **(Table #3b)** for the freeze protection required in your area. Then, double check calculations during installation with the proper hydrometer and specific gravity chart (Figure 7) to determine if the correct amount of antifreeze was added.

Table #3a: Pipe Fluid Volume

Type	Size	Volume Per 100ft US Gallons	Type	Size	Volume Per 100ft US Gallons
Copper	1" CTS	4.1	HDPE	.75" SDR11	3.0
Copper	1.25" CTS	6.4	HDPE	1" SDR11	4.7
Copper	1.5" CTS	9.2	HDPE	1.25" SDR11	7.5
			HDPE	1.5" SDR11	9.8
			HDPE	2" SDR11	15.4

Additional component volumes:
Unit coaxial heat exchanger = 1 Gallon
Flush Cart = 8-10 Gallons
10' of 1" Rubber Hose = 0.4 Gallons

Table #3b: Antifreeze Percentages by Volume

Type of Antifreeze	Minimum Temperature for Freeze Protection			
	10°F (-12.2°C)	15°F (-9.4°C)	20°F (-6.7°C)	25°F (-3.9°C)
ProCool (Ethanol)	26%	23%	18%	13%
Methanol	21%	17%	13%	5%
Propylene Glycol*	30%	25%	20%	13%
Heat Transfer Fluid (HTF)	Mix according to manufacturer's directions on container label			

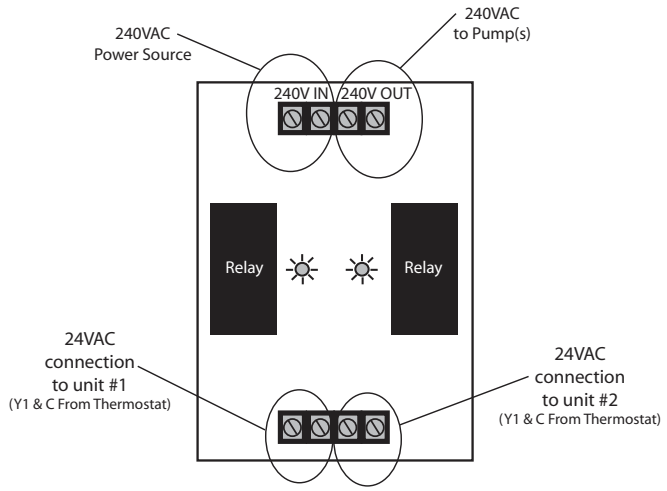
Antifreeze solutions are shown in pure form - not premixed
HTF is a premixed Methanol solution
*Concentrations below 25-30% (consult manufacturer) typically require additional inhibitors.

Section 6: Unit Piping Installation

APSMA Pump Sharing Module

The pump sharing module, part number APSMA, is designed to allow two units to share one flow center. With the APSMA module, either unit can energize the pump(s). Connect the units and flow center as shown in Figure 16, below. Figure 17 includes a schematic of the board. The module must be mounted in a NEMA enclosure or inside the unit control box. Local code supersedes any recommendations in this document.

Figure 16: APSMA Module Layout



Single Shared Flow Center, Dual Unit Piping Example

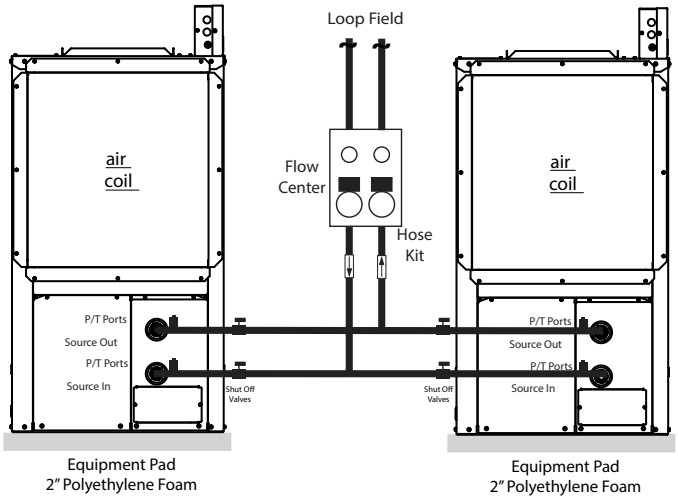
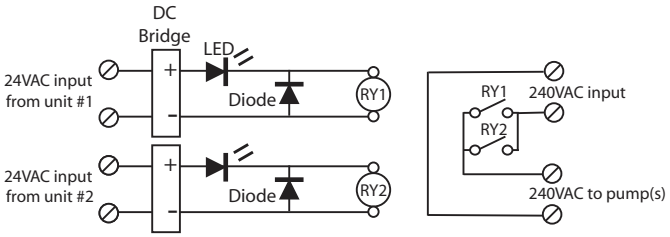
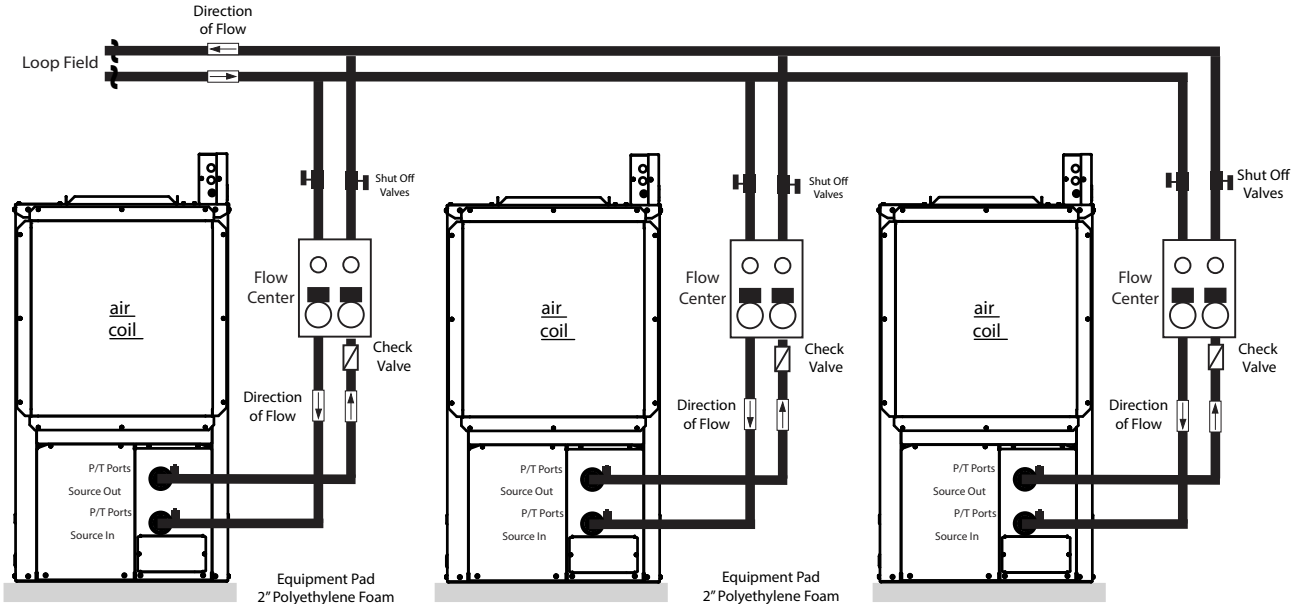


Figure 17: APSMA Module Wiring Schematic



Single Shared Loop Field, Individual Flow Center and Unit Piping Example



Section 6: Unit Piping Installation

Open Loop Piping and Connections

Placement of the components for an open loop system are important when considering water quality and long term maintenance. The water solenoid valve should always be placed on the outlet of the heat pump, which will keep the heat exchanger under pressure when the unit is not operating. If the heat exchanger is under pressure, minerals will stay in suspension. Water solenoid valves are also designed to close against the pressure, not with the pressure. Otherwise, they tend to be noisy when closing.

A flow regulator should be placed after the water solenoid valve. Always check the product specification catalog for proper flow rate. A calculation must be made to determine the flow rate, so that the leaving water temperature does not have the possibility of freezing.

Other necessary components include a strainer, boiler drains for heat exchanger flushing, P/T ports and ball valves. Ball valves allow the water to be shut off for service, and also help when velocity noise is noticeable through the flow regulator.

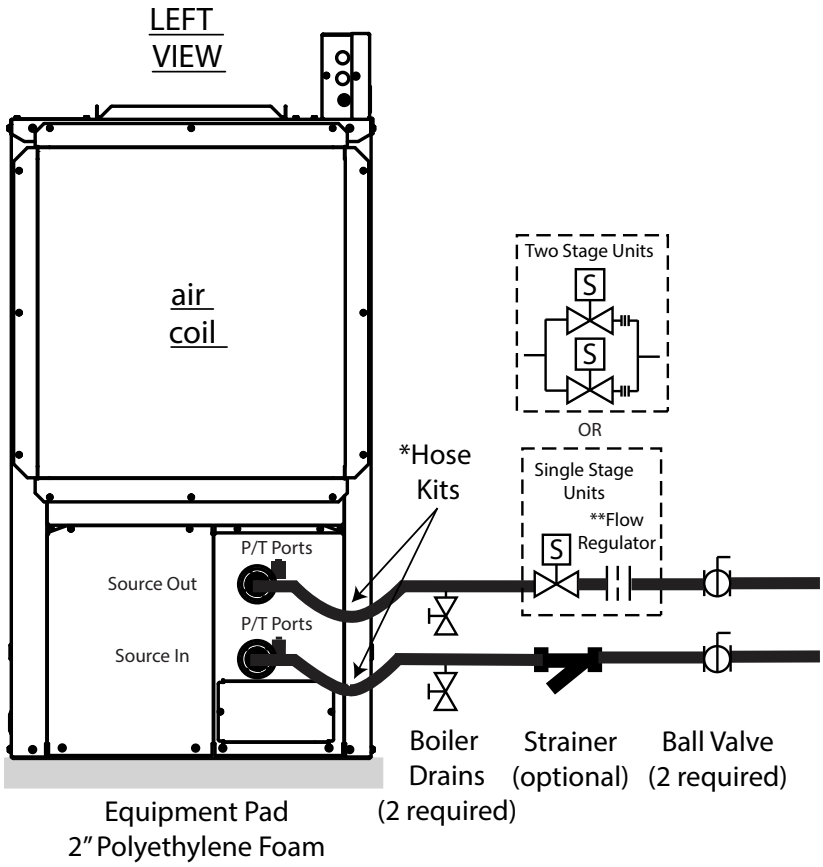
Spreading some of the pressure drop across the ball valves will lessen the velocity noise. Always double check flow rate at the P/T ports to make sure the ball valve adjustments have not lowered water flow too much, and essentially taken the flow regulator out of the equation. It's a good idea to remove the ball valve handles once the system is completed to avoid nuisance service calls.

Hose kits are optional, but make for an easier installation, since the P/T ports and connections are included. The hose also helps to isolate the heat pump from the piping system.

Since the heat pump can operate at lower waterflow on first stage, two stage units typically include two water solenoid valves to save water. The flow regulators should be sized so that when one valve is open the unit operates at first stage flow rate, and when both valves are open, the unit operates at full load flow rate. For example, a 4 ton unit needs approximately 4 GPM on first stage, and approximately 7 GPM at full load. The flow regulator after the first valve should be 4 GPM, and the flow regulator after the second valve should be 3 GPM. When both valves are open, the unit will operate at 7 GPM.

The drawings show typical components, wiring and connection points. Electrical connections are found at the control box terminal strips.

Figure 5: Open Loop Piping Example

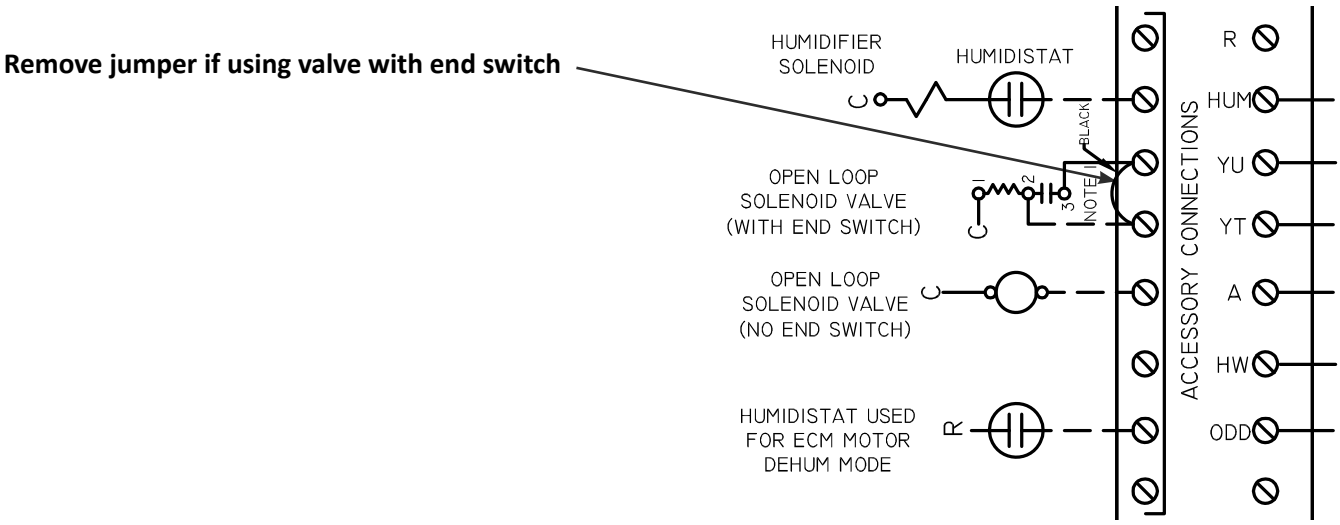


Hose kit is used for piping isolation, and includes fittings for P/T ports.
*See product specifications for flow rates.

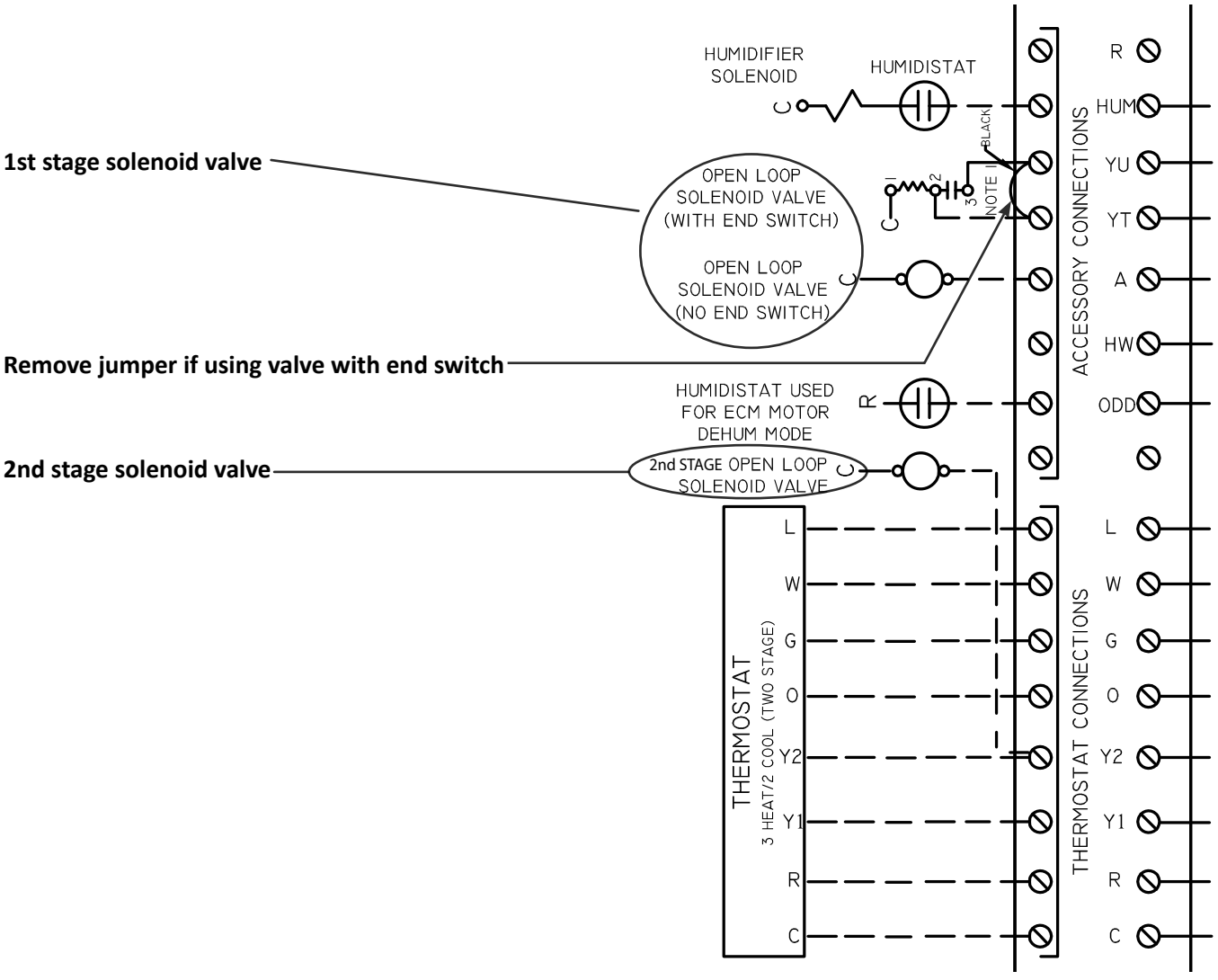
Note: All YT models are two-stage units.

Two-Stage solenoid example is optional for all sizes. It is not recommended for 3 ton and smaller. Use single solenoid and flow regulator.

Open Loop Single Stage Solenoid Connections



Open Loop Two-Stage Solenoid Connections



Section 7: Desuperheater Installation

Desuperheater Installation

Units that ship with the desuperheater function also ship with a connection kit. Installation of the kit and examples of connection to the potable water system is described in the following steps and drawings.

Notes:

- All enertech Desuperheater water to refrigerant heat exchangers are double walled and vented for use in potable water systems.
- ALL Enertech Global products meet the requirements of NSF-372 (Lead Free).
- Copper is the only approved material for desuperheater piping.
- Units that are shipped with a desuperheater do not have the desuperheater pump wires connected to the electrical circuit, to prevent accidentally running the pump while dry. Pump has to be connected to the electric circuit (master contactor) when the lines from the water heater are installed & air is removed.

Plumbing Installation

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

TIP: Measure the distance above the floor or shelf that the water heater is sitting on, to where the drain valve is located. This distance must be greater than one-half the width of the tee you're about to install, or you won't be able to thread the tee on to the water heater.

1. Disconnect electricity to water heater.
2. Turn off water supply to water heater.
3. Drain water heater. Open pressure relief valve.
4. Remove drain valve and fitting from water heater.
5. Thread the ¾" MPT x 3-1/2" nipple into the water heater drain port. Use Teflon tape, or pipe dope on threads.
6. Thread the center port of the ¾" brass tee to the other end of the nipple.
7. Thread one of the copper adaptors into the end of the tee closest to the heat pump.
8. Thread the drain valve into the other end of the nipple.
9. Above the water heater, cut the incoming cold water line. Remove a section of that line to enable the placement of the copper tee.
10. Insert the copper tee in the cold water line.
11. Thread the remaining two ½"SWT x ¾"MPT copper adaptors into the ¾" FPT fittings on the heat pump, marked HWG IN and HWG OUT.
12. Run interconnecting ½" copper pipe from the HOT WATER OUT on the heat pump, to the copper adaptor located on the tee at the bottom of the water heater.
13. Run interconnecting ½" copper pipe from the HOT WATER IN on the heat pump, to the copper tee in the cold water line.
14. Install an air vent fitting at the highest point of the line from step 13 (assuming it's the higher of the two lines from the heat pump to the water heater).
15. Shut off the valve installed in the desuperheater line close to the tee in the cold water line. Open the air vent and all shut off valves installed in the "hot water out".
16. Turn the water supply to the water heater on. Fill water heater. Open highest hot water faucet to purge air from tank and piping.
17. Flush the interconnecting lines, and check for leaks. Make sure air vent is shutoff when water begins to drip steadily from the vent.
18. Loosen the screw on the end of the desuperheater pump to purge the air from the pump's rotor housing. A steady drip of water will indicate the air is removed. Tighten the screw and the pump can be connected to the contactor or terminal block.
19. Install 3/8" closed cell insulation on the lines connecting the heat pump to the water heater.
20. Reconnect electricity to water heater.

Section 7: Desuperheater Installation

Contents of the Desuperheater Fitting Kit:

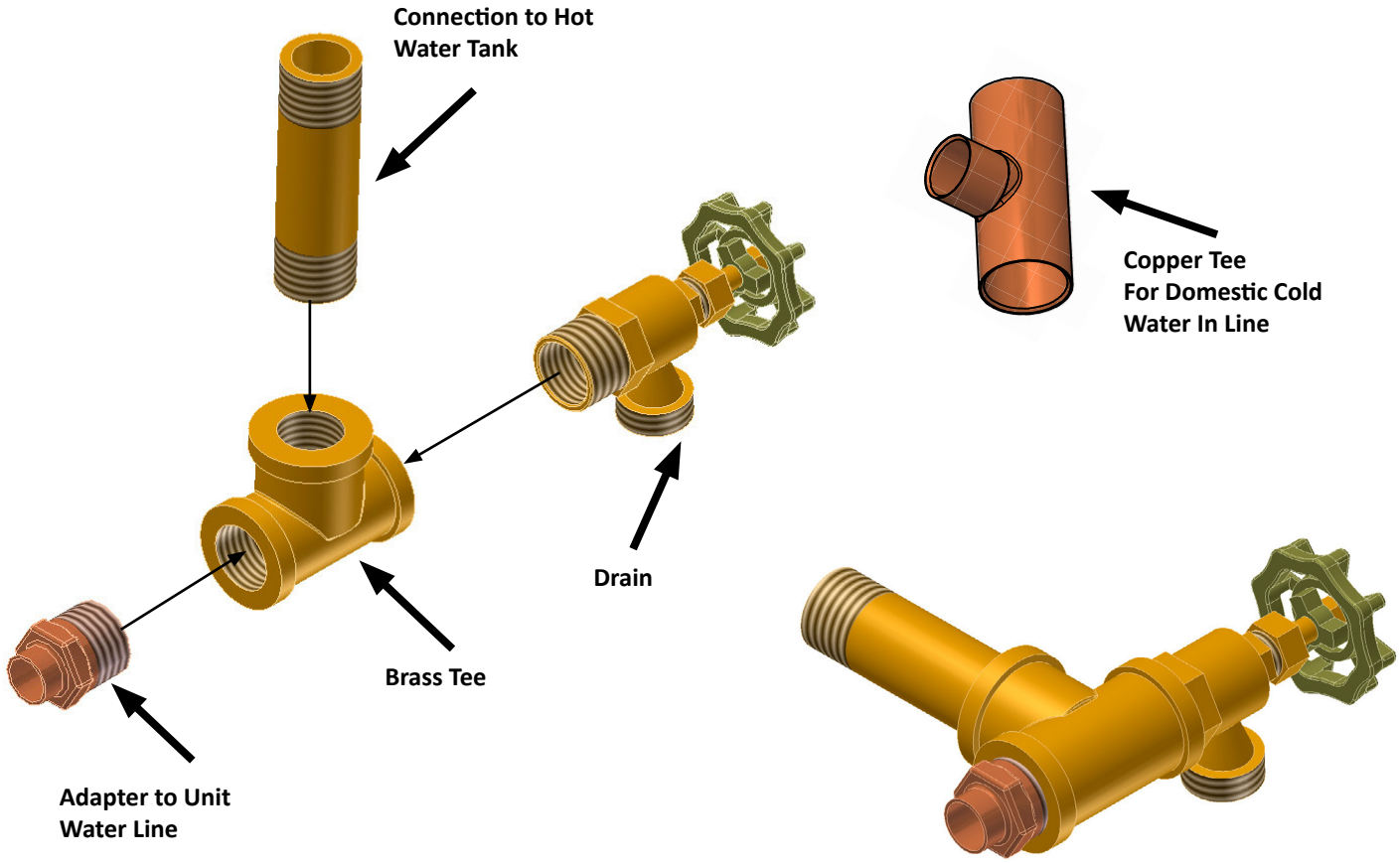
- (1) p/n 20D052-01NN, Installation Instructions
- (1) p/n 33P211-01BN, 3/4”x 3/4”x 3/4” FPT Brass Tee
- (1) p/n 33P210-01NN, ¾” Boiler Drain Valve
- (1) p/n 11080005001, ¾” MPT x 3-1/2” Brass Nipple
- (3) p/n 11080006001, ½” SWT x ¾” MPT Copper Adaptor
- (1) p/n 11080007001, ¾” x ¾” x ½” SWT Copper Tee

⚠ WARNING ⚠

TO AVOID SERIOUS INJURY, IT IS RECOMMENDED THAT AN ANTI-SCALD MIXING VALVE IS INSTALLED ON THE HOT WATER SUPPLY LINE INTO THE HOME. EVEN THOUGH HOT WATER TANK TEMPERATURES COULD APPEAR TO BE SET AT LOWER LEVELS, HIGH TEMPERATURE WATER FROM THE DESUPERHEATER COULD RAISE TANK TEMPERATURES TO UNSAFE LEVELS.

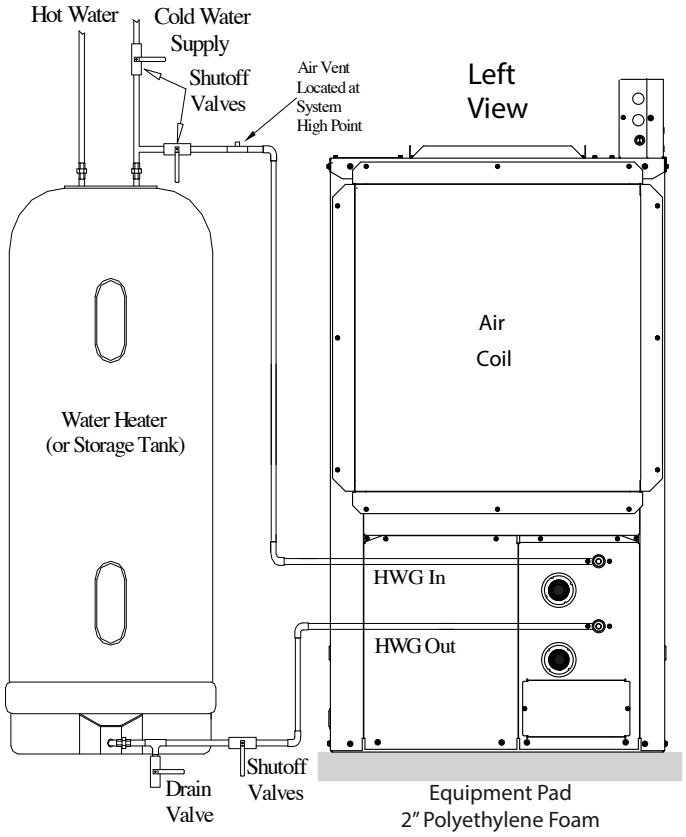
Water Heater Connection Kit Assembly for Bottom of Water Heater

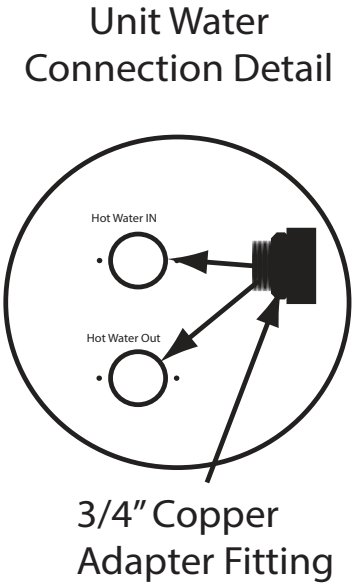
Note: Drawing shown vertically for detail. Fitting installs horizontally into hot water tank.



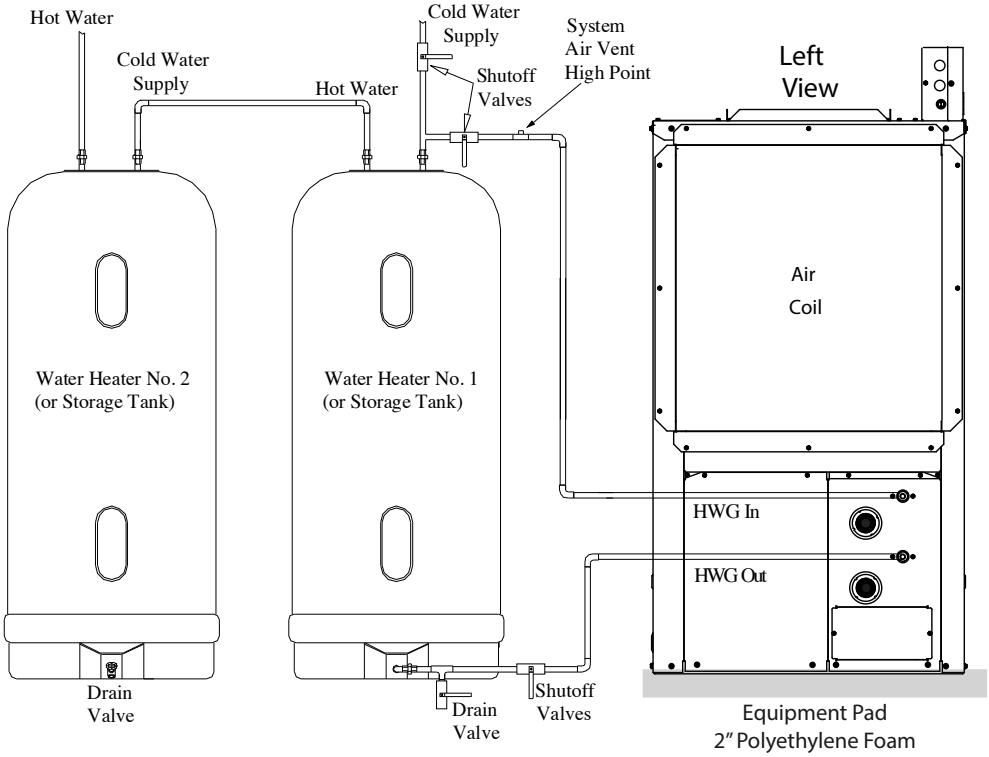
Section 7: Desuperheater Installation

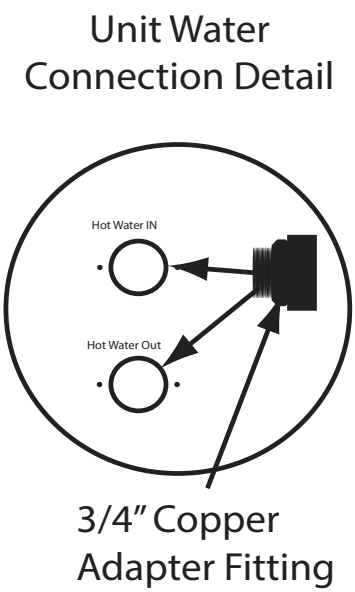
Desuperheater Installation with Single Water Heater





Desuperheater Installation with Preheat Tank

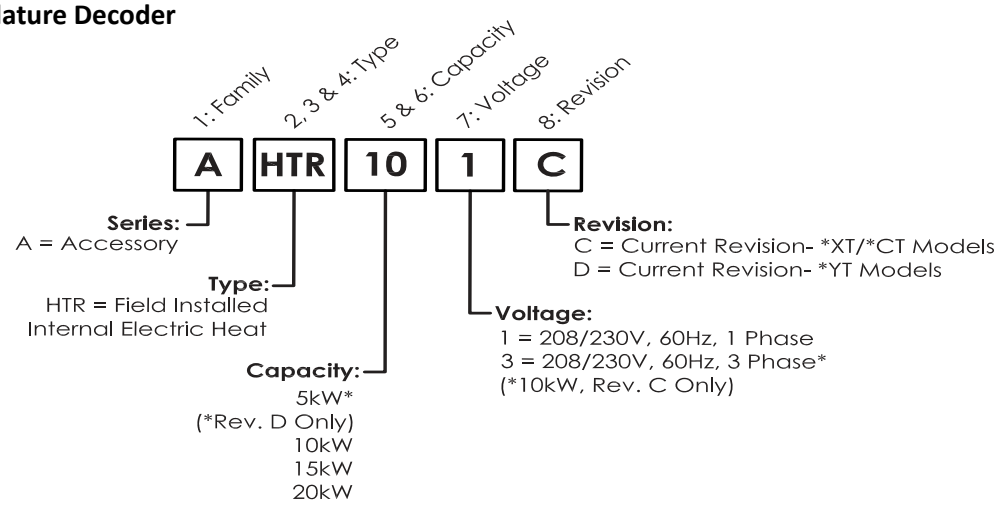




Representative drawing only, some models may vary in appearance.

Section 8: Auxiliary Heater Installation

Auxiliary Heater Nomenclature Decoder



Safety Labeling and Signal Words

DANGER, WARNING, CAUTION, and Note
The signal words **Danger, Warning, Caution,** and **Note** are used to identify levels of hazard seriousness. The signal word **Danger** is only used on product labels to signify an immediate hazard. The signal words **Warning, Caution,** and **Note** will be used on product labels and throughout this manual and other manuals that may apply to this product.

"NOTICE" Notification of installation, operation or maintenance information which is important, but which is NOT hazard-related.

"CAUTION" Indicates a potentially hazardous situation or an unsafe practice which, if not avoided, COULD result in minor or moderate injury, product or property damage.

"WARNING" Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

"DANGER" Indicates an immediate hazardous situation which, if not avoided, WILL result in death or serious injury.

"Note:" Used to highlight suggestions which will result in enhanced installation, reliability, or operation.

Signal Words in Manuals

The signal word WARNING is used throughout this manual in the following manner:

⚠ WARNING ⚠

The signal word **CAUTION** is used throughout this manual in the following manner:

⚠ CAUTION ⚠

Signal Words on Product Labeling
Signal words are used in combination with colors and/or on product labels.

⚠ 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 PROTECTIVE CLOTHING AND GLOVES WHEN HANDLING PARTS.

Section 8: Auxiliary Heater Installation

Introduction

The AHTR Revision D electric heaters are designed specifically for the Enertech YT Series Geothermal Heat Pump Units. Good performance depends on proper application and correct installation. The information contained within this manual is intended for use by a qualified service technician familiar with safety procedures and equipped with the proper tools and test instruments.

⚠ WARNING ⚠

ELECTRICAL SHOCK HAZARD
FAILURE TO FOLLOW THIS WARNING COULD RESULT IN PERSONAL INJURY, PROPERTY DAMAGE AND/OR DEATH. INSTALLATION OR REPAIRS MADE BY UNQUALIFIED PERSONS CAN RESULT IN HAZARDS TO YOU AND OTHERS.

INSTALLATION MUST CONFORM WITH LOCAL BUILDING CODES OR, IN THE ABSENCE OF LOCAL CODES, WITH NATIONAL ELECTRICAL CODE ANSI/NFPA 70-2014 OR CURRENT EDITION.

Inspection

Upon receipt of this geothermal accessory, carefully check the shipment against the packing slip and the freight company bill of lading. Verify that all units and packages have been received. Inspect the packaging of each unit for damages. Insure that the carrier makes proper notation of all damages and shortage on all bill of lading papers. Concealed damage should be reported to the freight company within 15 days. If not filled within 15 days, the freight company can deny all claims.

Note: Notify the Enertech Global, LLC shipping department of all damages within 15 days. It is the responsibility of the purchaser to file all necessary claims with the freight company.

Unit Protection

Protect units from damage and contamination due to plastering (spraying), painting and all other foreign materials that may be used at the job site. Keep all units covered on the job site with either the original packaging or equivalent protective covering. Cap or recap unit connections and all piping until unit is installed. Precautions must be taken to avoid physical damage and contamination which may prevent proper start-up and may result in costly equipment repair.

Overview

The AHTR electric heater kits are designed and approved for use with specific YT unit models. Table 1 lists all of the possible combinations.

Table 1: Heater Compatibility

Electric Heat Model	Description	YT
AHTR051D	5kW, 60Hz, 1 Phase, w/ Circuit Breaker	024
AHTR101D	10kW, 60Hz, 1 Phase, w/ Circuit Breaker	024-072
AHTR151D	15kW, 60Hz, 1 Phase, w/ Circuit Breaker & Single Point Connection	036-072
AHTR201D	20kW, 60Hz, 1 Phase, w/ Circuit Breaker & Single Point Connection	060-072

Note: All heaters are only approved for use on single phase, 208/230V units. The 15kW and 20kW heaters come with a single point connection jumper bar assembly already installed.

Components

Each AHTR electric heat kit should contain the following items:

- (QTY: 1) Electric Heat Module Assembly
- (QTY: 1) Filler plate (Only in AHTR101D)
- (QTY: 4) #10-16 x ½ Mounting Screws (Only in AHTR101D)

Section 8: Auxiliary Heater Installation

Mounting the Heater

1. Shut OFF electrical power at unit disconnect switch or service panel.
2. Remove the upper front panel from the unit. To do this, first remove the center insert panel by placing a flat blade screwdriver in the gap on one side and gently pulling outward.
3. Locate the blank filler plate in the plenum, above the blower wheel. Remove the (4) screws holding down the plate. Remove the plate and set aside the (4) screws for mounting the heater. See Figure 1.

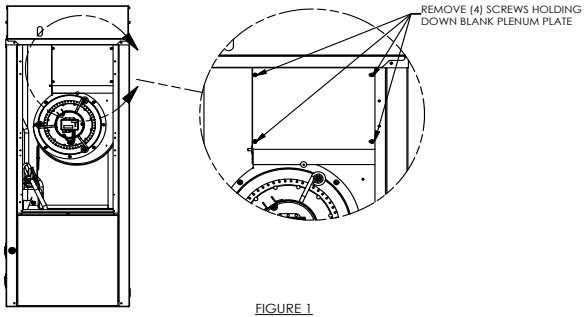


FIGURE 1

4. Remove the cover from the heater, in order to have access to the (4) mounting holes.

Notice: If installing a 10kW heater (AHTR101D) on a YT036, YT048, YT060, or YT072 model, skip to Step #6.

5. Insert the heater into the plenum opening. Exercise caution in order to prevent damage to the heater elements. The heater elements should be over the blower wheel opening. Secure the heater in place with the (4) screws that were removed from the plenum filler plate. See Figure 2.

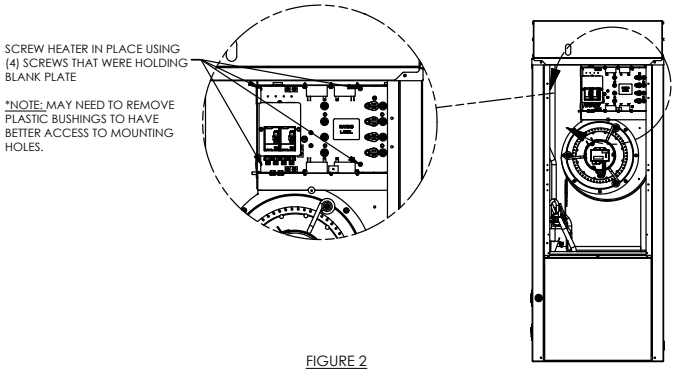


FIGURE 2

Note: The plastic bushings on the side of the heater may need to be removed to provide better access to the mounting holes in the back of the heater. However, they must be replaced once the heater has been properly mounted.

6. If installing a 10kW heater on a YT036, YT048, YT060, or YT072 model, first install the filler plate on the plenum. There are (4) #10-16 x ½ screws provided in the kit to mount this filler plate. See Figure 3.

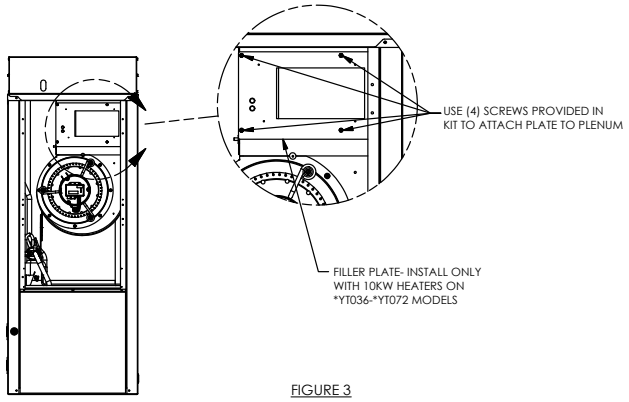


FIGURE 3

7. Insert the heater into the opening of the filler plate that was just installed, and secure the electric heater in place with the (4) screws that were removed from the plenum filler plate. See Figure 4.

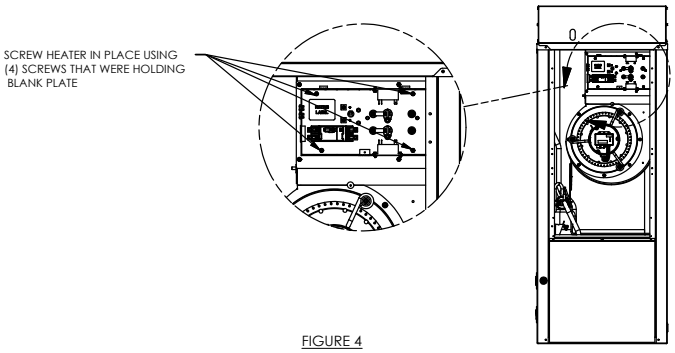


FIGURE 4

Notice: Installation of Heater in Right Hand Return Configuration (AHTR151D and AHTR201D only):

If the unit is going to be installed as a right hand return unit, the circuit breakers (along with the single point connection jumper bar assembly) will need to be removed and rotated 180 degrees, so the OFF position of the circuit breakers will be pointed DOWN when the heater is installed. This is an NEC requirement. Do one breaker at a time to make sure the wires are reconnected properly. Loosen terminal screws, and gently pull wires back from breaker. Remove the screws securing the breaker to the heater, and rotate 180 degrees.

Section 8: Auxiliary Heater Installation

Note: Make sure when the breakers and single point connection jumper bar assembly are being rotated, the screw holes circled in figure 5B are utilized. If the original holes are used the screws will interfere with the plenum. Screw breakers back in place, and reconnect the wires to the breakers, using a torque of 35 inch pounds. The blank plate and (2) screws, over the opening in the cover for the circuit breakers, will also need to be rotated and re-installed. See figure 5A.

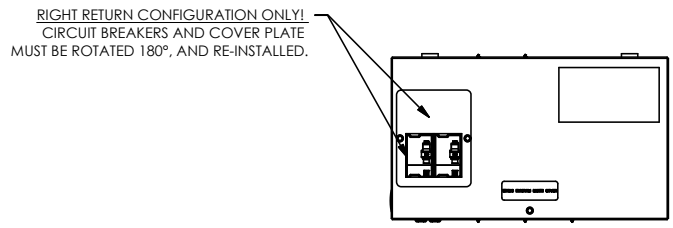


FIGURE 5A

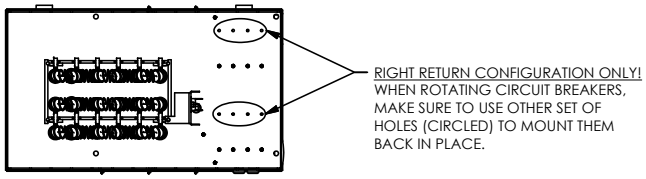


FIGURE 5B

Low Voltage Wiring

8. Connect the 6-pin low voltage, heater wiring harness connector to the bottom of the control box, from inside the cabinet. Some of the insulation on the bottom of the control box will need to be trimmed away in order to expose the cut-out for the connector. The mating half of the harness is already installed in the control box. A perfect match and positive connection must be made between the plug and receptacle.

Power Supply Wiring

9. Remove the cap plug in the top of the unit, labeled 'AUX HEAT POWER SUPPLY.' Route the power supply wires for the heater through this hole, down to the side of the electric heater control box. See Figure 6.

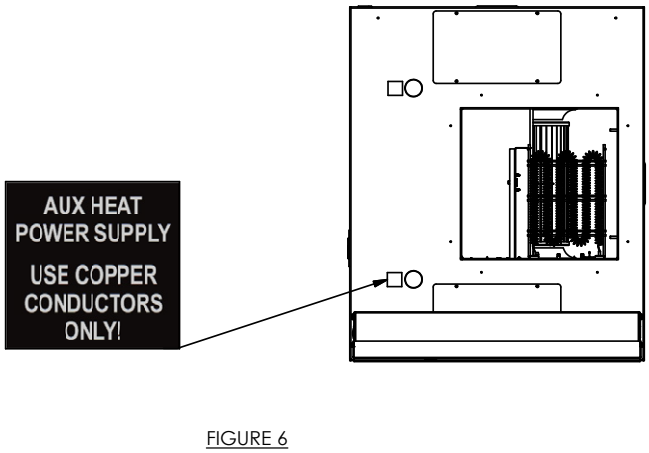


FIGURE 6

10. Remove the cap plug on the side of the electric heat control box, and pull the supply wires through.

Note: U.S. CUSTOMERS ONLY!! When installing a 15kW or 20kW heater in the U.S., the single point connection bar assembly may be removed. In this case, refer to the second Electrical Data Table in Section 5 for appropriate wire gauge and maximum size for the over current protection device.

11. Connect supply voltage wires to the line side of the circuit breakers/single point connection jumper bar assembly, and connect the ground wire to the open ground lug. See wiring diagram label, or wiring schematics in Section 6, to verify placement of all connections.

Caution: All line voltage connections MUST be made with copper wire. The power supply wiring MUST have overcurrent protection. This can either be fuses or circuit breakers. The maximum size for the overcurrent protection device is shown in the column labeled MOCP in the Electrical Data Table in Section 5.

12. Permanently ground the electric heater in accordance with local codes and ordinances and in the United States, with the current edition of the National Electrical Code. Use a copper conductor of the appropriate size from the electric heat ground lug, to a grounding lug on the circuit breaker panel.

Section 8: Auxiliary Heater Installation

Air Flow

13. Airflow requirements are different between models. Please refer to the unit Installation Instructions for airflow set-up information.
    Temperature Rise Check

14. To determine temperature rise, measure the temperature difference between the supply and return air temperatures.

Note: The maximum outlet air temperature for all models is 200°F (93.3°C)

Electrical Data

Technical Data Single Phase w/ Circuit Breaker																			
Heater Model	Supply Circuit Number	Heat kW		Heater kW Per Circuit		FLA Total AMPS		MCA- Minimum Circuit Ampacity		MOCP Maximum Overcurrent Protective Device (AMPS) NEC 240.4(B)		Recommended							
												Branch Circuit Conductor 75°C Copper NEC 310.15(B)(16), Ch. 9 Table 9					Ground Wire NEC 250.122		
												# of Wires	Min Wire Size (AWG)		Max Length (ft)		Min Wire Size (AWG)		
		240	208	240	208	240	208	240	208	240	208		240	208	240	208	240	208	
AHTR051D	Single	5	3.75	2.5	1.875	20.8	18.0	26.0	22.5	30	25	2	10	12	144	87	10		
AHTR101D	Single	10	7.5	5	3.75	41.7	36.1	52.1	45.1	60	50	2	6	8	176	111	8	10	
				5	3.75														
AHTR151D*	Single	15	11.25	5	3.75	62.5	54.1	78.1	67.6	80	70	2	4	4	186	186	8		
				10	7.50														
AHTR201D*	Single	20	15	10	7.50	83.3	72.1	104.2	90.1	110	100	2	2	3	216	173	6	8	
				10	7.50														

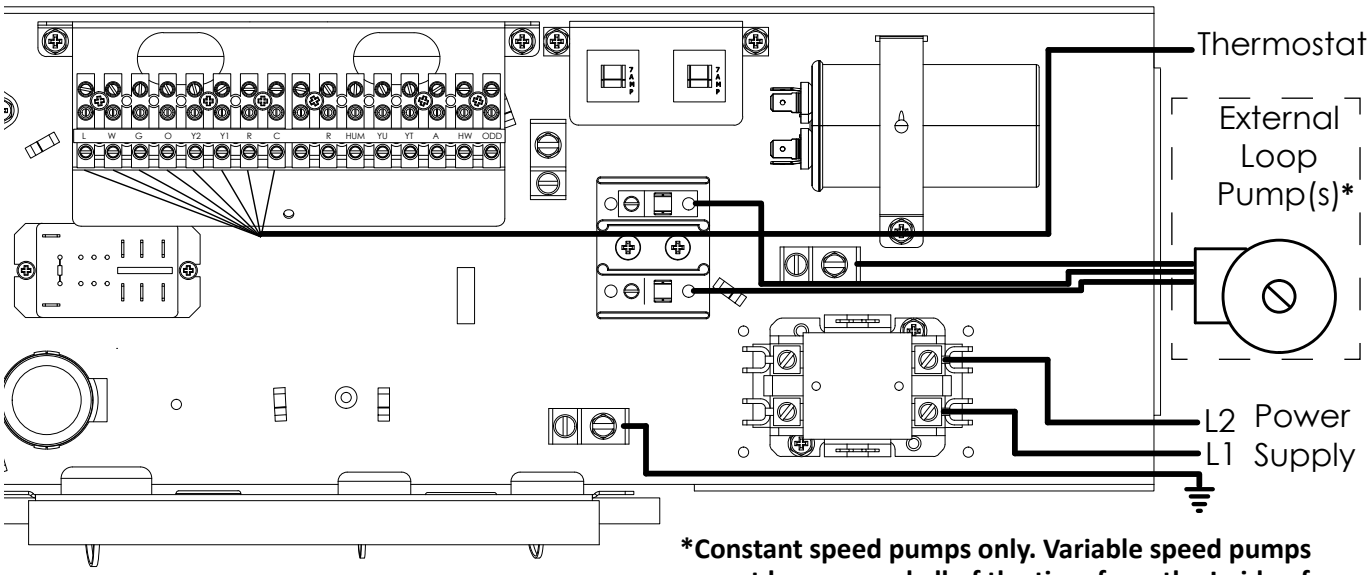
*Single Point Connection

Technical Data (US Customers ONLY!!) Single Phase w/ Circuit Breaker- Single Point Connection Removed																			
Heater Model	Supply Circuit Number	Heat kW		Heater kW Per Circuit		FLA Total AMPS		MCA- Minimum Circuit Ampacity		MOCP Maximum Overcurrent Protective Device (AMPS) NEC 240.4(B)		Recommended							
												Branch Circuit Conductor 75°C Copper NEC 310.15(B)(16), Ch. 9 Table 9					Ground Wire NEC 250.122		
												# of Wires	Min Wire Size (AWG)		Max Length (ft)		Min Wire Size (AWG)		
		240	208	240	208	240	208	240	208	240	208		240	208	240	208	240	208	
AHTR151D	L1/L2	15	11.25	5	3.75	20.8	18.0	26.0	22.5	30	25	2	10	12	144	87	10		
	L3/L4			10	7.50	41.7	36.1	52.1	45.1	60	50	2	6	8	176	111	10		
AHTR201D	L1/L2	20	15	10	7.50	41.7	36.1	52.1	45.1	60	50	2	6	8	176	111	10		
	L3/L4			10	7.50	41.7	36.1	52.1	45.1	60	50	2	6	8	176	111	10		

Note: Supply voltage, amperage, fuse, and disconnect switch sizes MUST conform to all technical specifications in this manual and on the unit rating plate.

Section 9: Electrical Data and Connections

High and Low Voltage Single Phase Connections



***Constant speed pumps only. Variable speed pumps must be powered all of the time from the L side of the contactor.**

Notes:

- Drawings represent a typical installation using wiring input knockouts marked on the outside of the control box cover.
- National and local electrical codes must be followed during installation of this unit.
- Use caution to avoid damaging the wiring and components during installation.
- Wiring shall be routed to avoid contact with other connections and temperature sensitive components.
- Assure all connections are securely fastened and routed to their proper locations.
- Install the thermostat per the manufacturer's instructions provided with that unit.

Section 10: Controls

Microprocessor Features and Operations

Enertech Global geothermal heat pump controls provide a unique modular approach for controlling heat pump operation. The control system uses one, two, or three printed circuit boards, depending upon the features of a particular unit. This approach simplifies installation and troubleshooting, and eliminates features that are not applicable for some units.

A microprocessor-based printed circuit board controls the inputs to the unit as well as outputs for status mode, faults, and diagnostics. A status LED and LED(s) for each fault are provided for diagnostics. Water-to-air models may offer an ECM control board option providing field selectable airflow and dehumidification mode, plus an LED to indicate CFM (100 CFM per flash).

A removable low voltage terminal strip provides the necessary terminals for thermostat connections. Some models offer an additional removable terminal strip for accessory wiring connections.

Startup/Random Start

The unit will not operate until all the inputs and safety controls are checked for normal conditions. A ten to twenty second random start delay is added at power up and whenever a Y1 call is received. This avoids multiple units from being energized at the same time after power loss or other situations.

Short Cycle Protection (ASC)

A built-in five minute anti-short cycle (ASC) timer provides short cycle protection of the compressor.

Component Sequencing Delays

Components are sequenced and delayed for optimum space conditioning performance and to make any startup noise less noticeable. There is a short delay between the blower motor and the compressor start up.

Test Mode

The microprocessor control allows the technician to shorten timing delays for faster diagnostics by removing the TEST jumper located on the lockout board. It should be reinstalled for normal operation after testing. The status LED will not be illuminated during the TEST mode.

Water Solenoid Valve Connections

When provided, the YT & YU on the accessory terminal strip provides a field connection for a valve with an end switch, which is recommended. (The YT terminal can be used to power the solenoid valve and end switch. The YU terminal can be powered through the end switch and connects to the Y1 circuit of the unit controls - see wiring diagram). An accessory relay terminal, “A”, can be used for solenoid valves without an end switch. This terminal is energized 10 seconds before the compressor contactor. A valve without an end switch could cause a water hammer issue and is not recommended.

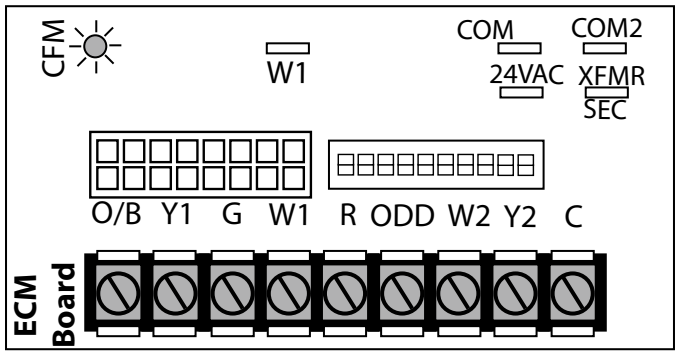
Humidifier/Dehumidification Connections

Connections for a humidistat are provided for some models, which automatically engage the fan when the humidistat contact closes. In addition, a field connection is provided at the terminal strip for external control of the On Demand Dehumidification (ODD) feature for the variable speed ECM fan motor, which automatically lowers the fan speed when the space humidity is higher than the set point. Either connection may be used with a thermostat that includes humidifier/ dehumidification outputs.

Airflow Monitor

A LED on the ECM fan control board flashes one time per 100 CFM when the unit’s fan is operating to indicate airflow.

ECM Board Layout



Section 10: Controls

Resistance Heat Control

The resistance heat control module contains the appropriate high-voltage control relays. Low voltage control signals from the lockout board energize the relays in the resistance heat module to engage backup resistance heat when necessary. The lockout board offers a pass through W1 (1st Stage) and a relay output for W2 (2nd Stage). See staging in sequence of operation section.

Electronic Condensate Overflow Protection

The control board utilizes an impedance sensing liquid sensor at the top of the drain pan. When water touches the sensor, CO fault occurs. If the fault is present for 30 continuous seconds, the lockout board indicates a condensate overflow fault has occurred.

Loop Pump Circuit Breakers

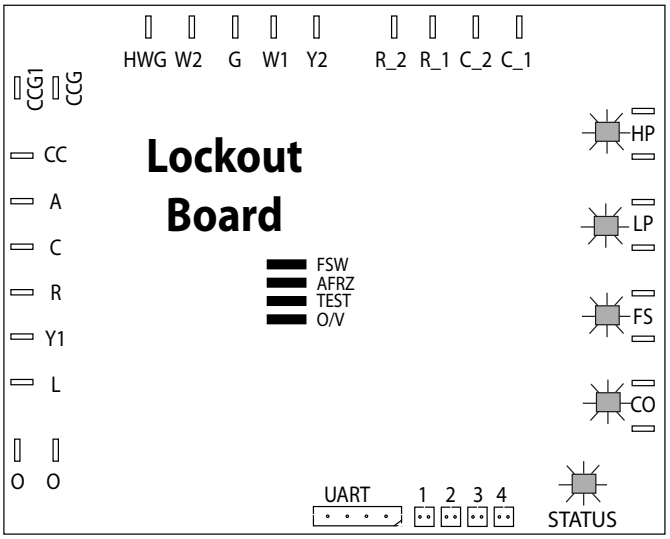
The loop pump(s) and HWG pump are protected by control box mounted circuit breakers for easy wiring of pumps during installation. Circuit breakers eliminate the need to replace fuses.

Safety Controls

The lockout board receives separate signals for high pressure, low pressure, low load heat exchanger freeze, source heat exchanger freeze, condensate overflow, and hot gas temperature limit faults. Upon a continuous 30-second measurement of all faults, except the high pressure fault, the compressor operation is suspended. The high pressure fault is immediate. The combination of LED(s) indicate each fault. Once the unit is locked out (see fault retry below), an output of 24VAC is energized on the “L” terminal for remote indication of a fault at the thermostat.

Low Pressure-LP: If the low pressure switch is open continuously for 30 seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. At startup, the low pressure switch is not monitored for 30 seconds to avoid nuisance faults. (If the low pressure switch is open before startup then the unit will not start upon receiving an Y1 call and will lock out instead.)

Lockout Board Layout



High Pressure-HP: If the high pressure switch opens, the compressor operation will be interrupted, and the control will go into fault retry mode. There is no delay between the time the switch opens and the board entering into fault retry mode. There is also no delay of switch monitoring at startup. (If the high pressure switch is open before startup then the unit will not start upon receiving an Y1 call and will lock out instead.)

Load Heat Exchanger Freeze-T1: When in cooling mode, if the heat exchanger temperature is lower than 30°F for 30 continuous seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. This sensor is located on the refrigerant line in between the heat exchanger and TXV (refrigerant inlet of heat exchanger in cooling mode).

Source Heat Exchanger Freeze (Flow Sensing)-T4: When in heating mode, if the heat exchanger is lower than setpoint for 30 continuous seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. The setpoint is 15°F for closed loop (A-FRZ jumper removed) and 30°F (A-FRZ jumper installed) for open loop. At startup, the flow sensor is not monitored for 30 seconds to avoid nuisance faults. This sensor is located on the refrigerant line in between the source heat exchanger and TXV (refrigerant inlet of heat exchanger in heating mode).

Condensate Overflow: If water touches the condensate overflow sensor for 30 continuous seconds, the compressor operation will be interrupted. The control will go into fault retry mode. There is no delay of switch monitoring at startup.

Hot Gas Line Temperature limit (T2>220°F): When T2 is >220°F for 30 continuous seconds, the compressor operation will be interrupted. The control will go into fault retry mode.

Temperature Sensor Operating Range

Sensors' Name	Range (°F)
T1	10 – 220
T2	20 – 257
T3	20 – 220
T4	10 – 220

Temperature vs Resistance Characteristics of Sensor

Temp. (°F)	Rst. (KΩ)	Temp. (°F)	Rst. (KΩ)
10	46.95	130	3.60
15	41.39	200	1.16
20	36.50	220	0.87
30	28.61	250	0.59
77	10.00	257	0.54

Over/Under Voltage Protection

The lockout board protects the compressor from operating when an over/under voltage condition exists. The control monitors secondary voltage (24VAC) to determine an over/under voltage condition is occurring on the primary side of the transformer. For example, if the secondary voltage is 18VAC, the primary voltage for a 240V unit would be approximately 180V which is below the minimum voltage (197V) recommended by the compressor manufacturer. Under voltage (<18VAC) causes the compressor to disengage and restart when the voltage returns to >20VAC. Over voltage (>31VAC) causes the compressor to disengage and restart when the voltage returns to <29VAC.

When an O/U Voltage condition occurs, the board will initiate a fault, shut down the compressor, and start the five minute ASC period. All four fault LEDs will flash (HP + LP + FS + CO) and the thermostat "Call For Service" indicator will be illuminated. This feature is self-resetting and never retries or locks out. If voltage returns to normal range normal operation will resume if/when the ASC period is over. When normal operation is restored the four fault LED's will stop flashing and the "Call For Service" indicator will turn off.

Fault Retry

All faults (except O/U Voltage) are retried twice before finally locking the unit out. The fault retry feature is designed to prevent nuisance service calls. There is an anti-short cycle (ASC) period (5 min.) between fault retries. On the third fault within 30 minutes, the board will go into lockout mode and the "Call For Service" indicator on the thermostat will illuminate.

Intelligent Lockout Reset

If the thermostat is powered off for one minute then back on (soft reset), the board will reset and the last fault will be stored in memory for ease of troubleshooting. If power is interrupted to the board, the fault memory will be cleared.

Lockout with Emergency Heat

While in lockout mode, if the thermostat is calling for auxiliary heat (W1), emergency heat mode will energize. W2 is energized two minutes after W1 is energized.

Hot Water Generator (HWG) Pump Control

Controls check for HWG temperature (T3) and hot gas (compressor discharge) line (HGT) temperature (T2). The hot water generator pump is de-energized when the leaving water temperature (T3) is above 130°F or when the compressor discharge line (T2) is cooler than leaving water temperature (T3). Also when the hot gas line temperature (T2) is higher than 220°F, the HWG pump will be de-energized. All of the issues above will break the circuit of the HWG pump (via the HWG signal from the lockout board) and will not lockout the compressor except when T2>220°F. Units without a HWG also do not have sensors T2 and T3. The control ignores T2 and T3 and disables Faults 15 and 16, Sensor BAD.

Section 10: Controls

LED Identification

LOCKOUT BOARD LED IDENTIFICATION & L TERMINAL STATUS						
CONDITION	GREEN HP	ORANGE LP	RED FS	YELLOW CO	STATUS GREEN	L TERMINAL[1]
NORMAL MODE					FLASH	
TEST MODE[2]						
HP FAULT	FLASH				FLASH	
HP LOCKOUT	ON				FLASH	ON
LP FAULT		FLASH			FLASH	
LP LOCKOUT		ON			FLASH	ON
SOURCE COIL FRZ/ WF FAULT (T4/FS)[3]			FLASH		FLASH	
SOURCE COIL FRZ/ WF LOCKOUT (T4/FS)[3]			ON		FLASH	ON
LOAD/ AIR COIL FRZ FAULT (T1)[4,5]		FLASH	FLASH		FLASH	
LOAD/ AIR COIL FRZ LOCKOUT (T1)[4,5]		ON	ON		FLASH	ON
CO FAULT[5]				FLASH	FLASH	
CO LOCKOUT[5]				ON	FLASH	ON
O/ U VOLTAGE	FLASH	FLASH	FLASH	FLASH	FLASH	ON
T1 FAULTY[5,6]	FLASH			ON	FLASH	FLASH
T2 FAULTY[5,6]		FLASH		ON	FLASH	FLASH
T3 FAULTY[5,6]			FLASH	ON	FLASH	FLASH
T4 FAULTY[5,6]		ON		FLASH	FLASH	FLASH
T1 & T4 SWAPPED[7]	ON			ON		FLASH
HOT GAS LINE FAULT > 220˚F (T2)[8]	FLASH		FLASH	ON	FLASH	
HOT GAS LINE LOCKOUT > 220˚F (T2)[8]	ON		ON	ON	FLASH	ON

LOCKOUT BOARD JUMPERS		
JUMPER	INSTALLED	REMOVED
FS	T1 & T4 MONITORED FOR FLOW- 'FS' TERMINALS IGNORED	FS' TERMINALS USED FOR FLOW SWITCH- T1 & T4 IGNORED
A-FRZ	OPEN LOOP MODE- 30˚F SETTING FOR T4	CLOSED LOOP MODE- 15˚F SETTING FOR T4
TEST	OPERATES IN NORMAL MODE WITH STANDARD DELAYS	OPERATES IN TEST MODE WITH DELAYS SPED UP
O/ V	FEATURE IS ACTIVE	FEATURE IS INACTIVE

NOTES:

1. THE 'L' TERMINAL CONTROLS A FAULT LED AT THE THERMOSTAT OR DRIVES AN AUXILIARY FAULT RELAY.
2. WHEN THE TEST JUMPER IS PULLED, GREEN STATUS LED WILL BE OFF.
3. DEPENDING UPON MODEL, THE SOURCE COIL FRZ/ WATER FLOW FAULT OR LOCKOUT CAN BE AN INTERNAL OR EXTERNAL FLOW SWITCH (FS), OR A SENSOR (T4) LOCATED BETWEEEN THE TXV AND SOURCE COIL.
4. THE LOAD/ AIR COIL FREEZE PROTECTION SENSOR IS LOCATED BETWEEN THE TXV AND LOAD/ AIR COIL.
5. NOT ALL MODELS HAVE THIS FEATURE.
6. THIS FAULT INDICATES A BAD SENSOR (OPEN, SHORTED, OR DISCONNECTED).
7. THIS CAN ONLY BE CHECKED WHILE IN TEST MODE.
8. HOT GAS LINE IS TOO HOT.

Section 10: Controls

Diagnostics
The lockout board includes five LEDs (Green-HP, Orange-LP, Red-FS, Yellow-CO, Green-Status) for fast and simple control board diagnosis. Refer to the LED Identification table for LED function.

Lockout Board Jumper Selection
The lockout board includes four jumpers for field selection of various board features.

Load/Source HX Temperature Sensing (FS)
When the FS jumper is installed (T1 and T4 monitored, FS terminals ignored), the board operates in the load and source heat exchanger temperature sensing mode, which is the factory setting.

Anti-Freeze (A-FRZ)
When the jumper is installed, the board operates in open loop mode. The setpoint for the source heat exchanger freeze sensor is 30°F. When the A-FRZ jumper is removed, the board operates in the closed loop mode. The setpoint for the source heat exchanger freeze sensor is 15°F.

Test Mode (TEST)
When the TEST jumper is installed, the board operates in the normal mode. When the jumper is removed, the board operates in test mode, which speeds up all delays for easier troubleshooting. While in the test mode the T1 & T4 sensors will be checked for the proper location based on temperature. Sensors are swapped if T1>T4 in cooling or T1<T4 in heating. This fault will only show up in the test mode. When service is complete, the jumper must be re-installed in order to make sure the unit operates with normal sequencing delays. While the test jumper is removed, the status light (bottom green) will remain off. If the test jumper is not re-installed the control will revert to normal mode after one (1) hour, green status light blinking.

Over/Under Voltage Disable (O/U)
When the O/U jumper is installed, the over/under voltage feature is active. When the jumper is removed, the over/under voltage feature is disabled. On rare occasions, variations in voltage will be outside the range of the over/under voltage feature, which may require removal of the jumper. However, removal of the jumper could cause the unit to run under adverse conditions, and therefore should not be removed without contacting technical services. An over/under voltage condition could cause premature component failure or damage to the unit controls. Any condition causing this fault must be thoroughly investigated before taking any action regarding the jumper removal.

Likely causes of an over/under voltage condition include power company transformer selection, insufficient entrance wire sizing, defective breaker panel, incorrect 24VAC transformer tap (unit control box), or other power-related issues.

Sequence of Operation
The description below is based on Water-to- Air Units, Two-Stage Compressor, with ECM Fan. Timings assume the ASC timer is expired. If the ASC timer is not expired the ECM fan will start immediately but the Accessory, compressor, and loop pump operation do not start until the ASC timer is expired.

Heating 1st Stage, (Y1, G) Two-Stage Units
The ECM fan immediately ramps up to 75% of 1st stage airflow (CFM) level (based on DIP switch settings), the Accessory (A) terminal output is energized after the random start timer (10s-20s) expires then first stage compressor and the loop pump(s) are energized 10 seconds after A. The ECM fan adjusts to 100% (of 1st stage operation) CFM level 90 seconds after the “Y1” input.

Heating 2nd Stage, (Y1, Y2, G) Two-Stage Units
The ECM fan adjusts to 2nd stage airflow (CFM) level (based on DIP switch settings), and the compressor full load solenoid is energized.

Heating 3rd Stage, (Y1, Y2, W1, G) Two-Stage Units
When provided, the ECM fan remains at 100% of 2nd stage airflow (CFM) level (based on DIP switch settings), and the first stage of electric resistance heat is energized. Second stage of electric resistance heat (W2) is energized ten minutes after first stage electric resistance heat (W1) is energized. (W2 is only available with 10kW, 15kW and 20kW electric heaters)

Emergency Heat (W1, G)
The fan is started immediately at 2nd stage airflow (CFM) level (based on DIP switch settings), and the electric resistance heat is energized. Second stage of electric heat (W2) is energized two minutes after first stage electric heat (W1) is energized. (W2 is only available with 10kW, 15kW and 20kW electric heaters)

Cooling Operation
The reversing valve is energized for cooling operation. Terminal "O" from the thermostat is connected to the reversing valve solenoid.

Cooling 1st stage (Y1, 0, G) Two-Stage Units
The ECM fan immediately ramps up to 75% of 1st stage airflow (CFM) level (based on DIP switch settings), the Accessory (A) terminal output is energized after the random start timer (10s-20s) expires then first stage compressor and the loop pump(s) are energized 10 seconds after A. The ECM fan adjusts to 100% (of 1st stage operation) CFM level 90 seconds after the "Y1" input.

Cooling 2nd Stage (Y1, Y2, O, G) Two-Stage Units
The ECM fan adjusts to 2nd stage airflow (CFM) level (based on DIP switch settings), and the compressor full load solenoid is energized.

Cooling, Dehumidification Mode
The ECM fan control board includes two types of dehumidification modes, Constant Dehumidification mode, and On Demand Dehumidification (ODD). If the ECM control board is set to Constant Dehumidification mode, the ECM fan runs at normal airflow (CFM) in all heating stages, but all cooling operation will be 85% of the current stage airflow (CFM) level (based on DIP switch settings). The dehumidification mode lowers the airflow (CFM) through the evaporator coil, to improve latent (dehumidification) capacity. In ODD mode, a humidistat or a thermostat with a dehumidification output (output must be reverse logic -- i.e. it must operate like a humidistat) is connected to the ODD terminal. When the module receives a call for dehumidification, the fan runs at 85% of the current stage airflow (CFM) in the cooling mode. Otherwise, the airflow is at the normal airflow (CFM) level. The signal is ignored in the heating mode. The signal is ignored in the heating mode.

Fan Only
When the ECM control module receives a "G" call without a call for heating or cooling, the fan operates at 50% of the full load airflow (CFM) level (based on DIP switch settings shown in following table).

Factory Installed Soft Start Option
All single phase *YT units have the option of a factory installed Soft Starter. During operation of the unit, if there is an issue with the soft start module, a fault signal will be sent to the lockout board, which in turn will send a fault signal to the thermostat. To determine the fault of the soft star module, reference the 'LED Status Identification' chart as listed in the table of contents.

YT Series Dehumidification Mode Options

DIP Switch		Mode	Operation
S9	S10		
ON	OFF	Normal	Dehumidification mode disabled (normal Htg/Clg CFM) - factory setting.
OFF	ON	ODD	On Demand Dehumidification mode (humidistat input at terminal ODD) -- Humidistat required.
OFF	OFF	Constant Dehum.	Constant Dehumidification mode (always uses dehum CFM for cooling and normal CFM for heating) -- No humidistat required.
ON	ON	Not Used	Not an applicable setting.

Notes:
1. To enter Dehumidification mode, ODD input should be 0 VAC; for normal cooling CFM, ODD input should be 24 VAC.
2. Heating CFM is not affected by dehumidification mode. When in dehumidification mode, cooling CFM is 85% of normal CFM

Soft Start Module
Enertech offers a factory installed single-phase Soft Start Module that reduces compressor starting currents and hence limits the peak energy demand. The Soft Start Module provides a one-package solution for compressor soft starting and starting capacitor control.

The Soft Start Module has a dedicated algorithm and built in current limit settings specifically for scroll compressor starting.

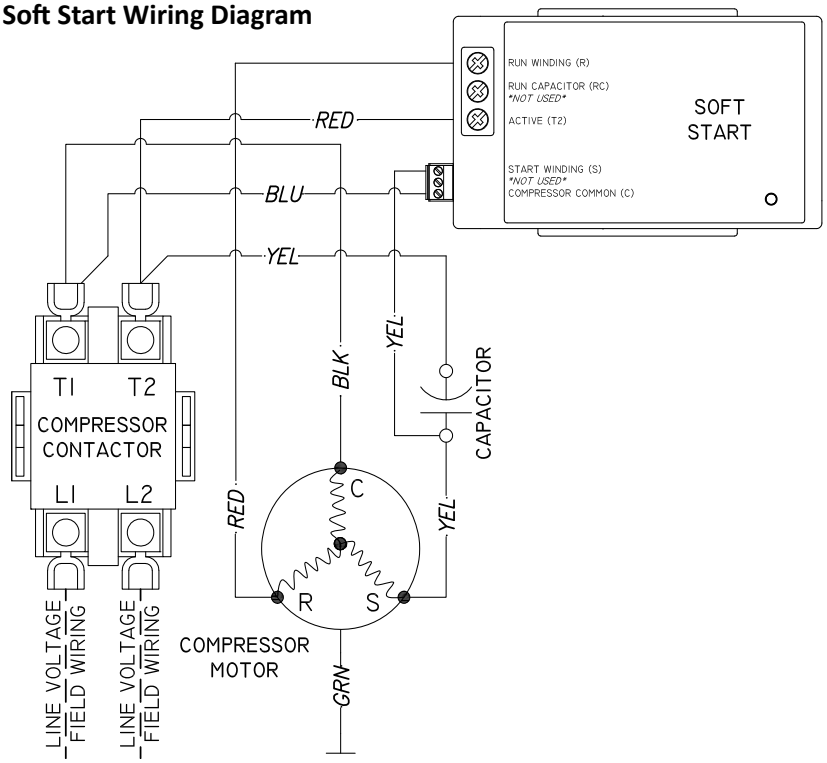
The Soft Start Module complies with Class B (residential) limits for conducted and radiated emissions which ensures that neighboring equipment is not negatively affected by any interference generated by the soft starter switching.

The Soft Start Module HP provides a dynamic current limit that ensures compressor starting even at higher starting pressures.

Details on the soft start module follow in Section 11.

Section 11: Hyper Engineering (SureStart) Soft Start Controls

Hyper Engineering (SureStart) Soft Start Wiring Diagram



Introduction

The SureStart Series soft-starter was the first of its kind invented by Hyper Engineering over a decade ago in Wollongong, Australia. It was invented for use in the residential heating, ventilation, and air-conditioning (HVAC) industry.

Hyper Engineering (SureStart)

SureStart Series is specifically targeted to reduce light flicker caused by the startup of fixed speed permanent split-capacitor motors (PSC). These motors are often of the scroll compressor types which are commonly used in air-conditioning and heat pump applications. The SureStart includes the following features:

- 60-70% reduction in direct on-line (DOL) or in-rush current.
- Sophisticated under voltage protection
- Motor reversal protection.
- Self-adjusting up to nominal 7 hp for optimal start performance.
- 50/60 Hz compatible.
- ETL, CE, EMC, and RoHs compliant.
- Tolerant to “dirty power” conditions.
- Versions available for retrofit installations or OEM production use.
- Fault LED
- Internal Current Limiting

Background

In air conditioning and heat pump applications, energy is moved through the system by a compressor which is an electrically driven pump that compresses refrigerant as it pumps to a heat exchanger. Compressors are the heart of air conditioning equipment so it is important to protect them against failure. Inside of every compressor is an electric motor that draws a significant electrical current at startup. This startup current is often referred to as the instantaneous current, in-rush current, locked-rotor amps (LRA), or direct-on-line (DOL) current. In-rush current is generally between 5-8 times higher than the current consumed by the compressor during normal operation.

As the name suggests, in-rush current is very brief lasting for a fraction of a second until the motor begins operating at normal speed. This time period may appear trivial; however, it is the cause of many issues for owners, power companies, and equipment manufacturers.

Below is a list of common problems created by high in-rush current.

- Flickering of lights
- Nuisance trips on safety protection equipment
- Disrupts sensitive electronics such as computers
- Increased stress on the motor which reduces the reliability of the air conditioning equipment.
- Higher installation cost due to insufficient transformer sizing
- Increased noise and vibration at compressor startup

Section 11: Hyper Engineering (SureStart) Soft Start Controls

Most contractors install hard start kits to eliminate these problems. Unfortunately, hard start kits don't provide a complete solution to the problem. Hard start kits do not reduce the startup current but only the startup time which may give a perceived improvement in light flicker, but still stress the compressor during every start. Mechanical shock is also increased to the compressor by use of a hard start device. Installing a SureStart corrects these problems by significantly reducing the start current, optimizing the start time to the compressor size, power supply and loading while providing vital protection to the compressor, and promoting improved reliability at startup.

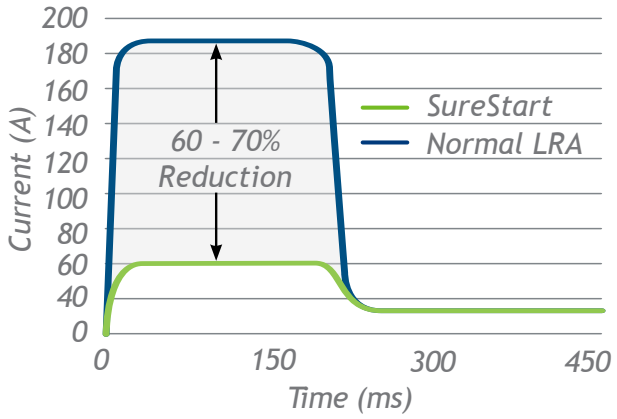
In-Rush Current

Motor in-rush occurs due to low resistance in motor windings essentially acting like a short circuit. This temporary short circuit causes an immediate spike in current and simultaneous drop in supply Voltage. Voltage drops for air conditioning compressors are often 15% or more which is 3-4 times greater than what most electrical power distributors prefer. The more frequently the compressor starts, the more noticeable the problem becomes. For most homes in the US, air conditioners usually start at a rate of 6-10 starts per hour.

SureStart In-Rush Reduction

HVAC Tons	Compressor RLA	Before In-Rush	After SureStart	% Reduction
1.5	9	48	15	69
2.0	14	73	22	70
2.5	17	79	24	69
3.0	20	109	33	70
4.0	26	134	40	71
5.0	30	158	47	71
7.0	32	185	56	54

Normal 5.0 Ton LRA vs. SureStart



Section 11: Hyper Engineering (SureStart) Soft Start Controls

SureStart Operation

When the system control calls for compressor operation, the compressor contactor will energize. If the supply voltage to the SureStart is less than "Minimum Startup Voltage", a 50 second delay is initiated. At the end of the delay, another attempt to start the compressor will begin unless the supply voltage remains unchanged. SureStart uses an optimized starting process that learns the starting characteristics of the compressor to further refine the starting cycle on each recurring start. If the compressor fails to start, the module will terminate the start attempt after 1 second and initiate a 3 minute lockout before attempting a restart. If the supply voltage falls below "Shutdown on Low voltage" limit for 2 seconds or below 130 volts for 0.1 seconds while the compressor is running the module will stop the compressor and initiate a 3 minute lockout. A restart will be attempted after 3 minutes if the supply voltage is equal to "Minimum Startup Voltage" or higher. This is done to protect the compressor against a sudden drop in supply voltage.

SureStart is able to detect an interruption in power, when the interruption is 0.1 seconds or longer. When a power interrupt is detected, SureStart will shut down the compressor for 3 minutes. SureStart is also able to determine if the compressor is running backwards. If this condition is detected, SureStart will stop the compressor for 3 minutes before a restart is attempted. A power interrupt that is shorter duration than 0.1 seconds may result in a compressor running backwards, which the SureStart can detect and stop compressor operation.

If the run capacitor is faulty or has failed, SureStart will shutdown the compressor for 3 minutes before attempting a restart.

Led Flash Codes

A Red LED indicator will flash under the following conditions.

NOTE: LED fault indicator is turned off in normal running mode.)

A. Rapid Flash (10/sec) : Low Voltage
B. Triple Flash Every Three Seconds (3 / 3 secs): Lockout on Three Failed Starts
C. Slow Flash (1 / 3 secs): Lockout on Over Current
D. Slow Steady Flash (1/sec): Cycle Delay / Fault Mode

Flash Code (Rapid Flash (10/sec) : Low Voltage)

- Displayed for "Low supply voltage" before or after a softstart.
- If Low voltage is detected before a start, a re-start is attempted after 50 seconds.
- If Low voltage is detected after a start, a re-start is attempted after 3 minutes.

Flash Code (Triple Flash every three seconds (3/3 secs): Lockout on Three Failed Starts)

- Displayed after failure to start on "Three consecutive start attempts".
- Re-start is attempted after 50 minutes.
- Standard lockout period is revised to 3 minutes after a successful start.

In circumstances where the compressor may have seized or is unable to startup due to failure of other components in the HVAC system, the software will check for three consecutive failed starts. On the third sequential failed start, the program goes into Lockout for 50 mins. On failing to get a good start even after 50 mins, it will re-attempt start again after duration of 50 mins. Once a good start is eventually achieved, it will reset the hardstart counter and will require 3 failed starts again to force it back into Lockout mode. Lockout can be cleared anytime through a power reset of the SureStart device.

Flash Code (Slow Flash (1/3 secs): Lockout on Over current)

Displayed for "Overcurrent" in running mode of the compressor motor.

- Overcurrent limit is "25A for 08-16A version" and "50A for 16-32A rated version".
- Also displayed, if internal Klixon of the compressor trips out on overheat.
- Re-start is attempted after 10 minutes.

To limit the current in compressors from extending abnormally beyond its stated capacities, SureStart is also equipped with Overcurrent limit protection. For models rated from 16-32A, SureStart is designed to trip out in overload conditions exceeding 50A. In smaller models, it is designed to cutoff power to the compressor if the current drawn exceeds 25A. On overcurrent lockout, SureStart attempts a re-start automatically after 10 minutes.

Both failed start lockout and overcurrent limit protection have been designed to prevent the compressor from drawing abnormal currents in conditions not feasible for the compressor operation.

Flash Code (Slow Steady Flash (1/sec): Cycle Delay / Fault Mode)

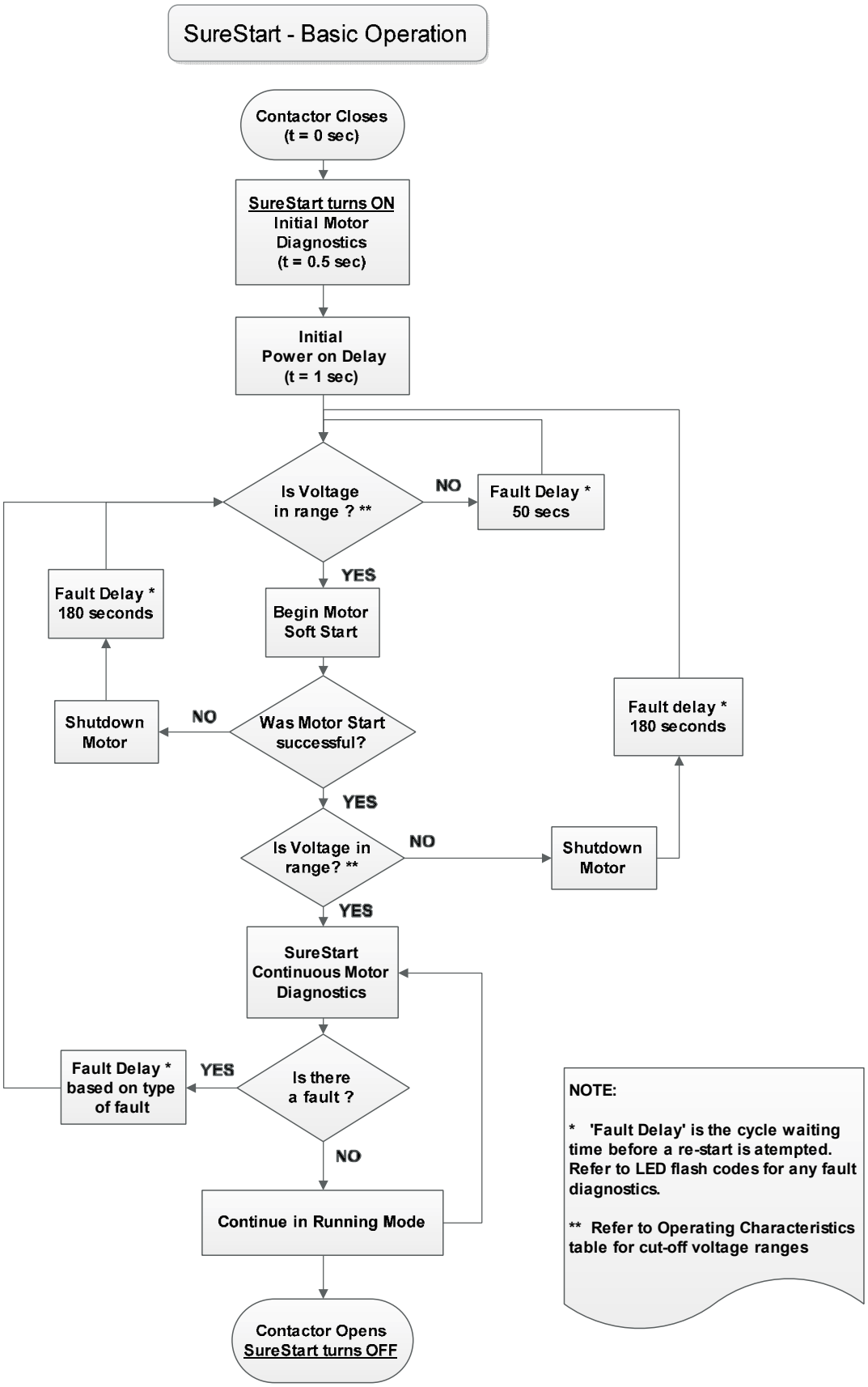
- Displayed for "Cycle delay" between two consecutive softstarts or other faults mentioned below.
- Re-start is attempted after a default period of 3 minutes.
- Other possible reasons for this Fault mode indicator can be due to:
  - incorrect wiring during installation
  - a failed Softstart attempt
  - intermittent power loss (duration longer than 100ms)
  - frequency out of range
  - failed run capacitor.

NOTICE

SureStart uses an optimized starting process that learns the starting characteristics of the compressor to further refine the starting cycle on each recurring start. It will usually optimize itself within the first (6) starts. For this reason, the first few starts should be ignored.

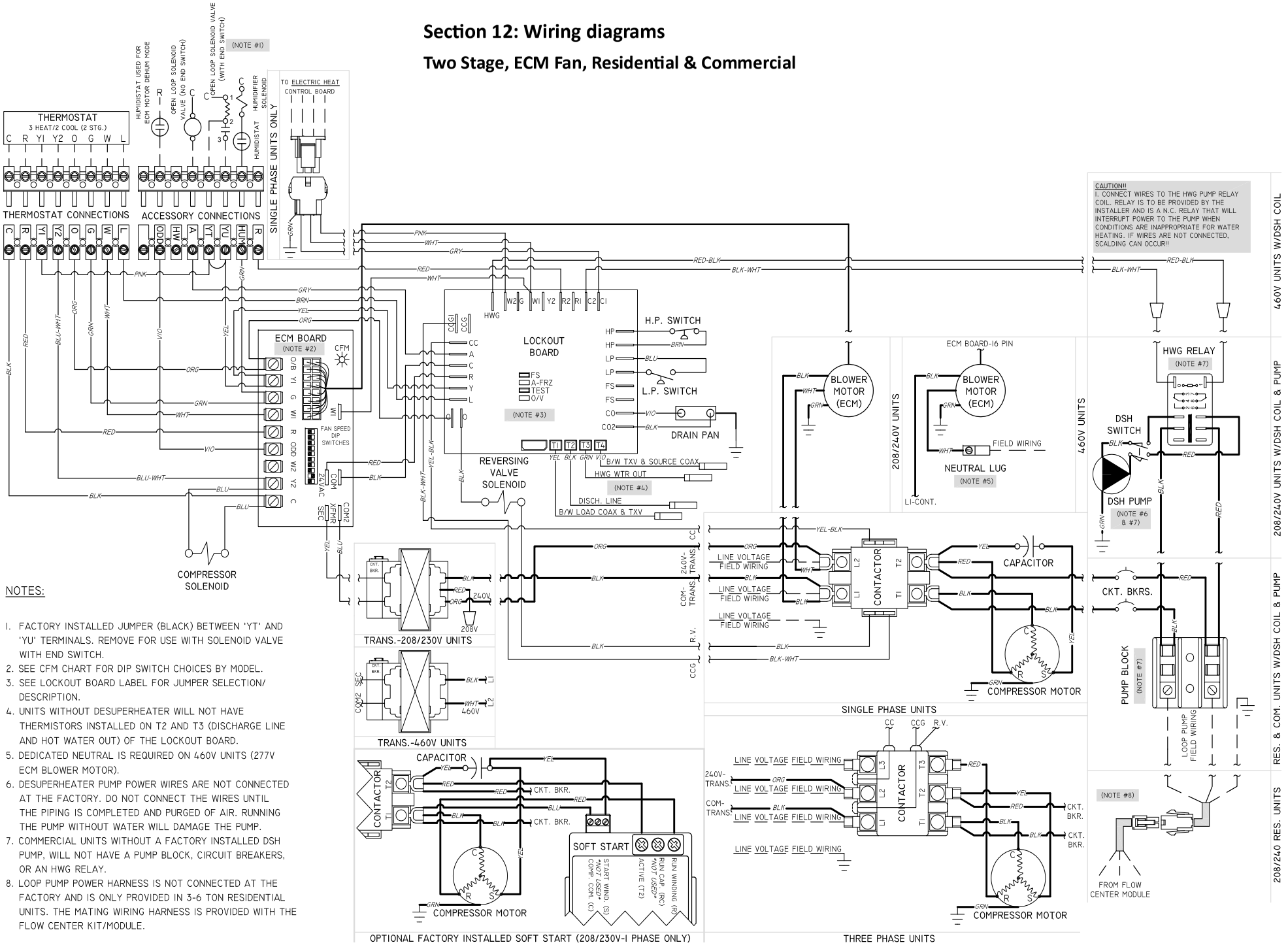
Section 11: Hyper Engineering (SureStart) Soft Start Controls

SureStart Basic Operation Chart



Section 12: Wiring diagrams

Two Stage, ECM Fan, Residential & Commercial



NOTES:

1. FACTORY INSTALLED JUMPER (BLACK) BETWEEN 'YT' AND 'YU' TERMINALS. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
3. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
4. UNITS WITHOUT DESUPERHEATER WILL NOT HAVE THERMISTORS INSTALLED ON T2 AND T3 (DISCHARGE LINE AND HOT WATER OUT) OF THE LOCKOUT BOARD.
5. DEDICATED NEUTRAL IS REQUIRED ON 460V UNITS (277V ECM BLOWER MOTOR).
6. DESUPERHEATER PUMP POWER WIRES ARE NOT CONNECTED AT THE FACTORY. DO NOT CONNECT THE WIRES UNTIL THE PIPING IS COMPLETED AND PURGED OF AIR. RUNNING THE PUMP WITHOUT WATER WILL DAMAGE THE PUMP.
7. COMMERCIAL UNITS WITHOUT A FACTORY INSTALLED DSH PUMP, WILL NOT HAVE A PUMP BLOCK, CIRCUIT BREAKERS, OR AN HWG RELAY.
8. LOOP PUMP POWER HARNESS IS NOT CONNECTED AT THE FACTORY AND IS ONLY PROVIDED IN 3-6 TON RESIDENTIAL UNITS. THE MATING WIRING HARNESS IS PROVIDED WITH THE FLOW CENTER KIT/MODULE.

Section 13: Equipment Start-Up Procedures

Equipment Start-Up Process

Check the following before power is applied to the equipment
Caution: Do not start-up the unit until the new structure is ready to be occupied

Electrical:

- High voltage wiring and breakers are properly sized and installed
- Auxiliary electric heaters are wired and installed correctly
- Circulator pumps are wired properly and connected to the proper terminal block
- Low voltage wiring is correct and completely installed
- Source voltage is correct and matches dataplate
- HWG pump is not wired or is switched off until all piping is correct and air is purged from the system
- Lockout board jumpers are properly selected for installation, i.e., A-FRZ jumper removed for closed loop

Plumbing:

- Piping is completed, properly sized and purged of all air and debris, loop, HWG and load side
- Pumps are properly sized and purged of all air
- Correct amount of antifreeze has been added
- All valves are open including flow center
- Condensate is trapped and properly piped to drain

Mechanical:

- Filter is installed and clean
- Packaging and shipping brackets are removed from the blower assembly
- Blower turns freely
- Canvas connections installed on supply plenum & return drop
- Replace all service panels and screws

Equipment Start-Up:

1. Energize geothermal unit with high voltage.
2. Make sure secondary/low voltage is between 20V and 29V. Check the transformer's primary connections at the main contactor for the correct voltage (Orange & Black = 230V; Red & Black = 208V). Correct any possible voltage drops in the main voltage.
3. Set the thermostat to "Heat" or "Cool." Adjust set point to energize the unit. System will energize after delays expire (typically a five minute delay).
4. Check water flow with a flow meter (non-pressurized) or pressure drop conversion (pressurized). Pressure drop tables must be used to convert the pressure drop to GPM. The pressure drop can be obtained by checking water pressure in and water pressure out at the P/T ports. Check the geothermal unit's electrical readings listed in the Unit Electrical Data table.
5. Check the source water temperature in and out at the P/T ports (use insertion probe). Allow 10 minutes of operation before recording temperature drop.
6. Calculate the heat of extraction or heat of rejection.
7. Check the temperature difference of the load coax (water-to-water) or air coil (water-to-air). P/T ports are recommended for use on the load side, but the line temperatures can be used to check the temperature difference.
8. Change the mode of the thermostat and adjust the set point to energize the unit. Check the data in opposite mode as the previous tests. Amp draws as well as temperature differences and flow rate should be recorded.
9. Check auxiliary heat operation by adjusting the thermostat set point 5°F above the room temperature in "Heat" mode or set thermostat to "Emergency." Record voltage, amperage, and air temperature difference.
10. Connect HWG wires or turn switch (if equipped) to on position.

Section 13: Equipment Start-Up Procedures

Equipment Start-Up Form

Customer Name:_____

Customer Address:_____

Model #:_____ Serial #:_____

Dealer Name:_____

Distributor Name:_____ Start-up Date:_____

Loop Type: Open Closed (Circle One)								
Flow Rate	**Cooling**		**Heating**		**Unit Electrical Data**	**Cooling**		**Heating**	
Source Water Pressure In		PSI		PSI	Line Voltage		V		
Source Water Pressure Out		PSI		PSI	Total Unit Amps		A		A
Source Water Pressure Drop		PSI		PSI	Compressor Amps		A		A
Flow Rate		GPM		GPM	Wire Size		GA		
*Check pressure drop chart for GPM					Circuit Breaker Size		A		

Source Water Temp. Difference	**Cooling**		**Heating**	
Source Water Temperature In		ºF		ºF
Source Water Temperature Out		ºF		ºF
Source Water Temperature Difference		ºF		ºF
Heat of Rejection/Extraction	**Cooling**		**Heating**	
Heat of Rejection		BTU/HR		
Heat Of Extraction				BTU/HR

Heat of Extraction/Rejection = GPM X Water Temp. Difference X 500 (Water - Open Loop)
Heat of Extraction/Rejection = GPM X Water Temp. Difference X 485 (Water & Antifreeze - Closed Loop)

Load Water Temp. Difference	**Cooling**		**Heating**	
Load Water Temperature In		ºF		ºF
Load Water Temperature Out		ºF		ºF
Load Water Temperature Difference		ºF		ºF
Air Temperature Difference	**Cooling**		**Heating**	
Supply Air Temperature		ºF		ºF
Return Air Temperature		ºF		ºF
Air Temp. Difference		ºF		ºF
*Confirm auxiliary heaters are de-energized for the above readings.				
Auxiliary Heat Operation Only			**Heating**	
Supply Air Temperature				ºF
Return Air Temperature				ºF
Air Temp. Difference				ºF
Auxiliary Heat Electrical Data			**Heating**	
Line Voltage				V
Total Amperage (Full kW - All Stages)				A
Wire Size				GA
Breaker Size				A
CFM = (Watts X 3.413) ÷ (Air Temp. Difference X 1.08)				
Watts = Volts X Auxiliary Heater Amps				

Installer/Technician:_____ Date:_____

Section 13: Equipment Start-Up Procedures

Water Flow Calculations and Selection

Proper flow rate is crucial for reliable operation of geothermal heat pumps. The performance data shows three flow rates for each entering water temperature (EWT column). The general "rule of thumb" when selecting flow rates is the following.

Top flow rate: Open loop systems (1.5 to 2.0 gpm per ton)
Middle flow rate: Minimum closed loop system flow rate (2.25 to 2.50 gpm/ton)
Bottom flow rate: Nominal (optimum) closed loop system flow rate (3.0 gpm/ton)

Heat of Extraction/Heat of Rejection Tables

Model		GPM	CFM (Heating/Cooling)	Heat of Extraction (MBtuh)				Heat of Rejection (MBtuh)			
				30 °F	50 °F	70 °F	90 °F	50 °F	70 °F	90 °F	110 °F
YT024	Part Load	2.0	750/740	9.1	12.8	17.5	22.7	26.7	25.6	24.5	23.0
		3.0		9.7	13.5	18.4	23.9	26.7	25.5	24.2	22.5
		4.0		10.1	14.1	19.1	24.8	26.7	25.4	24.1	22.2
	Full Load	3.0	990/1000	13.3	17.7	23.9	29.9	36.0	34.5	33.1	31.4
		4.5		13.9	18.6	25.0	31.3	35.9	34.4	32.8	31.0
		6.0		14.4	19.2	25.8	32.2	35.8	34.3	32.7	30.8
YT036	Part Load	3.0	1130/1130	13.1	19.8	26.3	33.1	37.3	36.2	34.3	32.2
		4.5		14.0	21.0	27.8	35.0	37.4	36.1	34.1	31.8
		6.0		14.7	22.0	29.0	36.5	37.6	36.3	34.1	31.8
	Full Load	4.5	1380/1420	21.3	29.4	37.8	46.2	52.1	50.8	48.3	45.6
		7.0		22.7	31.2	40.1	49.0	52.4	51.0	48.4	45.5
		9.0		23.4	32.1	41.3	50.3	52.6	51.1	48.4	45.4
YT048	Part Load	4.0	1420/1530	19.0	26.8	35.1	44.3	47.7	46.8	44.8	43.2
		6.0		20.3	28.5	37.1	46.8	47.8	46.7	44.5	42.5
		8.0		21.0	29.4	38.2	48.1	48.2	47.0	44.6	42.5
	Full Load	6.0	1790/1710	28.2	38.1	48.7	60.4	64.3	62.6	59.7	57.8
		9.0		29.7	40.0	51.2	63.4	64.3	62.6	59.5	57.3
		12.0		30.1	40.5	51.8	64.1	64.7	62.8	59.6	57.3
YT060	Part Load	5.0	1680/1610	22.7	31.9	42.9	53.9	59.5	57.7	55.4	53.0
		7.5		24.1	33.6	45.1	56.6	60.0	57.9	55.3	52.5
		10.0		25.0	34.9	46.7	58.7	60.3	58.0	55.3	52.3
	Full Load	7.5	1960/1960	33.7	45.6	59.1	72.6	79.9	79.7	75.8	71.9
		11.5		35.9	48.5	62.8	77.0	80.4	80.0	75.9	71.6
		15.0		36.7	49.6	64.1	78.7	80.5	80.1	75.8	71.4
YT072	Part Load	6.0	1870/1800	26.9	36.8	50.0	61.3	70.4	68.7	66.6	63.6
		9.0		28.8	39.3	53.2	65.1	72.4	70.3	67.6	64.0
		12.0		30.3	41.1	55.7	68.1	72.8	70.5	67.7	63.8
	Full Load	9.0	2160/2170	37.2	51.0	65.6	79.4	91.0	90.8	87.2	83.1
		13.5		40.2	54.9	70.6	85.3	91.3	90.9	87.0	82.6
		18.0		41.9	57.2	73.4	88.7	91.4	91.0	86.9	82.3

1. Capacity data is based on 15% (by volume) methanol antifreeze solution (multiplier: 485).
2. Heating data is based on 70°F EAT. Cooling data is based on 80/67°F EAT. Any condition outside performance table(s) requires correction factor(s).
3. Performance data accurate within ±15%.
4. Unit performance test is run without hot water generation.
5. Capacity data includes fan power but not pump power and it does not reflect fan or pump power correction for AHRI/ISO conditions.
6. Performance data is based upon the lower voltage of dual voltage rated units.
7. Interpolation of unit performance data is permissible; extrapolation is not.
8. Due to variations in installation, actual unit performance may vary from the tabulated data.

Performance Check
Heat of Extraction(HE)/Rejection(HR)
Record information on the Unit Start-up Form

Equipment should be in full load operation for a minimum **of 10 minutes in either mode – WITH THE HOT WATER GENERATOR TURNED OFF.**

1. Determine flow rate in gallons per minute
- Check entering water temperature
- Check entering water pressure
- Check leaving water pressure

Once this information is recorded,
- Find corresponding entering water temperature column in the HE/HR Table.
- Find pressure differential in PSI column.
- Then read the GPM column to determine flow in GPM.

2. Check leaving water temperature of unit.
- FORMULA: GPM x water temp diff. x 485 (antifreeze) or 500 (fresh water) = HE or HR in BTU/HR

A 10% variance from table is allowed. Always use the same pressure gauge & temperature measuring device. Water flow must be in range of table. If system has too much water flow, performance problems should be expected.

Section 13: Equipment Start-Up Procedures

Pressure Drop Tables

Model	GPM	Source Brine Pressure Drop							
		30 °F		50 °F		70 °F		90 °F	
		PSI	FT HD	PSI	FT HD	PSI	FT HD	PSI	FT HD
YT024 Part Load	2.0	1.0	2.3	0.9	2.1	0.8	1.8	0.7	1.6
	3.0	1.9	4.4	1.6	3.7	1.4	3.2	1.3	3.0
	4.0	3.0	6.9	2.5	5.8	2.2	5.1	2.0	4.6
	5.0	4.2	9.7	3.5	8.1	3.1	7.2	2.8	6.5
YT024 Full Load	3.0	2.0	4.6	1.7	3.9	1.4	3.2	1.3	3.0
	4.5	3.7	8.5	3.1	7.2	2.6	6.0	2.4	5.5
	6.0	5.6	12.9	4.7	10.8	4.1	9.5	3.6	8.3
	8.0	8.7	20.1	7.3	16.8	6.3	14.5	5.6	12.9
YT036 Part Load	3.0	0.8	1.8	0.7	1.6	0.6	1.4	0.6	1.4
	4.5	1.2	2.8	1.1	2.5	1.0	2.3	0.9	2.1
	6.0	1.8	4.2	1.6	3.7	1.4	3.2	1.3	3.0
	7.0	2.2	5.1	2.0	4.6	1.8	4.2	1.6	3.7
YT036 Full Load	4.5	1.2	2.8	1.1	2.5	1.0	2.3	0.9	2.1
	7.0	2.3	5.3	2.0	4.6	1.8	4.2	1.6	3.7
	9.0	3.3	7.6	2.9	6.7	2.6	6.0	2.3	5.3
	11.0	4.4	10.1	3.9	9.0	3.5	8.1	3.1	7.2
YT048 Part Load	4.0	1.5	3.5	1.4	3.2	1.4	3.2	1.4	3.2
	6.0	1.9	4.4	1.8	4.2	1.8	4.2	1.7	3.9
	8.0	2.5	5.8	2.4	5.5	2.3	5.3	2.3	5.3
	9.0	2.9	6.7	2.8	6.5	2.7	6.2	2.7	6.2
YT048 Full Load	6.0	2.1	4.8	1.9	4.4	1.8	4.2	1.7	3.9
	9.0	3.3	7.6	3.0	6.9	2.7	6.2	2.6	6.0
	12.0	5.0	11.5	4.5	10.4	4.1	9.5	3.9	9.0
	15.0	6.9	15.9	6.2	14.3	5.7	13.1	5.4	12.5
YT060 Part Load	5.0	0.8	1.8	0.7	1.6	0.7	1.6	0.7	1.6
	7.5	1.7	3.9	1.6	3.7	1.6	3.7	1.5	3.5
	10.0	2.4	5.5	2.3	5.3	2.2	5.1	2.1	4.8
	12.0	3.1	7.2	2.9	6.7	2.8	6.5	2.7	6.2
YT060 Full Load	7.5	1.9	4.4	1.8	4.2	1.7	3.9	1.7	3.9
	11.5	2.9	6.7	2.8	6.5	2.7	6.2	2.6	6.0
	15.0	3.9	9.0	3.7	8.5	3.5	8.1	3.4	7.8
	18.0	5.0	11.5	4.7	10.8	4.5	10.4	4.4	10.1
YT072 Part Load	6.0	1.7	3.9	1.7	3.9	1.7	3.9	1.6	3.7
	9.0	2.0	4.6	1.9	4.4	1.9	4.4	1.9	4.4
	12.0	2.7	6.2	2.6	6.0	2.6	6.0	2.5	5.8
	15.0	3.7	8.5	3.6	8.3	3.6	8.3	3.5	8.1
YT072 Full Load	9.0	2.2	5.1	2.0	4.6	2.0	4.6	1.9	4.4
	13.5	3.5	8.1	3.3	7.6	3.2	7.4	3.1	7.2
	18.0	5.7	13.1	5.3	12.2	5.1	11.8	5.0	11.5
	22.0	7.8	18.0	7.3	16.8	7.0	16.1	6.9	15.9

1. Pressure drop data is based on 15% (by volume) methanol antifreeze solution (multiplier: 485).
2. Pressure drop data accurate within ±25%.
3. Unit performance test is run without hot water generation.
4. Interpolation of unit pressure drop data is permissible; extrapolation is not.
5. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 14: Troubleshooting

QR Codes for Installation or Troubleshooting Tip Videos

Select the topic for your maintenance need. Scan the QR code to access the video. Follow the directions and tips provided to make your project easier to complete:

- ECM Temporary Replacement

- ECM Motor Troubleshooting

- Troubleshooting a TXV

- Compressor Troubleshooting

- Variable Speed Flow Centers

- Return Conversion for and XT or CT

- Heat Of Extraction and Rejection

- Measuring Subcooling/Superheat

- Nitrogen Purge While Brazing

- Leak Testing an Air Coil

- Loop Flushing

- Repairing a Microchannel Air Coil

- Testing a Coaxial Heat Exchanger

- Troubleshooting a TXV

Section 14: Troubleshooting

Operating Parameters

EWT	Flow	Full Load Heating - No Hot Water Generation					
		Discharge	Suction	Subcooling	Superheat	Water Temp Drop	Air Temp Rise
°F	GPM/Ton	PSIG	PSIG	°F	°F	°F	°F - DB
30	1.5	256-327	58-75	13-33	7-20	6-12	15-26
	3	262-334	68-83	11-29	6-18	3-7	16-28
50	1.5	276-351	88-104	7-29	5-18	9-15	19-33
	3	283-363	100-115	4-26	5-18	4-9	20-36
70	1.5	311-394	121-138	10-29	4-16	13-19	25-41
	3	319-411	134-156	6-26	7-18	6-11	27-44
90	1.5	348-443	154-180	7-25	4-15	16-23	31-49
	3	357-460	179-202	3-23	9-20	8-14	34-52

EWT	Flow	Full Load Cooling - No Hot Water Generation					
		Discharge	Suction	Subcooling	Superheat	Water Temp Rise	Air Temp Drop
°F	GPM/Ton	PSIG	PSIG	°F	°F	°F	°F - DB
50	1.5	211-237	114-143	18-28	11-26	18-27	19-25
	3	183-211	113-142	10-19	12-29	8-14	19-26
70	1.5	291-319	124-149	16-30	6-15	18-26	18-25
	3	252-280	122-148	7-21	9-17	8-14	18-25
90	1.5	381-421	128-153	17-32	4-15	17-25	17-24
	3	331-370	127-152	7-22	7-16	8-13	17-24
110	1.5	489-549	132-158	16-33	3-14	16-24	15-22
	3	425-482	130-157	7-23	5-15	7-13	16-23

EWT	Flow	Part Load Heating - No Hot Water Generation					
		Discharge	Suction	Subcooling	Superheat	Water Temp Drop	Air Temp Rise
°F	GPM/Ton	PSIG	PSIG	°F	°F	°F	°F - DB
30	1	253-303	62-78	13-26	5-18	7-12	13-23
	2	258-312	71-85	11-26	4-17	3-7	15-25
50	1	270-324	90-108	10-26	5-16	10-16	18-28
	2	276-333	103-118	4-26	4-15	5-10	20-31
70	1	302-366	124-143	12-25	4-15	15-20	24-36
	2	309-377	136-158	6-25	5-17	7-12	26-39
90	1	335-405	162-187	9-19	3-14	19-25	30-42
	2	344-417	182-206	3-18	6-17	9-15	33-46

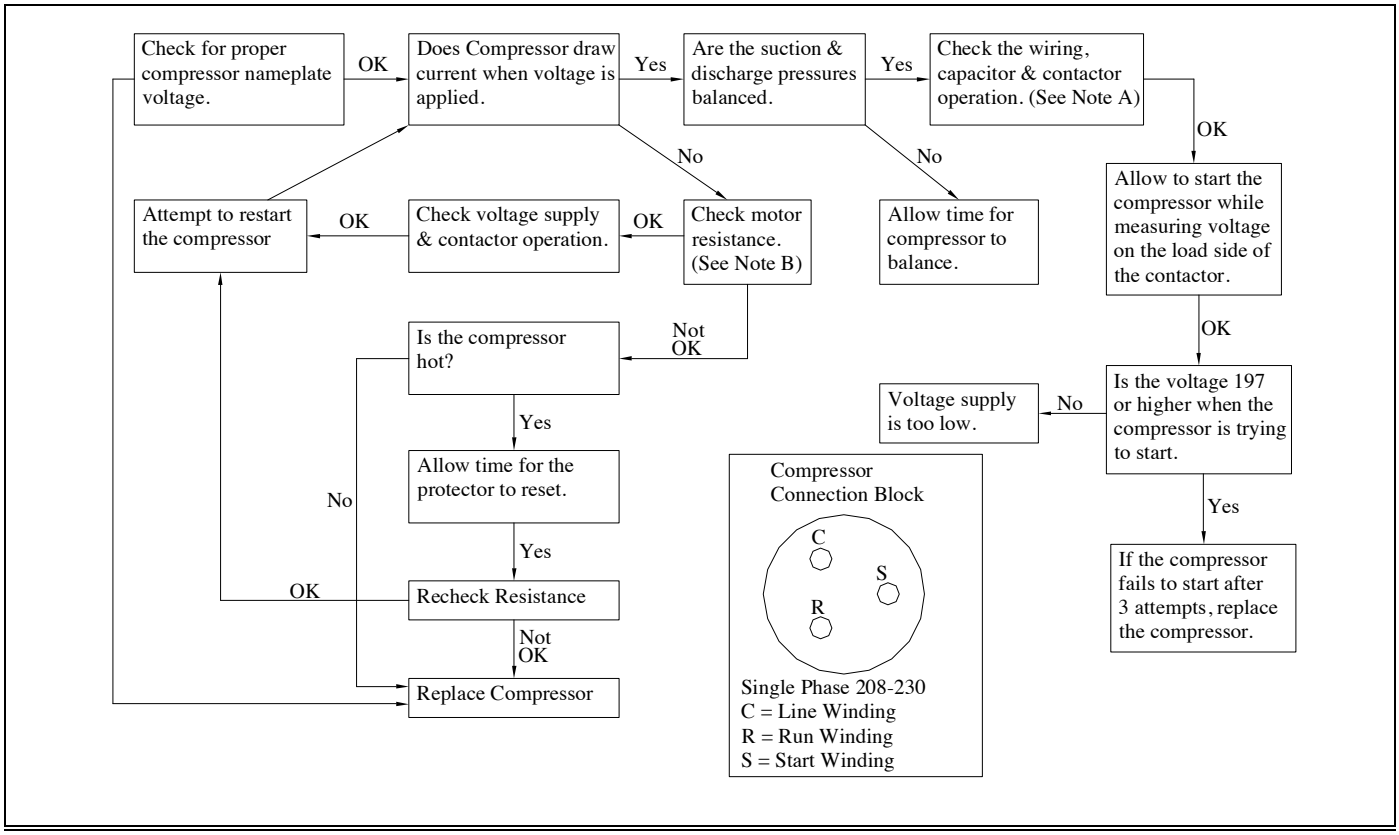
EWT	Flow	Part Load Cooling - No Hot Water Generation					
		Discharge	Suction	Subcooling	Superheat	Water Temp Rise	Air Temp Drop
°F	GPM/Ton	PSIG	PSIG	°F	°F	°F	°F - DB
50	1	209-238	124-152	15-28	10-24	21-30	17-26
	2	180-208	122-151	6-18	11-25	10-16	17-26
70	1	285-320	133-157	15-31	5-19	21-28	17-25
	2	247-277	130-156	4-20	7-19	10-15	17-25
90	1	375-421	136-161	16-32	3-20	20-27	16-24
	2	326-361	133-160	6-21	5-21	9-14	16-25
110	1	482-543	139-166	17-33	3-20	19-26	15-22
	2	418-465	137-165	6-20	5-21	9-13	15-23

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.
CFM is 320-500 CFM/Ton for heating and cooling.

Section 14: Troubleshooting

Compressor Troubleshooting

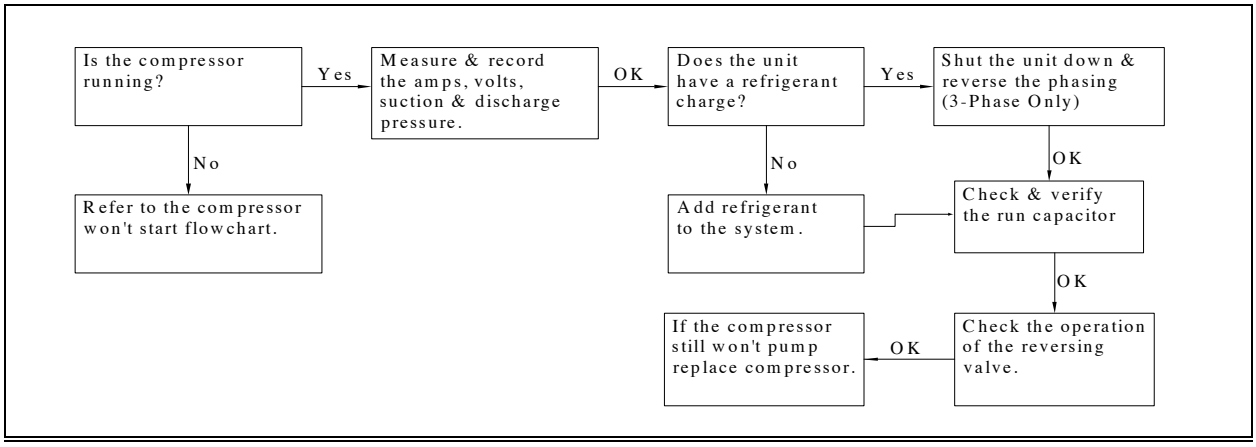
Compressor Won't Start



A: Check all terminals, wires & connections for loose or burned wires and connections. Check contactor and 24 Volt coil. Check capacitor connections & check capacitor with capacitor tester.

B: If ohm meter reads 0 (short) resistance from C to S, S to R, R to C or from anyone of one of these terminals to ground (shorted to ground), compressor is bad.

Compressor Won't Start



Section 14: Troubleshooting

Refrigeration Troubleshooting

Condition	Mode	Discharge Pressure	Suction Pressure	Superheat	Subcooling	Air TD	Water TD	Compressor Amps
Under Charge	Heat	Low	Low	High	Low	Low	Low	Low
	Cool	Low	Low	High	Low	Low	Low	Low
Over Charge	Heat	High	High/Normal	Normal	High	High	Normal	High
	Cool	High	High/Normal	Normal	High	Normal	High	High
Low Air Flow	Heat	High	High/Normal	Normal	High/Normal	High	Low	High
	Cool	Low	Low/Normal	Low	Normal	High	Low	High/Normal
Low Source Water Flow	Heat	Low	Low/Normal	Low	Normal	High	Low	High/Normal
	Cool	High	High/Normal	Normal	High/Normal	High	Low	High
Low Load Water Flow	Heat	High	High/Normal	Normal	High/Normal	High	Low	High
	Cool	Low	Low/Normal	Low	Normal	High	Low	High/Normal
Restricted TXV	Heat	High	Low	High	High	Low	Low	Low
	Cool	High	Low	High	High	Low	Low	Low
TXV Stuck Open	Heat	Low	High/Normal	Low	Low	Low	Low	High
	Cool	Low	High/Normal	Low	Low	Low	Low	High
Inadequate Compression	Heat	Low	High	High/Normal	Low/Normal	Low	Low	Low
	Cool	Low	High	High/Normal	Low/Normal	Low	Low	Low

Superheat/Subcooling Conditions

Superheat	Subcooling	Condition
Normal	Normal	Normal operation
Normal	High	Overcharged
High	Low	Undercharged
High	High	Restriction or TXV is stuck almost closed
Low	Low	TXV is stuck open

Section 14: Troubleshooting

Troubleshooting Worksheet

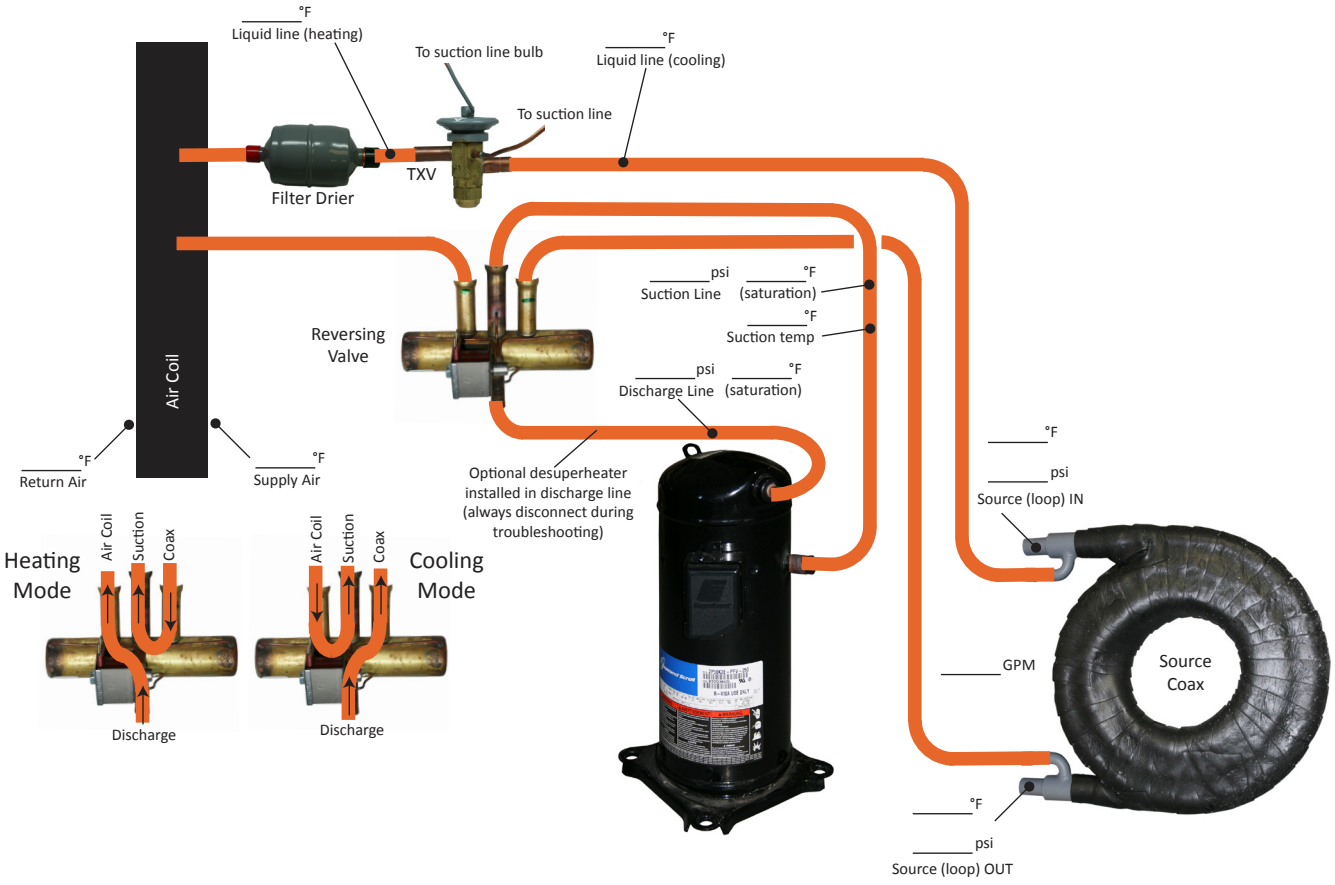
Customer/Job Name:_____ Date:_____

Model #:_____ Serial #:_____

Antifreeze Type:_____

HE or HR = GPM x TD x Fluid Factor
(Use 500 for water; 485 for antifreeze)

SH = Suction Temp. - Suction Sat.
SC = Disch. Sat. - Liq. Line Temp.



Section 14: Troubleshooting

A: UNIT WILL NOT START IN EITHER CYCLE	
Thermostat	Set thermostat on heating and highest temperature setting. Unit should run. Set thermostat on cooling and lowest temperature setting. Unit should run. Set fan to On position. Fan should run. If unit does not run in any position, disconnect wires at heat pump terminal block and jump R, G, Y. Unit should run in heating. If unit runs, replace thermostat with correct thermostat only.
Loose or Broken Wires	Tighten or replace wires.
Blown Fuse/	Check fuse size, replace fuse or reset circuit breaker. Check low voltage circuit breaker.
Tripped Circuit Breakers	Check fuse size, replace fuse or reset circuit breaker.
Low Voltage Circuit	Check 24 volt transformer. If burned out or less than 24 volt, replace. Before replacing, verify tap setting and correct if necessary.
B: BLOWER RUNS BUT COMPRESSOR WILL NOT START (COMPRESSOR OVERLOAD, BAD CAPACITOR, HP FAULT)	
Logic Board	Check if status light is on and logic board is working properly. Check fault lights. See LED Identification chart in Controls Section
Defective Sensors	Check status/fault lights. Sensor is out of normal range for resistance values, open, or shorted. Compare sensor resistance values with the charted resistance in Controls Section
Defective Capacitor	Check capacitor. If defective, replace.
Failed Compressor	See charts M and N for compressor diagnostic. If compressor still doesn't run, replace it.
Low Pressure Switch	Low refrigerant charge. Check for pressure. Check for leaks.
C: BLOWER RUNS BUT COMPRESSOR SHORT CYCLES OR DOES NOT RUN	
Wiring	Loose or broken wires. Tighten or replace wires. See A: Unit will not start in either cycle.
Blown Fuse	Check fuse size. Check unit nameplate for correct sizing. Replace fuse or reset circuit breaker.
Check low voltage circuit breaker.	Temporarily bypass flow switch for a couple seconds. If compressor runs properly, check switch. If defective, replace. If switch is not defective, check for air in loop system. Make sure loop system is properly purged. Verify flow rate before changing switch. .
Defective Sensors	Check status/fault lights. Sensor is out of normal range for resistance values, open, or shorted. Compare sensor resistance values with the charted resistance in Controls Section
Water Flow (Source Heat Exchanger Freeze Fault)	Check status/fault lights. To check water flow remove the FS jumper (see Controls Section for location) and jumper the two FS terminals (located between blue and violet wires on the right side of the board) together to complete the flow switch circuit. Determine if the required water pressure drop is present. If required pressure drop is present, check the resistance of T4 source sensor (15°F=41.39kΩ; 30°F=28.61kΩ) and temperature of the refrigerant line between the source heat exchanger and TXV.
High or Low Pressure Switches	If heat pump is out on high or low-pressure cutout (lockout), check for faulty switches by jumping the high and low-pressure switches individually. If defective replace. Check airflow, filters, water flow, refrigerant pressures, and ambient temperature. WARNING: Only allow compressor to run for a couple of seconds with the high pressure switch jumped.
Defective Logic Board Relay	Jump R to Y directly on lockout board. Check for 24V at Y. If no operation and no faults occur, replace lockout board.
Hot Gas Temperature>220°F	Check status/fault lights. Check hot gas/discharge line temperature with a thermocouple type thermometer. WARNING: Let the unit remain off for several minutes and touch the thermocouple to the discharge line to check if it is cooled enough to strap/tape a thermocouple to it. Check the discharge line temperature during the next operation cycle to compare the temperature to the lockout temperature of 220°F. Check water/air flow. If water/air flow is present, check the refrigerant pressures.
Condensate Overflow (CO)	Check status/fault lights. Check sensors for contact with water, debris, or a loose sensor touching metal. Clean sensors if contacting debris. Flush drain lines if the drain pan is full. If no debris is present and drain pan is empty, remove violet wire from CO terminal on lockout board (lower right). If CO lockout occurs with violet wire removed replace the lockout board.
Over/Under Voltage	Make sure secondary/low voltage is between 20V and 29V. Check the transformer's primary connections for the correct voltage (Orange & Black = 230V; Red & Black = 208V). Correct any possible voltage drops in the main voltage.
Load Heat Exchanger Frozen	Check status/fault lights. Check for reduced air flow due to dirty filter, obstructions, or poor blower performance. Check T1 sensor for the proper resistance (30°F = 28.61kΩ).

D: UNIT RUNNING NORMAL, BUT SPACE TEMPERATURE IS UNSTABLE

Thermostat	Thermostat is getting a draft of cold or warm air. Make sure that the wall or hole used to run thermostat wire from the ceiling or basement is sealed, so no draft can come to the thermostat. Faulty Thermostat (Replace).
E: NOISY BLOWER AND LOW AIR FLOW	
Noisy Blower	Blower wheel contacting housing—Readjust, Foreign material inside housing—Clean housing. Loose duct work—Secure properly.
Low air flow	Check speed setting, check nameplate or data manual for proper speed, and correct speed setting. Check for dirty air filter—Clean or replace; obstruction in system—Visually check. Balancing dampers closed, registers closed, leaks in ductwork. Repair. Ductwork too small. Resize ductwork.
F: NO WATER FLOW	
Pump Module	Make sure Pump Module is connected to the control box relay (check all electrical connections). For non-pressurized systems, check water level in Pump Module. If full of water, check pump. Close valve on the pump flanges and loosen pump. Take off pump and see if there is an obstruction in the pump. If pump is defective, replace. For pressurized systems, check loop pressure. Repressurize if necessary. May require re-flushing if there is air in the loop.
Solenoid valve	Make sure solenoid valve is connected. Check solenoid. If defective, replace.
G: IN HEATING OR COOLING MODE, UNIT OUTPUT IS LOW	
Water	Water flow & temperature insufficient.
Airflow	Check speed setting, check nameplate or data manual for proper speed, and correct speed setting. Check for dirty air filter—Clean or replace. Restricted or leaky ductwork. Repair.
Refrigerant charge	Refrigerant charge low, causing inefficient operation. Make adjustments only after airflow and water flow are checked.
Reversing valve	Defective reversing valve can create bypass of refrigerant to suction side of compressor. Switch reversing valve to heating and cooling mode rapidly. If problem is not resolved, replace valve. Wrap the valve with a wet cloth and direct the heat away from the valve. Excessive heat can damage the valve. Always use dry nitrogen when brazing. Replace filter/drier any time the circuit is opened.
Heat pump will not cool but will heat. Heat pump will not heat but will cool.	Reversing valve does not shift. Check reversing valve wiring. If wired wrong, correct wiring. If reversing valve is stuck, replace valve. Wrap the valve with a wet cloth and direct the heat away from the valve. Excessive heat can damage the valve. Always use dry nitrogen when brazing. Replace filter/drier any time the circuit is opened.
Water heat exchanger	Check for high-pressure drop, or low temperature drop across the coil. It could be scaled. If scaled, clean with condenser coil cleaner.
System undersized	Recalculate conditioning load.
H: WATER HEAT EXCHANGER FREEZES IN HEATING MODE	
Water flow	Low water flow. Increase flow. See F. No water flow.
Flow Switch	Check switch. If defective, replace.
I: EXCESSIVE HEAD PRESSURE IN COOLING MODE	
Inadequate water flow	Low water flow, increase flow.
J: EXCESSIVE HEAD PRESSURE IN HEATING MODE	
Low air flow	See E: Noisy blower and low air flow.
K: AIR COIL FREEZES OVER IN COOLING MODE	
Air flow	See E: Noisy blower and low air flow.
Blower motor	Motor not running or running too slow. Motor tripping off on overload. Check for overheated blower motor and tripped overload. Replace motor if defective.
Panels	Panels not in place.
Low air flow	See E: Noisy blower and low air flow.

Section 14: Troubleshooting

L: WATER DRIPPING FROM UNIT

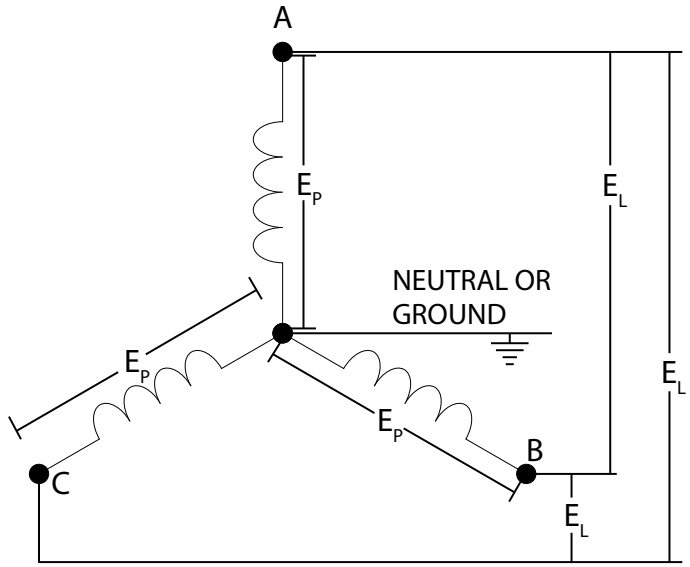
Unit not level	Level unit.
Condensation drain line plugged	Unplug condensation line.
Water sucking off the air coil in cooling mode	Too much airflow. Duct work not completely installed. If duct work is not completely installed, finish duct work. Check static pressure and compare with air flow chart in spec manual under specific models section. If ductwork is completely installed it may be necessary to reduce CFM.
Water sucking out of the drain pan	Install an EZ-Trap or P-Trap on the drain outlet so blower cannot suck air back through the drain outlet.

Unit Electrical Data

⚠ CAUTION ⚠

CHECK COMPRESSOR AMP DRAW TO VERIFY COMPRESSOR ROTATION ON THREE PHASE UNITS. COMPARE AGAINST UNIT ELECTRICAL TABLES. REVERSE ROTATION RESULTS IN HIGHER SOUND LEVELS, LOWER AMP DRAW, AND INCREASED COMPRESSOR WEAR. THE COMPRESSOR INTERNAL OVERLOAD WILL TRIP AFTER A SHORT PERIOD OF OPERATION.

Example 1: WYE (STAR) Electrical Circuit



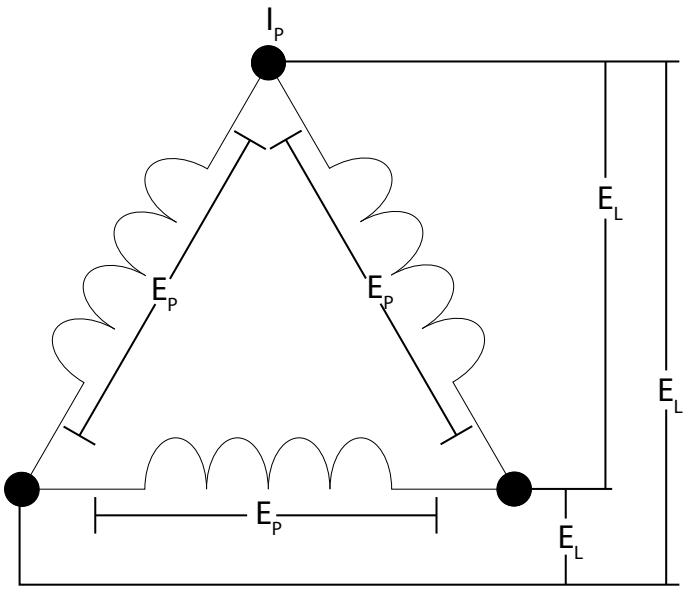
⚠ CAUTION ⚠

ALL VOLTAGE CODE “3” 460V UNITS UTILIZE A 277V ECM MOTOR WHICH REQUIRES A NEUTRAL WIRE. THE MOTORS ARE WIRED BETWEEN THE NEUTRAL AND ONE HOT LEG OF THE CIRCUIT. SOURCE WIRING MUST BE WYE (STAR) CONFIGURATION. 3-PHASE DELTA CONNECTIONS WILL NOT PROVIDE THE CORRECT WIRING AND WILL CAUSE THE UNIT NOT TO OPERATE.

Proper Power Supply Evaluation

When any compressor bearing unit is connected to a weak power supply, starting current will generate a significant “sag” in the voltage which reduces the starting torque of the compressor motor and increases the start time. This will influence the rest of the electrical system in the building by lowering the voltage to the lights. This momentary low voltage causes “light dimming”. The total electrical system should be evaluated with an electrician and HVAC technician. The evaluation should include all connections, sizes of wires, and size of the distribution panel between the unit and the utility’s connection. The transformer connection and sizing should be evaluated by the electric utility provider.

Example 2: DELTA Electrical Circuit



Claim Form

ENERTECH
ENERGY + TECHNOLOGY

WARRANTY ORDER & CLAIM

PHONE: 618.664.9010 **FAX:** 618.664.4597 **EMAIL:** WARRANTY@ENERTECHGEO.COM

ALL WARRANTY REGISTRATIONS SHOULD BE SUBMITTED WITHIN 10 DAYS OF INSTALLATION

COMPANY NAME _____ (Form submitter) DATE _____

PHONE _____ FAX _____ EMAIL _____

ORDERED BY _____ JOB NAME/PO # _____

UNIT *Model #* _____ *Serial #* _____

FAILURE DATE _____

SHIP TO _____ HOMEOWNER _____
(If different than company) _____ ADDRESS _____

_____ _____

Required if claim is for defective flow center

FLOW CENTER MODEL # _____ FLOW CENTER SERIAL # _____

FAILURE CODES, DESCRIPTION AND LABOR REIMBURSEMENT MUST BE FOUND IN WARRANTY MANUAL

FAILURE CODE	DESCRIPTION	PART NUMBER
_____	_____	_____
_____	_____	_____
_____	_____	_____

LABOR REIMBURSEMENT REQUESTED ☐ *NO* ☐ *YES*

DO YOU NEED PARTS ORDERED? ☐ *NO* ☐ *YES* _____ _____

(If no, and replacement was purchased from another vendor, attach copy of bill if reimbursement is needed[3].)

OTHER NOTES _____

_____

FOR ENERTECH COMPANIES USE ONLY

SRO# _____ CREDIT MEMO# _____

1) See warranty coverage summary sheet for labor allowances, conditions and exclusions, etc. **2)** Warranty start date is ship date from Enertech facility unless proof of startup is presented. **3)** Outsourced warranty replacement parts will be reimbursed in the form of credit for the part only. Credit will be no more than the standard equivalent part cost through Enertech. **4)** Factory pre-approval is required for anything outside the scope of this document. **5)** Fuses, hose kits and items not mentioned on Warranty Coverage Summary are not covered under this program.

Registration Form

ENERTECH
ENERGY + TECHNOLOGY

WARRANTY REGISTRATION

NOW REGISTER ONLINE AT WARRANTY-REGISTRATION.ENERTECHGEO.COM

WARRANTY REGISTRATIONS SHOULD BE SUBMITTED WITHIN 60 DAYS OF INSTALLATION

Model Number _____ Serial Number _____ Install Date _____

This unit is performing ☐ Satisfactorily ☐ Not Satisfactorily (please explain) _____

_____

Purchaser/User Name _____ Phone _____

Address _____ City _____ State/Prov _____

Postal Code _____ Email _____

Installer Company Name _____

City _____ State/Prov _____ Email _____

Application

☐ Residential New Construction ☐ Residential Geo Replacement ☐ Residential Replacement of Electric, Gas or Other

☐ Multi-Family (Condo/Townhome/Multiplex) ☐ Commercial ☐ Other _____

Use (check all that apply)

☐ Space Conditioning ☐ Domestic Water Heating ☐ Radiant Heat ☐ Swimming Pool ☐ Snow/Ice Melt

☐ Other _____

Loop Type

☐ Horizontal Loop ☐ Vertical Loop ☐ Pond Loop ☐ Open Loop

Demographics

Household Income ☐ Under $30,000 ☐ $30,000–$45,000 ☐ $45,000–$60,000 ☐ $60,000–$75,000 ☐ $75,000–$100,000 ☐ Over $100,000

Home Size ☐ Up to 1500 sq. ft. ☐ 1501 to 2500 sq. ft. ☐ 2501 to 4000 sq. ft. ☐ Over 4000 sq. ft.

Home Location ☐ Rural ☐ Urban ☐ Suburban

Value of Home ☐ Less than $100,000 ☐ $100,000–$250,000 ☐ $250,000–$500,000 ☐ $500,000–$1 mil ☐ Over $1 mil

Customer Satisfaction

How would you rate your overall satisfaction with your new geothermal system?

○ 1 (Very Dissatisfied) ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 (Very Satisfied)

How would you rate your overall satisfaction with your installing geothermal contractor?

○ 1 (Very Dissatisfied) ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 (Very Satisfied)

MAIL THIS FORM TO:
ENERTECH GLOBAL LLC
2506 SOUTH ELM STREET
GREENVILLE, IL 62246

EMAIL THIS FORM TO:
WARRANTY@ENERTECHGEO.COM

FAX THIS FORM TO:
ENERTECH GLOBAL LLC
618.664.4597

REGISTER ONLINE AT: warranty-registration.enertechgeo.com

Rev 30 DEC 2013B

Revision Table

Date	Description of Revision	Page
04OCT2019	Electrical Data Table updated	12
12AUG2019	Minor layout changes made	Various
26JUL2019	Wiring Diagram added	55-61
22JUL2019	Hyper Engineering Soft Start Wiring Diagram and LED explanation added	51-55
22JUL2019	YT IOM Rev C Document created	ALL

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