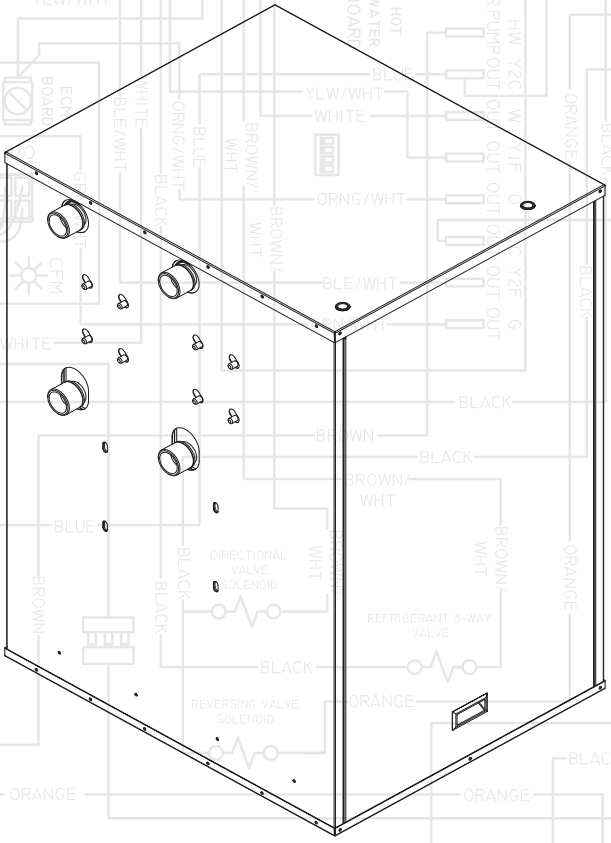
ENERTECH®

Geothermal Made Better®

Installation & Operations Manual

WD 20, 30 TON MODELS WATER-TO-WATER HEAT PUMPS



Revision A

20D814-10NN

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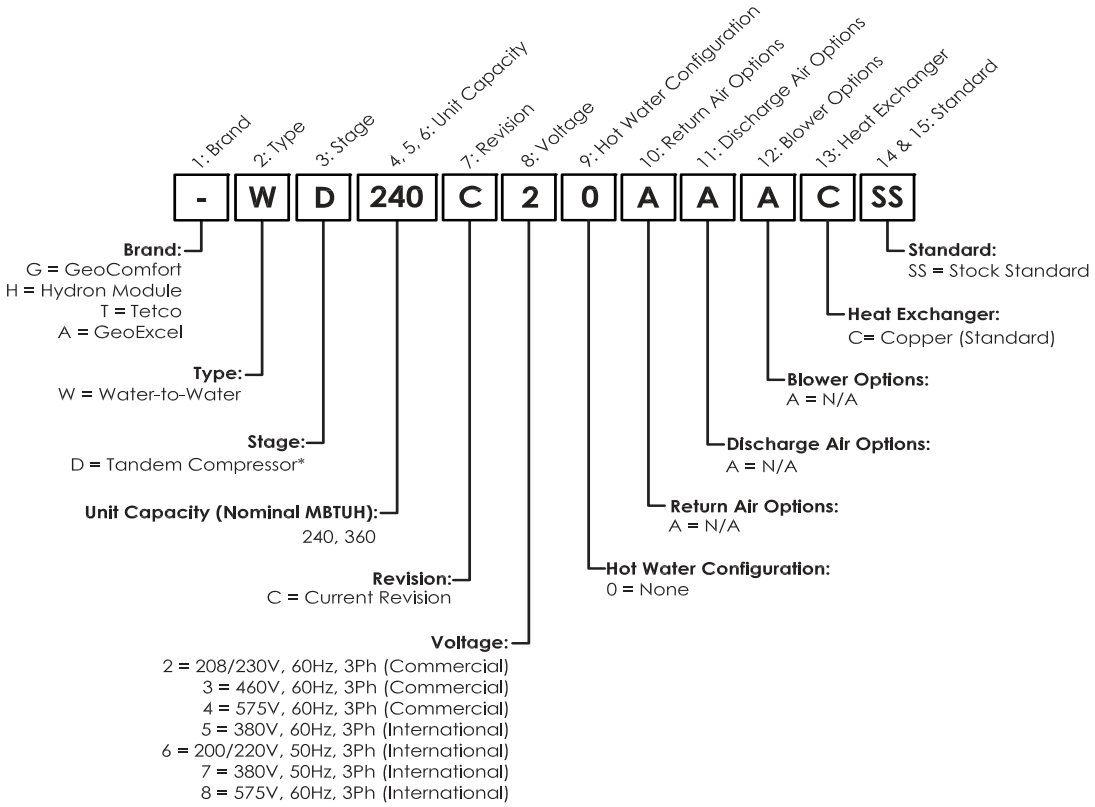
Section 1: Model Nomenclature and AHRI Performance Data

Unit Model Nomenclature Decoder



AHRI Ground Loop and Ground Water Heat Pump Performance Data

MODELS	APPLICATION	HEATING		COOLING	
		Mbtu/hr	COP	Mbtu/hr	EER
20 TON	Ground Loop Full Load	222,400	3.3	240,700	15.2
	Ground Loop Part Load	130,600	4.3	142,000	21.8
30 TON	Ground Loop Full Load	318,000	3.3	316,500	14.6
	Ground Loop Part Load	189,750	4.3	191,700	19.6

Ground Loop (GL) Notes:
Rated in accordance with ISO Standard 13256-2 which includes Pump Penalties.
Heating capacities based on 32°F EST & 104°F ELT.
Cooling capacities based on 77°F EST & 53.6°F ELT.
Entering load temperature over 120°F heating and under 45°F Cooling is not permissible.
Floor heating is most generally designed for 85°F entering load temperature.

Section 2: Installation Introduction

Introduction
This geothermal heat pump provides heated water and chilled water as well as optional domestic water heating capability. Engineering and quality control is built into every geothermal unit. Good performance depends on proper application and correct installation.

Notices, Cautions, Warnings, & Dangers:

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

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

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

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

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

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

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

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

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

⚠ CAUTION ⚠

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

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

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

Removal and Disposal
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.

Pre-Installation
Special care should be taken in locating the geothermal unit. Installation location chosen should include adequate service clearance around the unit. If units are being placed on racking, the unit must be placed on a solid foundation. All units should be located in an indoor area where the ambient temperature will remain above 55°F and should be located in a way that piping and ductwork or other permanently installed fixtures do not have to be removed for servicing and filter replacement.

⚠ 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.

Pre-Installation Steps

1. Compare the electrical data on the unit nameplate with packing slip and ordering information to verify that the correct unit has been shipped.
2. 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.
3. Verify that all refrigerant tubing is free of dents and kinks. Refrigerant tubing should not be touching other unit components.
4. Before unit start-up, read all manuals and become familiar with unit components and operation. Thoroughly check the unit before operating.

Components

Master Contactor: Energizes Compressor

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

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

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

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

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

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

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

Flow Switch (Freeze Protection Device): Protects the water heat exchanger from freezing, by shutting down compressor if water flow decreases. **(SOLD SEPARATELY)**

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

⚠ CAUTION ⚠

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

Section 3: Installation Considerations

Enertech Global D-I-Y Policy:

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

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

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

Equipment Installation:

Special care should be taken in locating the unit. All units should be located in an indoor area were the ambient temperature will remain above 55°F and should be located in a way that piping and ductwork or other permanently installed fixtures do not have to be removed for servicing and filter replacement.

Electrical:

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

Thermostat:

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

Unit Placement

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

1. ***Service Access.*** Is there enough space for service access? A general rule of thumb is at least 2 feet in the front and 2 feet on at least one side.
2. If units are being placed on racking, the unit must be placed on a solid foundation covering the full base of the unit. Also, utilize a foam pad between the unit and the rack.
3. The installer must verify that all applicable wiring, piping, and accessories are correct and on the job site.

Pre-Installation

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

- ☐ Fully inspect the unit after unpacking.
- ☐ Locate the Unit Start-Up form from this manual and have it available as the unit installation proceeds.

Guidelines For Heating Mode Operation

Enertech recommends the aquastat setting not be set above 110°F for the storage tank temperature. Excessive vibration and part failure can occur at higher than recommended temperature settings. The higher operating temperatures cause substantial efficiency and capacity reductions.

The performance is negatively affected as the unit operates at the higher water temperatures and it benefits the unit and the homeowner to operate at or below the recommended water temperature of 110°F.

With the lower efficiency created by higher water temperatures, the output capacity of the unit is decreased along with the efficiency. When operating at the higher entering water temperature the heat of extraction is significantly reduced, as well. In order to maintain the needed capacity, more of the heat is coming from the compressor working harder to compress the refrigerant.

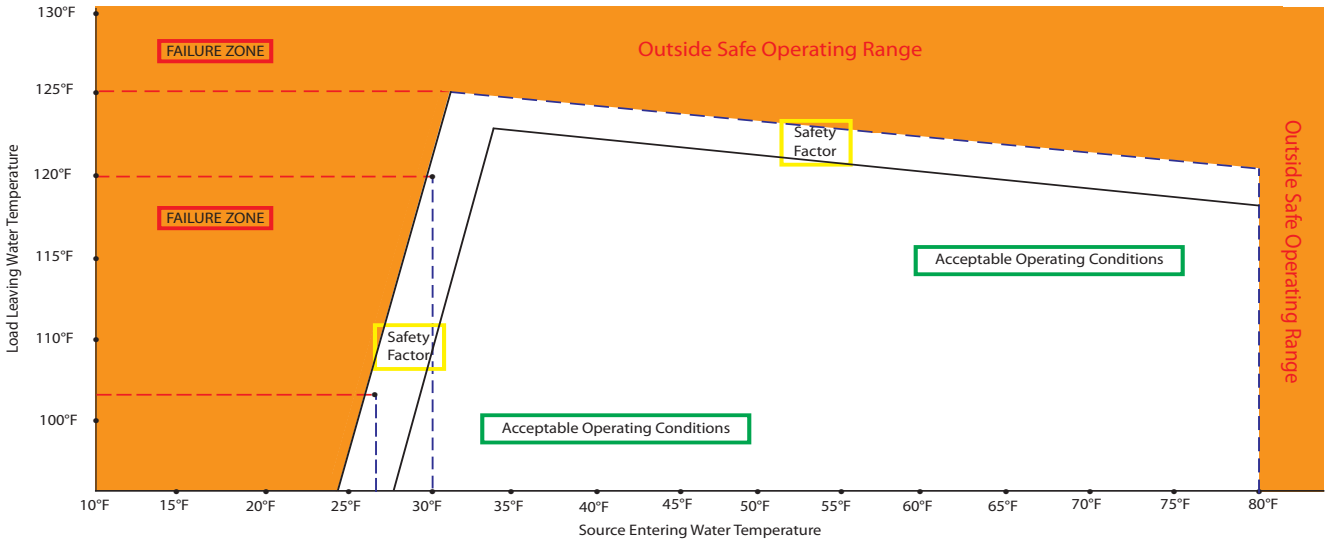
The illustration below shows the parameters which are safe for compressor operation. Based on the leaving load water of 120°F, the loop would have to maintain 35°F to operate within the acceptable operating conditions for the compressor. Once your loop temperatures drop below 35°F, the acceptable leaving load temperature drops below 120°F.

If you are designing loops for 30°F, the recommended leaving load temperature is 110°F. Because the water-to-water machines have become so popular for providing heated water for a multitude of uses, we've provided the above chart for reference.

The obvious correlation is that the warmer the Source Entering Water Temperature, the hotter the Load Leaving Water Temperature can be, to a point. R410A can only handle up to about 125°F Load Leaving Water Temperature before putting the compressor at risk.

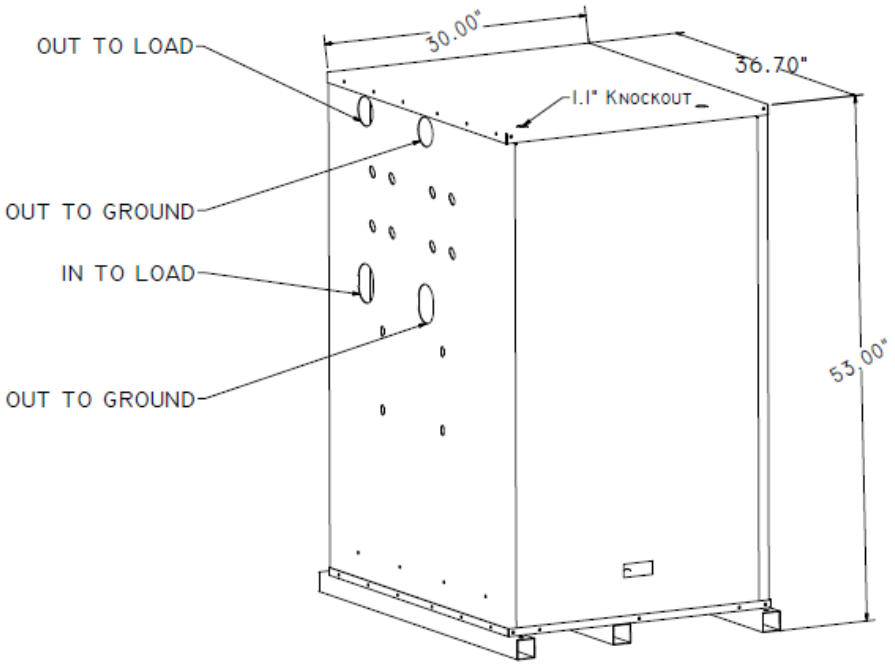
Actual usage, and choices of heat distribution devices need to follow the acceptable operating conditions presented in the chart. If a question arises, please consult the Technical Services Department.

SCROLL COMPRESSOR OPERATING CONDITIONS (WATER TO WATER)
HEATING MODE OPERATION



Unit Dimensional and Physical Data

20 & 30 Ton Series



Model	Ground		Hydronic	
	Inlet	Outlet	Inlet	Outlet
20 Ton	2.0 MPT	2.0 MPT	2.0 MPT	2.0 MPT
30 Ton	2.0 MPT	2.0 MPT	2.0 MPT	2.0 MPT

Physical Data

	20 Ton	30 Ton
Compressor	Compliant Scroll	
Expansion Device	Thermostatic	
Transformer (VA)	150	150
Weight (lbs)	800	1010

Section 4: Unit Data Information

Model	Voltage Code/ HWG Option	60 Hz OR (50 Hz[6]) Power		Compressor		HWG Pump FLA	Ext. Loop Pump FLA	Total Unit FLA	Min Circuit AMPS	Max Fuse HACR
		Volts	Phase	LRA	RLA					
WD240	2	208/230	3	239.0 ea.	33.3 ea.	0.0	0.0	66.6	74.9	100
	3	460	3	125.0 ea.	17.9 ea.	0.0	0.0	35.8	40.3	50
	4	575	3	80.0 ea.	12.8 ea.	0.0	0.0	25.6	28.8	40
	5	380	3	145.0 ea.	23.7 ea.	0.0	0.0	47.4	53.3	70
	6	200/220	3	239.0 ea.	34.6 ea.	0.0	0.0	69.2	77.9	110
	7	380	3	118.0 ea.	17.9 ea.	0.0	0.0	35.8	40.3	50
	8	575	3	80.0ea.	12.8 ea.	0.0	0.0	25.6	28.8	40
WD360	2	208/230	3	340.0 ea.	55.8 ea.	0.0	0.0	111.6	125.6	175
	3	460	3	173.0 ea.	26.9 ea.	0.0	0.0	53.8	60.5	80
	4	575	3	132.0 ea.	23.7 ea.	0.0	0.0	47.4	53.3	70
	5	380	3	196.0 ea.	34.0 ea.	0.0	0.0	68.0	76.5	110
	6	200/220	3	325.0 ea.	50.6 ea.	0.0	0.0	101.2	113.9	150
	7	380	3	173.0 ea.	25.0 ea.	0.0	0.0	50.0	56.3	80
	8	575	3	132.0 ea.	23.7 ea.	0.0	0.0	47.4	53.3	70

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. All fuses class RK-5.
4. Min/Max Voltage: 208/230/60 = 187-252, 460/60 = 432-502, 575/60 = 540-630, 380/50 = 327-418, 200/220/50= 172-242
5. See Wiring Diagrams for proper 460V and 575V power.
6. Voltage Code/ HWG Option 5, 6, & 7 are 50 Hz.

Section 5: Unit Piping Installation

Water Quality

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

Ideally, de-ionized water should be used for dilution with antifreeze solutions since de-ionizing removes both corrosive and hardness ions.
Distilled water and zeolite softened water are also acceptable. Softened water, although free of hardness ions, may actually have increased concentrations of corrosive ions and, therefore, its quality must be monitored. It is recommended that dilution water contain less than 100 PPM calcium carbonate or less than 25 PPM calcium plus magnesium ions; and less than 25 PPM chloride or sulfate ions.

Water Quality Table

Potential Problem	Chemical(s) or Condition	Range for Copper Heat Exchangers	Cupro-Nickel Heat Exchanger Ranges	Stainless Steel Heat Exchanger Ranges
Scaling	Calcium & Magnesium Carbonate	Less than 350 ppm	Less than 350 ppm	Less than 0.1 ppm
Corrosion	pH Range	7 - 9	5 - 9	7 - 9
	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 Nitrate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 2-20 ppm
	Calcium/Sodium Chloride See Note 4	Less than 125 ppm	Less than 125 ppm	None Allowed
	Chlorine	Less than 0.5 ppm	Less than 0.5 ppm	Less than 1 ppm*
	Hydrogen Sulfide	None Allowed	None Allowed	Less than 0.05 ppm
Biological Growth	Iron Bacteria	None Allowed	None Allowed	None Allowed
	Iron Oxide	Less than 1 ppm	Less than 1 ppm	Less than 0.2 ppm
Erosion	Suspended Solids - Note 5	Less than 10 ppm	Less than 10 ppm	16-20 mesh strainer recommended
	Water Velocity	Less than 8 ft/s	Less than 12 ft/s	Less than 5.5 m/s in the port

* Chlorine can not be used with 304 Stainless Steel.

Notes
1. Hardness in ppm is equivalent to hardness in mg/l.
2. Grains/gallon = ppm divided by 17.1.
3. Copper and cupro-nickel heat exchangers are not recommended for pool applications for water outside the range of the table. Secondary heat exchangers are required for 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 and the unit fittings.
5. Filter for maximum of 600 micron size.

Section 6: Antifreeze

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 coaxial 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 Tables 3a and 3b for volumes and percentages. The freeze protection should be checked during installation using the proper hydrometer to measure the specific gravity and freeze protection level of the solution.

Antifreeze Characteristics

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

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

Cost: Prices vary widely.

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

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

Stability: Will the brine require periodic change out or maintenance?
Convenience: Is the antifreeze available and easy to transport and install?

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

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

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

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

Propylene Glycol: Non-toxic, non-corrosive, mid to high price, poor heat transfer, high viscosity when cold, and can introduce micro air bubbles when adding to the system. It has also been known to form a "slime-type" coating inside the pipe. Food grade glycol is recommended because some of the other types have certain inhibitors that react poorly with geothermal systems. A 25% brine solution is a minimum required by glycol manufacturers, so that bacteria does not start to form.

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

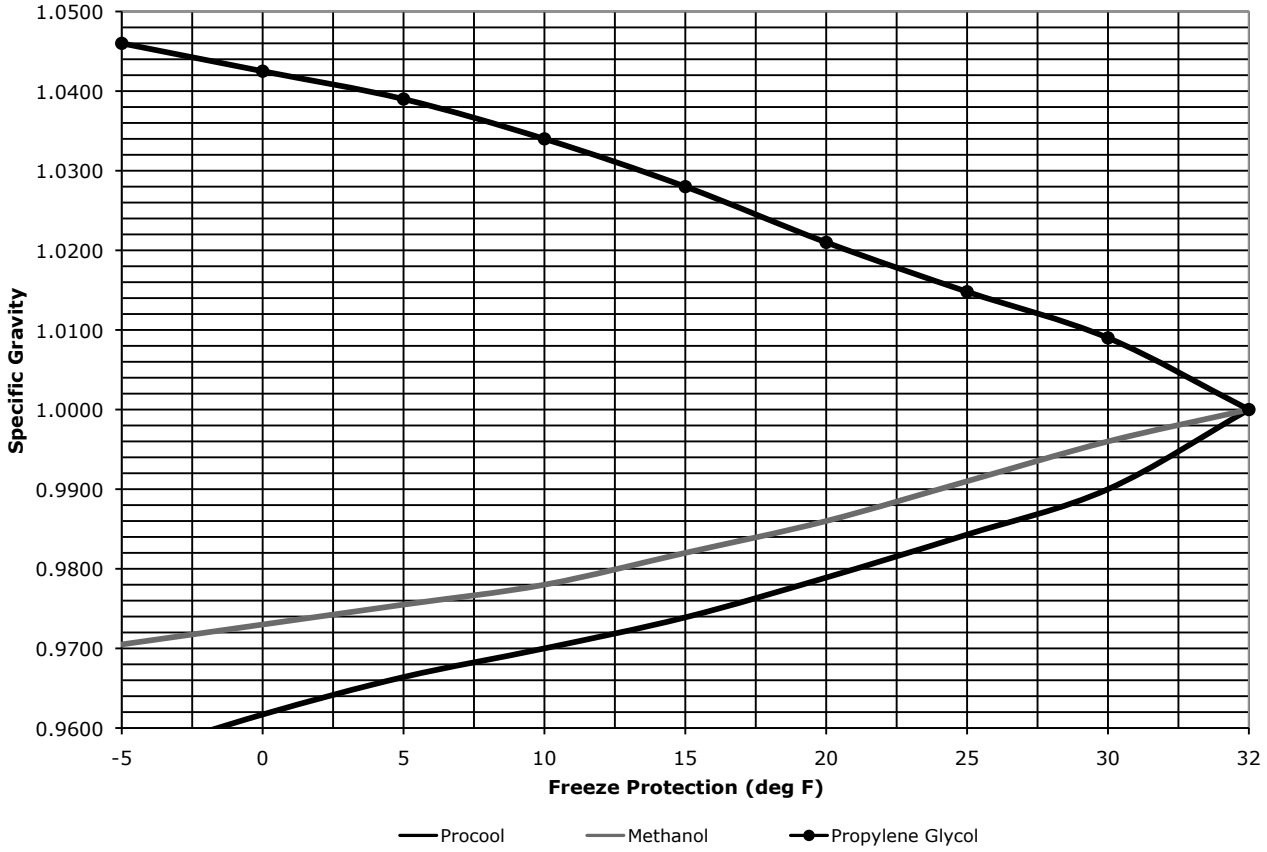
Potassium acetate (GS4): Considered highly corrosive (especially if air is present in the system) and has a very low surface tension, which causes leaks through most mechanical fittings. This brine is not recommended for use in earth loop applications.

Antifreeze Charging

Calculate the total amount of pipe in the system and use Table 3a to calculate the amount of volume For each specific section of the system. Add the entire volume together, and multiply that volume by the proper antifreeze percentage needed (Table 3b) for the freeze protection required in your area. Then, double check calculations during installation with the proper hydrometer and specific gravity chart (Figure 6) to determine if the correct amount of antifreeze was added.

Section 6: Antifreeze

Figure 6: Antifreeze Specific Gravity



Notes:

1. Consult with your representative or distributor if you have any questions regarding antifreeze selection or use.
2. All antifreeze suppliers and manufacturers recommend the use of either de-ionized or distilled water with their products.

⚠ CAUTION ⚠

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

Table 5: Antifreeze Percentages by Volume

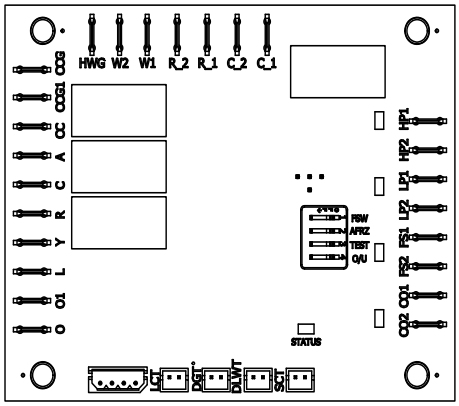
Antifreeze Type	Minimum Temperature for Freeze Protection			
	10°F -12.2°C	15°F -9.4°C	20°F -6.7°C	25°F -3.9°C
ProCool (Ethanol)	25%	22%	17%	12%
Methanol	25%	21%	16%	10%
Propylene Glycol	38%	30%	22%	15%
Geothermal Transfer Fluid (GTF)	Mix according to manufacturer's directions on container label			

Antifreeze solutions are shown in pure form - not premixed
GTF is a premixed Methanol solution

Section 7: Controls

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.

Lockout Board Layout



The Lockout Board controls the inputs to the unit as well as outputs for current mode, faults, and diagnostics. A status LED and different combination of four LEDs for each fault are provided for diagnostics. The Lockout Board Terminal (L) puts out the number of corresponding 24VAC pulses to indicate the Lockout condition on the Thermostat (if equipped and wired).

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 events such as power loss or brown outs.

Short Cycle Protection
A built-in five minute anti-short cycle (ASC) timer provides short cycle protection ensuring that the compressor isn't damaged due to rapid cycling.

Test Mode
The Lockout Board allows the technician to shorten timing delays for faster diagnostics by placing the DIP switch 'TEST' switch in the ON position (See 'Settings' section). It should be moved back to OFF for normal operation after testing. The status LED will not be illuminated during the TEST mode.

4-Way Valve Control
When 24Vac is applied to the O terminal on the field wiring block, the controller energizes its O1 output to provide 24Vac power to the reversing valve to switch the refrigerant circuit to the cooling mode.

Changeover from heating to cooling can be achieved in two ways:
1. A manual toggle switch to select the heating or the cooling hydronic control (Aquastat), or.
2. A cooling thermostat which powers the coil of a single pole/double throw relay to select the heating hydronic control (normally closed contact) or the cooling hydronic control (normally open contact).

Compressor Control
When 24Vac is applied to the Y terminal on the controller wiring block, the controller decides, based on lockout and anti-short-cycle periods, when to turn on the compressor contactor. The CC output of the controller energizes the contactor(s) until 24Vac is removed from the Y terminal or a fault is detected.

Safety
The lockout board receives feedback signals for high pressure, low pressure, load heat exchanger temperature, source heat exchanger temperature, condensate overflow, and hot gas temperature faults. Upon a continuous 10-second measurement of all faults (except the high pressure) the compressor operation is suspended. The high pressure fault is tripped instantly. The different combination of LED(s) indicate each temporary fault. Once the unit is locked out (see fault retry below), the Lockout Board outputs a number of 24VAC pulses equal to the numbered fault code. In lock out the unit will not start until a soft or hard reset.

Low Pressure (LP)
If the low pressure switch is open continuously for 10 seconds, the compressor operation will be interrupted and the control will go into fault retry mode. At startup, the low pressure switch monitoring is suspended for 30 seconds to avoid nuisance faults. However, 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.

Section 7: Controls

NOTE: Flow switches are not equipped with this unit. A jumper wire overrides this feature. A flow switch kit is available to add on:
Part Number: 28K062-01NN.

Flow Switch (FS)
Flow switches ensure the source and load water maintain the minimum required flow rate. This ensures that pumps are working and water connections remain intact. If the flow switch is open continuously for 10 seconds, the compressor operation will be interrupted with a FS fault. At startup, the flow switch monitoring is suspended for 30 seconds to avoid nuisance faults. The flow switches will also trip when the water begins to freeze, providing additional protection.

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

Load Heat Exchanger Freeze (LCT)
When in cooling mode, if the heat exchanger temperature is lower than 30°F for 10 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 (SCT)
When in heating mode, if the heat exchanger is lower than the setpoint for 10 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 (DIP switch
AFRZ = ON) and 30°F for open loop (DIP switch AFRZ = OFF). 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 Discharge Gas Temperature (DGT)
When the hot discharge gas temperature is above 220°F for 30 continuous seconds, the compressor operation will be interrupted. The control will go into fault retry mode.

Thermistor Sensors
The following table indicates the normal operating range of the temperature sensing thermistors. Readings outside this range are indicative of a bad sensor. The Lockout Board will display the associated fault.

When diagnosing a possible bad sensor, the following table may be used to verify a valid temperature reading.

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

Over/Under Voltage Protection
The lockout board protects the compressor from operating when an over/under voltage condition exists. The control monitors secondary voltage from the transformer (24VAC) to determine an over/ under voltage condition is occurring on the primary side of the transformer. 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 and the thermostat "Call For Service" indicator will be flashing 11 pulses. 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.

Section 7: Controls

Fault Retry

All faults (except O/U Voltage and Bad Thermistor Sensors) are retried twice before finally locking the unit out (three faults total).

The fault retry feature is designed to prevent nuisance service calls. There is an anti-short cycle (ASC) period of 5 minutes between fault retries. On the third fault of the same sensor, within 30 minutes, the board will go into lockout mode and the "Call For Service" indicator on the thermostat will flash the number of pulses that correspond to the fault as shown in Fault Indication Table.

Intelligent Lockout Reset

If the thermostat is powered off (Y1 removed) 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 main power is interrupted to the board, the fault memory will be cleared (hard reset).

Reference the Lockout Board LED Identification Table on page 17, for a list of all faults and alarms.

WD360 Compressor Modules

The WD360 comes equipped with CoreSense modules installed in the compressor electrical box. This module provides advanced diagnostics and protection. **See below** for a chart which outlines the Warning and Alert Codes, as well as the DIP Switch Settings for these modules. Additional information can be found on AE Bulletin 1408 on the Emerson-Climate web-site.

LOCKOUT BOARD LED IDENTIFICATION & L TERMINAL STATUS						
CONDITION	GREEN HP	ORANGE LP	RED FS	YELLOW CO	GREEN STATUS	L TERMINAL- 24 VAC[8,9]
NORMAL MODE					FLASH	
TEST MODE[1]						
HP FAULT	FLASH				FLASH	
HP LOCKOUT	ON				FLASH	FLASH-2 PULSES
LP FAULT		FLASH			FLASH	
LP LOCKOUT		ON			FLASH	FLASH-4 PULSES
WF FAULT (FS)[3]			FLASH		FLASH	
WF LOCKOUT (FS)[3]			ON		FLASH	FLASH- 6 PULSES
LOAD/ AIR COIL FRZ FAULT (LCT)[2, 3]		FLASH	FLASH		FLASH	
LOAD/ AIR COIL FRZ LOCKOUT (LCT)[2, 3]		ON	ON		FLASH	FLASH-8 PULSES
SOURCE COIL FRZ FAULT (SCT)			FLASH	FLASH		
SOURCE COIL FRZ LOCKOUT (SCT)			ON	ON		FLASH-19 PULSES
CO FAULT[3]				FLASH	FLASH	
CO LOCKOUT[3]				ON	FLASH	FLASH-10 PULSES
O/ U VOLTAGE	FLASH	FLASH	FLASH	FLASH	FLASH	FLASH-11 PULSES
LCT SENSOR LOCKOUT/FAULTY[4]	FLASH			ON	FLASH	FLASH-12 PULSES
DGT SENSOR FAULTY[3,4]		FLASH		ON	FLASH	FLASH-13 PULSES
DLWT SENSOR FAULTY[4,7]			FLASH	ON	FLASH	FLASH-14 PULSES
SCT SENSOR LOCKOUT/ FAULTY[4]		ON		FLASH	FLASH	FLASH-15 PULSES
LCT & SCT SWAPPED[5]	ON			ON		FLASH-16 PULSES
DGT > 220˚F FAULT[3,6]	FLASH		FLASH	ON	FLASH	
DGT > 220˚F LOCKOUT[3,6]	ON		ON	ON	FLASH	FLASH-18 PULSES

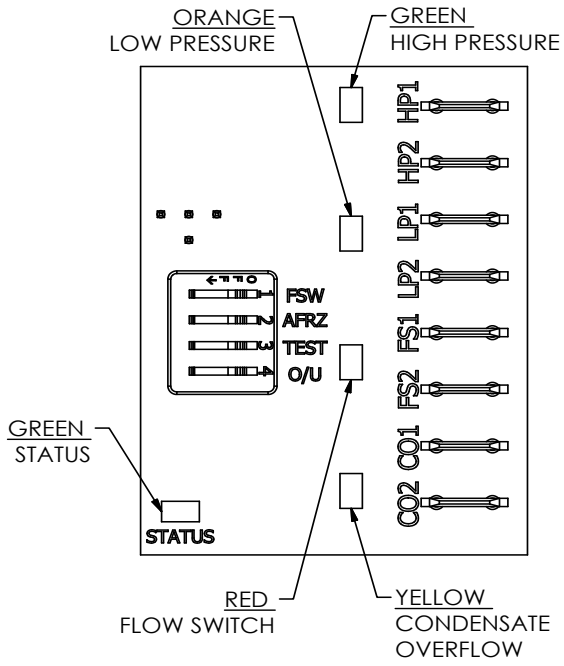
LOCKOUT BOARD DIP SWITCHES		
DIP SWITCH	OFF	ON
FSW[11]	LCT & SCT SENSORS AND 'FS' TERMINALS MONITORED FOR FLOW	FS' TERMINALS MONITORED FOR FLOW
AFRZ	OPEN LOOP MODE- 30˚F SETTING FOR SCT	CLOSED LOOP MODE- 12˚F SETTING FOR SCT
TEST	OPERATES IN NORMAL MODE WITH STANDARD DELAYS	OPERATES IN TEST MODE WITH DELAYS SPED UP
O/ U	FEATURE IS INACTIVE	FEATURE IS ACTIVE

NOTES:

1. WHEN TEST MODE DIP SWITCH IS 'ON', GREEN STATUS LED WILL BE OFF.
2. THE LOAD/ AIR COIL FREEZE PROTECTION SENSOR IS LOCATED BETWEEN THE TXV AND LOAD COAX IN WATER-TO-WATER UNITS, AND BETWEEN THE TXV AND AIR COIL IN WATER-TO-AIR UNITS.
3. NOT ALL MODELS HAVE THIS FEATURE.
4. THIS FAULT INDICATES A BAD SENSOR (OPEN, SHORTED, DISCONNECTED, OR INVALID VALUE).
5. THE CHECK TO DETERMINE IF THE LCT AND SCT SENSORS ARE SWAPPED, OCCURS IN TEST MODE ONLY, 120 SECONDS AFTER THE 'CC' TERMINAL IS ENERGIZED.
6. THIS FAULT/ LOCKOUT INDICATES THAT THE DISCHARGE GAS TEMPERATURE IS ABOVE 220°F.
7. UNITS WITHOUT DESUPERHEATER (HWG) HAVE A 10K RESISTOR IN POSITION T3 (DLWT).
8. CONNECT A MULTIMETER ACROSS THE 'L' AND 'C' TERMINALS TO CHECK FOR 24 VAC LOCKOUT SIGNAL. THERMOSTAT TURNS ON/FLASHES 'CALL FOR SERVICE' INDICATION.
9. THE 'L' TERMINAL CONTROLS A FAULT LED AT THE THERMOSTAT OR DRIVES AN AUXILLIARY FAULT RELAY.
10. UNITS THAT DO NOT CONTAIN A FLOW SWITCH, WILL CONTAIN A JUMPER BETWEEN THE 'FS1' AND 'FS2' TERMINALS.

Lockout Board DIP Switches

The lockout board has four DIP switches for field selection of features shown below.



Load/Source Temperature Sensing (FSW)

When the DIP switch FSW is OFF, the board operates in dual protection mode. The load and source heat exchanger temperatures are monitored (with LCT and SCT thermistors) as well as field installed flow switches. When the DIP switch FSW is ON, the board operates in thermistor override mode and monitors only the flow switch (LCT and SCT are ignored).

NOTE: No setting allows ignoring of the flow switch. A factory installed jumper wire disables flow monitoring. An optional flow switch kit is available PN 28K062-01NN.

Anti-Freeze (AFRZ)

When DIP switch AFRZ is OFF, the Lockout Board operates in open loop mode. The setpoint for the source heat exchanger freeze sensor is set to 30°F. When DIP switch AFRZ is ON, the board operates in the closed loop mode. The setpoint for the source heat exchanger freeze sensor is 12°F in closed loop mode.

Test Mode (TEST)

When DIP switch TEST is OFF, the Lockout board operates in the normal mode. When DIP switch TEST is ON, the board operates in test mode, which speeds up all delays for easier troubleshooting. While in the test mode the LCT & SCT sensors will be checked for the proper location based on temperature. Sensors are swapped if LCT > SCT in cooling or LCT < SCT in heating. This fault will only show up in the test mode. When service is complete, the DIP switch TEST must be returned to the OFF position in order to make sure the unit operates with normal sequencing delays. While the unit is in Test Mode, the status light (bottom green) will remain off. The Lockout Board will revert back to normal mode after one (1) hour (green status light blinks), if DIP switch TEST is not moved to OFF position.

Over/Under Voltage Disable (O/U)

When the DIP switch O/U is ON, the over/under voltage feature is active. When the DIP switch O/U is OFF, 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 to disabling of the feature. However, disabling the feature could cause the unit to run under adverse conditions, and therefore should not be turned off without contacting Enertech 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 disabling O/U feature. 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 like brownouts.

Section 7: Controls

Sequence of Operation

The description below is based on water-to-water units with a double compressor.

Timings assume the ASC timer is expired. If the ASC timer is not expired the accessory, compressor, and loop pump operation do not start until the ASC timer is expired. Components are sequenced and delayed for reduction in surge current, and to reduce startup noise of the system. The WD240 and 360 have staged compressors controlled with separate Y1 and Y2 inputs. The CC output of the controller energizes the first compressor contactor and begins the time-out relay (adjustable 10 to 1000 seconds; factory set at 10). After the time-out delay, A Y2 input can energize the 2nd compressor contactor.

NOTE: Ensure there is always a delay time between the operations of the two compressors to avoid nuisance low-pressure lockouts.

Heating 1st Stage, (Y1)

The Accessory (A) terminal output is energized after the random start timer (10s-20s) expires (to provide time for external pumps to provide adequate water flow prior to the system starting). Next, after another 10s delay, the compressor first stage and the loop pump(s) are energized.

Heating 2nd Stage, (Y1, Y2)

After the adjustable time delay relay expires and a Y2 call is received, the second compressor is energized.

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)

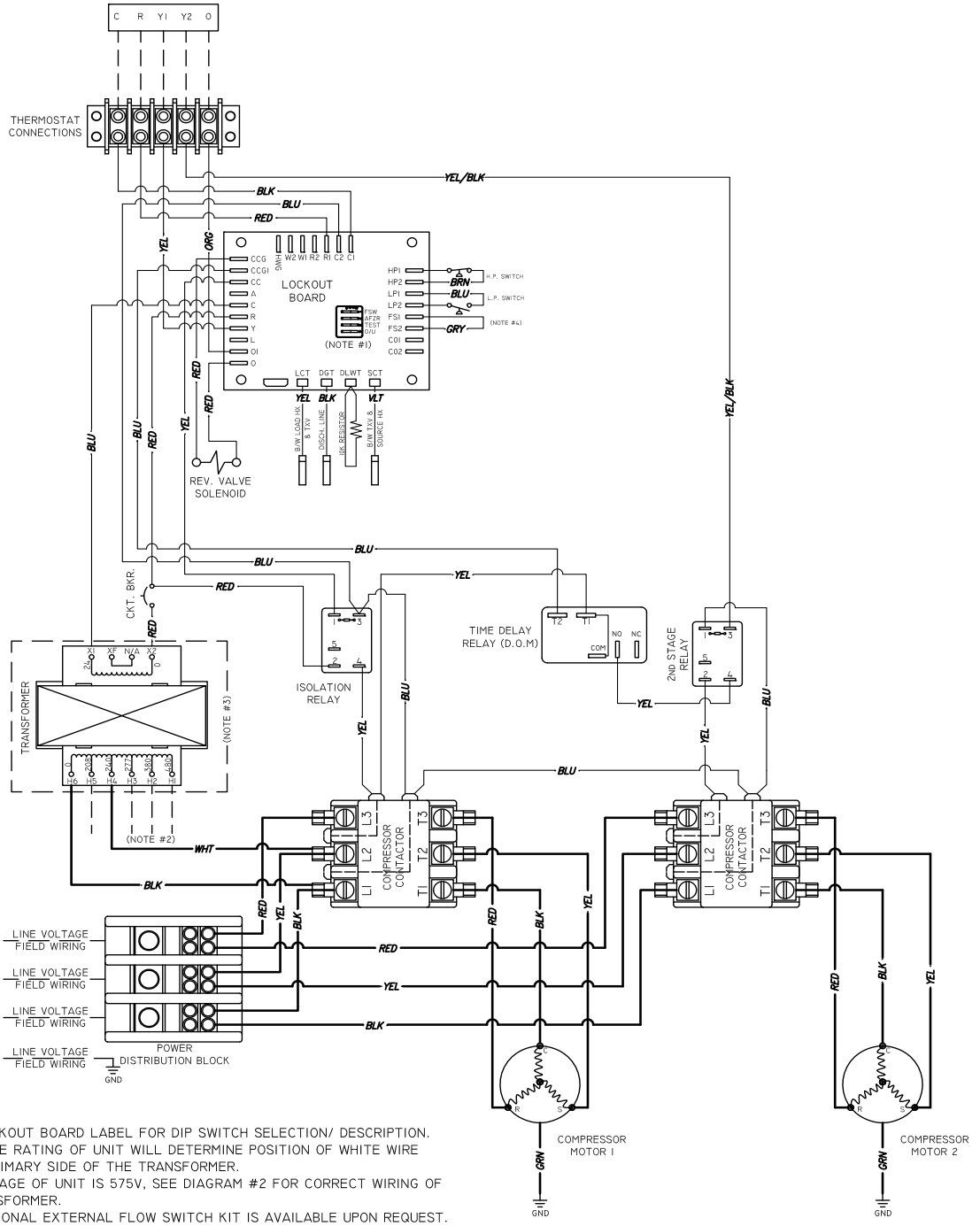
The Accessory (A) terminal output is energized after the random start timer (10s-20s) expires then the first stage compressor and the loop pump(s) are energized 10 seconds after A.

Cooling 2nd Stage (Y1, Y2, O)

After the adjustable time delay relay expires and a Y2 call is received, the second compressor is energized.

WD 240 Series Wiring Diagram

WATER-TO-WATER UNIT, TWO STAGE, THREE PHASE, 208/230V, 277V, 380V, 460V OR 575V, 50/60Hz, COMMERCIAL *WD240 SERIES



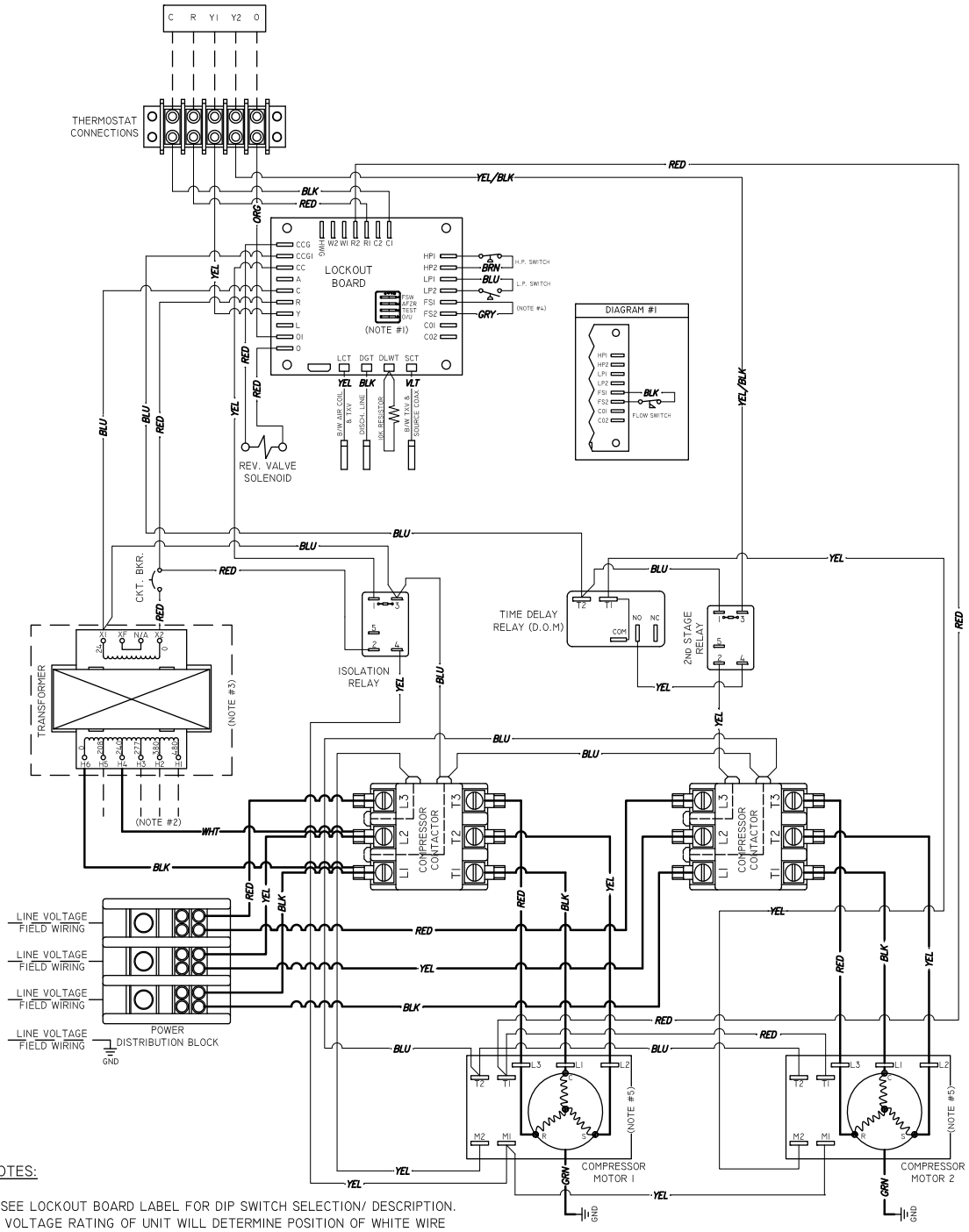
NOTES:

1. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
2. VOLTAGE RATING OF UNIT WILL DETERMINE POSITION OF WHITE WIRE ON THE PRIMARY SIDE OF THE TRANSFORMER.
3. IF VOLTAGE OF UNIT IS 575V, SEE DIAGRAM #2 FOR CORRECT WIRING OF THE TRANSFORMER.
4. AN OPTIONAL EXTERNAL FLOW SWITCH KIT IS AVAILABLE UPON REQUEST. WHEN INSTALLED, THE GRAY JUMPER WIRE (INSTALLED BETWEEN FSI AND FS2 ON THE LOCKOUT BOARD) WILL BE REMOVED, AND THE FLOW SWITCH WIRES WILL BE RAN TO THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.

Section 8: Wiring Diagrams: WD 360 Series

WD 360 Series Wiring Diagram

460V OR 575V, 50/60Hz, COMMERCIAL *WD360 SERIES



NOTES:

1. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
2. VOLTAGE RATING OF UNIT WILL DETERMINE POSITION OF WHITE WIRE ON THE PRIMARY SIDE OF THE TRANSFORMER.
3. IF VOLTAGE OF UNIT IS 575V, SEE DIAGRAM #2 FOR CORRECT WIRING OF THE TRANSFORMER.
4. AN OPTIONAL EXTERNAL FLOW SWITCH KIT IS AVAILABLE UPON REQUEST. WHEN INSTALLED, THE GRAY JUMPER WIRE (INSTALLED BETWEEN FSI AND FS2 ON THE LOCKOUT BOARD) WILL BE REMOVED, AND THE FLOW SWITCH WIRES WILL BE RAN TO THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.
5. COMPRESSORS HAVE A CORESENSE MODULE INSTALLED ON THEM FROM THE MANUFACTURER. SEE IOM AND ALERT CODE/ DIP SWITCH CHART FOR

Section 9: Equipment Start-Up Procedures

Equipment Start-up Form

Customer Name:_____

Customer Address:_____

Model #:_____ Serial #:_____

Dealer Name:_____

Distributor Name:_____ Start-up Date:_____

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

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

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

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

Installer/Technician:_____ Date:_____

Section 9: Equipment Start-Up Procedures

Equipment Start-up Process

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

Electrical:

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

Plumbing:

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

Ductwork:

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

Equipment Start-Up

1. Energize geothermal unit with high voltage.
2. Set the thermostat to “Heat” or “Cool.” Adjust set point to energize the unit. System will energize after delays expire (typically a five minute delay).
3. Check water flow with a flow meter (non-pressurized) or pressure drop conversion (pressurized). Pressure drop tables must be used to convert the pressure drop to GPM. The pressure drop can be obtained by checking water pressure in and water pressure out at the P/T ports.
4. Check the geothermal unit’s electrical readings listed in the Unit Electrical Data table.
5. Check the source water temperature in and out at the P/T ports (use insertion probe). Allow 10 minutes of operation before recording temperature drop.
6. Calculate the heat of extraction or heat of rejection.
7. Check the temperature difference of the load coax (water-to-water) or air coil (water-to-air). P/T ports are recommended for use on the load side, but the line temperatures can be used to check the temperature difference.
8. Change the mode of the thermostat and adjust the set point to energize the unit. Check the data in opposite mode as the previous tests. Amp draws as well as temperature differences and flow rate should be recorded.
9. Check auxiliary heat operation by adjusting the thermostat set point 5°F above the room temperature in “Heat” mode or set thermostat to “Emergency." Record voltage, amperage, and air temperature difference.

Section 9: Equipment Start-Up Procedures

Pressure Drop Table

Model	BPHE	GPM	Pressure Drop, Compressor Off																		
			Water				20% (by mass) Methanol Water Solution					20% (by mass) Ethanol Water Solution					30% (by mass) Propylene Glycol Water Solution				
			110 °F	90 °F	70 °F	50 °F	110 °F	90 °F	70 °F	50 °F	25 °F	110 °F	90 °F	70 °F	50 °F	25 °F	110 °F	90 °F	70 °F	50 °F	25 °F
			PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI	PSI
WD240	Source Pressure Drop	30	0.7	0.7	0.8	0.8	0.7	0.8	0.8	0.9	1.0	0.7	0.8	0.9	1.0	1.2	0.8	0.9	1.0	1.1	1.4
		37.5	1.1	1.1	1.1	1.2	1.1	1.1	1.2	1.3	1.5	1.0	1.2	1.3	1.4	1.7	1.3	1.4	1.5	1.6	2.0
		45	1.5	1.5	1.6	1.7	1.5	1.6	1.7	1.8	2.1	1.5	1.6	1.8	2.0	2.3	1.7	1.9	2.0	2.3	2.7
		52.5	2.1	2.1	2.1	2.2	2.0	2.1	2.2	2.4	2.7	2.0	2.2	2.4	2.6	3.1	2.3	2.5	2.7	3.0	3.5
		60	2.7	2.7	2.7	2.8	2.6	2.7	2.8	3.1	3.5	2.6	2.7	3.0	3.3	3.9	2.9	3.1	3.4	3.8	4.4
		65	3.1	3.2	3.2	3.2	3.1	3.1	3.3	3.5	4.0	3.0	3.2	3.5	3.8	4.5	3.4	3.6	3.9	4.3	5.0
		70	3.6	3.7	3.7	3.7	3.6	3.6	3.7	4.0	4.6	3.5	3.6	4.0	4.4	5.1	3.8	4.1	4.5	4.9	5.7
	Load Pressure Drop	30	0.8	0.8	0.9	1.0	0.9	0.9	1.0	1.1	1.2	0.8	0.9	1.0	1.2	1.4	1.0	1.1	1.2	1.3	1.7
		37.5	1.3	1.3	1.3	1.4	1.3	1.3	1.4	1.6	1.8	1.2	1.4	1.5	1.7	2.0	1.5	1.6	1.7	1.9	2.3
		45	1.8	1.8	1.9	2.0	1.8	1.9	2.0	2.2	2.5	1.8	1.9	2.1	2.4	2.8	2.0	2.2	2.4	2.7	3.1
		52.5	2.5	2.5	2.5	2.6	2.4	2.4	2.6	2.8	3.2	2.4	2.5	2.8	3.1	3.6	2.7	2.9	3.2	3.5	4.1
		60	3.2	3.2	3.3	3.3	3.1	3.2	3.3	3.6	4.1	3.1	3.2	3.5	3.9	4.6	3.4	3.7	4.0	4.4	5.2
		65	3.7	3.8	3.8	3.9	3.7	3.7	3.8	4.1	4.7	3.6	3.7	4.1	4.5	5.3	3.9	4.2	4.6	5.1	6.0
		70	4.3	4.4	4.4	4.5	4.2	4.3	4.4	4.7	5.4	4.2	4.3	4.6	5.1	6.0	4.6	4.8	5.3	5.8	6.8
WD360	Source Pressure Drop	45	1.0	1.0	1.0	1.1	1.0	1.0	1.1	1.2	1.3	1.0	1.1	1.1	1.2	1.5	1.1	1.2	1.3	1.4	1.7
		54	1.4	1.4	1.4	1.5	1.4	1.4	1.5	1.6	1.8	1.3	1.5	1.6	1.7	2.0	1.6	1.7	1.8	1.9	2.3
		70	2.3	2.3	2.3	2.4	2.2	2.3	2.4	2.6	2.9	2.2	2.4	2.6	2.8	3.2	2.5	2.7	2.9	3.1	3.5
		78	2.8	2.8	2.9	3.0	2.8	2.8	3.0	3.2	3.5	2.7	2.9	3.1	3.4	3.8	3.1	3.2	3.5	3.8	4.3
		90	3.7	3.8	3.8	3.9	3.7	3.7	3.9	4.1	4.5	3.6	3.8	4.1	4.4	5.0	4.0	4.2	4.5	4.9	5.6
		95	4.2	4.2	4.2	4.3	4.1	4.1	4.3	4.5	5.0	4.0	4.1	4.5	4.8	5.5	4.4	4.7	5.0	5.4	6.1
		100	4.6	4.7	4.7	4.7	4.5	4.5	4.7	5.0	5.5	4.5	4.6	4.9	5.3	6.0	4.8	5.1	5.5	5.9	6.7
	Load Pressure Drop	45	1.0	1.1	1.1	1.2	1.1	1.1	1.2	1.3	1.4	1.0	1.1	1.3	1.4	1.6	1.2	1.3	1.4	1.5	1.9
		54	1.5	1.5	1.6	1.6	1.5	1.6	1.7	1.8	2.0	1.4	1.6	1.7	1.9	2.2	1.7	1.8	2.0	2.1	2.5
		70	2.5	2.5	2.5	2.6	2.4	2.5	2.6	2.8	3.1	2.4	2.6	2.8	3.0	3.5	2.7	2.9	3.1	3.4	3.9
		78	3.1	3.1	3.1	3.2	3.0	3.1	3.2	3.4	3.8	3.0	3.1	3.4	3.7	4.2	3.3	3.5	3.8	4.1	4.7
		90	4.1	4.1	4.2	4.2	4.0	4.0	4.2	4.5	5.0	4.0	4.1	4.4	4.8	5.5	4.3	4.6	4.9	5.4	6.1
		95	4.6	4.6	4.6	4.7	4.5	4.5	4.6	4.9	5.5	4.4	4.5	4.9	5.3	6.0	4.8	5.1	5.4	5.9	6.7
		100	5.1	5.1	5.1	5.2	4.9	5.0	5.1	5.4	6.0	4.9	5.0	5.3	5.8	6.6	5.3	5.6	6.0	6.5	7.4

1. Pressure drop data are BPHE prpessure drop data, with compressor off.
2. Pressure drop data accurate within ±25%.
3. Interpolation of unit pressure drop data is permissible; extrapolation is not.
4. Pressure drop data is a result of lab testing and is not related to warranty.
5. Due to variations in installation, actual unit WPD may vary from the tabulated data.

Performance Check

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

Equipment should be in 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
a. Check entering water temperature
b. Check entering water pressure
c. Check leaving water pressure
Once this information is recorded, find corresponding entering water temperature column in Specification Manual for unit.

Find pressure differential in PSI column in Spec Manual. Then read the GPM column in Spec Manual to determine flow in GPM.

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

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

Specification Glossary, Calculations

Glossary

COP = Coefficient of Performance = BTU Output / BTU Input	HR = Total Heat Of Rejection, Btu/hr
DH = Desuperheater Capacity, Btu/hr	KW = Total Power Unit Input, Kilowatts
EER = Energy Efficiency Ratio = BTU output/Watts input	LWT = Leaving Source Water Temperature, Fahrenheit
EST = Entering Source Water Temperature, Fahrenheit	LLT = Leaving Load Water Temperature, Fahrenheit
ELT = Entering Load Water Temperature, Fahrenheit	TC = Total Cooling Capacity, Btu/hr
GPM = Water Flow, Gallons Per Minute	HC = Heating Capacity, Btu/hr
HE = Total Heat Of Extraction, Btu/hr	WPD = Water Pressure Drop, PSI & Feet of Water

Section 9: Equipment Start-Up Procedures

Heating & Cooling Calculations Table

Heating	Cooling
LWT = EST - $\frac{HE}{GPM \times 500^*}$	LWT = EST + $\frac{HR}{GPM \times 500^*}$
HE = 500* x GPM x (EWT - LWT)	HR = 500* x GPM x (LWT - EWT)

*500 = Constant factor for pure water. Brine should be 485.

Source Water Flow 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 (EST column). The general "rule of thumb" when selecting flow rates is the following:

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

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

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

Determine minimum EST based upon your geographical area.

Go to the performance data table for the heat pump model selected and look up the the Heat of Extraction (HE) at the "rule of thumb" water flow rate (GPM) and at the design Entering Load Temperature (ELT).
Calculate the temperature difference (TD) based upon the HE and GPM of the model.
TD = HE / (GPM x 500).
Calculate the LWT.
LWT = EST - TD.

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

Example 1:
EST = 50°F, ELT = 95°F.
Model 036 Full Load, heating. Flow rate = 5 GPM. HE = 33,600 Btuh.
TD = 33,600 / (5 x 500) = 13.4°F
LWT = 50 - 13.4 = 36.6°F
Water flow rate should be adequate under these conditions.

Example 2:
EST = 40°F, ELT = 95°F.
Model 036 Full Load, heating. Flow rate = 5 GPM. HE = 28,700 Btuh.
TD = 28,700 / (5 x 500) = 11.5°F
LWT = 40 - 11.5 = 28.5°F
Water flow rate must be increased.

Application Notes for Performance Data

Notes:
1. Desuperheater Capacity is based upon 0.4 GPM Flow per nominal ton at 90°F entering hot water temperature.
2. Extrapolation data down to 25°F for heating and interpolation between EST & GPM data is permissible.
3. EWT (Entering Water Temperature) is also called EST (Entering Source Temperature).
4. Load flow rate is the same as the nominal source flow rate, approximately 3 GPM per ton.

Section 10: Troubleshooting

QR Codes for Maintenance and Troubleshooting Tips Videos

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

ECM Temporary Motor Replacement

ECM Motor Troubleshooting

Troubleshooting a TXV

Compressor Troubleshooting

Variable Speed Flow Centers

Return Conversion for a XT or CT

Heat Of Extraction and Rejection

Measuring Subcooling and Superheat

Section 10: Troubleshooting

A: Unit will not start in either cycle

Thermostat	Set thermostat on heating and highest temperature setting. Unit should run. Set thermostat on cooling and lowest temperature setting. Unit should run. Set fan to On position. Fan should run. If unit does not run in any position, disconnect wires at heat pump terminal block and jump R, G, Y. Unit should run in heating. If unit runs, replace thermostat with correct thermostat only.
Loose or broken wires	Tighten or replace wires.
Blown Fuse/ Tripped Circuit Breakers	Check fuse size, replace fuse or reset circuit breaker. Check low voltage 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.
Water Flow (runs for 30 sec)	If water flow is low (less than 3.5 GPM), unit will not start. Make sure Pump Module or solenoid valve is connected (see wiring diagram). Water has to flow through the heat exchanger in the right direction (see labels at water fitting connections) before the compressor can start. If water flow is at normal flow, use an ohmmeter to check if you get continuity at the flow switch. If no switch is open and flow is a normal flow, remove switch and check for stuck particles or bad switch.

B: Unit Running Normal, But SPACE Temperature Is Unstable

Thermostat	Thermostat is getting a draft of cold or warm air. Make sure that the wall or hole used to run thermostat wire from the ceiling or basement is sealed, so no draft can come to the thermostat. Faulty Thermostat (Replace).

C: 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.

D: In heating or cooling mode, unit output is low

Water	Water flow & temperature insufficient.
Load Side Flow	Check speed setting, check nameplate or data manual for proper speed, and correct speed setting. Check for dirty air filter—Clean or replace. Restricted or leaky ductwork. Repair.
Refrigerant charge	Refrigerant charge low, causing inefficient operation. Make adjustments only after airflow and water flow are checked.
Reversing valve	Defective reversing valve can create bypass of refrigerant to suction side of compressor. Switch reversing valve to heating and cooling mode rapidly. If problem is not resolved, replace valve. Wrap the valve with a wet cloth and direct the heat away from the valve. Excessive heat can damage the valve. Always use dry nitrogen when brazing. Replace filter/drier any time the circuit is opened.

E: In heating or cooling mode, unit output is low

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.

F: 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.

G: Excessive head pressure in cooling mode

Inadequate water flow	Low water flow, increase flow.

H: Excessive head pressure in heating model

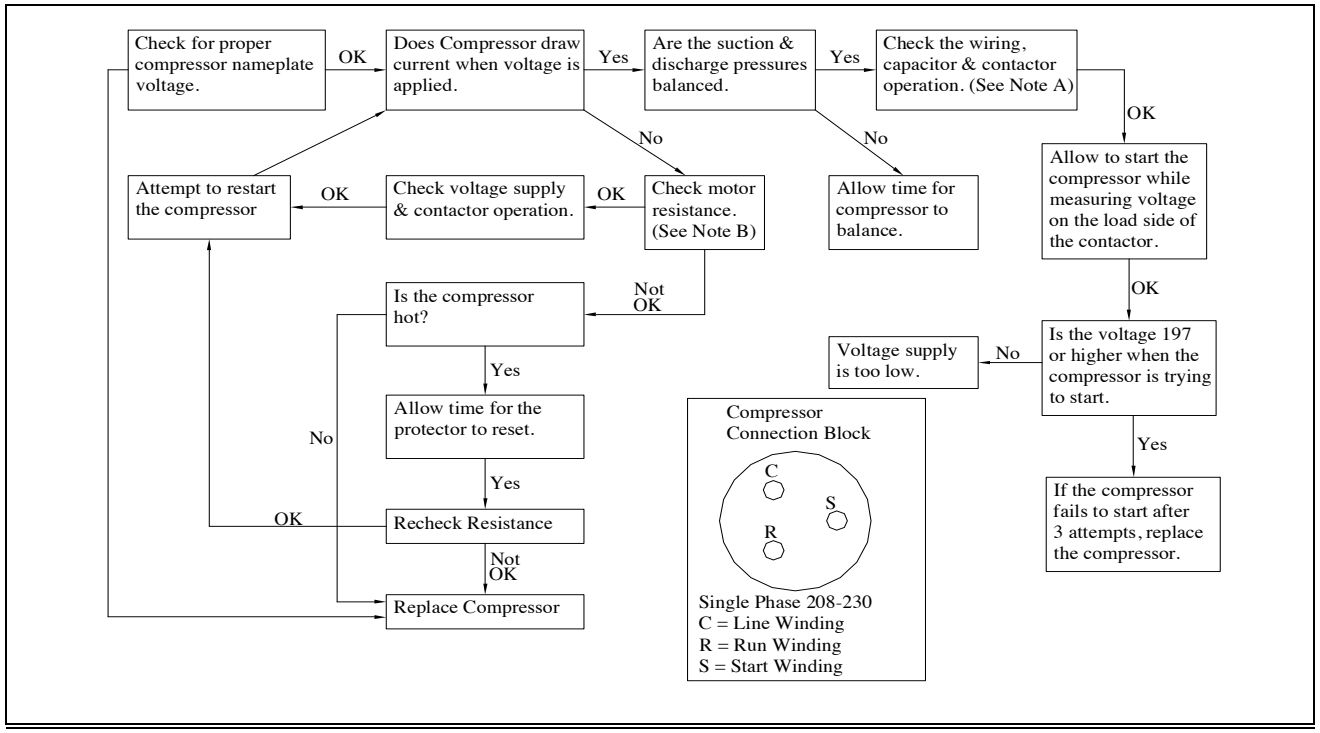
Load Side Flow	See E: Noisy blower and low air flow.

I: 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.

Compressor Troubleshooting Tips

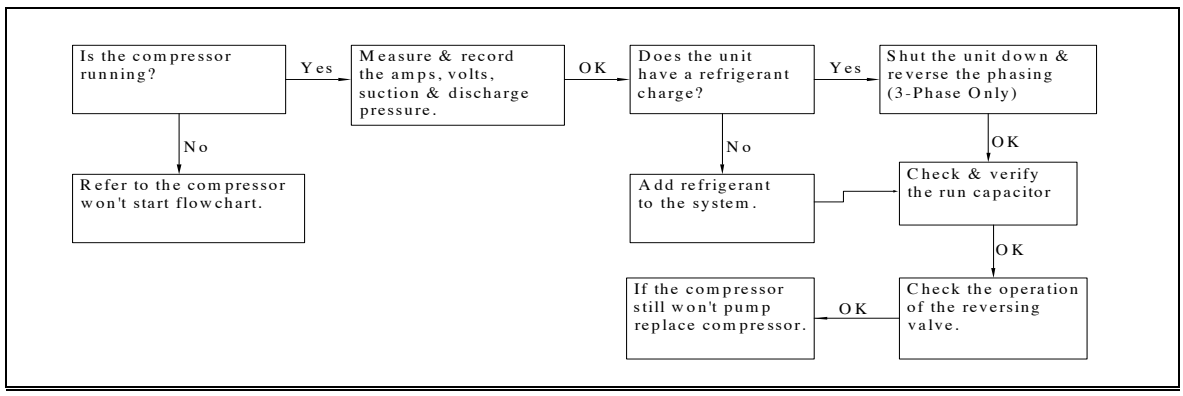
J: Compressor Won't Start



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

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

K: Compressor Won't Pump Chart



Section 10: Troubleshooting

Refrigeration Troubleshooting

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

Superheat/Subcooling Conditions

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

Typical R-410A Unit Superheat/Subcooling Values

		Heating - Without Desuperheater					
EWT	**GPM Per Ton**	**Discharge Pressure (PSIG)**	**Suction Pressure (PSIG)**	**Sub Cooling**	**Super Heat**	**Air Temperature Rise (°F-DB)**	**Water Temperature Drop (°F)**
30	1.5	285-310	68-76	4-10	8-12	14-20	5-8
	3	290-315	70-80	4-10	8-12	16-22	3-6
50	1.5	315-345	100-110	6-12	9-14	22-28	7-10
	3	320-350	105-115	6-12	9-14	24-30	5-8
70	1.5	355-395	135-145	7-12	10-15	30-36	9-12
	3	360-390	140-150	7-12	10-15	32-38	7-10

		Cooling - Without Desuperheater					
EWT	**GPM Per Ton**	**Discharge Pressure (PSIG)**	**Suction Pressure (PSIG)**	**Sub Cooling**	**Super Heat**	**Air Temperature Drop (°F-DB)**	**Water Temperature Rise (°F)**
50	1.5	220-235	120-130	10-16	12-20	20-26	19-23
	3	190-210	120-130	10-16	12-20	20-26	9-12
70	1.5	280-300	125-135	8-14	10-16	19-24	18-22
	3	250-270	125-135	8-14	10-16	19-24	9-12

ENERTECH® Geothermal Made Better™

WARRANTY ORDER & CLAIM

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

ALL WARRANTY REGISTRATIONS SHOULD BE SUBMITTED WITHIN 10 DAYS OF INSTALLATION

COMPANY NAME _____ (Form submitter) DATE _____

PHONE _____ FAX _____ EMAIL _____

ORDERED BY _____ JOB NAME/PO # _____

UNIT *Model #* _____ *Serial #* _____

FAILURE DATE _____

SHIP TO _____
(If different than company) _____

_____

HOMEOWNER ADDRESS _____

_____

_____

Required if claim is for defective flow center

FLOW CENTER MODEL # _____ FLOW CENTER SERIAL # _____

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

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

LABOR REIMBURSEMENT REQUESTED ☐ *NO* ☐ *YES*

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

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

OTHER NOTES _____

_____

FOR ENERTECH COMPANIES USE ONLY

SRO# _____ CREDIT MEMO# _____

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

Registration

ENERTECH® Geothermal Made Better®

WARRANTY REGISTRATION

NOW REGISTER ONLINE AT WARRANTY-REGISTRATION.ENERTECHGEO.COM

WARRANTY REGISTRATIONS SHOULD BE SUBMITTED WITHIN 60 DAYS OF INSTALLATION

Model Number _____ Serial Number _____ Install Date _____

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

_____

Purchaser/User Name _____ Phone _____

Address _____ City _____ State/Prov _____

Postal Code _____ Email _____

Installer Company Name _____

City _____ State/Prov _____ Email _____

Application

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

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

Use (check all that apply)

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

☐ Other _____

Loop Type

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

Demographics

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

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

Home Location ☐ Rural ☐ Urban ☐ Suburban

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

Customer Satisfaction

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

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

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

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

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

EMAIL THIS FORM TO:
WARRANTY@ENERTECHGEO.COM

FAX THIS FORM TO:
ENERTECH GLOBAL LLC
618.664.4597

REGISTER ONLINE AT: warranty-registration.enertechgeo.com

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