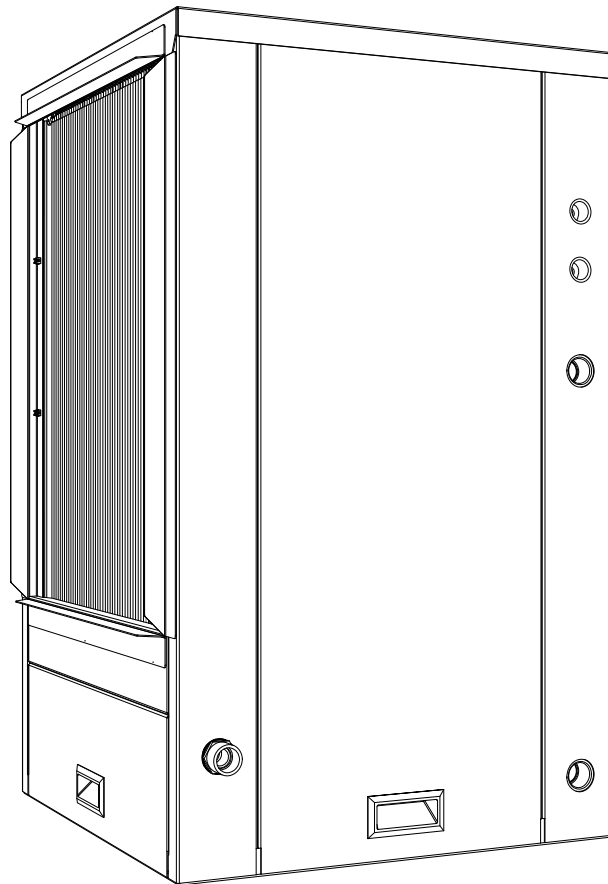


Installation & Operations Manual

VS/VT MODELS PACKAGED WATER-TO-AIR HEAT PUMPS



20D218-02NN



REVISION: A

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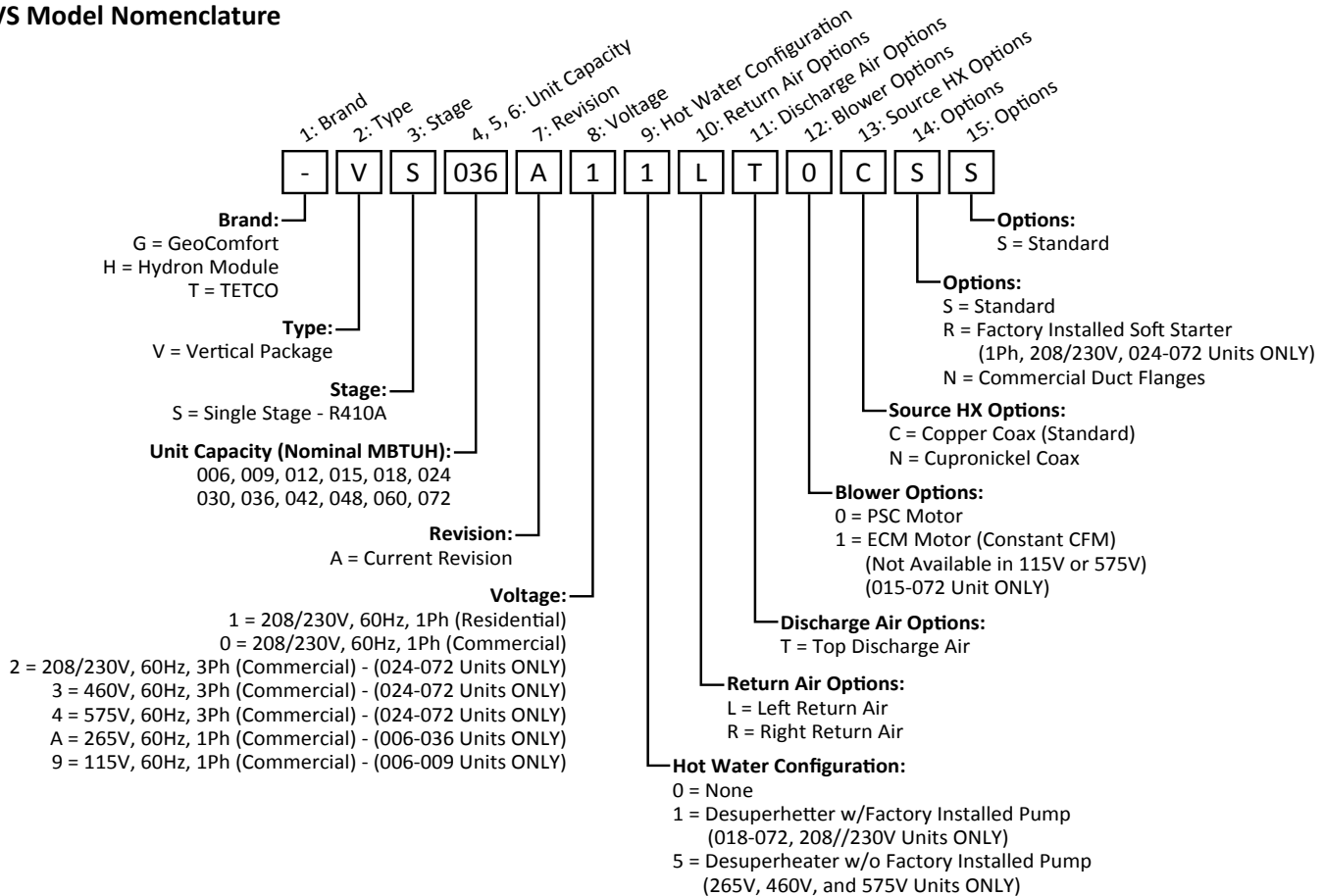
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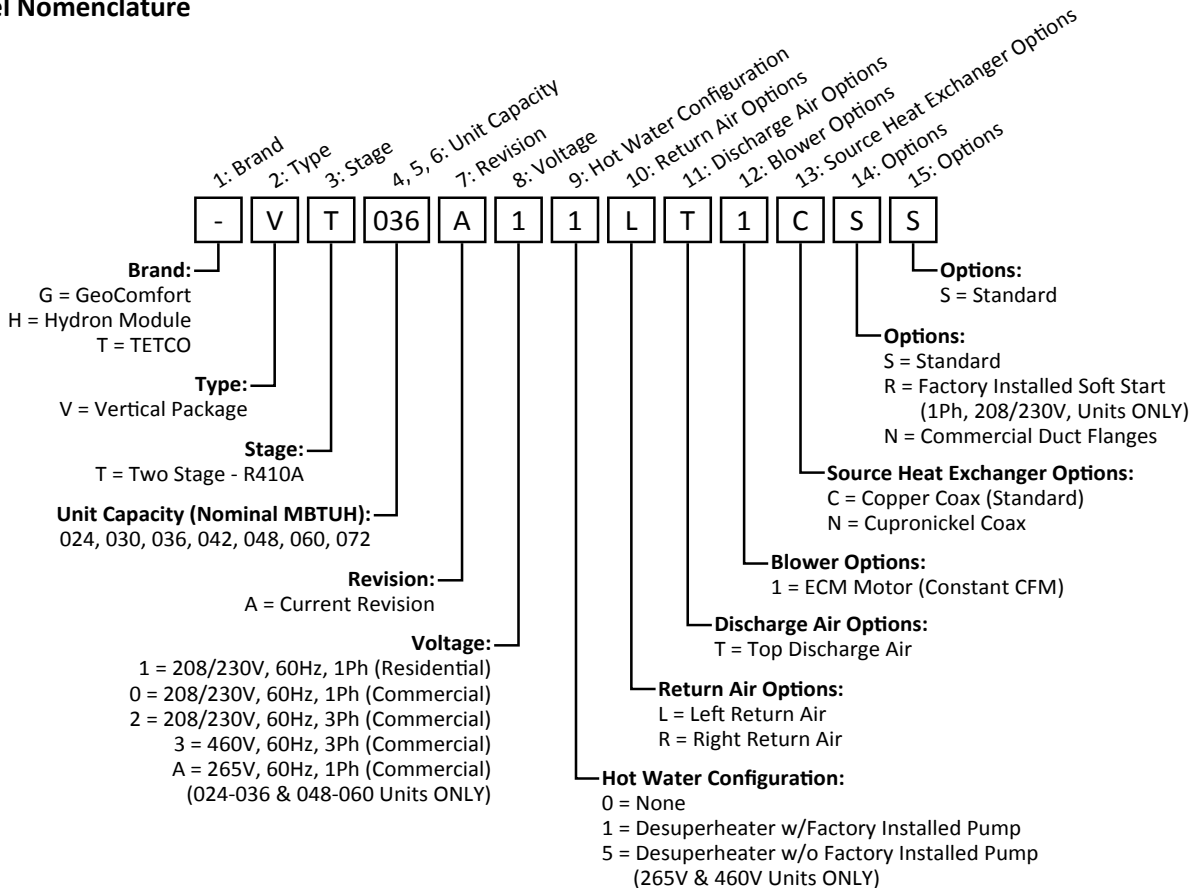
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Section 1: Model Nomenclature

VS Model Nomenclature



VT Model Nomenclature



Section 2: Installation Introduction

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.

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 all damages or shortage on all bill of lading papers. Concealed damage should be reported to the freight company within 15 days. If not filed within 15 days the freight company can deny all claims.

Note: Notify Enertech Global’s shipping department of all damages within 15 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 appropriate unit service panels to locate technical documents and accessory items prior to installation.

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.

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.

Removal and Disposal

Geothermal units removed from service should have all components, oils, antifreeze and refrigerants properly disposed of according to 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 polystyrene 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.

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 motor armature shaft shipping bracket from the rear of the blower.
3. Inspect all electrical connections
4. Compare the electrical data on the unit nameplate with packing slip and ordering information to verify that the correct unit has been shipped.
5. Remove any packaging used to support or hold the blower during shipping. Remove and discard the blower motor armature shaft shipping bracket from the rear of the blower.
6. 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.
7. Verify that all refrigerant tubing is free of dents and kinks. Refrigerant tubing should not be touching other unit components.
8. Before unit start-up, read all manuals and become familiar with unit components and operation. Thoroughly check the unit before operating.



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

Section 2: Installation Introduction

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.

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.

Blower Motor (PSC) PSC blower motor.

Blower Motor (ECM) ECM, Constant CFM blower motor.

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, 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. Downflow units should be placed on a non-combustible base. 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.

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 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).

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.

Section 3: Installation Considerations

- The installer has verified that all applicable wiring, ductwork, piping, and accessories are correct and on the job site.
- Determine left or right side return air pattern prior to unit assembly and installation

⚠ CAUTION ⚠
THIS GEOTHERMAL EQUIPMENT 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. EQUIPMENT IS NOT CERTIFIED FOR OUTDOOR APPLICATIONS. SUCH INSTALLATION WILL VOID ALL WARRANTIES.

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.

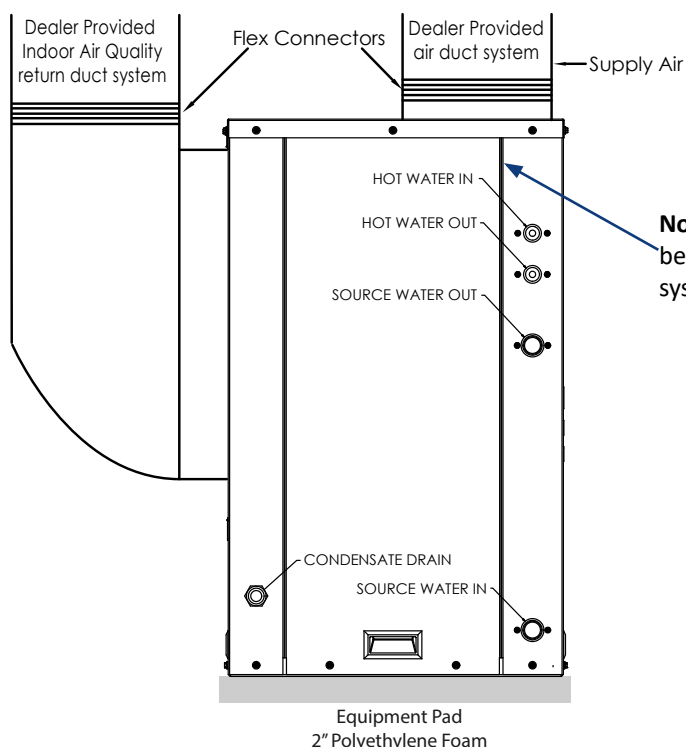
As a general rule, maximum recommended face velocity for a supply outlet used in a residential application is 750 FPM. Maximum recommended return grille velocity is 600 FPM. Systems with higher velocity, are likely to have noise problems.

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

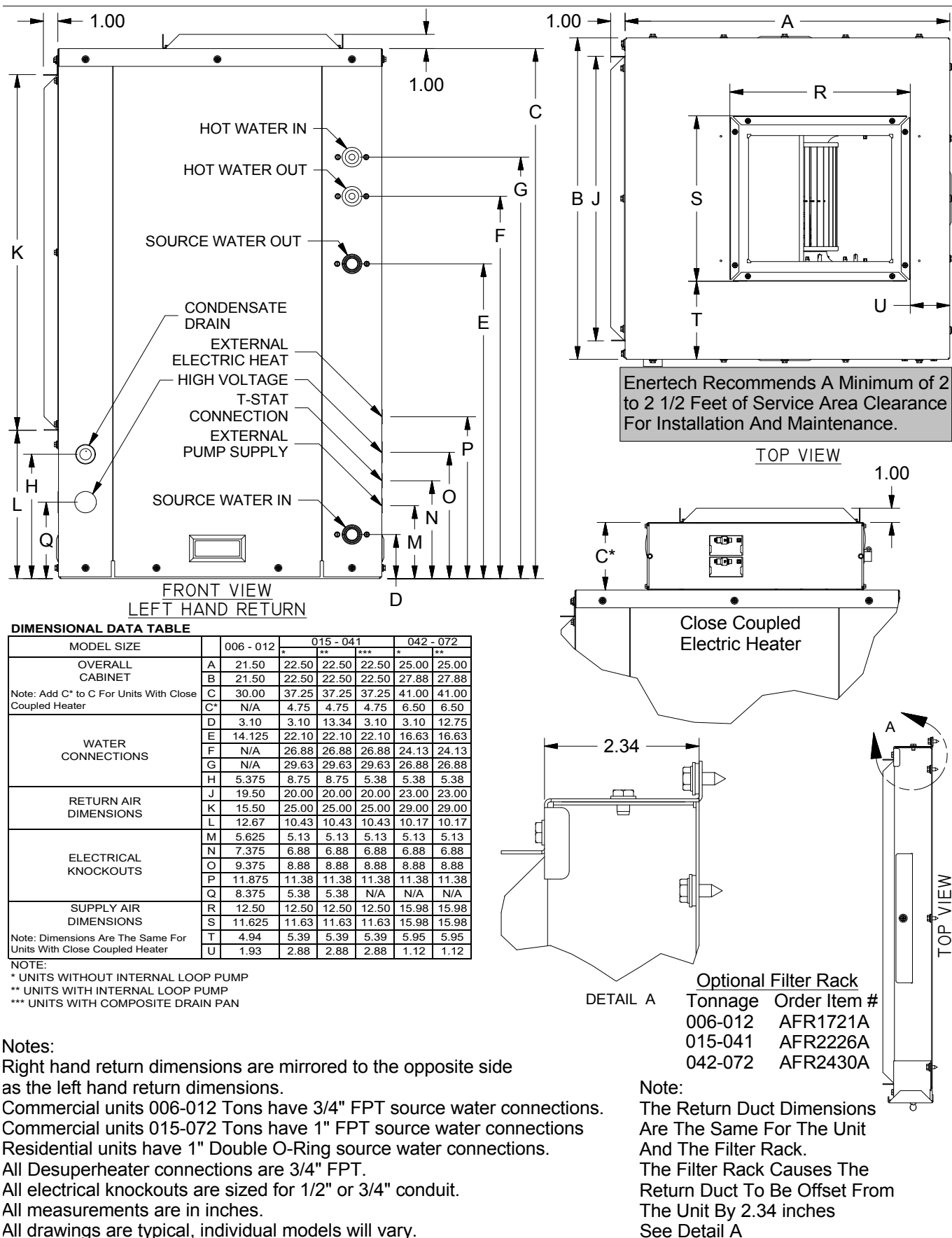
Location	Supply	Return
Main Ducts	900 FPM	600 FPM
Branch Ducts	700 FPM	600 FPM
Grills, Registers, Diffusers	750 FPM	600 FPM

Typical Supply and Return Ductwork Connections



Section 4: Unit Data Information

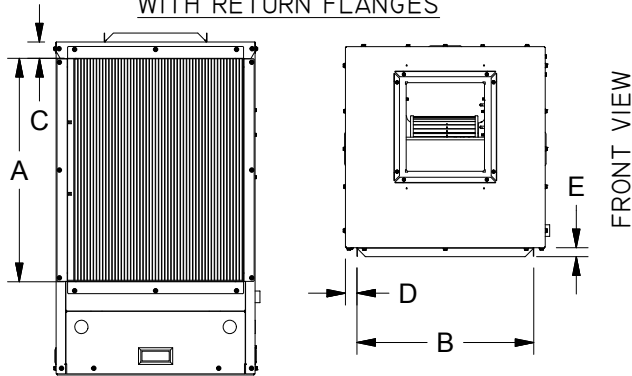
Dimensional Data and Installation Clearances



Section 4: Unit Data Information

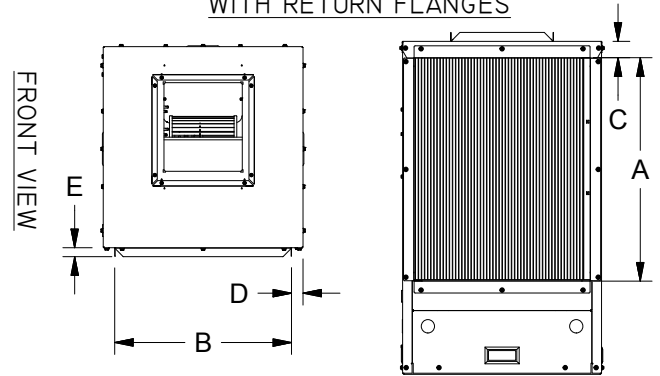
LEFT HAND RETURN MODELS

WITH RETURN FLANGES

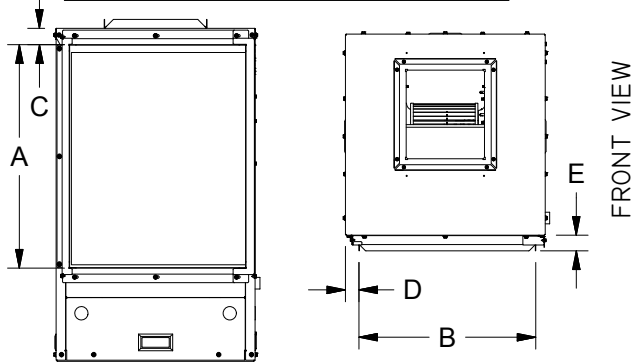


RIGHT HAND RETURN MODELS

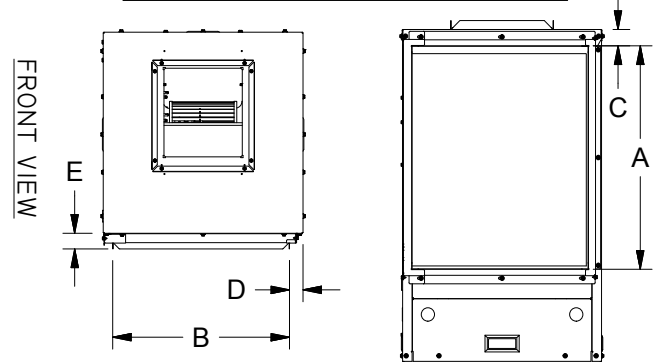
WITH RETURN FLANGES



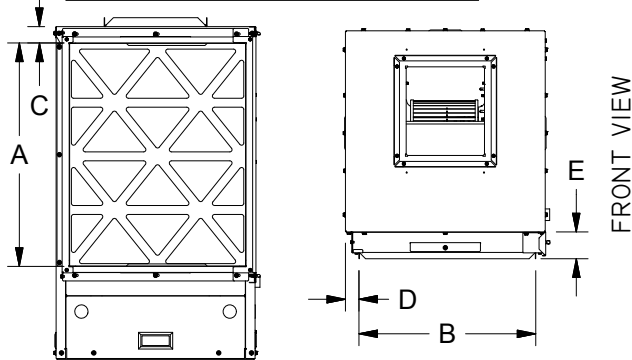
WITH 1" COMMERCIAL FILTER RACK



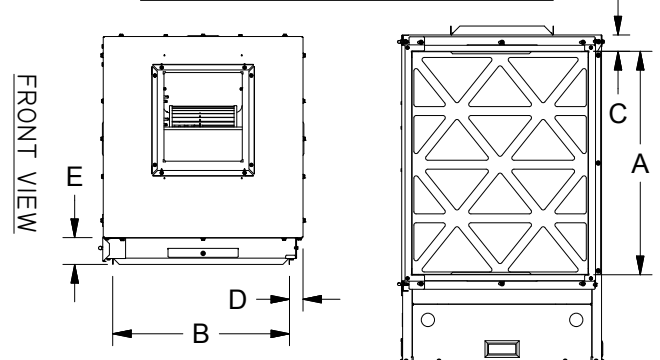
WITH 1" COMMERCIAL FILTER RACK



WITH 1"-2" DELUXE FILTER RACK



WITH 1"-2" DELUXE FILTER RACK



UNIT	DESCRIPTION	A	B	C	D	E
006-012	RETURN DUCT FLANGES	15.50	19.50	1.83	1.00	1.00
	1" COMMERCIAL RACK	15.50	19.50	1.83	1.00	1.75
	1"-2" DELUXE RACK	15.50	19.50	1.83	1.00	3.00
015/041	RETURN DUCT FLANGES	25.00	20.00	1.83	1.30	1.00
	1" COMMERCIAL RACK	25.00	20.00	1.83	1.30	1.75
	1"-2" DELUXE RACK	25.00	20.00	1.83	1.30	3.00
042/072	RETURN DUCT FLANGES	29.00	23.00	1.83	3.25	1.00
	1" COMMERCIAL RACK	29.00	23.00	1.83	3.25	1.75
	1"-2" DELUXE RACK	29.00	23.00	1.83	3.25	3.00

Section 4: Unit Data Information

Unit Physical Data

VS Vertical Packaged Unit													
Model Number	006	009	012	015	018	024	030	036	041	042	048	060	072
Compressor Type	Single Stage Rotary				Single Stage Scroll								
Fan Wheel (in.)	6 x 8			9 x 7	9 x 7			10 x 8T		11 x 10T			
Fan Motor PSC (HP)	1/16			1/4	1/4	1/3	1/3	1/2		1/2	3/4	1	1
Fan Motor ECM (HP)	N/A	N/A	N/A	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4	1	1
*Refrigerant Charge (oz.)	29	30	28.5	40	44	43	53	54	52	69	69	65	70
Air Coil													
Face Area (Sq. Ft.)	2.02			3.49						4.76			
Dimensions (in.)	15.5 x 18.8 x 1			25.4 x 19.8 x 1						28.9 x 23.7 x 1.26			
Number of Rows	N/A Micro-Channel Coil												
Shipped Unit Weight (Nominal) lbs.	187	187	187	234	240	248	265	271	302	357	360	375	367

* Always check the unit data plate for actual refrigerant charge volume

VT Vertical Packaged Unit							
Model Number	024	030	036	042	048	060	072
Compressor Type	Dual Stage Unloading Scroll						
Fan Wheel (in.)	9 x 7		10 x 8T	11 x 10T			
Fan Motor ECM (HP)	1/2	1/2	3/4	3/4	3/4	1	1
*Refrigerant Charge (oz.)	44	52	51	72	69	69	64
Air Coil							
Face Area (Sq. Ft.)	3.49			4.76			
Dimensions (in.)	25.4 x 19.8 x 1.00			28.9 x 23.7 x 1.26			
Number of Rows	N/A Micro-Channel Coil						
Shipped Unit Weight (Nominal) lbs.	248	265	271	357	361	373	375

* Always check the unit data plate for actual refrigerant charge volume

Section 4: Unit Data Information

VS - ECM Electrical Data - 015-041

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						
VS015	00	208/230	1	26.0	5.5	3.9	0.0	0.0	9.4	10.8	15
	10	208/230	1	26.0	5.5	3.9	0.0	4.0	13.4	14.8	20
	A	265	1	28.0	5.0	3.2	0.0	0.0	8.2	9.5	15
VS018	00	208/230	1	48.0	9.0	3.9	0.0	0.0	12.9	15.2	20
	01	208/230	1	48.0	9.0	3.9	0.5	0.0	13.4	15.7	25
	10	208/230	1	48.0	9.0	3.9	0.0	4.0	16.9	19.2	25
	11	208/230	1	48.0	9.0	3.9	0.5	4.0	17.4	19.7	25
	A	265	1	43.0	7.1	3.2	0.0	0.0	10.3	12.1	15
VS024	00	208/230	1	58.3	13.5	3.9	0.0	0.0	17.4	20.8	30
	01	208/230	1	58.3	13.5	3.9	0.5	0.0	17.9	21.3	35
	10	208/230	1	58.3	13.5	3.9	0.0	4.0	21.4	24.8	35
	11	208/230	1	58.3	13.5	3.9	0.5	4.0	21.9	25.3	35
	20	208/230	3	55.4	7.1	3.9	0.0	0.0	11.0	12.8	20
	21	208/230	3	55.4	7.1	3.9	0.5	0.0	11.5	13.3	20
	30/35	460	3	28.0	3.5	3.2	0.0	0.0	6.7	7.6	15
	A	265	1	54.0	9.0	3.2	0.0	0.0	12.2	14.5	20
VS030	00	208/230	1	64.0	12.8	3.9	0.0	0.0	16.7	19.9	30
	01	208/230	1	64.0	12.8	3.9	0.5	0.0	17.2	20.4	30
	10	208/230	1	64.0	12.8	3.9	0.0	4.0	20.7	23.9	35
	11	208/230	1	64.0	12.8	3.9	0.5	4.0	21.2	24.4	35
	20	208/230	3	58.0	8.3	3.9	0.0	0.0	12.2	14.3	20
	21	208/230	3	58.0	8.3	3.9	0.5	0.0	12.7	14.8	20
	30/35	460	3	28.0	5.1	3.2	0.0	0.0	8.3	9.6	15
	A	265	1	60.0	10.9	3.2	0.0	0.0	14.1	16.8	25
VS036	00	208/230	1	79.0	16.7	5.2	0.0	0.0	21.9	26.1	40
	01	208/230	1	79.0	16.7	5.2	0.5	0.0	22.4	26.6	40
	10	208/230	1	79.0	16.7	5.2	0.0	4.0	25.9	30.1	45
	11	208/230	1	79.0	16.7	5.2	0.5	4.0	26.4	30.6	45
	20	208/230	3	73.0	10.4	5.2	0.0	0.0	15.6	18.2	25
	21	208/230	3	73.0	10.4	5.2	0.5	0.0	16.1	18.7	25
	30/35	460	3	38.0	5.8	4.7	0.0	0.0	10.5	12.0	15
	A	265	1	72.0	13.5	4.7	0.0	0.0	18.2	21.6	35
VS041	00	208/230	1	109.0	16.7	5.2	0.0	0.0	21.9	26.1	40
	01	208/230	1	109.0	16.7	5.2	0.5	0.0	22.4	26.6	40
	10	208/230	1	109.0	16.7	5.2	0.0	5.5	27.4	31.6	45
	11	208/230	1	109.0	16.7	5.2	0.5	5.5	27.9	32.1	45
	20	208/230	3	88.0	11.2	5.2	0.0	0.0	16.4	19.2	30
	21	208/230	3	88.0	11.2	5.2	0.5	0.0	16.9	19.7	30
	30/35	460	3	44.0	5.6	4.7	0.0	0.0	10.3	11.7	15

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 = 432-504, 575/60 = 540-630, 265/60 = 249-291
 4. See Wiring Diagrams for proper 460V and 575V power.
- *The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 041-072 and two pumps for 006-036.

Section 4: Unit Data Information

VS - ECM Electrical Data - 042-072

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						
VS042	00	208/230	1	109.0	16.7	5.2	0.0	0.0	21.9	26.1	40
	01	208/230	1	109.0	16.7	5.2	0.5	0.0	22.4	26.6	40
	10	208/230	1	109.0	16.7	5.2	0.0	5.5	27.4	31.6	45
	11	208/230	1	109.0	16.7	5.2	0.5	5.5	27.9	32.1	45
	20	208/230	3	88.0	11.2	5.2	0.0	0.0	16.4	19.2	30
	21	208/230	3	88.0	11.2	5.2	0.5	0.0	16.9	19.7	30
	30/35	460	3	44.0	5.6	4.7	0.0	0.0	10.3	11.7	15
VS048	00	208/230	1	130.0	19.6	5.2	0.0	0.0	24.8	29.7	45
	01	208/230	1	130.0	19.6	5.2	0.5	0.0	25.3	30.2	50
	10	208/230	1	130.0	19.6	5.2	0.0	5.5	30.3	35.2	50
	11	208/230	1	130.0	19.6	5.2	0.5	5.5	30.8	35.7	50
	20	208/230	3	83.1	13.7	5.2	0.0	0.0	18.9	22.3	35
	21	208/230	3	83.1	13.7	5.2	0.5	0.0	19.4	22.8	35
	30/35	460	3	41.0	6.2	4.7	0.0	0.0	10.9	12.5	15
VS060	00	208/230	1	144.2	24.4	6.9	0.0	0.0	31.3	37.4	60
	01	208/230	1	144.2	24.4	6.9	0.5	0.0	31.8	37.9	60
	10	208/230	1	144.2	24.4	6.9	0.0	5.5	36.8	42.9	60
	11	208/230	1	144.2	24.4	6.9	0.5	5.5	37.3	43.4	60
	20	208/230	3	110.0	16.0	6.9	0.0	0.0	22.9	26.9	40
	21	208/230	3	110.0	16.0	6.9	0.5	0.0	23.4	27.4	40
	30/35	460	3	52.0	7.8	6.0	0.0	0.0	13.8	15.8	20
VS072	00	208/230	1	178.0	30.8	6.9	0.0	0.0	37.7	45.4	70
	01	208/230	1	178.0	30.8	6.9	0.5	0.0	38.2	45.9	70
	10	208/230	1	178.0	30.8	6.9	0.0	5.5	43.2	50.9	80
	11	208/230	1	178.0	30.8	6.9	0.5	5.5	43.7	51.4	80
	20	208/230	3	136.0	19.6	6.9	0.0	0.0	26.5	31.4	50
	21	208/230	3	136.0	19.6	6.9	0.5	0.0	27.0	31.9	50
	30/35	460	3	66.1	8.2	6.0	0.0	0.0	14.2	16.3	20

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 = 432-504, 575/60 = 540-630, 265/60 = 249-291
4. See Wiring Diagrams for proper 460V and 575V power.

*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 041-072 and two pumps for 006-036.

Section 4: Unit Data Information

VS - PSC Electrical Data - 006-036

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						
VS006	00	208/230	1	17.7	2.5	0.8	0.0	0.0	3.3	3.9	15
	10	208/230	1	17.7	2.5	0.8	0.0	4.0	7.3	7.9	15
	A0	265	1	13.5	2.1	0.7	0.0	0.0	2.8	3.3	15
	90	115	1	36.2	5.0	1.5	0.0	0.0	6.5	7.8	15
VS009	00	208/230	1	20.0	4.4	0.8	0.0	0.0	5.2	6.3	15
	10	208/230	1	20.0	4.4	0.8	0.0	4.0	9.2	10.3	15
	A0	265	1	21.0	3.4	0.7	0.0	0.0	4.1	4.9	15
	90	115	1	50.0	7.8	1.5	0.0	0.0	9.3	11.3	15
VS012	00	208/230	1	26.0	4.7	0.8	0.0	0.0	5.5	6.7	15
	10	208/230	1	26.0	4.7	0.8	0.0	4.0	9.5	10.7	15
	A0	265	1	23.0	3.8	0.7	0.0	0.0	4.5	5.5	15
VS015	00	208/230	1	26.0	5.5	1.5	0.0	0.0	7.0	8.4	15
	10	208/230	1	26.0	5.5	1.5	0.0	4.0	11.0	12.4	15
	A0	265	1	28.0	5.0	2.0	0.0	0.0	7.0	8.3	15
VS018	00	208/230	1	48.0	9.0	1.5	0.0	0.0	10.5	12.8	20
	01	208/230	1	48.0	9.0	1.5	0.5	0.0	11.0	13.3	20
	10	208/230	1	48.0	9.0	1.5	0.0	4.0	14.5	16.8	25
	11	208/230	1	48.0	9.0	1.5	0.5	4.0	15.0	17.3	25
	A	265	1	43.0	7.1	2.0	0.0	0.0	9.1	10.9	15
VS024	00	208/230	1	58.3	13.5	1.9	0.0	0.0	15.4	18.8	30
	01	208/230	1	58.3	13.5	1.9	0.5	0.0	15.9	19.3	30
	10	208/230	1	58.3	13.5	1.9	0.0	4.0	19.4	22.8	35
	11	208/230	1	58.3	13.5	1.9	0.5	4.0	19.9	23.3	35
	20	208/230	3	55.4	7.1	1.9	0.0	0.0	9.0	10.8	15
	21	208/230	3	55.4	7.1	1.9	0.5	0.0	9.5	11.3	15
	30/35	460	3	28.0	3.5	0.9	0.0	0.0	4.4	5.3	15
	40/45	575	3	24.5	2.9	1.1	0.0	0.0	4.0	4.7	15
	A	265	1	54.0	9.0	2.2	0.0	0.0	11.2	13.5	20
VS030	00	208/230	1	64.0	12.8	1.9	0.0	0.0	14.7	17.9	30
	01	208/230	1	64.0	12.8	1.9	0.5	0.0	15.2	18.4	30
	10	208/230	1	64.0	12.8	1.9	0.0	4.0	18.7	21.9	35
	11	208/230	1	64.0	12.8	1.9	0.5	4.0	19.2	22.4	35
	20	208/230	3	58.0	8.3	1.9	0.0	0.0	10.2	12.3	20
	21	208/230	3	58.0	8.3	1.9	0.5	0.0	10.7	12.8	20
	30/35	460	3	28.0	5.1	0.9	0.0	0.0	6.0	7.3	15
	40/45	575	3	23.7	3.3	1.1	0.0	0.0	4.4	5.2	15
	A	265	1	60.0	10.9	2.2	0.0	0.0	13.1	15.8	25
VS036	00	208/230	1	79.0	16.7	2.9	0.0	0.0	19.6	23.8	40
	01	208/230	1	79.0	16.7	2.9	0.5	0.0	20.1	24.3	40
	10	208/230	1	79.0	16.7	2.9	0.0	4.0	23.6	27.8	40
	11	208/230	1	79.0	16.7	2.9	0.5	4.0	24.1	28.3	45
	20	208/230	3	73.0	10.4	2.9	0.0	0.0	13.3	15.9	25
	21	208/230	3	73.0	10.4	2.9	0.5	0.0	13.8	16.4	25
	30/35	460	3	38.0	5.8	1.2	0.0	0.0	7.0	8.5	15
	40/45	575	3	36.5	3.8	1.0	0.0	0.0	4.8	5.8	15
	A	265	1	72.0	13.5	3.4	0.0	0.0	16.9	20.3	30

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 = 432-504, 575/60 = 540-630, 265/60 = 249-291
4. See Wiring Diagrams for proper 460V and 575V power.

*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 041-072 and two pumps for 006-036.

Section 4: Unit Data Information

VS - PSC Electrical Data - 041-072

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						
VS041	00	208/230	1	109.0	16.7	2.9	0.0	0.0	19.6	23.8	40
	01	208/230	1	109.0	16.7	2.9	0.5	0.0	20.1	24.3	40
	10	208/230	1	109.0	16.7	2.9	0.0	5.5	25.1	29.3	45
	11	208/230	1	109.0	16.7	2.9	0.5	5.5	25.6	29.8	45
	20	208/230	3	84.0	11.2	2.9	0.0	0.0	14.1	16.9	25
	21	208/230	3	84.0	11.2	2.9	0.5	0.0	14.6	17.4	25
	30/35	460	3	44.0	5.6	1.2	0.0	0.0	6.8	8.2	15
	40/45	575	3	34.0	3.8	1.0	0.0	0.0	4.8	5.8	15
VS042	00	208/230	1	109.0	16.7	2.9	0.0	0.0	19.6	23.8	40
	01	208/230	1	109.0	16.7	2.9	0.5	0.0	20.1	24.3	40
	10	208/230	1	109.0	16.7	2.9	0.0	5.5	25.1	29.3	45
	11	208/230	1	109.0	16.7	2.9	0.5	5.5	25.6	29.8	45
	20	208/230	3	84.0	11.2	2.9	0.0	0.0	14.1	16.9	25
	21	208/230	3	84.0	11.2	2.9	0.5	0.0	14.6	17.4	25
	30/35	460	3	84.0	5.6	1.2	0.0	0.0	6.8	8.2	15
	40/45	575	3	34.0	3.8	1.0	0.0	0.0	4.8	5.8	15
VS048	00	208/230	1	130.0	19.6	4.0	0.0	0.0	23.6	28.5	45
	01	208/230	1	130.0	19.6	4.0	0.5	0.0	24.1	29.0	45
	10	208/230	1	130.0	19.6	4.0	0.0	5.5	29.1	34.0	50
	11	208/230	1	130.0	19.6	4.0	0.5	5.5	29.6	34.5	50
	20	208/230	3	83.1	13.7	4.0	0.0	0.0	17.7	21.1	35
	21	208/230	3	83.1	13.7	4.0	0.5	0.0	18.2	21.6	35
	30/35	460	3	41.0	6.2	2.1	0.0	0.0	8.3	9.9	15
	40/45	575	3	33.0	4.8	3.8	0.0	0.0	7.9	9.1	15
VS060	00	208/230	1	144.2	24.4	5.6	0.0	0.0	30.0	36.1	60
	01	208/230	1	144.2	24.4	5.6	0.5	0.0	30.5	36.6	60
	10	208/230	1	144.2	24.4	5.6	0.0	5.5	35.5	41.6	60
	11	208/230	1	144.2	24.4	5.6	0.5	5.5	36.0	42.1	60
	20	208/230	3	110.0	16.0	5.6	0.0	0.0	21.6	25.6	40
	21	208/230	3	110.0	16.0	5.6	0.5	0.0	22.1	26.1	40
	30/35	460	3	52.0	7.8	2.6	0.0	0.0	10.4	12.4	20
	40/45	575	3	38.9	5.7	2.1	0.0	0.0	7.8	9.2	15
VS072	00	208/230	1	178.0	30.8	5.6	0.0	0.0	36.4	44.1	70
	01	208/230	1	178.0	30.8	5.6	0.5	0.0	36.9	44.6	70
	10	208/230	1	178.0	30.8	5.6	0.0	5.5	41.9	49.6	80
	11	208/230	1	178.0	30.8	5.6	0.5	5.5	42.4	50.1	80
	20	208/230	3	136.0	19.6	5.6	0.0	0.0	25.2	30.1	50
	21	208/230	3	136.0	19.6	5.6	0.5	0.0	25.7	30.6	50
	30/35	460	3	66.1	8.2	2.6	0.0	0.0	10.8	12.9	20
	40/45	575	3	55.3	6.6	2.1	0.0	0.0	8.7	10.4	15

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 = 432-504, 575/60 = 540-630, 265/60 = 249-291
 4. See Wiring Diagrams for proper 460V and 575V power.
- *The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 041-072 and two pumps for 006-036.

Section 4: Unit Data Information

VT - ECM Electrical Data - 024-048

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						
VT024	00	208/230	1	58.3	11.7	3.9	0.0	0.0	15.6	18.5	30
	01	208/230	1	58.3	11.7	3.9	0.5	0.0	16.1	19.0	30
	10	208/230	1	58.3	11.7	3.9	0.0	4.0	19.6	22.5	30
	11	208/230	1	58.3	11.7	3.9	0.5	4.0	20.1	23.0	35
	20	208/230	3	55.4	6.5	3.9	0.0	0.0	10.4	12.0	15
	21	208/230	3	55.4	6.5	3.9	0.5	0.0	10.9	12.5	15
	30/35	460	3	28.0	3.5	3.2	0.0	0.0	6.7	7.6	15
	A	265	1	54.0	9.1	3.2	0.0	0.0	12.3	14.6	20
VT030	00	208/230	1	73.0	13.1	3.9	0.0	0.0	17.0	20.3	30
	01	208/230	1	73.0	13.1	3.9	0.5	0.0	17.5	20.8	30
	10	208/230	1	73.0	13.1	3.9	0.0	4.0	21.0	24.3	35
	11	208/230	1	73.0	13.1	3.9	0.5	4.0	21.5	24.8	35
	20	208/230	3	58.0	8.7	3.9	0.0	0.0	12.6	14.8	20
	21	208/230	3	58.0	8.7	3.9	0.5	0.0	13.1	15.3	20
	30/35	460	3	28.0	4.3	3.3	0.0	0.0	7.6	8.7	15
	A	265	1	60.0	10.2	3.3	0.0	0.0	13.5	16.1	25
VT036	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
	A	265	1	72.0	13.0	4.7	0.0	0.0	17.7	21.0	30
VT042	00	208/230	1	96.0	17.9	5.9	0.0	0.0	23.8	28.3	45
	01	208/230	1	96.0	17.9	5.9	0.5	0.0	24.3	28.8	45
	10	208/230	1	96.0	17.9	5.9	0.0	5.5	29.3	33.8	50
	11	208/230	1	96.0	17.9	5.9	0.5	5.5	29.8	34.3	50
	20	208/230	3	88.0	14.2	5.9	0.0	0.0	20.1	23.7	35
	21	208/230	3	88.0	14.2	5.9	0.5	0.0	20.6	24.2	35
	30/35	460	3	44.0	6.2	4.8	0.0	0.0	11.0	12.6	15
VT048	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
	A	265	1	109.7	16.0	4.7	0.0	0.0	20.7	24.7	40

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 = 432-504, 575/60 = 540-630, 265/60 = 249-291
4. See Wiring Diagrams for proper 460V and 575V power.

*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 042-072 and two pumps for 024-036.

Section 4: Unit Data Information

VT - ECM Electrical Data - 060-072

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						
VT060	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
	A	265	1	130.0	22.4	6.0	0.0	0.0	28.4	34.0	50
VT072	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 = 432-504, 575/60 = 540-630, 265/60 = 249-291
 4. See Wiring Diagrams for proper 460V and 575V power.
- *The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 042-072 and two pumps for 024-036.

Section 4: Unit Data Information

PSC Fan Performance, Single Stage Compressor Units

*VS Series PSC Fan Performance Data																
Model	Motor Speed	Blower Size	Motor HP	CFM Nominal	Static Pressure (inches w.c.)											
					0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.80
006/009/012	H	6 x 9	1/16	350 (009, 012)	410	400	400	390	380	375	360	350	335	300	265	
	M/H				370	355	350	340	335	320	300	275				
	M/L			275 (006)	340	330	325	315	305	295	285	275	260			
	L				290	280	270	265	255							
015/018	H	9 x 7	1/4		1120	1110	1090	1065	1040	1015	990	960	935	870	770	595
	M			700 (018)	775	775	770	760	750	740	730	715	695	635	525	
	L			600 (015)	665	660	660	660	650	640	630	610	590	525	430	
024/030	H	9 x 7	1/3	1000 (030)	1230	1220	1200	1170	1145	1120	1090	1060	1025	955	860	720
	M			800 (024)	950	950	945	940	925	915	900	890	870	830	755	625
	L				810	810	815	810	810	805	800	790	775	740	670	
036	H	10 x 8	1/2	1150	1445	1430	1420	1410	1400	1388	1375	1360	1340	1290	1215	1120
	M				985	990	990	995	995	995	995	990	985	960	920	860
	L				840	850	850	855	860	860	865	860	860	840	805	755
041	H	10 x 8	1/2	1200	1445	1430	1420	1410	1400	1388	1375	1360	1340	1290	1215	1120
	M				985	990	990	995	995	995	995	990	985	960	920	860
	L				840	850	850	855	860	860	865	860	860	840	805	755
042	H	11 x 10	1/2	1450	1500	1510	1510	1510	1510	1515	1520	1520	1505	1490	1465	1425
	M				890	890	895	890	895	885	880					
	L															
048	H	11 x 10	3/4		1945	1940	1940	1945	1950	1950	1950	1945	1930	1880	1820	1750
	M			1550	1480	1485	1500	1510	1515	1530	1540	1545	1540	1515	1485	1430
	L				1150	1180	1190	1200	1210	1215	1225	1225	1220	1220	1205	1170
060/072	H	11 x 10	1	2100 (072)									2280	2250	2210	2160
	M			1850 (060)	1890	1900	1905	1905	1905	1910	1915	1920	1930	1915	1880	1795
	L						1500	1515	1525	1545	1550	1560	1570	1560	1540	

Notes:

- PSC Blower motors come with 3 or 4 speed taps. To change the speed of the motor to a higher or lower speed, remove the electric box cover that is mounted on the blower. Locate the label on the motor to identify the wire color for each speed. Remove the wire nut on the existing speed and replace with the wire of selected speed.
- Max ESP for VS015 through VS030 and models with external 5kW electric heat is 0.6 in. w.c.; for VS024 models with external 10kW heat it is 0.5 in. w.c.; for VS030 models with external 10kW electric heat it is 0.6 in. w.c.; for VS036 through VS041 models with external 5kW or 10kW electric heat it is 0.6 in. w.c.; for VS036 through VS041 models with

Section 4: Unit Data Information

ECM Fan Performance, Single & Two-Stage Compressor Units

*VS/*VT Series ECM Fan Performance Data: One & 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
015	1.1	A	-	660	-	660	-	550	330	-	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		B	-	550	-	550	-	490	290	-	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
		C	-	490	-	490	-	400	240	-	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
		D	-	410	-	400	-		200	-	ON	ON	OFF	OFF	ON	ON	OFF	OFF
018	1.1	A	-	750	-	750	-	670	390	-	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
		B	-	700	-	700	-	625	370	-	ON	ON	ON	OFF	ON	ON	OFF	OFF
		C	-	675	-	675	-	540	320	-	ON	ON	OFF	OFF	ON	ON	OFF	OFF
		D	-	570	-	570	-	490	250	-	ON	ON	OFF	OFF	ON	ON	OFF	OFF
024	1.1	A	700	880	700	880	590	750	450	870	ON	OFF	ON	OFF	ON	OFF	OFF	OFF
		B	650	800	650	800	540	680	400	800	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
		C	570	720	570	720	450	630	340	730	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
		D	520	680	520	680			310	700	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
030	1.1	A	800	1100	825	1100	700	935	575	1100	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
		B	740	1000	760	1000	650	850	500	990	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		C	725	900	725	900	600	765	450	890	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
		D	650	800	650	800			400	800	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
036	1.1	A	880	1320	880	1210	750	1030	605	1480	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
		B	800	1200	800	1100	680	935	550	1400	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
		C	720	1080	720	990			495	1270	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
		D	640	990	640	880			440	1140	ON	ON	ON	OFF	ON	ON	OFF	OFF
041	1.1	A	-	1320	-	1300	800	1100	650	1480	ON	OFF	ON	OFF	ON	OFF	OFF	OFF
		B	-	1320	-	1210	750	1030	605	1480	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
		C	-	1200	-	1100	680	935	550	1400	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
		D	-	1080	-	990			495	1270	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
042	1.1	A	1220	1510	1250	1600	1055	1350	730	1660	ON	OFF	ON	OFF	ON	OFF	OFF	OFF
		B	1160	1400	1160	1450	975	1235	660	1490	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
		C	1000	1220	1025	1300	875	1120	590	1330	ON	OFF	OFF	ON	ON	OFF	OFF	OFF
		D	900	1110	950	1200			490	1220	ON	ON	OFF	OFF	ON	ON	OFF	OFF
048	1.1	A	1380	1710	1380	1770	1175	1500	810	1880	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
		B	1250	1540	1270	1610	1060	1345	750	1720	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
		C	1130	1400	1190	1430	940	1225	670	1540	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
		D	1000	1220	1000	1260			610	1350	ON	ON	ON	OFF	ON	ON	OFF	OFF
060	1.1	A	1850	2180	1800	2200	1500	1850	1030	2190	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
		B	1680	1980	1580	2000	1350	1650	940	1990	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		C	1500	1700	1430	1750			820	1770	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
		D	1160	1350	1250	1500			710	1430	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
072	0.9	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		B	1850	2180	1800	2200	1500	1850	1030	2190	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
		C	1680	1980	1580	2000			940	1990	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		D	1500	1700	1430	1750			820	1770	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF

Notes:

- Program **B (Bold Type)** is factory settings and rated CFM. CFM is controlled within 5% up to the Max ESP.
- Max ESP includes allowance for wet coil and NO FILTER
- Power must be off to the unit for at least 3 seconds before the ECM motor will recognize a program change.
- Max ESP for VS015 and VS018 models with external electric heat is 0.9 in. w.c.; for VS/VT024 and VS/VT030 models it is 0.6 in. w.c.; for VS/VT036 and VS041 (with 5kW or 10kW heater) it is 0.6 in. w.c.; for VS/VT036 and VS041 (with 15kW heater) it is 0.5 in. w.c.; and for VS/VT042 through VS/VT072 it is 0.9 in. w.c. Exceeding the Max ESP may result in nuisance trips of the electric heat. Thermal limits are rated at 100,000 cycles.

*VS/*VT Series Dehumidification Mode Options

DIP Switch		Mode	Operation
S9	S10		
OFF	ON	ODD	On Demand Dehumidification mode (humidistat input at terminal ODD)-- Humidistat
OFF	OFF	Constant Dehum	Constant Dehumidification mode (always uses dehum CFM for cooling and normal CFM for
ON	ON	Not Used	Not an applicable selection.

Notes:

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

Section 4: Unit Data Information

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)

Although the industry standard is adequate in most areas of North America, it is important to consider the application type before applying this “rule of thumb.” Antifreeze is generally required for all closed loop (geothermal) applications. Extreme Southern U.S. locations are the only exception. Open loop (well water) systems cannot use antifreeze, and must have enough flow rate in order to avoid freezing conditions at the Leaving Source Water Temperature (LWT) connection.

Calculations must be made for all systems without antifreeze to determine if the top flow rate is adequate to prevent LWT at or near freezing conditions. The following steps should be taken in making this calculation:

Determine minimum EWT based upon your geographical area.

Go to the performance data table for the heat pump model selected and look up the Heat of Extraction (HE) at the “rule of thumb” water flow rate (GPM) and at the design Entering Air Temperature (EAT).

Calculate the temperature difference (TD) based upon the HE and GPM of the model.

$$TD = HE / (GPM \times 500).$$

Calculate the LWT.

$$LWT = EWT - TD.$$

If the LWT is below 35-38°F, there is potential for freezing conditions if the flow rate or water temperature is less than ideal conditions, and the flow rate must be increased.

Example 1:

EWT = 50°F.

Model VT048, high capacity. Flow rate = 6 GPM.

Air Flow = 1500 CFM. HE = 36,700 Btuh.

$$TD = 36,700 / (6 \times 500) = 12.2^\circ\text{F}$$

$$LWT = 50 - 12.2 = 37.8^\circ\text{F}$$

Since the water flow is leaving at approximately 38°F, the flow rate is acceptable.

Example 2:

EWT = 40°F.

Model VT048, high capacity. Flow rate = 6 GPM.

Air Flow = 1500 CFM. HE = 36,700 Btuh.

$$TD = 36,700 / (6 \times 500) = 12.2^\circ\text{F}$$

$$LWT = 40 - 12.2 = 27.8^\circ\text{F}$$

Water flow rate must be increased to avoid freezing.

Performance Data Notes

1. Capacity data is based upon 15% (by volume) methanol antifreeze solution.
2. Desuperheater capacity is based upon 0.2 GPM Flow per nominal ton at 70°F entering hot water temperature.
3. Interpolation between above categories is permissible; extrapolation is not.
4. See Flow Rate Selection above for proper application.

Section 5: 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, its quality must be monitored. 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.

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 5: 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.**

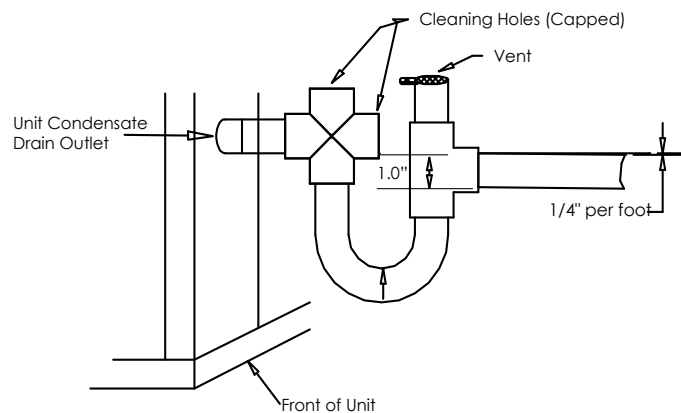
Table 3: Pipe Insulation

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 1**. 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 1: 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 3/4" 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. 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.

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.

Section 5: 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 2**). 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 2: Acceptable mounting positions for Flo-Link and GPM series flow centers.

Equally important to pump longevity is terminal box orientation. See **Figure 3** 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. “Weep holes” are located on three sides of the pump.

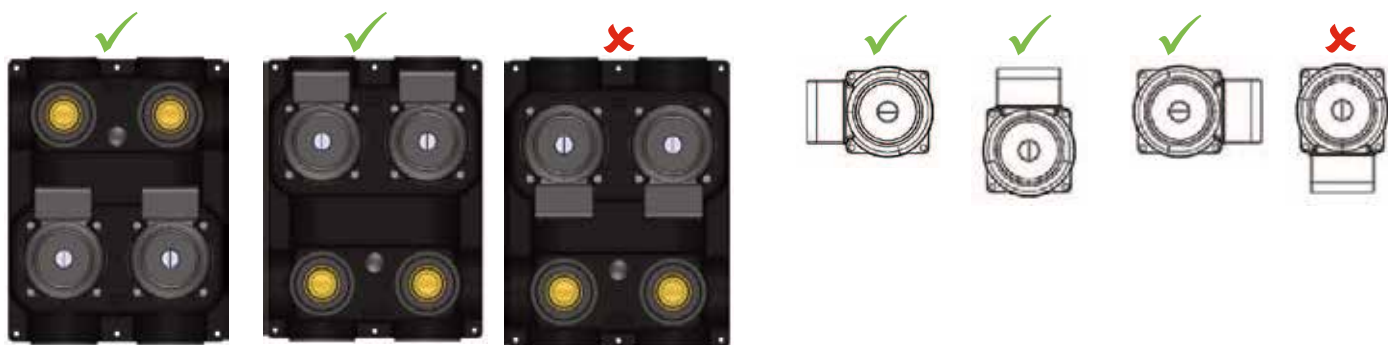
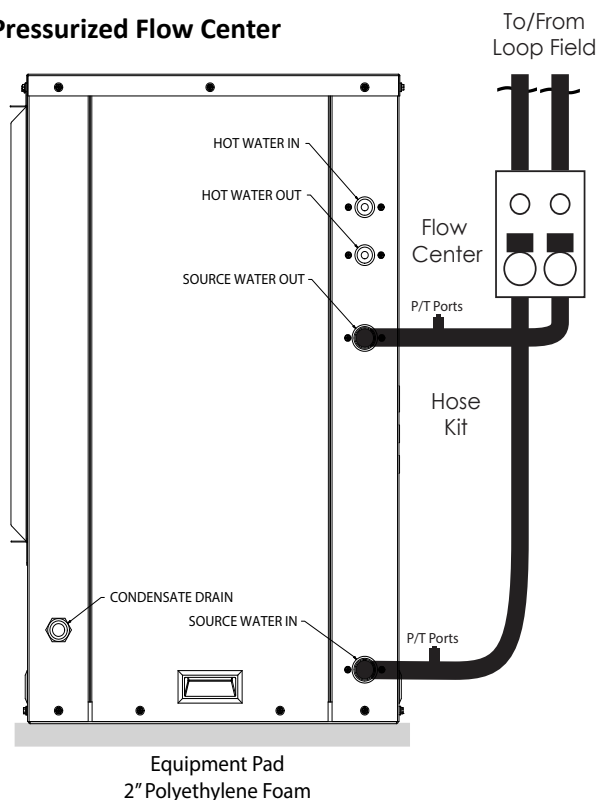


Figure 3: Acceptable terminal box locations for UPS26-99, UP26-99, and UP26-116 pumps.

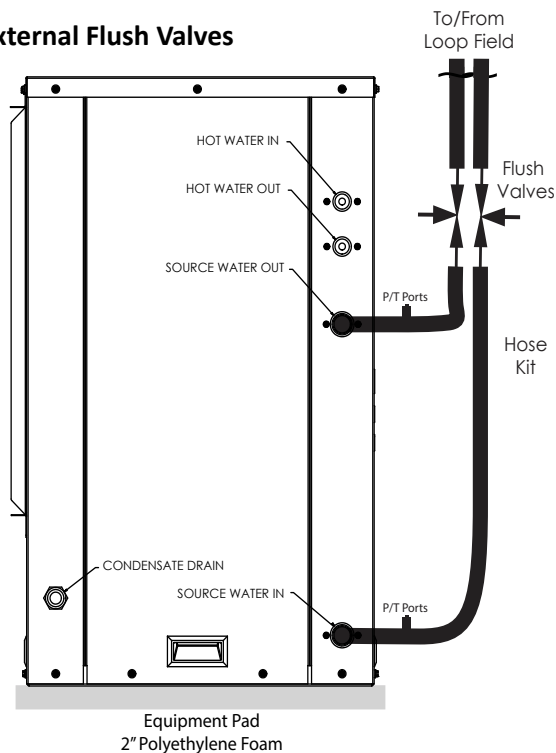
Section 5: Unit Piping Installation

Typical Unit Piping Connections

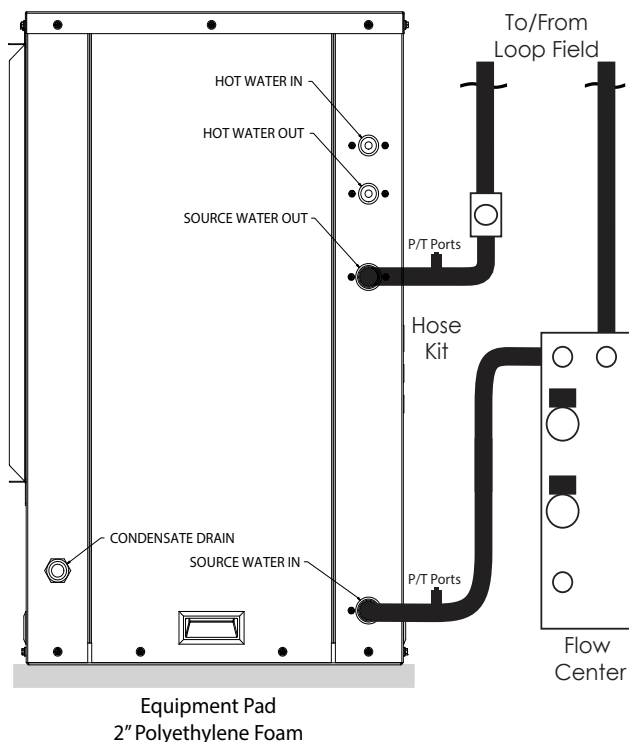
Pressurized Flow Center



External Flush Valves



Non-Pressurized Flow Center



Notes: P/T ports should be angled away from the unit for ease of gauge reading.

Drawings represent typical installation. The manufactures installation guides should be used for final installation

Section 5: Unit Piping Installation

Open Loop Piping and Connections

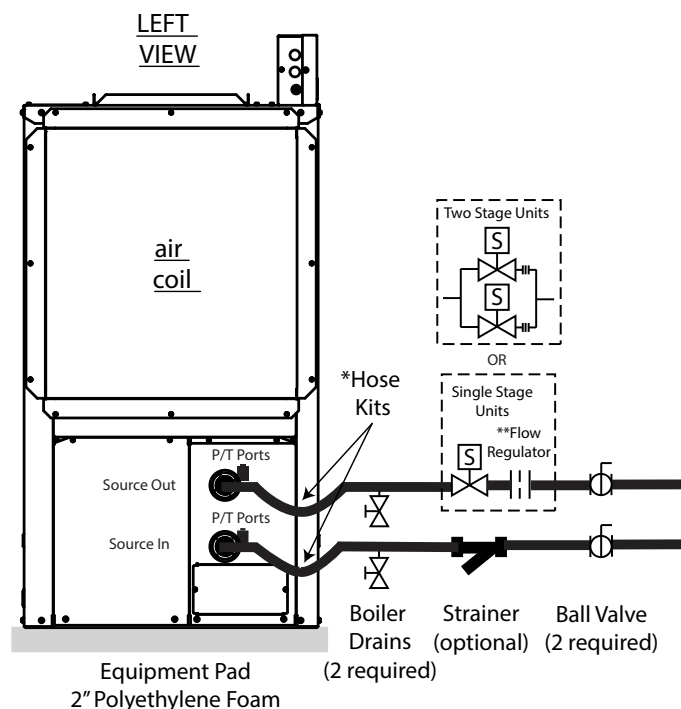
Placement of the components for an open loop system are important when considering water quality and long term maintenance. The water solenoid valve should always be placed on the outlet of the heat pump, which will keep the heat exchanger under pressure when the unit is not operating. If the heat exchanger 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.

Note: Model shown in drawing reflects typical connection locations. Your model may have different connection locations. Please identify correct input and output port locations. 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 Other necessary components include a strainer, boiler drains for heat exchanger flushing, P/T ports and ball valves.

Figure 4: Open Loop Piping Example

Drawings represent typical unit installation.



*Hose kit is used for piping isolation, and includes fittings for P/T ports.

**See product specifications for flow rates.

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 recommended and 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 water flow 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 in the control box on the lock out board spade lugs or terminal strips.

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

Section 5: Unit Piping Installation

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 5** for connection details.

The 3-way valves on the flow center include direction indicators on the valves which determine the flow path (see **Figure 6**). 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.

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.

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.

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.

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

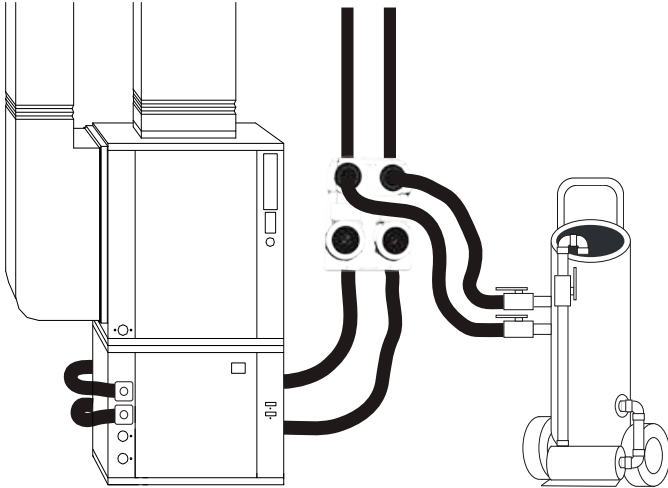


Step 1: Flushing the Earth Loop

- 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).

Section 5: Unit Piping Installation

Figure 5: Typical Flush Cart Connections

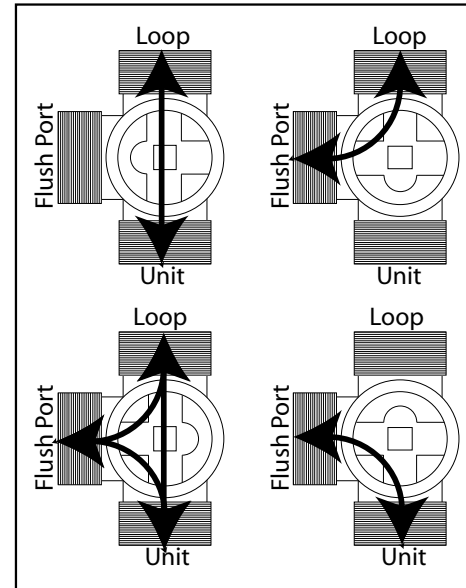


- Run the pump for a minimum of 2 hours for proper flushing and purging (depending on system size it may take longer).
- “Dead head” the pump every so often and watch the water level in the reservoir. Once all the air is removed there should not be more than a 1” to 2” drop in water level in the reservoir. 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.

Step 2: Flushing the Unit

- Turn off the pump on the flush cart.
- Turn both 3-way valves to the unit and flush port position.
- 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.
- This should only take 5 to 10 minutes to purge the unit.
- Once this is done, the entire system is now full of water, and the flush cart pump may be turned off.

Figure 6: Flow Center 3-Way Valves



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.

- Turn both 3-way “Ts” back to the original position for flushing the loop only.
- Close the return side ball valve on the flush cart.
- Connect hose to the return side discharge line and run it to a drain. Open the ball valve on discharge line on flush cart.
- 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.
- Fill the reservoir back up with the antifreeze.
- Repeat steps 5 and 6 until all the antifreeze is in the system and reservoir.
- Turn the discharge line ball valve off at the flush cart. Turn the return line ball valve back to the on position.
- 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.
- 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.
- Check the antifreeze level every so often to insure that the proper amount was added to the system (see antifreeze charging section).

Section 5: Unit Piping Installation

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.

- 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).

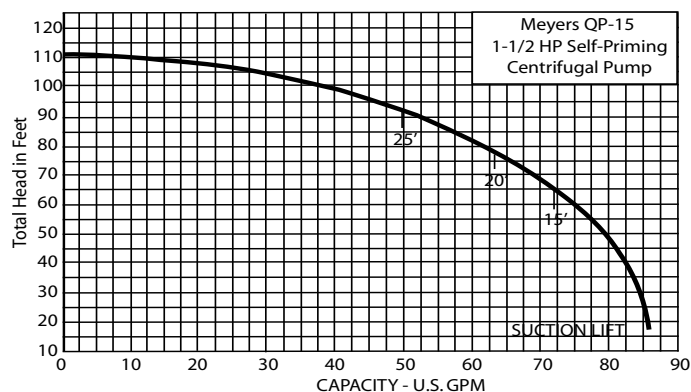
Enertech Manufacturing Flush Cart

- Turn the flush cart pump on and allow the system to start circulating.
- With the pump running, turn the return line ball valve to the off position on the flush cart, “dead heading” the pump.
- 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.
- Next, turn the supply line ball valve to the off position on the flush cart (isolates the flow center from the flush cart).
- 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.
- 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.
- 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!
- Turn the 3-way valves on the flow center back to the normal operation mode, which closes the flush port connections.
- 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.

Figure 7: Flush Cart Pump Curve



Section 5: 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 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 on previous page 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:

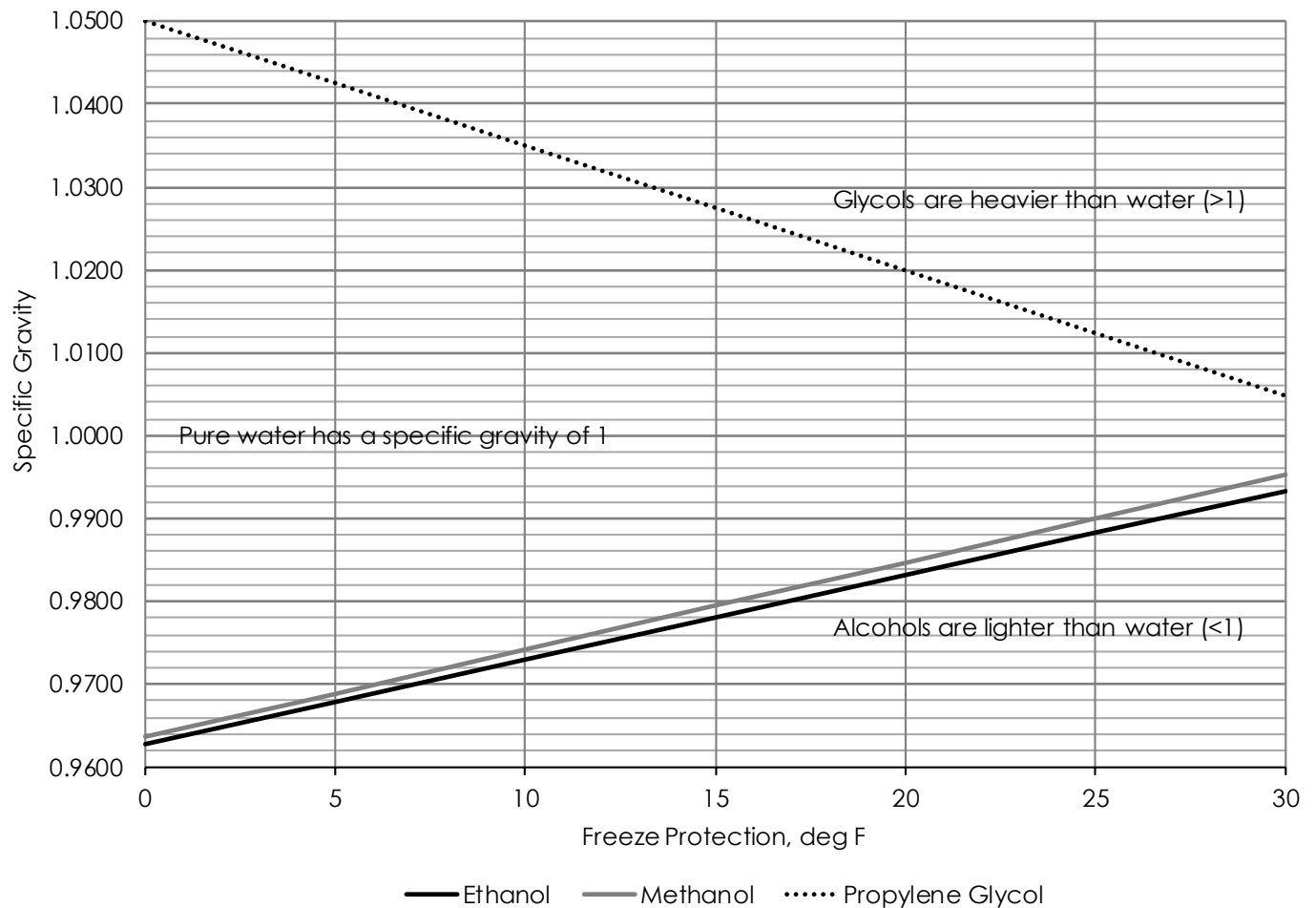
Methanol: Wood grain alcohol that is considered toxic in pure form. It has good heat transfer, low viscosity, is non-corrosive, and is mid to low price. The biggest down side is that it is flammable in concentrations greater than 25%.

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.

Section 5: Unit Piping Installation

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 5: Unit Piping Installation

Antifreeze Charging

Calculate the total amount of pipe in the system and use Pipe Fluid Volume Table below 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 from the Antifreeze Percentages by Volume Table below for the freeze protection required in your area. Then, double check calculations during installation with the proper hydrometer and specific gravity chart to determine if the correct amount of antifreeze was added.

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

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 5: Unit Piping Installation

AP SMA 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 (Figure 10), either unit can energize the pump(s). Connect the units and flow center as shown in Figures 8 and 9, below.

Figure 11 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 8: Single Shared Flow Center, Dual Unit Piping Example

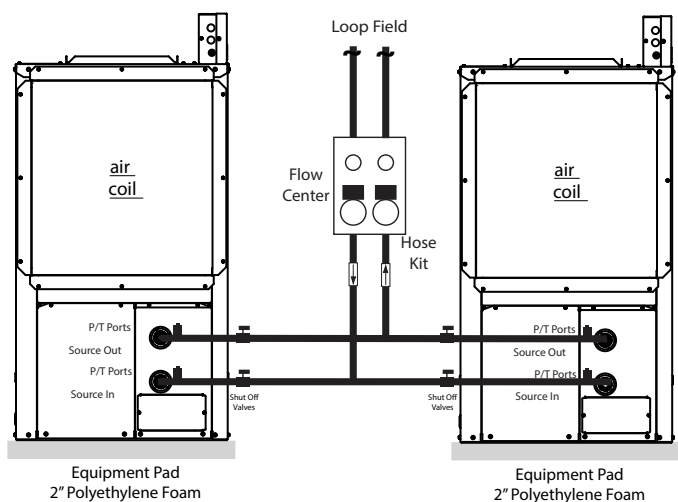


Figure 10: APSMA Module Layout

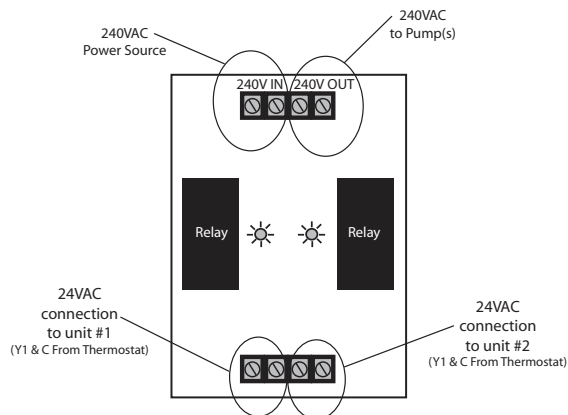


Figure 11: APSMA Module Wiring Schematic

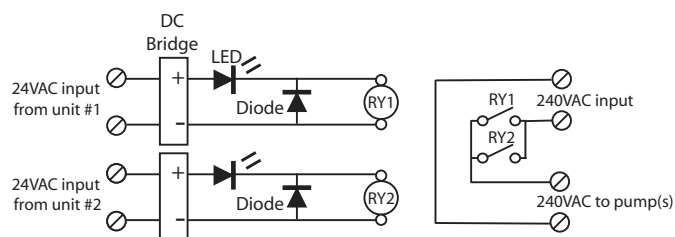
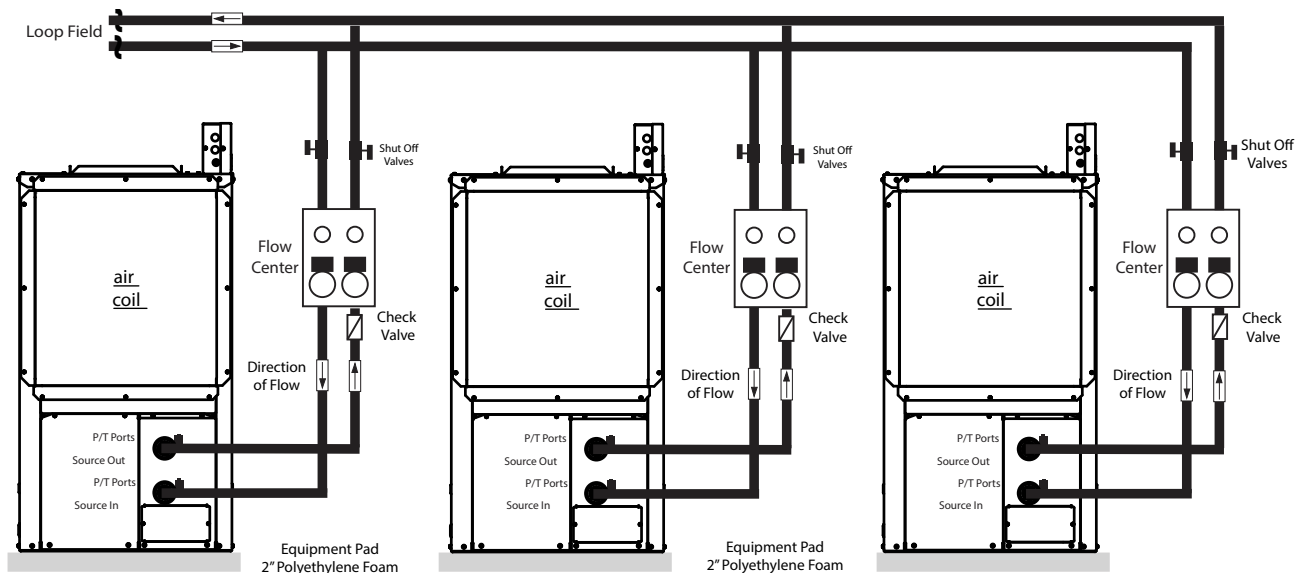


Figure 9: Single Shared Loop Field, Individual Flow Center and Unit Piping Example



Drawings represent typical unit installation, connection location, type and appearance may differ per other models

Section 6: 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.

Note: Enertech Desuperheater water to refrigerant heat exchangers are double walled and vented for use in potable water systems.

Note: ALL Enertech Global products meet the requirements of NSF-372 (Lead Free).

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

Note: 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 6: Desuperheater Installation

Contents of the Desuperheater Fitting Kit

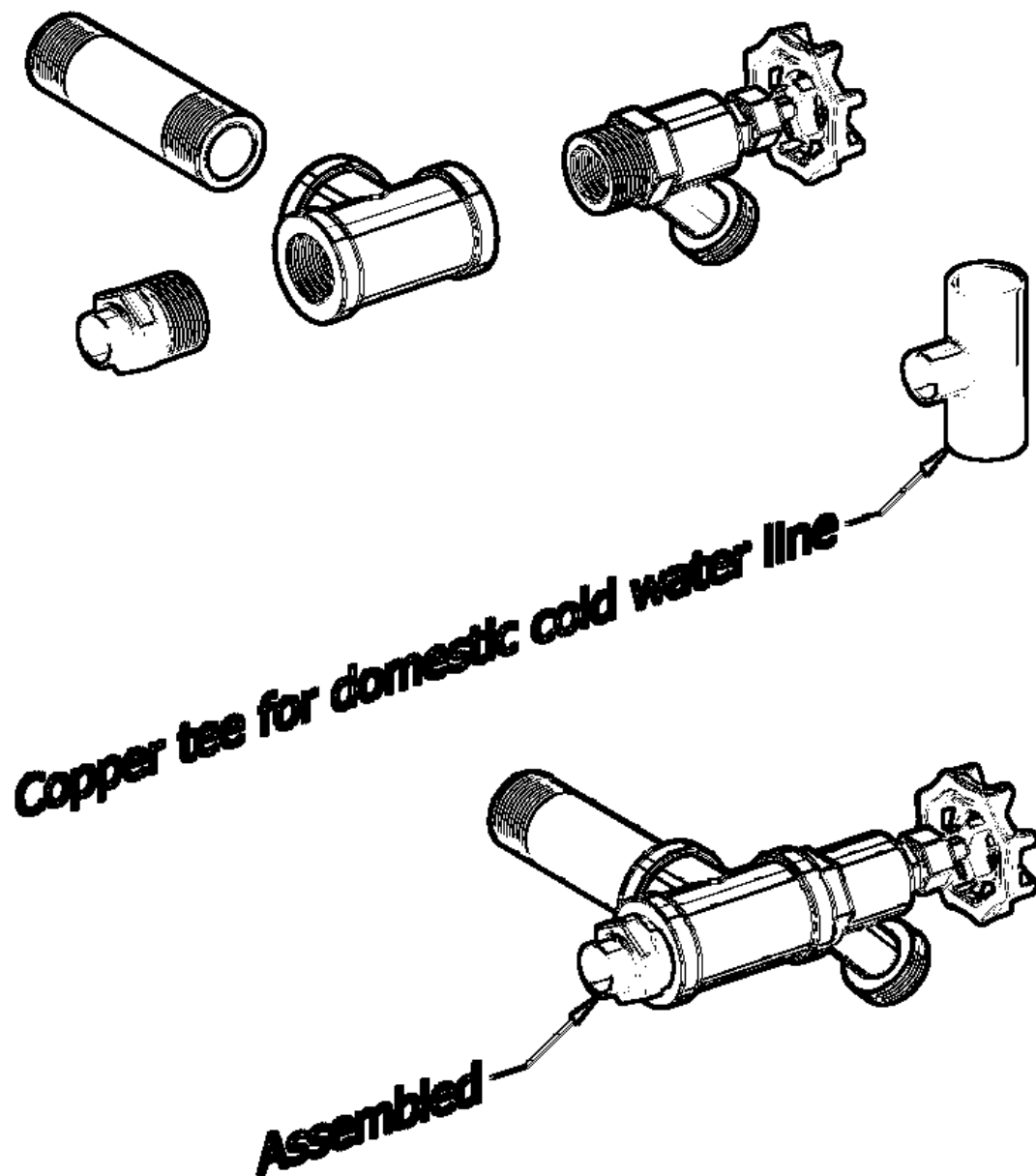
- (1) p/n 20D052-01NN, Installation Instructions
- (1) p/n 33P211-01BN, 3/4"x 3/4"x 3/4" FPT Brass Tee
- (1) p/n 33P210-01NN, 3/4" Boiler Drain Valve
- (1) p/n 11080005001, 3/4" MPT x 3-1/2" Brass Nipple
- (3) p/n 11080006001, 1/2" SWT x 3/4" MPT Copper Adaptor
- (1) p/n 11080007001, 3/4" x 3/4" x 1/2"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

Water Heater Connection Kit Assembly for Bottom of Water Heater

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

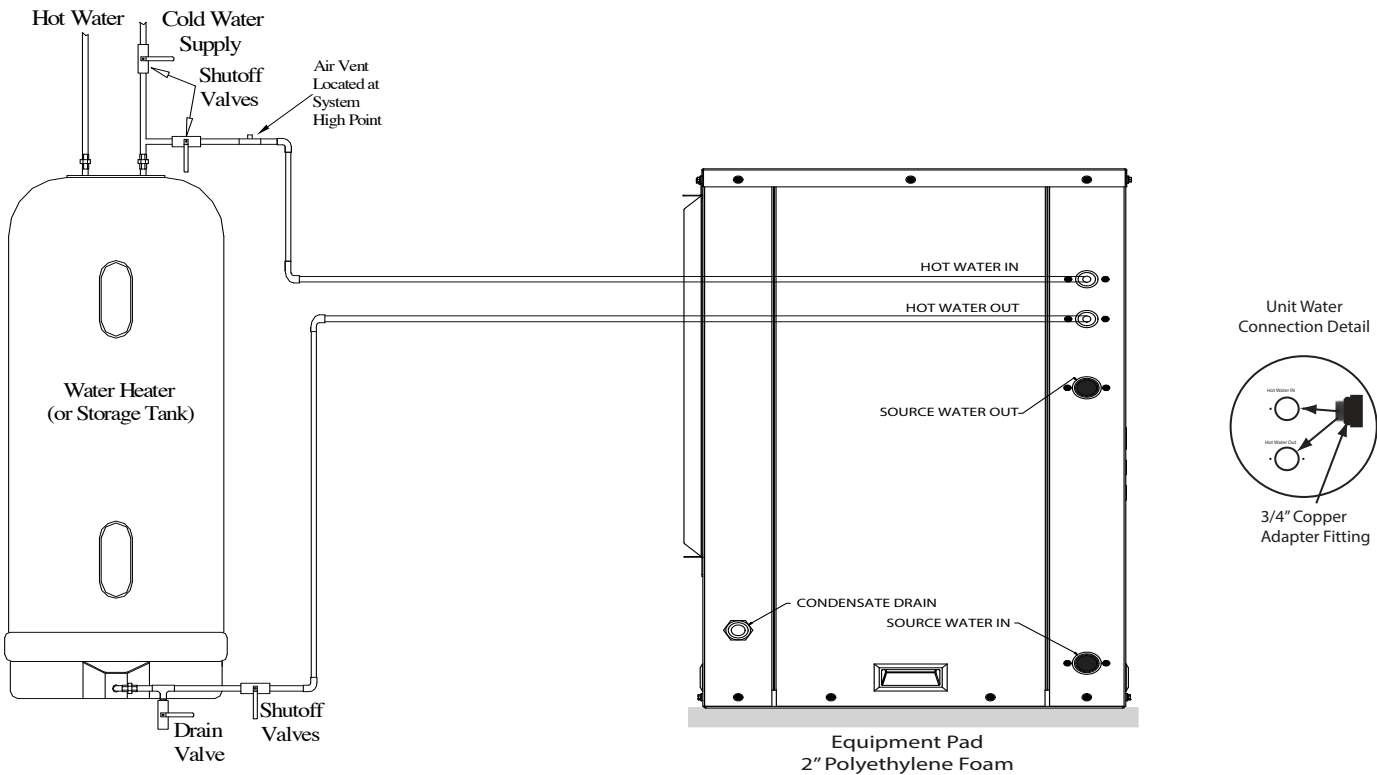
⚠ WARNING ⚠

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 DESUPERHATER COULD RAISE TANK TEMPERATURES.

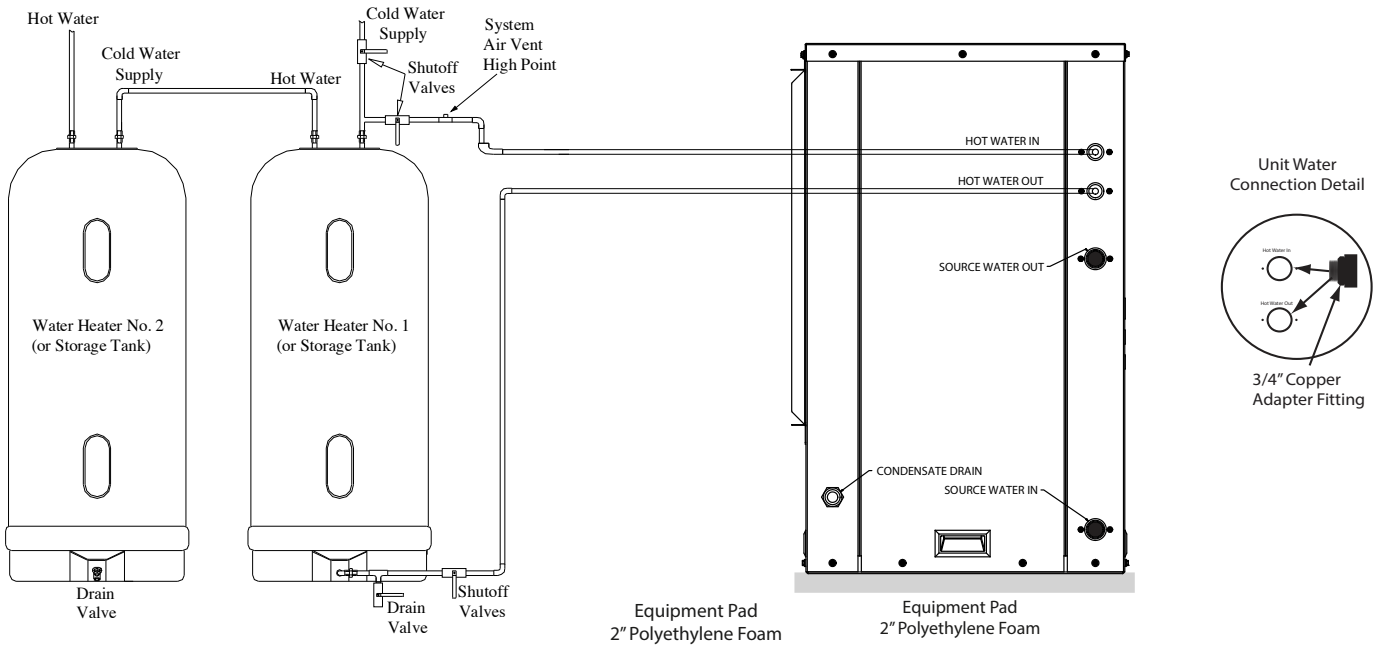


Section 6: Desuperheater Installation

Desuperheater Installation with Single Water Heater

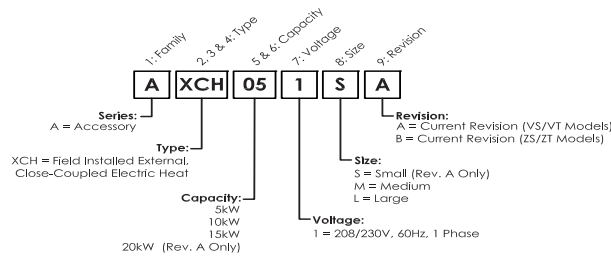


Desuperheater Installation with Preheat Tank

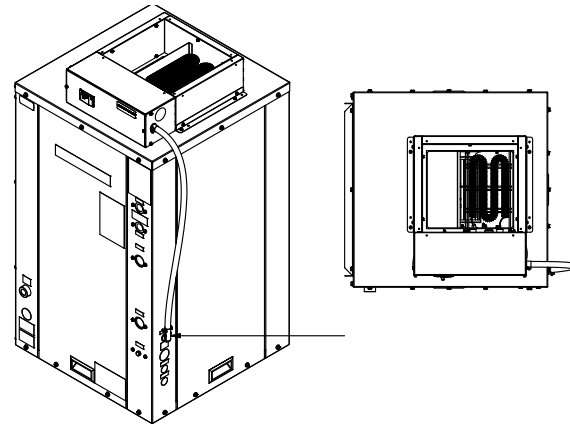


Section 7: Auxiliary Heater

Auxiliary Heater Nomenclature Decoder



Typical Heater Installation



Overview

THE AXCH electric heater kits are designed and approved for use with specific sizes of Enertech's VS/VT unit models. Table 1 lists all of the possible combinations. The information contained in the manual shipped with every separately purchased heater is intended for use by a qualified service technician familiar with safety procedures and equipped with the proper tools and test instruments.

Components

Each AXCH electric heat kit should contain the following items:

- (QTY: 1) 20D219-01NN Installation, Operation & Maintenance manual
- (QTY: 1) Electric Heat Module Assembly
- (QTY: 2) Mounting Brackets
- (QTY: 48") Gasket Tape
- (QTY: 8) #8-18 x .375 Mounting Screws

Heater and Unit Compatibility

Heater Model	Unit Model Capacity	Heater Model	Unit Model Capacity
AXCH051SA	VS015-VS041 VT024-VT036	AXCH101MA	VS042-VS072 VT042-VT072
AXCH101SA	VS024-VS041 VT024-VT036	AXCH151MA*	VS042-VS072 VT042-VT072
AXCH151SA*	VS036-VS041 VT036	AXCH201MA*	VS060-VS072 VT060-VT072

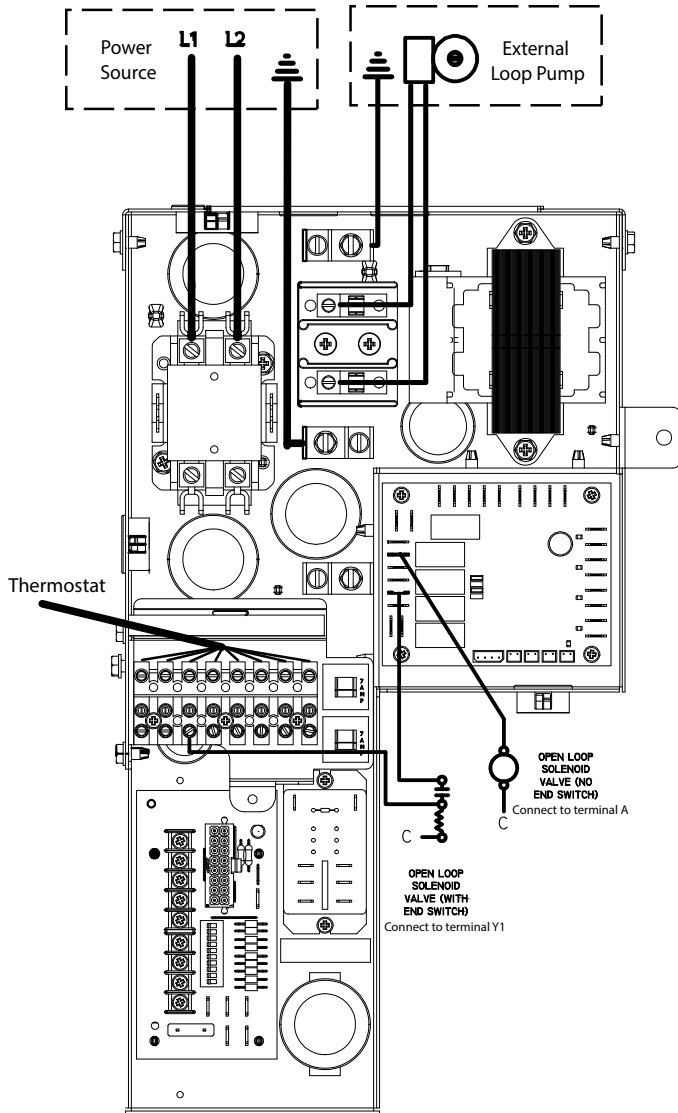
* Single Point Connection

Auxiliary Heater Electrical Data

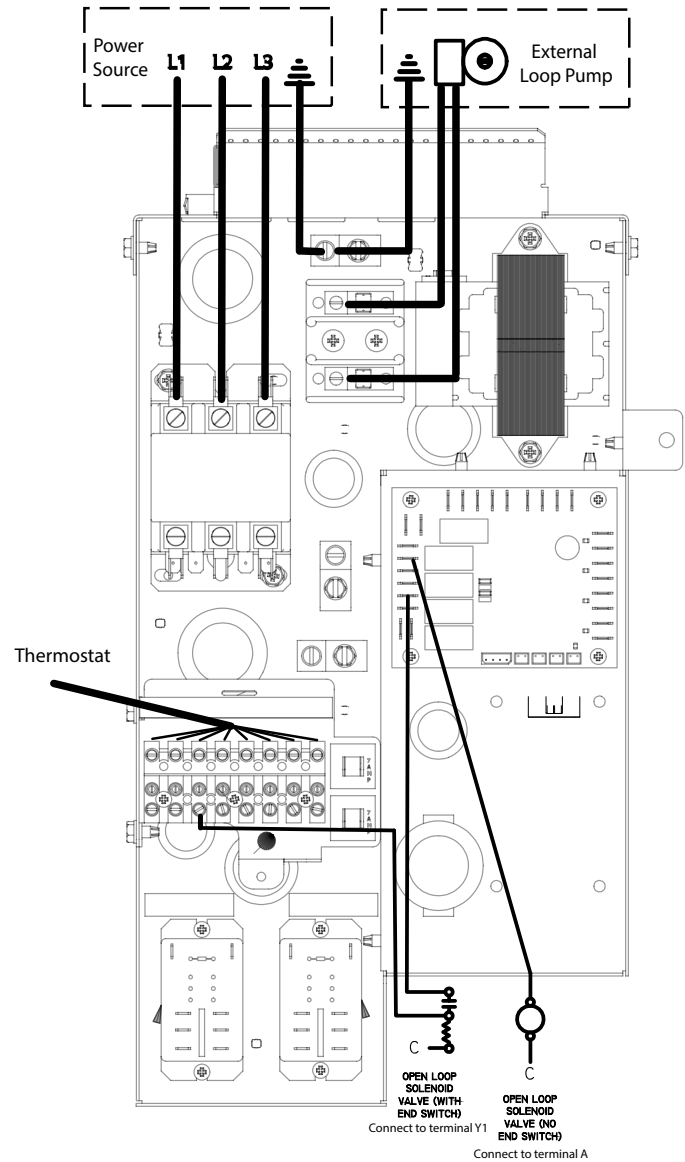
Technical Data 60Hz, Single Phase, w/ Circuit Breaker (*Single Point Connection)																	
Heater Model	Supply Circuit Number	Heat kW		Heater kW Per Circuit		FLA Total AMPS		MCA- Minimum Circuit Ampacity		MOCP Maximum Overcurrent Protective Device (AMPS) NEC 240.4(B)		Recommended					
												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
AXCH051SA	Single	5	3.75	2.5	1.875	20.8	18.0	26.0	22.5	30	25	2	10	12	144	87	10
AXCH101SA AXCH101MA	Single	10	7.5	5	3.75	41.7	36.1	52.1	45.1	60	50	2	6	8	176	110.9	8 10
AXCH151SA* AXCH151MA*	Single	15	11.25	5	3.75	62.5	54.1	78.1	67.6	80	70	2	4	4	186	186.1	8
AXCH201MA*	Single	20	15	10	7.50	83.3	72.1	104.2	90.1	110	100	2	2	3	216	173.1	6 8
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
AXCH151SA AXCH151MA	L1/L2 L3/L4	15	11.25	5	3.75	20.8	18.0	26.0	22.5	30	25	2	10	12	144	87	10
AXCH201MA	L1/L2 L3/L4	20	15	10	7.50	41.7	36.1	52.1	45.1	60	50	2	6	8	176	111	10

Section 8: Electrical Connections

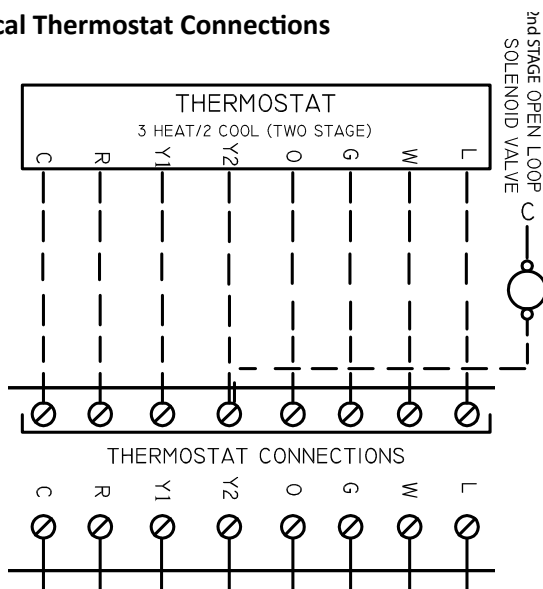
Single Phase Connections



Three Phase Connections



Typical Thermostat Connections



Notes:

- Drawings represent a typical installation using wiring input knockouts marked on the outside of the unit corner post.
- 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 9: Controls

Microprocessor Features and Operation

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 p/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 an Y1 call is received. This avoids multiple units from being energized at the same time after power loss or other situations.

Short Cycle Protection

A built-in five minute anti-short cycle 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.

In models without an accessory terminal strip provided, connect the valve with an end switch in between Y1 of thermostat and Y1 at the thermostat terminal strip. Also, a valve without an end switch can be connected via the spade terminal labeled (A) on the lock out board.

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.

In ECM equipped models without an accessory terminal strip provided, connect ODD and G on the ECM board directly (package units only). For units equipped with PSC blower motors, connect thermostat's humidifier terminal to G on the unit's thermostat terminal strip.

Airflow Monitor

When provided, a LED on the ECM fan control board flashes one time per 100 CFM when the unit's fan is operating to indicate airflow.

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.

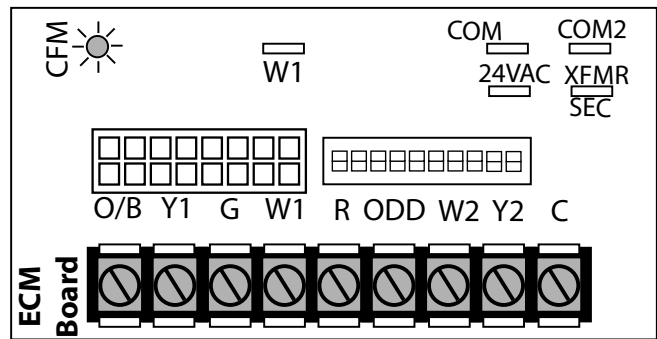
When water touches the sensor for 30 continuous seconds, the sensor sends a ground signal to the lockout board indicates a condensate overflow fault has occurred.

Section 9: Controls

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.

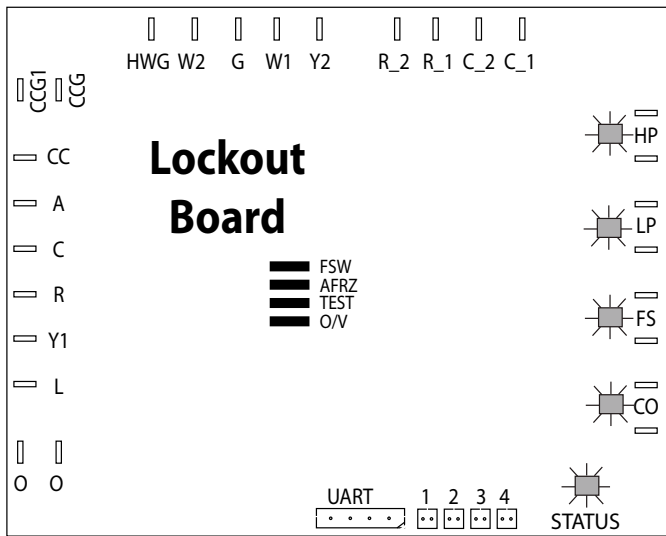
Figure 12: ECM Board Layout



Safety Controls

The lockout board receives separate signals for high pressure, low pressure, 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 appropriate LED(s) flash for 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.

Figure 13: Lockout Board Layout



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.)

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>220°F for 30 continuous seconds, the compressor operation will be interrupted. The control will go into fault retry mode.

Section 9: Controls

Temperature Sensor Operating Range

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

Temperature Sensor Operating Range

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

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.

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.

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.

Diagnostics

The lockout board includes five LEDs (Green-HP, Orange-LP, Red-FS, Yellow-CO, Green-Status) for fast and simple control board diagnosis. Below is a table showing LED function.

Section 9: Controls

LED Identification

FAULT CODE	CONDITION	LEDs						NOTES
		Green HP	Orange LP	RED FS	YELLOW CO	GREEN STATUS	L TERMINAL	
01	NORMAL MODE	-	-	-	-	FLASH	-	
02	TEST MODE	-	-	-	-	-	-	1
03	HIGH PRESSURE FAULT (HP)	FLASH	-	-	-	FLASH	-	
04	HIGH PRESSURE LOCKOUT (HP)	ON	-	-	-	FLASH	ON	
05	LOW PRESSURE FAULT (LP)	-	FLASH	-	-	FLASH	-	
06	LOW PRESSURE LOCKOUT (LP)	-	ON	-	-	FLASH	ON	
07	SOURCE HEAT EXCHANGER FREEZE/ WATER FLOW FAULT (T4/FS)	-	-	FLASH	-	FLASH	-	2
08	SOURCE HEAT EXCHANGER FREEZE/ WATER FLOW LOCKOUT (T4/FS)	-	-	ON	-	FLASH	ON	2
09	LOAD HEAT EXCHANGER FREEZE FAULT (T1)	-	FLASH	FLASH	-	FLASH	-	3,4
10	LOAD HEAT EXCHANGER FREEZE LOCKOUT (T1)	-	ON	ON	-	FLASH	ON	3,4
11	CONDENSATE FAULT (CO)	-	-	-	FLASH	FLASH	-	
12	CONDENSATE LOCKOUT (CO)	-	-	-	ON	FLASH	ON	
13	OVER/UNDER VOLTAGE	FLASH	FLASH	FLASH	FLASH	FLASH	ON	
14	SENSOR T1 BAD LOCKOUT	FLASH	-	-	ON	FLASH	FLASH	5
15	SENSOR T2 BAD	-	FLASH	-	ON	FLASH	FLASH	5, 8
16	SENSOR T3 BAD	-	-	FLASH	ON	FLASH	FLASH	5, 8
17	SENSOR T4 BAD LOCKOUT	-	ON	-	FLASH	FLASH	FLASH	5
18	T1 & T4 SWAPPED	ON	-	-	ON	-	FLASH	6
19	HGT(T2) > 220F FAULT	FLASH	-	FLASH	ON	FLASH	-	7
20	HGT(T2) > 220F LOCKOUT	ON	-	ON	ON	FLASH	ON	7

Notes:

1. When the TEST jumper is removed, the green status LED will be off.
2. The source heat exchanger freeze/water flow fault sensor is located between the TXV and source heat exchanger.
3. The load heat exchanger freeze sensor is located between the TXV and the load heat exchanger.
4. Only package and Water-to-Water models have this feature.
5. This fault indicates a bad sensor - open, shorted, disconnected, or invalid value.
6. Check for T1 & T4 being swapped (only shown in TEST mode).
7. Hot Gas Line temperature is too high (>220F).
8. Units without HWG do not use sensors T2 and T3. The control will disable faults 15 and 16.

Section 9: Controls

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 $T2 > 220^{\circ}\text{F}$. 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.

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/V): When the O/V 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

VS Series has a One-Stage compressor with PSC fan motor or optional ECM fan motor.

VT Series has a Two-Stage compressor with ECM fan motor (PSC not available).

Timings assume the ASC timer is expired. If the ASC timer is not expired the 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 (VT) or 2nd stage (VS) 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% airflow (CFM) level 90 seconds after the "Y1" input. VS units with a PSC fan start at 100% airflow (CFM) level immediately upon the "G" input.

Heating 2nd Stage, (Y1, Y2, G) VT Units Only

The ECM fan adjusts to 2nd stage airflow (CFM) level (based on DIP switch settings), and the compressor full load solenoid is energized.

Section 9: Controls

Heating 3rd Stage, (Y1, Y2, W1, G) VT Units or Heating 2nd Stage (Y1, W1, G) VS 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 20 kW electric heaters)

Emergency Heat (W1, G) VT or VS Units

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 20 kW 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, O, G) VT or VS Units

The ECM fan immediately ramps up to 75% of 1st stage (VT) or 2nd stage (VS) 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% airflow (CFM) level 90 seconds after the "Y1" input. VS units with a PSC fan start at 100% airflow (CFM) level immediately upon the "G" input.

Cooling 2nd Stage (Y1, Y2, O, G) VT Units Only

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 VT or VS Units

When provided with an ECM fan motor, 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.

Fan Only VT or VS Units

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). VS units with a PSC fan start at 100% airflow (CFM) level immediately upon the "G" input.

Dehumidification Mode Options (ECM Fans Only)

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

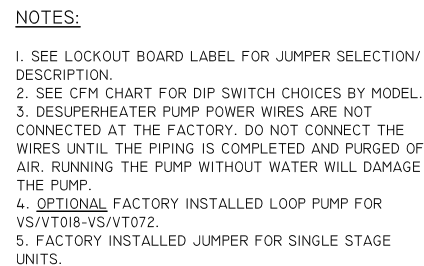
Notes:

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

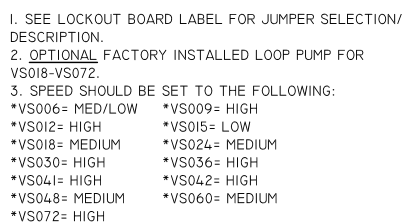
Single Stage, PSC Fan, Single Phase, 208/230V, 60HZ, DSH, Residential/Commercial



Two Stage or Single Stage, ECM Fan, single Phase, 208/230V, 60Hz, DSH

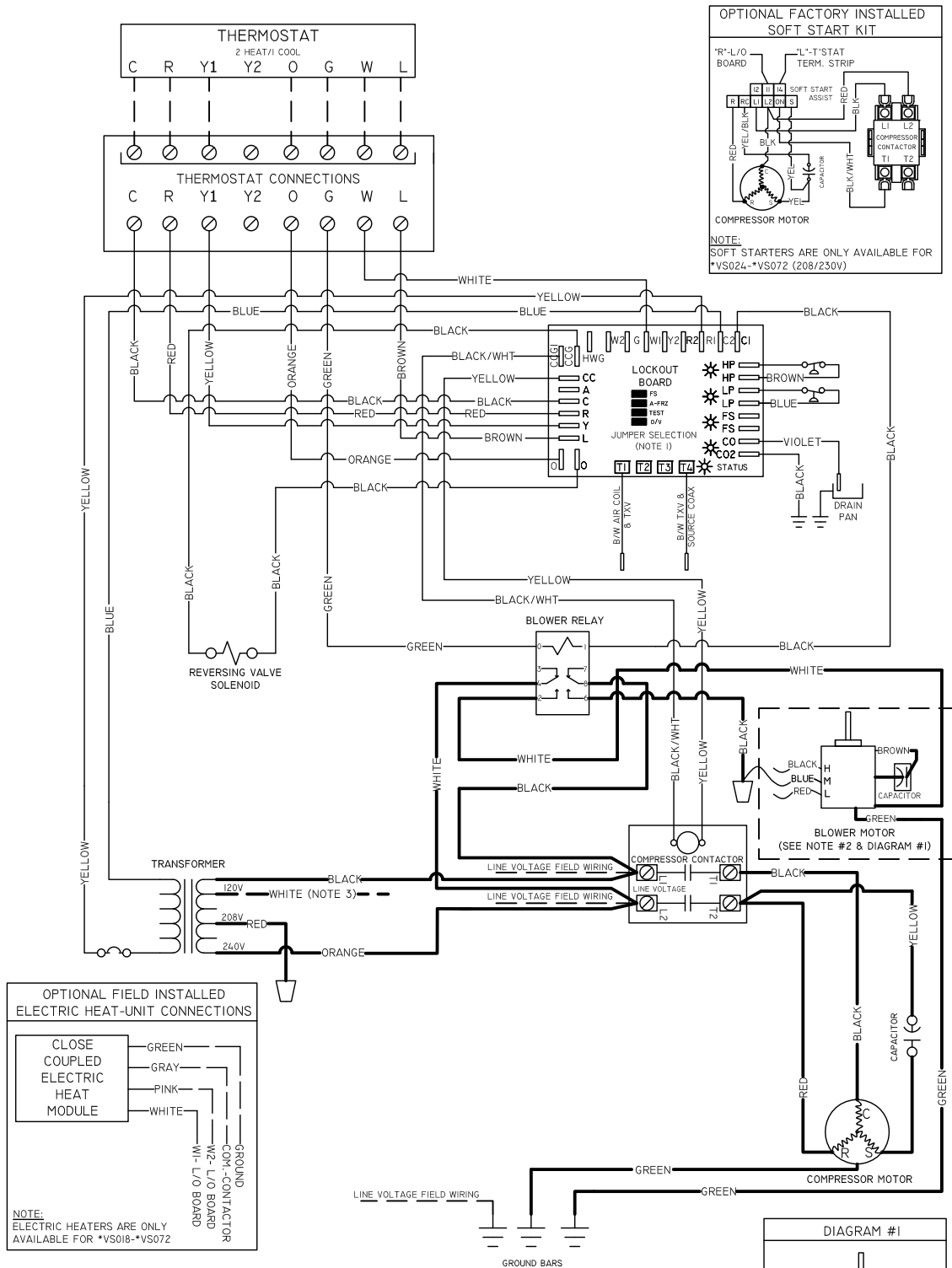


Single Stage, PSC Fan, Single Phase, 208/230V, 60Hz, Residential/Commercial



Section 10: Wiring Diagrams

Single Stage, PSC Fan, Single Phase, 208/230V or 115V, 60Hz, Commercial



NOTES:

- SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
- SPEED SHOULD BE SET TO THE FOLLOWING:

*VS006= MED/LOW	*VS009= HIGH
*VS012= HIGH	*VS015= LOW
*VS018= MEDIUM	*VS024= MEDIUM
*VS030= HIGH	*VS036= HIGH
*VS041= HIGH	*VS042= HIGH
*VS048= MEDIUM	*VS060= MEDIUM
*VS072= HIGH	
- WHITE WIRE WILL BE HOOKED TO L2-TERMINAL AT THE CONTACTOR FOR 115V UNITS.

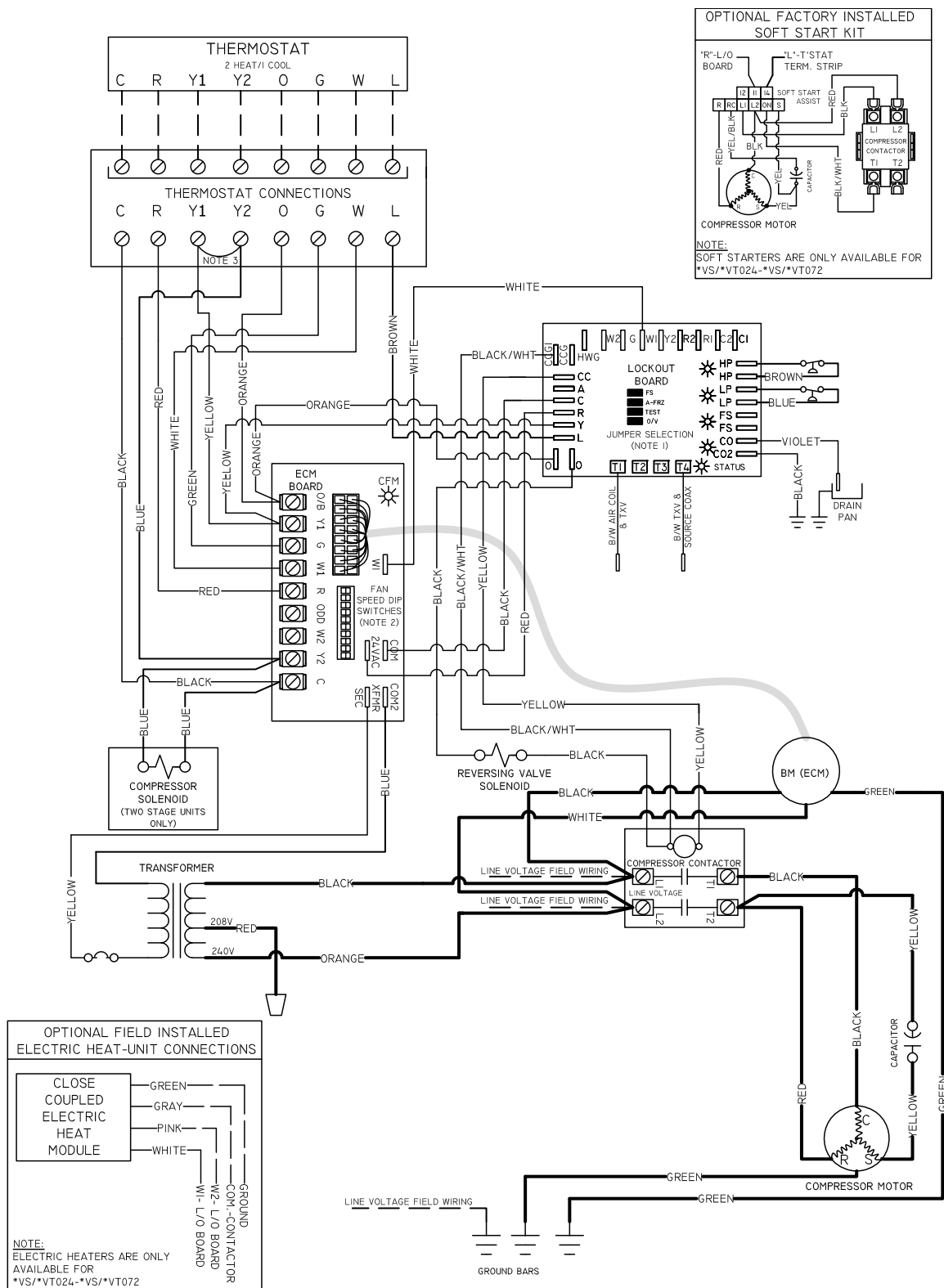
Two Stage or Single Stage, ECM Fan, Single Phase, 208/230V, 60Hz



1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
3. OPTIONAL FACTORY INSTALLED LOOP PUMP FOR VS/VT018-VS/VT072.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.

Section 10: Wiring Diagrams

Two Stage or Single Stage, ECM Fan, Single Phase, 208/230V, 60Hz, Commercial

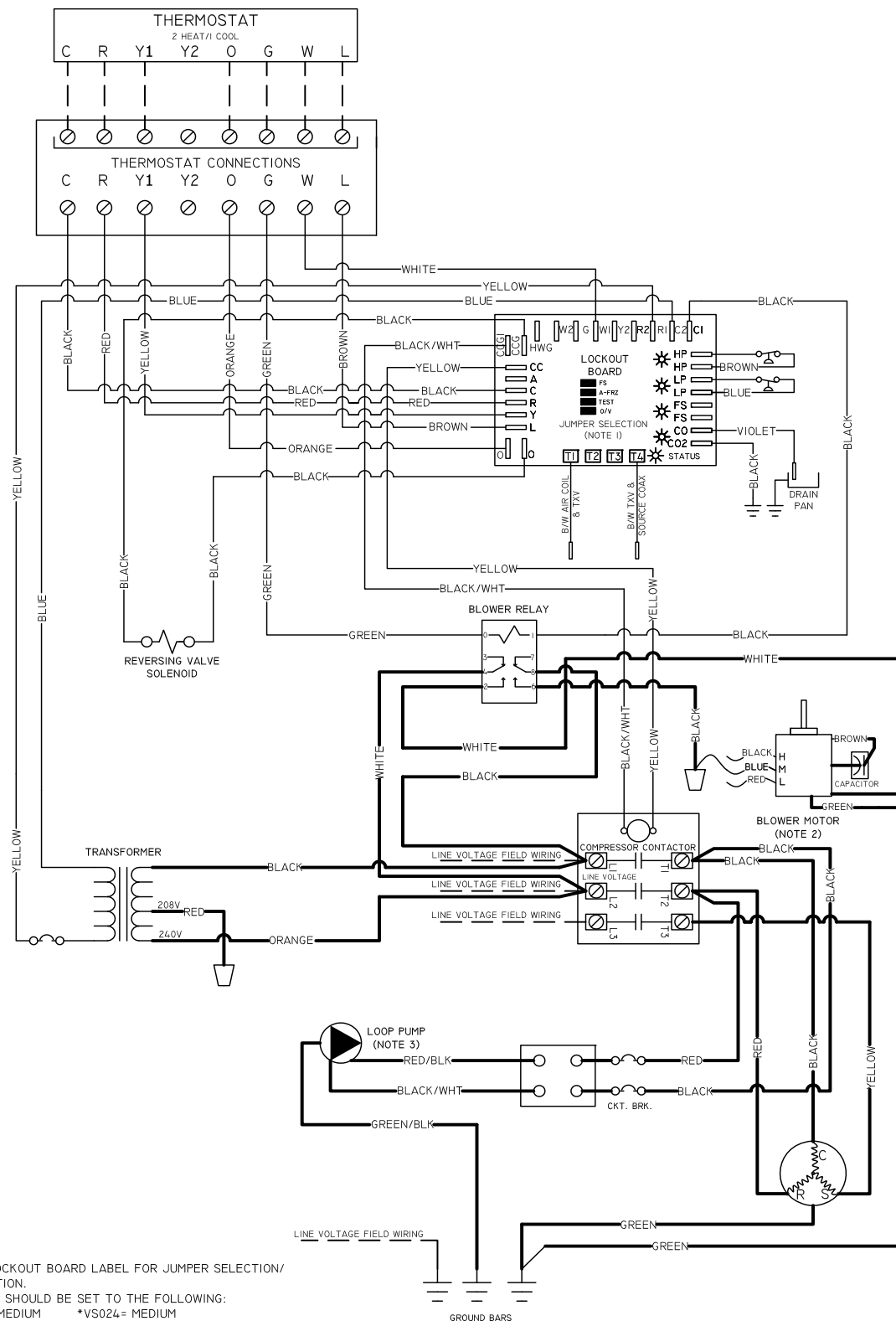


NOTES:

1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
3. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.

Section 10: Wiring Diagrams

Single Stage, PSC Fan, Three Phase, 208/230V, 60Hz, Commercial

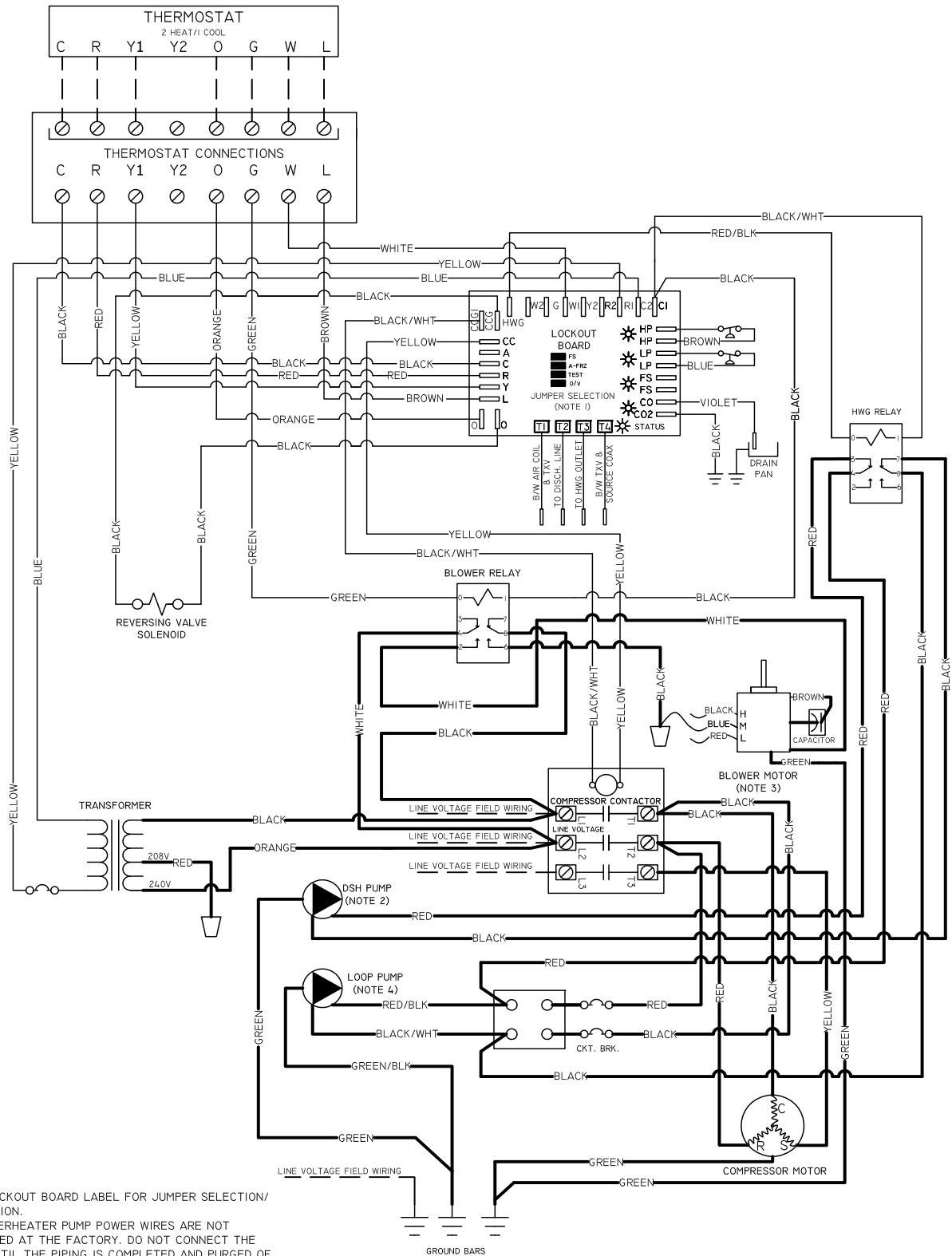


NOTES:

1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. SPEED SHOULD BE SET TO THE FOLLOWING:
 - *VS018= MEDIUM *VS024= MEDIUM
 - *VS030= HIGH *VS036= HIGH
 - *VS041= HIGH *VS042= HIGH
 - *VS048= MEDIUM *VS060= MEDIUM
 - *VS072= HIGH
3. OPTIONAL FACTORY INSTALLED LOOP PUMP.

Section 10: Wiring Diagrams

Single Stage, PSC Fan, Three Phase, 208/230V, 60Hz, DSH, Commercial



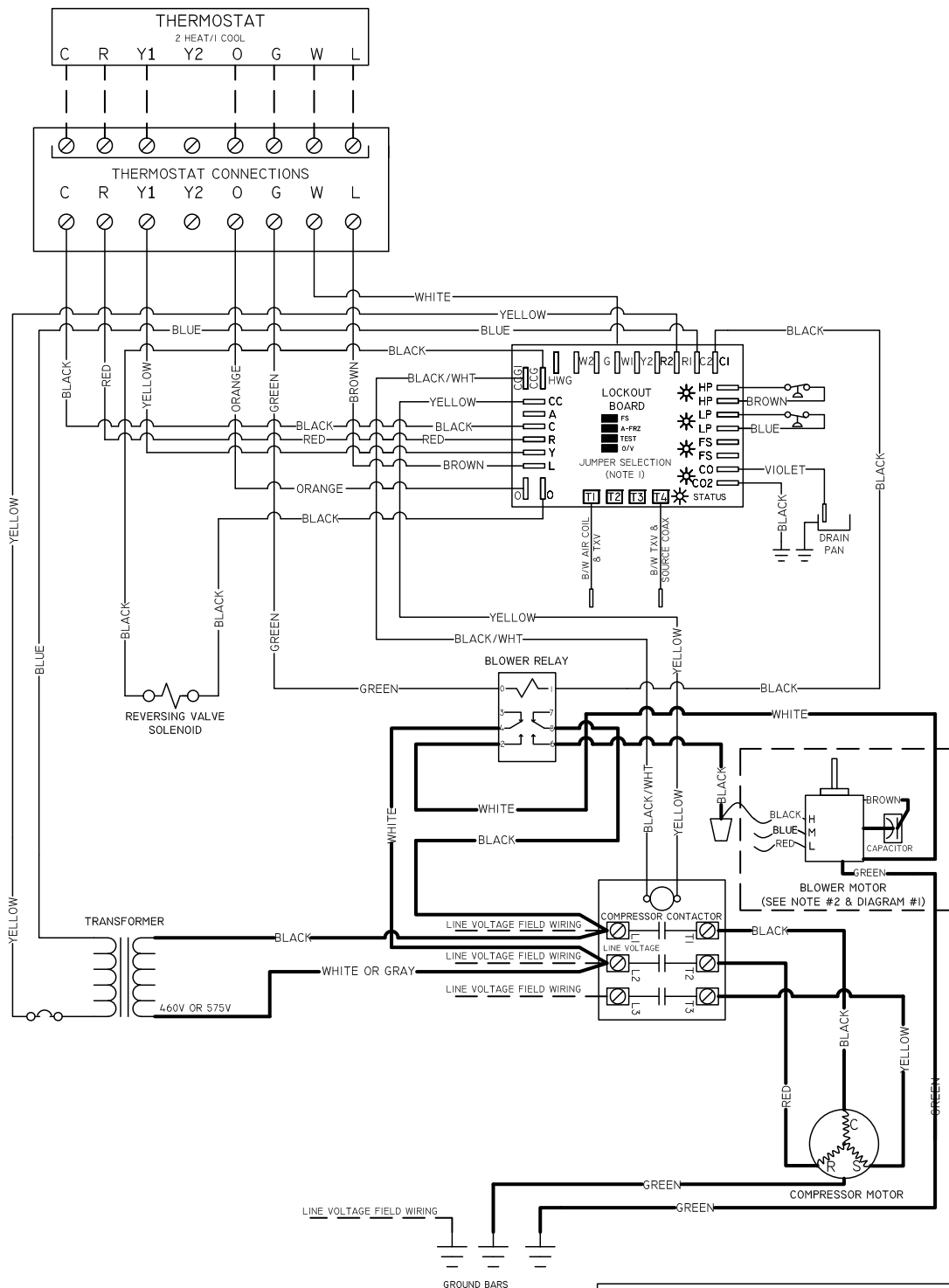
NOTES:

- SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
- 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.
- SPEED SHOULD BE SET TO THE FOLLOWING:

*VS018= MEDIUM	*VS024= MEDIUM
*VS030= HIGH	*VS036= HIGH
*VS041= HIGH	*VS042= HIGH
*VS048= MEDIUM	*VS060= MEDIUM
*VS072= HIGH	
- OPTIONAL FACTORY INSTALLED LOOP PUMP.

Section 10: Wiring Diagrams

Single Stage, PSC Fan, Three Phase, 460V, 60Hz, Commercial

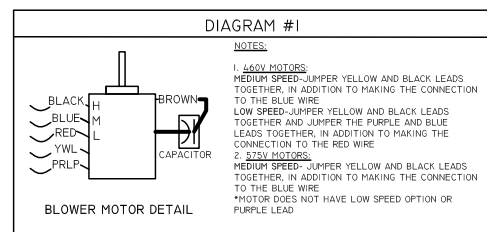


NOTES:

1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.

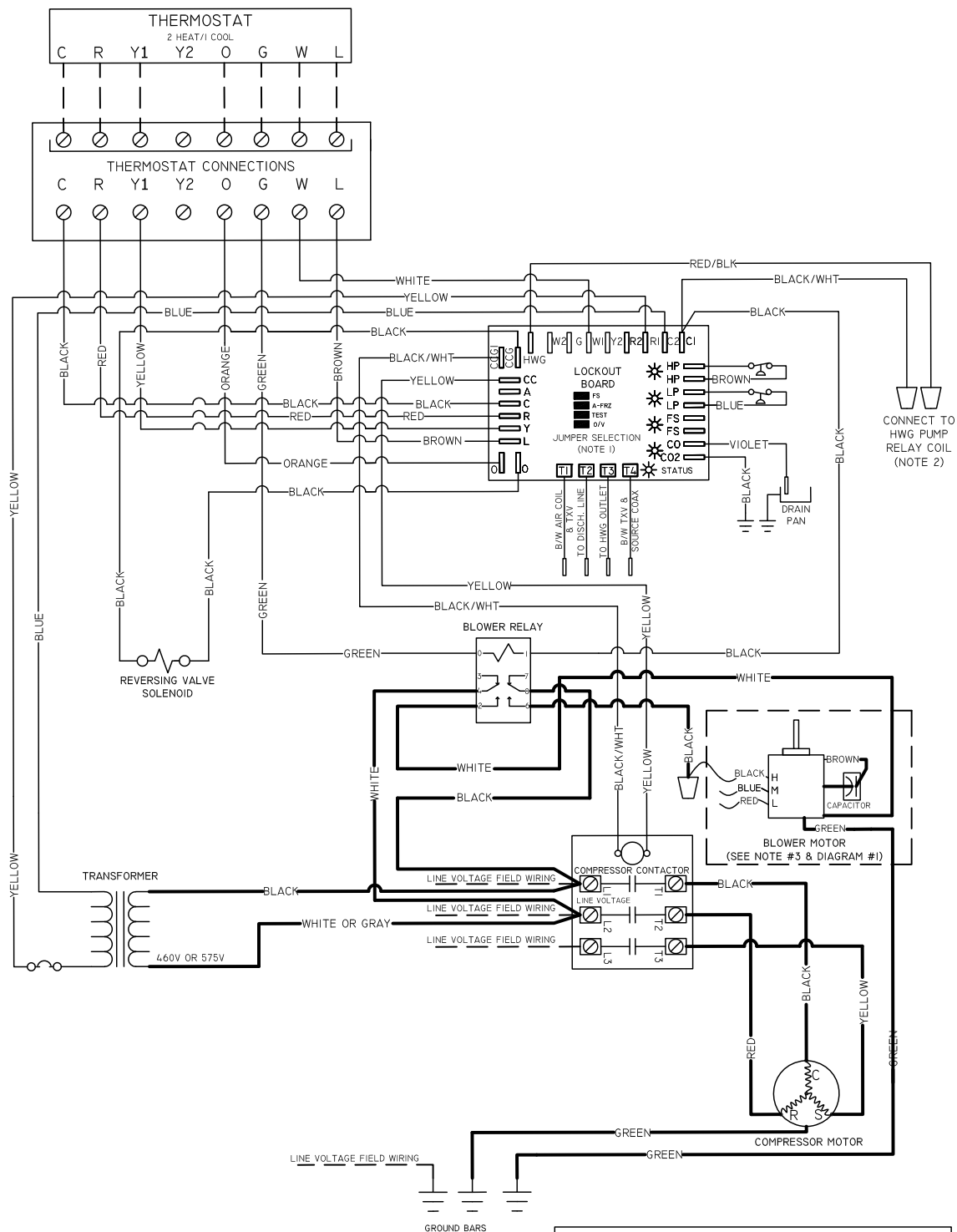
2. SPEED SHOULD BE SET TO THE FOLLOWING:

- | | |
|----------------|----------------|
| *VS018= MEDIUM | *VS024= MEDIUM |
| *VS030= HIGH | *VS036= HIGH |
| *VS041= HIGH | *VS042= HIGH |
| *VS048= MEDIUM | *VS060= MEDIUM |
| *VS072= HIGH | |



Section 10: Wiring Diagrams

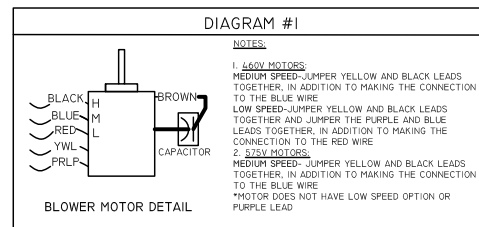
Single Stage, Three Phase , 460V or 575V, 60Hz, DSH, Commercial



NOTES:

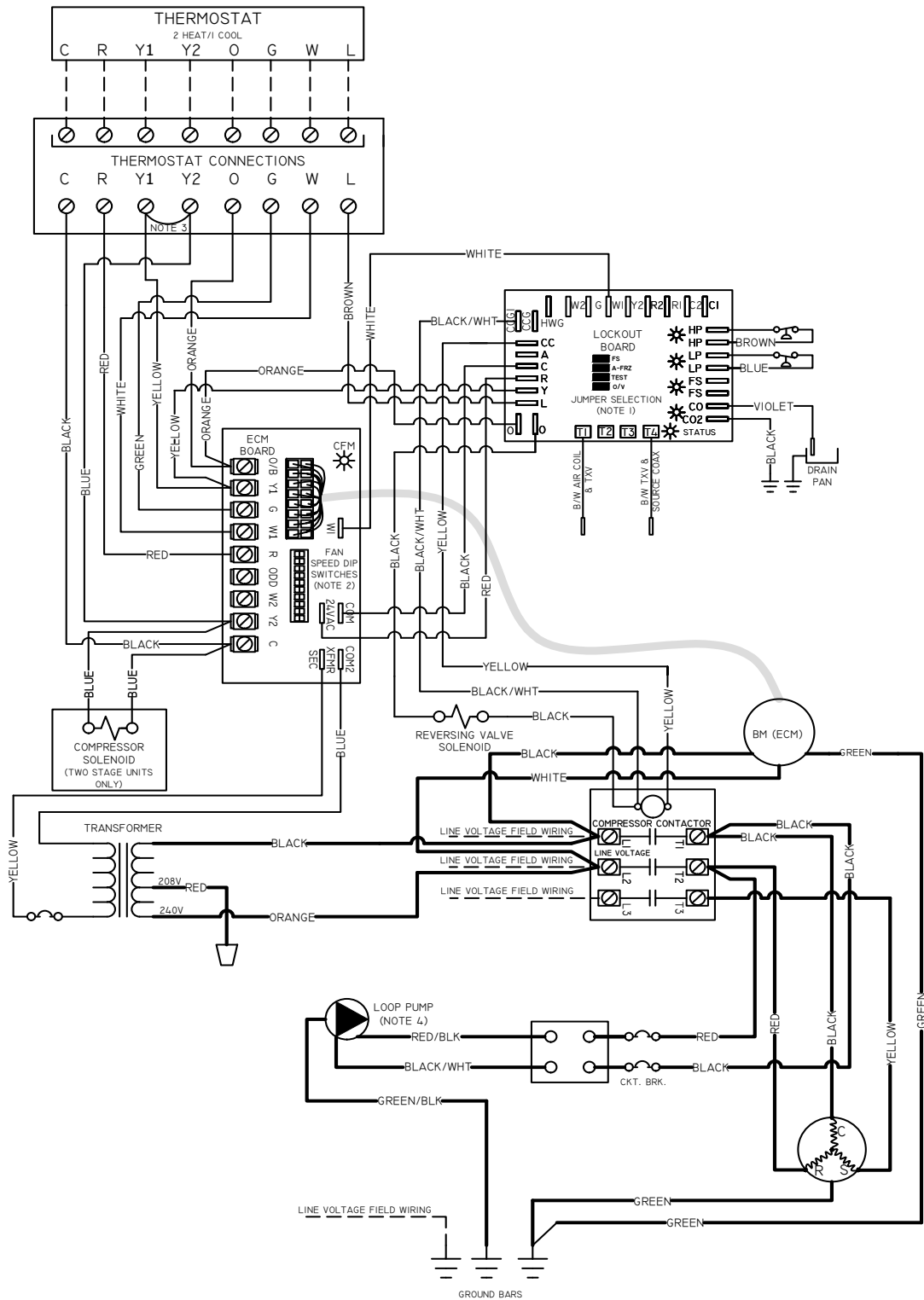
- SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
- CONNECT WIRES TO THE HWG PUMP RELAY COIL. RELAY IS TO BE PROVIDED BY THE INSTALLER AND IS A N.C. RELAY THAT WILL INTERRUPT POWER TO THE PUMP WHEN CONDITIONS ARE INAPPROPRIATE FOR WATER HEATING. IF WIRES ARE NOT CONNECTED TO RELAY, SCALDING CAN OCCUR.
- SPEED SHOULD BE SET TO THE FOLLOWING:

*VS018= MEDIUM	*VS024= MEDIUM
*VS030= HIGH	*VS036= HIGH
*VS041= HIGH	*VS042= HIGH
*VS048= MEDIUM	*VS060= MEDIUM



Section 10: Wiring Diagrams

Two Stage or Single Stage, ECM Fan, Three Phase, 208/230V, 60Hz, Commercial

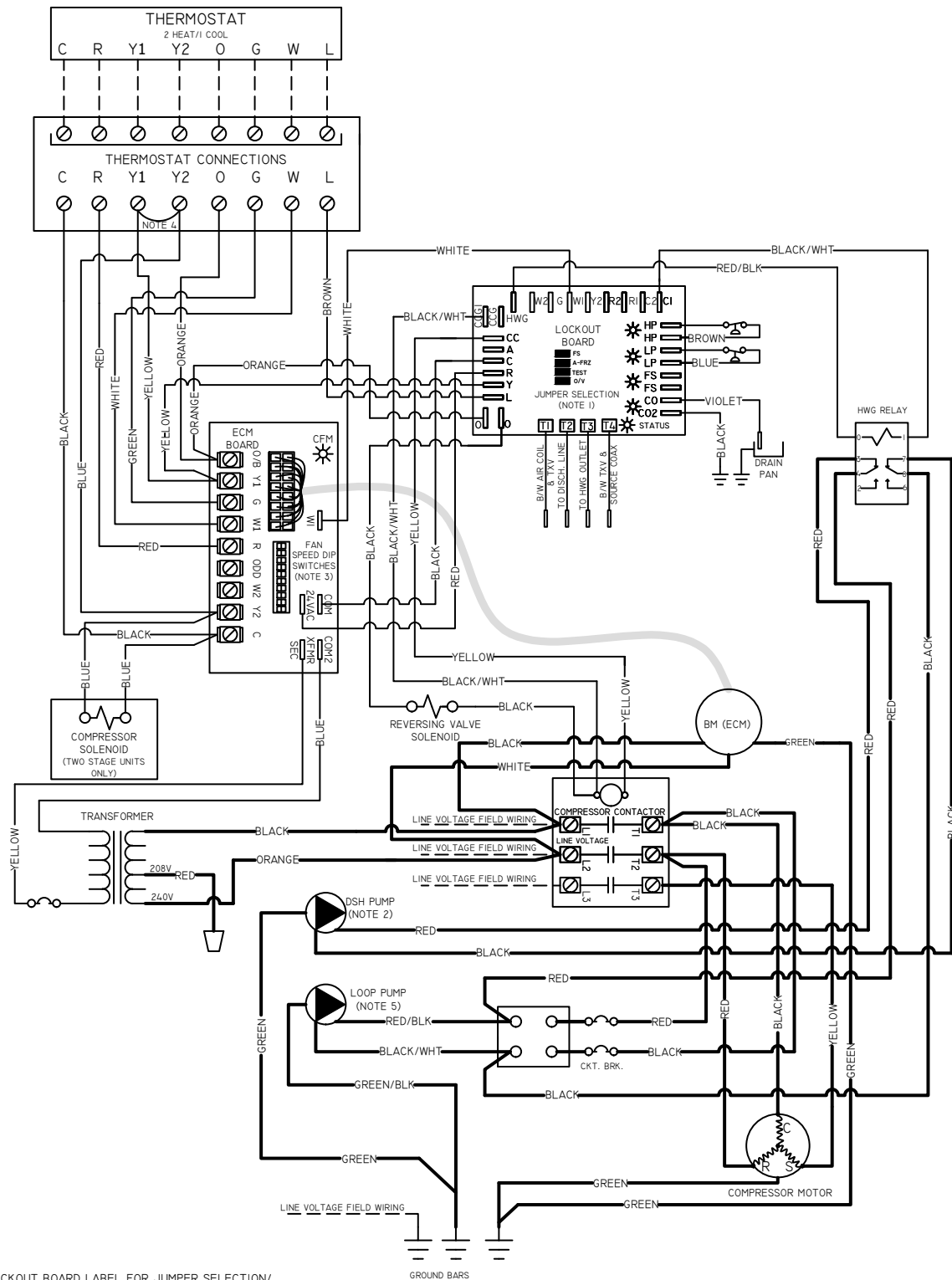


NOTES:

1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
3. JUMPER REMOVED FOR TWO STAGE UNITS.
4. OPTIONAL FACTORY INSTALLED LOOP PUMP.

Section 10: Wiring Diagrams

Two Stage or Single Stage, ECM Fan, Three Phase, 208/230V, 60Hz, DSH, Commercial

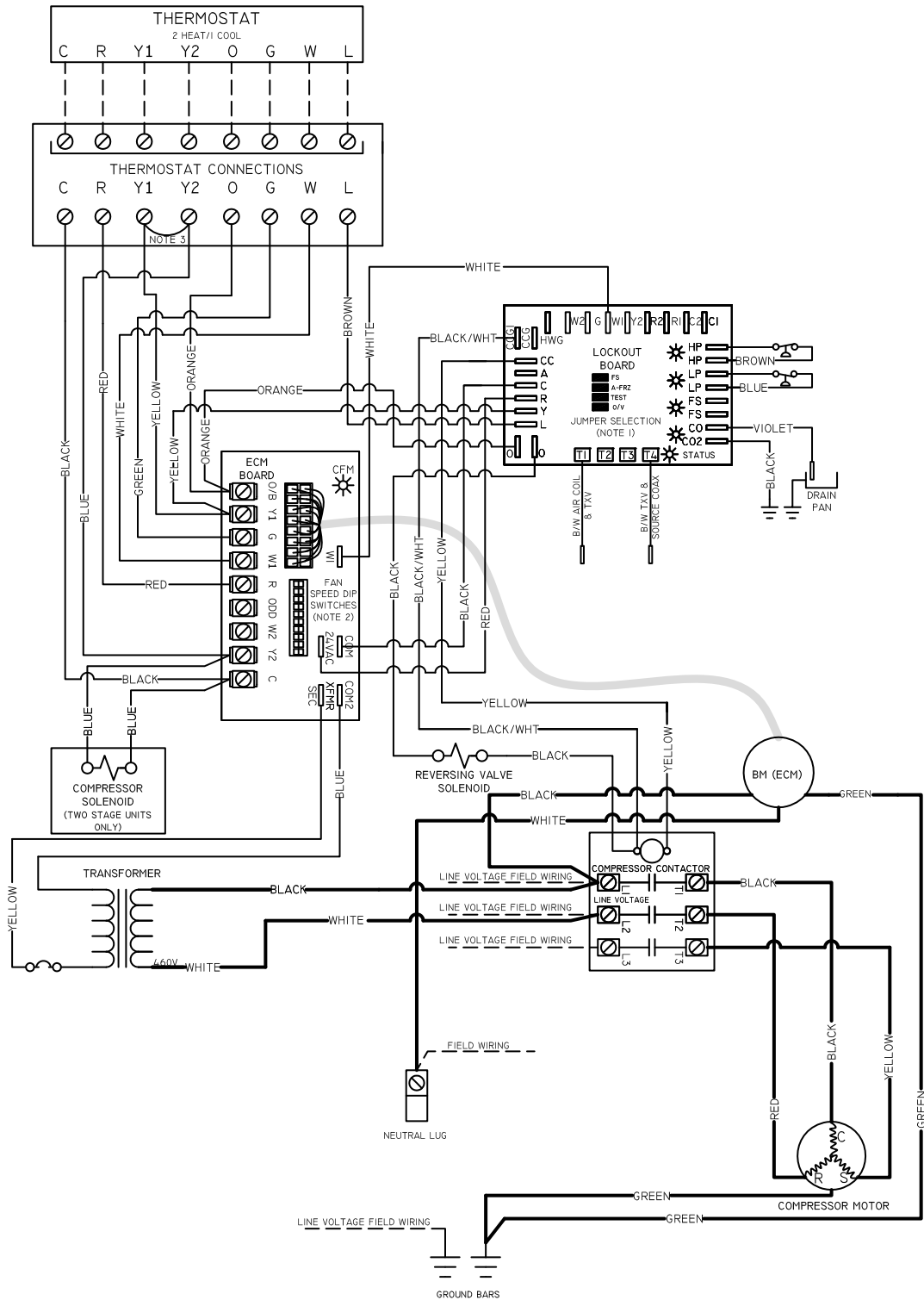


NOTES:

1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. 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.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. JUMPER REMOVED FOR TWO STAGE UNITS.
5. OPTIONAL FACTORY INSTALLED LOOP PUMP.

Section 10: Wiring Diagrams

Two Stage or Single Stage, ECM Fan, Three Phase, 460V, 60Hz, Commercial



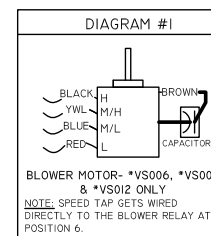
NOTES:

1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
3. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.

Single Stage, PSC Fan, Single Phase, 265V, 60Hz, Commercial



1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. SPEED SHOULD BE SET TO THE FOLLOWING:
- | | |
|-----------------|----------------|
| *VS006= MED/LOW | *VS009= HIGH |
| *VS012= HIGH | *VS015= LOW |
| *VS018= MEDIUM | *VS024= MEDIUM |
| *VS030= HIGH | *VS036= HIGH |



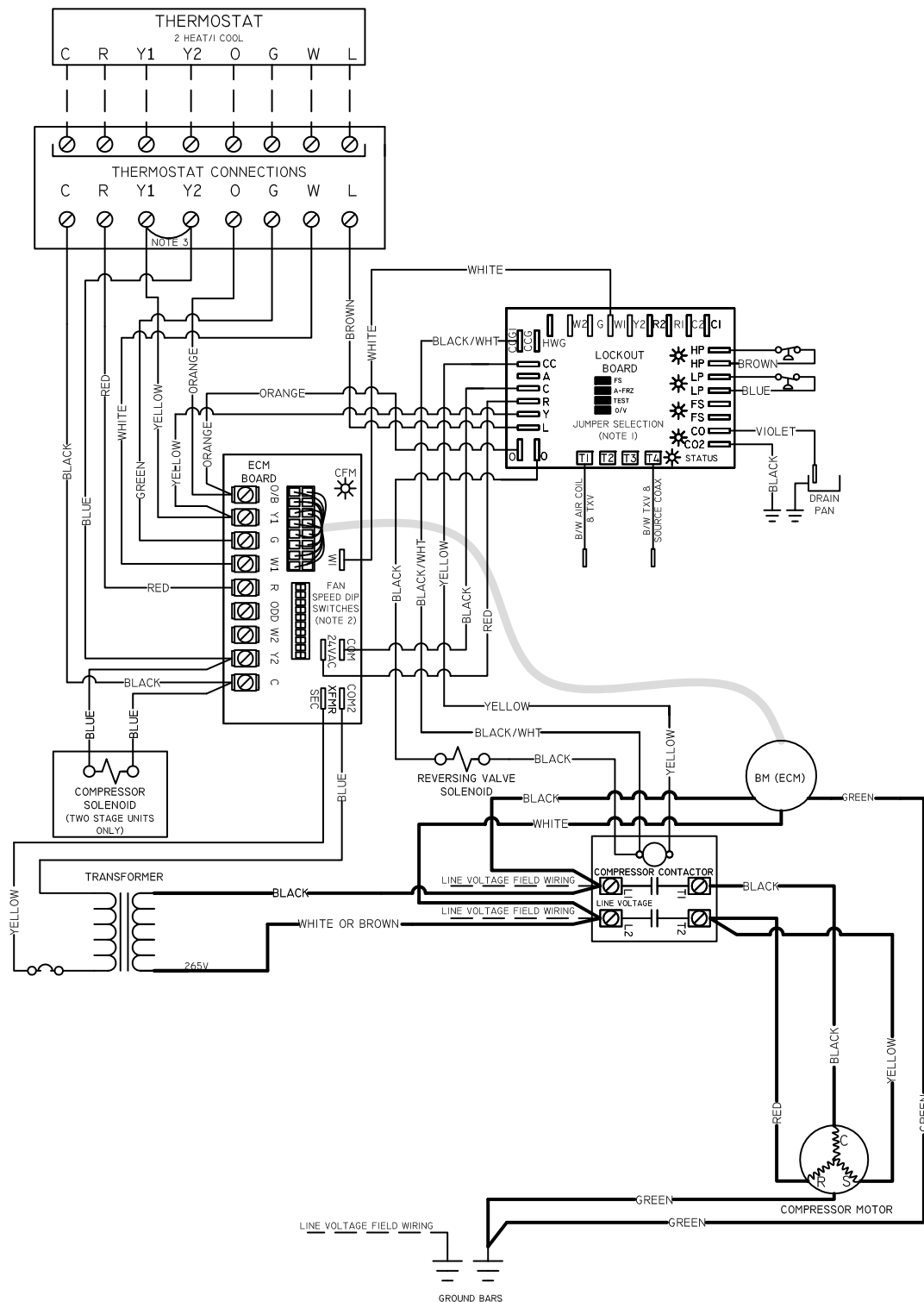
Single Stage, PSC Fan, Single Phase, 265V, 60Hz, DSH, Commercial



1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. CONNECT WIRES TO THE HWG PUMP RELAY COIL. RELAY IS TO BE PROVIDED BY THE INSTALLER AND IS A N.C. RELAY THAT WILL INTERRUPT POWER TO THE PUMP WHEN CONDITIONS ARE INAPPROPRIATE FOR WATER HEATING. IF WIRES ARE NOT CONNECTED TO RELAY, SCALDING CAN OCCUR.
3. SPEED SHOULD BE SET TO THE FOLLOWING:
*VS018= MEDIUM *VS024= MEDIUM
*VS030= HIGH *VS036= HIGH

Section 10: Wiring Diagrams

Two Stage or Single Stage, ECM Fan, Single Phase, 265V, 60Hz, Commercial

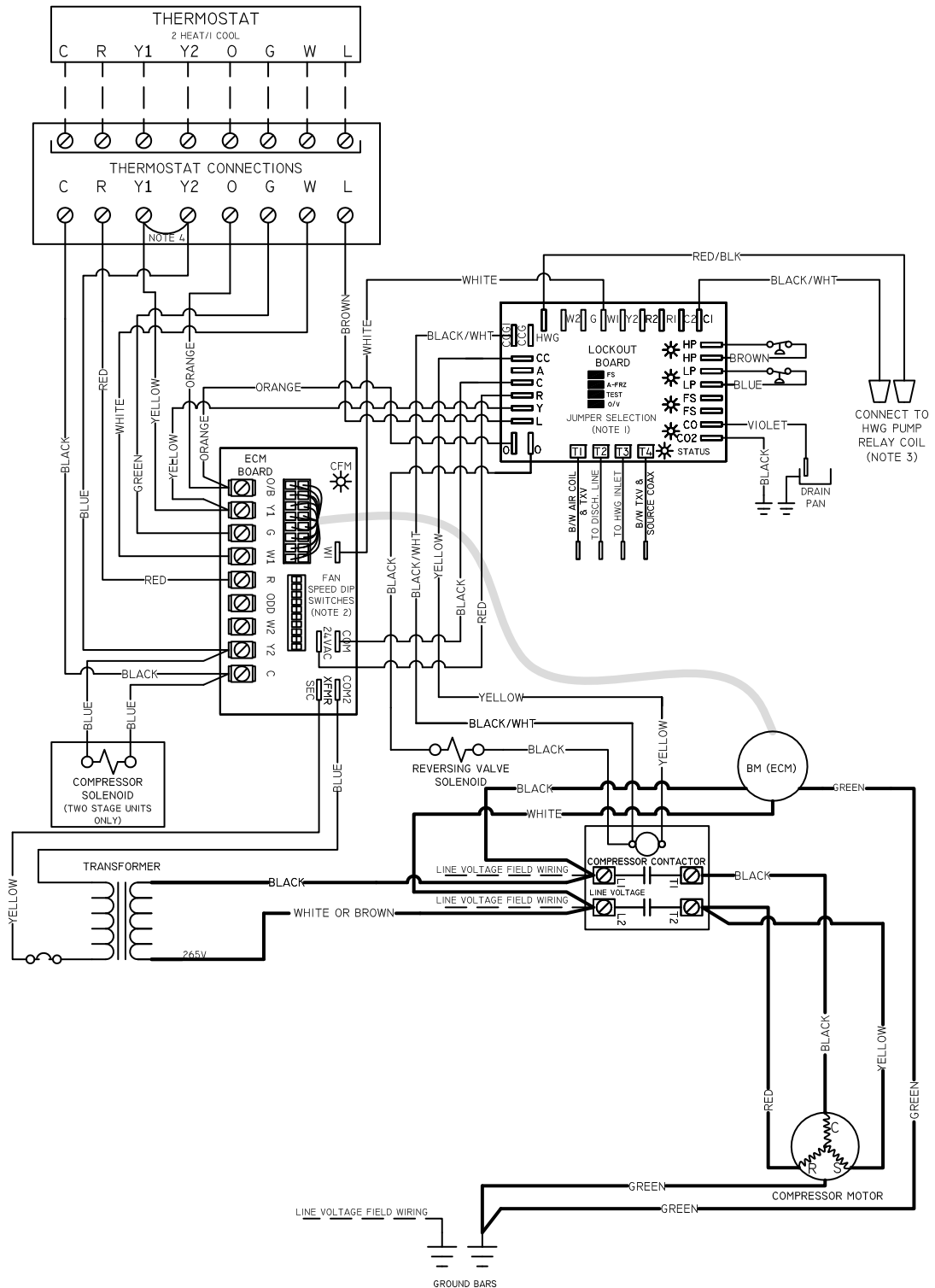


NOTES:

1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
3. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.

Section 10: Wiring Diagrams

Two Stage or Single Stage, ECM Fan, Single Phase, 265V, 60Hz, DSH, Commercial

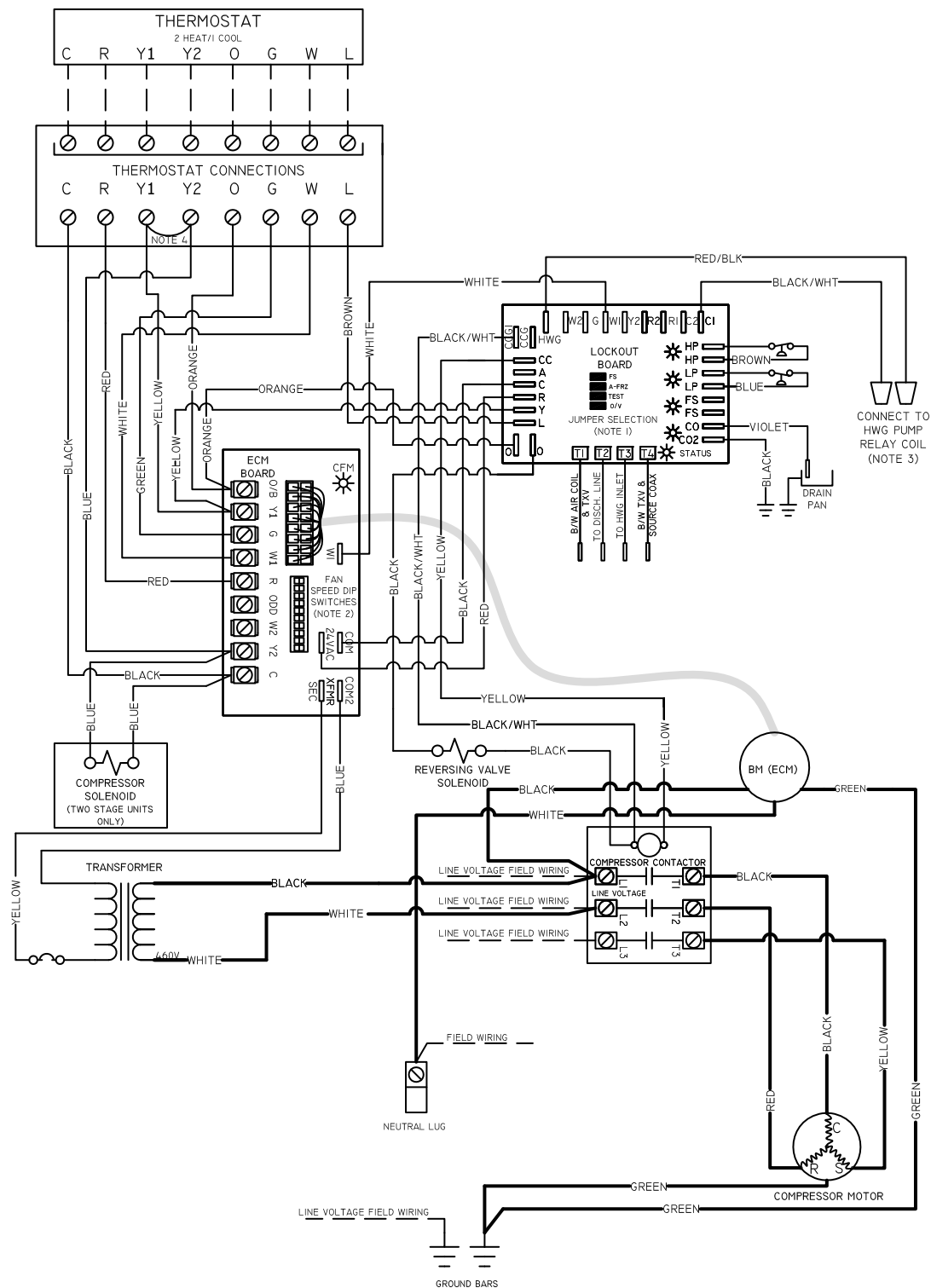


NOTES:

1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
3. CONNECT WIRES TO THE HWG PUMP RELAY COIL. RELAY IS TO BE PROVIDED BY THE INSTALLER AND IS A N.C. RELAY THAT WILL INTERRUPT POWER TO THE PUMP WHEN CONDITIONS ARE INAPPROPRIATE FOR WATER HEATING. IF WIRES ARE NOT CONNECTED TO RELAY, SCALDING CAN OCCUR.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.

Section 10: Wiring Diagrams

Two Stage or Single Stage, ECM Fan, Three Phase, 460V, 60Hz, DSH, Commercial



NOTES:

1. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION.
2. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
3. CONNECT WIRES TO THE HWG PUMP RELAY COIL. RELAY IS TO BE PROVIDED BY THE INSTALLER AND IS A N.C. RELAY THAT WILL INTERRUPT POWER TO THE PUMP WHEN CONDITIONS ARE INAPPROPRIATE FOR WATER HEATING. IF WIRES ARE NOT CONNECTED TO RELAY, SCALDING CAN OCCUR.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.

Section 11: Equipment Start-Up Procedures

Equipment Start-Up Process

Check the following before power is applied to the equipment



Do not start-up the unit until the new structure is ready to be occupied

Check the following before power is applied to the equipment

Electrical:

- Geothermal unit high voltage wiring is installed correctly
- Geothermal unit high voltage wiring and breaker are the correct size
- Auxiliary electric heaters are wired and installed correctly
- Circulating pumps are wired and fused (if necessary) correctly Desuperheater pump is NOT wired, unless piping is complete and all air is purged
- Low voltage wiring is correct and completely installed

Plumbing:

- Pipe and pump sizes are correct
- Air is purged from all lines
- Antifreeze is installed
- All valves are open, including those on the flow center
- Condensate is trapped and piped to the drain

Ductwork:

- Filter is installed and clean
- Packaging is removed from the blower assembly
- Blower turns freely
- Canvas connections installed on supply plenum & return drop

Equipment Start-up:

1. Energize geothermal unit with high voltage.
2. 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).
3. 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. **ON UNITS WITH INTERNAL LOOP CIRCULATION PUMPS, USE THE INTERNAL SOURCE SIDE INPUT PT PORT. DO NOT USE ANY EXTERNAL SOURCE SIDE INPUT PT PORT.** Output test readings may be taken at any external PT port.
4. 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.

Section 11: 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		°F		°F
Source Water Temperature Out		°F		°F
Source Water Temperature Difference		°F		°F

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		°F		°F
Load Water Temperature Out		°F		°F
Load Water Temperature Difference		°F		°F

Air Temperature Difference	Cooling		Heating	
Supply Air Temperature		°F		°F
Return Air Temperature		°F		°F
Air Temp. Difference		°F		°F

*Confirm auxiliary heaters are de-energized for the above readings.

Auxiliary Heat Operation Only	Heating	
Supply Air Temperature		°F
Return Air Temperature		°F
Air Temp. Difference		°F

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 11: Equipment Start-Up Procedures

HE/HR Table, Standard PSC Blower

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
VS006	0.8	300/300	3.7	5.2	6.6	7.8	9.5	9.2	8.8	8.3
	1.1		3.9	5.4	6.9	8.1	9.5	9.3	8.8	8.2
	1.5		4.1	5.7	7.1	8.4	9.5	9.3	8.8	8.2
VS009	1.1	350/350	5.5	7.5	9.7	12.0	14.9	14.1	13.4	12.4
	1.7		5.9	8.0	10.4	12.8	15.1	14.2	13.5	12.4
	2.3		6.1	8.3	10.7	13.2	15.1	14.3	13.5	12.3
VS012	1.5	350/350	6.1	8.6	11.1	13.6	15.7	15.0	14.1	13.1
	2.3		6.6	9.1	11.8	14.3	16.0	15.2	14.2	13.2
	3.0		6.7	9.3	12.1	14.7	16.1	15.3	14.3	13.2
VS015	1.9	500/500	7.7	10.7	13.9	17.3	20.7	19.5	18.6	17.2
	2.8		8.1	11.3	14.7	18.2	20.8	19.5	18.6	17.1
	3.8		8.5	11.8	15.3	18.9	20.7	19.4	18.4	16.9
VS018	2.3	600/600	10.2	14.3	18.1	22.3	26.3	25.5	24.7	23.9
	3.4		11.0	15.2	19.2	23.6	26.3	25.5	24.5	23.6
	4.5		11.3	15.7	19.7	24.2	26.7	25.8	24.8	23.7
VS024	3.0	800/800	13.6	18.2	23.5	28.5	33.2	32.4	31.2	30.2
	4.5		14.3	19.1	24.6	29.8	33.3	32.4	31.0	29.8
	6.0		14.9	19.8	25.5	30.9	33.3	32.4	31.0	29.7
VS030	3.8	1000/1000	13.7	19.0	24.6	30.3	38.8	37.8	36.2	34.7
	5.6		16.7	22.8	29.4	36.0	38.9	37.7	36.0	34.4
	7.5		17.6	23.9	30.8	37.7	38.9	37.7	36.0	34.3
VS036	4.5	1100/1100	19.9	27.1	35.3	43.7	48.6	47.5	45.9	44.3
	7.0		21.2	28.7	37.3	46.1	48.6	47.3	45.5	43.7
	9.0		21.9	29.5	38.4	47.4	48.5	47.2	45.4	43.5
VS041	5.3	1150/1150	21.4	28.6	35.8	43.1	51.7	50.1	48.5	46.3
	7.9		22.6	30.1	37.6	45.2	51.8	50.1	48.3	45.9
	10.5		23.3	30.9	38.7	46.5	52.0	50.2	48.3	45.8
VS042	5.3	1450/1450	21.6	30.1	39.1	48.5	54.5	53.8	51.7	50.1
	7.9		23.1	32.1	41.6	51.5	54.5	53.8	51.5	49.7
	10.5		23.7	32.9	42.6	52.8	54.5	53.7	51.3	49.5
VS048	6.0	1550/1550	26.0	35.3	45.0	55.3	63.8	63.5	61.6	59.5
	9.0		27.7	37.4	47.7	58.5	63.8	63.5	61.3	59.0
	12.0		28.7	38.6	49.2	60.3	63.9	63.5	61.3	58.8
VS060	7.5	1850/1850	31.3	42.5	53.7	65.1	73.8	73.9	72.0	69.4
	11.3		33.2	44.9	56.7	68.7	73.7	73.7	71.5	68.7
	15.0		33.9	45.9	58.0	70.1	73.4	73.4	71.2	68.2
VS072	9.0	2100/2100	33.1	46.6	60.0	73.5	89.7	89.7	86.4	83.1
	13.5		35.1	49.3	63.4	77.5	89.7	89.6	86.0	82.3
	18.0		36.2	50.8	65.3	79.7	89.6	89.4	85.7	81.9

HE/HR Table, Optional ECM Blower

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
VS015	1.9	550/550	7.7	10.9	14.0	17.3	21.2	20.0	19.2	17.8
	2.8		8.2	11.5	14.8	18.3	21.4	20.1	19.2	17.6
	3.8		8.5	11.9	15.3	18.9	21.4	20.1	19.1	17.5
VS018	2.3	700/700	10.5	14.6	18.4	22.6	26.9	26.2	25.4	24.6
	3.4		11.2	15.5	19.5	24.0	27.0	26.2	25.2	24.3
	4.5		11.6	16.0	20.0	24.6	27.4	26.5	25.5	24.4
VS024	3.0	800/800	13.7	18.2	23.6	28.7	33.1	32.4	31.1	30.1
	4.5		14.5	19.1	24.7	30.0	33.2	32.4	31.0	29.8
	6.0		15.0	19.7	25.5	30.9	33.4	32.5	31.0	29.7
VS030	3.8	1000/1000	16.2	22.1	28.3	34.9	38.6	37.6	36.1	34.6
	5.6		17.0	23.1	29.6	36.4	38.8	37.7	36.0	34.3
	7.5		17.6	23.9	30.6	37.6	38.9	37.7	35.9	34.2
VS036	4.5	1200/1100	20.1	27.3	35.5	43.9	48.7	47.5	45.8	44.2
	7.0		21.4	28.9	37.5	46.4	48.6	47.3	45.5	43.6
	9.0		22.0	29.7	38.6	47.7	48.6	47.2	45.3	43.4
VS041	5.3	1320/1210	21.8	29.1	36.4	43.8	52.1	50.6	49.0	46.9
	7.9		23.0	30.6	38.3	46.0	52.3	50.5	48.8	46.5
	10.5		23.7	31.5	39.4	47.3	52.4	50.6	48.8	46.4
VS042	5.3	1400/1450	21.6	30.1	39.0	48.5	54.5	53.8	51.8	50.2
	7.9		23.1	32.0	41.5	51.5	54.5	53.8	51.5	49.7
	10.5		23.7	32.8	42.5	52.7	54.5	53.7	51.3	49.5
VS048	6.0	1540/1610	26.1	35.2	45.0	55.2	64.0	63.8	62.0	59.9
	9.0		27.7	37.4	47.6	58.4	64.1	63.8	61.7	59.3
	12.0		28.7	38.6	49.1	60.2	64.2	63.8	61.6	59.1
VS060	7.5	1980/2000	31.6	42.8	54.1	65.5	74.7	74.9	73.1	70.6
	11.3		33.4	45.2	57.1	69.2	74.6	74.7	72.6	69.8
	15.0		34.2	46.3	58.4	70.6	74.4	74.4	72.2	69.3
VS072	9.0	2180/2200	33.3	46.9	60.4	73.8	90.5	90.6	87.3	84.2
	13.5		35.3	49.5	63.7	77.9	90.5	90.4	86.9	83.3
	18.0		36.4	51.0	65.6	80.1	90.5	90.3	86.6	82.9

Section 11: Equipment Start-Up Procedures

HE/HR Table, Standard ECM Blower

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
VT024	Part Load	2.0	500/500	8.8	12.6	16.4	20.2	23.9	23.2	22.6	21.8
		3.0		9.4	13.3	17.4	21.3	23.9	23.1	22.4	21.4
		4.0		9.8	13.8	17.9	21.9	24.0	23.2	22.3	21.3
	Full Load	3.0	800/800	13.5	18.1	23.3	28.4	33.5	32.4	31.2	30.1
		4.5		14.2	19.1	24.5	29.9	33.5	32.3	31.1	29.8
		6.0		14.6	19.6	25.1	30.6	33.7	32.5	31.2	29.9
VT030	Part Load	2.5	740/760	11.5	16.1	20.9	26.0	30.1	29.7	28.4	27.2
		3.7		12.3	17.0	22.1	27.5	30.4	29.8	28.4	27.0
		5.0		12.6	17.4	22.6	28.0	30.4	29.7	28.2	26.6
	Full Load	3.8	1000/1000	16.9	22.4	28.5	33.5	39.6	40.6	38.1	37.0
		5.6		17.8	23.6	29.9	35.2	39.7	40.6	37.8	36.7
		7.5		18.3	24.3	30.7	36.1	39.5	40.4	37.1	36.5
VT036	Part Load	3.0	800/800	12.8	18.2	23.9	29.4	34.0	33.3	32.4	31.5
		4.5		13.8	19.4	25.4	31.2	34.2	33.3	32.1	31.0
		6.0		14.4	20.2	26.4	32.4	34.2	33.3	32.0	30.8
	Full Load	4.5	1200/1100	19.5	27.0	34.3	41.8	48.3	47.1	45.8	44.1
		7.0		20.9	28.8	36.4	44.3	48.3	46.9	45.5	43.6
		9.0		21.6	29.7	37.6	45.7	48.2	46.8	45.3	43.4
VT042	Part Load	3.5	1160/1160	14.6	21.0	28.2	36.0	42.7	41.4	39.4	36.9
		5.3		15.7	22.6	30.2	38.4	43.2	41.6	39.4	36.5
		7.0		16.3	23.4	31.2	39.7	43.2	41.6	39.2	36.0
	Full Load	5.3	1400/1450	22.3	30.2	39.7	48.9	59.2	58.4	56.4	53.8
		7.9		23.7	32.0	41.9	51.6	59.4	58.4	56.2	53.4
		10.5		24.5	33.0	43.2	53.2	59.4	58.4	56.1	53.2
VT048	Part Load	4.0	1250/1270	16.7	23.9	32.4	41.6	44.8	44.8	42.4	40.2
		6.0		18.0	25.5	34.4	44.2	45.1	44.9	42.2	39.6
		8.0		18.6	26.4	35.5	45.5	45.1	44.7	41.8	39.0
	Full Load	6.0	1540/1610	26.0	35.1	45.0	53.8	62.8	64.3	62.4	59.9
		9.0		27.4	36.9	47.2	56.5	62.7	64.1	62.0	59.2
		12.0		28.2	38.0	48.5	58.1	62.7	64.0	61.8	58.9
VT060	Part Load	5.0	1680/1580	21.8	30.5	40.3	49.9	54.6	55.5	53.8	51.5
		7.5		23.4	32.6	43.0	53.1	54.9	55.6	53.6	50.9
		10.0		24.3	33.8	44.5	54.9	54.9	55.5	53.2	50.3
	Full Load	7.5	1980/2000	31.7	42.5	54.8	67.4	76.3	78.4	76.5	73.3
		11.3		33.6	45.0	57.9	71.1	76.4	78.4	76.2	72.8
		15.0		34.6	46.3	59.5	73.2	76.7	78.7	76.4	72.8
VT072	Part Load	6.0	1850/1800	24.1	34.7	46.0	57.3	64.9	65.2	62.4	59.9
		9.0		26.0	37.2	49.1	61.1	65.4	65.5	62.2	59.2
		12.0		27.0	38.5	50.8	63.2	65.5	65.3	61.9	58.5
	Full Load	9.0	2180/2200	34.5	47.4	61.1	72.4	85.6	88.1	86.1	82.8
		13.5		36.4	50.0	64.2	76.1	85.6	88.0	85.7	82.0
		18.0		37.5	51.4	66.1	78.2	85.6	87.9	85.6	81.7

- Capacity data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
- 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).
- Performance data accurate within ±15%.
- Unit performance test is run without hot water generation.
- Capacity data includes fan power but not pump power and it does not reflect fan or pump power correction for AHRI/ISO conditions.
- Performance data is based upon the lower voltage of dual voltage rated units.
- Interpolation of unit performance data is permissible; extrapolation is not.
- Performance data is a result of lab testing and is not related to warranty.
- Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 11: Equipment Start-Up Procedures

VS Series, 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
VS006	0.8	0.6	1.4	0.5	1.2	0.4	0.9	0.4	0.9
	1.1	0.8	1.8	0.7	1.6	0.6	1.4	0.6	1.4
	1.5	1.2	2.8	1.0	2.3	0.9	2.1	0.8	1.8
	2.5	2.5	5.8	2.2	5.1	1.9	4.4	1.7	3.9
VS009	1.1	0.8	1.8	0.7	1.6	0.6	1.4	0.5	1.2
	1.7	1.5	3.5	1.3	3.0	1.1	2.5	1.0	2.3
	2.3	2.3	5.3	2.0	4.6	1.8	4.2	1.6	3.7
	3.0	3.4	7.8	3.0	6.9	2.6	6.0	2.4	5.5
VS012	1.5	1.4	3.2	1.2	2.8	1.0	2.3	0.9	2.1
	2.3	2.5	5.8	2.1	4.8	1.8	4.2	1.7	3.9
	3.0	3.6	8.3	3.1	7.2	2.7	6.2	2.4	5.5
	4.0	5.5	12.7	4.7	10.8	4.1	9.5	3.7	8.5
VS015	1.9	1.0	2.3	0.9	2.1	0.8	1.8	0.8	1.8
	2.8	1.5	3.5	1.3	3.0	1.2	2.8	1.1	2.5
	3.8	2.0	4.6	1.8	4.2	1.6	3.7	1.5	3.5
	5.0	2.8	6.5	2.5	5.8	2.2	5.1	2.1	4.8
VS018	2.3	1.3	3.0	1.2	2.8	1.1	2.5	1.0	2.3
	3.4	1.9	4.4	1.7	3.9	1.6	3.7	1.5	3.5
	4.5	2.6	6.0	2.3	5.3	2.1	4.8	1.9	4.4
	6.0	3.7	8.5	3.3	7.6	3.0	6.9	2.8	6.5
VS024	3.0	1.7	3.9	1.5	3.5	1.3	3.0	1.2	2.8
	4.5	2.7	6.2	2.3	5.3	2.1	4.8	1.9	4.4
	6.0	3.8	8.8	3.3	7.6	3.0	6.9	2.7	6.2
	7.0	4.7	10.8	4.1	9.5	3.6	8.3	3.3	7.6
VS030	3.8	1.8	4.2	1.7	3.9	1.7	3.9	1.7	3.9
	5.6	2.3	5.3	2.2	5.1	2.1	4.8	2.1	4.8
	7.5	2.9	6.7	2.8	6.5	2.7	6.2	2.7	6.2
	9.0	3.7	8.5	3.5	8.1	3.4	7.8	3.3	7.6
VS036	4.5	1.9	4.4	1.9	4.4	1.8	4.2	1.6	3.7
	7.0	2.7	6.2	2.6	6.0	2.5	5.8	2.3	5.3
	9.0	3.7	8.5	3.6	8.3	3.5	8.1	3.1	7.2
	11.0	4.9	11.3	4.8	11.1	4.6	10.6	4.1	9.5
VS041	5.3	1.7	3.9	1.5	3.5	1.4	3.2	1.3	3.0
	7.9	2.9	6.7	2.6	6.0	2.3	5.3	2.1	4.8
	10.5	4.4	10.1	3.9	9.0	3.5	8.1	3.2	7.4
	13.0	6.1	14.1	5.3	12.2	4.8	11.1	4.4	10.1
VS042	5.3	2.3	5.3	2.1	4.8	1.9	4.4	1.9	4.4
	7.9	3.3	7.6	3.1	7.2	2.9	6.7	2.8	6.5
	10.5	4.9	11.3	4.5	10.4	4.2	9.7	4.0	9.2
	13.0	6.6	15.2	6.1	14.1	5.7	13.1	5.5	12.7
VS048	6.0	2.2	5.1	1.9	4.4	1.7	3.9	1.6	3.7
	9.0	3.9	9.0	3.4	7.8	3.1	7.2	2.8	6.5
	12.0	6.1	14.1	5.3	12.2	4.8	11.1	4.4	10.1
	15.0	8.7	20.1	7.6	17.5	6.7	15.5	6.2	14.3
VS060	7.5	3.6	8.3	3.2	7.4	2.9	6.7	2.7	6.2
	11.3	6.2	14.3	5.4	12.5	5.0	11.5	4.7	10.8
	15.0	9.4	21.7	8.3	19.1	7.5	17.3	7.2	16.6
	19.0	13.6	31.4	12.0	27.7	10.9	25.1	10.4	24.0
VS072	9.0	4.2	9.7	3.7	8.5	3.4	7.8	3.3	7.6
	13.5	7.5	17.3	6.6	15.2	6.1	14.1	5.8	13.4
	18.0	11.6	26.8	10.3	23.8	9.4	21.7	9.0	20.8
	22.0	16.0	36.9	14.2	32.8	13.1	30.2	12.4	28.6

1. Pressure drop data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Pressure drop data accurate within $\pm 25\%$.
3. Unit performance test is run without hot water generation.
4. Interpolation of unit pressure drop data is permissible; extrapolation is not.
5. Pressure drop data is a result of lab testing and is not related to warranty.
6. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 11: Equipment Start-Up Procedures

VT Series, 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
VT024 Part Load	2.0	1.2	2.8	1.1	2.5	1.0	2.3	0.9	2.1
	3.0	1.8	4.2	1.6	3.7	1.4	3.2	1.3	3.0
	4.0	2.3	5.3	2.1	4.8	1.9	4.4	1.8	4.2
	5.0	3.0	6.9	2.7	6.2	2.5	5.8	2.3	5.3
VT024 Full Load	3.0	1.8	4.2	1.6	3.7	1.4	3.2	1.3	3.0
	4.5	2.8	6.5	2.4	5.5	2.2	5.1	2.0	4.6
	6.0	3.9	9.0	3.4	7.8	3.1	7.2	2.8	6.5
	8.0	5.6	12.9	4.9	11.3	4.4	10.1	4.0	9.2
VT030 Part Load	2.5	1.3	3.0	1.1	2.5	1.1	2.5	1.0	2.3
	3.7	1.6	3.7	1.4	3.2	1.3	3.0	1.2	2.8
	5.0	2.1	4.8	1.9	4.4	1.8	4.2	1.6	3.7
	6.6	2.9	6.7	2.6	6.0	2.4	5.5	2.2	5.1
VT030 Full Load	3.8	1.6	3.7	1.5	3.5	1.4	3.2	1.3	3.0
	5.6	2.4	5.5	2.2	5.1	2.0	4.6	1.8	4.2
	7.5	3.4	7.8	3.1	7.2	2.7	6.2	2.5	5.8
	10.0	5.0	11.5	4.4	10.1	3.9	9.0	3.5	8.1
VT036 Part Load	3.0	1.8	4.2	1.6	3.7	1.5	3.5	1.4	3.2
	4.5	1.9	4.4	1.7	3.9	1.6	3.7	1.6	3.7
	6.0	2.5	5.8	2.2	5.1	2.1	4.8	2.0	4.6
	8.0	3.5	8.1	3.1	7.2	2.9	6.7	2.9	6.7
VT036 Full Load	4.5	2.3	5.3	2.2	5.1	2.2	5.1	2.1	4.8
	7.0	3.1	7.2	3.0	6.9	2.9	6.7	2.9	6.7
	9.0	3.6	8.3	3.4	7.8	3.4	7.8	3.3	7.6
	11.0	4.5	10.4	4.3	9.9	4.2	9.7	4.1	9.5
VT042 Part Load	3.5	1.4	3.2	1.3	3.0	1.2	2.8	1.1	2.5
	5.2	2.3	5.3	2.0	4.6	1.8	4.2	1.7	3.9
	6.9	3.2	7.4	2.7	6.2	2.5	5.8	2.3	5.3
	9.2	4.7	10.8	4.1	9.5	3.6	8.3	3.3	7.6
VT042 Full Load	5.3	2.3	5.3	2.0	4.6	1.8	4.2	1.6	3.7
	7.9	4.0	9.2	3.4	7.8	2.9	6.7	2.7	6.2
	10.5	5.9	13.6	5.1	11.8	4.3	9.9	4.0	9.2
	14.0	9.0	20.8	7.9	18.2	6.7	15.5	6.1	14.1
VT048 Part Load	4.0	1.9	4.4	1.7	3.9	1.7	3.9	1.6	3.7
	6.0	2.5	5.8	2.3	5.3	2.3	5.3	2.2	5.1
	8.0	3.4	7.8	3.2	7.4	3.1	7.2	3.0	6.9
	10.0	5.2	12.0	4.8	11.1	4.7	10.8	4.5	10.4
VT048 Full Load	6.0	2.7	6.2	2.4	5.5	2.2	5.1	2.1	4.8
	9.0	4.2	9.7	3.8	8.8	3.5	8.1	3.4	7.8
	12.0	6.4	14.8	5.8	13.4	5.3	12.2	5.2	12.0
	15.0	9.0	20.8	8.1	18.7	7.5	17.3	7.3	16.8
VT060 Part Load	5.0	2.0	4.6	1.8	4.2	1.6	3.7	1.5	3.5
	7.5	3.3	7.6	2.9	6.7	2.6	6.0	2.4	5.5
	10.0	5.0	11.5	4.4	10.1	4.0	9.2	3.6	8.3
	12.0	6.6	15.2	5.8	13.4	5.2	12.0	4.8	11.1
VT060 Full Load	7.5	3.4	7.8	3.0	6.9	2.7	6.2	2.5	5.8
	11.3	6.1	14.1	5.3	12.2	4.8	11.1	4.4	10.1
	15.0	9.3	21.5	8.1	18.7	7.3	16.8	6.7	15.5
	18.0	12.3	28.4	10.8	24.9	9.7	22.4	8.9	20.5
VT072 Part Load	6.0	2.6	6.0	2.4	5.5	2.2	5.1	2.1	4.8
	9.0	4.0	9.2	3.6	8.3	3.4	7.8	3.2	7.4
	12.0	6.0	13.8	5.4	12.5	5.0	11.5	4.8	11.1
	14.0	7.5	17.3	6.8	15.7	6.3	14.5	6.0	13.8
VT072 Full Load	9.0	4.2	9.7	3.7	8.5	3.4	7.8	3.3	7.6
	13.5	7.4	17.1	6.6	15.2	6.0	13.8	5.7	13.1
	18.0	11.3	26.1	10.1	23.3	9.2	21.2	8.8	20.3
	21.0	14.4	33.2	12.8	29.5	11.7	27.0	11.2	25.8

1. Pressure drop data is based on 15% (by mass) 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. Pressure drop data is a result of lab testing and is not related to warranty.

6. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 12: Troubleshooting

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: $\text{GPM} \times \text{water temp diff.} \times 485 \text{ (antifreeze) or } 500 \text{ (fresh water)} = \text{HE or HR in BTU/HR}$

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.

QR Codes for Installation or Troubleshooting Tip Videos



- Nitrogen Purge While Brazing



- Leak Testing an Air Coil



- Loop Flushing



- Repairing a Microchannel Air Coil



- Testing a Coaxial Heat Exchanger



- Troubleshooting a TXV

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

Section 12: Troubleshooting

Model VS Operating Parameter Tables

EWT °F	Flow GPM/Ton	Heating - No Hot Water Generation					
		Discharge PSIG	Suction PSIG	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F - DB
30	1.5	238-368	59-79	5-43	5-24	6-12	12-31
	3	246-370	66-87	5-38	3-23	3-7	13-33
50	1.5	262-384	87-110	4-34	3-20	9-15	17-39
	3	271-387	97-122	4-29	3-20	5-9	18-41
70	1.5	291-413	120-147	4-29	4-20	12-20	21-47
	3	301-416	132-162	4-23	6-21	6-11	22-50
90	1.5	321-448	155-186	4-20	4-25	15-24	24-56
	3	332-459	171-210	3-20	8-27	8-13	26-60

EWT °F	Flow GPM/Ton	Cooling - No Hot Water Generation					
		Discharge PSIG	Suction PSIG	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F - DB
50	1.5	197-249	114-147	16-29	6-29	19-30	16-28
	3	171-221	112-147	10-21	7-30	9-15	16-28
70	1.5	269-329	123-157	16-31	4-22	19-28	15-27
	3	239-291	121-154	8-21	5-19	9-14	15-27
90	1.5	352-427	127-162	14-30	4-20	18-27	14-25
	3	313-376	126-159	6-21	4-19	8-13	14-25
110	1.5	455-547	132-167	13-32	4-20	16-25	12-24
	3	406-481	131-165	5-20	5-20	8-12	13-24

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.

CFM is 285-475 CFM/Ton for heating and cooling except for VS006 (260-340 CFM for 1/2 Ton).

Section 12: Troubleshooting

Model VT Operating Parameter Tables

EWT °F	Flow GPM/Ton	Full Load Heating - No Hot Water Generation					
		Discharge PSIG	Suction PSIG	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F - DB
30	1.5	268-339	57-73	10-31	7-22	7-10	19-26
	3	278-343	64-81	10-28	6-20	3-6	20-27
50	1.5	300-364	85-102	9-25	5-19	10-13	24-32
	3	311-368	94-114	9-21	6-18	5-8	26-34
70	1.5	338-408	117-137	7-24	5-18	13-17	30-39
	3	345-413	129-154	5-19	7-19	6-10	33-42
90	1.5	370-457	147-174	2-22	6-24	15-21	37-47
	3	379-462	162-192	2-17	10-26	8-12	40-50

EWT °F	Flow GPM/Ton	Full Load Cooling - No Hot Water Generation					
		Discharge PSIG	Suction PSIG	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F - DB
50	1.5	219-246	113-141	21-27	15-31	18-24	18-27
	3	192-217	111-140	13-19	16-33	9-13	18-27
70	1.5	296-327	123-148	19-29	9-17	19-23	19-26
	3	260-289	122-147	11-20	11-18	9-12	19-26
90	1.5	388-423	129-154	19-29	5-15	18-22	18-25
	3	341-374	128-152	10-20	7-17	9-12	18-25
110	1.5	498-537	134-158	21-30	5-16	18-22	16-23
	3	439-474	132-157	11-20	7-17	8-11	17-23

EWT °F	Flow GPM/Ton	Part Load Heating - No Hot Water Generation					
		Discharge PSIG	Suction PSIG	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F - DB
30	1	252-338	61-78	9-35	7-20	7-10	15-28
	2	262-343	69-87	9-29	5-19	4-6	16-30
50	1	279-362	89-106	9-23	5-17	11-14	20-36
	2	290-368	100-119	8-16	6-17	6-8	22-39
70	1	313-405	124-143	7-22	4-16	15-18	26-44
	2	324-412	139-159	6-13	6-17	8-10	28-47
90	1	348-454	161-185	3-21	6-17	19-22	31-52
	2	361-461	178-206	2-14	7-19	10-13	34-56

EWT °F	Flow GPM/Ton	Part Load Cooling - No Hot Water Generation					
		Discharge PSIG	Suction PSIG	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F - DB
50	1	217-245	123-144	18-25	14-29	21-26	18-29
	2	186-211	121-142	9-16	14-30	10-13	18-29
70	1	295-325	131-153	16-27	9-19	21-25	18-28
	2	253-280	129-151	6-17	10-20	10-13	18-28
90	1	387-421	135-156	16-28	4-20	20-24	17-26
	2	333-361	133-154	5-17	6-21	9-13	17-26
110	1	498-535	140-160	18-29	4-18	19-23	15-24
	2	428-458	138-159	6-17	5-20	9-12	15-24

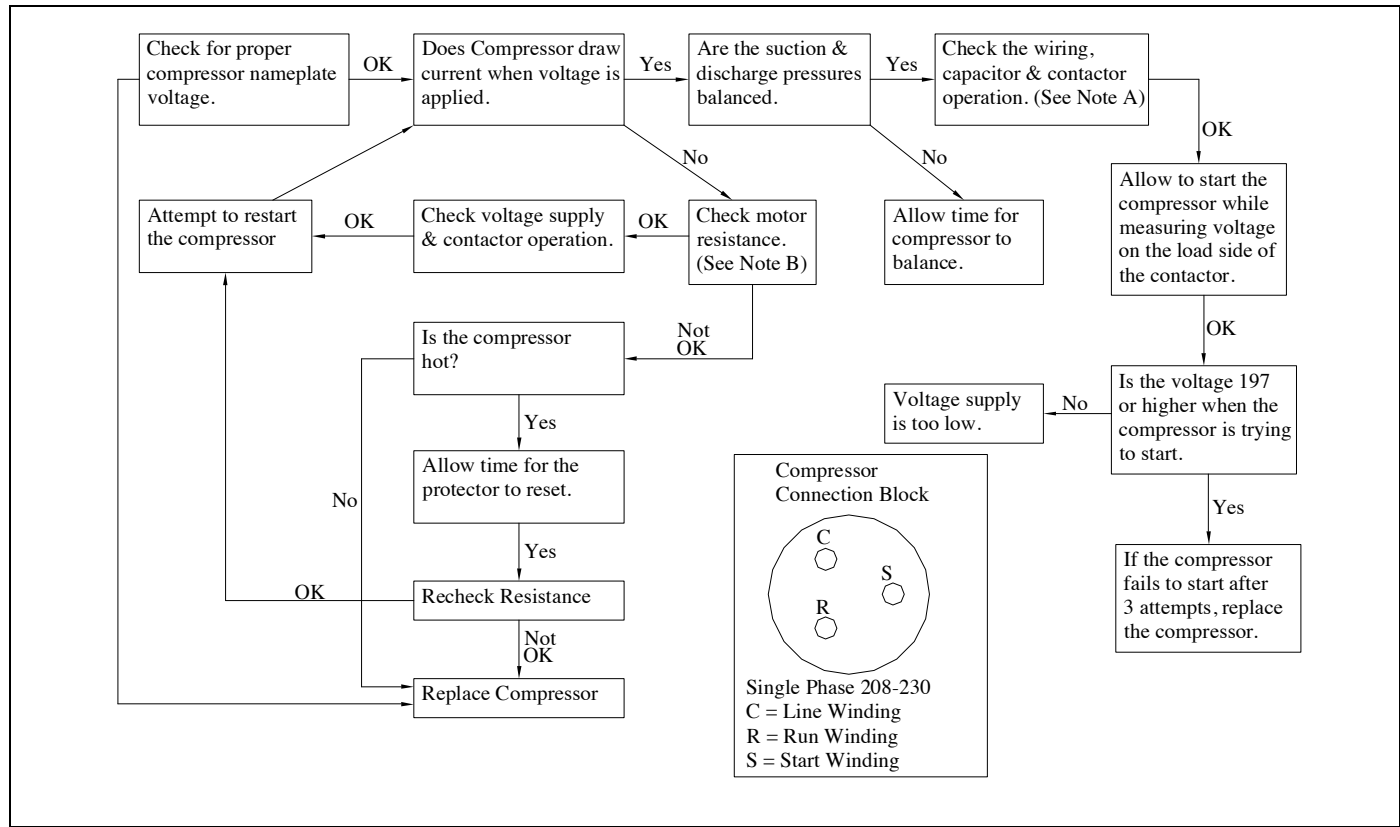
Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.

CFM is 330-400 CFM/Ton for heating and cooling.

Section 12: Troubleshooting

Compressor Troubleshooting

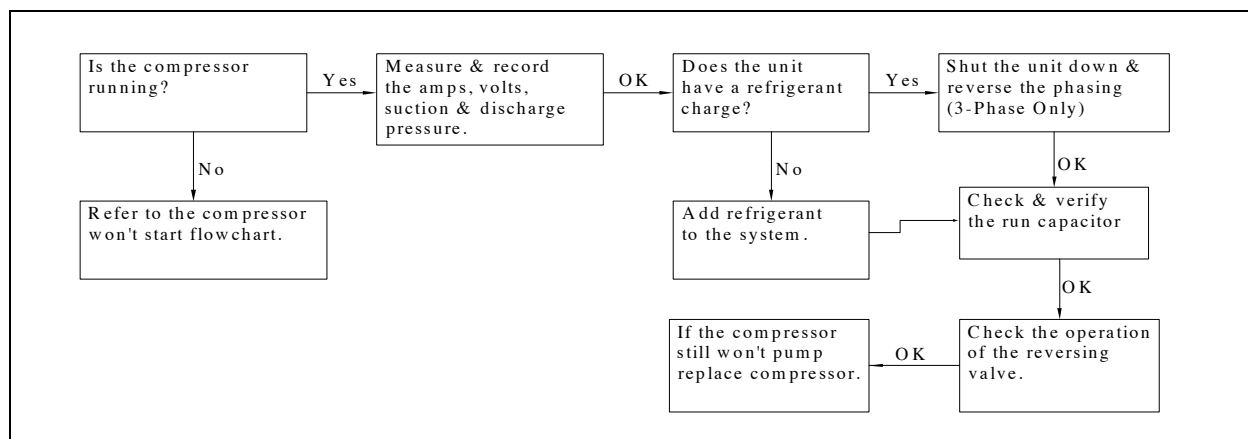
Compressor Won't Start



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 Pump



Section 12: 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 12: Troubleshooting

Troubleshooting Worksheet

Customer/Job Name: _____ Date: _____

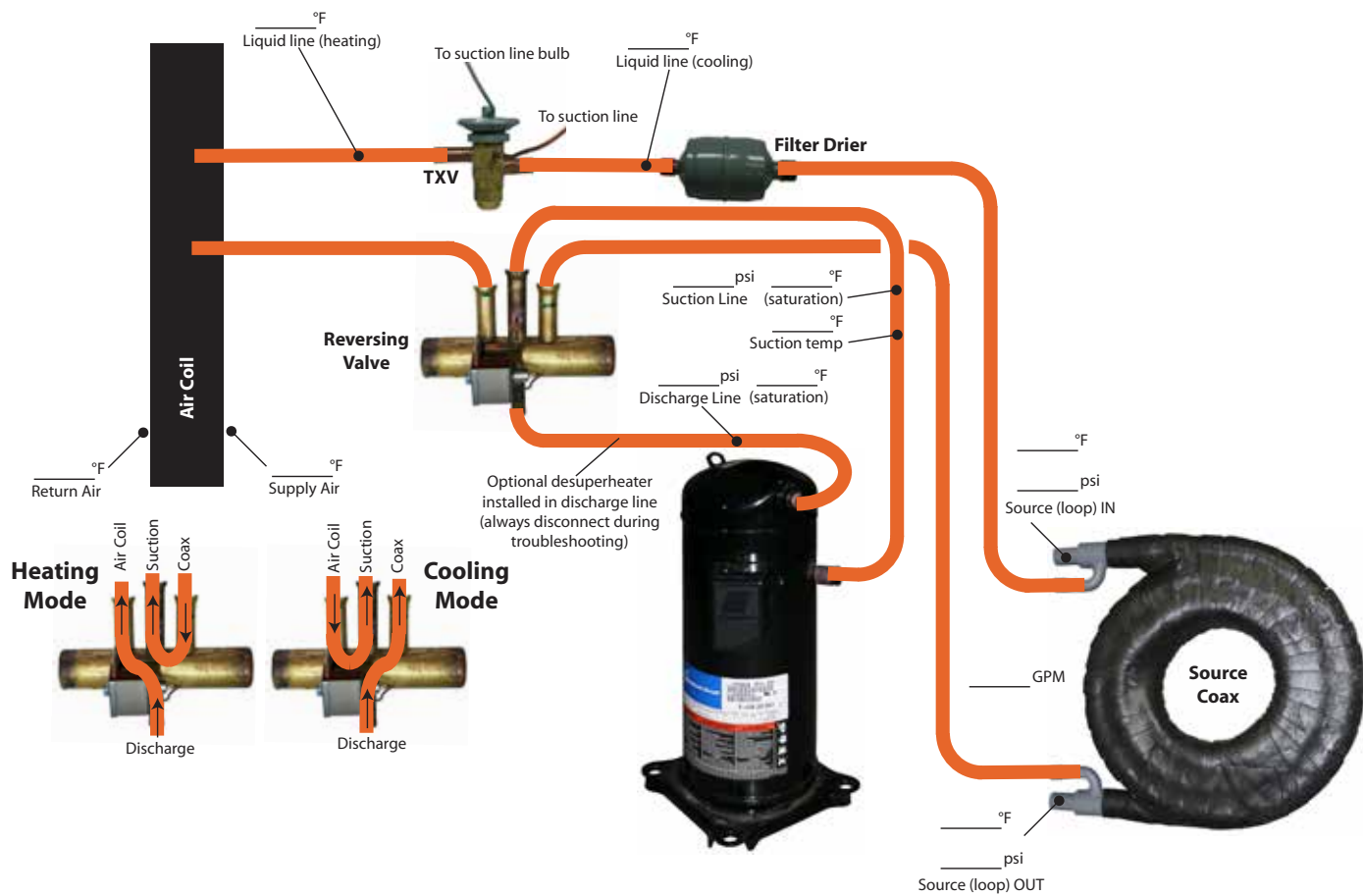
Model #: _____ Serial #: _____

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 12: Troubleshooting

Troubleshooting Tips

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).
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Section 12: Troubleshooting

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.
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J: EXCESSIVE HEAD PRESSURE IN HEATING MODE

Low air flow	See E: Noisy blower and low air flow.
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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.

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.

Section 12: Troubleshooting

Unit Electrical Data

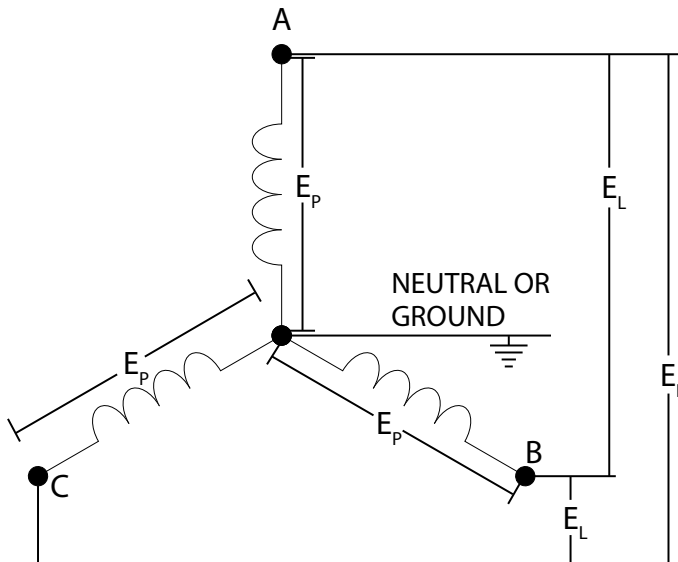
⚠ CAUTION ⚠

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.

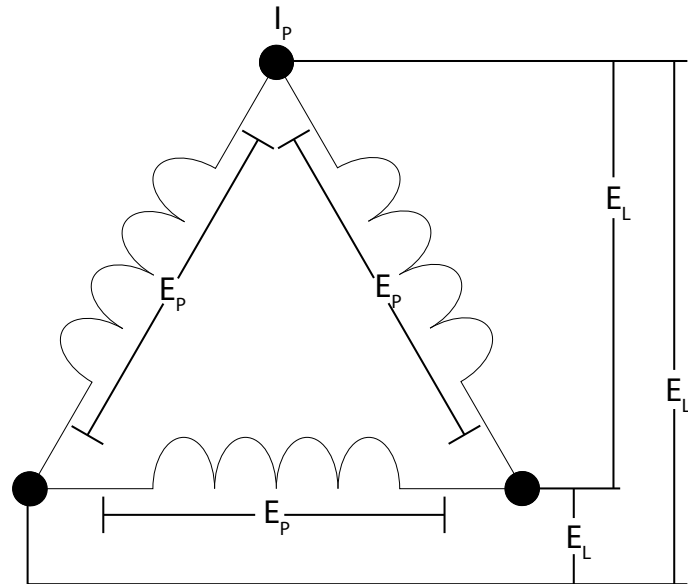
Note: Proper Power Supply Evaluation

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 1: WYE (STAR) Electrical Circuit



Example 2: DELTA 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.

Section 13: Warranty and Revision Table

Warranty Registration Form



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

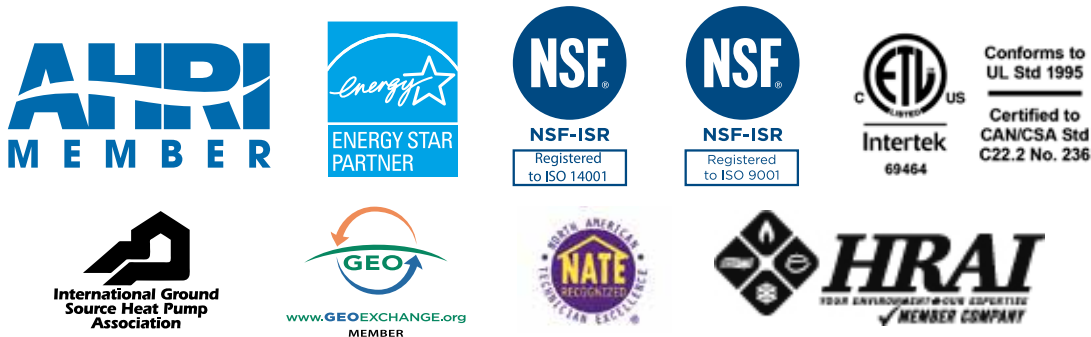
Date	Description of Revision	Page
24OCT2023	Various Updates	Various
12MAY2021	Electrical Data Table updated	13-14
08JUL2020	VT Electrical Data Tables updated	15, 16
02JAN2020	VT Electrical Data Tables updated	15, 16
20DEC2019	Electric Heater Compatibility Table updated	35
19DEC2019	VT HE/HR and VT Pressure Drop Tables updated	64, 66
10DEC2019	ECM Fan Performance chart updated.	18
	Unit Physical Data entered updated (VT030-042 added)	11
	Electrical Data Tables updated (VT030 and 042 added).	16-17
06SEP2019	Electrical Data Tables updated	12-16
27JUN2019	VS018 Refrigerant Charge changed from 43 oz. to 44 oz. VS024 Refrigerant Charge changed from 45 oz. to 43 oz. VT024 Refrigerant Charge changed from 45 oz. to 44 oz. VS036 Refrigerant Charge changed from 54 oz. to 51 oz.	11
12JUN2019	VS Wiring Diagrams updated.	45,46,56
10JUN2019	Fan Chart updated. AHRI Data removed.	6

Revision Table Continued

Date	Description of Revision	Page
05APR2019	Heater and Unit Compatibility Table updated (VS041 added)	37
	Fan Chart updated (VS041 added), Unit Physical Data Table updated (VS041 added)	13, 19
	Filter Rack options table updated	12
	VS Nomenclature updated (VS041 added)	4
03APR2019	HE/HR Tables updated	65
	WPD Table for VS updated	67
	Operating Parameter Table VS/VT updated	70,71
12DEC2018	Added AHRI note to VT table "126.5 for 265 Volt Version"	-
30MAY2018	Correct AHRI numbers VS015.	-
23APR2018	Unit Physical Data adjusted	-
11APR2018	Dimensional Data updated	-
09APR2018	Nomenclature drawings updated	-
14NOV2017	Updated Electrical Data	-
23OCT2017	Wiring Diagrams updated	-
14AUG2017	Updated Wiring Diagrams	-
18APR2017	Updated Electrical Data Tables	-
28MAR2017	Updated Electrical Data Table	-
01MAR2017	Dimension Data revised	-
23FEB2017	Updated Electrical Data Tables	-
19OCT2016	Updated AHRI Data Table for VS006 PSC	-
05JUL2016	Updated HE/HR, Ops and WPD tables	-
29JUN2016	Revised perf table	-
14JUN2016	Updated heater info, nomenclature, elec data, unit compatibility.	-
02MAY2016	Corrected 024 - 035 alignment. GL, GL, GW	-
25APR2016	Added Removing Debris paragraph	-
20APR2016	Added new QR Codes	-
16MAR2016	Updated various charts, elect data, PSC fan chart, wiring diagrams.	-
02FEB2016	Updated dimension drawing	-
20JAN2016	Revised nomenclature, elect table, fan charts, physical data	-
15JAN2016	Revised Elec data table	-
12JAN2016	Added unit with installed heater drawing	-
05JAN2016	Revised ECM fan chart, WPD, HE/HR, Operating Parameter tables, physical data table	-
14DEC2015	Revised AHRI perf charts	-
10DEC2015	Revised PSC fan chart, desuperheater page reduction	-
21OCT2015	Corrected VT Perf Charts	-
23SEP2015	Revised water quality table footnotes for pools and PSC blower table, added Terminal A, Y1 notes in electrical connection drawings	-
22SEP2015	Revised physical data table	-
09SEP2015	Added Removal and Disposal paragraph	-
08SEP2015	Revised AHRI perf, WPD Table, HE/HR Table, OPS Parameters	-
31AUG2015	Corrected 018 to 036 on AHRI WL table	-
26AUG2015	Revised nomenclatures drawings Elec data, PSC fan perf char	-
13AUG2015	Revised dimensions	-
032JUL2015	Corrected AHRI data tables	-
18JUN2015	Replaced wiring diagrams	-
28MAY2015	Inserted updated open loop piping drawing	-
2014	Document created	



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