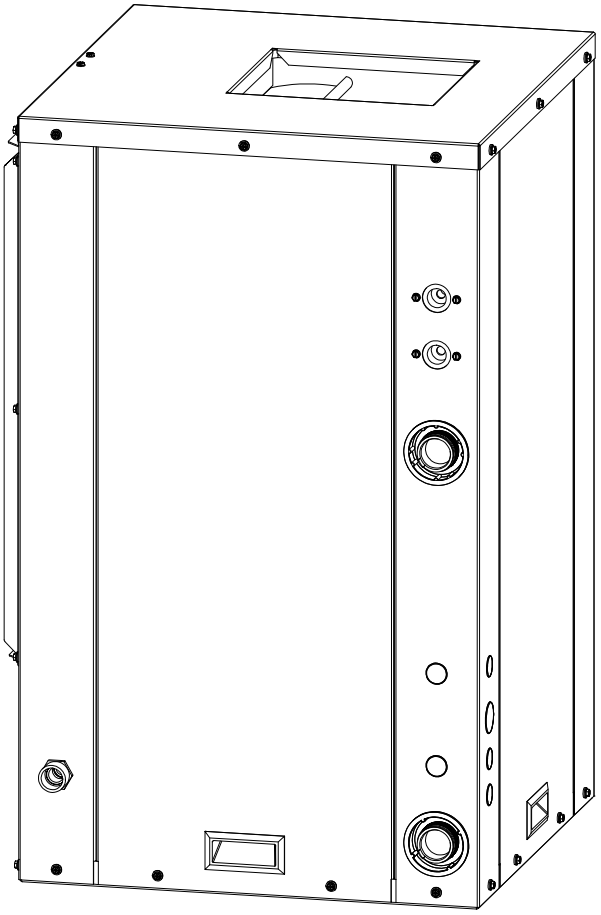
ENERTECH
ENERGY + TECHNOLOGY

# Installation & Operations Manual

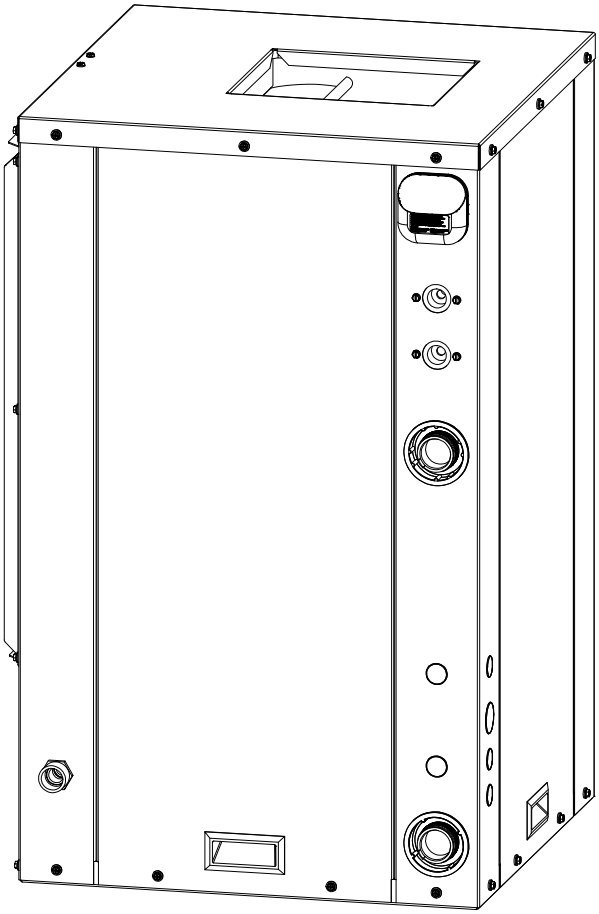
## VS-Single Stage / VT Two-Stage R454B Models
## Packaged Water-to-Air Multi-Positional Heat Pumps

**VT Model**
***without*** **EPIC Connected Controls**



**VT Model**
**EPIC Connected Controls**

epic™



20D454-06NN

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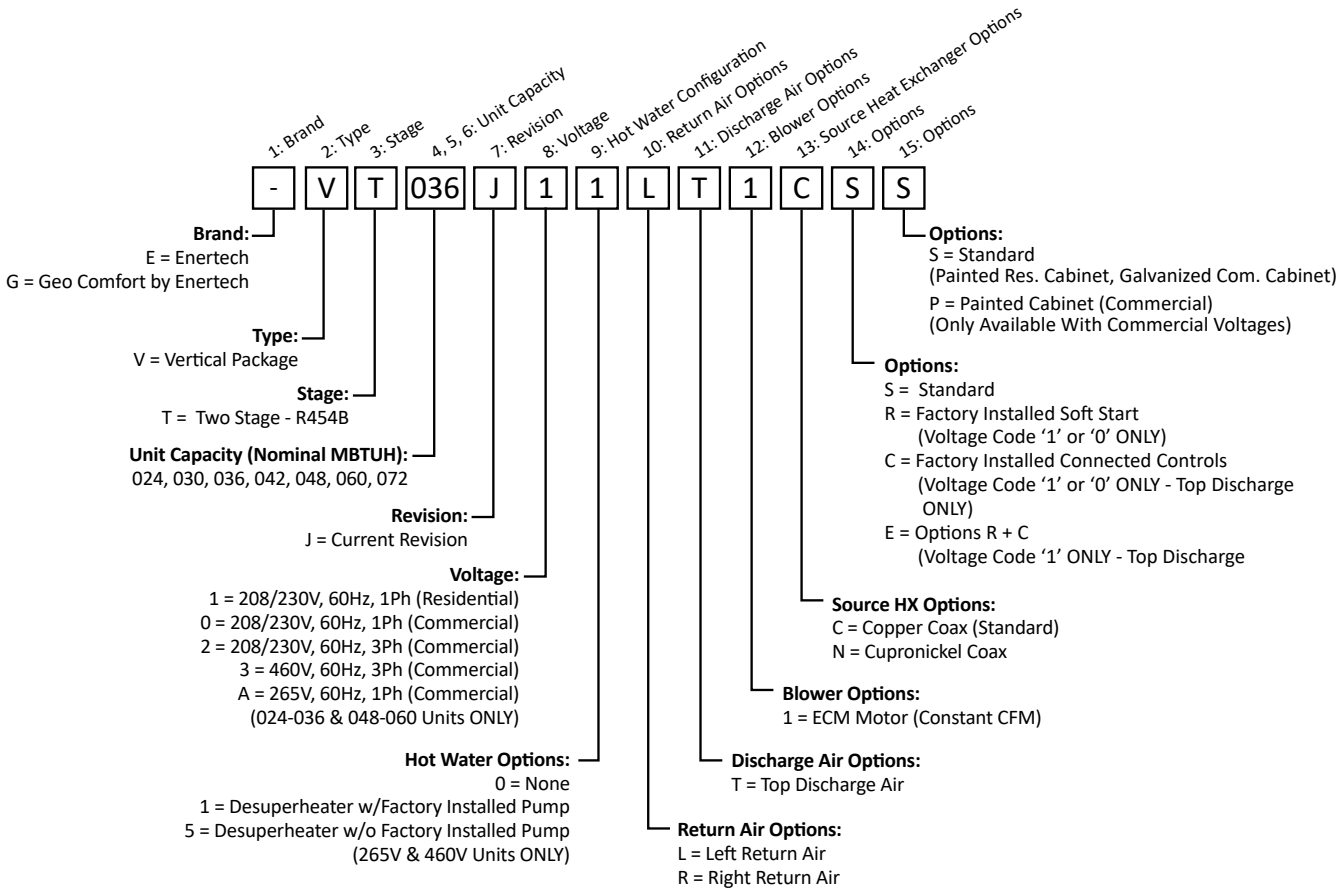
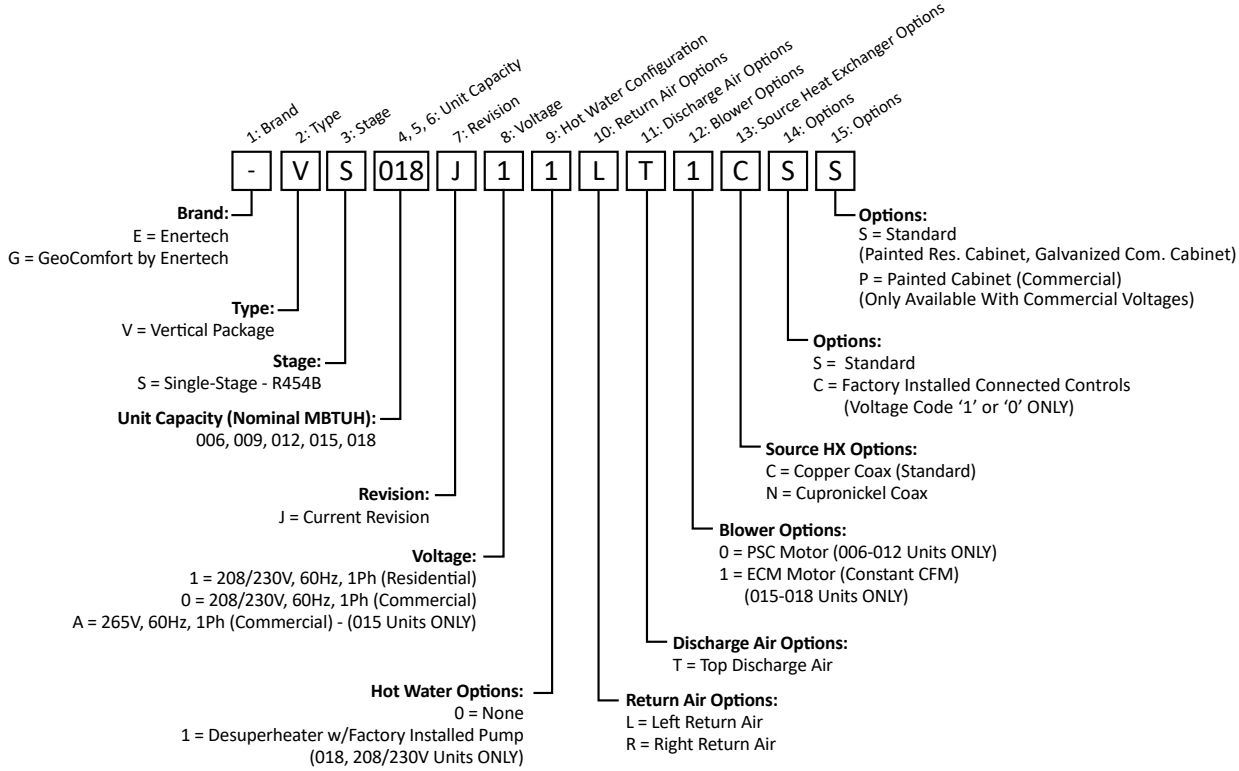
## Section 1: Model Nomenclature

### Nomenclature Decoder



## Section 2: Introduction & Operational Considerations

### Introduction

Engineering and quality control is built into every geothermal unit. Good performance depends on proper application and correct installation.

This geothermal heat pump provides heated and cooled air as well as optional domestic water heating.

**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.

**Introduction Notes:**
Installation above 2000 meters will cause degradation of capacity and efficiency. Declared maximum altitude is 3500 meters.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure they do not play with the appliance.

Units rated at 208/230V are factory wired to 230V. To change to 208V, the red transformer wire (capped from factory) will need to be connected to the contactor at the connection point of the current orange wire. The orange wire will need to be capped off. Refer to wire diagrams for details.

### Inspection

Upon receipt of any geothermal equipment, carefully check the shipment against the packing slip and the freight company bill of lading. Verify all units and packages have been received. Inspect the packaging of each package and each unit for damages. Ensure 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 5 days. If not filed within 5 days the freight company can deny all claims.

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

**⚠ CAUTION ⚠**
**DO NOT PIERCE OR BURN.**
**BEFORE DRILLING OR DRIVING ANY SCREWS INTO CABINET, CHECK TO BE SURE THE SCREW WILL NOT HIT ANY INTERNAL PARTS OR REFRIGERANT LINES.**

**⚠ MISE EN GARDE ⚠**
**NE PAS PERCER NI BRÛLER.**
**AVANT DE PERCER OU DE VISSER À TRAVERS L'ARMOIRE, S'ASSURER QUE LA VIS N'ENTRERA EN CONTACT AVEC AUCUNE PIÈCE INTERNE NI AUCUNE CONDUITE DE FLUIDE FRIGORIGÈNE.**

**⚠ CAUTION ⚠**
**DO NOT OPERATE THE GEOTHERMAL HEAT PUMP UNIT DURING BUILDING CONSTRUCTION PHASE**

**⚠ MISE EN GARDE ⚠**
**NE PAS FAIRE FONCTIONNER LA THERMOPOMPE GÉOTHERMIQUE PENDANT LA PHASE DE CONSTRUCTION DU BÂTIMENT**

**⚠ WARNING ⚠**
**DO NOT USE MEANS TO ACCELERATE THE DEFROSTING PROCESS OR TO CLEAN, OTHER THAN THOSE RECOMMENDED BY THE MANUFACTURER.**

**THE APPLIANCE SHALL BE STORED IN A ROOM WITHOUT CONTINUOUSLY OPERATING IGNITION SOURCES. (FOR EXAMPLE: OPEN FLAMES, AN OPERATING GAS APPLIANCE OR AND OPERATING ELECTRIC HEATER)**

**BE AWARE THAT REFRIGERANTS MAY NOT CONTAIN AN ODOR.**

**⚠ AVERTISSEMENT ⚠**
**NE PAS RECOURIR À D'AUTRES MOYENS POUR ACCÉLÉRER LE PROCESSUS DE DÉGIVRAGE OU LE NETTOYAGE, À L'EXCEPTION DE**

**CEUX RECOMMANDÉES PAR LE FABRICANT.**
**ENTREPOSER L'APPAREIL DANS UNE PIÈCE OÙ IL N'Y A AUCUNE SOURCE D'INFLAMMATION**
**EN FONCTIONNEMENT CONTINU. (PAR EXEMPLE : FLAMMES NUES, APPAREIL À GAZ EN FONCTIONNEMENT OU APPAREIL DE CHAUFFAGE ÉLECTRIQUE EN FONCTIONNEMENT)**

**À NOTER QUE LES FRIGORIGÈNES PEUVENT NE PAS AVOIR D'ODEUR.**

### 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 damage the finished surface of the unit. Keep all cardboard or other packaging material for safe storage and transport to the job site prior to installation.

Remove the front service panel to locate technical documents (manuals, bulletins or instructions) and accessory items (HWG piping kits, and strainers.

### 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 the unit warranty being void due to misuse or mishandling.

### 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.

## Section 2: Introduction & Operational Considerations

### Pre-Installation Steps

Before you fully install the geothermal equipment, it is recommended you do the following:

1. Fully inspect the unit after unpacking
2. Compare the electrical data on the unit nameplate with packing slip and ordering information to verify the correct unit has been shipped.
3. 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.
4. Remove any packaging used to support or hold the blower during shipping. Remove and discard the blower support bracket (if equipped) and motor armature shaft shipping bracket from the rear of the blower.
5. Remove and discard the air coil protective shipping cover (if equipped).
6. Verify all refrigerant tubing is free of dents and kinks. Refrigerant tubing should not be touching other unit components.
7. Before unit start-up, read all manuals and become familiar with unit components and operation. Thoroughly check the unit before operating.
8. Locate the Unit Start-Up Form from this manual and have it available as the unit installation proceeds.
9. Determine discharge and return air patterns prior to unit assembly and installation

### Equipment Installation

All units should be located in an indoor area were the ambient temperature will remain above 55°F and should be located in a way that piping and ductwork or other permanently installed fixtures do not have to be removed for servicing and filter replacement. For appliances containing more than 62.4oz of mildly flammable refrigerant and installed in an unventilated area, the room area shall be sufficiently constructed or modified to not allow any refrigerant leak to stagnate and create a fire or explosion hazard.

### Unit Placement

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

- 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.
- Unit Air Pad. All vertical geothermal heating and cooling equipment should be placed on either a formed plastic, dense rubber or a high density, closed cell polyethylene pad. This helps eliminate vibration noise from transmitting through the floor. The use of corner pads alone is not recommended.
- Determine left or right side return air pattern prior to unit assembly and installation.
- The installer must verify that all applicable wiring, piping, and accessories are correct and on the job site.

### Electrical

All wiring, line and low voltage, should comply with the manufacturer's recommendations, The National Electrical Code, and all local codes and ordinances. The equipment main disconnect must be incorporated in the field wiring in accordance with NEC code.

### Thermostat

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

### Loop Pumping Modules

Must be wired to the heat pump's electric control box. A pump module connection block (connected to the master contactor) and circuit breaker is provided to connect the pump module wiring.

### Desuperheater

The desuperheater package can make up to 60% (depending on heat pump usage) of most domestic water needs, but a water heater is still recommended. The maximum inlet water pressure for the desuperheater circuit is 145 psi/1000kpa.

### Desuperheater Piping

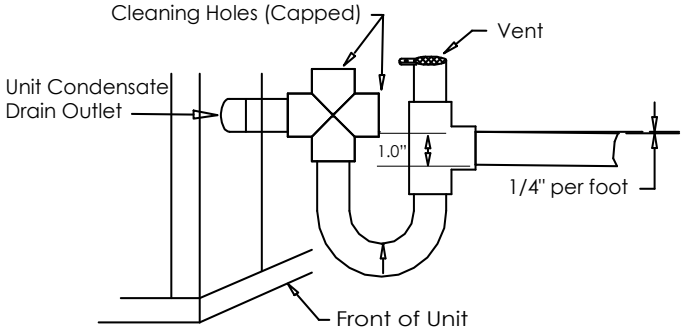
All copper tubes & fittings should be 5/8" O.D (1/2" nom) minimum with a maximum of 50 ft. separation. Piping should be insulated with 3/8" wall closed cell insulation.

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

### Condensation Drain Connection

Connect the EZ-Trap to the 3/4" equipment condensate drain connection as shown below. 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.

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




**⚠ CAUTION ⚠**

**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.**

**⚠ MISE EN GARDE ⚠**

**L'ÉQUIPEMENT GÉOTHERMIQUE EST CONÇU POUR UNE INSTALLATION À L'INTÉRIEUR SEULEMENT. NE PAS INSTALLER OU ENTREPOSER L'APPAREIL DANS UN ENVIRONNEMENT CORROSIF OU DANS UN ENDROIT OÙ IL SERAIT EXPOSÉ À UNE TEMPÉRATURE ET UNE HUMIDITÉ EXTRÊMES. L'ÉQUIPEMENT N'EST PAS CERTIFIÉ POUR UNE INSTALLATION À L'EXTÉRIEUR. UNE TELLE INSTALLATION ANNULERA TOUTES LES GARANTIES.**

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

## Components

**Master Contactor:** Energizes compressor and optional hydronic pump and/or desuperheater pump 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).

**Thermostat Connection Board:** Provides connection to the thermostat or other accessories to the low voltage circuit.

**Transformer:** Converts incoming (source) voltage to 24VAC.

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

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

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

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

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

**Blower Motor (ECM & PSC):** ECM (Electronically Commutated Motor) for variable fan speeds. PSC (Permanent Split Capacitor) for constant fan speed.

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

**Note:** The use of a UV light in the unit return air plenum should not allow the light to 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 (such as pad or housing).

**Note:** If installing a 24V electronic air cleaner supplied by Enertech as an accessory, the air cleaner must get the 24V supply from R and C on the geothermal unit's thermostat terminal strip. In the event there is a leak or airflow falls too low, R and C will be de-energized.

## Ductwork

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 models do not have more than 2% air leakage

**⚠ WARNING ⚠**

**AUXILIARY DEVICES WHICH MAY BE A POTENTIAL IGNITION SOURCE SHALL NOT BE INSTALLED IN THE DUCT WORK. EXAMPLES OF SUCH POTENTIAL IGNITION SOURCES ARE HOT SURFACES WITH A TEMPERATURE EXCEEDING 744F(396C) AND ELECTRIC SWITCHING DEVICES.**

**⚠ AVERTISSEMENT ⚠**

**LES DISPOSITIFS AUXILIAIRES POUVANT ÊTRE UNE SOURCE D'INFLAMMATION POTENTIELLE NE DOIVENT PAS ÊTRE INSTALLÉS DANS LES GAINES. DES EXEMPLES DE TELLES SOURCES D'INFLAMMATION POTENTIELLES NE DOIVENT PAS ÊTRE INSTALLÉS DANS LES GAINES. LES SURFACES CHAUDES DONT LA TEMPÉRATURE EST SUPÉRIEURE À 396 °C (744 °F) ET LES DISPOSITIFS DE COMMUTATION ÉLECTRIQUE EN SONT DES EXEMPLES.**

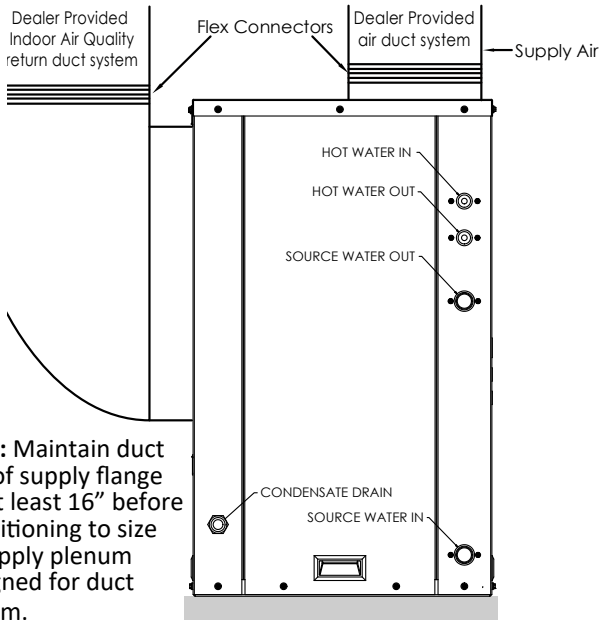
All supply/return plenums should be isolated from the unit by a flexible connector (canvas) or equivalent to prevent transfer of vibration noise to the ductwork. The flex connector should be designed so as not to restrict airflow. Turning vanes should be used on any transition with airflow over 500 CFM. **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 ducts 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.

### Typical Supply and Return Ductwork Connections:




**Note:** Maintain duct size of supply flange for at least 16" before transitioning to size of supply plenum designed for duct system.

**⚠ WARNING ⚠**

**ONLY AUXILIARY DEVICES APPROVED BY ENERTECH GLOBAL SHALL BE INSTALLED IN CONNECTING DUCTWORK. REFER TO "SECTION 4" FOR APPROVED AUXILIARY HEATING KITS.**

**⚠ AVERTISSEMENT ⚠**

**SEULS LES DISPOSITIFS AUXILIAIRES APPROUVÉS PAR ENERTECH GLOBAL PEUVENT ÊTRE INSTALLÉS DANS LES SYSTÈMES DE GAINES CONNECTÉS. CONSULTER LA SECTION 4 POUR LES ENSEMBLES DE CHAUFFAGE AUXILIAIRE APPROUVÉS.**

**⚠ WARNING ⚠**

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

**⚠ AVERTISSEMENT ⚠**

**LE NON-RESPECT DE CETTE MISE EN GARDE PEUT ENTRAÎNER DES BLESSURES. FAIRE PREUVE DE PRUDENCE ET PORTER DES VÊTEMENTS DE PROTECTION, DES LUNETTES DE SÉCURITÉ ET DES GANTS DE PROTECTION APPROPRIÉS LORS DE L'ENTRETIEN DE L'APPAREIL ET DE LA MANIPULATION DES PIÈCES.**

### 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 |

**⚠ NOTICE ⚠**

**PRIOR TO OPERATING THE UNIT, REMOVE AND DISCARD THE BLOWER MOTOR ARMATURE SUPPORT BRACKET LOCATED ON THE BACK OF THE BLOWER. IF APPLICABLE, REMOVE AND DISCARD THE BLOWER SHIPPING BRACKET LOCATED ON THE BOTTOM OR SIDE OF THE BLOWER HOUSING. FAILURE TO REMOVE THESES BRACKETS COULD RESULT IN NOISY OPERATION AND EQUIPMENT DAMAGE.**

### Consumer Instructions

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

### Enertech Global D-I-Y Policy

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

Due to 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.

## Section 3: Unit Data

### Unit Physical Data

| VS Vertical Packaged Unit | | | | | |
|---|---|---|---|---|---|
| **Model Number** | **006** | **009** | **012** | **015** | **018** |
| Compressor Type | Single Stage Rotary | | | | Single Stage Scroll |
| Fan Wheel (in.) | 6 x 8 | | | 9 x 7 | |
| Fan Motor PSC (HP) | 1/16 | | | N/A | |
| Fan Motor ECM (HP) | N/A | | | 1/2 | |
| *Refrigerant Charge (oz.) | 27 | 27 | 27 | 36 | 38 |
| **Air Coil** | | | | | |
| Face Area (Sq. Ft.) | 2.02 | | | 3.49 | |
| Dimensions (in.) | 15.5 x 18.8 x 1 | | | 25.4 x 19.8 x 1 | |
| Number of Rows | N/A Micro-Channel Coil | | | | |
| Shipped Unit Weight (Nominal) lbs. | 187 | | | 234 | 240 |

*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.) | 38 | 45 | 47 | 62 | 58 | 62 | 56 |
| **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 3: Unit Data

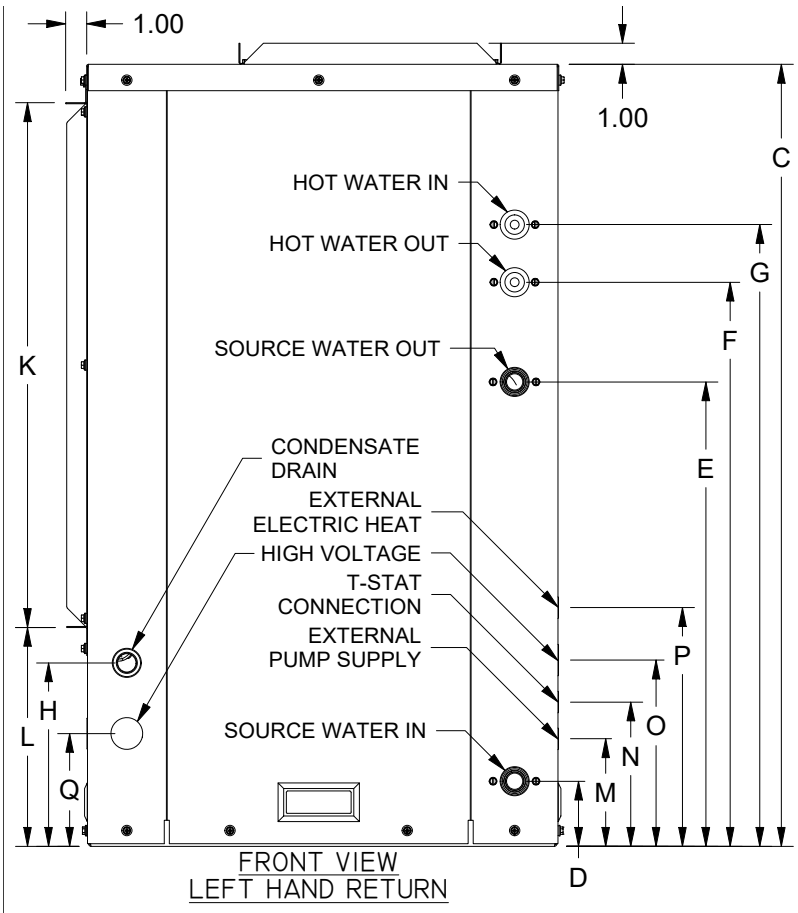
### Unit AHRI Performance Data

| Model (VS) | Type | Cooling with PSC Blower | | Heating with PSC Blower | | Cooling with ECM Blower | | Heating with ECM Blower | |
|---|---|---|---|---|---|---|---|---|---|
| | | BTU | EER | BTU | COP | BTU | EER | BTU | COP |
| VS006 | Water Loop | 6,800 | 16.0 | 8,400 | 5.5 | – | – | – | – |
| | Ground Water | 7,625 | 25.9 | 6,500 | 4.4 | – | – | – | – |
| | Ground Loop | 7,025 | 18.6 | 4,950 | 3.4 | – | – | – | – |
| VS009 | Water Loop | 10,200 | 16.3 | 12,425 | 5.2 | – | – | – | – |
| | Ground Water | 11,900 | 24.2 | 10,150 | 4.4 | – | – | – | – |
| | Ground Loop | 10,900 | 18.8 | 7,975 | 3.5 | – | – | – | – |
| VS012 | Water Loop | 12,150 | 15.7 | 14,575 | 5.0 | – | – | – | – |
| | Ground Water | 13,400 | 24.1 | 12,100 | 4.3 | – | – | – | – |
| | Ground Loop | 12,625 | 18.2 | 9,475 | 3.6 | – | – | – | – |
| VS015 | Water Loop | – | – | – | – | 15,775 | 19.9 | 17,700 | 6.4 |
| | Ground Water | – | – | – | – | 18,150 | 35.1 | 14,400 | 5.4 |
| | Ground Loop | – | – | – | – | 16,725 | 24.1 | 11,500 | 4.3 |
| VS018 | Water Loop | – | – | – | – | 21,300 | 20.5 | 23,700 | 6.3 |
| | Ground Water | – | – | – | – | 24,025 | 33.6 | 19,600 | 5.3 |
| | Ground Loop | – | – | – | – | 22,275 | 24.1 | 15,400 | 4.2 |

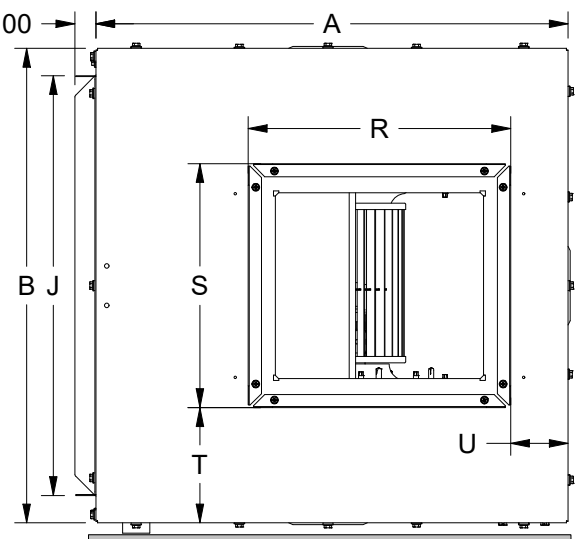
| Model (VT) | Type | Cooling BTU | | | | Heating BTU | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Full Load | EER | Part Load | EER | Full Load | COP | Part Load | COP |
| VT024 | Water Loop | 24,650 | 17.5 | 18,150 | 19.8 | 29,100 | 5.6 | 21,100 | 6.5 |
| | Ground Water | 27,825 | 27.3 | 20,875 | 37.0 | 23,900 | 4.9 | 16,800 | 5.3 |
| | Ground Loop | 25,775 | 20.5 | 19,925 | 30.1 | 19,400 | 4.0 | 14,800 | 4.6 |
| VT030 | Water Loop | 31,750 | 16.9 | 23,175 | 18.9 | 37,150 | 5.2 | 27,600 | 5.7 |
| | Ground Water | 35,000 | 25.8 | 26,500 | 33.4 | 30,300 | 4.7 | 22,100 | 4.8 |
| | Ground Loop | 32,900 | 19.8 | 25,500 | 27.7 | 24,425 | 3.9 | 20,000 | 4.2 |
| VT036 | Water Loop | 36,975 | 16.3 | 27,250 | 17.9 | 45,500 | 5.3 | 32,375 | 5.4 |
| | Ground Water | 41,050 | 24.3 | 30,725 | 30.9 | 36,900 | 4.7 | 26,075 | 4.7 |
| | Ground Loop | 38,450 | 18.8 | 29,675 | 25.9 | 29,500 | 3.9 | 23,00 | 4.2 |
| VT042 | Water Loop | 44,000 | 16.8 | 32,000 | 18.5 | 51,725 | 5.5 | 38,625 | 6.1 |
| | Ground Water | 49,200 | 25.3 | 36,500 | 33.2 | 41,900 | 4.8 | 31,000 | 5.1 |
| | Ground Loop | 45,900 | 19.4 | 35,025 | 27.4 | 32,975 | 4.1 | 27,600 | 4.6 |
| VT048 | Water Loop | 49,300 | 16.2 | 34,000 | 17.9 | 58,400 | 5.3 | 42,100 | 6.0 |
| | Ground Water | 53,600 | 24.5 | 39,100 | 32.6 | 48,500 | 4.9 | 32,500 | 4.9 |
| | Ground Loop | 50,300 | 18.8 | 37,400 | 26.6 | 38,500 | 4.0 | 28,850 | 4.3 |
| VT060 | Water Loop | 58,600 | 15.4 | 42,200 | 16.6 | 71,700 | 5.1 | 52,000 | 5.8 |
| | Ground Water | 64,200 | 22.0 | 48,300 | 27.1 | 58,550 | 4.4 | 41,570 | 4.7 |
| | Ground Loop | 60,900 | 17.6 | 46,600 | 23.6 | 46,700 | 3.8 | 37,000 | 4.2 |
| VT072 | Water Loop | 66,200 | 13.9 | 50,600 | 15.2 | 80,025 | 4.8 | 61,000 | 5.4 |
| | Ground Water | 72,800 | 19.8 | 56,900 | 25.5 | 64,575 | 4.2 | 49,600 | 4.5 |
| | Ground Loop | 68,900 | 15.9 | 55,300 | 21.5 | 52,100 | 3.59 | 44,000 | 4.0 |

Rated in accordance with ISO Standard 13256-1 which includes Pump Penalties.
Heating capacities based on 68.0°F DB, 59.0°F WB entering air temperature.
Cooling capacities based on 80.6°F DB, 66.2°F WB entering air temperature.
GLHP - Entering water temperatures Full Load: 32°F heating / 77°F cooling.
GLHP - Entering water temperatures Part Load: 41°F heating / 68°F cooling.
GWHP - Entering water temperatures: 50°F heating / 59°F cooling.

## Unit Dimensional Data

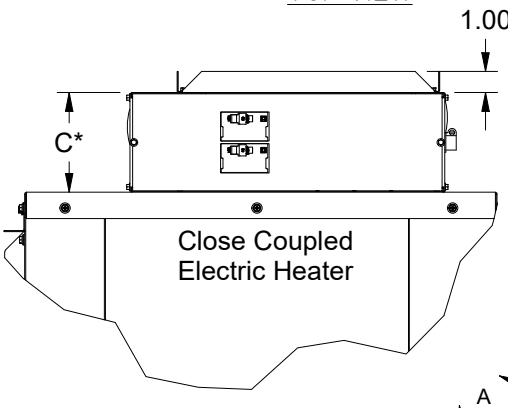



FRONT VIEW
LEFT HAND RETURN




Enertech Recommends A Minimum of 2 to 2 1/2 Feet of Service Area Clearance For Installation And Maintenance.

TOP VIEW

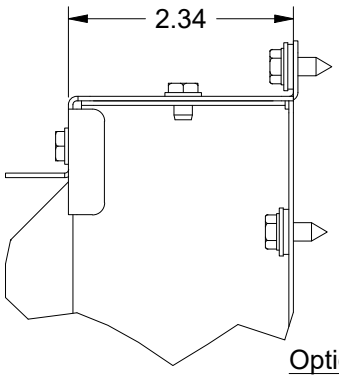



Close Coupled Electric Heater

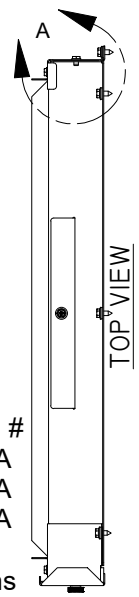
**DIMENSIONAL DATA TABLE**

| MODEL SIZE | | 006 - 012 | 015 - 041 | | | 042 - 072 | |
|---|---|---|---|---|---|---|---|
| | | | * | ** | *** | * | ** |
| OVERALL CABINET | A | 21.50 | 22.50 | 22.50 | 22.50 | 25.00 | 25.00 |
| | B | 21.50 | 22.50 | 22.50 | 22.50 | 27.88 | 27.88 |
| Note: Add C* to C For Units With Close Coupled Heater | C | 30.00 | 37.25 | 37.25 | 37.25 | 41.00 | 41.00 |
| | C* | N/A | 4.75 | 4.75 | 4.75 | 6.50 | 6.50 |
| WATER CONNECTIONS | D | 3.10 | 3.10 | 13.34 | 3.10 | 3.10 | 12.75 |
| | E | 14.125 | 22.10 | 22.10 | 22.10 | 16.63 | 16.63 |
| | F | N/A | 26.88 | 26.88 | 26.88 | 24.13 | 24.13 |
| | G | N/A | 29.63 | 29.63 | 29.63 | 26.88 | 26.88 |
| | H | 5.375 | 8.75 | 8.75 | 5.38 | 5.38 | 5.38 |
| RETURN AIR DIMENSIONS | J | 19.50 | 20.00 | 20.00 | 20.00 | 23.00 | 23.00 |
| | K | 15.50 | 25.00 | 25.00 | 25.00 | 29.00 | 29.00 |
| | L | 12.67 | 10.43 | 10.43 | 10.43 | 10.17 | 10.17 |
| ELECTRICAL KNOCKOUTS | M | 5.625 | 5.13 | 5.13 | 5.13 | 5.13 | 5.13 |
| | N | 7.375 | 6.88 | 6.88 | 6.88 | 6.88 | 6.88 |
| | O | 9.375 | 8.88 | 8.88 | 8.88 | 8.88 | 8.88 |
| | P | 11.875 | 11.38 | 11.38 | 11.38 | 11.38 | 11.38 |
| | Q | 8.375 | 5.38 | 5.38 | N/A | N/A | N/A |
| SUPPLY AIR DIMENSIONS | R | 12.50 | 12.50 | 12.50 | 12.50 | 15.98 | 15.98 |
| | S | 11.625 | 11.63 | 11.63 | 11.63 | 15.98 | 15.98 |
| Note: Dimensions Are The Same For Units With Close Coupled Heater | T | 4.94 | 5.39 | 5.39 | 5.39 | 5.95 | 5.95 |
| | U | 1.93 | 2.88 | 2.88 | 2.88 | 1.12 | 1.12 |

NOTE:
* UNITS WITHOUT INTERNAL LOOP PUMP
** UNITS WITH INTERNAL LOOP PUMP
*** UNITS WITH COMPOSITE DRAIN PAN




DETAIL A




Optional Filter Rack

| Tonnage | Order Item # |
|---|---|
| 006-012 | AFR1721A |
| 015-036 | AFR2226A |
| 042-072 | AFR2430A |

Note:
The Return Duct Dimensions are the same for the Unit and the Filter Rack.
The Deluxe Filter Rack causes the Return Duct to be offset from the Unit by 2.34 inches.
See Detail A

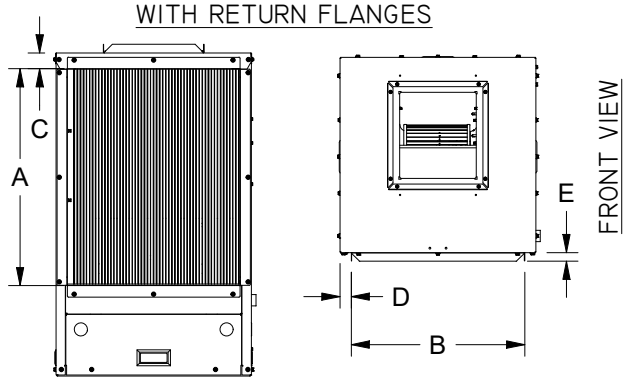
Notes:
Right hand return dimensions are mirrored to the opposite side as the left hand return dimensions.
Commercial units 006-015 Tons have 3/4" FPT source water connections.
Commercial units 018-072 Tons have 1" FPT source water connections
Residential units have 1" Double O-Ring source water connections.
All Desuperheater connections are 3/4" FPT.
All electrical knockouts are sized for 1/2" or 3/4" conduit.
All measurements are in inches.
All drawings are typical, individual models will vary.

## Section 3: Unit Data

### Unit Dimensional Data

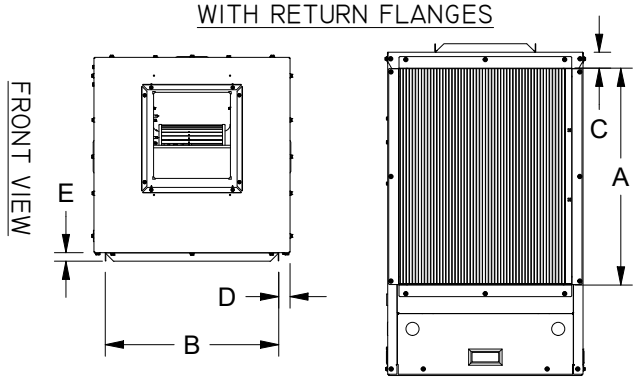
LEFT HAND RETURN MODELS

WITH RETURN FLANGES

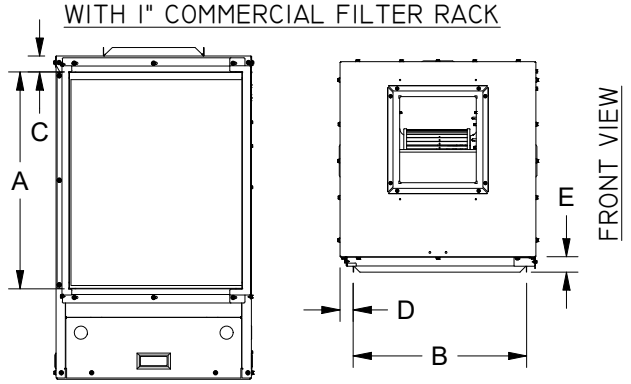



RIGHT HAND RETURN MODELS

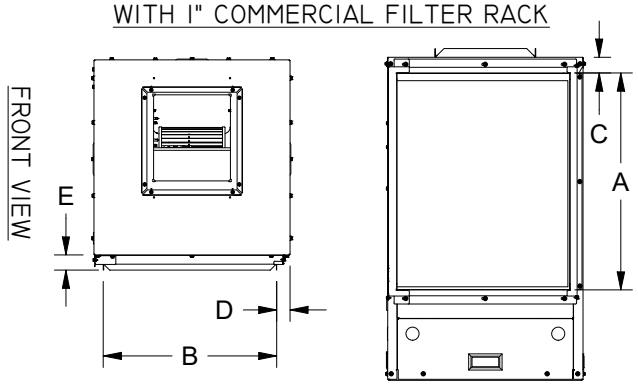
WITH RETURN FLANGES



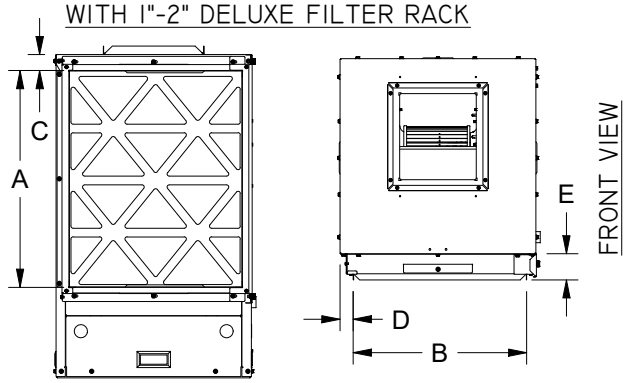

WITH 1" COMMERCIAL FILTER RACK



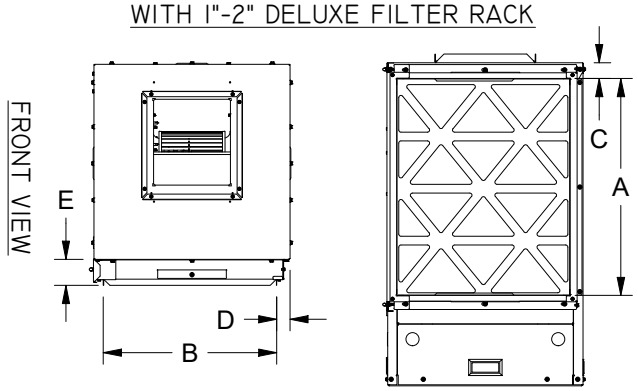

WITH 1" COMMERCIAL FILTER RACK




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 |
| 015-036 | 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 | 1.83 |
| | 1" COMMERCIAL RACK | 29.00 | 23.00 | 1.83 | 3.25 | 1.83 |
| | 1" - 2" DELUXE RACK | 29.00 | 23.00 | 1.83 | 3.25 | 1.83 |

## Unit Electrical Data: PSC, VS006-012

| 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 | 19.6/ 17.7 | 2.7/ 2.4 | 0.9/ 0.8 | 0.0 | 0.0 | 3.6/ 3.2 | 4.3/ 3.8 | 15/ 15 |
| | 10 | 208/230 | 1 | 19.6/ 17.7 | 2.7/ 2.4 | 0.9/ 0.8 | 0.0 | 4.4/ 4.0 | 8.0/ 7.2 | 8.7/ 7.8 | 15/ 15 |
| | A0 | 265 | 1 | 13.5 | 2.0 | 0.7 | 0.0 | 0.0 | 2.7 | 3.2 | 15 |
| | 90 | 115 | 1 | 36.2 | 4.6 | 1.5 | 0.0 | 0.0 | 6.1 | 7.3 | 15 |
| VS009 | 00 | 208/230 | 1 | 24.3/ 22.0 | 4.4/ 4.0 | 0.9/ 0.8 | 0.0 | 0.0 | 5.3/ 4.8 | 6.4/ 5.8 | 15/ 15 |
| | 10 | 208/230 | 1 | 24.3/ 22.0 | 4.4/ 4.0 | 0.9/ 0.8 | 0.0 | 4.4/ 4.0 | 9.7/ 8.8 | 10.8/ 9.8 | 15/ 15 |
| | A0 | 265 | 1 | 23.0 | 4.0 | 0.7 | 0.0 | 0.0 | 4.7 | 5.7 | 15 |
| | 90 | 115 | 1 | 50.0 | 8.0 | 1.5 | 0.0 | 0.0 | 9.5 | 11.5 | 20 |
| VS012 | 00 | 208/230 | 1 | 27.6/ 25.0 | 5.1/ 4.6 | 0.9/ 0.8 | 0.0 | 0.0 | 6.0/ 5.4 | 7.3/ 6.6 | 15/ 15 |
| | 10 | 208/230 | 1 | 27.6/ 25.0 | 5.1/ 4.6 | 0.9/ 0.8 | 0.0 | 4.4/ 4.0 | 10.4/ 9.4 | 11.7/ 10.6 | 15/ 15 |
| | A | 265 | 1 | 21.0 | 3.9 | 0.7 | 0.0 | 0.0 | 4.6 | 5.6 | 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, 265/60 = 249-291, 115 = 102-127
4. Units rated at 208/230V are factory wired for 230V. To change to 208V, the red transformer wire (with wire nut) will need to be hooked to the contactor in the position the current orange (230V) wire is. The orange wire will need to be capped off. Refer to wire diagram for details.

*The external loop pump FLA is based on a maximum of two UP26-116F-230V (1/2hp) for 006-012.

## Unit Electrical Data: ECM, VS015-018

| 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 | 28.8/ 26.0 | 5.8/ 5.2 | 3.9/ 3.8 | 0.0 | 0.0 | 9.7/ 9.0 | 11.2/ 10.3 | 15/ 15 |
| | 10 | 208/230 | 1 | 28.8/ 26.0 | 5.8/ 5.2 | 3.9/ 3.8 | 0.0 | 4.4/ 4.0 | 14.1/ 13.0 | 15.6/ 14.3 | 20/ 20 |
| | A | 265 | 1 | 21.0 | 4.7 | 3.3 | 0.0 | 0.0 | 8.0 | 9.2 | 15 |
| VS018 | 00 | 208/230 | 1 | 49.9/ 45.1 | 9.2/ 8.3 | 3.9/ 3.8 | 0.0 | 0.0 | 13.1/ 12.1 | 15.4/ 14.2 | 25/ 20 |
| | 01 | 208/230 | 1 | 49.9/ 45.1 | 9.2/ 8.3 | 3.9/ 3.8 | 0.6/ 0.5 | 0.0 | 13.7/ 12.6 | 16.0/ 14.7 | 25/ 20 |
| | 10 | 208/230 | 1 | 49.9/ 45.1 | 9.2/ 8.3 | 3.9/ 3.8 | 0.0 | 4.4/ 4.0 | 17.5/ 16.1 | 19.8/ 18.2 | 25/ 25 |
| | 11 | 208/230 | 1 | 49.9/ 45.1 | 9.2/ 8.3 | 3.9/ 3.8 | 0.6/ 0.5 | 4.4/ 4.0 | 18.1/ 16.6 | 20.4/ 18.7 | 30/ 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, 265/60 = 249-291
4. Units rated at 208/230V are factory wired for 230V. To change to 208V, the red transformer wire (with wire nut) will need to be hooked to the contactor in the position the current orange (230V) wire is. The orange wire will need to be capped off. Refer to wire diagram for details.

*The external loop pump FLA is based on a maximum of two UP26-116F-230V (1/2hp) for 015-018.

## Section 3: Unit Data

### Unit Electrical Data: ECM, VT024-072

*20D237-41NN: VT Electrical Data*

| Model | Voltage Code/ HWG Option | 60 Hz Power | | Compressor | | Fan Motor FLA | HWG Pump FLA | Ext. Loop Pump FLA | Total Unit FLA | Min Circuit AMPS | Max Brkr HACR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Volts | Phase | LRA | RLA | | | | | | |
| VT024 | 00 | 208/230 | 1 | 68.6/ 62.0 | 11.4/ 10.3 | 3.9/ 3.8 | 0.0 | 0.0 | 15.3/ 14.1 | 18.2/ 16.7 | 30/ 25 |
| | 01 | 208/230 | 1 | 68.6/ 62.0 | 11.4/ 10.3 | 3.9/ 3.8 | 0.6/ 0.5 | 0.0 | 15.9/ 14.6 | 18.8/ 17.2 | 30/ 25 |
| | 10 | 208/230 | 1 | 68.6/ 62.0 | 11.4/ 10.3 | 3.9/ 3.8 | 0.0 | 4.4/ 4.0 | 19.7/ 18.1 | 22.6/ 20.7 | 30/ 30 |
| | 11 | 208/230 | 1 | 68.6/ 62.0 | 11.4/ 10.3 | 3.9/ 3.8 | 0.6/ 0.5 | 4.4/ 4.0 | 20.3/ 18.6 | 23.2/ 21.2 | 35/ 30 |
| | 20 | 208/230 | 3 | 61.9/ 56.0 | 7.0/ 6.3 | 3.9/ 3.8 | 0.0 | 0.0 | 10.9/ 10.1 | 12.7/ 11.7 | 20/ 15 |
| | 21 | 208/230 | 3 | 61.9/ 56.0 | 7.0/ 6.3 | 3.9/ 3.8 | 0.6/ 0.5 | 0.0 | 11.5/ 10.6 | 13.3/ 12.2 | 20/ 15 |
| | 30/35 | 460 | 3 | 29.0 | 3.8 | 3.3 | 0.0 | 0.0 | 7.1 | 8.1 | 15 |
| | A | 265 | 1 | 52.0 | 7.8 | 3.3 | 0.0 | 0.0 | 11.1 | 13.1 | 20 |
| VT030 | 00 | 208/230 | 1 | 90.7/ 82.0 | 16.1/ 14.6 | 3.9/ 3.8 | 0.0 | 0.0 | 20.0/ 18.4 | 24.0/ 22.1 | 40/ 35 |
| | 01 | 208/230 | 1 | 90.7/ 82.0 | 16.1/ 14.6 | 3.9/ 3.8 | 0.6/ 0.5 | 0.0 | 20.6/ 18.9 | 24.6/ 22.6 | 40/ 35 |
| | 10 | 208/230 | 1 | 90.7/ 82.0 | 16.1/ 14.6 | 3.9/ 3.8 | 0.0 | 4.4/ 4.0 | 24.4/ 22.4 | 28.4/ 26.1 | 45/ 40 |
| | 11 | 208/230 | 1 | 90.7/ 82.0 | 16.1/ 14.6 | 3.9/ 3.8 | 0.6/ 0.5 | 4.4/ 4.0 | 25.0/ 22.9 | 29.0/ 26.6 | 45/ 40 |
| | 20 | 208/230 | 3 | 73.0/ 66.0 | 8.7/ 7.9 | 3.9/ 3.8 | 0.0 | 0.0 | 12.6/ 11.7 | 14.8/ 13.7 | 20/ 20 |
| | 21 | 208/230 | 3 | 73.0/ 66.0 | 8.7/ 7.9 | 3.9/ 3.8 | 0.6/ 0.5 | 0.0 | 13.2/ 12.2 | 15.4/ 14.2 | 20/ 20 |
| | 30/35 | 460 | 3 | 39.0 | 4.8 | 3.3 | 0.0 | 0.0 | 8.1 | 9.3 | 15 |
| | A | 265 | 1 | 72.0 | 8.3 | 3.3 | 0.0 | 0.0 | 11.6 | 13.7 | 20 |
| VT036 | 00 | 208/230 | 1 | 99.5/ 90.0 | 16.1/ 14.6 | 5.9/ 5.5 | 0.0 | 0.0 | 22.0/ 20.1 | 26.0/ 23.8 | 40/ 35 |
| | 01 | 208/230 | 1 | 99.5/ 90.0 | 16.1/ 14.6 | 5.9/ 5.5 | 0.6/ 0.5 | 0.0 | 22.6/ 20.6 | 26.6/ 24.3 | 40/ 35 |
| | 10 | 208/230 | 1 | 99.5/ 90.0 | 16.1/ 14.6 | 5.9/ 5.5 | 0.0 | 4.4/ 4.0 | 26.4/ 24.1 | 30.4/ 27.8 | 45/ 40 |
| | 11 | 208/230 | 1 | 99.5/ 90.0 | 16.1/ 14.6 | 5.9/ 5.5 | 0.6/ 0.5 | 4.4/ 4.0 | 27.0/ 24.6 | 31.0/ 28.3 | 45/ 40 |
| | 20 | 208/230 | 3 | 90.7/ 82.0 | 10.9/ 9.9 | 5.9/ 5.5 | 0.0 | 0.0 | 16.8/ 15.4 | 19.5/ 17.9 | 30/ 25 |
| | 21 | 208/230 | 3 | 90.7/ 82.0 | 10.9/ 9.9 | 5.9/ 5.5 | 0.6/ 0.5 | 0.0 | 17.4/ 15.9 | 20.1/ 18.4 | 30/ 25 |
| | 30/35 | 460 | 3 | 44.3 | 4.8 | 4.8 | 0.0 | 0.0 | 9.6 | 10.8 | 15 |
| | A | 265 | 1 | 79.0 | 12.5 | 4.8 | 0.0 | 0.0 | 17.3 | 20.4 | 30 |
| VT042 | 00 | 208/230 | 1 | 117.2/ 106.0 | 20.1/ 18.2 | 5.9/ 5.5 | 0.0 | 0.0 | 26.0/ 23.7 | 31.0/ 28.3 | 50/ 45 |
| | 01 | 208/230 | 1 | 117.2/ 106.0 | 20.1/ 18.2 | 5.9/ 5.5 | 0.6/ 0.5 | 0.0 | 26.6/ 24.2 | 31.6/ 28.8 | 50/ 45 |
| | 10 | 208/230 | 1 | 117.2/ 106.0 | 20.1/ 18.2 | 5.9/ 5.5 | 0.0 | 6.1/ 5.5 | 32.1/ 29.2 | 37.1/ 33.8 | 50/ 50 |
| | 11 | 208/230 | 1 | 117.2/ 106.0 | 20.1/ 18.2 | 5.9/ 5.5 | 0.6/ 0.5 | 6.1/ 5.5 | 32.7/ 29.7 | 37.7/ 34.3 | 50/ 50 |
| | 20 | 208/230 | 3 | 126.1/ 114.0 | 12.7/ 11.5 | 5.9/ 5.5 | 0.0 | 0.0 | 18.6/ 17.0 | 21.8/ 19.9 | 30/ 30 |
| | 21 | 208/230 | 3 | 126.1/ 114.0 | 12.7/ 11.5 | 5.9/ 5.5 | 0.6/ 0.5 | 0.0 | 19.2/ 17.5 | 22.4/ 20.4 | 35/ 30 |
| | 30/35 | 460 | 3 | 56.0 | 6.5 | 4.8 | 0.0 | 0.0 | 11.3 | 12.9 | 15 |
| VT048 | 00 | 208/230 | 1 | 152.6/ 138.0 | 20.2/ 18.3 | 5.9/ 5.5 | 0.0 | 0.0 | 26.1/ 23.8 | 31.2/ 28.4 | 50/ 45 |
| | 01 | 208/230 | 1 | 152.6/ 138.0 | 20.2/ 18.3 | 5.9/ 5.5 | 0.6/ 0.5 | 0.0 | 26.7/ 24.3 | 31.8/ 28.9 | 50/ 45 |
| | 10 | 208/230 | 1 | 152.6/ 138.0 | 20.2/ 18.3 | 5.9/ 5.5 | 0.0 | 6.1/ 5.5 | 32.2/ 29.3 | 37.3/ 33.9 | 50/ 50 |
| | 11 | 208/230 | 1 | 152.6/ 138.0 | 20.2/ 18.3 | 5.9/ 5.5 | 0.6/ 0.5 | 6.1/ 5.5 | 32.8/ 29.8 | 37.9/ 34.4 | 50/ 50 |
| | 20 | 208/230 | 3 | 123.8/ 112.0 | 13.2/ 11.9 | 5.9/ 5.5 | 0.0 | 0.0 | 19.1/ 17.4 | 22.4/ 20.4 | 35/ 30 |
| | 21 | 208/230 | 3 | 123.8/ 112.0 | 13.2/ 11.9 | 5.9/ 5.5 | 0.6/ 0.5 | 0.0 | 19.7/ 17.9 | 23.0/ 20.9 | 35/ 30 |
| | 30/35 | 460 | 3 | 61.8 | 6.8 | 4.8 | 0.0 | 0.0 | 11.6 | 13.3 | 20 |
| VT060 | 00 | 208/230 | 1 | 162.9/ 147.3 | 27.9/ 25.2 | 7.4/ 6.9 | 0.0 | 0.0 | 35.3/ 32.1 | 42.3/ 38.4 | 70/ 60 |
| | 01 | 208/230 | 1 | 162.9/ 147.3 | 27.9/ 25.2 | 7.4/ 6.9 | 0.6/ 0.5 | 0.0 | 35.9/ 32.6 | 42.9/ 38.9 | 70/ 60 |
| | 10 | 208/230 | 1 | 162.9/ 147.3 | 27.9/ 25.2 | 7.4/ 6.9 | 0.0 | 6.1/ 5.5 | 41.4/ 37.6 | 48.4/ 43.9 | 70/ 60 |
| | 11 | 208/230 | 1 | 162.9/ 147.3 | 27.9/ 25.2 | 7.4/ 6.9 | 0.6/ 0.5 | 6.1/ 5.5 | 42.0/ 38.1 | 49.0/ 44.4 | 70/ 70 |
| | 20 | 208/230 | 3 | 165.9/ 150.0 | 15.3/ 13.8 | 7.4/ 6.9 | 0.0 | 0.0 | 22.7/ 20.7 | 26.5/ 24.2 | 40/ 35 |
| | 21 | 208/230 | 3 | 165.9/ 150.0 | 15.3/ 13.8 | 7.4/ 6.9 | 0.6/ 0.5 | 0.0 | 23.3/ 21.2 | 27.1/ 24.7 | 40/ 35 |
| | 30/35 | 460 | 3 | 58.0 | 6.9 | 6.0 | 0.0 | 0.0 | 12.9 | 14.6 | 20 |
| | A | 265 | 1 | 133.0 | 21.5 | 6.0 | 0.0 | 0.0 | 27.5 | 32.9 | 50 |
| VT072 | 00 | 208/230 | 1 | 183.6/ 166.0 | 31.0/ 28.0 | 7.4/ 6.9 | 0.0 | 0.0 | 38.4/ 34.9 | 46.2/ 41.9 | 70/ 70 |
| | 01 | 208/230 | 1 | 183.6/ 166.0 | 31.0/ 28.0 | 7.4/ 6.9 | 0.6/ 0.5 | 0.0 | 39.0/ 35.4 | 46.8/ 42.4 | 70/ 70 |
| | 10 | 208/230 | 1 | 183.6/ 166.0 | 31.0/ 28.0 | 7.4/ 6.9 | 0.0 | 6.1/ 5.5 | 44.5/ 40.4 | 52.3/ 47.4 | 80/ 70 |
| | 11 | 208/230 | 1 | 183.6/ 166.0 | 31.0/ 28.0 | 7.4/ 6.9 | 0.6/ 0.5 | 6.1/ 5.5 | 45.1/ 40.9 | 52.9/ 47.9 | 80/ 70 |
| | 20 | 208/230 | 3 | 179.5/ 162.3 | 21.2/ 19.2 | 7.4/ 6.9 | 0.0 | 0.0 | 28.6/ 26.1 | 33.9/ 30.9 | 50/ 50 |
| | 21 | 208/230 | 3 | 179.5/ 162.3 | 21.2/ 19.2 | 7.4/ 6.9 | 0.6/ 0.5 | 0.0 | 29.2/ 26.6 | 34.5/ 31.4 | 50/ 50 |
| | 30/35 | 460 | 3 | 70.8 | 9.1 | 6.0 | 0.0 | 0.0 | 15.1 | 17.4 | 25 |

**Notes:**

1. All line and low voltage wiring must adhere to the National Electrical Code and local codes, whichever is the most stringent.
2. In determining the correct supply wire size and maximum length, reference NFPA 70, Section 310. If the calculation is close to the maximum allowable ampacity of a particular wire size, use the next size up. This will ensure that no adverse effects occur, such as light dimming and/or shortened compressor life.
3. Min/Max Voltage: 208/230/60 = 187-252, 460/60 = 432-502, 265/60 = 249-291
4. Units rated at 208/230V are factory wired for 230V. To change to 208V, the red transformer wire (with wire nut) will need to be hooked to the contactor in the position the current orange (230V) wire is. The orange wire will need to be capped off. Refer to wire diagram for details.
5. See Wiring Diagrams for proper 460V power.

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

## Section 3: Unit Data

### PSC Fan Performance Data: VS006-012

| *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 | | | | | | | |

Notes:

1. 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.

## Section 3: Unit Data

### Fan Performance Data: ECM, VS/VT 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 | 660 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |
| | | **B** | **-** | **550** | **-** | **550** | **-** | **490** | **290** | **550** | **ON** | **OFF** | **OFF** | **OFF** | **ON** | **OFF** | **OFF** | **OFF** |
| | | C | - | 490 | - | 490 | - | 400 | 240 | 490 | OFF | ON | OFF | OFF | OFF | ON | OFF | OFF |
| | | D | - | 410 | - | 400 | - | | 200 | 410 | ON | ON | OFF | OFF | ON | ON | OFF | OFF |
| 018 | 1.1 | A | - | 750 | - | 750 | - | 670 | 390 | 740 | OFF | ON | OFF | OFF | OFF | ON | OFF | OFF |
| | | **B** | **-** | **700** | **-** | **700** | **-** | **625** | **370** | **640** | **ON** | **ON** | **ON** | **OFF** | **ON** | **ON** | **OFF** | **OFF** |
| | | C | - | 675 | - | 675 | - | 540 | 320 | 580 | ON | ON | OFF | OFF | ON | ON | OFF | OFF |
| | | D | - | 570 | - | 570 | - | 490 | 250 | 520 | ON | ON | OFF | ON | 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 | ON | 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 |
| 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:

1. Program **B (Bold Type)** is factory settings and rated CFM. CFM is controlled within 5% up to the Max ESP.

2. Max ESP includes allowance for wet coil and NO FILTER

3. Power must be off to the unit for at least 3 seconds before the ECM motor will recognize a program change.

4. Max ESP for VS015 and VS018 models with external electric heat is 0.9 in. w.c.; for VT024 and VT030 models it is 0.6 in. w.c.; for VT036 (with 5kW or 10kW heater) it is 0.6 in. w.c.; for VT036 (with 15kW heater) it is 0.5 in. w.c.; and for VT042 through 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 | | |
| 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 |
| 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. |

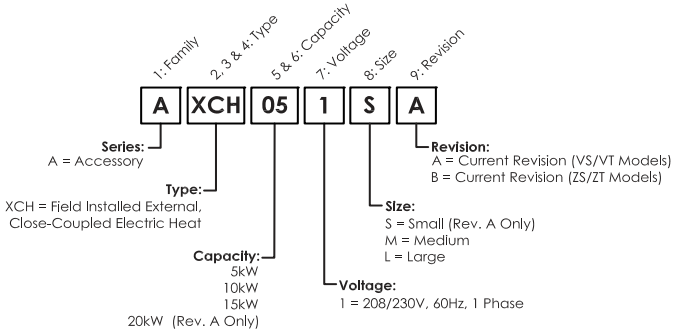
Notes:

1. To enter dehumidification mode, ODD input should be 0 VAC; for normal cooling CFM, ODD input should be 24 VAC.

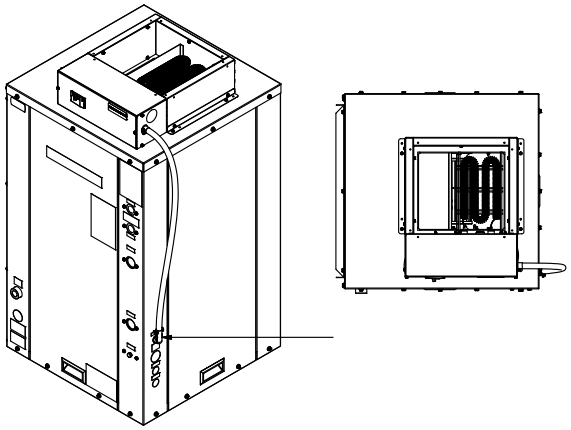
2. Heating CFM is not affected by dehumidification mode. When in dehumidification mode, cooling CFM is 85% of normal CFM.

## Section 3: Unit Data

### Auxiliary Heater
### Nomenclature Decoder




### Typical Heater Installation



### Introduction

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

### 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 |
|---|---|---|---|---|
| AXCH051SC | VS015-VS018<br>VT024-VT036 | | AXCH101MA | VT042-VT072 |
| AXCH101SC | VT024-VT036 | | AXCH151MA* | VT042-VT072 |
| AXCH151SC* | VT036 | | AXCH201MA* | VT060-VT072 |

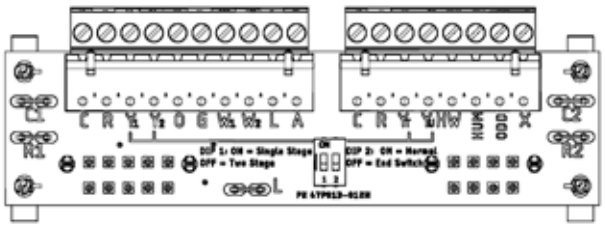
* Single Point Connection

### Auxiliary Heater Electrical Data

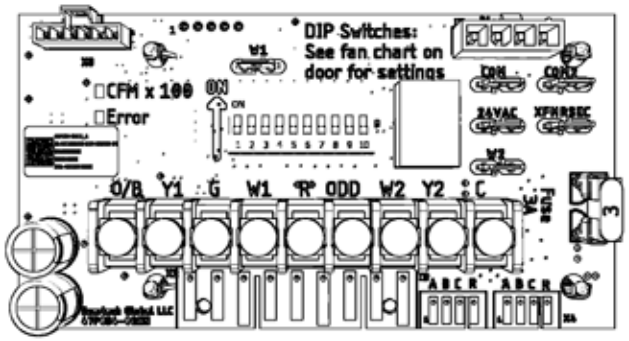
| Technical Data Single Phase w/ Circuit Breaker (*Single Point Connection) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heater Model | Supply Circuit Number | Heat kW | | Heater kW Per Circuit | | FLA Total AMPS | | MCA- Minimum Circuit Ampacity | | MOCP Maximum Overcurrent Protective Device (AMPS) NEC 240.4(B) | |
| | | 240 | 208 | 240 | 208 | 240 | 208 | 240 | 208 | 240 | 208 |
| AXCH051SC | Single | 5 | 3.75 | 2.5 | 1.875 | 20.8 | 18.0 | 26.0 | 22.5 | 30 | 25 |
| AXCH101SC<br>AXCH101MA | Single | 10 | 7.5 | 5 | 3.75 | 41.7 | 36.1 | 52.1 | 45.1 | 60 | 50 |
| | | | | 5 | 3.75 | | | | | | |
| AXCH151SC*<br>AXCH151MA* | Single | 15 | 11.25 | 5 | 3.75 | 62.5 | 54.1 | 78.1 | 67.6 | 80 | 70 |
| | | | | 10 | 7.50 | | | | | | |
| AXCH201MA* | Single | 20 | 15 | 10 | 7.50 | 83.3 | 72.1 | 104.2 | 90.1 | 110 | 100 |
| | | | | 10 | 7.50 | | | | | | |
| **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) | |
| | | 240 | 208 | 240 | 208 | 240 | 208 | 240 | 208 | 240 | 208 |
| AXCH151SC<br>AXCH151MA | L1/L2 | 15 | 11.25 | 5 | 3.75 | 20.8 | 18.0 | 26.0 | 22.5 | 30 | 25 |
| | L3/L4 | | | 10 | 7.50 | 41.7 | 36.1 | 52.1 | 45.1 | 60 | 50 |
| AXCH201MA | L1/L2 | 20 | 15 | 10 | 7.50 | 41.7 | 36.1 | 52.1 | 45.1 | 60 | 50 |
| | L3/L4 | | | 10 | 7.50 | 41.7 | 36.1 | 52.1 | 45.1 | 60 | 50 |

## Section 4: Controls

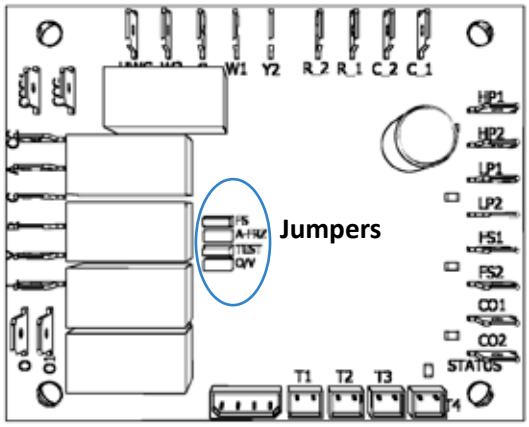
### Thermostat Board Layout



### ECM Board Layout




### Lockout Board Layout




### Features

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

### Microprocessor Features and Operations

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

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.

### Startup/Random Start

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

### Short Cycle Protection (ASC)

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

### Component Sequencing Delays

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

### Test Mode

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

### Airflow Monitor

When provided, an LED on the ECM fan control board flashes one time per 100 CFM to indicate airflow during fan operation.

### 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.

### Loop Pump Circuit Breakers

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

### Safety Controls

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

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

**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.)

### Electronic Condensate Overflow Protection (CO)

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

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

### Flow Switch - FS (If equipped - brazed plate only)

A flow switch ensures the source water maintains the minimum required flow rate. This ensures that pumps are working and water connections remain intact. The flow switch will also trip when the source water begins to freeze, providing additional protection. A Flow Switch is utilized on units with a BPHE source coil. A Flow Switch is not included on units utilizing a COAX source coil.

### Load Heat Exchanger Freeze-T1

**(If equipped - units with coaxial heat exchangers)**

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 -T4

**(If equipped - units with coaxial heat exchangers)**

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 12°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).

### Hot Gas Line Temperature limit (T2>220°F)

When T2 is >220°F for 30 continuous seconds, the compressor operation will be interrupted. The control will go into fault retry mode.

### Over/Under Voltage Protection

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

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

### Fault Retry

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

### Intelligent Lockout Reset

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

### Lockout with Emergency Heat

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

### Hot Water Generator (HWG) Pump Control

**(If equipped with Desuperheater)**

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

### Diagnostics

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

The temperature versus resistance chart is for the 10kOhm thermistors used for the four thermistors (Load Coil Temperature, Discharge Gas Temperature, Desuperheater Leaving Water Temperature, and Source Coil Temperature). Reference this chart and the temperature at the thermistor location to test the resistance of each thermistor.

| Temperature vs Resistance Characteristics of Sensor | | | | |
|---|---|---|---|---|
| Temp. (°F) | Rst. (KΩ) | | Temp. (°F) | Rst. (KΩ) |
| 10 | 46.95 | | 130 | 3.60 |
| 15 | 41.39 | | 200 | 1.16 |
| 20 | 36.50 | | 220 | 0.87 |
| 30 | 28.61 | | 250 | 0.59 |
| 77 | 10.00 | | 257 | 0.54 |

| Temperature Sensor Operating Range | |
|---|---|
| Sensor's Name | Range(°F) |
| T1 | 10 – 220 |
| T2 | 20 – 257 |
| T3 | 20 – 220 |
| T4 | 10 – 220 |

**LED Identification:**

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

| LOCKOUT BOARD JUMPERS | | |
|---|---|---|
| JUMPER | INSTALLED | REMOVED |
| FS | T1 & T4 MONITORED FOR FLOW- 'FS' TERMINALS IGNORED | FS' TERMINALS USED FOR FLOW SWITCH- T1 & T4 IGNORED |
| A-FRZ | OPEN LOOP MODE- 30˚F SETTING FOR T4 | CLOSED LOOP MODE- 12˚F SETTING FOR T4 |
| TEST | OPERATES IN NORMAL MODE WITH STANDARD DELAYS | OPERATES IN TEST MODE WITH DELAYS SPED UP |
| O/ V | FEATURE IS ACTIVE | FEATURE IS INACTIVE |

NOTES:

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

## Lockout Board Jumper Selection

The lockout board includes four jumpers for field selection of various board features.

### Load/Source 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. When the FS jumper is removed, the board monitors the flow switch to ensure adequate flow through the heat exchanger. **Factory set, NOT field selectable.**

### 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 12°F.

### Test Mode (TEST)

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

### Over/Under Voltage Disable (O/U)

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

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

## Thermostat Board DIP Switch Selection

Verify that the switches are set correctly prior to starting the unit with the following options:

**DIP #1 - Single Stage or Two Stage**

- ON = Single Stage
- OFF = Two Stage (factory default)

**Note:** Setting this DIP switch ON connects Y1 to Y2 and provides full load capacity for single speed systems, or for two-stage systems that are used in single-stage mode (e.g. with a single stage buffer tank controller).

**DIP #2 - Water Valve End Switch (terminals YT & YU)**

- ON = No end switch (YT is jumpered to YU)
- OFF = Water valve has end switch (see wiring diagram)

## Sequence of Operation

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

### Heating 1st Stage, (Y1, G) Two-Stage Units

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

### Heating 2nd Stage, (Y1, Y2, G) Two-Stage Units

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

### Heating 3rd Stage, (Y1, Y2, W1, G) Two-Stage Units

**(If equipped with electric heat)**

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

### Emergency Heat (W1, G)

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

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

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

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

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

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

| 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 | Mitigation | Mitigation Test mode. |

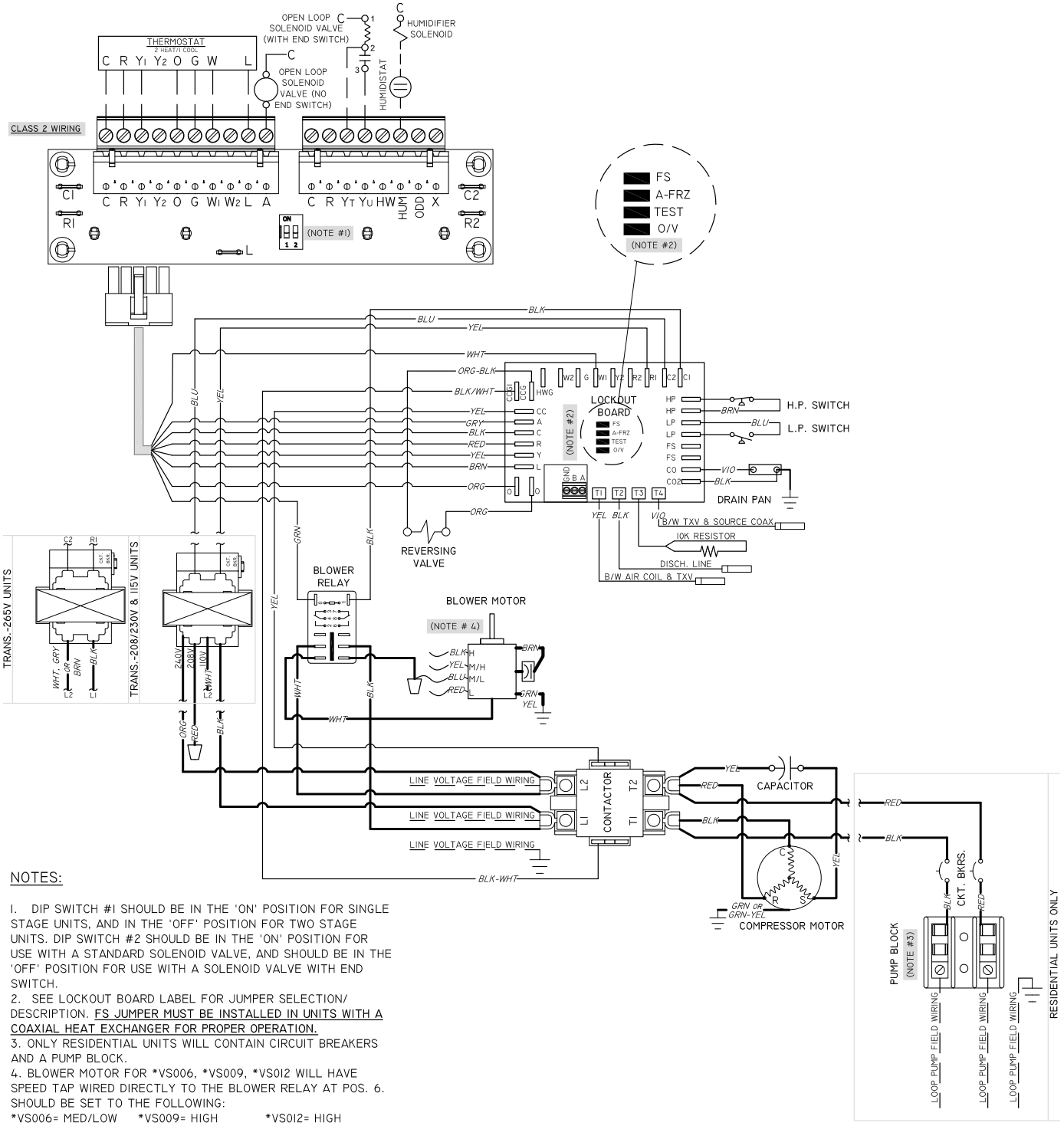
Notes:

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

**Wiring Diagram: PSC**

AND CC61

# WATER-TO-AIR UNIT, SINGLE STAGE, PSC FAN, RESIDENTIAL & COMMERCIAL
# *VS SERIES



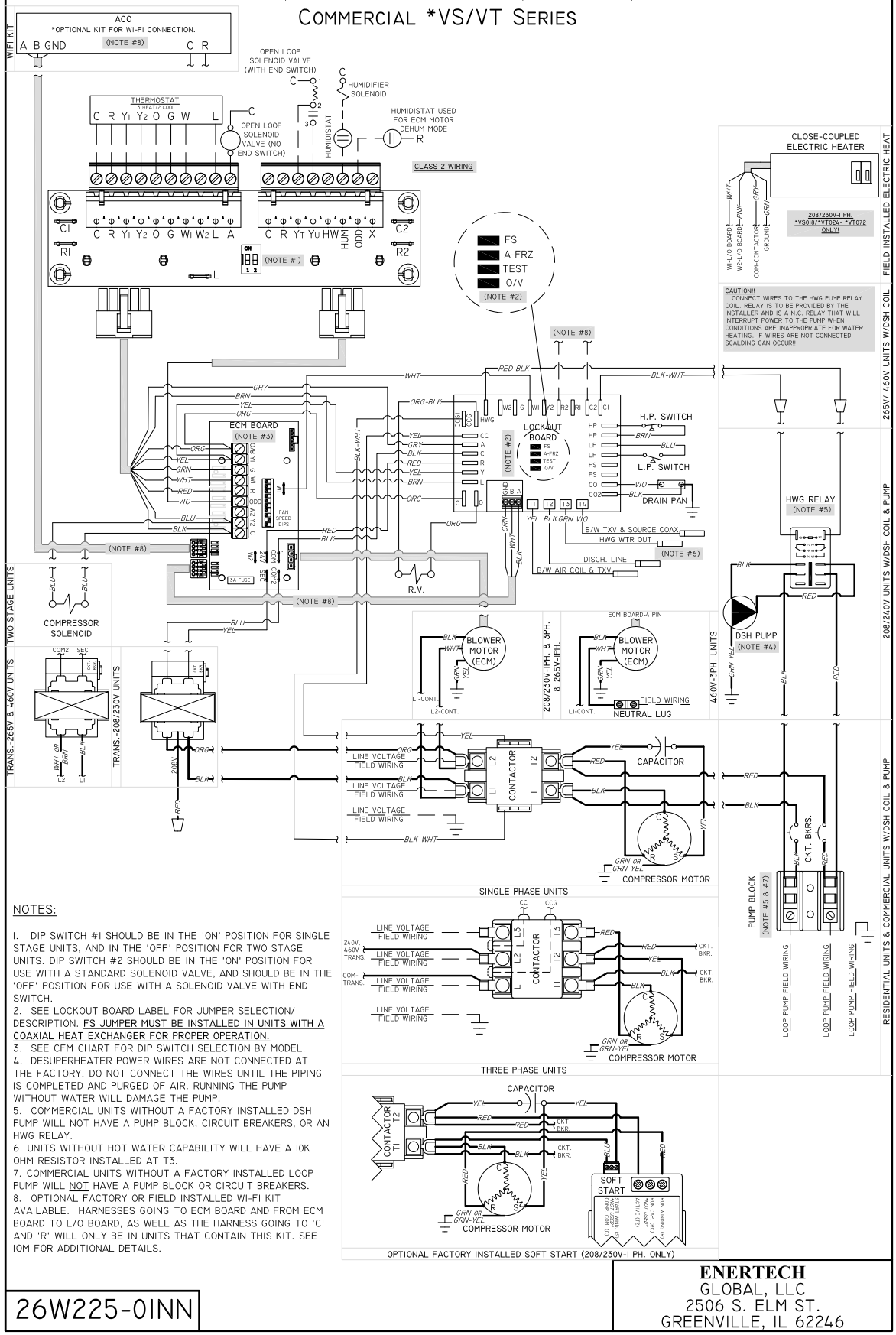

NOTES:

1. DIP SWITCH #1 SHOULD BE IN THE 'ON' POSITION FOR SINGLE STAGE UNITS, AND IN THE 'OFF' POSITION FOR TWO STAGE UNITS. DIP SWITCH #2 SHOULD BE IN THE 'ON' POSITION FOR USE WITH A STANDARD SOLENOID VALVE, AND SHOULD BE IN THE 'OFF' POSITION FOR USE WITH A SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION. FS JUMPER MUST BE INSTALLED IN UNITS WITH A COAXIAL HEAT EXCHANGER FOR PROPER OPERATION.
3. ONLY RESIDENTIAL UNITS WILL CONTAIN CIRCUIT BREAKERS AND A PUMP BLOCK.
4. BLOWER MOTOR FOR *VS006, *VS009, *VS012 WILL HAVE SPEED TAP WIRED DIRECTLY TO THE BLOWER RELAY AT POS. 6. SHOULD BE SET TO THE FOLLOWING:
*VS006= MED/LOW *VS009= HIGH *VS012= HIGH

## Wiring Diagram: ECM

| REVISION HISTORY | | | | |
|---|---|---|---|---|
| REV | DESCRIPTION | DATE | ECN | APPD |
| G | UPDATE TRANSFORMER WIRES | 8/6/2025 | 25-273-N01 | KW |

# WATER-TO-AIR UNIT, SINGLE OR TWO STAGE, ECM FAN, RESIDENTIAL & COMMERCIAL *VS/VT SERIES




NOTES:

1. DIP SWITCH #1 SHOULD BE IN THE 'ON' POSITION FOR SINGLE STAGE UNITS, AND IN THE 'OFF' POSITION FOR TWO STAGE UNITS. DIP SWITCH #2 SHOULD BE IN THE 'ON' POSITION FOR USE WITH A STANDARD SOLENOID VALVE, AND SHOULD BE IN THE 'OFF' POSITION FOR USE WITH A SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION. FS JUMPER MUST BE INSTALLED IN UNITS WITH A COAXIAL HEAT EXCHANGER FOR PROPER OPERATION.
3. SEE CFM CHART FOR DIP SWITCH SELECTION BY MODEL.
4. DESUPERHEATER 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.
5. COMMERCIAL UNITS WITHOUT A FACTORY INSTALLED DSH PUMP WILL NOT HAVE A PUMP BLOCK, CIRCUIT BREAKERS, OR AN HWG RELAY.
6. UNITS WITHOUT HOT WATER CAPABILITY WILL HAVE A 10K OHM RESISTOR INSTALLED AT T3.
7. COMMERCIAL UNITS WITHOUT A FACTORY INSTALLED LOOP PUMP WILL NOT HAVE A PUMP BLOCK OR CIRCUIT BREAKERS.
8. OPTIONAL FACTORY OR FIELD INSTALLED WI-FI KIT AVAILABLE. HARNESSES GOING TO ECM BOARD AND FROM ECM BOARD TO L/O BOARD, AS WELL AS THE HARNESS GOING TO 'C' AND 'R' WILL ONLY BE IN UNITS THAT CONTAIN THIS KIT. SEE IOM FOR ADDITIONAL DETAILS.

26W225-01NN

**ENERTECH**
GLOBAL, LLC
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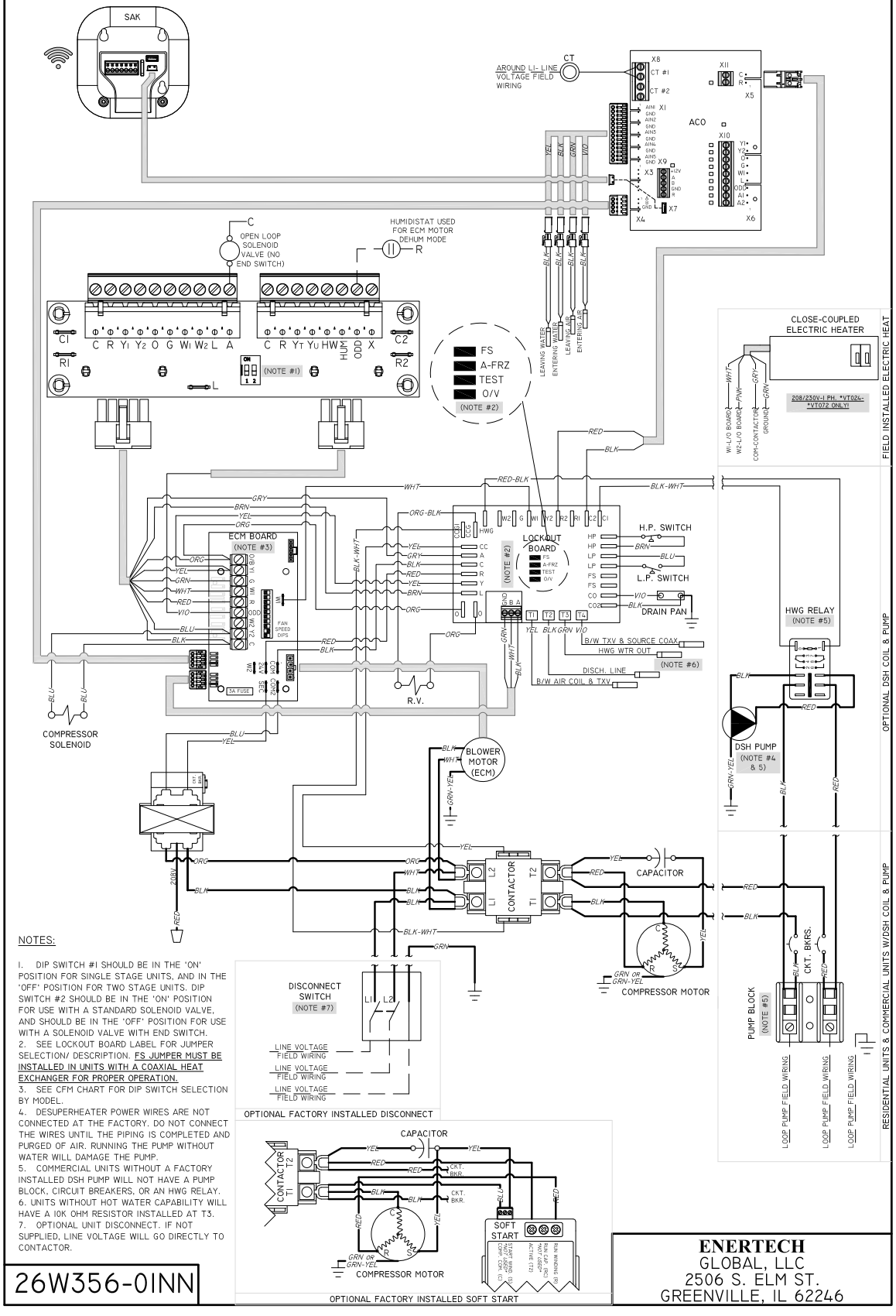
GREENVILLE, IL 62246

## Wiring Diagram: ECM, Connected Controls

| REVISION HISTORY | | | | |
|---|---|---|---|---|
| REV | DESCRIPTION | DATE | ECN | APPD |
| A | INITIAL RELEASE FOR REV. J | 7/31/2024 | 24-135-N02 | KW |

# WATER-TO-AIR UNIT, TWO STAGE, ECM FAN, 208/230V, 60Hz, RESIDENTIAL OR COMMERCIAL *VT SERIES




NOTES:

1. DIP SWITCH #1 SHOULD BE IN THE 'ON' POSITION FOR SINGLE STAGE UNITS, AND IN THE 'OFF' POSITION FOR TWO STAGE UNITS. DIP SWITCH #2 SHOULD BE IN THE 'ON' POSITION FOR USE WITH A STANDARD SOLENOID VALVE, AND SHOULD BE IN THE 'OFF' POSITION FOR USE WITH A SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR JUMPER SELECTION/ DESCRIPTION. FS JUMPER MUST BE INSTALLED IN UNITS WITH A COAXIAL HEAT EXCHANGER FOR PROPER OPERATION.
3. SEE CFM CHART FOR DIP SWITCH SELECTION BY MODEL.
4. DESUPERHEATER 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.
5. COMMERCIAL UNITS WITHOUT A FACTORY INSTALLED DSH PUMP WILL NOT HAVE A PUMP BLOCK, CIRCUIT BREAKERS, OR AN HWG RELAY.
6. UNITS WITHOUT HOT WATER CAPABILITY WILL HAVE A 10K OHM RESISTOR INSTALLED AT T3.
7. OPTIONAL UNIT DISCONNECT. IF NOT SUPPLIED, LINE VOLTAGE WILL GO DIRECTLY TO CONTACTOR.

26W356-01NN

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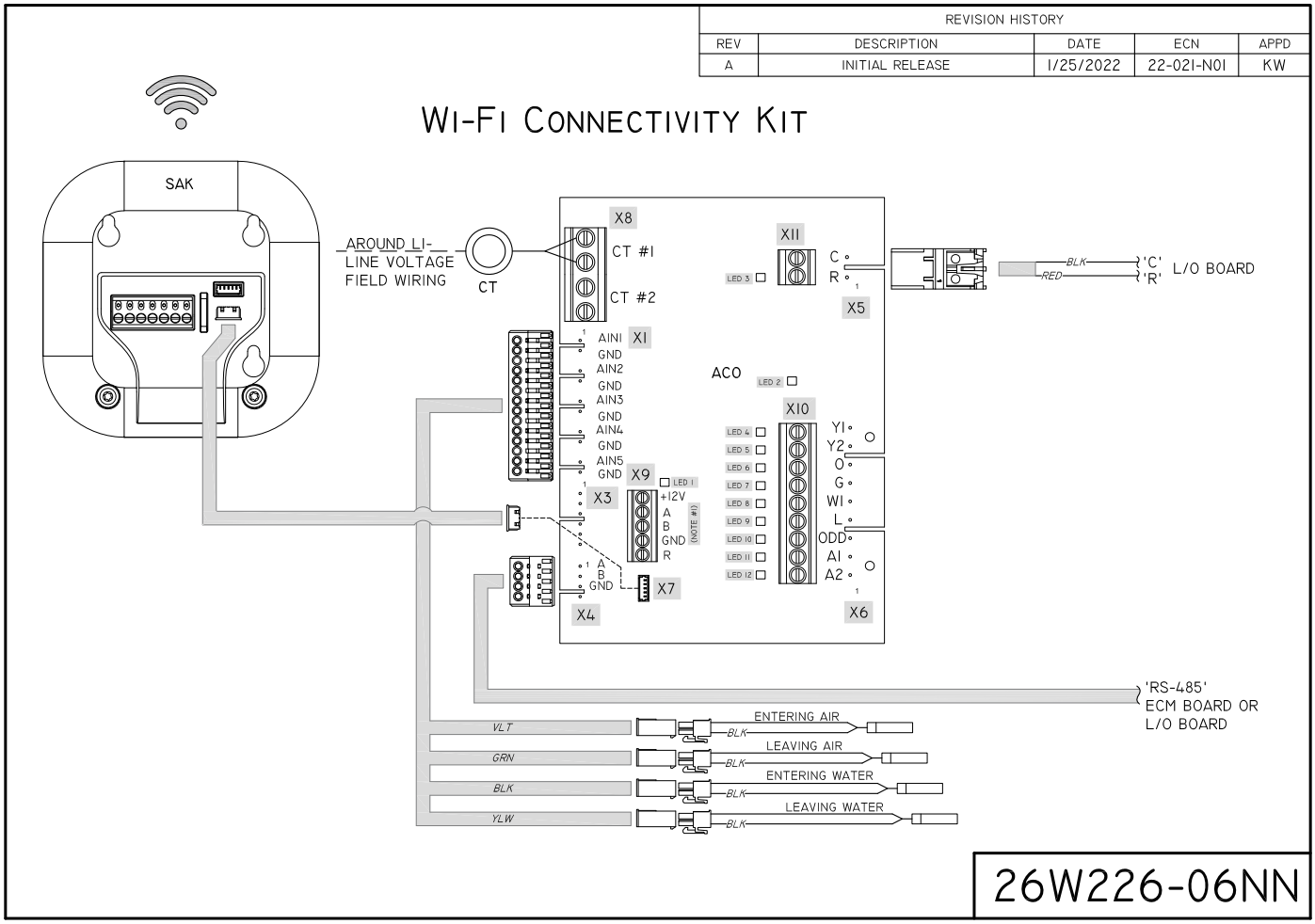
GLOBAL, LLC
2506 S. ELM ST.
GREENVILLE, IL 62246

## Wiring Diagram - Connected Controls

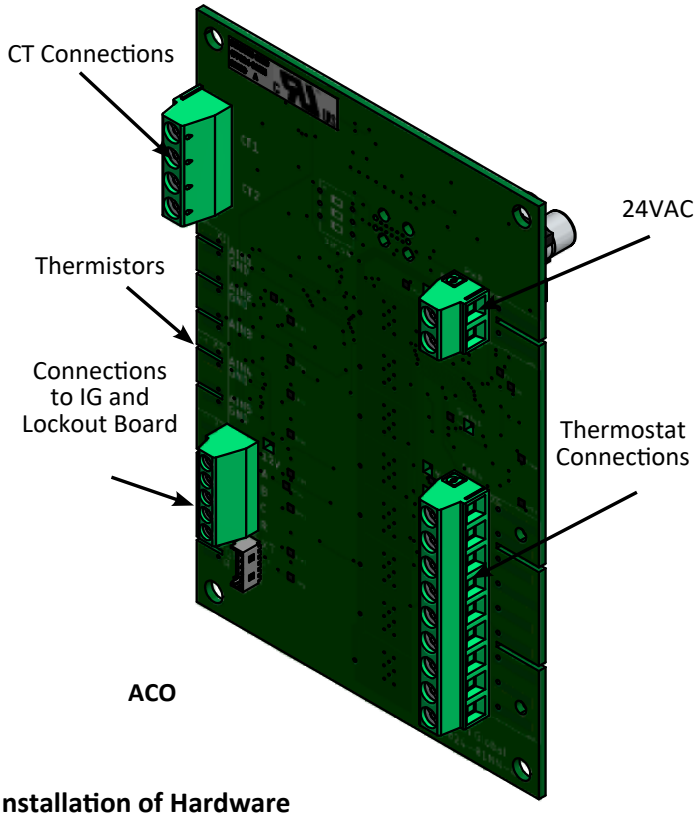


## Connected Controls

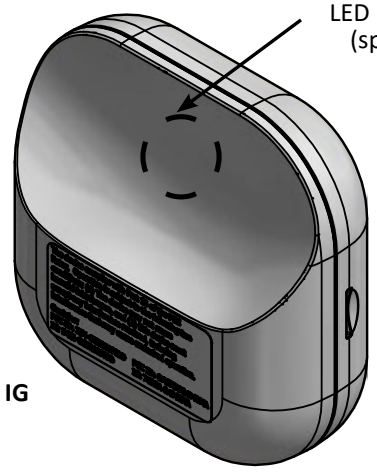
### Overview

Connected Controls provide energy monitoring, as well as diagnostics based upon water temperatures, air temperatures, and lockout board faults. The controls utilize three main components to interface with the heat pump, as follows:

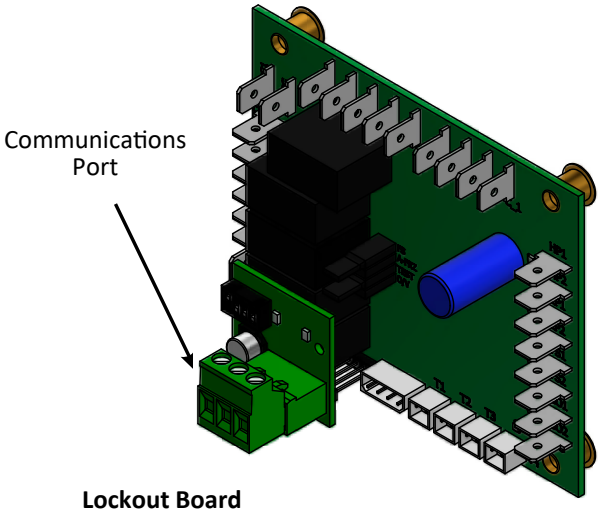
- **IG (Internet gateway) device:** The IG connects to the owner's WiFi router to allow data to be transmitted to the cloud for access by the owner and installing/servicing technician.
- **ACO (Accessory Controls Output) board:** The ACO board is a connection point between the heat pump lockout board and the IG. It allows 24VAC heat pump controls to interface with Internet connected controls.
- **Lockout board with communications capability:** The lockout board for Connected Controls has a RS-485 port that allows faults/lockouts and jumper position to be communicated to the cloud. All other features are the same as a lockout board without a communications port.




**ACO**



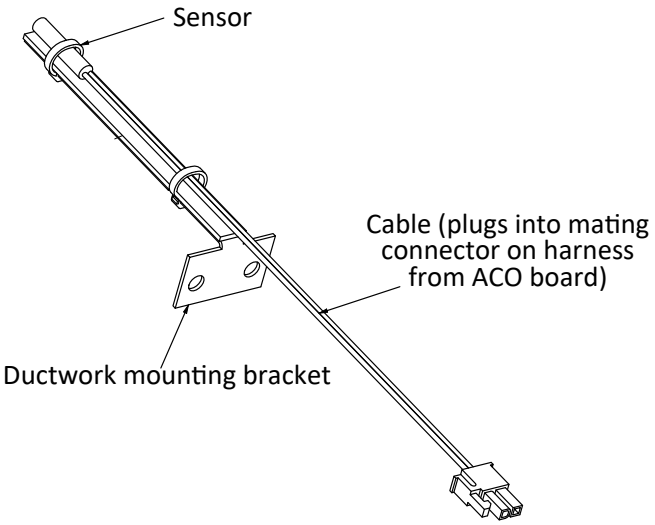

**IG**

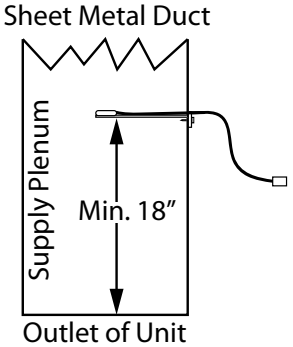


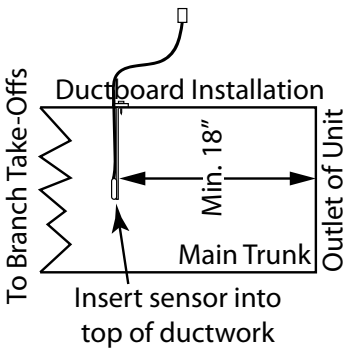

**Lockout Board**

### Installation of Hardware

Controls hardware is factory installed except the C/T (current transformer) and the return/supply air sensors, which must be field installed. The air sensors must be at least 18" from the inlet/outlet of the air handler (farther away is better) to provide proper mixing. See drawings below.

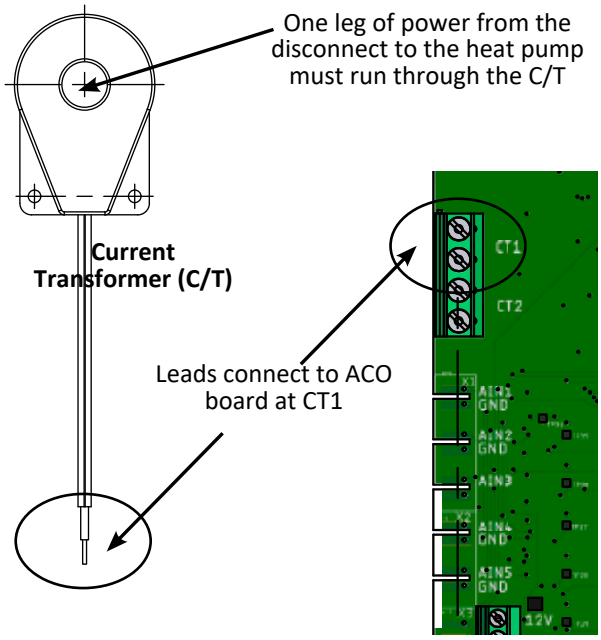


## Section 5: Controls

For current sensing (part of the energy monitoring feature), one leg of power from the disconnect to the heat pump must be run though the C/T (see below). The C/T leads connect to the ACO board at terminals CT1.




### Software Setup

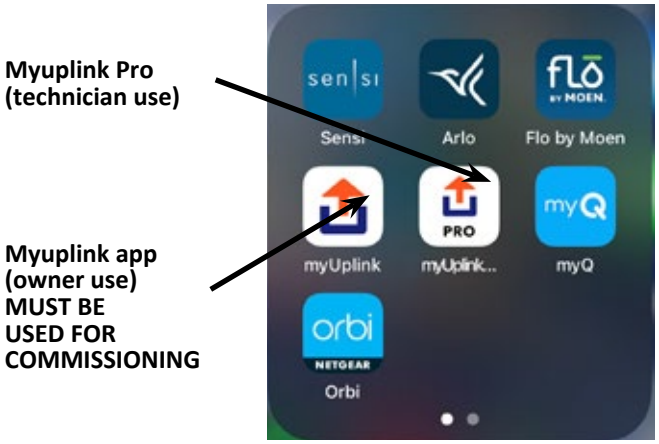
Enertech Connected Controls provide multiple ways to access the control system and data. There are two smartphone apps, as well as access via a web browser. To protect customer privacy and to ensure the best experience for both the end user and the installing/servicing technician, it is important to understand how the various access tools operate. Below is a summary of each access method.

- **myUplink smartphone app:** The myUplink smartphone app is for use by the end user as the main interface to the Connected Controls. It may be downloaded from the app store for the brand of phone used. **IMPORTANT:** This app must be used for commissioning the system. The Pro app cannot be used to commission the system; the system also cannot be commissioned via a web browser.
- **myUplink Pro smartphone app:** The Pro smartphone app is for use by the installing and servicing technician. It provides additional information to the technician if the end user gives permission to view the system. It may also be used to access the system while on site without the need to access the owner's WiFi network. In other words, it can connect directly to the IG, avoiding the need to ask for the owner's WiFi password.

**⚠ NOTICE ⚠**

**THE MYUPLINK APP MUST BE USED FOR COMMISSIONING. THE MYUPLINK PRO APP OR A WEB BROWSER CANNOT COMMISSION A SYSTEM.**

- **Web browser:** The system may be accessed via a web browser at **https://myuplink.com/login (owner) or https://pro.myuplink.com (dealer).** This is helpful if the owner does not want to use a smartphone to access the system. **IMPORTANT:** The myUplink app must be used for commissioning the system. A web browser may be used to access the system after it is commissioned, but it cannot be used to commission the system.




### Commissioning Scenario - Add App to Owner's Phone

Once the hardware is installed and the unit is operational, re-attach all unit access panels and control box panel, ensuring that no high voltage is accessible. It is important that the customer is available with his/her smartphone before proceeding with the steps below. IMPORTANT: The owners phone must be connected to the same WiFi network the controls will be using.

Follow the setup steps in the startup guide or videos located on the Epic controls support website. The website can be found at support.enertechusa.com/epic or scan the QR code below.

## Section 5: Controls

| LED Status | Pattern |
|---|---|
| Booting (starting up after powering on) | Circle with 5 second delay in between |
| Waiting to be commissioned | Continuous circle with no delay |
| Idle | Pulsing (heartbeat) with no delay in between |
| Running in heating or cooling | Slower continuous circle with delay |
| Emergency Heat | Same as htg/clg but red center LED blinking twice followed by 5 sec delay |
| Lockout | Red center LED blinks twice, followed by 5 seccond delay |
| WiFi disconnected | Faster plulsing with 5 second delay in between |
| WiFi connected - connecting to Cloud | Circle with 5 second delay in between |
| During software update | LEDs bounce left and right, back and forth |
| Software update success | Circle LEDs blink 5 times |
| Factory reset | |

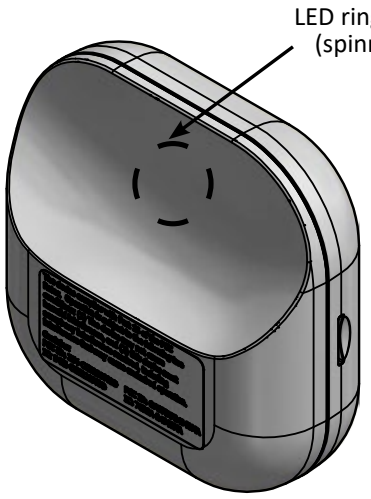
### Troubleshooting

Troubleshooting the controls primarily involves monitoring the LED status (see table above), reviewing the myUplink and myUplink Pro apps, and determining if the issue is with the connected controls or with the owner's WiFi network. The following steps will help determine how to troubleshoot the controls:

1. If the system is not online, try resetting power to the cable/DSL modem and WiFi router. Additional WiFi troubleshooting can be found at the previous link and QR code.
2. Attempt to connect directly from the myUplink Pro app. If system connects to the app, the connectivity issue is with the WiFi network, not the connected controls.
3. Compare the current LED status to the table above to determine the state of the control.
4. Ensure that all connections are as shown in the wiring diagram to the right.

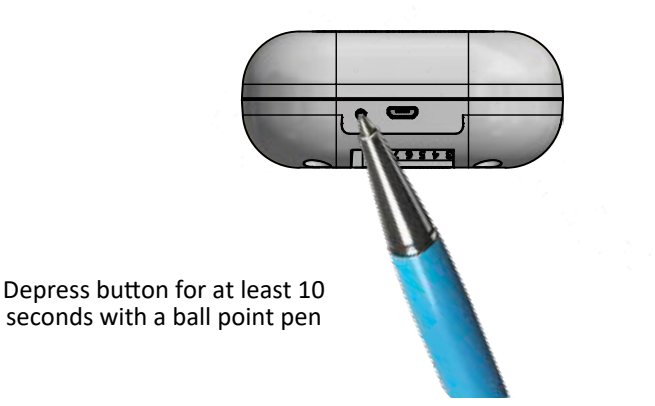
### Internet Gateway (IG) LED Ring Display

The IG has an LED ring that displays the current state of the IG, indicating if it is connected to the WiFi network, ready for setup, etc. The table on the next page lists the various operating states of the LED ring.




### Factory Reset

There may be a need to reset the Internet Gateway (IG) to factory settings. For example, if the owner installs a new router, the IG will need to be recommissioned. Resetting the IG simply involves holding the button at the bottom of the IG for at least 10 continuous seconds. Once the IG is reset, the LED ring will flash five times, indicating that it has been reset. Once the IG is reset, it may be recommissioned based upon the four scenarios mentioned earlier in the Connected Controls section.



## Soft Start Controls

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

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

### Background

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

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

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

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

### In-Rush Current

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

**SureStart In-Rush Reduction**

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

### SureStart Operation

When the system control calls for compressor operation, the compressor contactor will energize. If the supply voltage to the SureStart is less than “Minimum Startup Voltage”, a 50 second delay is initiated. At the end of the delay, another attempt to start the compressor will begin unless the supply voltage remains unchanged.

SureStart uses an optimized starting process that learns the starting characteristics of the compressor to further refine the starting cycle on each recurring start. If the compressor fails to start, the module will terminate the start attempt after 1 second and initiate a 3 minute lockout before attempting a restart. If the supply voltage falls below “Shutdown on Low voltage” limit for 2 seconds or below 130 volts for 0.1 seconds while the compressor is running the module will stop the compressor and initiate a 3 minute lockout. A restart will be attempted after 3 minutes if the supply voltage is equal to “Minimum Startup Voltage” or higher. This is done to protect the compressor against a sudden drop in supply voltage.

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

**⚠ NOTICE ⚠**

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

### Led Flash Codes

A Red LED indicator will flash under the following conditions.

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

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

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

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

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

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

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

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

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

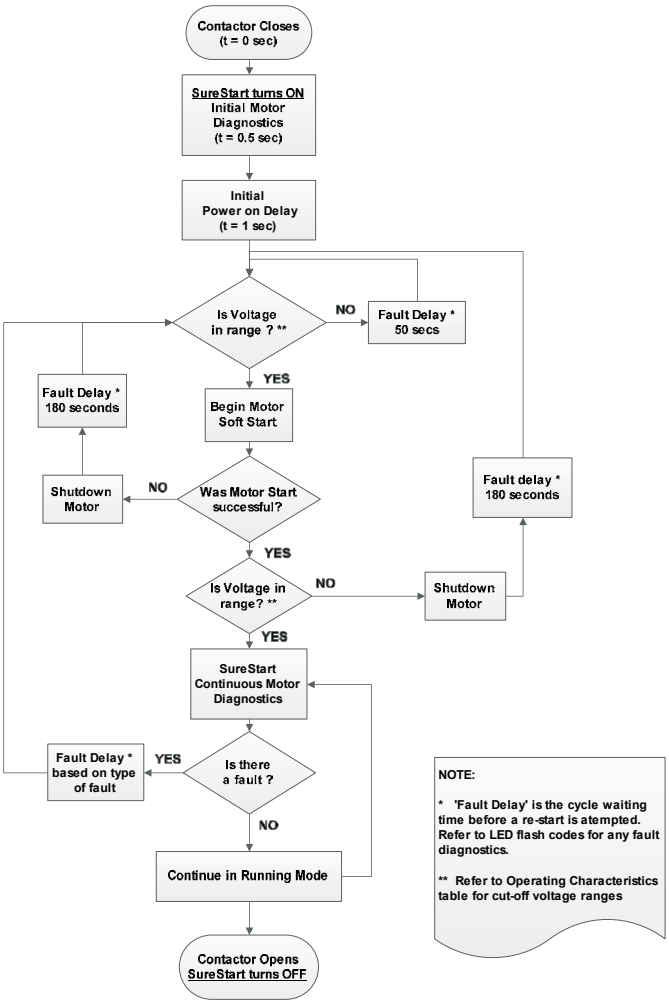
To limit the current in compressors from extending abnormally beyond its stated capacities, SureStart is also equipped with Overcurrent limit protection. For models rated from 16-32A, SureStart is designed to trip out in overload conditions exceeding 50A. In smaller models, it is designed to cutoff power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

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

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

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

### SureStart Basic Operation Chart:



## Section 5: Unit Piping

### Water Quality Table

| 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 | 5 - 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.
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.

### Water Quality

The quality of the water used in geothermal systems is very important. Water quality is not only important for the source side of the system, but even more so for the load side of the system. Due to use of dissimilar metals throughout the system (i.e. stainless braze plates, cast iron pump volutes, etc.) certain minerals or chemicals may build up and become detrimental to system operation and longevity. Filling the system with good quality water that meets the specifications outlined in the table above.

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.

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

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

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

### 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: 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 |

### Flow Center

#### Typical Pressurized Flow Center Installation

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

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

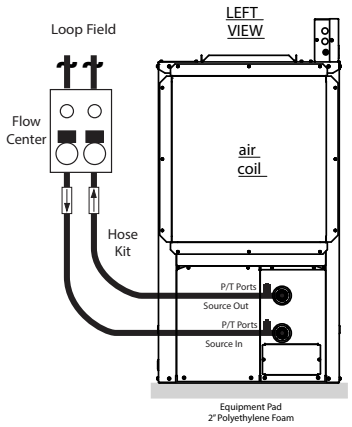
## Section 5: Unit Piping

### 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 below for connection details.

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

### Typical Single Unit Piping Connection (Pressurized Flow Center)



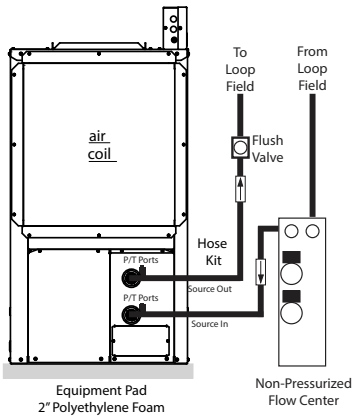

### Typical Non-Pressurized Flow Center Installation

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

### Flushing the Interior Piping (Non-Pressurized)

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

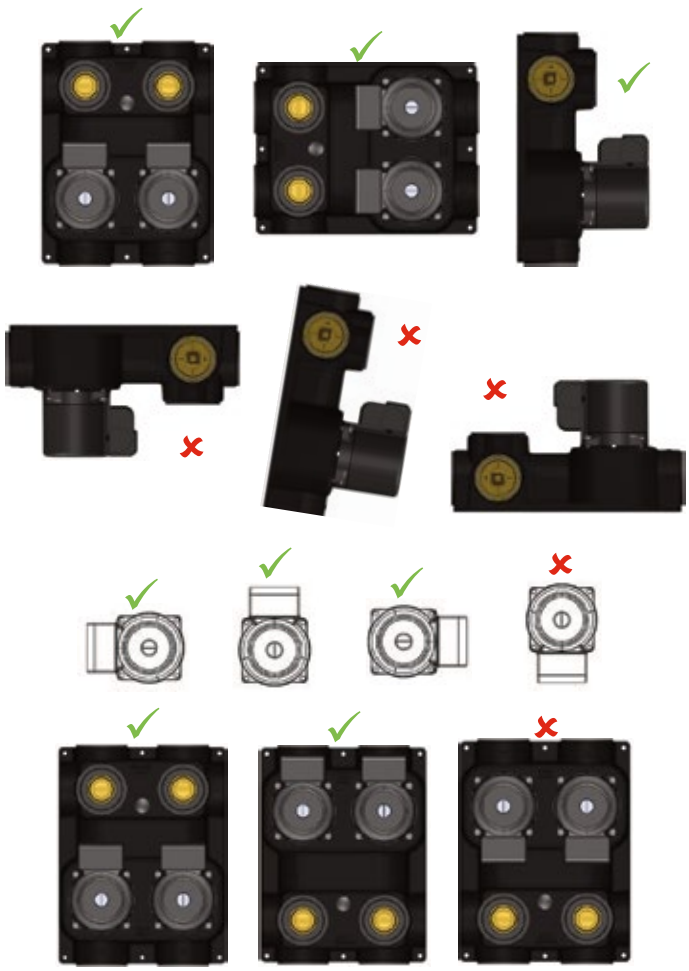
### Typical Single Unit Piping Connection (Non-Pressurized Flow Center)




### Pressurized Flow Center and Pump Mounting

The flow center can be mounted with the flow paths either vertical or horizontal (see Acceptable mounting positions for Flo-Link and GPM series flow centers). 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.

Equally important to pump longevity is terminal box orientation (See Acceptable terminal box locations for UPS26-99, UP26-99, and UP26-116 pumps) 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.

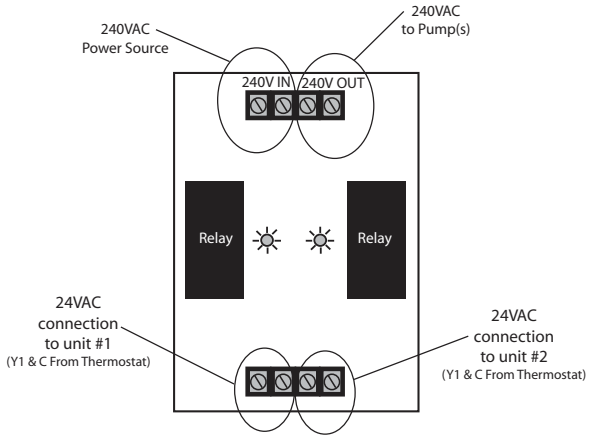


## Section 5: Unit Piping

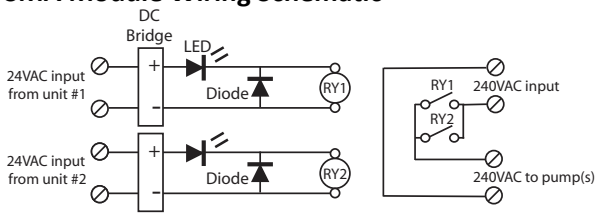
### APSMA Pump Sharing Module

The pump sharing module, part number APSMA, is designed to allow two units to share one flow center. With the APSMA module, either unit can energize the pump(s). Connect the units and flow center as shown in APSMA Module Layout Diagram, below. The APSMA Module Wiring Schematic provides a layout 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.

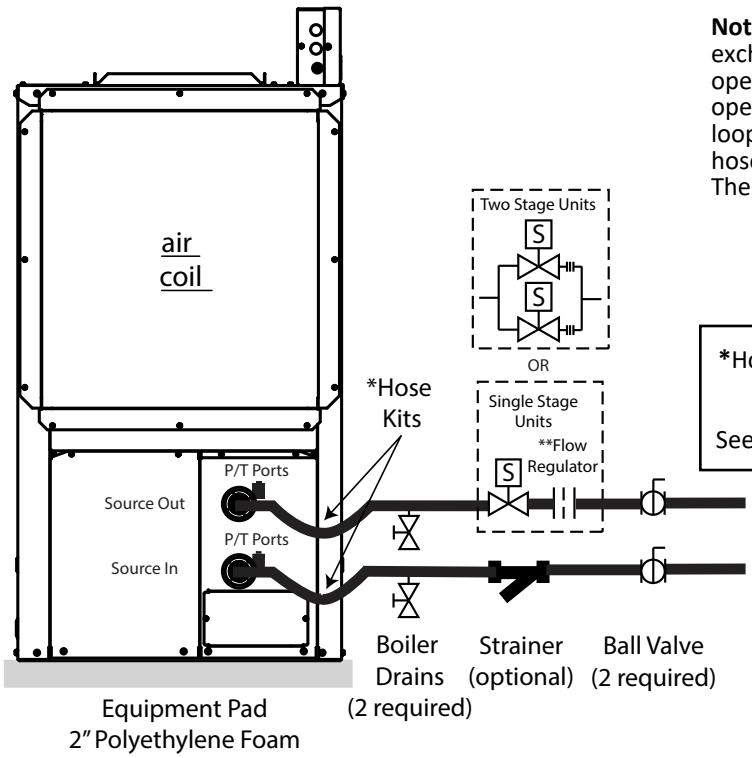
### APSMA Module Layout




### APSMA Module Wiring Schematic




### Open Loop Piping Example




### Open Loop Piping

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

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

Other necessary components include a strainer, boiler drains for heat exchanger flushing, P/T ports and ball valves. Ball valves allow the water to be shut off for service, and help when velocity noise is noticeable through the flow regulator. Spreading some of the pressure drop across the ball valves will lessen the velocity noise. Always double check flow rate at the P/T ports to make sure the ball valve adjustments have not lowered water flow too much, and essentially taken the flow regulator out of the equation. It's a good idea to remove the ball valve handles once the system is completed to avoid nuisance service calls. Hose kits are optional, but make for an easier installation,since the P/T ports and connections are included. The hose also helps to isolate the heat pump from the piping system.

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

**Note:** Units equipped with a brazed plate for the source heat exchanger are not recommended for direct connection to an open loop system. If further assistance is required for your open loop application, please consult technical service. Open loop systems connected to the water mains by detachable hose require a new hose set to be installed with a new unit. The old hose set should not be reused with a new unit.

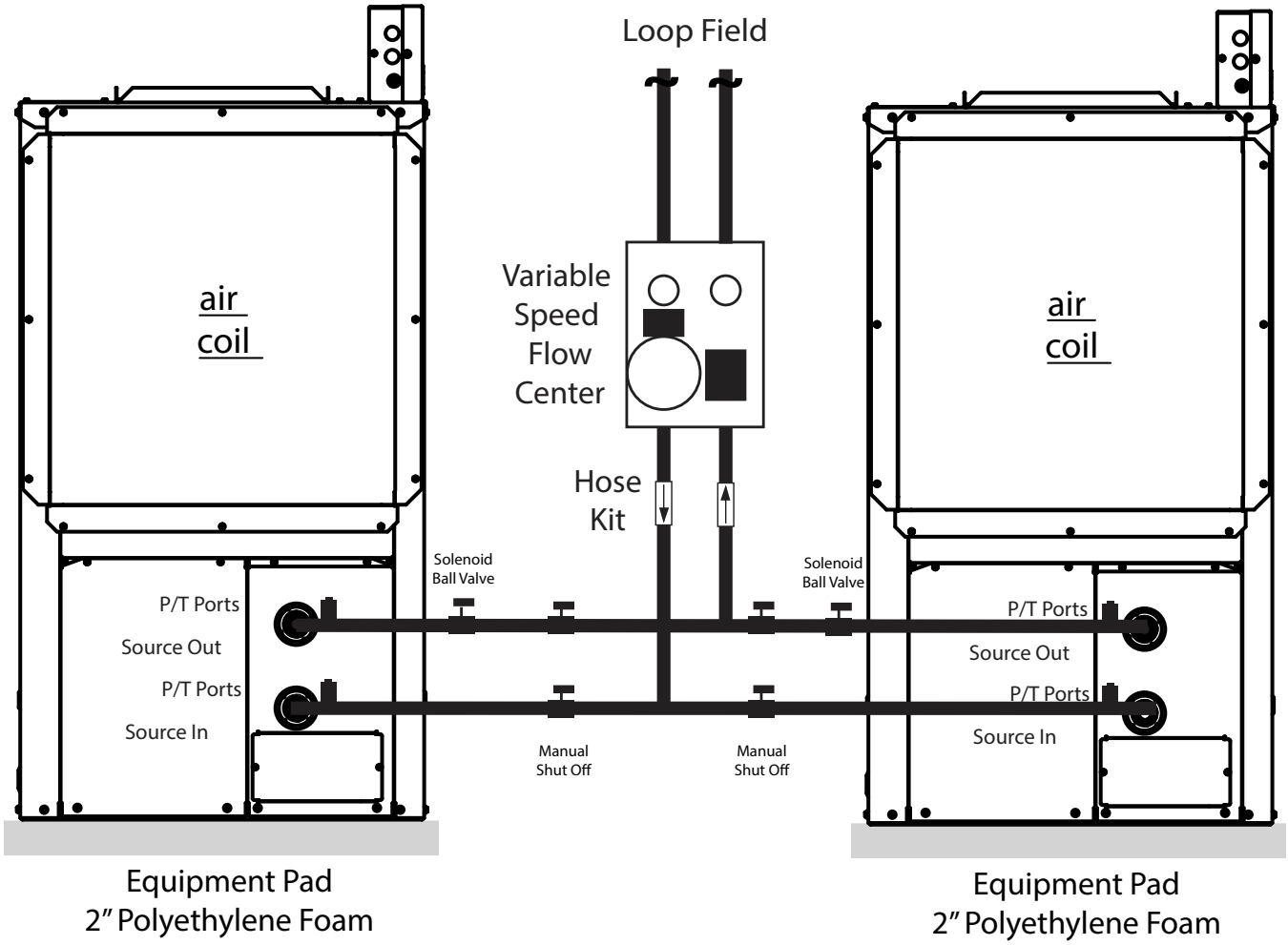
*****Hose kit is used for piping isolation and includes fittings for P/T ports.

See product specifications for flow rates.

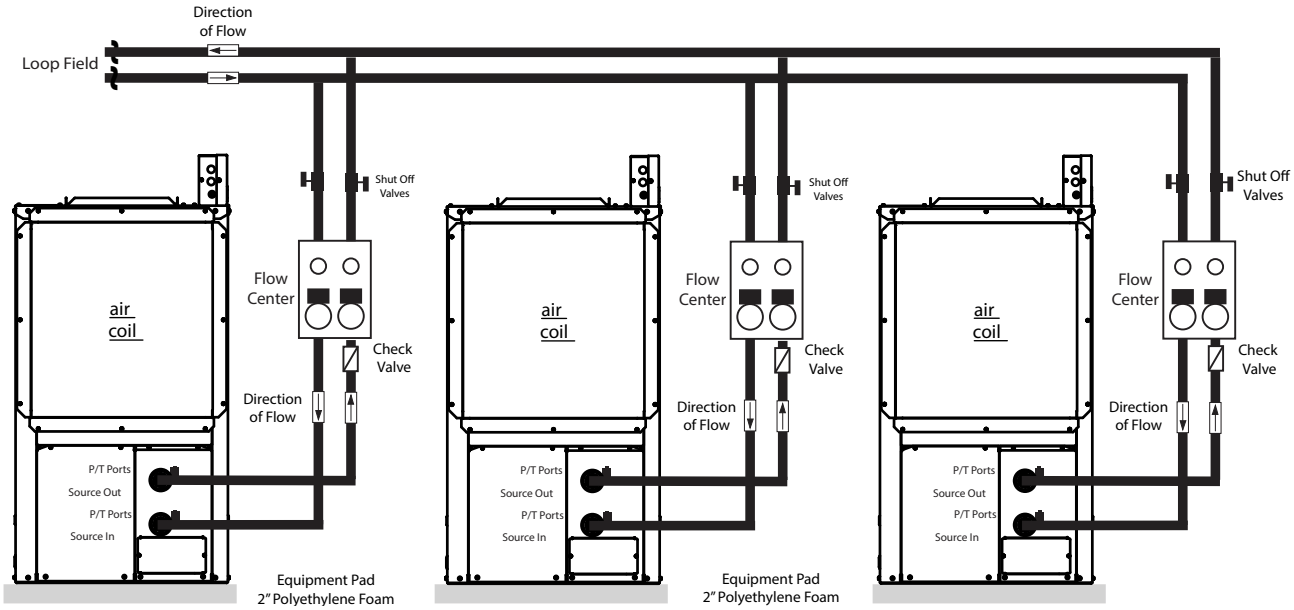
**Note:** All VT models are two-stage units.

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

**Single Shared Flow Center, Dual Unit Piping Example**




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



## Section 5: Unit Piping

### Flush Cart Design

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

### Removing Debris During Flushing

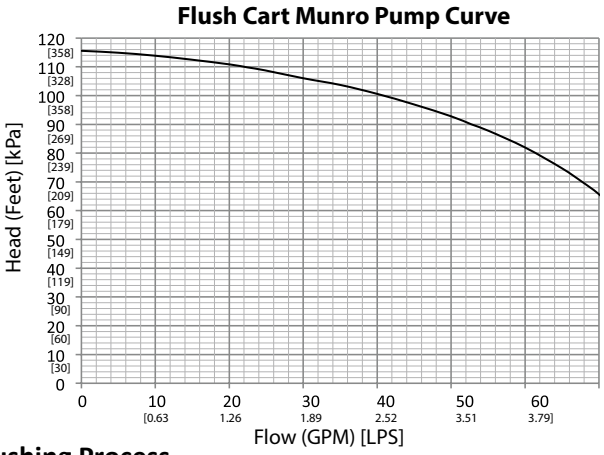
Most flow center or pump failures are a result of poor water quality or debris. Debris entering the loop during fusion and installation can cause noise and premature pump failure. Enertech recommends a double flush filtering method during purging. When purging, use a 100 micron bag filter until air bubbles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

### Features of the flush cart:

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

### Enertech Flush Cart


### Flush Cart Pump Curve

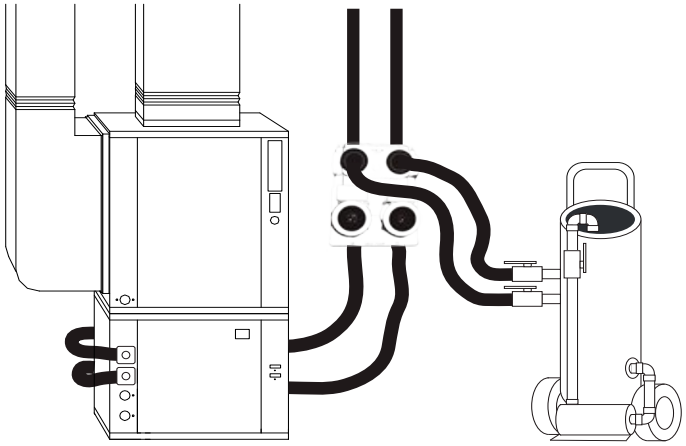



### Flushing Process

#### Step 1: Flushing the Earth Loop

1. Connect flush cart hoses to flow center flush ports using proper adapters #AGAFP.
2. Connect water supply to hose connection on return line of flush cart.
3. Turn both 3-way valves on flow center to flush ports and loop position.
4. Turn on water supply (make sure water is of proper quality).
5. 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.
6. Once the water level remains above the water outlet in the reservoir leave the pump running continuously.
7. Once the water level stays above the “T” in the reservoir, turn off the water supply (this also allows observation of air bubbles).
8. Run the pump for a minimum of 2 hours for proper flushing and purging (depending on system size it may take longer).
9. “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.
10. 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.

### Flush Cart Connections



## Section 5: Unit Piping

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

### Step 2: Flushing the Unit

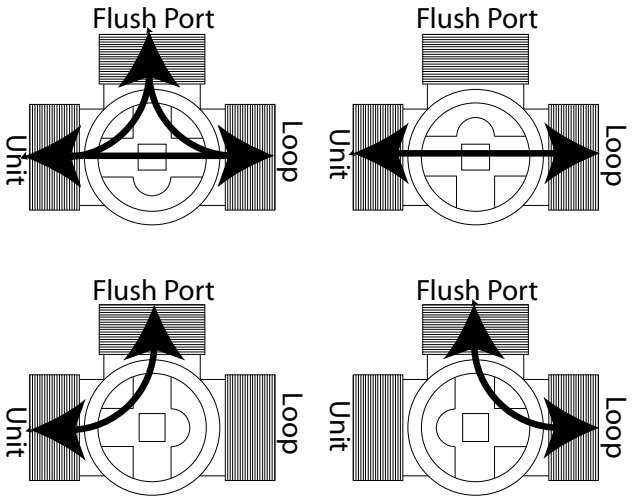
1. Turn off the pump on the flush cart.
2. Turn both 3-way valves to the unit and flush port position.
3. Turn the pump back on. It may be necessary to turn the water supply back on to keep the water level in the reservoir above the return tee.
4. This should only take 5 to 10 minutes to purge the unit.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

### Step 3: Adding Antifreeze by Displacement

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

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

**Flow Center 3-Way Valves**




### Step 4: Final Pressurization of System

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

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

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

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

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

## Section 6: Desuperheater Package

### Desuperheater Package

Water heating is standard on all residential units (units may be ordered without). It uses excess heat during both heating and cooling cycles, to provide hot water for domestic needs. A vented double wall desuperheater exchanger (coil) located between the compressor and the reversing valve, extracts superheated vapor to heat domestic water; still satisfying its heating and cooling needs. The water circulation pump comes pre-mounted in all residential units.

### Desuperheater Installation

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

**Notes:**

- ALL Enertech Global products meet the requirements of NSF-372 (Lead Free).
- Desuperheater capacity is based on 0.4 GPM Flow per nominal ton at 90°F entering hot water temperature.
- 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.

**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.

**⚠ WARNING ⚠**

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

**⚠ AVERTISSEMENT ⚠**

**POUR ÉVITER LES BLESSURES GRAVES, IL EST RECOMMANDÉ D'INSTALLER UN MITIGEUR ANTIBRÛLURES SUR LA CONDUITE D'ALIMENTATION EN EAU CHAUDE DANS LA MAISON. MÊME SI LA TEMPÉRATURE DU RÉSERVOIR D'EAU CHAUDE SEMBLE ÊTRE RÉGLÉE À UN NIVEAU RAISONNABLE, L'EAU CHAUDE DU DÉSURCHAUFFEUR POURRAIT FAIRE AUGMENTER CETTE TEMPÉRATURE À UN NIVEAU DANGEREUX.**

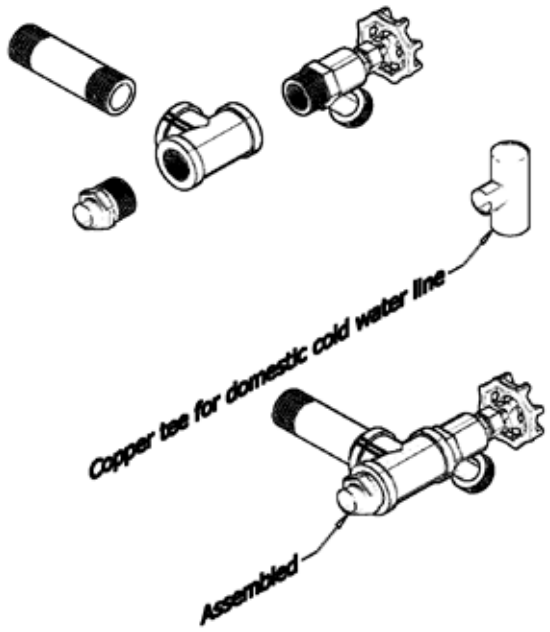
### Plumbing Installation

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

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 shut off when water begins to drip steadily from the vent.
18. Loosen the screw on the end of the despuerheater 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.

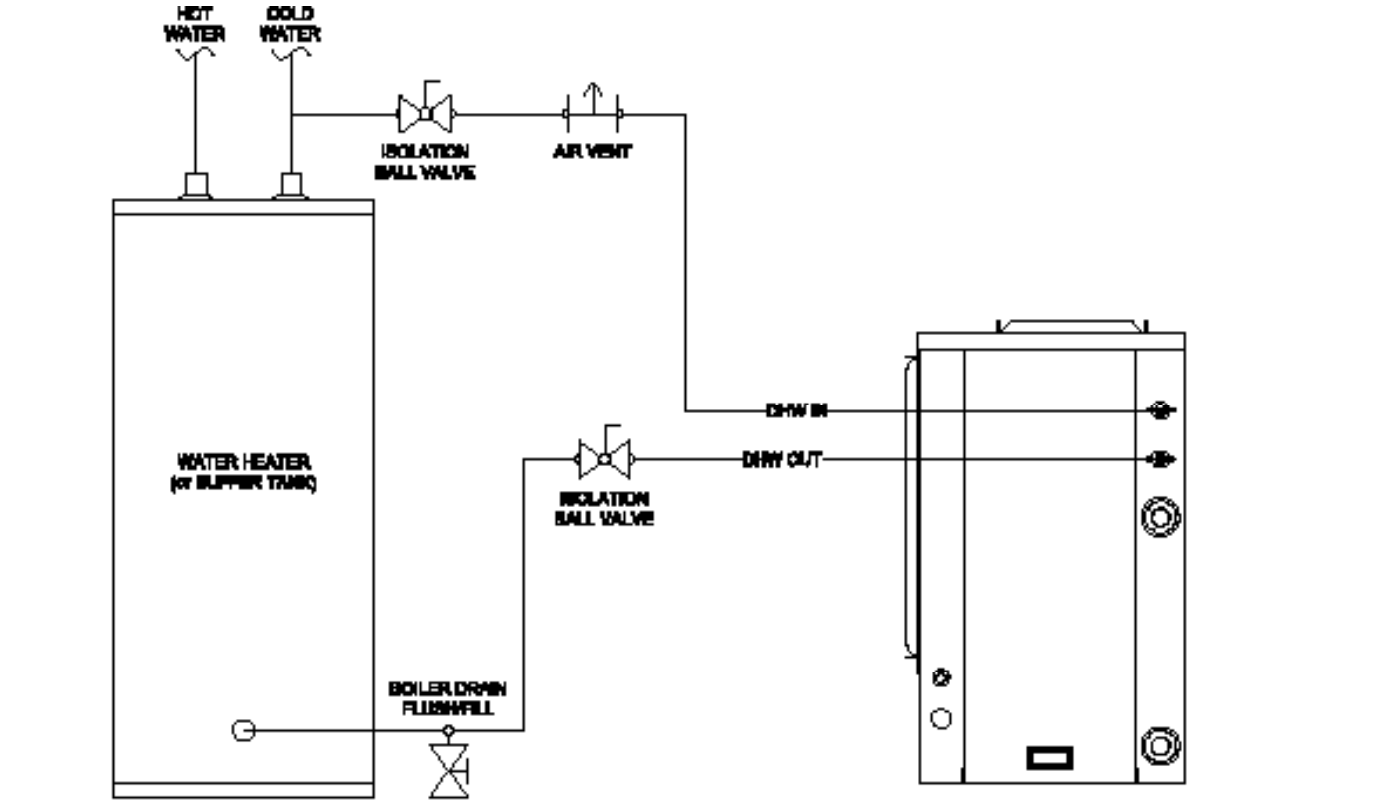
### Contents of the Desuperheater Fitting Kit

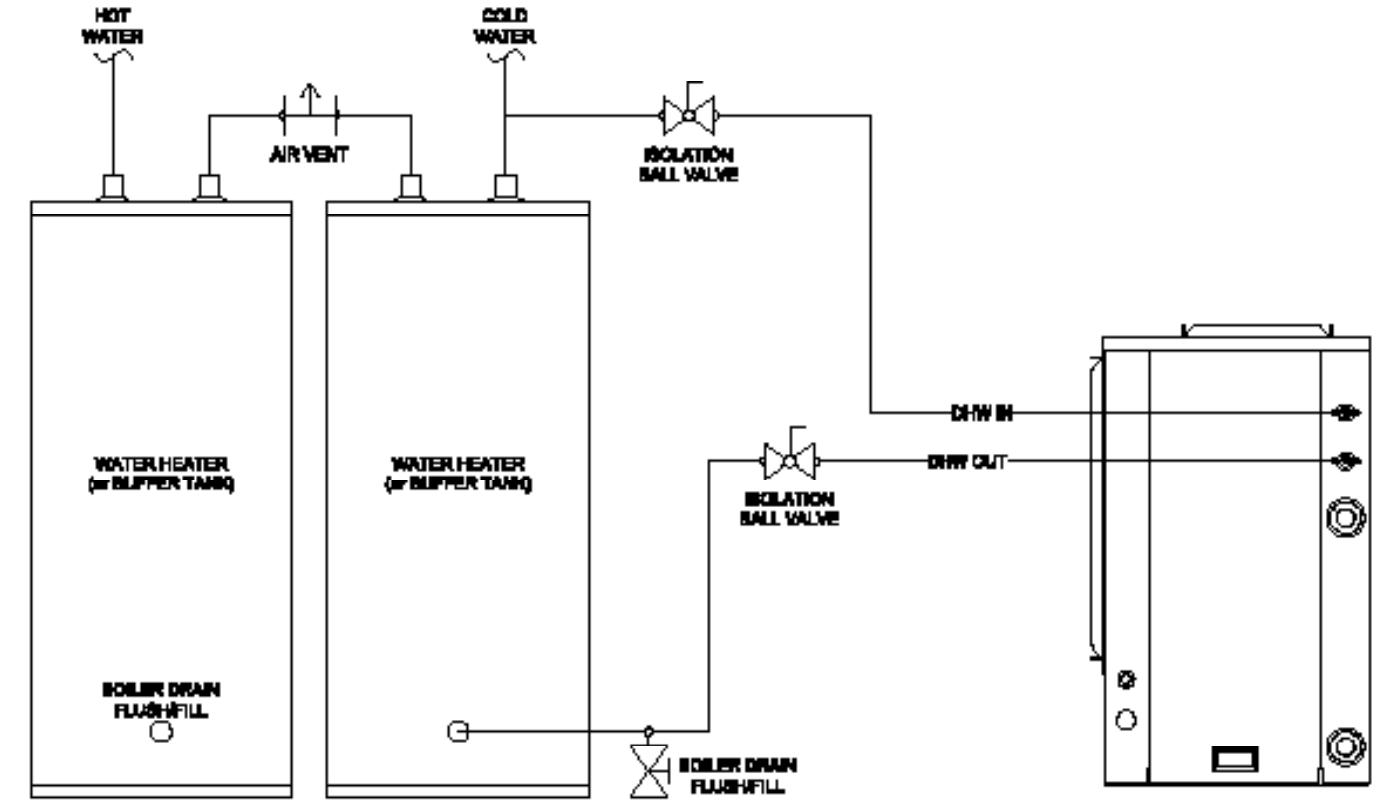
- (1) Installation Instructions
- (1) 3/4"x 3/4"x 3/4" FPT Brass Tee
- (1) ¾" Boiler Drain Valve
- (1) ¾" MPT x 3-1/2" Brass Nipple
- (3) ½" SWT x ¾" MPT Copper Adaptor
- (1) ¾" x ¾" x ½" SWT Copper Tee



## Section 6: Desuperheater Package

**Typical Desuperheater Installation Diagrams:**



## Section 7: Antifreeze

### Overview

In areas where minimum entering loop 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. 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 loop 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 Pipe Fluid Volume and Antifreeze Percentages by Volume Tables 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.

### 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, 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 is also 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.

**Ethylene Glycol:** Considered toxic and is not recommended for use in earth loop applications.

### Charging

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

**⚠ CAUTION ⚠**

**GROUND LOOPS AND/OR HYDRONIC LOOPS MUST BE ANTIFREEZE PROTECTED. HYDRONIC LOOP ANTIFREEZE MUST BE NON-FLAMMABLE. INSUFFICIENT AMOUNTS OF ANTIFREEZE MAY CAUSE SEVERE DAMAGE AND MAY VOID WARRANTY.**

**⚠ MISE EN GARDE ⚠**

**LES BOUCLES DE MASSE ET/OU LES BOUCLES HYDRONIQUES DOIVENT ÊTRE PROTÉGÉES CONTRE L'ANTIGEL. L'ANTIGEL POUR BOUCLES HYDRONIQUES DOIT ÊTRE ININFLAMMABLE. UNE QUANTITÉ INSUFFISANTE D'ANTIGEL PEUT CAUSER DE GRAVES DOMMAGES ET ANNULER LA GARANTIE.**

**Antifreeze Percentages by Volume Table**

| 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) |
| Propylene Glycol | 30% | 25% | *20% | *13% |
| Methanol | 21% | 17% | 13% | 5% |
| Ethanol | 26% | 23% | 18% | 13% |
| Heat Transfer Fluid (HTF) | Mix according to manufacturer's directions on container label | | | |

**Note:** 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 7: Antifreeze

| Pipe Fluid Volume Table | | |
|---|---|---|
| Type | Size | Volume Per 100ft US Gallons |
| Copper | 1” CTS | 4.1 |
| Copper | 1.25” CTS | 6.4 |
| Copper | 1.5” CTS | 9.2 |
| HDPE | .75” SDR11 | 3.0 |
| HDPE | 1” SDR11 | 4.7 |
| HDPE | 1.25” SDR11 | 7.5 |
| HDPE | 1.5” SDR11 | 9.8 |
| HDPE | 2” SDR11 | 15.4 |

**Notes:**
Unit coaxial heat exchanger = 1 Gallon
Flush Cart = 8-10 Gallons
10’ of 1” Rubber Hose = 0.4 Gallons

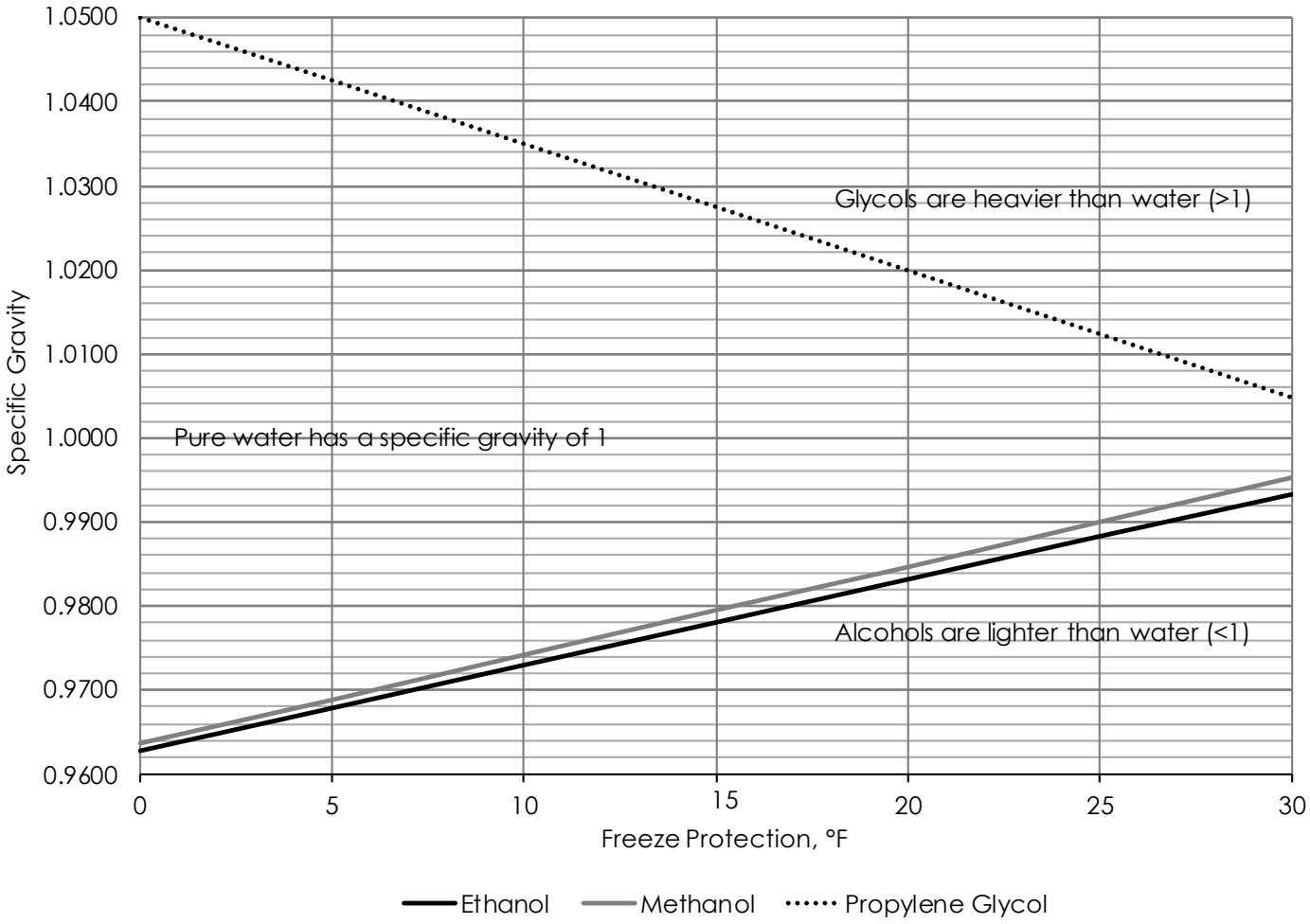
**⚠ WARNING ⚠**

**USE EXTREME CARE WHEN OPENING, POURING, AND MIXING FLAMMABLE ANTIFREEZE SOLUTIONS. REMOTE FLAMES OR ELECTRICAL SPARKS CAN IGNITE UNDILUTED ANTIFREEZES AND VAPORS. DO NOT SMOKE WHEN HANDLING FLAMMABLE SOLUTIONS AND USED ONLY IN A WELL VENTILATED AREA. FAILURE TO OBSERVE SAFETY PRECAUTIONS MAY RESULT IN FIRE, INJURY, OR DEATH. NEVER WORK WITH 100% ALCOHOL SOLUTIONS.**

**⚠ AVERTISSEMENT ⚠**

**FAIRE TRÈS ATTENTION LORS DE L’OUVERTURE, DU DÉVERSEMENT OU DU MÉLANGE DE SOLUTIONS ANTIGEL INFLAMMABLES. LES FLAMMES DISTANTES OU LES ÉTINCELLES ÉLECTRIQUES PEUVENT ENFLAMMER L’ANTIGEL NON DILUÉ OU LES VAPEURS. UTILISER UNIQUEMENT DANS UN ENDROIT BIEN VENTILÉ. NE PAS FUMER LORS DE LA MANIPULATION DES SOLUTIONS INFLAMMABLES. LE NON-RESPECT DES CONSIGNES DE SÉCURITÉ PEUT ENTRAÎNER UN INCENDIE, DES BLESSURES, VOIRE LA MORT. NE JAMAIS TRAVAILLER AVEC DES SOLUTIONS D’ALCOOL À 100 %.**

**Antifreeze Specific Gravity Table**




**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 ⚠**
**DO NOT START-UP THE UNIT UNTIL THE NEW STRUCTURE IS READY TO BE OCCUPIED.**

**⚠ MISE EN GARDE ⚠**
**NE PAS DÉMARRER L'APPAREIL AVANT QUE LA NOUVELLE STRUCTURE SOIT PRÊTE À ÊTRE OCCUPÉE.**

**⚠ CAUTION ⚠**
**CHECK THE FOLLOWING BEFORE POWER IS APPLIED TO THE EQUIPMENT.**

**⚠ MISE EN GARDE ⚠**
**VÉRIFIER LES POINTS SUIVANTS AVANT DE METTRE L'ÉQUIPEMENT SOUS TENSION.**

## Equipment Start-Up Checklist

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

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

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

**Equipment Start-Up:**

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

## Section 8: Equipment Start-Up

Equipment Start-Up Form

Customer Name: _____

Customer Address: _____

Model #: _____ Serial #: _____

Dealer Name: _____

Distributor Name: _____ Start-up Date: _____

| **Loop Type: Open / Closed** (circle one) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FLOW | COOLING | | HEATING | | | ELECTRICAL DATA | COOLING | | HEATING | |
| Source IN Water Pressure | | PSI | | PSI | | Line Voltage | | V | | |
| Source OUT Water Pressure | | 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** | COOLING | | HEATING | |
|---|---|---|---|---|
| Source IN Water Temp. | | °F | | °F |
| Source OUT Water Temp. | | °F | | °F |
| Source Water Temp. Diff. | | °F | | °F |

| **HE/HR** | COOLING | | HEATING | |
|---|---|---|---|---|
| Heat of Rejection | | BTU/HR | | |
| Heat of Extraction | | | | BTU/HR |
| Notes: HE/HR = GPM x Water Temp. Diff. x 500 (Water – Open Loop)<br>HE/HR = GPM x Water Temp. Diff. x 485 (Water/Antifreeze – Closed Loop) | | | | |

| **Load Water** | COOLING | | HEATING | |
|---|---|---|---|---|
| Load IN Water Temp. | | °F | | °F |
| Load OUT Water Temp. | | °F | | °F |
| Load Water Temp. Diff. | | °F | | °F |

| **Air Coil** | COOLING | | HEATING | |
|---|---|---|---|---|
| Supply Air Temp. | | °F | | °F |
| Return Air Temp. | | °F | | °F |
| Air Temp. Diff. | | °F | | °F |
| *Confirm auxiliary heat is de-energized for the above readings. | | | | |

| **Auxiliary Heat Operation** | HEATING | |
|---|---|---|
| Supply Air Temp. | | °F |
| Return Air Temp. | | °F |
| Air Temp. Diff. | | °F |

| **Auxiliary Heat Elec. Data** | HEATING | |
|---|---|---|
| Line Voltage | | V |
| Total AMPS (Full KW – All Stages) | | A |
| Wire Size | | GA |
| Breaker Size | | A |
| CFM = (Watts x 3.413) ÷ (Air Temp. Diff. x 1.08)<br>Watts = Volts x Auxiliary Heat AMPS | | |

Installer / Technician: _____ Date: _____

## 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)

## 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

2. **After information is recorded.**
   - Find corresponding entering water temperature column in the WPD Table
   - Find pressure differential in PSI column
   - Then read the GPM column to determine flow in GPM

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

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

## Section 8: Equipment Start-Up

### HE / HR Tables: VS

| 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 |
| VS009 | Full Load | 1.1 | 300/300 | 4.5 | 6.6 | 8.5 | 10.3 | 12.9 | 13.1 | 12.7 | 12.1 |
| | | 1.7 | | 4.9 | 7.1 | 9.1 | 11.0 | 13.0 | 13.1 | 12.7 | 12.0 |
| | | 2.3 | | 5.1 | 7.4 | 9.5 | 11.4 | 12.9 | 13.0 | 12.6 | 11.9 |
| | | 3 | | 5.2 | 7.6 | 9.7 | 11.7 | 12.9 | 13.0 | 12.5 | 11.8 |
| VS012 | Full Load | 1.5 | 350/350 | 6.0 | 8.9 | 11.5 | 14.6 | 17.4 | 16.8 | 16.1 | 15.4 |
| | | 2.3 | | 6.4 | 9.4 | 12.1 | 15.4 | 17.5 | 16.8 | 16.1 | 15.3 |
| | | 3 | | 6.6 | 9.7 | 12.5 | 15.8 | 17.6 | 16.8 | 16.1 | 15.3 |
| | | 4 | | 6.7 | 9.9 | 12.7 | 16.2 | 17.5 | 16.8 | 16.0 | 15.2 |
| VS015 | Full Load | 1.9 | 590/610 | 7.8 | 11.0 | 14.7 | 18.5 | 21.4 | 20.5 | 19.2 | 17.9 |
| | | 2.8 | | 8.3 | 11.7 | 15.6 | 19.6 | 21.6 | 20.5 | 19.2 | 17.8 |
| | | 3.8 | | 8.5 | 11.9 | 15.9 | 20.0 | 21.7 | 20.6 | 19.2 | 17.7 |
| | | 5 | | 8.9 | 12.4 | 16.5 | 20.8 | 21.7 | 20.6 | 19.2 | 17.6 |
| VS018 | Full Load | 2.3 | 710/740 | 10.9 | 15.0 | 19.4 | 24.2 | 27.9 | 27.2 | 26.3 | 25.3 |
| | | 3.4 | | 11.6 | 16.0 | 20.6 | 25.8 | 27.9 | 27.1 | 26.1 | 25.0 |
| | | 4.5 | | 12.1 | 16.5 | 21.3 | 26.6 | 27.9 | 27.1 | 26.0 | 24.8 |
| | | 6 | | 12.4 | 16.9 | 21.8 | 27.2 | 27.9 | 27.0 | 25.8 | 24.6 |

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

## Section 8: Equipment Start-Up

### HE / HR Tables: VT

| 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 | 680/700 | 8.7 | 12.6 | 17.0 | 21.6 | 24.8 | 24.0 | 23.5 | 22.5 |
| | | 3 | | 9.4 | 13.4 | 18.1 | 22.9 | 25.2 | 24.2 | 23.5 | 22.3 |
| | | 4 | | 9.8 | 13.9 | 18.8 | 23.7 | 25.1 | 24.1 | 23.3 | 22.0 |
| | | 5.3 | | 10.1 | 14.3 | 19.3 | 24.3 | 25.3 | 24.2 | 23.3 | 21.9 |
| | Full Load | 3 | 810/850 | 13.2 | 18.1 | 23.4 | 29.2 | 34.5 | 33.5 | 32.6 | 31.4 |
| | | 4.5 | | 13.9 | 19.0 | 24.6 | 30.7 | 34.8 | 33.7 | 32.6 | 31.2 |
| | | 6 | | 14.3 | 19.6 | 25.3 | 31.5 | 34.7 | 33.6 | 32.4 | 31.0 |
| | | 8 | | 14.5 | 19.8 | 25.7 | 32.0 | 34.7 | 33.6 | 32.4 | 30.8 |
| VT030 | Part Load | 2.5 | 740/760 | 11.2 | 16.0 | 21.0 | 25.9 | 30.7 | 29.8 | 29.1 | 28.2 |
| | | 3.8 | | 12.1 | 17.2 | 22.5 | 27.7 | 31.0 | 30.0 | 29.1 | 27.9 |
| | | 5 | | 12.6 | 17.9 | 23.3 | 28.8 | 31.0 | 29.9 | 28.9 | 27.6 |
| | | 6.7 | | 12.9 | 18.2 | 23.8 | 29.3 | 31.1 | 29.9 | 28.9 | 27.5 |
| | Full Load | 3.8 | 960/1000 | 17.1 | 23.3 | 29.8 | 36.4 | 42.4 | 41.5 | 40.2 | 38.7 |
| | | 5.6 | | 18.1 | 24.6 | 31.5 | 38.5 | 42.6 | 41.6 | 40.2 | 38.5 |
| | | 7.5 | | 18.6 | 25.3 | 32.3 | 39.5 | 42.7 | 41.6 | 40.1 | 38.4 |
| | | 10 | | 19.2 | 26.0 | 33.3 | 40.6 | 42.7 | 41.6 | 40.0 | 38.2 |
| VT036 | Part Load | 3 | 830/850 | 13.9 | 19.9 | 25.4 | 32.0 | 37.0 | 36.2 | 35.1 | 34.1 |
| | | 4.5 | | 15.0 | 21.4 | 27.2 | 34.2 | 37.2 | 36.2 | 34.9 | 33.5 |
| | | 6 | | 15.6 | 22.2 | 28.2 | 35.5 | 37.4 | 36.3 | 34.9 | 33.3 |
| | | 8 | | 16.0 | 22.8 | 28.9 | 36.3 | 37.1 | 35.9 | 34.5 | 32.9 |
| | Full Load | 4.5 | 1210/1130 | 20.9 | 29.0 | 36.2 | 45.3 | 51.1 | 49.8 | 48.3 | 46.9 |
| | | 6.8 | | 22.2 | 30.7 | 38.3 | 47.9 | 51.0 | 49.6 | 48.0 | 46.3 |
| | | 9 | | 23.1 | 31.9 | 39.8 | 49.7 | 51.2 | 49.7 | 47.9 | 46.1 |
| | | 12 | | 23.8 | 32.8 | 40.9 | 51.0 | 51.2 | 49.6 | 47.8 | 45.9 |
| VT042 | Part Load | 3.5 | 1160/1180 | 15.8 | 22.8 | 30.3 | 37.4 | 43.6 | 42.3 | 41.1 | 39.5 |
| | | 5.3 | | 17.0 | 24.5 | 32.4 | 39.9 | 43.8 | 42.4 | 40.9 | 39.0 |
| | | 7 | | 17.8 | 25.5 | 33.7 | 41.4 | 44.0 | 42.5 | 40.9 | 38.7 |
| | | 9.3 | | 18.3 | 26.2 | 34.6 | 42.5 | 44.1 | 42.4 | 40.8 | 38.5 |
| | Full Load | 5.3 | 1360/1440 | 23.5 | 32.2 | 41.6 | 49.7 | 59.5 | 58.2 | 56.7 | 55.3 |
| | | 7.9 | | 24.9 | 34.0 | 44.0 | 52.5 | 59.5 | 58.1 | 56.4 | 54.8 |
| | | 10.5 | | 25.6 | 35.0 | 45.2 | 53.9 | 59.5 | 58.0 | 56.2 | 54.5 |
| | | 14 | | 26.3 | 35.9 | 46.3 | 55.2 | 59.5 | 58.0 | 56.1 | 54.4 |
| VT048 | Part Load | 4 | 1360/1380 | 16.9 | 25.2 | 33.4 | 42.4 | 45.2 | 43.6 | 42.1 | 39.7 |
| | | 6 | | 18.2 | 26.9 | 35.5 | 45.0 | 45.6 | 43.8 | 42.0 | 39.2 |
| | | 8 | | 18.9 | 27.9 | 36.8 | 46.6 | 45.7 | 43.8 | 41.9 | 39.0 |
| | | 10.7 | | 19.4 | 28.6 | 37.7 | 47.7 | 45.9 | 43.9 | 41.9 | 38.8 |
| | Full Load | 6 | 1640/1720 | 26.2 | 36.5 | 47.1 | 57.0 | 64.2 | 62.2 | 60.8 | 59.3 |
| | | 9 | | 27.7 | 38.5 | 49.6 | 60.1 | 64.3 | 62.2 | 60.6 | 58.8 |
| | | 12 | | 28.8 | 40.0 | 51.5 | 62.3 | 64.0 | 61.8 | 60.2 | 58.3 |
| | | 16 | | 29.5 | 40.8 | 52.5 | 63.5 | 64.3 | 62.1 | 60.3 | 58.3 |
| VT060 | Part Load | 5 | 1630/1590 | 22.2 | 31.6 | 42.7 | 52.9 | 56.8 | 55.1 | 53.5 | 51.9 |
| | | 7.5 | | 23.8 | 33.8 | 45.4 | 56.2 | 57.6 | 55.6 | 53.7 | 51.7 |
| | | 10 | | 24.8 | 35.1 | 47.1 | 58.2 | 57.9 | 55.7 | 53.7 | 51.4 |
| | | 13.3 | | 25.5 | 36.0 | 48.3 | 59.7 | 58.1 | 55.9 | 53.7 | 51.3 |
| | Full Load | 7.5 | 1900/1910 | 33.5 | 46.2 | 58.1 | 71.7 | 79.6 | 78.3 | 76.6 | 74.5 |
| | | 11.3 | | 35.4 | 48.7 | 61.2 | 75.6 | 79.7 | 78.2 | 76.3 | 74.0 |
| | | 15 | | 36.3 | 49.8 | 62.6 | 77.2 | 79.7 | 78.1 | 76.1 | 73.6 |
| | | 20 | | 37.5 | 51.4 | 64.5 | 79.6 | 79.8 | 78.2 | 76.1 | 73.5 |
| VT072 | Part Load | 6 | 1890/1830 | 25.1 | 37.1 | 49.0 | 60.4 | 68.8 | 66.7 | 65.0 | 62.2 |
| | | 9 | | 26.9 | 39.5 | 52.0 | 64.0 | 69.0 | 66.7 | 64.6 | 61.4 |
| | | 12 | | 27.9 | 40.8 | 53.7 | 66.0 | 69.1 | 66.6 | 64.4 | 61.0 |
| | | 16 | | 28.8 | 42.1 | 55.3 | 67.9 | 69.2 | 66.6 | 64.3 | 60.7 |
| | Full Load | 9 | 2230/2230 | 36.4 | 50.2 | 63.5 | 76.1 | 91.2 | 90.2 | 87.7 | 86.1 |
| | | 13.5 | | 38.4 | 52.8 | 66.8 | 79.9 | 91.4 | 90.2 | 87.5 | 85.5 |
| | | 18 | | 40.7 | 55.8 | 70.5 | 84.4 | 91.0 | 89.7 | 87.0 | 84.8 |
| | | 24 | | 40.6 | 55.7 | 70.4 | 84.2 | 91.4 | 90.0 | 87.1 | 84.9 |

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

## Section 8: Equipment Start-Up

### WPD Tables: VS

| Model | | GPM | Source Brine Pressure DropTemperatures | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 30 °F | | 50 °F | | 70 °F | | 90 °F | | 110 °F | |
| | | | PSI | FT HD | PSI | FT HD | PSI | FT HD | PSI | FT HD | PSI | FT HD |
| VS009 | Full Load | 1.1 | 1.6 | 3.6 | 1.4 | 3.3 | 1.3 | 3.0 | 1.2 | 2.8 | 1.2 | 2.7 |
| | | 1.7 | 2.2 | 5.1 | 2.0 | 4.5 | 1.8 | 4.2 | 1.7 | 3.9 | 1.6 | 3.6 |
| | | 2.3 | 2.9 | 6.8 | 2.6 | 6.0 | 2.4 | 5.5 | 2.2 | 5.2 | 2.1 | 4.8 |
| | | 3 | 4.0 | 9.1 | 3.5 | 8.0 | 3.2 | 7.4 | 3.0 | 6.9 | 2.8 | 6.4 |
| VS012 | Full Load | 1.5 | 2.0 | 4.7 | 1.7 | 4.0 | 1.6 | 3.6 | 1.4 | 3.3 | 1.3 | 3.0 |
| | | 2.3 | 3.2 | 7.4 | 2.7 | 6.3 | 2.5 | 5.7 | 2.3 | 5.2 | 2.0 | 4.7 |
| | | 3 | 4.5 | 10.3 | 3.8 | 8.8 | 3.4 | 7.9 | 3.1 | 7.2 | 2.8 | 6.5 |
| | | 4 | 6.5 | 15.1 | 5.6 | 12.9 | 5.0 | 11.6 | 4.6 | 10.6 | 4.2 | 9.6 |
| VS015 | Full Load | 1.9 | 1.2 | 2.8 | 1.0 | 2.4 | 0.9 | 2.1 | 0.8 | 1.9 | 0.7 | 1.7 |
| | | 2.8 | 1.6 | 3.7 | 1.4 | 3.3 | 1.3 | 2.9 | 1.1 | 2.6 | 1.0 | 2.4 |
| | | 3.8 | 2.3 | 5.2 | 1.9 | 4.4 | 1.7 | 3.9 | 1.5 | 3.6 | 1.4 | 3.2 |
| | | 5 | 3.1 | 7.1 | 2.6 | 6.1 | 2.3 | 5.4 | 2.1 | 4.9 | 1.9 | 4.3 |
| VS018 | Full Load | 2.3 | 1.9 | 4.3 | 1.6 | 3.8 | 1.5 | 3.4 | 1.4 | 3.1 | 1.3 | 2.9 |
| | | 3.4 | 2.5 | 5.7 | 2.1 | 4.9 | 1.9 | 4.5 | 1.8 | 4.1 | 1.6 | 3.8 |
| | | 4.5 | 3.2 | 7.3 | 2.7 | 6.2 | 2.5 | 5.7 | 2.3 | 5.2 | 2.1 | 4.7 |
| | | 6 | 4.3 | 9.8 | 3.6 | 8.3 | 3.3 | 7.6 | 3.0 | 7.0 | 2.7 | 6.3 |

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

## Section 8: Equipment Start-Up

### WPD Tables: VT

| Model | | GPM | Source Brine Pressure DropTemperatures | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 30 °F | | 50 °F | | 70 °F | | 90 °F | | 110 °F | |
| | | | PSI | FT HD | PSI | FT HD | PSI | FT HD | PSI | FT HD | PSI | FT HD |
| VT024 | Part Load | 2 | 1.8 | 4.1 | 1.6 | 3.7 | 1.5 | 3.4 | 1.4 | 3.2 | 1.3 | 3.0 |
| | | 3 | 2.3 | 5.4 | 2.1 | 4.8 | 1.9 | 4.4 | 1.8 | 4.1 | 1.7 | 3.9 |
| | | 4 | 3.0 | 6.9 | 2.6 | 6.0 | 2.4 | 5.6 | 2.2 | 5.2 | 2.1 | 4.8 |
| | | 5.3 | 4.0 | 9.2 | 3.5 | 8.1 | 3.2 | 7.3 | 3.0 | 6.8 | 2.7 | 6.2 |
| | Full Load | 3 | 2.4 | 5.6 | 2.1 | 4.8 | 1.9 | 4.3 | 1.7 | 4.0 | 1.6 | 3.6 |
| | | 4.5 | 3.5 | 8.1 | 2.9 | 6.8 | 2.6 | 6.1 | 2.4 | 5.6 | 2.2 | 5.0 |
| | | 6 | 4.7 | 10.9 | 4.0 | 9.2 | 3.6 | 8.2 | 3.3 | 7.5 | 2.9 | 6.8 |
| | | 8 | 6.6 | 15.3 | 5.5 | 12.8 | 5.0 | 11.5 | 4.6 | 10.5 | 4.1 | 9.4 |
| VT030 | Part Load | 2.5 | 1.6 | 3.7 | 1.5 | 3.5 | 1.4 | 3.3 | 1.4 | 3.2 | 1.3 | 3.1 |
| | | 3.8 | 2.1 | 4.8 | 1.9 | 4.4 | 1.8 | 4.2 | 1.7 | 4.0 | 1.7 | 3.8 |
| | | 5 | 2.6 | 5.9 | 2.3 | 5.4 | 2.2 | 5.1 | 2.1 | 4.9 | 2.0 | 4.5 |
| | | 6.7 | 3.4 | 7.9 | 3.2 | 7.3 | 2.9 | 6.7 | 2.8 | 6.4 | 2.6 | 5.9 |
| | Full Load | 3.8 | 2.1 | 4.9 | 1.9 | 4.4 | 1.7 | 4.0 | 1.6 | 3.7 | 1.6 | 3.6 |
| | | 5.6 | 3.0 | 6.9 | 2.7 | 6.1 | 2.4 | 5.5 | 2.2 | 5.2 | 2.1 | 4.9 |
| | | 7.5 | 4.1 | 9.4 | 3.5 | 8.1 | 3.2 | 7.4 | 3.0 | 6.8 | 2.8 | 6.3 |
| | | 10 | 5.7 | 13.2 | 4.9 | 11.3 | 4.4 | 10.2 | 4.1 | 9.5 | 3.8 | 8.7 |
| VT036 | Part Load | 3 | 1.8 | 4.2 | 1.7 | 3.9 | 1.6 | 3.6 | 1.5 | 3.4 | 1.4 | 3.3 |
| | | 4.5 | 2.4 | 5.6 | 2.2 | 5.1 | 2.0 | 4.7 | 1.9 | 4.5 | 1.8 | 4.2 |
| | | 6 | 3.1 | 7.2 | 2.8 | 6.5 | 2.6 | 6.0 | 2.5 | 5.7 | 2.3 | 5.3 |
| | | 8 | 4.2 | 9.7 | 3.8 | 8.8 | 3.5 | 8.1 | 3.3 | 7.6 | 3.0 | 7.0 |
| | Full Load | 4.5 | 2.5 | 5.7 | 2.2 | 5.1 | 2.0 | 4.7 | 1.9 | 4.3 | 1.8 | 4.1 |
| | | 6.8 | 3.7 | 8.5 | 3.2 | 7.5 | 2.9 | 6.8 | 2.7 | 6.2 | 2.5 | 5.8 |
| | | 9 | 5.0 | 11.6 | 4.4 | 10.1 | 4.0 | 9.2 | 3.6 | 8.4 | 3.4 | 7.7 |
| | | 12 | 7.2 | 16.5 | 6.2 | 14.3 | 5.6 | 13.0 | 5.2 | 11.9 | 4.7 | 10.9 |
| VT042 | Part Load | 3.5 | 0.4 | 0.8 | 0.3 | 0.7 | 0.3 | 0.6 | 0.2 | 0.5 | 0.2 | 0.4 |
| | | 5.3 | 1.3 | 3.1 | 1.1 | 2.4 | 0.9 | 2.1 | 0.8 | 1.8 | 0.7 | 1.5 |
| | | 7 | 2.5 | 5.7 | 2.0 | 4.5 | 1.7 | 3.9 | 1.4 | 3.3 | 1.2 | 2.8 |
| | | 9.3 | 4.3 | 9.9 | 3.5 | 8.2 | 2.9 | 6.7 | 2.5 | 5.7 | 2.1 | 4.9 |
| | Full Load | 5.3 | 1.3 | 3.0 | 1.0 | 2.4 | 0.9 | 2.1 | 0.8 | 1.8 | 0.7 | 1.6 |
| | | 7.9 | 3.1 | 7.2 | 2.4 | 5.6 | 2.1 | 4.9 | 1.9 | 4.4 | 1.7 | 3.8 |
| | | 10.5 | 5.3 | 12.2 | 4.2 | 9.7 | 3.7 | 8.5 | 3.3 | 7.5 | 2.9 | 6.8 |
| | | 14 | 8.7 | 20.1 | 7.0 | 16.2 | 6.2 | 14.2 | 5.4 | 12.5 | 5.0 | 11.4 |
| VT048 | Part Load | 4 | 0.9 | 2.0 | 0.7 | 1.6 | 0.6 | 1.3 | 0.5 | 1.1 | 0.4 | 0.9 |
| | | 6 | 2.0 | 4.7 | 1.6 | 3.8 | 1.4 | 3.2 | 1.2 | 2.7 | 1.0 | 2.3 |
| | | 8 | 3.5 | 8.0 | 2.8 | 6.6 | 2.4 | 5.5 | 2.1 | 4.8 | 1.8 | 4.1 |
| | | 10.7 | 5.6 | 13.0 | 5.0 | 11.5 | 4.0 | 9.2 | 3.5 | 8.0 | 3.1 | 7.1 |
| | Full Load | 6 | 2.0 | 4.7 | 1.6 | 3.7 | 1.4 | 3.2 | 1.2 | 2.8 | 1.0 | 2.4 |
| | | 9 | 4.3 | 10.0 | 3.5 | 8.0 | 3.0 | 7.0 | 2.7 | 6.2 | 2.4 | 5.4 |
| | | 12 | 7.1 | 16.3 | 5.8 | 13.3 | 5.0 | 11.6 | 4.5 | 10.3 | 3.9 | 9.1 |
| | | 16 | 11.4 | 26.3 | 9.4 | 21.7 | 8.2 | 18.9 | 7.3 | 16.9 | 6.6 | 15.2 |
| VT060 | Part Load | 5 | 1.2 | 2.7 | 0.9 | 2.2 | 0.8 | 1.9 | 0.7 | 1.6 | 0.6 | 1.3 |
| | | 7.5 | 2.8 | 6.4 | 2.2 | 5.2 | 1.9 | 4.5 | 1.7 | 3.9 | 1.4 | 3.3 |
| | | 10 | 4.7 | 10.8 | 3.8 | 8.8 | 3.3 | 7.6 | 2.9 | 6.6 | 2.5 | 5.7 |
| | | 13.3 | 7.7 | 17.8 | 6.6 | 15.3 | 5.5 | 12.7 | 4.8 | 11.1 | 4.2 | 9.6 |
| | Full Load | 7.5 | 2.8 | 6.5 | 2.2 | 5.1 | 2.0 | 4.5 | 1.7 | 4.0 | 1.5 | 3.4 |
| | | 11.3 | 5.9 | 13.5 | 4.8 | 11.0 | 4.2 | 9.7 | 3.8 | 8.7 | 3.3 | 7.7 |
| | | 15 | 9.5 | 21.9 | 7.8 | 18.0 | 6.9 | 15.8 | 6.2 | 14.2 | 5.5 | 12.7 |
| | | 20 | 15.3 | 35.3 | 12.8 | 29.5 | 11.3 | 26.0 | 10.1 | 23.4 | 9.2 | 21.3 |
| VT072 | Part Load | 6 | 1.6 | 3.6 | 1.2 | 2.8 | 1.0 | 2.4 | 0.9 | 2.1 | 0.7 | 1.7 |
| | | 9 | 3.6 | 8.3 | 2.9 | 6.7 | 2.5 | 5.8 | 2.2 | 5.2 | 1.9 | 4.4 |
| | | 12 | 6.1 | 14.1 | 5.0 | 11.5 | 4.3 | 10.0 | 3.8 | 8.8 | 3.3 | 7.6 |
| | | 16 | 9.9 | 22.9 | 8.7 | 20.0 | 7.2 | 16.6 | 6.4 | 14.7 | 5.7 | 13.1 |
| | Full Load | 9 | 3.7 | 8.6 | 2.9 | 6.7 | 2.6 | 5.9 | 2.3 | 5.4 | 2.0 | 4.6 |
| | | 13.5 | 7.6 | 17.5 | 6.2 | 14.2 | 5.4 | 12.5 | 4.9 | 11.4 | 4.3 | 10.0 |
| | | 18 | 12.3 | 28.4 | 10.2 | 23.5 | 9.0 | 20.7 | 8.2 | 18.8 | 7.3 | 16.9 |
| | | 24 | 19.9 | 45.9 | 16.7 | 38.5 | 14.7 | 33.9 | 13.4 | 30.8 | 12.2 | 28.1 |

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

## A2L Servicing Requirements

Technicians must be qualified for the work being performed. The use of A2L refrigerants requires careful consideration to the safety of the technician and others in the vicinity. Examples of service activities requiring increased qualifications include breaking into the refrigerant circuit, opening of sealed components, opening of ventilated enclosures. As such, it is recommended to have the EPA 608 Type I & II cetification from an accredited institution.

**Note:** This unit is equipped with electrically powered safety measures. To be effective, the unit must be electrically powered at all times after installation, unless servicing.

**⚠ WARNING ⚠**

**DO NOT USE MEANS TO ACCELERATE THE DEFROSTING PROCESS OR TO CLEAN, OTHER THAN THOSE RECOMMENDED BY THE MANUFACTURER.**

**THE APPLIANCE SHALL BE STORED IN A ROOM WITHOUT CONTINUOUSLY OPERATING IGNITION SOURCES. (FOR EXAMPLE: OPEN FLAMES, AN OPERATING GAS APPLIANCE OR AND OPERATING ELECTRIC HEATER)**

**DO NOT PIERCE OR BURN**

**BE AWARE THAT REFRIGERANTS MAY NOT CONTAIN AN ODOR.**

**⚠ AVERTISSEMENT ⚠**

**NE PAS RECOURIR À D'AUTRES MOYENS POUR ACCÉLÉRER LE PROCESSUS DE DÉGIVRAGE OU LE NETTOYAGE, À L'EXCEPTION DE CEUX RECOMMANDÉES PAR LE FABRICANT.**

**ENTREPOSER L'APPAREIL DANS UNE PIÈCE OÙ IL N'Y A AUCUNE SOURCE D'INFLAMMATION EN FONCTIONNEMENT CONTINU. (PAR EXEMPLE : FLAMMES NUES, APPAREIL À GAZ EN FONCTIONNEMENT OU APPAREIL DE CHAUFFAGE ÉLECTRIQUE EN FONCTIONNEMENT)**

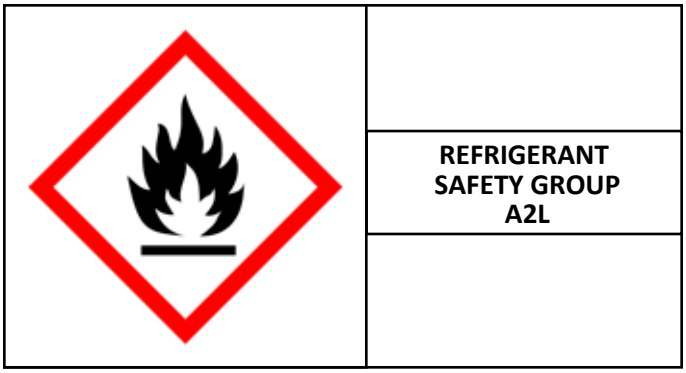
**NE PAS PERCER NI BRÛLER.**

**À NOTER QUE LES FRIGORIGÈNES PEUVENT NE PAS AVOIR D'ODEUR.**

## Safety Checks

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure the risk of ignition is minimized. For repair to the refrigerating system, work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed. No person carrying out work in relation to a refrigerating system which involves exposing any pipe work shall use any sources of ignition in such a manner leading to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, during repairing, removing, disposal and any other times which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure no flammable hazards or ignition risks are present. Smoking is bad for your health and the health of those around you. "No smoking" signs shall be displayed.

Work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed. Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.




All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.

The area shall be checked with a refrigerant detector compatible for detection of A2L refrigerants, prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.

## Leak Checks

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used. The following leak detection methods are deemed acceptable for all refrigerant systems.

**Electronic leak detectors** - These may be used to detect refrigerant leaks. For electronic detectors used for flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free-area.) Ensure the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.

**Leak detection fluids** - These are suitable for use with most refrigerants, but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

Leak detection fluid examples:

- bubble method
- fluorescent method agents.

If a leak is suspected, all naked flames shall be removed or extinguished.

If leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Recovery of refrigerant shall be carried out according to the Decommissioning section of this manual.

### Refrigeration Components

Where refrigeration components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines shall be followed. If in doubt, consult the manufacturers technical department for assistance. The following checks apply to installations using flammable refrigerants:

- The ventilation machinery and outlets are operating adequately and are not obstructed;
- The actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed;
- If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant;
- Marking to the equipment continues to be visible and legible. Illegible marking and signs shall be corrected.
- Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being corroded.

### Electrical Components

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists compromising the technicians safety, no electrical supply shall be connected to the circuit until the fault is satisfactorily repaired. Initial safety checks shall include:

- Discharging of the capacitors with main power verified to be de-energized. Discharging shall be done in a safe manner to avoid a possibility of sparking. Use insulated clips and a 5 W 20 kohm resistor to short across the capacitor terminals. Verify voltage drops to 0V.
- Ensure no live electrical components and wiring are exposed while charging, recovering, or purging the system.
- Check for the presence of continuity to earth bonding.

Check to make sure cabling will not be subject to wear, corrosion, excessive pressure, excessive vibration, sharp edges or any other adverse environmental conditions. During the check take into account effects of aging or continual vibration from sources such as compressors or fans. Sealed electrical components and intrinsically safe components shall be replaced and shall not be repaired.

### Removal/Evacuation

When breaking into the refrigerant circuit to make repairs, or for any other purpose, conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

- safely remove refrigerant following location and national regulations

1. evacuate
2. purge the circuit with inert gas (optional for A2L)
3. evacuate (optional for A2L)
4. continuously flush or purge with inert gas when using flame to open circuit
5. open the circuit.

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging the refrigerant systems.

For appliances containing flammable refrigerants, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process shall be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

### Charging

In addition to conventional charging procedures, the following requirements shall be followed:

- Ensure cross contamination of different refrigerants does not occur when using charging equipment.
- Hoses or lines shall be as short as possible to minimize the amount of refrigerant in each hose.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Refrigeration system must be earth grounded prior to charging the system with refrigerant.
- Label the total charge on the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigeration system.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas (inert nitrogen). The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site. See the proper procedures under the leak checks section in this section of the manual.

| Refrigeration Troubleshooting Table | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 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 |

| 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.<br>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.<br>Faulty Thermostat (Replace). |

| | |
|---|---|
| **E: NOISY BLOWER AND LOW AIR FLOW** | |
| Noisy Blower | Blower wheel contacting housing—Readjust, Foreign material inside housing—Clean housing.<br>Loose duct work—Secure properly. |
| Low air flow | Check speed setting, check nameplate or data manual for proper speed, and correct speed setting.<br>Check for dirty air filter—Clean or replace; obstruction in system—Visually check.<br>Balancing dampers closed, registers closed, leaks in ductwork. Repair.<br>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.<br>Check for dirty air filter—Clean or replace.<br>Restricted or leaky ductwork. Repair. |
| Refrigerant charge | Refrigerant charge low, causing inefficient operation. Make adjustments only after airflow and water flow are checked. |
| Reversing valve | Defective reversing valve can create bypass of refrigerant to suction side of compressor. Switch reversing valve to heating and cooling mode rapidly. If problem is not resolved, replace valve. Wrap the valve with a wet cloth and direct the heat away from the valve. Excessive heat can damage the valve. Always use dry nitrogen when brazing. Replace filter/drier any time the circuit is opened. |
| Heat pump will not cool but will heat. Heat pump will not heat but will cool. | Reversing valve does not shift. Check reversing valve wiring. If wired wrong, correct wiring. If reversing valve is stuck, replace valve. Wrap the valve with a wet cloth and direct the heat away from the valve. Excessive heat can damage the valve. Always use dry nitrogen when brazing. Replace filter/drier any time the circuit is opened. |
| Water heat exchanger | Check for high-pressure drop, or low temperature drop across the coil. It could be scaled. If scaled, clean with condenser coil cleaner. |
| System undersized | Recalculate conditioning load. |
| **H: WATER HEAT EXCHANGER FREEZES IN HEATING MODE** | |
| Water flow | Low water flow. Increase flow. See F. No water flow. |
| Flow Switch | Check switch. If defective, replace. |
| **I: EXCESSIVE HEAD PRESSURE IN COOLING MODE** | |
| Inadequate water flow | Low water flow, increase flow. |
| **J: EXCESSIVE HEAD PRESSURE IN HEATING MODE** | |
| Low air flow | See E: Noisy blower and low air flow. |
| **K: AIR COIL FREEZES OVER IN COOLING MODE** | |
| Air flow | See E: Noisy blower and low air flow. |
| Blower motor | Motor not running or running too slow. Motor tripping off on overload. Check for overheated blower motor and tripped overload. Replace motor if defective. |
| Panels | Panels not in place. |
| Low air flow | See E: Noisy blower and low air flow. |
| **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. |

**ECM Error Code Chart:**

| ECM Board LED Code Chart | | | | |
|---|---|---|---|---|
| **LED State Name** | **Green LED Behavior** | **Red LED Behavior** | **Causes Mitigation Mode*** | **Notes** |
| Off/Not Programmed | OFF | OFF | NO | **Solution:** Check 24vac power and 3 amp fuse, Replace ECM Board if fuse and Power are good. |
| In Bootloader | Rapidly Flashing | OFF | NO | **Solution:** Power Cycle. If stuck in this mode, Replace ECM Board |
| Running, No Blower Configuration | Ping-Pong | Ping-Pong | NO | **Solution:** Power Cycle. If Stuck in this mode Replace ECM Board |
| Running, Mitigation Enabled | Flashes 5 Times | OFF | NO | **Solution:** Everything is Operating Correctly. This only happens at start up as a general indication it is a mitigation enabled board. |
| Running, Telling Blower Not to Run | ON | OFF | NO | **Solution:** Everything is Operating Correctly |
| Running, Asking The Motor to Run | Flashing once per 100 CFM demand | OFF | NO | **Solution:** Everything is Operating Correctly |
| **Error Modes (If the ECM board is mitigation enabled, power to all controls will be shut off and the blower will be told to run at max speed) (Some exceptions apply as stated in the Notes column)** | | | | |
| Mitigation Sensor Error | ON | Flashing 1 x Every 3 Sec. | YES | **Solution**: Check harness connection on ECM board and Mitigation Sensor(s). If a Fault is active on the lockout board, diagnose accordingly. Leaks may still be present without a Low Pressure or Freeze fault active. |
| Blower Communication Error | ON | Flashing 2 x Every 3 Sec. | YES | **Solution:** With Power Off, Check both Blower Motor Communication and high voltage Harnesses(s). Turn on power, Confirm high voltage at blower motor harnness.(Do not unplug High voltage with Power On) If good, Replace Motor. |
| Locked Rotor Error | ON | Flashing 4 x Every 3 Sec. | YES | **Solution**: Check Blower Motor High voltage. Check funcitonality of ECM board. With power off, Check if blower wheel spins freely. If not, Replace Blower Motor. |
| Lost Rotor Error | ON | Flashing 7 x Every 3 Sec. | YES | **Solution**: Check Blower Motor High voltage. Check funcitonality of ECM board. With power off, Check if blower wheel spins freely and is still attacehd to motor shaft. If not, Replace Blower Motor. |
| Over Current Error | ON | Flashing 8 x Every 3 Sec. | YES | **Solution**: Check Blower Motor High voltage. Be sure filters are clean and all registers are open. Check Duct Static Pressure. Reference E.S.P limits per unit in Installation Manaul. Check Duct Zoning operation if Applicable. If good, Replace Blower Motor. |
| Over Voltage Error | ON | Flashing 9 x Every 3 Sec. | YES | **Solution**: Check Blower Motor AC High voltage. If Good, Replace Blower Motor. |
| Under Voltage Error | ON | Flashing 10 x Every 3 Sec. | YES | **Solution**: Check Blower Motor High voltage. If Good, Replace Blower Motor. |
| Over Temperature Error | ON | Flashing 11 x Every 3 Sec. | YES | **Solution**: Check High voltage. Be sure filters are clean and all registers are open. Check Duct Static Pressure. Reference E.S.P limits per unit in Installation Manaul. Check Duct Zoning operation if Applicable. Check Blower Motor High voltage. If Good, Replace Blower Motor.Trip Point >97C , Reset <80C |
| ***Applies to units above M1 Charge level** | | | | |

**Error Modes (If the ECM board is mitigation enabled, power to all controls will be shut off and the blower will be told to run at max speed) (Some exceptions apply as stated in the Notes column)**

| LED State Name | Green LED Behavior | Red LED Behavior | Causes Mitigation Mode* | Notes |
|---|---|---|---|---|
| Torque Limit Error | ON | Flashing 13 x Every 3 sec. | YES | **Solution:** Be sure filters are clean and all registers are open. Check Duct Static Pressure. Reference E.S.P limits per unit in Installation Manaul. Check Duct Zoning operation if Applicable. |
| Undesired Parameter Error | Flashing once per 100 CFM demand | Flashing 14 x Every 3 sec. | NO | **Solution:** Power Cycle. Check Low Voltage Harness connections. Check function of ECM board. Call Tech Support for further assistance. |
| Incomplete Parameters Error | Flashing once per 100 CFM demand | Flashing 3 x Every 3 Sec. | NO | **Solution:** Power Cycle. Check Low Voltage Harness connections. Check function of ECM board. Call Tech Support for further assistance. |
| Power Limit Error | Flashing once per 100 CFM demand | Flashing 5 x Every 3 Sec. | NO | **Solution:** Check high voltage Power. Be sure filters are clean and all registers are open. Check Duct Static Pressure. Reference E.S.P tables per unit in Installation Manaul. Check Duct Zoning operation if Applicable. |
| Temperature Limit Error | Flashing once per 100 CFM demand | Flashing 6 x Every 3 Sec. | NO | **Solution:** Check high voltage Power. Be sure filters are clean and all registers are open. Check Duct Static Pressure. Reference E.S.P limits per unit in Installation Manaul. Check Duct Zoning operation if Applicable. |
| Speed Limit Error | Flashing once per 100 CFM demand | Flashing 12 x Every 3 Sec. | NO | **Solution:** Be sure filters are clean and all registers are open. Check Duct Static Pressure. Reference E.S.P limits per unit in Installation Manaul. Check Duct Zoning operation if Applicable. |

***Applies to units above M1 Charge level**

## Troubleshooting Form

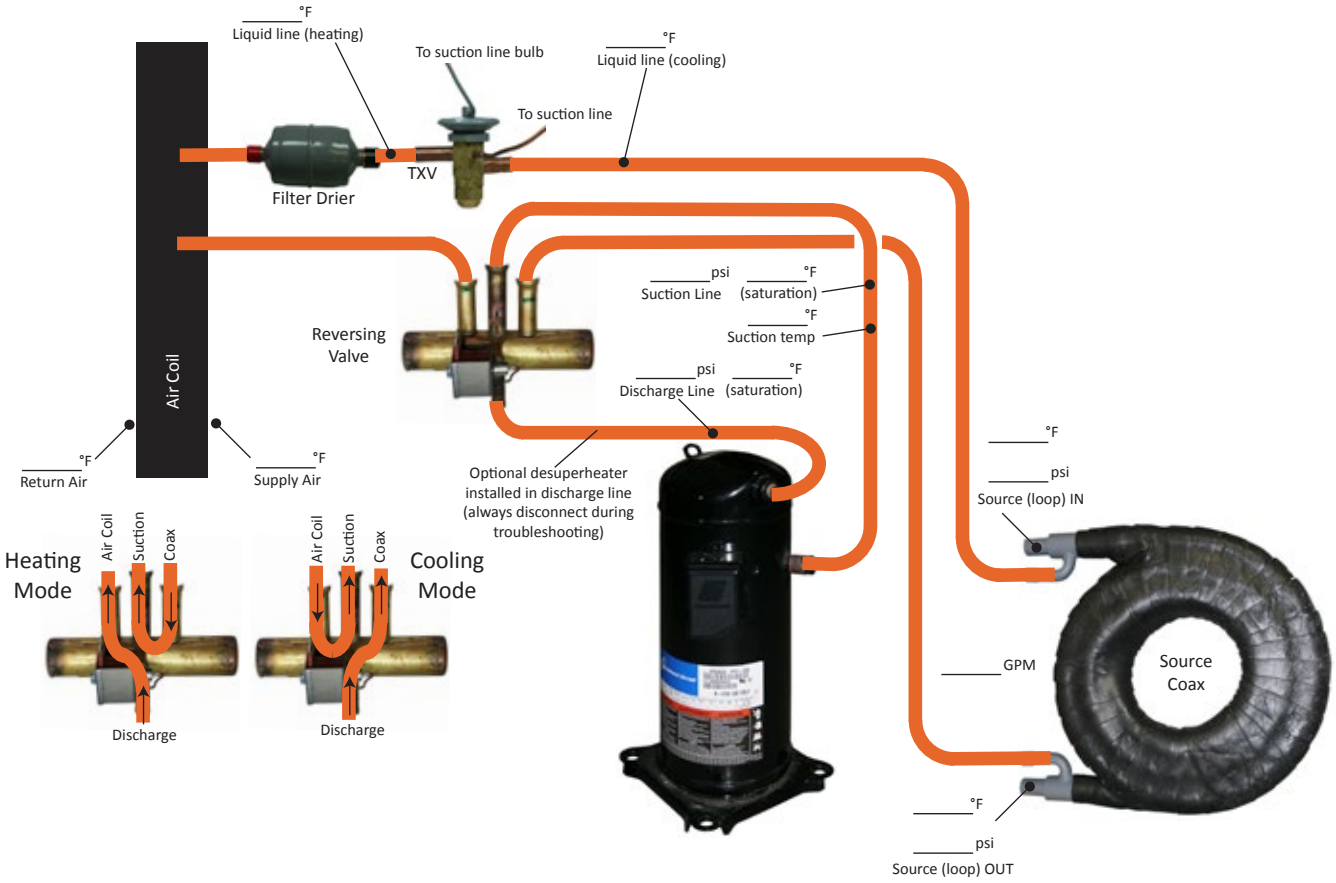
Customer/Job Name:_____ Date:_____

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.**



## QR Codes for Enertechnician App Download and Troubleshooting Videos

EnerTechnician

**Download this app to make installation and service easier.**

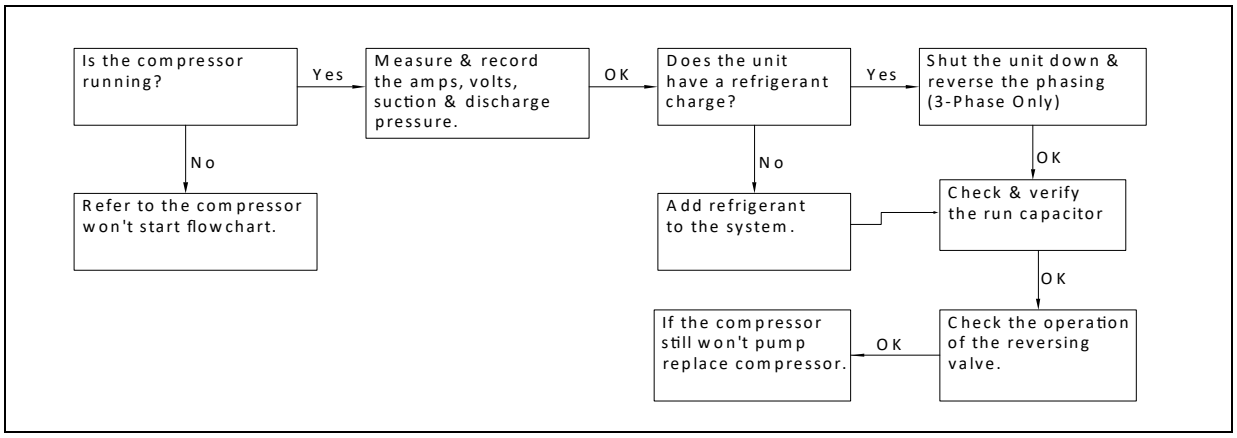
ENERTECH UNIVERSITY

**View these videos for geothermal troubleshooting.**

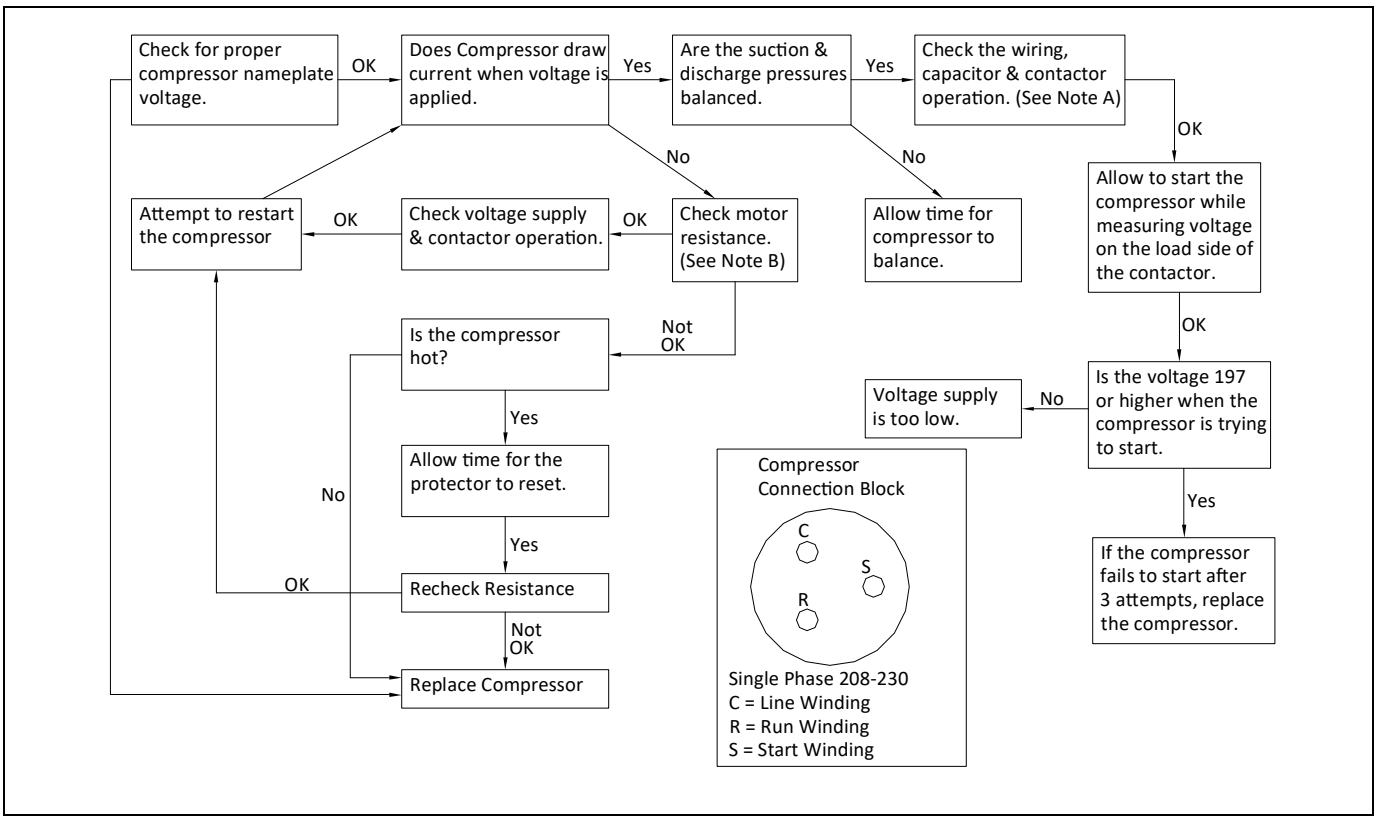
## Compressor Troubleshooting

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

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




**Compressor Won't Start:**



## ⚠ 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.**

## ⚠ MISE EN GARDE ⚠

**TOUS LES APPAREILS DE 460 V AVEC UN CODE DE TENSION " 3" UTILISENT UN MOTEUR À COMMUTATION ÉLECTRONIQUE (ECM) DE 277 V CONNECTÉ À UN CONDUCTEUR NEUTRE. LES MOTEURS SONT CONNECTÉS ENTRE LE CONDUCTEUR NEUTRE ET LE CONDUCTEUR ACTIF DU CIRCUIT. LA CONNEXION DE LA SOURCE DOIT ÊTRE UNE CONNEXION EN ÉTOILE. LES CONNEXIONS EN TRIANGLE TRIPHASÉES NE FOURNISSENT PAS LE BON CÂBLAGE ET L'APPAREIL NE FONCTIONNERA PAS.**

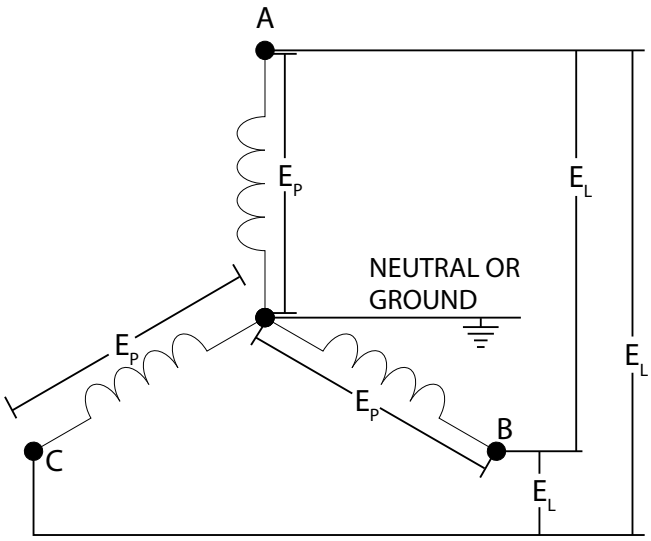
## ⚠ CAUTION ⚠

**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.**

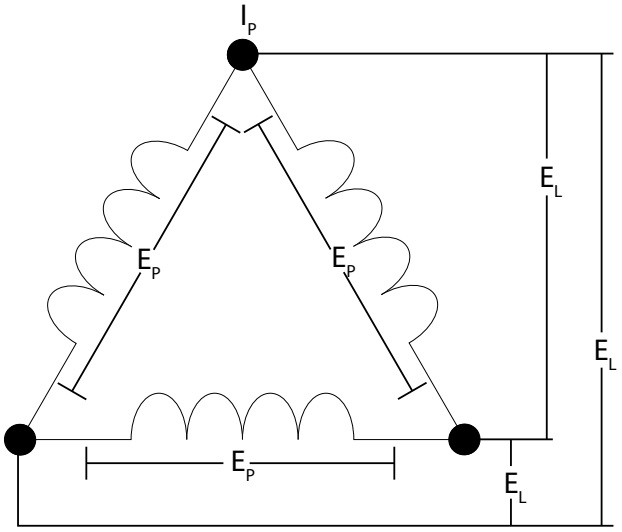
## ⚠ MISE EN GARDE ⚠

**VÉRIFIER L'AMPÉRAGE DU COMPRESSEUR POUR VÉRIFIER LA ROTATION DU COMPRESSEUR DES APPAREILS TRIPHASÉS. COMPARER AVEC LES TABLEAUX ÉLECTRIQUES DE L'APPAREIL. UNE ROTATION INVERSE ENTRAÎNE UN NIVEAU SONORE PLUS ÉLEVÉ, UN FAIBLE AMPÉRAGE ET UNE USURE ACCRUE DU COMPRESSEUR. UNE SURCHARGE INTERNE DU COMPRESSEUR SE DÉCLENCHE APRÈS UNE COURTE PÉRIODE DE FONCTIONNEMENT.**

**Example 1: WYE (STAR) Electrical Circuit**




**Example 2: DELTA Electrical Circuit**



## Section 10: Decommissioning

### A2L Recovery

Before carrying out this procedure, it is essential for the technician to be completely familiar with the equipment and all its detail. It is recommended good practice to recover all refrigerants safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. Ensure safe electrical power is available for recovery equipment before the task is commenced. Complete these steps:

A. Become familiar with the equipment and its operation.

B. Isolate system electrically.

C. Before attempting the procedure, ensure that:
   - Mechanical handling equipment is available, if required, for handling refrigerant cylinders;
   - All personal protective equipment is available and being used correctly;
   - The recovery process is supervised at all times by a competent person;
   - Recovery equipment and cylinders must conform to the appropriate standards for mildly flammable, A2L refrigerants.

D. Make sure the cylinder is situated on the scales before recovery takes place.

E. Start the recovery machine and operate in accordance with instructions.

F. Pump down refrigerant system, if possible.

G. If a vacuum is not possible, make a manifold connection to allow refrigerant to be removed from all sections of the system.

H. Do not overfill cylinders (no more than 80% volume liquid charge).

I. Do not exceed the maximum working pressure of the cylinder, even temporarily.

J. When the cylinders have been filled correctly and the process completed, make sure the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.

K. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.

Equipment shall be labeled stating it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing flammable refrigerants, ensure labels on the equipment state the equipment contains flammable refrigerant.
When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice for all refrigerants to be removed safely.

When transferring refrigerant into cylinders ensure only appropriate refrigerant recovery cylinders are employed. Ensure the correct number of cylinders for holding the total system charge are available. All cylinders to be used are designated for the recovered refrigerant and labeled for refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment at hand and shall be suitable for the recovery of the mildly flammable, A2L refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.

The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure it has been evacuated to an acceptable level to make certain flammable refrigerant does not remain within the lubricant. The compressor body shall **not** be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

### Removal and Disposal

All 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.

## Warranty Registration Form

# WARRANTY REGISTRATION

NOW REGISTER ONLINE AT SUPPORT.ENERTECHUSA.COM/WARRANTY-REGISTRATION

**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@ENERTECHUSA.COM

**FAX THIS FORM TO:**
ENERTECH GLOBAL LLC
618.664.4597

**REGISTER ONLINE AT: support.enertechusa.com/warranty-registration**

QMS-CSF-007
Rev 7.05.2023

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# Revision Table

| Date | Description of Revision | Page |
|---|---|---|
| 23DEC2024 | VT Unit Revision J IOM created. | ALL |
| 14MAY2025 | Updated with Rev. J VS Units | ALL |
| 25AUG2025 | Updated AHRI Tables and updated 26W225-01NN to rev. G | 10, 24 |
| 26SEP2025 | Added ECM Error Code Charts, updated nomenclature to allow voltage code '0' factory installed EPIC | 54,55 |
| 26NV2025 | Updated dimensional drawing to correct note, updated electrical data tables | 11-14 |
| 25FEB2026 | Updated VS Nomenclature | 4 |
| 15APRIL2026 | Updated HE/HR and WPD tables, Updated VS Nomenclature | 4, 45-48 |

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