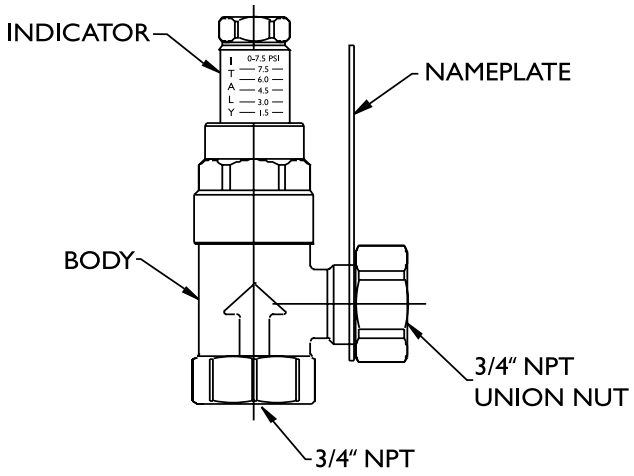
Remove this page from the manual before providing to building owner.

CAUTION

THIS SYSTEM UTILIZES A PRESSURIZED LOAD CIRCUIT. PLEASE ENSURE THE FOLLOWING:

1. The load side piping is flushed completely and purged of air (see Section 6, Figures 7a to 7j).
2. The differential bypass valve is installed, and in the correct orientation (see page 16 and drawing below).



3. The minimum pump speed is set to allow 5 GPM through the bypass valve with all zones closed (see page 16) if hydraulic separator or buffer tank is not used (a hydraulic separator or buffer tank is recommended).

NOTICE: A flush cart is required for purging air from the load side piping. See figures 6b to 6d for valve arrangement and Section 6 (Flushing and Filling) for flushing steps.

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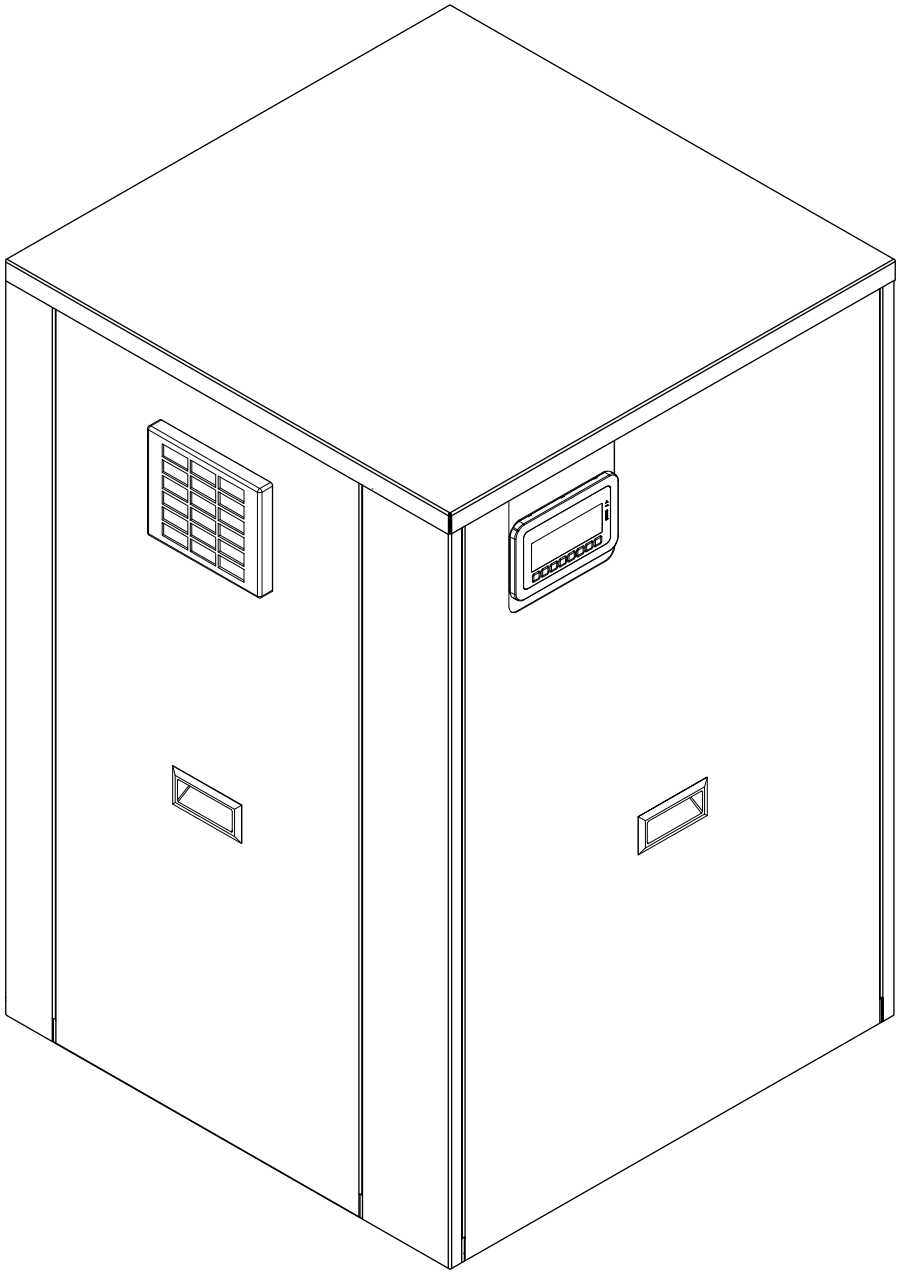
ENERTECH
ENERGY + TECHNOLOGY

Installation & Operations Manual

WV MODELS WATER-TO-WATER HEAT PUMPS



20D812-01NN

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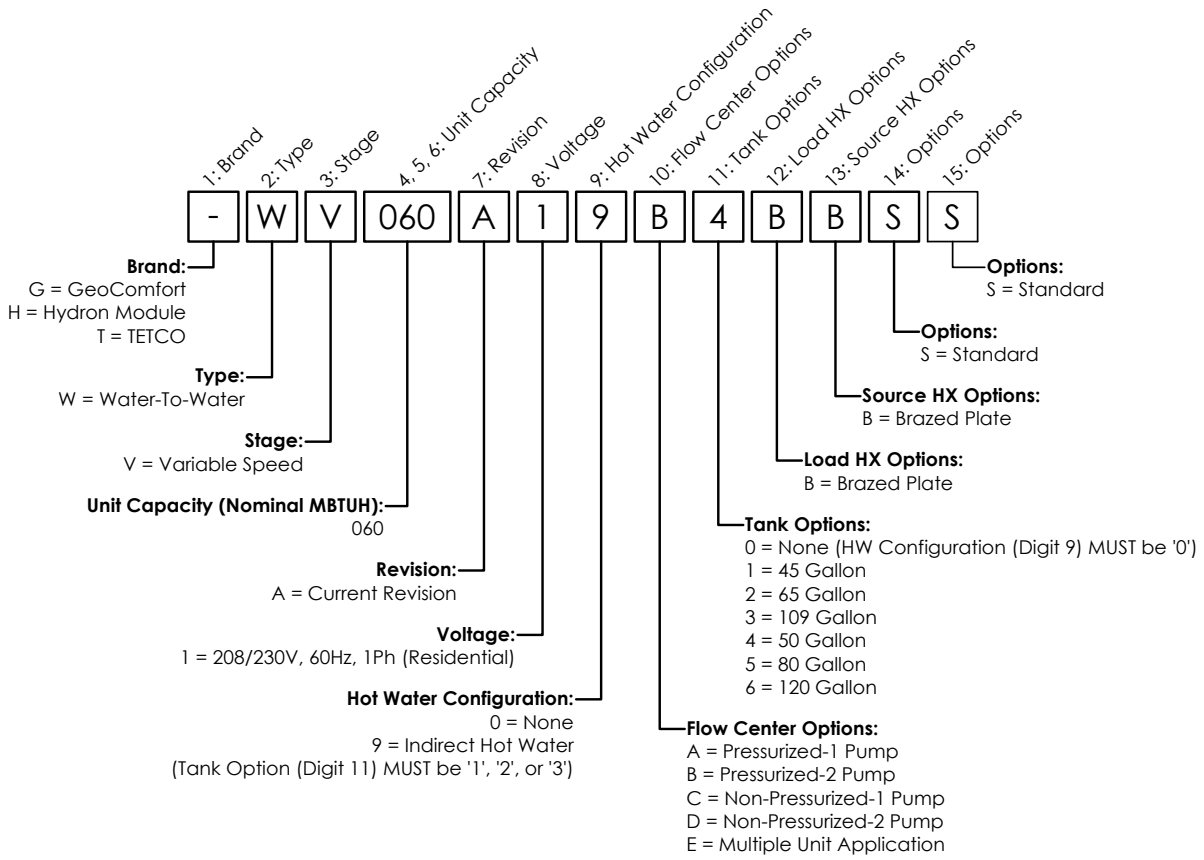
Section 1: Model Nomenclature

Nomenclature Decoder



Section 2: Product & Unit Data

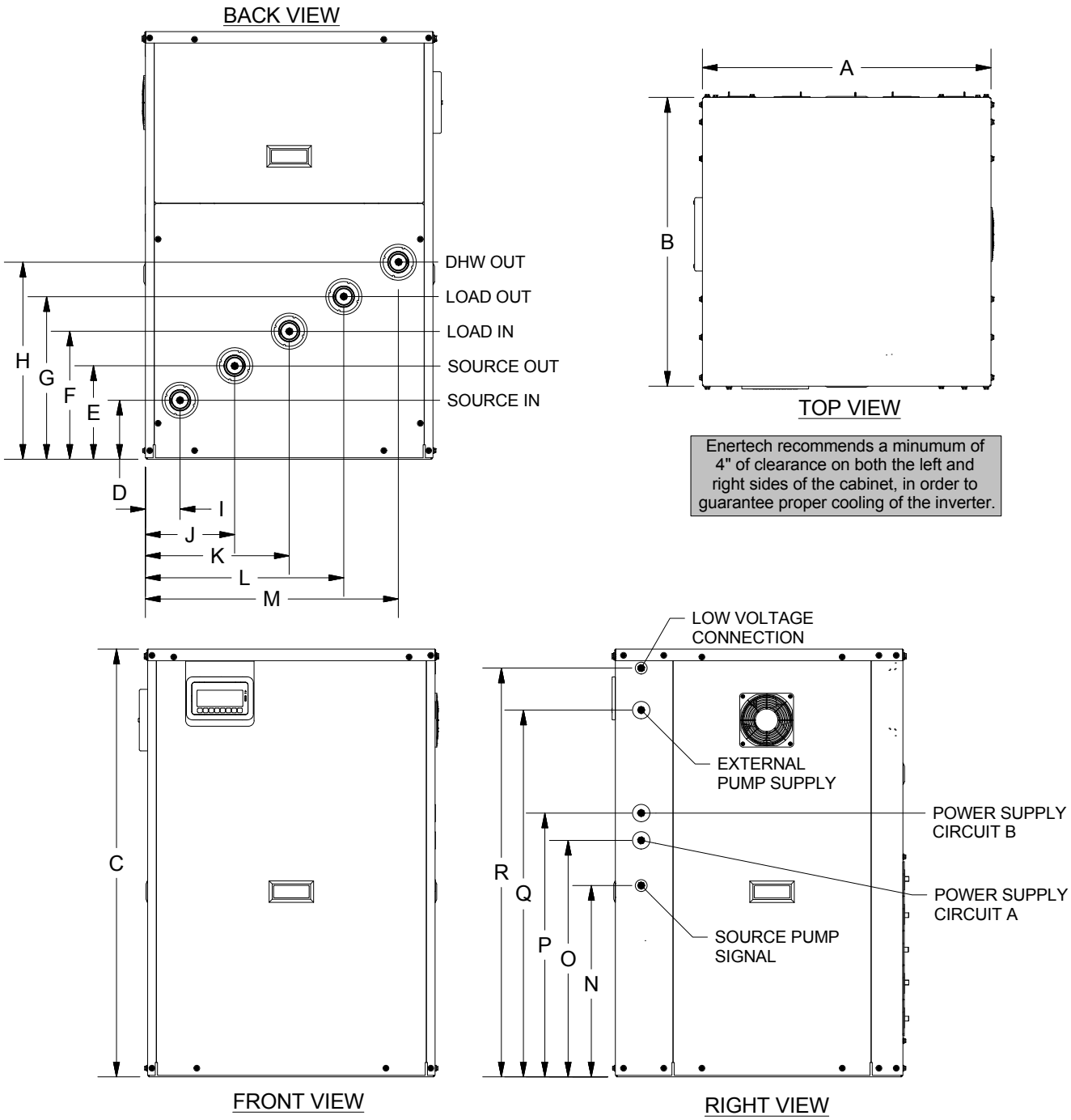
Unit Electrical Data

Model	Voltage Code/ Flow Center Option	60 Hz Power		Supply Circuit A [1-3]								Supply Circuit B [1-3]				
				Compressor	Drive		Int. Pump FLA	Ext. Loop Pump FLA	Total FLA	Min Circuit AMPS	Max Brkr HACR	Immersion Heater			Min Circuit AMPS	MOCP
		Volts	Phase	CMCC [4]	LRA	MOC						Volts	kW	FLA		
WV060	1*A/C	208/230	1	38.0	36.0	50.0	1.5	1.5	39.1	48.1	80	230	9.0	39.1	48.9	50
	1*B/D/E	208/230	1	38.0	36.0	50.0	1.5	2.4	40.0	49.0	80	230	9.0	39.1	48.9	50

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
4. CMCC (Compressor Maximum Output Current Limit): This value is the maximum output of the dirve (inverter) to the compressor. Although not significant to the installation (continue to use FLA and MCA for wire/breaker sizing), this value is a required listing for the unit electrical data.

Section 2: Product & Unit Data

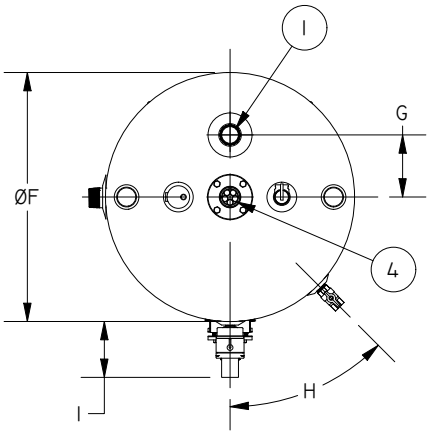
Unit Dimensional Data



Variable Speed Water-to-Water																				
Model	Overall Cabinet			Source Water				Load Water				DHW Water		Electrical Connections					Weight	Factory Charge (oz)
	A	B	C	D	I	E	J	F	K	G	L	H	M	N	O	P	Q	R		
060	25.1	25.1	37.2	5.13	13.01	8.13	7.76	11.13	12.50	14.13	17.24	17.13	21.99	16.63	20.55	22.93	31.88	35.53	320	88

Notes:
- All brands use 1" Double O-Ring fittings for all source and load loop connections.
- All electrical knockouts are sized for 1/2" or 3/4" conduit.
- All measurements are in inches.
- Stacking unit is not recommended. The top cover MUST remain accessable for service.
- Units that **DO NOT** have hot water capability will not have connection for 'DHW OUT'.

Physical Data : TurboMax

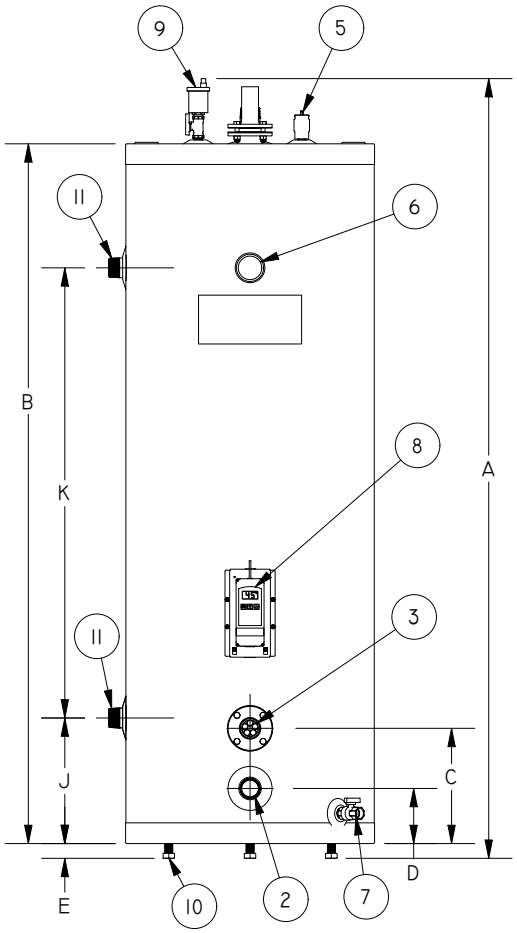


TOP VIEW

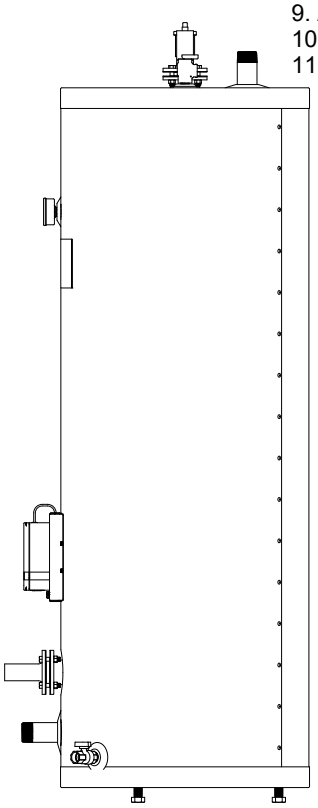
TECHNICAL DATA				
MODEL	TANK VOLUME	HEAT TRANSFER AREA (SQ.FT.)	EQUIPMENT WEIGHT	SHIPPING WEIGHT
01A011-0INN (ETC AQUASTAT VERSION)	50 GAL. U.S.	32.7 SQFT	230 LBS.	268 LBS.
01A012-0INN (ETC AQUASTAT VERSION)	80 GAL. U.S.	32.7 SQFT	308 LBS.	353 LBS.
01A013-0INN (ETC AQUASTAT VERSION)	120 GAL. U.S.	59.8 SQFT	430 LBS.	480 LBS.

COMPONENT IDENTIFICATION

1. Boiler Water Supply (Inlet)
2. Boiler Water Return (Outlet)
3. Domestic Water Inlet (**1-1/2" I.D. Copper**)
4. Domestic Water Outlet (**1-1/2" I.D. Copper**)
5. Pressure Relief Valve - **3/4 NPTF**
6. Temp. and Press. Indicator - **1/2 NPTM**
7. Tank Drain Valve - **3/4 NPTF**
8. Temperature Control - Remove cover and connect thermistor wire.
9. Automatic Air Vent - **1/2 NPTM**
10. Adjustable Leg
11. Extra Tappings - be sure to close with provided caps or attach to your system.

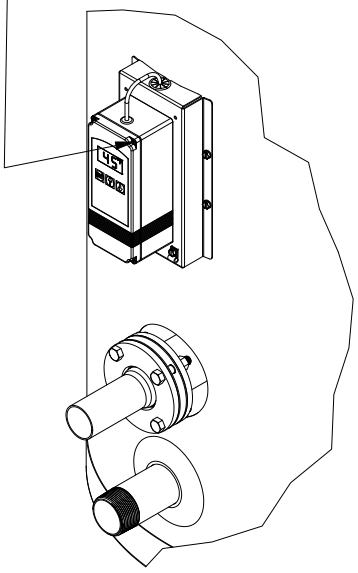


FRONT VIEW



RIGHT VIEW

Remove cover (4 screws). Feed wire through plastic body of ETC. Strip and connect wire to terminals. Review I.O.M. and replace cover when complete.

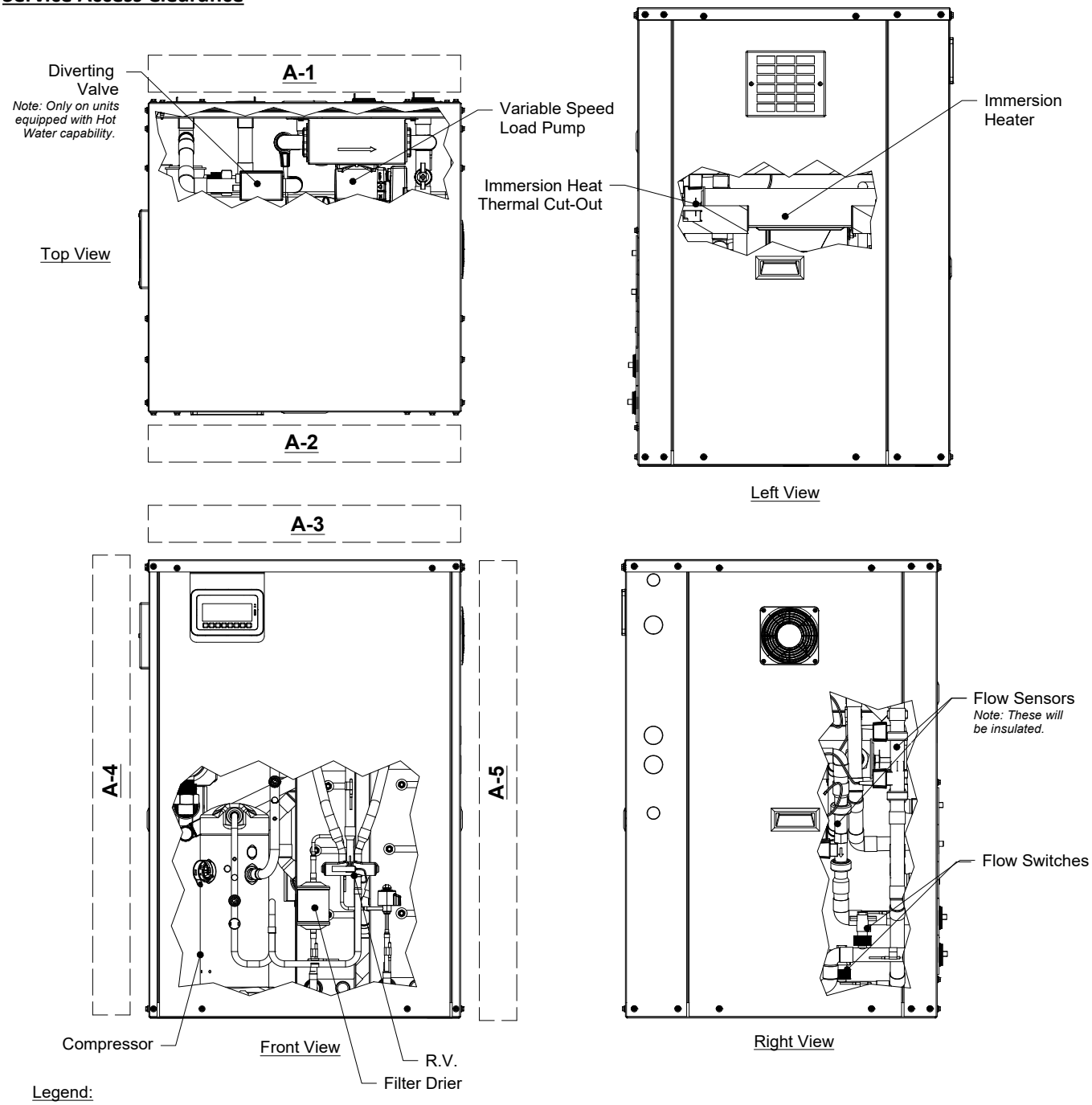


NOTE:
Review and utilize TurboMax Use and Care Manual during installation. Once unit is installed, properly store manual.

TURBOMAX WITH ETC AQUASTAT												
MODEL	GAL.	A (IN.)	B (IN.)	C (IN.)	D (IN.)	E (IN.)	F (IN.)	G (IN.)	H (DEG.)	I (IN.)	J (IN.)	K (IN.)
01A011-0INN	50 GAL.	60 11/16	52 13/16	11 13/32	7 13/32	1 1/2	22 1/16	4	45	5 1/4	7 13/32	38
01A012-0INN	80 GAL.	75 3/8	67 5/8	11 1/8	5 5/16	1 1/2	24 1/16	6	45	5 3/8	12 1/8	43 1/2
01A013-0INN	120 GAL.	77 7/16	69 9/16	12 1/8	6 5/16	1 1/2	28 1/16	6	45	5 3/16	13 1/8	43 1/2

Section 2: Product & Unit Data

Service Access Clearance



Legend:

A-1: (Back) Leave enough room for all load and source piping, as well as enough space to remove the back door. (Minimum of 8-10")

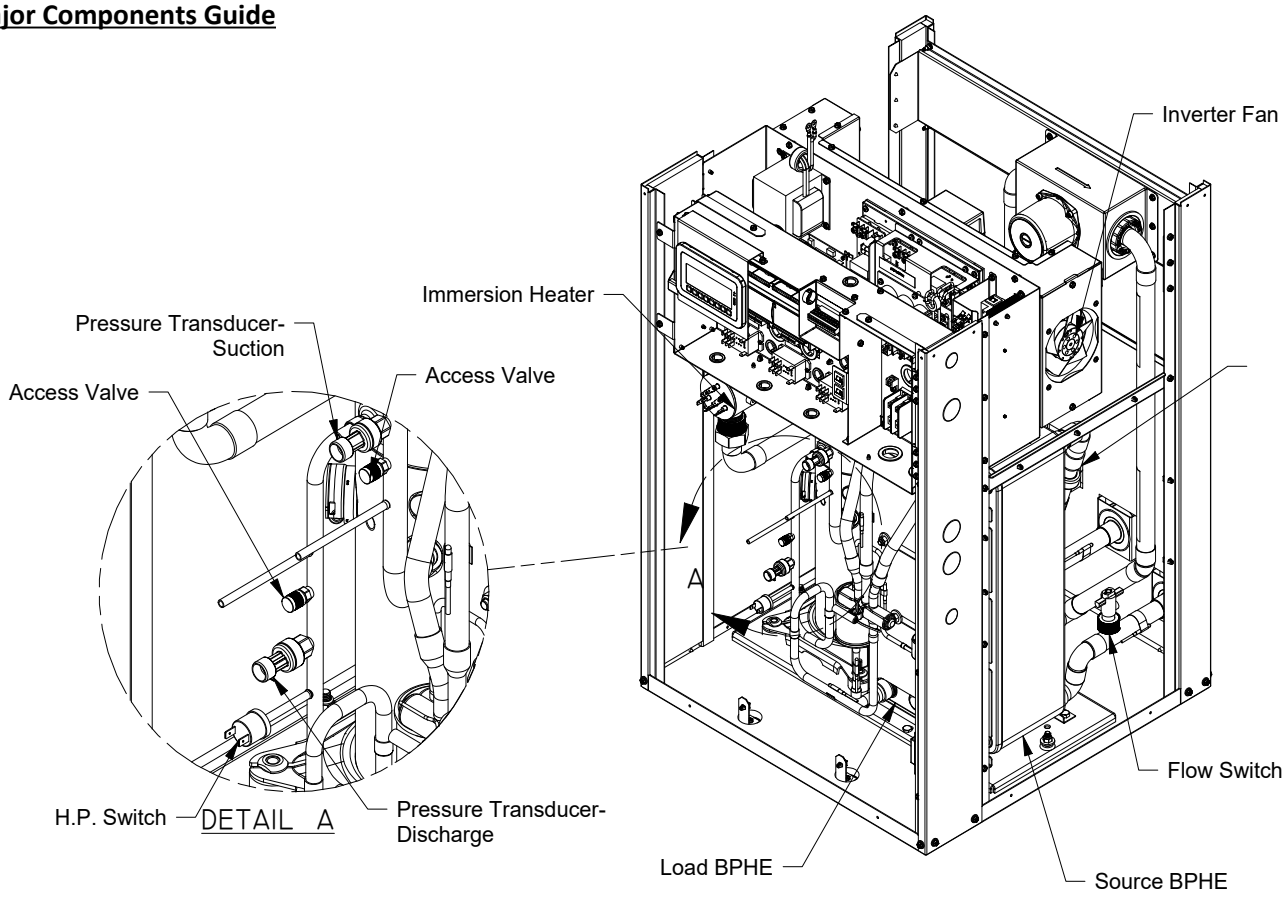
A-2 (Front): Requires a minimum of 3 feet of clearance. The front door gives access to the main control panel, lower control panel, as well as the entire refrigerant circuit (EXV, Filter Drier, Compressor, R.V.). Control box details are located in the Control Section of the IOM.

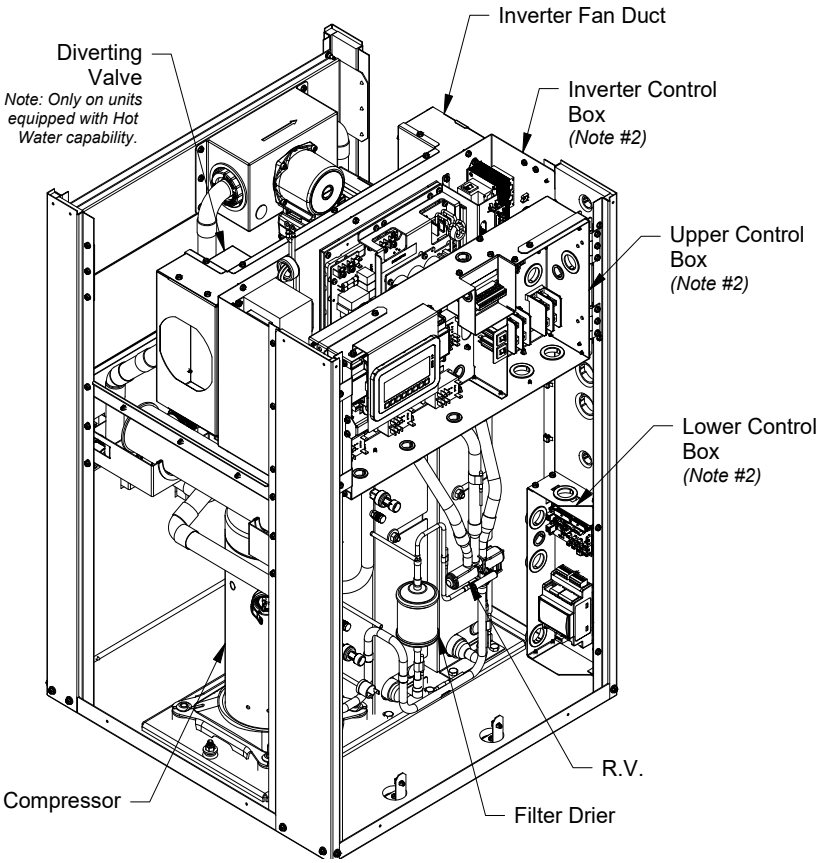
A-3 (Top): Stacking units is not allowed, and a minimum of 3 feet of clearance is recommended. The top cover gives access to the load pump and diverting valve located in the back of the unit.

A-4 (Left): Requires of minimum of 4 inches for proper cooling of the inverter. The air filter will also need to be accessed, and replaced by the Home Owner, so additional space should be accounted for.

A-5 (Right): Requires of minimum of 2 feet of clearance. The right side door gives access to the flow sensors and flow switches in the back of the unit.

Major Components Guide





Notes:

1. All piping will be insulated, except the discharge line.
2. Refer to the controls section for detailed views of the control box assembly components.
3. Internal wiring not shown in views above.

Section 3: 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 water and chilled water as well as optional domestic water heating capability.

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 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. Ensure 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 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.

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.

⚠ NOTICE ⚠

ENERTECH REQUIRES THAT A STRAINER BE INSTALLED ON THE INLET OF SOURCE AND LOAD SIDE BRAZED-PLATE HEAT EXCHANGERS

⚠ CAUTION ⚠

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

⚠ WARNING ⚠

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

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 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 that 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. Verify that all refrigerant tubing is free of dents and kinks. Refrigerant tubing should not be touching other unit components.
5. Before unit start-up, read all manuals and become familiar with unit components and operation. Thoroughly check the unit before operating.
6. Locate the Unit Start-Up Form from this manual and have it available as the unit installation proceeds.

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.

⚠ 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.

⚠ CAUTION ⚠

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

Unit Placement

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

- 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.
- Unit Air Pad. All geothermal heating and cooling equipment should be placed on a high-density rubber pad, a formed plastic air pad, or a high density, closed cell polystyrene pad. This helps eliminate vibration noise that could be transmitted through the floor.
- Unit Racking: 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.
- 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.

Thermostat

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

Loop Pumping Modules

Must be wired to the heat pump's electric control box. A 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.

Desuperheater Piping

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

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

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.

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).

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.

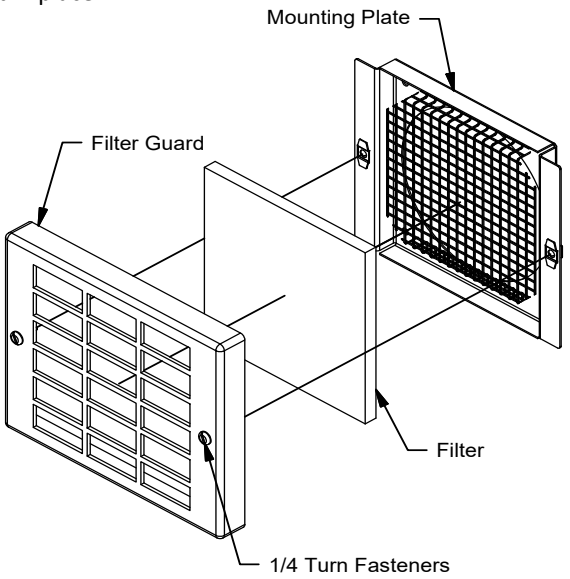
Compressor (Copeland Scroll): Pumps refrigerant through the heat exchangers and pressurizes the refrigerant, which increases the temperature of the refrigerant.

Maintenance

The WV series contains a case cooling fan with an air filter to keep the internal cabinet clean. The filter should be checked annually and replaced as needed.

The unit does not need to be turned off in order to change the filter. The mounting plate remains secured to the door during the entire process.

- Using a flat blade screw driver, turn the 1/4 turn fasteners to release the filter guard/cover.
- Once the filter guard is removed, the exposed filter can be replaced with a new one, Enertech P/N: RF 119.
- Place the guard back in place and turn the fasteners to hold it in place.



Variable Speed

Overview

Enertech's Variable speed Heat Pumps are designed to match their capacity to the load of the zone. With a true variable speed compressor and variable water flow, you now maximize the efficiency from inverter driven technology. With the installation of a pressure differential bypass valve, even a small radiant floor heating zone (three or four 1/2" PEX circuits, 3 gpm of load flow) can allow a variable speed heat pump to operate without the use of a buffer tank. To maintain the minimum flow rate required for the heat pump (minimum 5 gpm), part of the flow is returned to the heat pump through the bypass valve, and the remainder is delivered to the hydronic zone (minimum 3 gpm). This approach works well for radiant floor zones. Very small loads will cause the heat pump to cycle, but the minimum load flow rate for the refrigerant circuit is always maintained. Systems that require cooling must utilize fan coils that are large enough to allow sufficient run time to provide adequate latent capacity. Fan coils smaller than one ton could cause the heat pump to cycle too often, not allowing the system to maintain a cold enough coil to provide good dehumidification. Therefore, Enertech recommends that fan coils, one ton (12,000 BTU's) and larger are used with variable speed heat pumps. Zones that are smaller than 3 gpm are referred to as Micro-zones. Micro-zones do not work with Variable speed heat pumps, the flow rates are too low and cause the heat pump to short cycle.

Enertech's Advantage System has almost limitless flexibility, we will be happy to provide a custom solution for your project! If your project falls outside of the provided guidelines for water flow or BTU's, please call our Design Services.

Buffer Tank

Buffer tanks are not recommended with Variable speed heat pumps. The purpose of a buffer tank is primarily to keep the heat pump running long enough to prevent short cycling when the hydronic load is much smaller than the heat pump capacity. Another important use of the buffer tank is to decouple the flow rate required for the heat pump from the flow rate of the hydronic system, which is typically much less than the heat pump requires. Heat pumps with single speed and two-stage compressors almost always need more flow rate than the design flow rate of the hydronic system they serve, especially if only one zone is calling for heating or cooling.

Designing the System

Enertech strongly recommends using the HBX ZON-600 control to provide the most compatible operation with the WV unit. Although other control systems will work, Enertech Technical Services personnel are most familiar with the approved controls. Other controls may be difficult to support should troubleshooting be needed.

DHW Considerations

According to the Water Research Foundation, the average American shower uses approximately 15.8 gallons and lasts for 7.8 minutes at an average flow rate of 2.1 gpm. Depending upon local regulations, shower heads may be available with 1.8, 2.0, or 2.5 gpm flow rates. The state of California, for example limits the flow rate to 1.8 gpm, as of July 2018. In some cases flow restrictors can be removed/modified or multiple shower heads may allow significantly more water usage.

Following are some considerations when determining indirect water heater choice, as well as the need for a second water heater:

WV Capacity: The WV unit has much higher capacity than a standard electric or gas water heater, although the indirect water heater storage is for "load water", not potable water. Therefore, the Turbomax indirect water heater operates more like an instantaneous water heater than a standard water heater. Based upon Enertech lab testing, draws of 5 gpm for a sustained period from the water heater will cause the supply temperature at the fixture to drop.

Indirect Tank Sizing

Tank selection is based upon the number of bathrooms (types of showers and tubs), dishwashers, washing machines, and number of people in the home. Enertech offers two selections, a 50 gallon indirect tank and a 80 gallon indirect tank. Typically, a 50 gallon tank will handle two bathrooms with water efficient fixtures, one dishwasher, and one automatic clothes washer. A 80 gallon tank will handle 3-1/2 bathrooms with water efficient fixtures, one dishwasher, and one automatic clothes washer. If the home has been identified as a large usage application (see "Large Usage", below), a second water heater in series with the Turbomax indirect water heater is required. Even applications that are not "Large Usage" will benefit from a backup water heater for times when the outdoor temperature is very cold, during defrost cycle, or for emergency use.

Large Usage: In a typical residential application, a second water heater is not necessary for capacity reasons. In large usage applications (spa tubs and multi-head showers), a second water heater might be necessary to meet the hot water needs of the customer. A gas or electric water heater can be added to the system to cover these needs. A review of the required gpm and gallons of hot water will be required to size the tank. Keep in mind that multiple shower heads could legally use as much as 10 gpm.

Redundancy: A second water heater will provide some redundancy to the system if there is a pump failure in the heat pump or some other issue not allowing the heat pump to run.

Backup Heat Considerations

The WV unit has an internal 9kW immersion heater that can be used for supplementing the heat pump capacity for hydronic heating and/or DHW heating. The elements are on a separate power supply and may not need to be connected in the heat pump. Depending upon the application, either the internal heater or external backup may make more sense. If additional heating capacity is needed, a determination should be made based upon type of heating required. For example, in most cases, a backup electric heater is installed in the fan coil. Since the fan coil is required for cooling anyway, it can be used for backup or for emergency heat. For DHW, a second water heater can provide both backup heating capacity and emergency DHW heating. If electric heat is installed in the fan coil and a backup water heater is used, the internal electric heat is less important and will allow room in the electric panel for other loads. The advantage of the internal electric heat is that duct heaters and second water heaters are not needed. However, if a pump fails, the internal electric heat cannot operate. Each application must be evaluated individually to ensure that the type of backup fits the requirements. Enertech recommends a second water heater and electric heat in the fan coil, utilizing the internal electric heat as optional, depending upon the electrical panel capacity.

Operation Considerations

Guidelines for Heating Mode Operation

Enertech requires the aquastat setting not to be set above the curve in the following graph. Excessive vibration and part failure can occur at higher than allowed temperature settings. If higher water temperature is needed, a water tank with digital aquastat (with a tolerance level of +/- 1 °F), it is suggested to set the aquastat no higher than 130 °F for all seasons. If an even higher temperature is desired in winter time, a higher set point is allowed as long as it does not exceed the solid curve below. Please keep in mind that higher entering load water temperatures cause efficiency and capacity reductions, so it would benefit the homeowner to operate at a lower, yet comfortable temperature setpoint.

Two common extreme conditions to watch out for when it comes to compressor protection in heating mode:

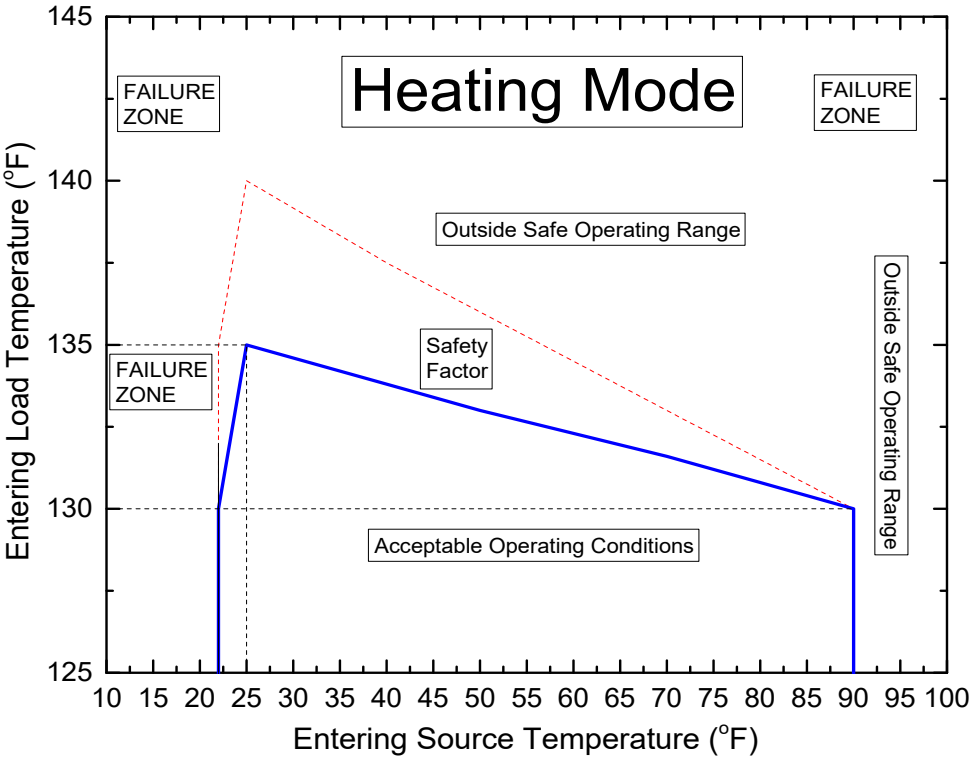
1. Extremely low entering source temperature in combination with very high entering load water temperature. This may lead to a high discharge gas temperature. The maximum allowable discharge gas temperature for the WV060 compressor is 250 °F.
2. High entering source temperature in combination with very high entering load water temperature. This may lead to a high discharge pressure that will trigger high pressure cut out, causing nuisance trips.

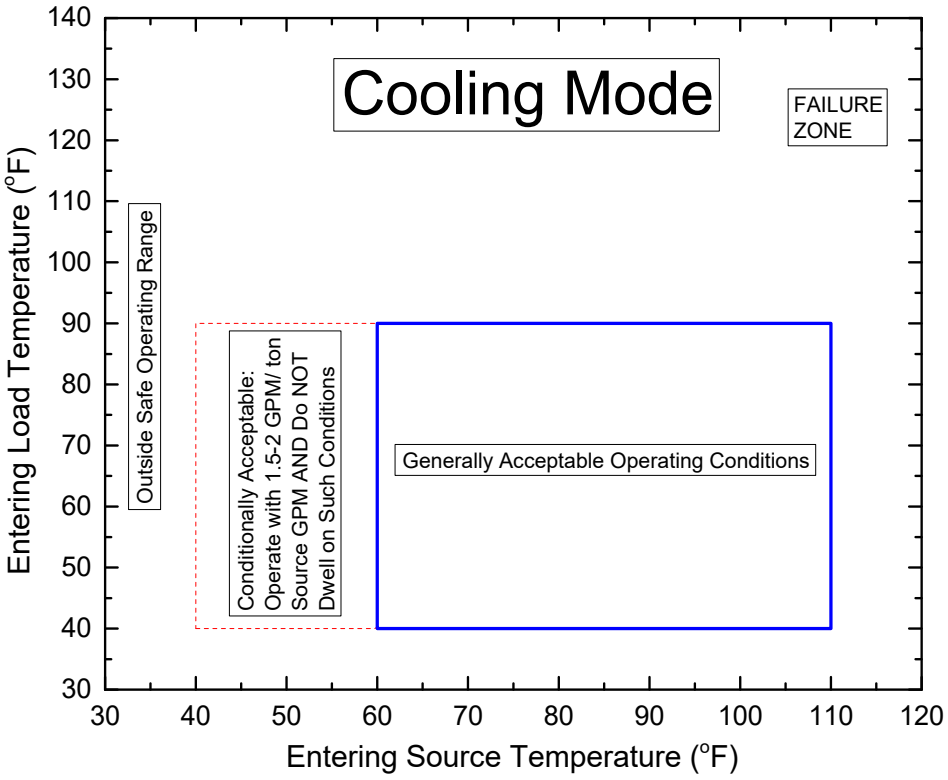
A key to smooth and safe operation is to stay within the compressor operating envelope. The following graphs translate refrigerant temperatures to water temperatures for easier implementation.

Guidelines for Cooling Mode Operation

Enertech generally allows for a wide range for the water temperatures. It is important to operate at a sufficiently low source GPM if entering source temperature is 40-60 °F to ensure that the refrigerant condensing temperature is above 63 °F (i.e., 179 PSIG).

Operating Conditions





Notes:

1. Water temperatures are required not to exceed the acceptable operating conditions.

2. Despite not shown in the heating mode graph, the WV series allows the minimum entering water temperature to be 50 °F for the cold start of a water tank.

3. The minimum air handler size is 2 tons.

Water Quality Table

Potential	Problem Chemical(s) or Condition	Range for Stainless Steel BPHE
Scaling	Calcium & Magnesium	Less than 0.1 ppm
	pH Range	7.5-9
Corrosion	Total Dissolved Solids	No rigid setpoint
	Ammonia, Ammonium Hydroxide	Not allowed
	Ammonium Chloride, Ammonium	Less than 2-20 ppm
	Calcium Chloride/ Sodium	Not allowed
	Chlorine	Not allowed
	Hydrogen Sulfide	Less than 0.05 ppm
	Sulfates	Less than 100 ppm
	Hydrogen Carbonate	Between 60 ppm and 200 ppm
	Hydrogen Carbonate/ Sulfates	More than 1.5 ppm
	Calcium & Magnesium/Hydrogen Carbonate	More than 0.5 ppm
	Conductivity	Less than 500 micros/cm
Biological	Iron Bacteria	Not allowed
	Iron Oxide	Less than 0.2 ppm
Erosion	Suspended Solids	40 mesh strainer required
	Water Velocity	Less than 5.5 m/s in the port

Notes:
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

Enertech recommends that all hydronic systems water be tested prior to being used in any installation.

Water quality is important 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 table above**.**

The quality of the water used in hydronic 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 the 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. The Department of Natural Resources or your local municipality can direct you to the proper testing agency.

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

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.

Flow Rates and Piping Sizing

Successful design of the system must also include pipe diameter and layout. The following guidelines should be considered for all hydronic designs:

- **Proper Flow Rate:** There could be two different flow rates on each side of the hydraulic separator, depending upon the size and number of zones and the size of the heat pump. Supply/return lines for the heat pump size of the hydraulic separator must be sized for the heat pump flow rate; supply/return lines on the system pump side of the hydraulic separator must be sized based upon the number and size of connected zones.
- **Supply/Return Pipe Diameter:** Any hydronic system with parallel piping to various zones requires large enough piping diameter to provide sufficient flow to all zone, but also to assist in purging air from the system. The flow rate though the supply/return lines must be high enough to achieve 2 feet per second velocity in all of the parallel branches. "Home Run" style piping, as mentioned below, is helpful in purging air, as well.
- **Low Pressure Drop:** Selecting Pipe diameter for supply/return lines will help ensure low pressure drop and good performance.

"Home Run" Style Piping (Page #19)

Enertech recommends "Home Run" style piping to help facilitate air removal, but also for ease of access to the zone valves. In the "Branch" style piping, branches can be difficult to purge, depending upon the size of the supply/return lines feeding the branches, especially if fan coils are piped in this manner.

Note: Purging air from the system is one of biggest challenges for hydronic systems. Flow Sensors installed in this equipment are extremely sensitive to micro-bubbles.

Piping Design Flow Capacities

Pipe Diameter/Type	Maximum Flow Rate (GPM)	
	Radiant Floor Loop*	Supply/Return**
1/2" PEX	0.75	N/A
5/8" PEX	1	
3/4" PEX	1.25	4
3/4" Copper or 1" PEX	N/A	7
1" Copper or 1-1/4" PEX		12
1-1/4" Copper or 1-1/2" PEX		17
1-1/2" Copper		25
2" Copper		45

* Based upon 300 ft. circuits.

**Based upon 25ft. length (one-way) and 4 elbows with water. When using antifreeze, increase pipe size to the next size if close to the maximum flow rate.

Example (steps for sizing typical residential system piping)
System includes a model 060 heat pump with one 3 ton fan coil and 3 radiant zones. Two radiant zones each have 5 circuits and one radiant zone has 3 circuits (13 total circuits). All circuits are 1/2" PEX piping.

The radiant heating calculations determined that the PEX loops will be at 9" O.C. spacing and that the flow rate per circuit will be 0.42 GPM (5.5 GPM total). The system will use 25% Fernox Alphi-11 propylene glycol antifreeze. The following steps should be used to determine pipe sizing:

1. Determine flow rate and pipe diameter for piping from Indoor Module to the "Home Run" hydronic zones. The fan coil needs 9 GPM, and the 1/2" radiant tubing could be up to 0.75 GPM per circuit, but since 0.42 GPM was specified, the application will use the specified flow rate (13 x 0.42 = 5.5 GPM). Total flow rate is 14.5 GPM (9 + 5.5). The supply/return lines from the Indoor Module to the zones should be 1-1/4" copper or 1-1/2" PEX.
2. Similar calculations should be done for each zone. For the fan coil zone (9 GPM), 1" copper or 1-1/4" PEX should be run to the fan coil; for the 5 circuit manifold, 3/4" PEX may be used (same for the 3 circuit manifold).

Recommended Flow Rates

Heat Pump	
WV060 – 15 GPM	
EAH Hydronic Air Handlers & EEH Hydronic Cased Coils	
EAH/EEH024 – 6 GPM	
EAH/EEH036 – 9 GPM	
EAH/EEH048 – 12 GPM	
EAH/EEH060 – 15 GPM	
Multi-Aqua Fan Coils	
High-wall units	Console Units
MHQWW-9 – 3 GPM	CFFWA-3 – 3 GPM
MHQWW-12 – 6 GPM	CFFWA-6 – 4.5 GPM
MHQWW-18 – 6 GPM	CFFWA-8 – 5.5 GPM
MHQWW-24 – 7 GPM	CFFWA-12 – 8 GPM
MHQWW-36 – 10 GPM	CFFWA-16 – 10.5 GPM
	CFFWA-20 – 12.5 GPM
Radiant Floor	
1/2" PEX – 0.5 to 0.75 GPM per circuit	
5/8" PEX – 0.75 to 1 GPM per circuit	
3/4" PEX - 1 to 1.25 GPM per circuit	
Example: A 5 loop manifold with 1/2" PEX circuits would need supply/return piping capable of supplying 2.5 to 3.75 GPM	
DHW Piping	
Use flow rate for heat pump	

Section 5: Unit Piping

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.

⚠ NOTICE ⚠

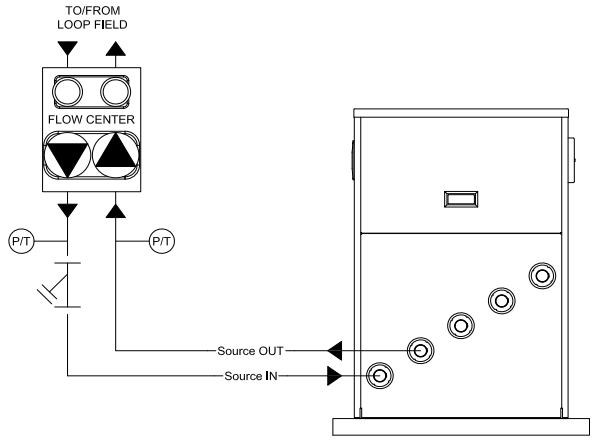
THE EAV MONITORS FEEDBACK FROM THE CONNECTED VARIABLE SPEED PUMP AND WILL NOT OPERATE WITHOUT IT. A FLOW FAULT WILL OCCUR.

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)



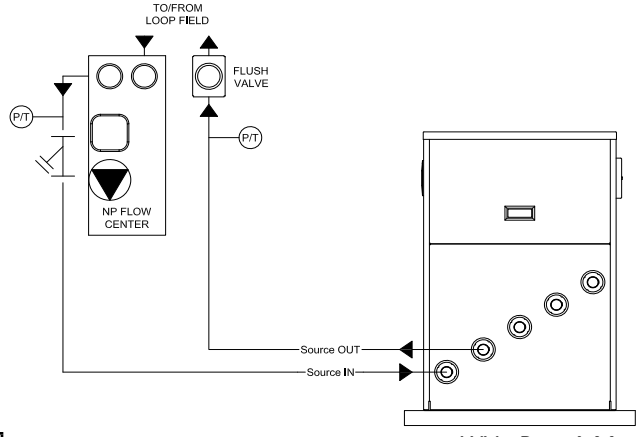
Typical Non-Pressurized Flow Center Installation

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).

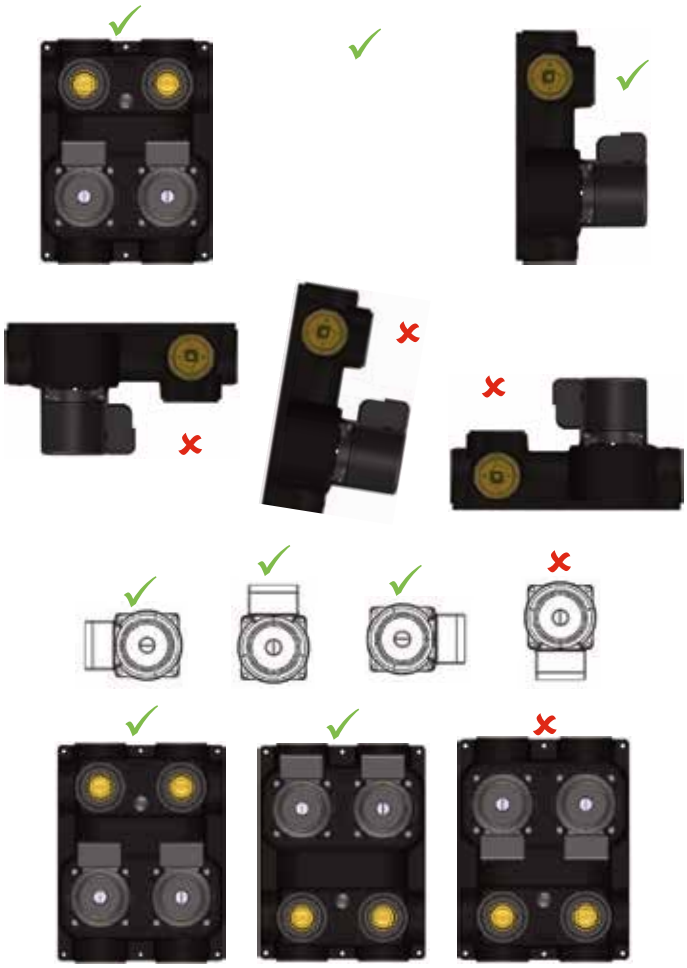
Typical Single Unit Piping Connection (Non-Pressurized Flow Center)



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.

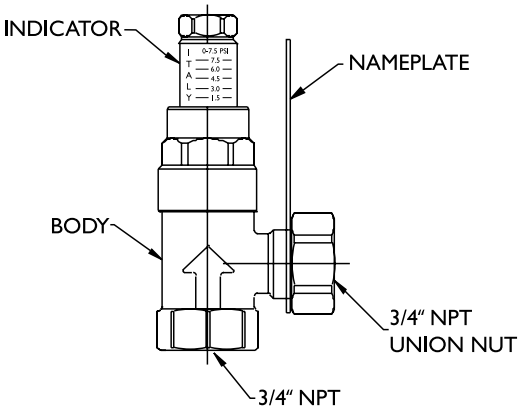


Load Side Installation

It is important that the load side piping of the WV system is sized properly for the required flow rates and is flushed and filled with good quality water and treatment. This will help ensure that the longevity of the pump(s), braze plates, and other water side components.

Per the installation diagrams shown in this section, boiler drains and isolation valves need to be integrated into the load piping for proper flushing of the system at start up, as well as for future service. Full port isolation valves should be used in order to ensure low pressure drop throughout the system.

Zone valves should be utilized on each circuit to control the water flow to each manifold/zone/circuit or distribution device. Enertech recommends zone valves have a CV rating of 8.9 or higher to help guarantee proper flow and low pressure drop throughout the system. All zone valves must be on/off style valves. **A pressure differential bypass valve (included with Heat Pump) is required for proper unit operation.**



Bypass Valve

Follow the steps below for valve settings.

1. The bypass valve is factory set to 7.5 PSI and will typically not need to be adjusted in the field.
2. The minimum pumps speed is factory defaulted to 30%. The advanced flow control algorithms mean that no adjustment is required in the field.

Other Hydronic Components

Most local codes require certain components be installed within the system. Local codes should be followed when determining the exact requirements. A pressure relief valve may be required, which should be rated for 30 PSI and terminated 6” from the floor surface. Additionally, back-flow preventer may be required and should be installed if a make-up water line is connected from the water source to the load side piping of the system.

Note: Even if a back-flow preventer is not required, it is highly recommended.

Recommendations for All WV Unit Applications

Following is a detailed list of recommendations for WV variable speed water-to-water heat pumps:

Zone Piping: All zone piping should be direct to load “Home Run” style to assist with purging air and to maintain lower pressure drop.

Hydronic Components: System should include expansion tank, air separator/automatic air vent, and system feeder. In addition, an automatic air vent should be located at the highest point in the piping system.

Antifreeze: All systems must include antifreeze and Fernoxs F1 inhibitor, or approved alternate, in the hydronic piping (this is a warranty requirement). Source Piping (ground loop) must also include antifreeze.

Flush Valves: System should include flush valves to facilitate purging of air.

Strainers: Strainers must be installed on the load and source piping (this is a warranty requirement). Unions, Adapters, Misc Fittings: All necessary unions, adapters and fittings should be installed to allow ease of service and to meet any local code requirements.

System Accessories Selection Table

Accessories Included w/ Unit	Notes
Flow Center	Ordered as part of the model number. (digit 10)
TurboMax Indirect Water Heater	Ordered as part of the model number. (digit 11) *Includes Pressure Relief Valve & Pressure Gauge.
Hose Kit	Included with unit. Includes: (5) double o'ring elbows for source and load connections, insulated elbows, PT plugs, (2) double o'ring fittings for flow center, hose, & hose clamps.
Plumbing Kit	Included with unit. Includes: (2) Y-Strainers, brass nipple, (2) insulated 3 way valves, (2) 3/4" Boiler Drains, (2) sets of double o'ring x 1" fpt fittings.
Suggested Accessories	**Notes**
1" Taco Geo-Sentry Zone Valve	One per radiant manifold and one per fan coil.
Axiom System Feeder	For maintaining pressure on the hydronic loop.
Automatic Air Vent	Install at highest point in hydronic system for air removal.
Antifreeze	For both source and load sides to prevent freezing.
Fernox F1 Protector	For both source and load sides to ensure longevity of hydronic components.
Rubber Equipment Pad	For sound deadening.
Expansion Tank	To allow for expansion on the hydronic loop.
Secondary Pump Kit	Insulated Pump Module, UPMXL 25-124, 208-230V, with 1"Isolation Valves for systems with a higher pressure drop.
Radiant Tubing/Accessories	Review Enertech price books for Mr. Pex radiant products.
Air Handler(s)	Review Enertech price books for ducted or ductless air handlers.
Optional Water Heater	Supplied by contractor.
Ball Valves, Adapters, Fittings	Supplied by contractor.

Pump Mounting

It is important to follow best practices for mounting the system pump to provide long life, serviceability, and the ability to purge air out of the system. Following are two important tips for ensuring a good installation:

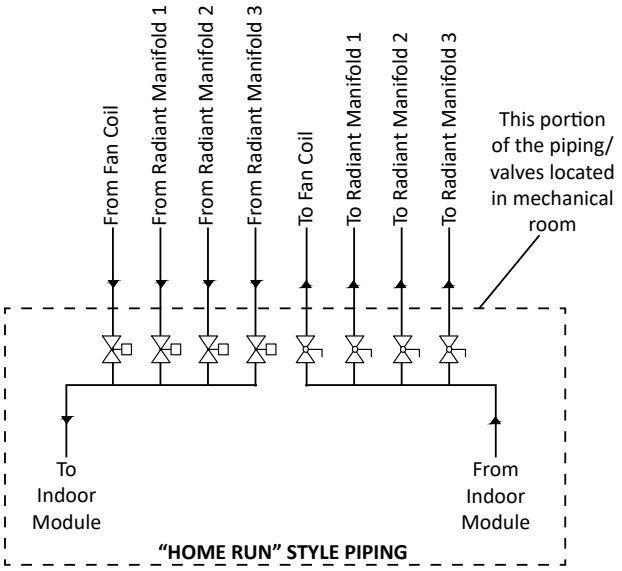
- **Pumping Direction:** Pumping up is the best way to mount the pump. If there is air in the system, it will have the best chance of the air getting though the pump, to the air separator, and out of the system. If the pump air locks, turn the pump off and the air will go up out of the impeller and will be replaced with water. Restart the pump and it will start pumping. The air will flow to the air separator. In most cases the air will go through the pump. Pumping horizontally will work as long as there are small pockets of air in the system. They will keep moving around the system with the water to the air separator. If there are big pockets of air in the system, this will create problems for horizontal mounting. The pump will cavitate, lose water flow, overheat, and fail. If the pump does get air locked, there will need to be a purge port so that the air can be flushed out of the pump and system. Pumping down is the poorest way to mount a pump. If there is air in the system it will get trapped in the pump, causing it to cavitate, loose water flow, overheat, and fail. The air creates resistance in the down flowing water because the air wants to flow up. If the pumps loses flow or stops, the air comes back up the pipe into the impeller, amplifying the problem. If the pump gets air locked, there will need to be a purge port so that the air can be flushed out of the pump and system.
- **Motor/Electrical Box:** The pump is a wet rotor pump. The motor shaft must be horizontal to keep the bearings properly lubricated. Do not put the pump on its back or pointing down (vertical shaft) because this orientation can cause premature pump failure. In most cases, the direction of the electrical box is important to keep any condensation out of the windings. Some pumps have a yellow sticker that is on the head of the pump, indicating the proper direction.

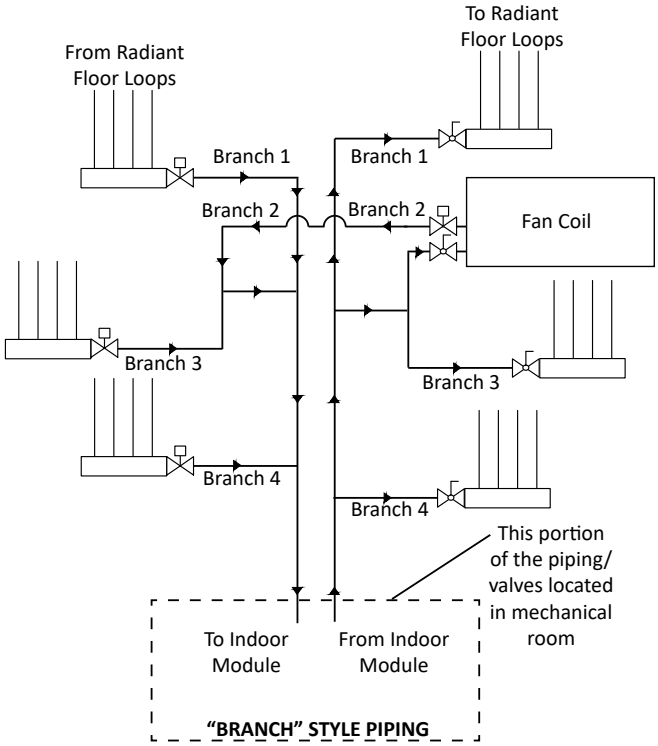
Piping Diagrams

Not all components are shown, such as union fittings, piping adapters/reducers, and other components. Schematics are designed for illustrating the arrangement/function of the components. Always use best practices when considering the location of the various components. For example, the expansion tank must always be on the suction side of the pump; check valves (if applicable) must always be on discharge of the pump.

Two Wye Strainers are supplied with the unit. One must be installed on the 'Source Water In' connection of the WV. See the installation diagrams for the recommended location and orientation.

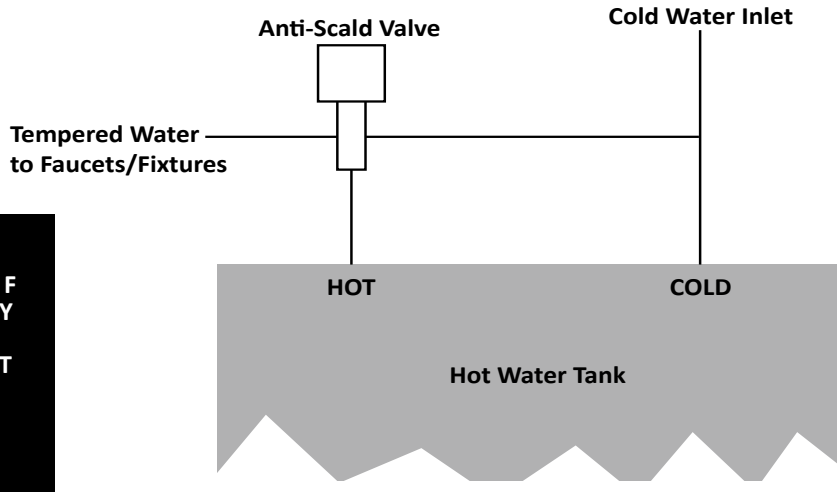
Piping Diagram - Flow Rates and Piping Sizing





RECOMMENDED PIPING

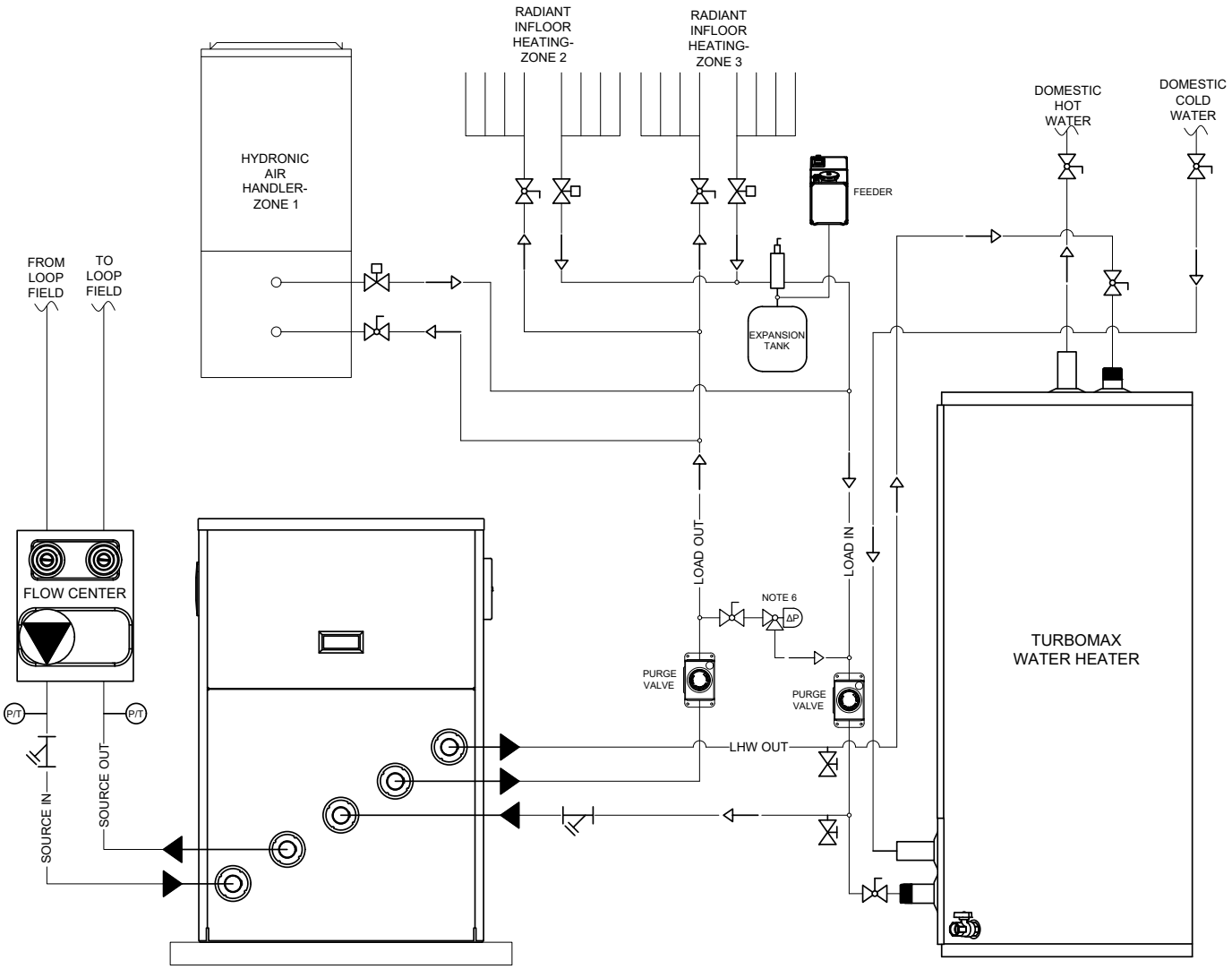
Anti-Scald Valve Piping Connections

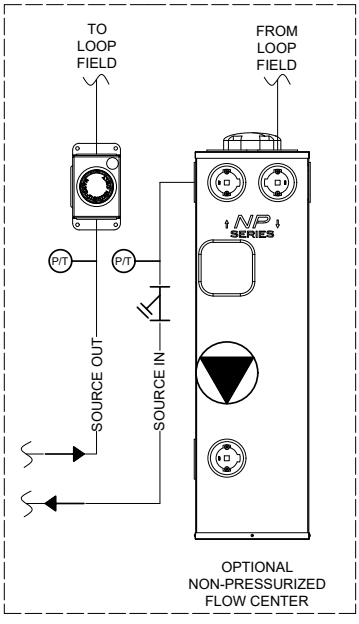


⚠ WARNING ⚠

WATER TEMPERATURES ABOVE 120° F CAN CAUSE SEVERE PHYSICAL INJURY IN THE FORM OF SCALDING OR BURNS. AN ANTI-SCALD VALVE MUST BE INSTALLED AT THE HOT WATER TANK OUTLET WITH THE VALVE SETTING PROPERLY ADJUSTED TO PREVENT SCALDING OR BURNS.

Piping Diagram - Heating and Cooling - with Hot Water Fan Coil/Hydronic Air Handler(s) is 2 tons or larger





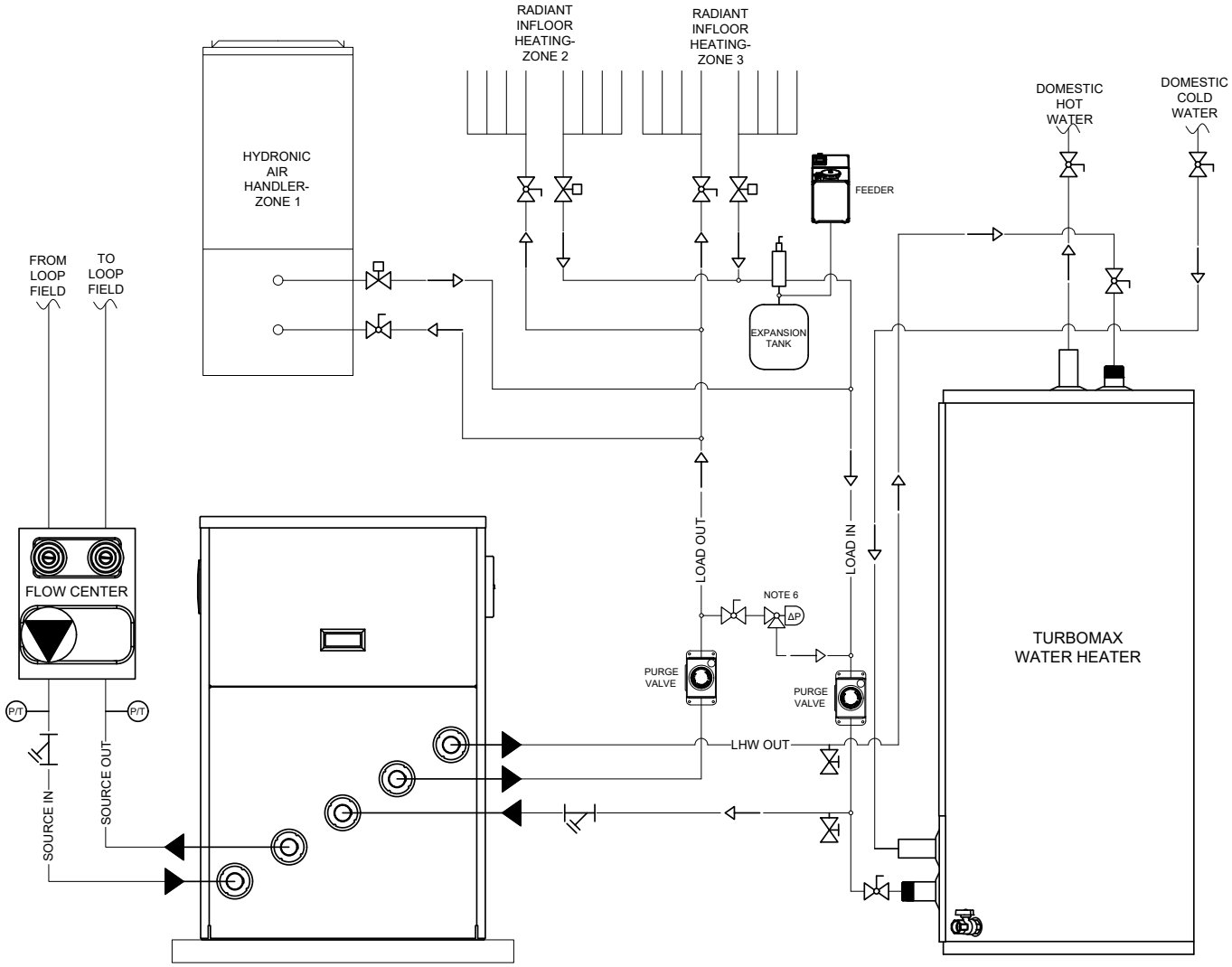
LEGEND

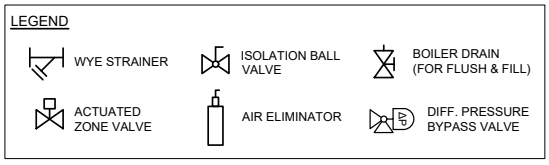
- WYE STRAINER
- ISOLATION BALL VALVE
- BOILER DRAIN (FOR FLUSH & FILL)
- ACTUATED ZONE VALVE
- AIR ELIMINATOR
- DIFF. PRESSURE BYPASS VALVE

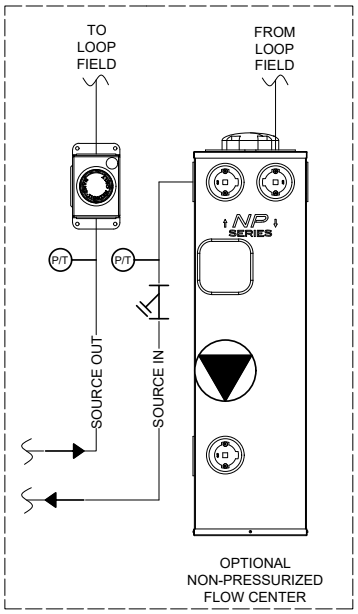
NOTES:

1. INSTALLATION DIAGRAM SHOWN ABOVE IS AN EXAMPLE OF A TYPICAL (RECOMMENDED) INSTALL. ADDITIONAL ZONES ARE ALLOWED, AS WELL AS ALTERNATE PIPING LAYOUTS.
2. UNIT CONFIGURATION/MODEL INCLUDES FLOW CENTER AND OPTIONAL TANK (REQUIRED IF INDIRECT HOT WATER OPTION IS ORDERED).
3. A HOSE KIT, SPECIFICALLY DESIGNED FOR THE *WV, HAS BEEN PROVIDED WITH THE UNIT, AND SHOULD BE UTILIZED FOR THE ABOVE INSTALLATION. HOSE KIT INCLUDES ALL D/O-RING UNIT CONNECTIONS, AS WELL AS ALL SOURCE IN AND SOURCE OUT PIPING AND FLOW CENTER CONNECTIONS.
4. THE (2) WYE-STRAINERS SHOWN ABOVE, ARE ALSO PROVIDED WITH THE UNIT.
5. ALL OTHER ITEMS SHOWN NEED TO BE PROVIDED BY THE INSTALLER.
6. BYPASS VALVE (REQUIRED) IS USED TO ENSURE MINIMUM FLOW REQUIREMENTS ARE MET.

Piping Diagram - Heating and Cooling - No Hot Water Fan Coil/Hydronic Air Handler(s) is 2 tons or larger







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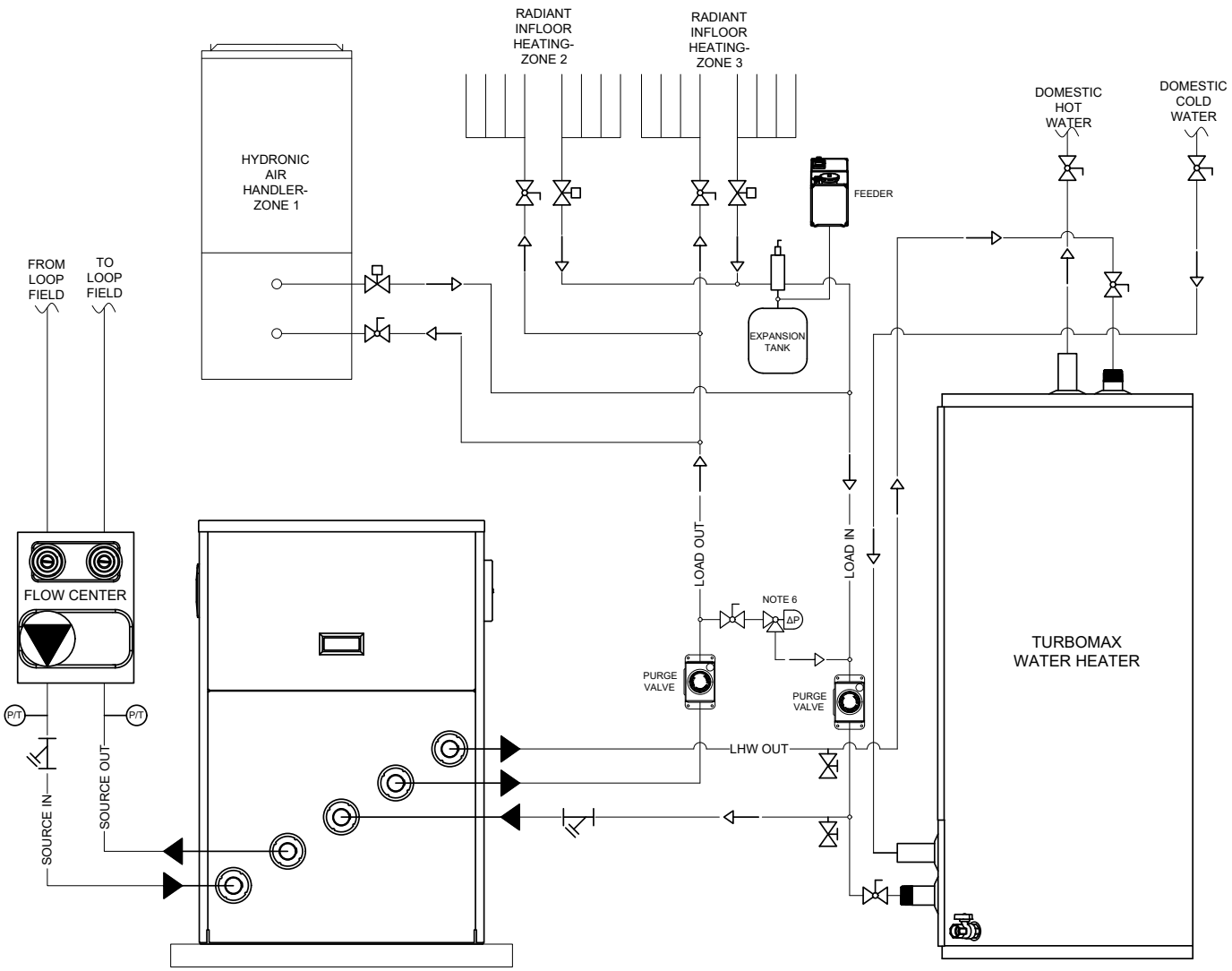
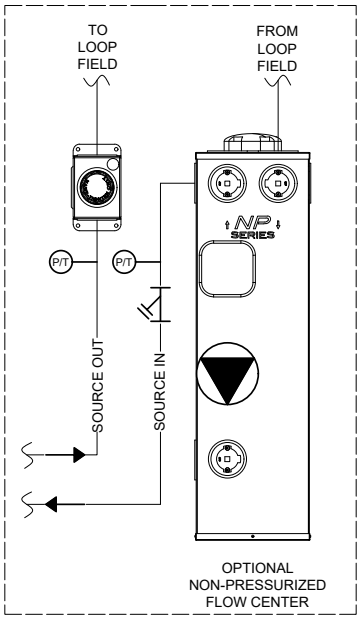
4. THE (2) WYE-STRAINERS SHOWN ABOVE, ARE ALSO PROVIDED WITH THE UNIT.
5. ALL OTHER ITEMS SHOWN NEED TO BE PROVIDED BY THE INSTALLER.
6. BYPASS VALVE (REQUIRED) IS USED TO ENSURE MINIMUM FLOW REQUIREMENTS ARE MET.

Piping Diagram - Heating and Cooling Fan Coil/Hydronic Air Handler(s) is Less Than 2 Tons





LEGEND

- WYE STRAINER
- ISOLATION BALL VALVE
- BOILER DRAIN (FOR FLUSH & FILL)
- ACTUATED ZONE VALVE
- AIR ELIMINATOR
- DIFF. PRESSURE BYPASS VALVE

NOTES:

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4. THE (2) WYE-STRAINERS SHOWN ABOVE, ARE ALSO PROVIDED WITH THE UNIT.
5. ALL OTHER ITEMS SHOWN NEED TO BE PROVIDED BY THE INSTALLER.
6. BYPASS VALVE (REQUIRED) IS USED TO ENSURE MINIMUM FLOW REQUIREMENTS ARE MET.

Section 6: Antifreeze

Antifreeze Overview

If the unit will be used for cooling, antifreeze must be added on the load side of the system to protect the braze plate heat exchanger from rupturing. Chilled solution set points are in the 40's °F. The load solution so within the heat exchanger, could be near freezing. To protect against freezing. Enertech recommends the use of Propylene Glycol (20-25%) for the load side antifreeze. Additional inhibitor may be required if the concentration is less than 25% to 30% (depending upon brand) to provide corrosion protection and prevent bacterial growth.

Important: Propylene glycol concentrations below 30% typically require additional inhibitors to be added to the solution. Enertech recommends Fernox F1.

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?

⚠ CAUTION ⚠

HYDRONIC LOOPS MUST BE ANTIFREEZE PROTECTED. INSUFFICIENT AMOUNTS OF ANTIFREEZE MAY CAUSE SEVERE DAMAGE AND MAY VOID WARRANTY. HYDRONIC LOOP ANTIFREEZE MUST BE NON-FLAMMABLE. NEVER OPERATE WITH HYDRONIC LOOP FLOW RATES LESS THAN SPECIFIED. CONTINUOUS OPERATION AT LOW FLOW OR NO FLOW MAY CAUSE SEVERE DAMAGE AND MAY VOID WARRANTY.

⚠ WARNING ⚠

IF MORE THAN 30% ANTIFREEZE IS ADDED, HEAT TRANSFER AND VISCOSITY ISSUES MAY ARISE. BE SURE TO KNOW WHAT TYPE OF ANTIFREEZE IS BEING USED, AND IF IT IS PURE OR PRE-MIXED.

⚠ 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.

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.

Antifreeze 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.

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

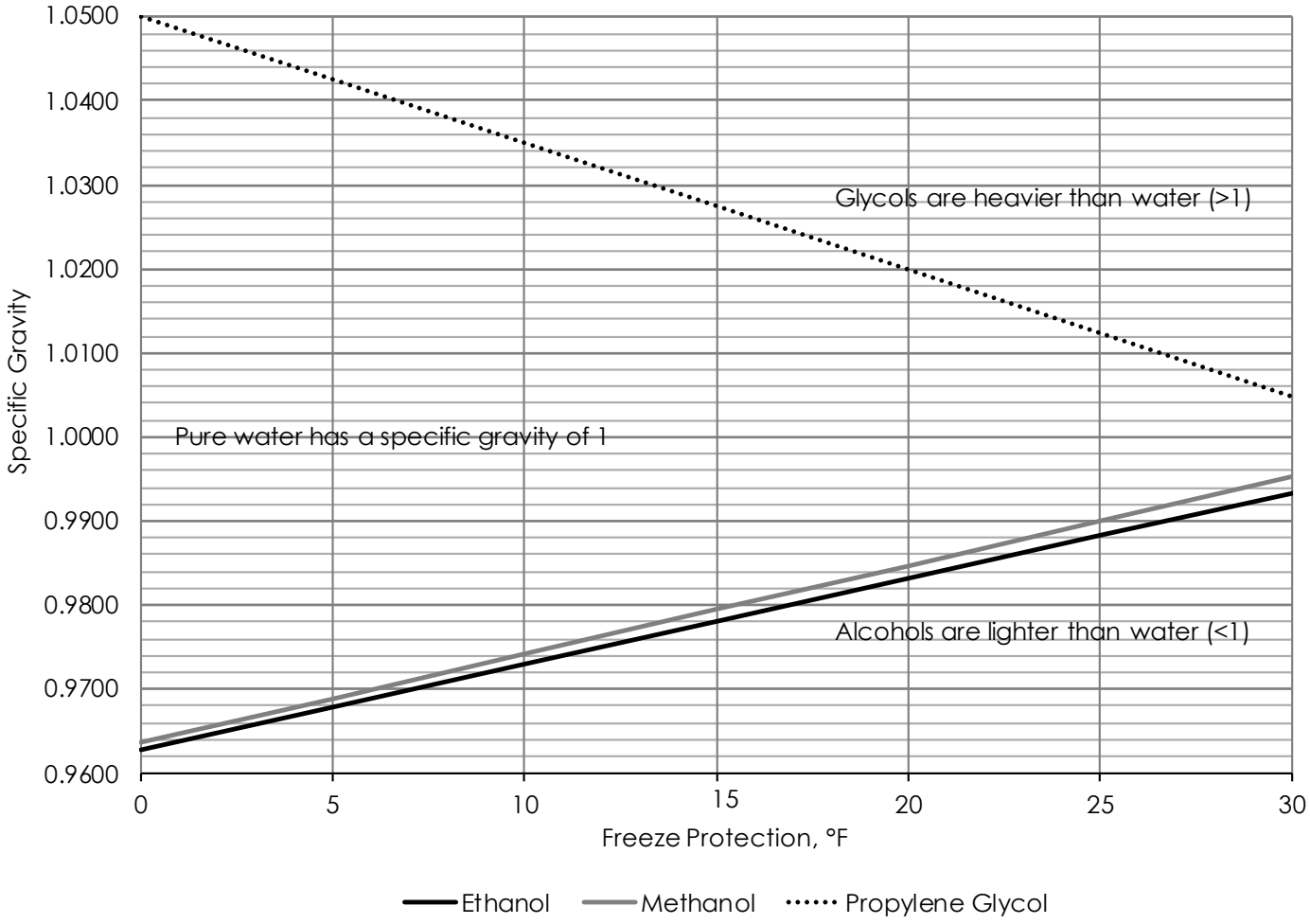
Notes:
Unit coaxial heat exchanger = 1 Gallon
Flush Cart = 8-10 Gallons
10' of 1" Rubber Hose = 0.4 Gallons

Section 6: Antifreeze

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.

Antifreeze Specific Gravity Table

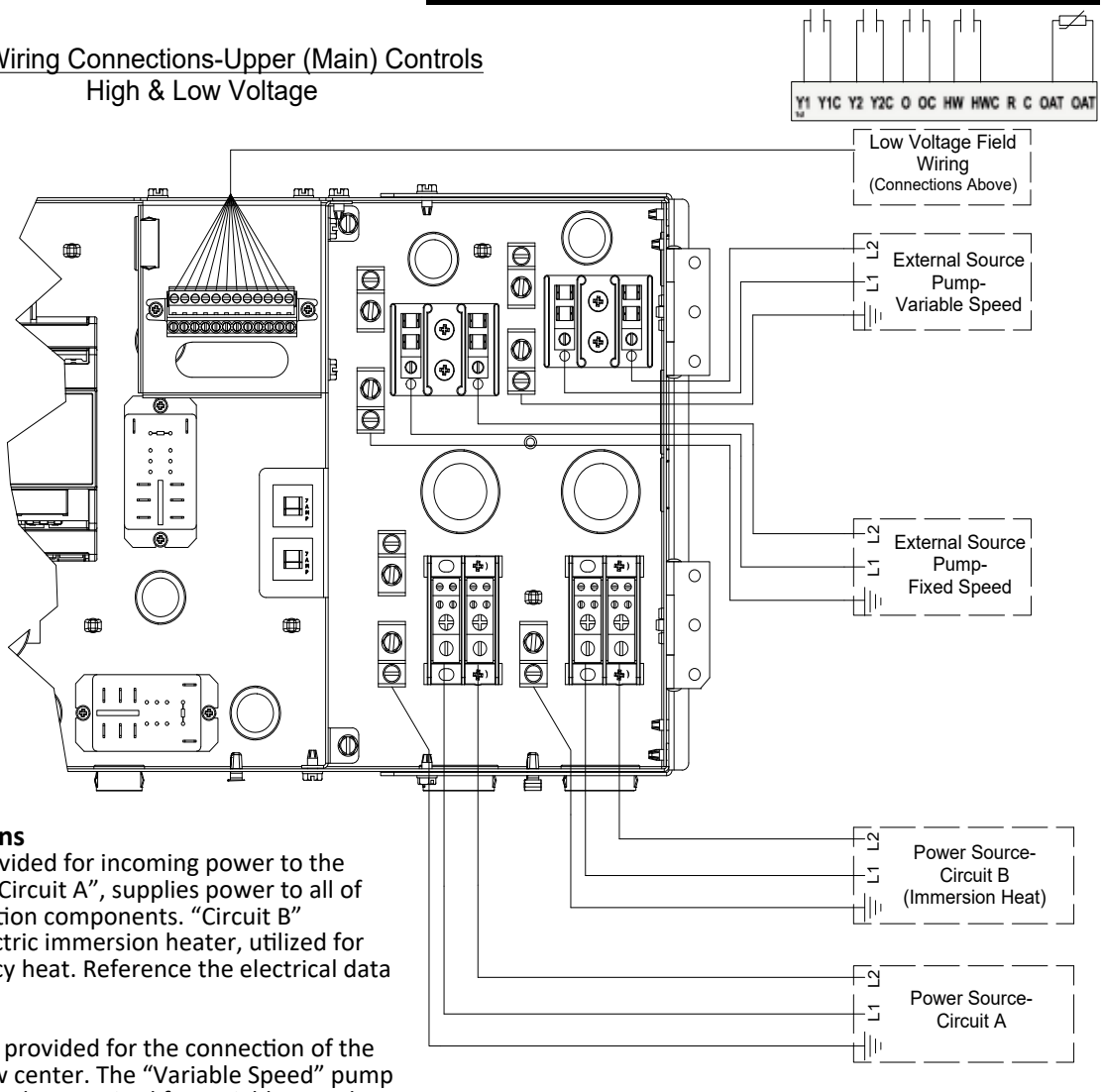


Notes:
1. Consult with your representative or distributor if you have any questions regarding antifreeze selection or use.
2. Some antifreeze suppliers and manufacturers recommend the use of either de-ionized or distilled water with their products. Some brands are designed to work with tap water. Consult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

Field Wiring Connections

⚠ WARNING ⚠
THIS SYSTEM MUST USE DRY CONTACT INPUTS. DO NOT SUPPLY 24VAC ACROSS THE TERMINALS.

Field Wiring Connections-Upper (Main) Controls
High & Low Voltage



Line Voltage Connections

Two power blocks are provided for incoming power to the WV. The primary circuit, "Circuit A", supplies power to all of the controls and refrigeration components. "Circuit B" supplies power to the electric immersion heater, utilized for auxiliary and/or emergency heat. Reference the electrical data for circuit sizing.

Two pump blocks are also provided for the connection of the source water external flow center. The "Variable Speed" pump block is constantly energized as required for variable speed pumps. The "Fixed Speed" pump block is toggled on when the unit receives a call and off once the call is satisfied.

Note: The WV has built in surge protection. The system may also be protected as part of a whole house surge protector.

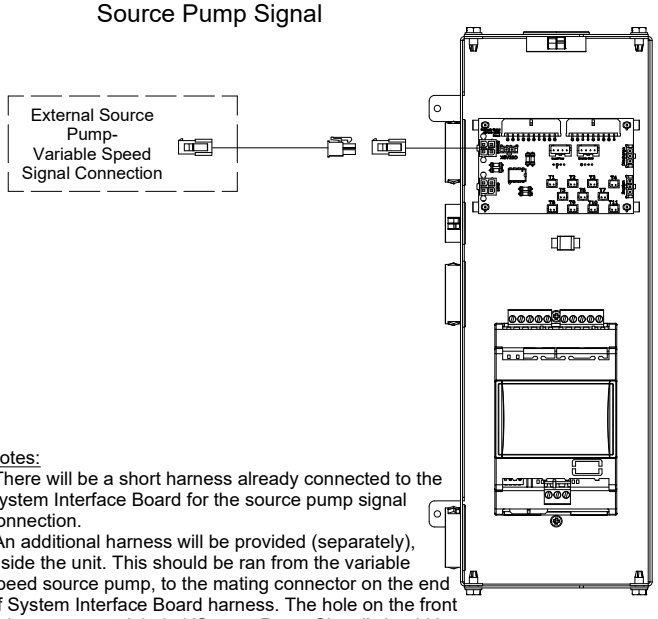
Low Voltage

The WV field wiring provides dry contact inputs to interface directly with industry standard zone controllers and aquastats. These are indicated with the following input pairs:

- **Y1 and Y1C:** Radiant heating demand input
- **Y2 and Y2C:** Air handler heating demand input (120°F outlet temperature)
- **O and OC:** Air handler cooling demand input (low temperature water)
- **HW and HWC:** Domestic hot water demand input (if equipped)
- **OAT and OAT:** Outdoor air temperature for outdoor reset used with radiant heating (sensor provided with unit)

Note: The WV also provides plug and play field wiring for the low voltage signal to a variable speed flow center. The variable speed signal wire MUST be connected to the flow center or the WV will indicate a flow fault.

Field Wiring Connections-Lower Controls
Source Pump Signal



Notes:
-There will be a short harness already connected to the System Interface Board for the source pump signal connection.
-An additional harness will be provided (separately), inside the unit. This should be ran from the variable speed source pump, to the mating connector on the end of System Interface Board harness. The hole on the front right corner post labeled 'Source Pump Signal' should be used to access the end of the mating connector.

Section 7: Field Wiring

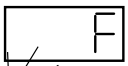
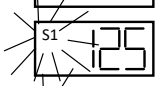
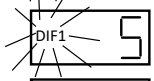
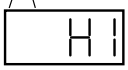
Domestic Water Heating Controls
If the WV is configured with the Turbomax domestic hot water tank, a digital aquastat comes factory installed for monitoring tank temperatures (typically 120-125°F. The normally open terminals should be connected to the WV field wiring terminal strip:

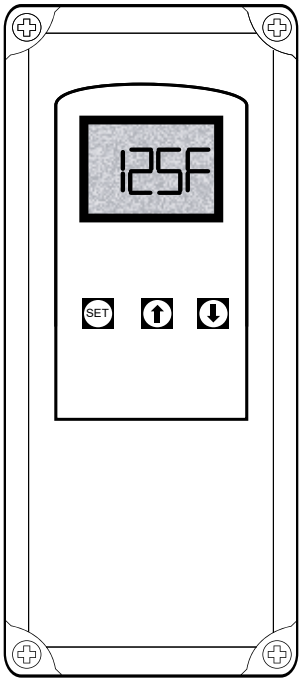
HW and HWC: Domestic Hot Water Demand Input
The aquastat should be set to "heating" with the setpoint at the desired temperature (Typically 120-125 deg). The aquastat differential should also be set for the cut-in and cut-out temperature, minimum 5 deg differential (typically 5 -10 deg). If short cycling of the WV occurs, it is recommended to increase the differential of the aquastat. Reference the aquastat manual included with the tank.

The tank aquastat setpoint needs to be a minimum of 5 degrees below (typically 5 - 10 deg) the Heat Pump setpoint (default 130°F). If the heat pump is set at 130°F, the tank aquastat can not be set any higher than 125°F.

The Normally open contacts will OPEN at the set point. The differential temperature is below the set point in the heat mode.

Example of setting:
Set point 125°F
Differential 5°F
ON Temperature = 120°F
OFF Temperature = 125°F

Step		Display	
1	Press SET button		
2	SET		Fahenheit or Celsius
3	SET		Setpoint Temp (S1 flashing)
4	SET		Differential (DIF1 flashing)
5	SET		Heating (H1) or Cooling (C1)



⚠ NOTICE ⚠

THE AQUASTAT NEEDS TO BE SET BELOW THE LOAD LEAVING TEMPERATURE (LLT DEFAULT = 130°F). IF THE AQUASTAT IS SET ABOVE THE LOAD LEAVING TEMPERATURE, THE SYSTEM MAY NOT BE ABLE TO SATISFY THE DEMAND. THE HOT WATER SETTINGS OF THE WV ARE DESCRIBED IN SECTION 3 - OPERATIONS CONSIDERATIONS.

Space Conditioning Controls
The WV has been developed to easily interface with zone control modules that can be used with zone control valves. Enertech recommends the HBX ZON-0600 which requires HBX THM-0600 thermostats. HBX ZON-0600 is a good fit when there are one or more fan coils/air handlers, and multiple radiant zones. If there are only fan coils (no radiant), it is possible to use an EWC UZ4 zone panel.

Zone valves are recommended to have a CV of at least 8.9 and have 24VAC actuators. These valves can be powered through the zone controller via the "R" and "C" terminals on the WV field terminal strip, as long as the demand at any time is less than 50VA (approximately 5 valves opening at once). If the load will exceed this amount, an external transformer is required.

WV Input Requirements from Zone Panel
The WV field wiring terminal strip requires the following dry contact input pairs:

Y1 and Y1C: Radiant heating demand input (outdoor reset controlled temperature)

Y2 and Y2C: Air handler heating demand input (120°F outlet temperature)

O and OC: Air handler cooling demand input (low temperature water)

Outdoor Air Temperature (OAT)

A pair of terminals are dedicated to connecting the included outdoor temperature sensor. This is a 10K type thermistor and does not have polarity (it can be connected in either orientation to the OAT terminals).

OAT Terminals: Outdoor air temperature for outdoor reset used with radiant heating.

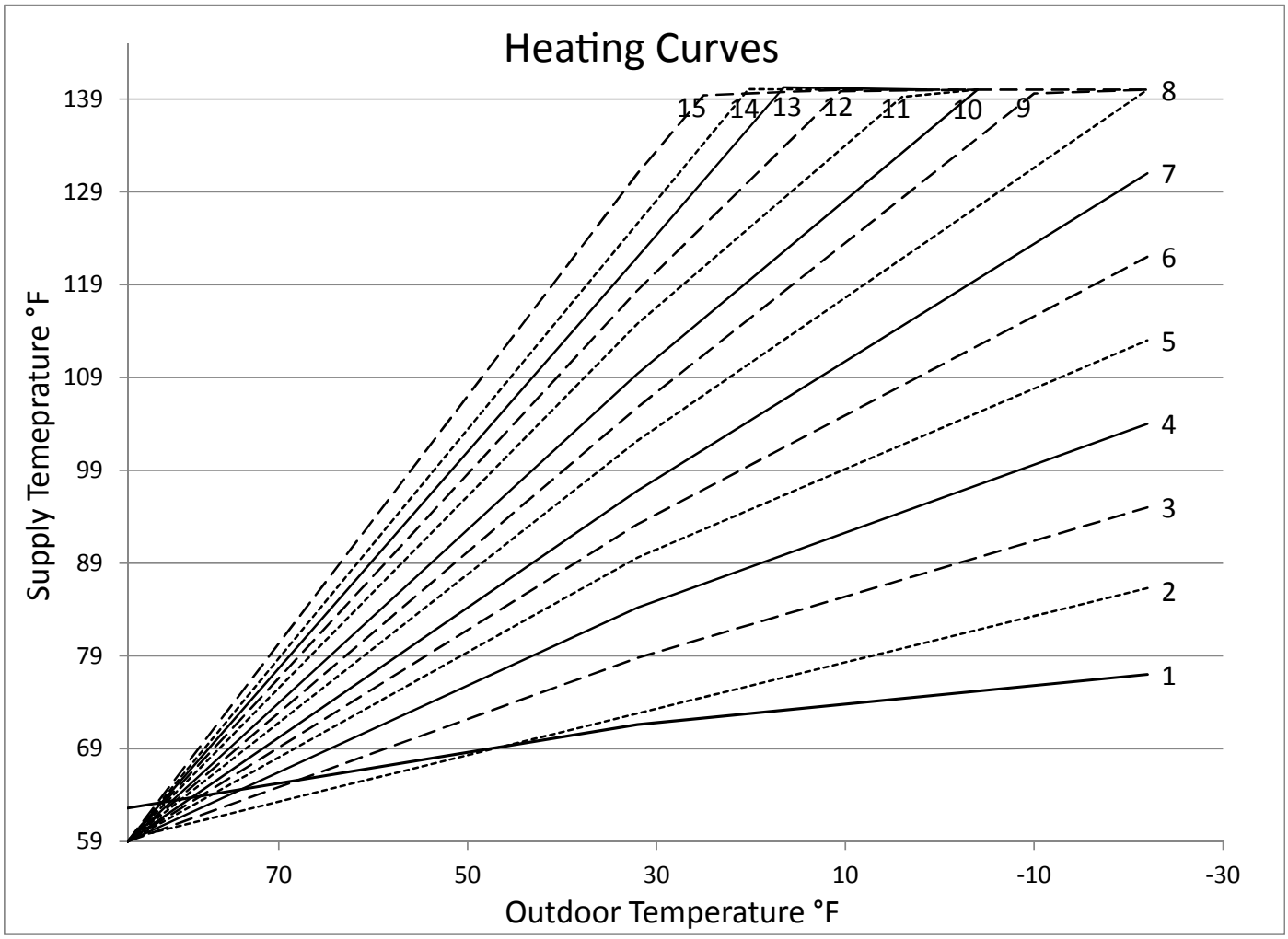
Outdoor reset control will vary the design load temperature based on outdoor temperature. The colder the outside temperature, the warmer the load water temperature. This offers several advantages. The COP of the system is improved by targeting the lowest outlet temperatures possible. Additionally, user comfort is improved by maintaining ideal temperatures for the current outdoor conditions. If necessary, the WV can operate without outdoor reset by setting a static load water temperature.

NOTE: The outdoor temperature is a running one hour average to avoid dramatic shifts.

The WV utilizes a set of temperature curves as seen below. The default curve is #3 and has been found to work in many installations. Depending on the load calculation and environmental requirements, a different curve may be preferable: The higher numbered curves produce higher radiant floor temperatures for a given outdoor temperature while the lower numbered curves produce lower temperatures. For example, at 30°F outdoor temperature, curve #3 will produce 79°F outlet temperature. Changing to curve #4 would produce 84°F outlet at that same condition.

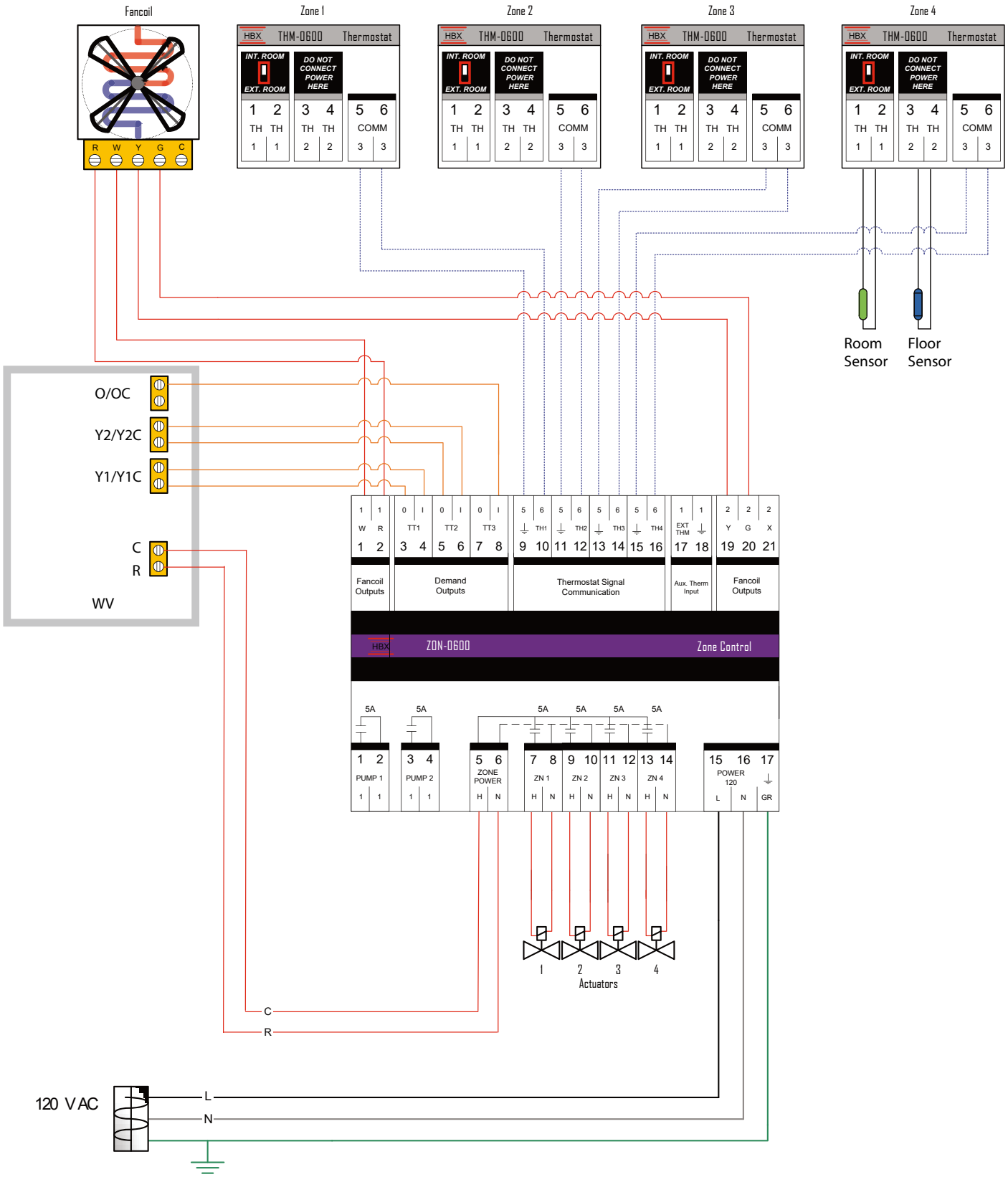
NOTE: Flooring manufacturers may have maximum recommended temperatures for radiant heat. This can be established on the HMI to cap the highest possible load temperature, regardless of outdoor temperatures.

NOTE: Position the sensor on the North side of the home. Avoid sun exposure!



Section 7: Field Wiring

Diagram: Heating/Cooling - Radiant - One Zone Control Per Fan Coil (fan coil is Enertech EAH series)



Section 7: Field Wiring

Diagram: Radiant Heating + Fan Coil Heating/Cooling - Two Stage Operation, 1-Radiant/2-Fan - One Zone Control Per Fan Coil (fan coil is Enertech EAH series)

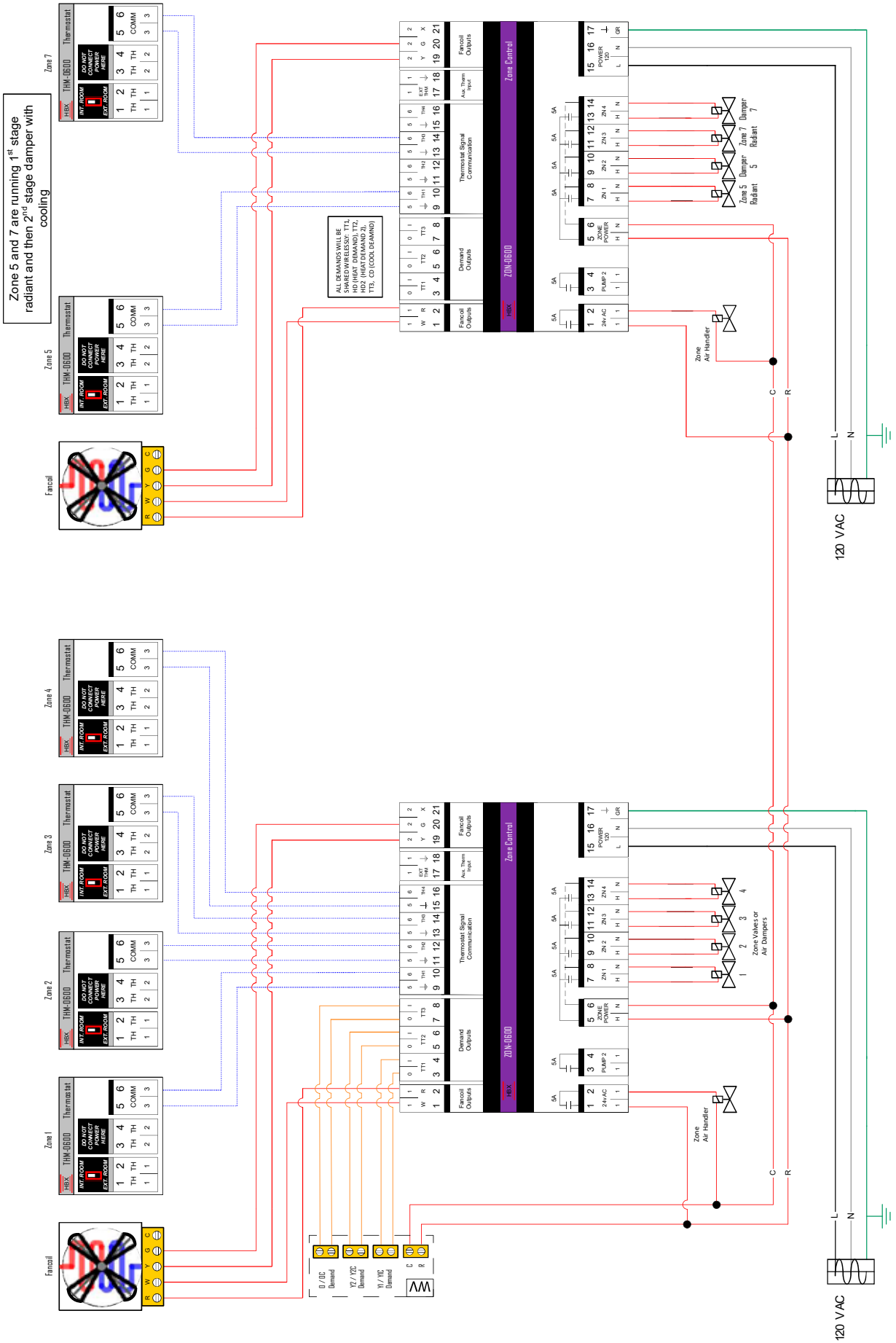
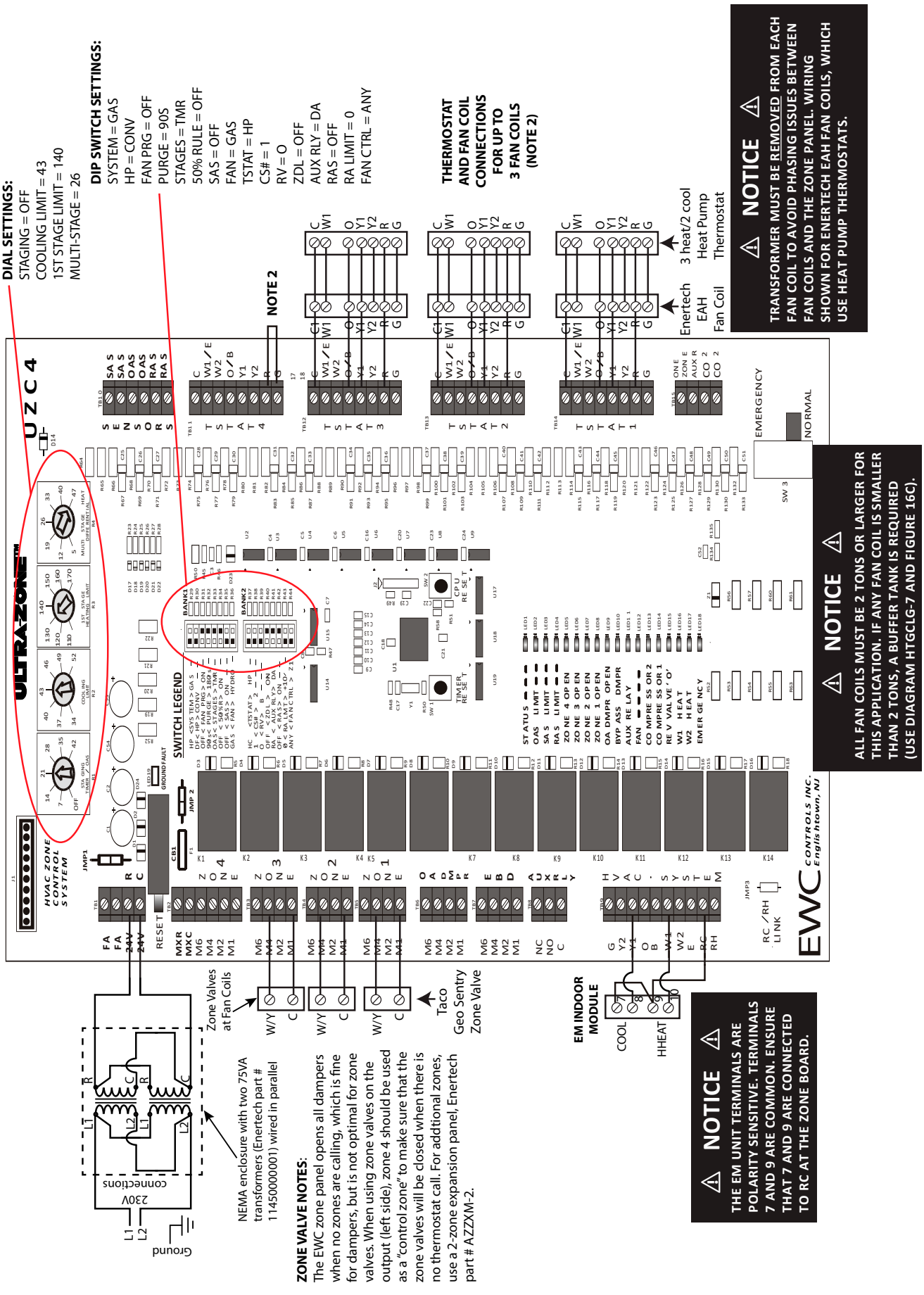
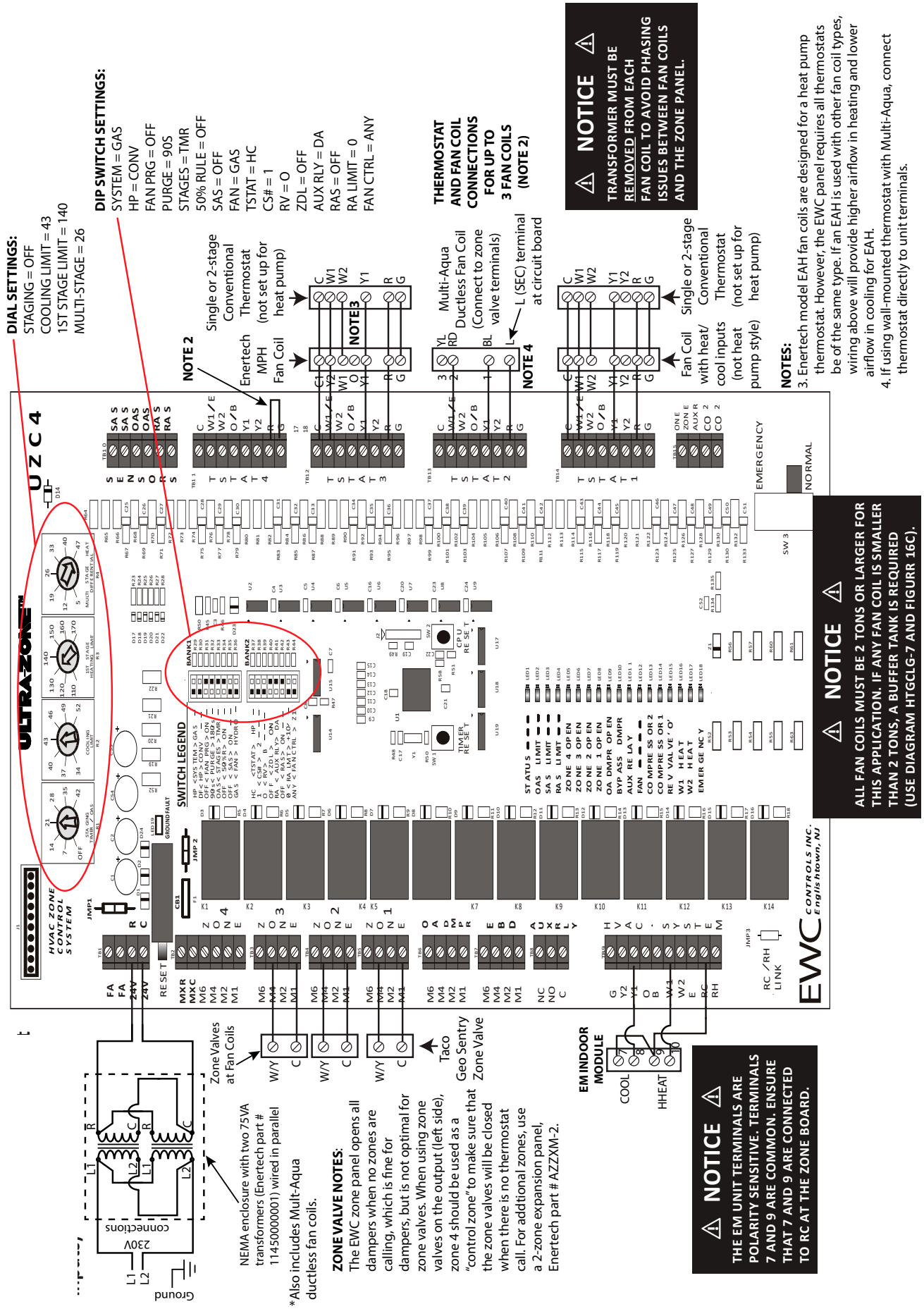


Diagram: Heating/Cooling - Multiple Fan Coils - No Radiant (All fan coils are Enertech EAH series)



ZONE VALVE NOTES:
The EWC zone panel opens all dampers when no zones are calling, which is fine for dampers, but is not optimal for zone valves. When using zone valves on the output (left side), zone 4 should be used as a "control zone" to make sure that the zone valves will be closed when there is no thermostat call. For addtional zones, use a 2-zone expansion panel, Enertech part # AZZXM-2.

Diagram: Heating/Cooling - Multiple Fan Coils - No Radiant (at least one fan coil has Y/W inputs)*



Section 8: Equipment Start-Up

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

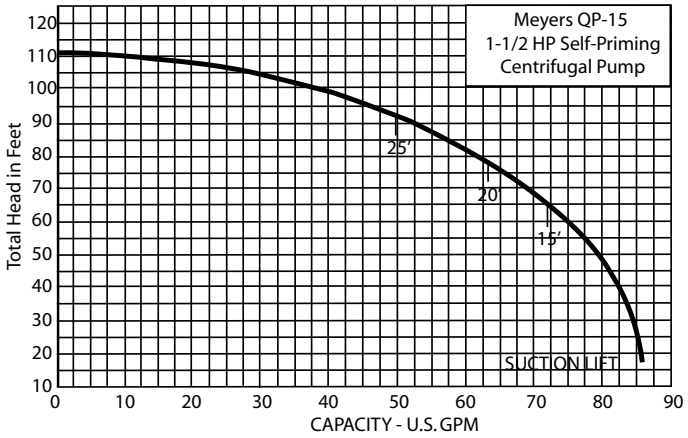
Most flow center or pump failures are a result of poor water quality or debris. Debris entering the loop during fusion and installation can cause noise and premature pump failure. Enertech recommends a double flush filtering method during purging. When purging, use a 100 micron bag filter until air bubbles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

Flushing and Filling

The system needs to be flushed of air and debris, and filled before it is put into service. All systems have dirt and debris from the piping, soldering, etc. Enertech recommends using a flush cart to the purge the system. The flush cart should utilize a ½ HP pump, which is sufficient for almost all residential hydronic systems, as long as each circuit is isolated and flushed one at a time.

⚠ CAUTION ⚠

USING JUST THE ON-SITE CITY OR WELL WATER PRESSURE, WILL NOT PROPERLY FLUSH THE AIR AND DEBRIS OUT FROM THE SYSTEM.

Note: Water flow direction is crucial during Purging. If the water flow is backwards, the Wye Strainer is not protecting the braze plate heat exchangers from the miscellaneous debris that hasn't been flushed out into the flush cart. Remember to clean the Wye strainer after purging.

1. Isolate each circuit, including the heat pump and DHW tank (if equipped). Then, flush each zone of air, and fill each zone with water (radiant tubing, air handler, etc.).

2. Open the isolation valves and flush/ fill the hot water tank (if equipped), making sure to keep the system between 15 and 25 PSI. Once this step is complete, close the isolation valves.

This step can be skipped if the unit is not equipped with hot water capability.

3. Open the isolation valves and flush/ fill the heat pump, making sure that the water flow direction is as it would be in normal operation.

NOTE: Water flow direction is crucial during this step. If the water flow is backwards, the Wye Strainer is not protecting the braze plate heat exchangers from the miscellaneous debris that hasn't been flushed out into the flush cart.

4. Once the entire system has been flushed and filled, the antifreeze and water treatment can be added, using the flush cart to add and mix the treatment. All zones should be open during this process, so that proper mixing can take place.

Take multiple readings, and check the antifreeze percentage, as the system is being mixed.

5. Go through the Startup Wizard on the controller (HMI) to energize the diverting valve (if equipped) and verify that the last bit of air is removed from the system. **See Controls Section for additional details**. Once completed, the flush cart can be removed from the system.

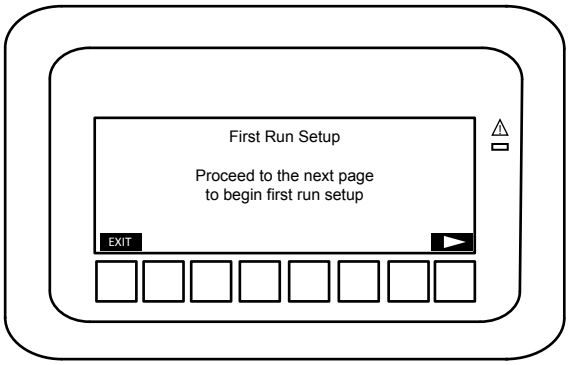
NOTE: If any small amount of air is still in the system, the air elimination device will remove it and the System Feeder, as well as the expansion tank, will keep pressure on the system. Recommended pressure setting is 15-25 PSI.

⚠ WARNING ⚠

MAKE SURE TO ISOLATE THE DOMESTIC WATER TANK BECAUSE THE RELIEF VALVE INSTALLED IN THE TANK WILL PURGE WATER AS THE SYSTEM IS FLUSHED.

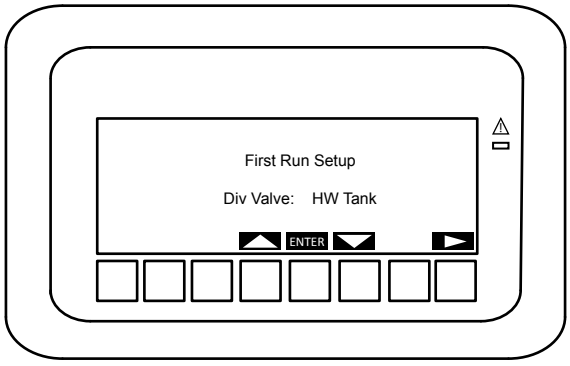
Startup Wizard

In order to complete critical settings and ensure the pumps do not run until the loop is completely flushed, a startup wizard will guide you through the first start of the system. It keeps the pumps off and guides the installer through flushing, pump settings, and critical heat settings. The startup wizard sequence is described below.



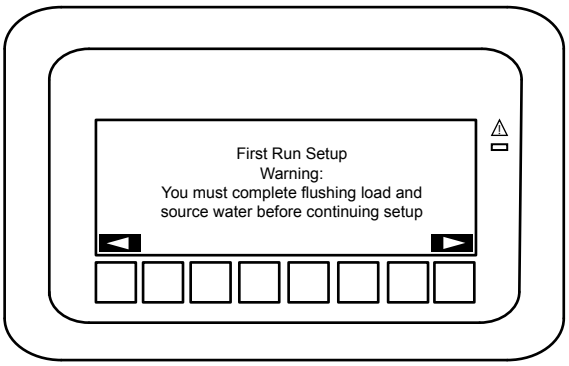
Step 1: The first step of the startup wizard allows the installer to modulate the internal 3-way diverting valve. This ensures both load water circuits (heating and hot water) can be flushed appropriately.

NOTE: Step 1 can be skipped if unit does not have hot water capability.



NOTICE: After changing the diverting valve direction, you MUST press **ENTER** for the change to occur.

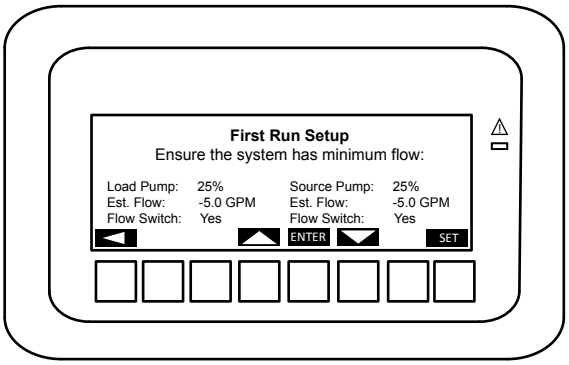
After flushing of the load side is complete we can proceed to the next step. In the next step, the pumps will be energized, so we need to be sure flushing is complete.



Step 2: Now, the pumps will be energized and running and we are able to view the flow rate and status of the flow switches. Next, we want to set the minimum flow rate of the pumps to ensure at least 5.0 GPM is achieved under all conditions. This means each zone should be checked individually to ensure the flow rate is maintained. Here we can also adjust the bypass valve as needed. The unit will fault if the flow is less than 4.0 gpm. Therefore, 5.0 gpm provides some room for error as the viscosity of the fluid changes with temperature.

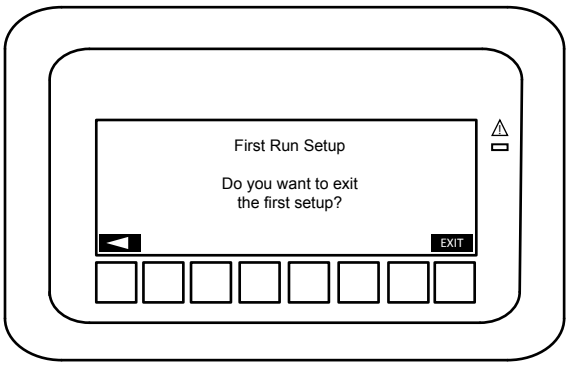
NOTICE: After changing the pump speed, you MUST press **ENTER** for the change to occur. It will take a moment for the pumps to settle.

NOTE: If, after setup, the WV detects the minimum flow rate allows less than 4.0 GPM, it will attempt to increase the minimum flow percentage until 4.0 GPM is achieved. This will overwrite the previous minimum setting.



Step 3: Our last step is to set the heating parameters. Here we will set the appropriate heating curve for the region **(Section 8/Figure 10 above)** as well as set the maximum outlet temperature as needed for the flooring manufacturer's recommendation.

⚠ CAUTION ⚠
DO NOT EXCEED MANUFACTURER'S SPECIFICATIONS FOR RADIANT FLOORING TEMPERATURES.



Final: Now, we can complete the process. If needed, the wizard is available to run again in the future.

After completing the startup wizard, the system will automatically be placed in "manual mode". This will cause the pumps to run at 100% speed and allow the operator to verify functionality of the system. After exiting the startup wizard, proceed to "MENU" and then "5. Control".

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

Equipment should be in operation for a minimum of 10 minutes in either mode.

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

Once this information is recorded, find corresponding entering water temperature located in WPD Table. Find pressure differential in PSI column, then read the GPM column to determine flow in GPM.

2. Check Heat of Extraction/Heat of Rejection.
   - FORMULA: GPM x water temp diff, x 485 (antifreeze) or 500 (fresh water) = HE or HR in BTU/HR

NOTE: A 10% variance is allowed. Always use the same pressure gauge & temperature measuring device.

Water flow must be in range stated in Unit Piping Section. If system has too much water flow, performance problems should be expected.

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

⚠ MISES 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)
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)
Watts = Volts x Auxiliary Heat AMPS

Installer / Technician: _____ Date: _____

HE/HR Tables

Model	Mode	RPM	Source Flow		Heat of Extraction (MBtuh)														
					50 °F	80 °F	100 °F	110 °F	130 °F	50 °F	80 °F	100 °F	110 °F	130 °F	50 °F	80 °F	100 °F	110 °F	130 °F
			EST (°F)	Source GPM	Load Flow 10 GPM					Load Flow 11.3 GPM					Load Flow 15 GPM				
WV060	Full Load Heating	6000	30	10.0	38.7	40.4	37.8	36.1	29.7	38.4	40.0	37.4	35.8	29.4	37.6	39.2	36.6	35.0	28.7
				11.3	39.2	40.9	38.3	36.7	30.2	38.9	40.6	38.0	36.4	29.9	38.1	39.8	37.2	35.6	29.2
				15.0	40.4	42.2	39.5	37.9	31.2	40.0	41.8	39.2	37.5	30.9	39.2	40.9	38.4	36.7	30.3
			50	10.0	49.8	52.5	49.8	48.1	ONR	49.4	52.1	49.4	47.6	ONR	48.4	51.0	48.4	46.7	39.4
				11.3	50.5	53.2	50.5	48.8	ONR	50.0	52.8	50.1	48.4	ONR	49.0	51.7	49.1	47.4	40.1
				15.0	51.9	54.8	52.1	50.3	ONR	51.4	54.3	51.6	49.8	ONR	50.4	53.2	50.5	48.8	41.4
			70	10.0	55.5	58.7	56.0	54.2	ONR	55.0	58.2	55.5	53.7	ONR	53.9	57.1	54.4	52.6	44.9
				11.3	56.2	59.6	56.8	55.0	ONR	55.8	59.1	56.3	54.5	ONR	54.7	57.9	55.2	53.4	45.6
				15.0	57.8	61.3	58.5	56.7	ONR	57.3	60.7	58.0	56.2	ONR	56.2	59.5	56.8	55.0	47.1
			90	10.0	58.6	62.1	59.3	57.5	ONR	58.1	61.6	58.8	57.0	ONR	56.9	60.3	57.6	55.8	47.9
				11.3	59.4	63.0	60.2	58.3	ONR	58.9	62.4	59.7	57.8	ONR	57.7	61.2	58.4	56.6	48.6
				15.0	61.0	64.7	61.9	60.1	ONR	60.5	64.2	61.4	59.5	ONR	59.3	62.9	60.2	58.3	50.2
			EST (°F)	Source GPM	Load Flow 4 GPM					Load Flow 5 GPM					Load Flow 6 GPM				
WV060	Part Load Heating	2600	30	4.0	18.7	18.4	15.2	13.3	10.2	18.9	18.6	15.4	13.6	10.5	19.0	18.7	15.6	13.8	10.7
				5.0	19.5	19.2	15.9	14.0	10.9	19.6	19.4	16.1	14.3	11.2	19.7	19.5	16.3	14.5	11.4
				6.0	20.1	19.8	16.5	14.6	11.4	20.2	20.0	16.7	14.8	11.7	20.3	20.1	16.9	15.0	11.9
			50	4.0	25.4	25.4	21.6	19.5	15.9	25.5	25.6	21.9	19.7	16.2	25.6	25.7	22.0	19.9	16.4
				5.0	26.4	26.4	22.6	20.4	16.8	26.5	26.6	22.8	20.6	17.1	26.6	26.8	23.0	20.8	17.3
				6.0	27.2	27.3	23.4	21.1	17.5	27.3	27.5	23.6	21.4	17.8	27.4	27.7	23.8	21.6	18.0
			70	4.0	33.3	33.8	29.4	26.8	ONR	33.4	34.0	29.6	27.1	23.2	33.6	34.2	29.8	27.3	23.4
				5.0	34.5	35.1	30.6	28.0	ONR	34.7	35.3	30.9	28.3	24.3	34.9	35.5	31.1	28.5	24.5
				6.0	35.6	36.2	31.6	29.0	ONR	35.7	36.4	31.9	29.3	25.2	35.9	36.6	32.1	29.5	25.4
			90	4.0	42.4	43.5	38.4	35.5	ONR	42.6	43.8	38.7	35.8	ONR	42.8	44.0	38.9	36.0	31.6
				5.0	44.0	45.2	40.0	37.0	ONR	44.2	45.5	40.3	37.3	ONR	44.4	45.7	40.5	37.5	33.0
				6.0	45.3	46.6	41.3	38.2	ONR	45.5	46.8	41.6	38.5	ONR	45.7	47.0	41.8	38.7	34.1

1. It is recommended to avoid extended operation in the shaded areas. ONR=Operation Not Recommended.
2. Capacity data is based on 15% (by volume) methanol antifreeze solution on the source side and pure water on the load side.
3. Performance data accurate within ±15%.
4. Unit performance test is run without hot water generation.
5. Capacity data does not include the source-side pump power and it does not reflect pump power correction for AHRI/ISO conditions.
6. Performance data is based upon the lower voltage of dual voltage rated units.
7. Interpolation of unit performance data is permissible; extrapolation is not.
8. Due to variations in installation, actual unit performance may vary from the tabulated data.

Model	Mode	RPM	Source Flow		Heat of Rejection (MBtuh)														
					40 °F	50 °F	60 °F	70 °F	90 °F	40 °F	50 °F	60 °F	70 °F	90 °F	40 °F	50 °F	60 °F	70 °F	90 °F
			EST (°F)	Source GPM	Load Flow 7 GPM					Load Flow 8 GPM					Load Flow 10.5 GPM				
WV060	Full Load Cooling	3750	50	7.0	38.5	54.3	50.8	54.6	57.5	39.4	46.4	51.9	55.8	58.8	41.2	48.6	54.3	58.4	61.6
				8.0	38.4	45.3	50.6	54.4	57.4	39.3	46.3	51.8	55.7	58.7	41.1	48.5	54.2	58.3	61.5
				10.5	38.2	45.1	50.4	54.2	57.2	39.0	46.1	51.5	55.4	58.5	40.8	48.2	53.9	58.0	61.2
			70	7.0	39.4	46.1	51.3	55.0	57.9	40.3	47.1	52.4	56.2	59.1	42.1	49.2	54.8	58.8	61.9
				8.0	39.3	45.9	51.1	54.8	57.7	40.1	46.9	52.2	56.0	59.0	41.9	49.1	54.6	58.6	61.7
				10.5	39.0	45.6	50.8	54.5	57.4	39.8	46.6	51.9	55.7	58.6	41.6	48.7	54.3	58.3	61.4
			90	7.0	38.6	44.6	49.3	52.6	55.3	39.3	45.5	50.3	53.7	56.4	41.0	47.5	52.5	56.1	59.0
				8.0	38.4	44.4	49.1	52.4	55.1	39.1	45.3	50.1	53.5	56.2	40.8	47.3	52.3	55.9	58.8
				10.5	37.9	44.0	48.6	52.0	54.6	38.7	44.9	49.7	53.1	55.8	40.4	46.9	51.9	55.5	58.3
			110	7.0	38.1	43.6	47.8	50.8	53.2	38.9	44.4	48.7	51.8	54.3	40.5	46.3	50.8	54.1	56.7
				8.0	37.9	43.3	47.5	50.5	52.9	38.6	44.1	48.5	51.6	54.0	40.2	46.0	50.6	53.8	56.4
				10.5	37.3	42.7	47.0	50.0	52.4	38.1	43.6	47.9	51.0	53.5	39.6	45.5	50.0	53.2	55.8
			EST (°F)	Source GPM	Load Flow 4 GPM					Load Flow 5 GPM					Load Flow 6 GPM				
WV060	Part Load Cooling	1800	50	4.0	19.6	22.6	22.5	22.3	21.8	20.6	23.7	23.6	23.5	23.0	21.4	24.7	24.6	24.4	23.9
				5.0	19.5	22.5	22.4	22.2	21.7	20.5	23.7	23.6	23.4	22.9	21.3	24.6	24.5	24.3	23.8
				6.0	19.4	22.4	22.3	22.2	21.7	20.4	23.6	23.5	23.4	22.8	21.2	24.5	24.4	24.3	23.8
			70	4.0	18.9	21.9	25.0	28.4	35.6	19.8	22.9	26.3	29.8	37.5	20.6	23.8	27.3	31.0	39.0
				5.0	18.8	21.7	24.9	28.2	35.5	19.7	22.8	26.1	29.7	37.4	20.4	23.6	27.1	30.9	38.9
				6.0	18.7	21.6	24.8	28.2	35.5	19.6	22.7	26.0	29.6	37.4	20.3	23.5	27.0	30.8	38.9
			90	4.0	19.0	21.3	21.1	20.8	19.6	19.8	22.3	22.1	21.8	20.6	20.5	23.1	22.9	22.6	21.4
				5.0	18.8	21.2	21.0	20.6	19.5	19.6	22.1	21.9	21.6	20.5	20.3	22.9	22.7	22.4	21.3
				6.0	18.7	21.0	20.8	20.5	19.4	19.5	22.0	21.8	21.5	20.4	20.2	22.8	22.6	22.3	21.2
			110	4.0	18.7	20.7	20.5	20.1	18.5	19.5	21.6	21.4	20.9	19.4	20.1	22.3	22.1	21.6	20.1
				5.0	18.5	20.5	20.3	19.8	18.4	19.2	21.4	21.1	20.7	19.2	19.9	22.1	21.8	21.4	19.9
				6.0	18.3	20.3	20.1	19.7	18.3	19.0	21.2	20.9	20.5	19.1	19.7	21.9	21.7	21.2	19.8

1. It is recommended to avoid extended operation in the shaded areas. ONR=Operation Not Recommended.
2. Capacity data is based on 15% (by volume) methanol antifreeze solution (multiplier: 485) on the source side and pure water on the load side.
3. Performance data accurate within ±15%.
4. Unit performance test is run without hot water generation.
5. Capacity data does not include the source-side pump power and it does not reflect pump power correction for AHRI/ISO conditions.
6. Performance data is based upon the lower voltage of dual voltage rated units.
7. Interpolation of unit performance data is permissible; extrapolation is not.
8. Due to variations in installation, actual unit performance may vary from the tabulated data.

WPD Tables

Model	Compressor RPM	Source GPM	Source Pressure Drop with Antifreeze									
			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
WV060 Part Load Heating	2600	4	0.3	0.7	0.3	0.7	0.2	0.5	0.2	0.5	N/A	N/A
		5	0.5	1.2	0.4	0.9	0.4	0.9	0.4	0.9	N/A	N/A
		6	0.8	1.8	0.7	1.6	0.6	1.4	0.6	1.4	N/A	N/A
		8	1.4	3.2	1.2	2.8	1.1	2.5	1.1	2.5	N/A	N/A
WV060 Part Load Cooling	1800	4	N/A	N/A	0.4	0.9	0.3	0.7	0.3	0.7	0.3	0.7
		5	N/A	N/A	0.6	1.4	0.5	1.2	0.5	1.2	0.5	1.2
		6	N/A	N/A	0.9	2.1	0.8	1.8	0.7	1.6	0.7	1.6
		8	N/A	N/A	1.5	3.5	1.4	3.2	1.3	3.0	1.2	2.8
WV060 Full Load Heating	6000	10	2.3	5.3	2.2	5.1	2.1	4.8	2.0	4.6	N/A	N/A
		11.3	2.9	6.7	2.8	6.5	2.6	6.0	2.5	5.8	N/A	N/A
		15	4.9	11.3	4.6	10.6	4.5	10.4	4.3	9.9	N/A	N/A
		18	6.8	15.7	6.4	14.8	6.2	14.3	5.9	13.6	N/A	N/A
WV060 Full Load Cooling	3750	7	N/A	N/A	1.0	2.3	0.9	2.1	0.9	2.1	0.9	2.1
		8	N/A	N/A	1.3	3.0	1.3	2.9	1.2	2.8	1.2	2.8
		10.5	N/A	N/A	2.3	5.3	2.2	5.1	2.1	4.8	2.0	4.6
		12.0	N/A	N/A	3.0	6.9	2.8	6.5	2.7	6.2	2.6	6.0

1. Source WPD data are based on 15% (by volume) methanol solution while the unit is operating.
2. Pressure drop data accurate within ±25%.
3. Unit 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.

Model	Load GPM	Load Side Pressure Drop with Antifreeze							
		50 °F		80 °F		100 °F		110 °F	
		PSI	FT HD	PSI	FT HD	PSI	FT HD	PSI	FT HD
WV060	5.0	1.8	4.1	1.6	3.8	1.6	3.6	1.5	3.5
	6.0	2.4	5.4	2.2	5.1	2.1	4.9	2.1	4.8
	8.0	4.1	9.5	3.9	9.0	3.8	8.7	3.7	8.6
	10.0	6.4	14.6	6.0	13.7	5.8	13.4	5.7	13.2
	12.0	8.8	20.2	8.3	19.1	8.1	18.7	8.1	18.6
	15.0	13.3	30.7	12.8	29.4	12.6	28.9	12.5	28.7
	18.0	18.9	43.7	18.4	42.4	17.9	41.3	17.8	41.1
	20.0	23.3	53.8	22.6	52.2	22.0	50.7	21.7	50.1

1. Load WPD data are based on 15% (by volume) methanol solution while the unit and the load-side pump are off.
2. Pressure drop data accurate within ±25%.
3. Unit 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.
6. This table is for use in design the hydronic piping system. DO NOT use this table for troubleshooting (refer to the flow rate at the HMI (display). The pump is located at the inlet of the heat exchanger (pumping towards the heat exchanger). Therefore checking pressure drop at the P/T plugs will provide pressure drop of the piping system, not the pressure drop across the heat exchanger.

Sequence of Operations

Idle
The system is off and waiting for a call. If the pumps are set to "continuous" they will circulate water.

Pump Start
Pumps are left off for 55 seconds to allow zone valves and the 3-way valve to move before turning on the pumps.

The source and load pumps run at maximum speed and the EXV opens completely to equalize the system and prepare for the compressor to start. The diverting valve and reversing valve move into position accordingly. The reversing valve is energized only in cooling. The diverting valve is energized only in hot water heating. This state runs for one minute to allow temperatures and pressures to equalize and provide relevant sensor information.

Equalization
This step is primarily a verification of conditions.
If the pressures have not equalized, the system will not continue to the running phase. Also, the system will verify that the load temperature does not exceed the required target temperature (see the next section "Variable Speed Control").

Compressor Start
The EXV moves to the starting position and the compressor starts at the minimum speed (1650RPMs).

Run
The compressor modulates speed according to the required load. The EXV modulates as needed to maintain 8°F superheat. The pumps modulate to maintain ΔT across the heat exchangers. See the next section, "Variable Speed Control", for more information.

Compressor Stop
After all calls have been satisfied, the compressor ramps down gradually to zero RPMs.

Pump Stop
The pumps maintain their current speed for one minute as they slowly ramp down to turn off.

NOTE: Zone controls must allow post purge after a call to allow the internal load pump to stop. It is important to ensure that the differential bypass valve is installed correctly and adjusted to provide adequate post purge if the zone panel does not have this feature.

ASC
The anti-short cycle timer prevents the compressor from running for three minutes after the unit has been shut down. All calls will be held until the ASC timer has expired. The three minute ASC is in addition to the pump start and stop durations to provide an industry standard five minute anti-shortcycle of the compressor.

Heat/Cool/HW Transitions
- The compressor ramps down to minimum speed (1650RPMs) for 45 seconds. The pumps throttle down to minimum speed.
- The reversing valve is de-energized to put the system in heating mode.
- The diverting valve is energized and moves from the space load out to the domestic hot water load out. (if equipped)
- After the valves have transitioned, the system is released to its normal running mode where the pumps, compressor, and EXV modulate accordingly.
- Pumps throttle down to minimum speed.

When the higher priority call is satisfied, and there is still a call holding, the system will transition back to the original call in the same manner. Again, the compressor is able to continue running and thus no ASC delay is experienced.

Variable Speed Control
The use of the variable speed compressor and pumps includes advanced control algorithms to match the load demand of the space. The control described here takes place during the "Run" portion in the system sequence of operation described in the previous section.

Compressor
Control of the compressor is based on the target outlet temperature of the system. The system monitors the current load out water temperature and compares that with the target temperature. Using the control algorithm, the system seeks to maintain the exact target outlet temperature. Outlet temperature above or below the target temperature causes the compressor to throttle faster or slower as needed. In radiant floor heating, with an outdoor thermistor, the outdoor reset dictates the targeted load water temperature. In cooling and hot water, the static menu settings control the target temperature. This control allows the system to react to changing conditions. As zone valves open and close, the compressor speed is adjusted to meet the current demand.

In some small load situations, such as very small radiant zones, the system may not be able to run slow enough to avoid thermal runaway. To accommodate this situation, the compressor can shut down when the load water outlet temperature over/under shoots its target by 4°F. During this time, the pumps will continue to circulate water and the ASC timer is started.

The compressor will be cycled on again when the ASC timer expires AND the outlet temperature has dropped below the target temperature. All priorities are still obeyed during this time. If the call becomes satisfied the system will shut down normally.

NOTE: It is recommended to size zones in order to avoid this cycling condition. It is preferred to avoid compressor cycling and improve efficiency.

Pumps
When the pumps are in "auto" mode, they control to maintain ΔT (Default 5°F) across the heat exchangers. To do so, water entering and leaving temperatures are continually monitored. A sensed ΔT above the 5°F setpoint will cause the pump to run faster. Below the setpoint causes the pump to run slower – down to the set minimum speed. The variable speed pumps on both the load and source water operate in this manner.

At conditions in which the source water is below 30°F, the source pump will increase speed to ensure adequate flow (80% or higher, depending upon temperature and pressure drop).

NOTE: If, after setup, the WV detects the minimum flow rate allows less than 4.0 GPM, it will attempt to increase the minimum flow percentage until 4.0 GPM is achieved. This will overwrite the previous minimum setting.

EXV
The EXV modulates as needed to maintain 8°F superheat. Above the setpoint causes the EXV to open and below causes it to close. The EXV remains completely closed when the system is idle. Movement of the valve can be observed on the LEDs of the driver in the lower control box.

NOTE: In some conditions it is normal for the EXV to open 100% and the superheat to be above 8°F.

Section 9: Controls

Control Boxes

Enertech's variable speed controls platform is designed to provide efficiency, comfort, and safety. The system includes a set of communicating control modules and an EV2 variable speed drive. These modules communicate via serial protocols for command and control of the system. The following page includes diagrams of the modules described in this section.

The communication between the modules uses the CAN (Controller Area Network) serial protocol. Transmit and receive (Tx/Rx) orange LEDs flash to indicate communication activity. Additionally, the modules, described below, will indicate a red LED error status if communication is lost.

Upper (Main) Control Box

In addition to the field wiring terminal strip described previously, the upper control box contains the Main Controller, Expansion Module, Human Machine Interface (HMI), pump relay, and immersion heat relays.

The bottom set of plugs on the Main Control Module provides inputs for ten thermistors (via the Sensor Interface Board) located throughout the system. It also accepts the digital inputs from the external field controls and flow switches. The top of the module provides 24VAC outputs for the reversing valve, diverting valve (if equipped), pump relay, immersion heat relays, and audible alarm.

The upper control box also includes an Expansion Module. This expansion module provides additional inputs and outputs that are communicated to the Main Control Module. Inputs into this module include pressure transducers, flow meters, and pump feedback. This module also supplies variable speed pump outputs for both the source and load pumps.

Lower Control Box

The lower control box includes the Sensor Interface Board which provides simple connection interfacing with thermistors, pressure transducers, and flow meters. The Sensor Interface Board also provides isolated PWM control of the variable speed pumps.

NOTE: Field wiring connection for an external variable speed pump.

NOTE: The variable speed signal wire MUST be connected to the flow center or the WV will indicate a flow fault.

The Electronic Expansion Valve (EXV) driver module is also located in the lower control box. This controller interfaces with the five wire unipolar stepper refrigerant valve. Control of this valve driver comes from the serial interface to the Main Control Module.

Inverter Control Box

The rear control box (accessible by opening the Upper Control Box) contains the EV2 variable speed drive. The drive also uses a choke and filter on the line voltage to minimize transient effects to and from the drive. The drive itself provides connections to the compressor, high pressure switch, and discharge gas thermistor (DGT). There are also status LEDs that show green for normal operation and yellow/red flashing LEDs for faults.

NOTE: The status LEDs only need to be accessed if it is believed there are errors with the variable speed drive. Text based fault indications are available on the HMI.

Additionally, two 24VAC transformers are located in this cabinet. The primary transformer uses bus connections to distribute 24VAC throughout the system.

NOTE: No field wiring connections are made in this box. It should only be accessed for troubleshooting purposes.

Sensors

Sensor Interface Board (breakout board)

In the lower control box, the Sensor Interface Board provides simplified interfacing with the sensors located throughout the cabinet. This board connects all pressure transducers, thermistors (except DGT), flow meters, pump feedback, and pump PWM output signals.

Thermistors

The WV includes multiple thermistors. These are used for both normal operation control, such as targeting load leaving water temperatures or maintaining the proper pump speeds, but also for faults and alarms. The thermistors are color coded and plug into the Sensor Interface Board in connections labeled T1 through T11. These are standard 10k thermistors and can be checked with an ohm meter to verify operation.

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

The WV contains both discharge and suction pressure transducers. These are used for monitoring the system for faults and alarms, modulation of the EXV, as well as maintaining the compressor within the operational map.

Flow Meters

Flow meters provide accurate measurement of GPM through the source and load water circuits. These are used for modulation of pumps, ensuring minimum flow in all conditions. They are also used for simple readouts on the HMI as well as flow faults and alarms.

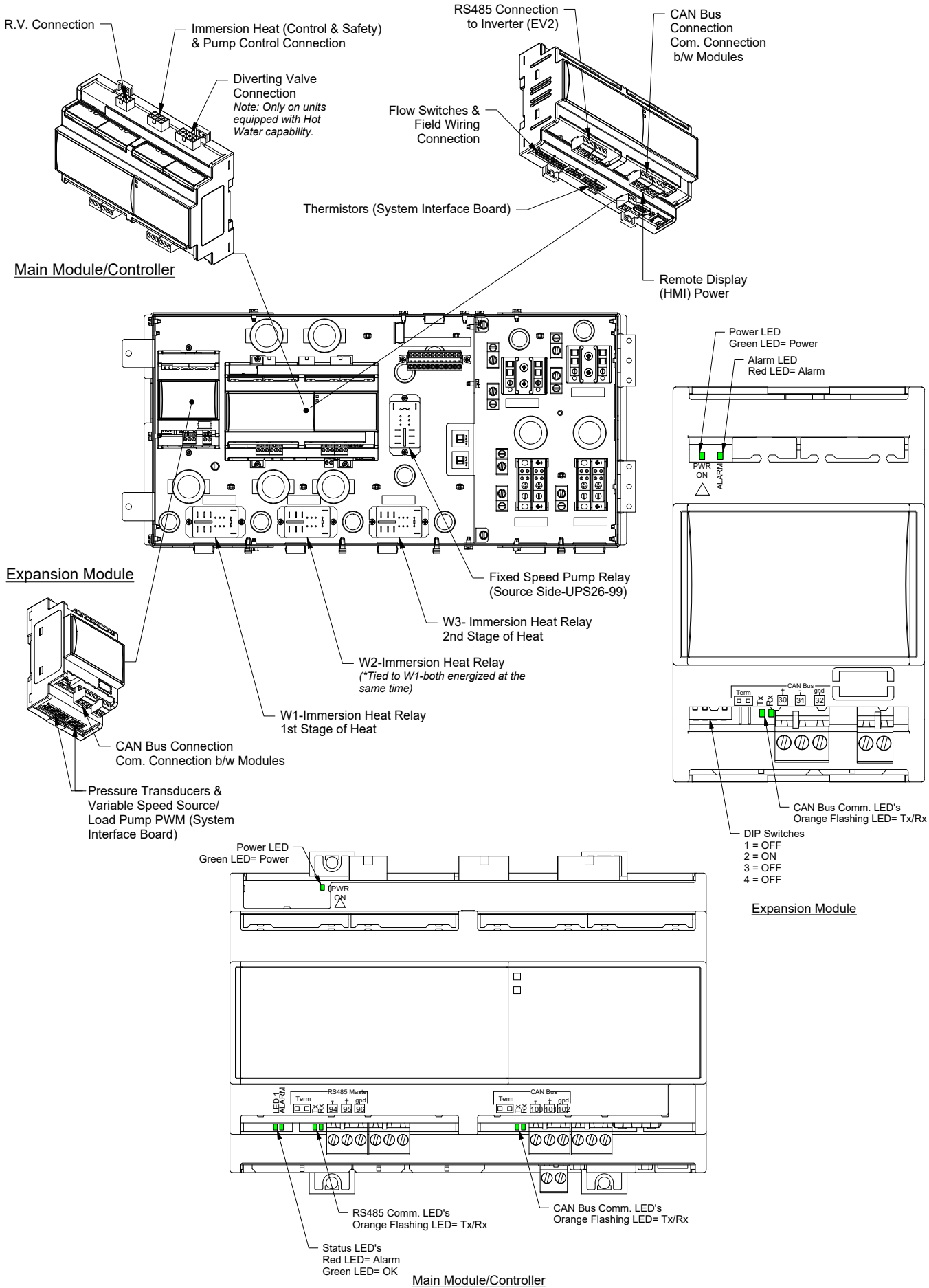
Flow Switches

Flow switches on the source and load water circuits provide redundant safety to ensure flow is present while the system is running. These switches are ON when at least 3 GPM flows through the system. If flow is not present for 15 seconds, a fault is thrown.

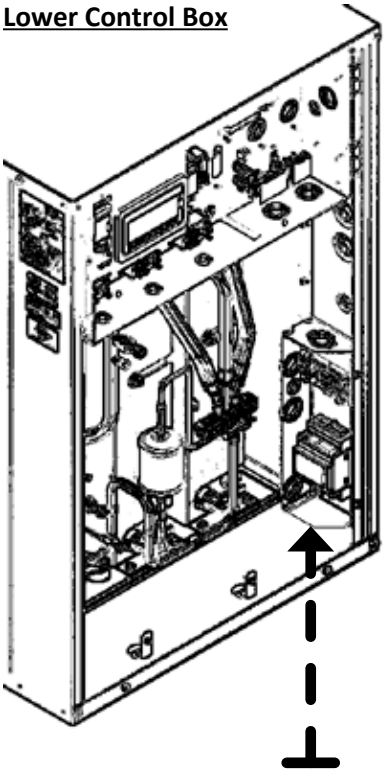
High Pressure Switch

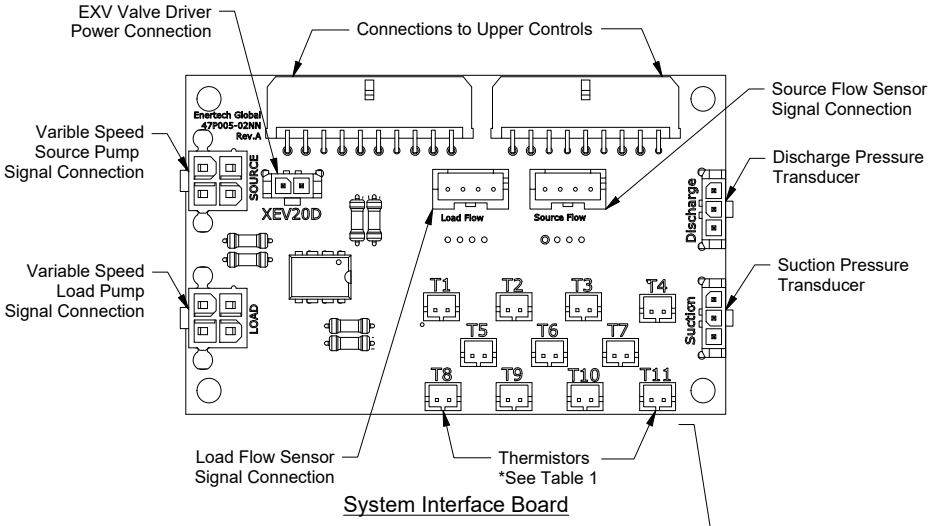
On the discharge line of the compressor, a high pressure switch is installed rated at 650PSI. This switch is connected to the EV2 (variable speed drive) in the rear control box and immediately disables the compressor if high pressure is detected.

Upper (Main) Control Box



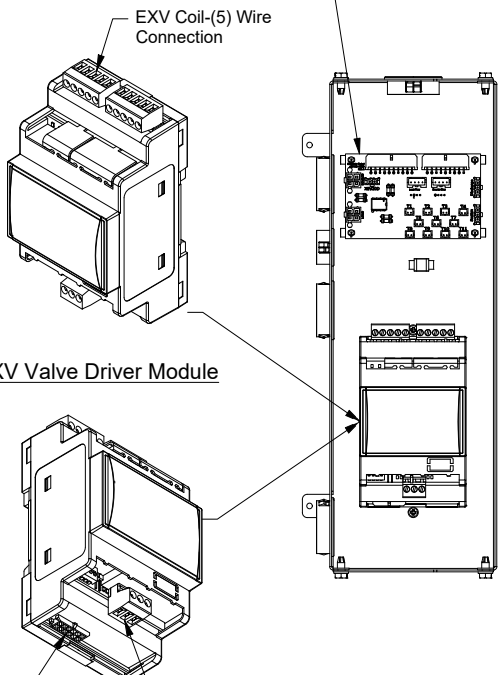
Lower Control Box



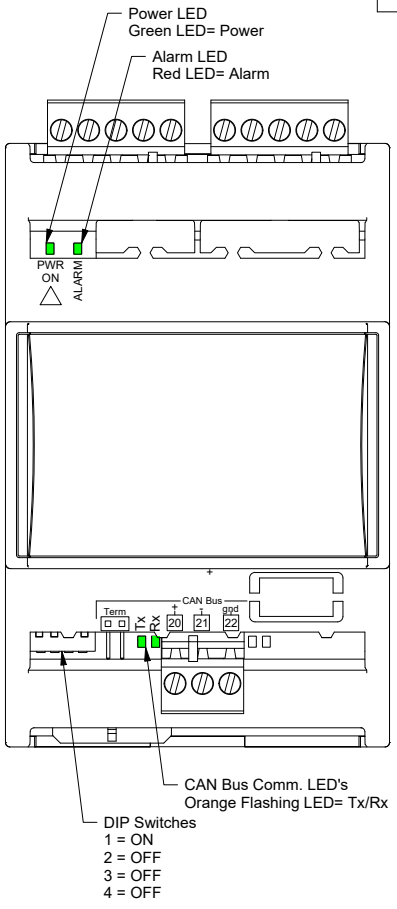


System Interface Board

Table 1		
Thermistor	Location	Color
T1	Load Coil	Blue
T2	Source Coil	Yellow
T3	Suction Gas	Green
T4	Liquid Line	Violet
T5	Source Wtr In	Grey
T6	Source Wtr Out	Black
T7	Load Wtr In	White
T8	Load Wtr Out	Red
T9	Not Used	-
T10	Not Used	-
T11	Discharge Gas	Orange



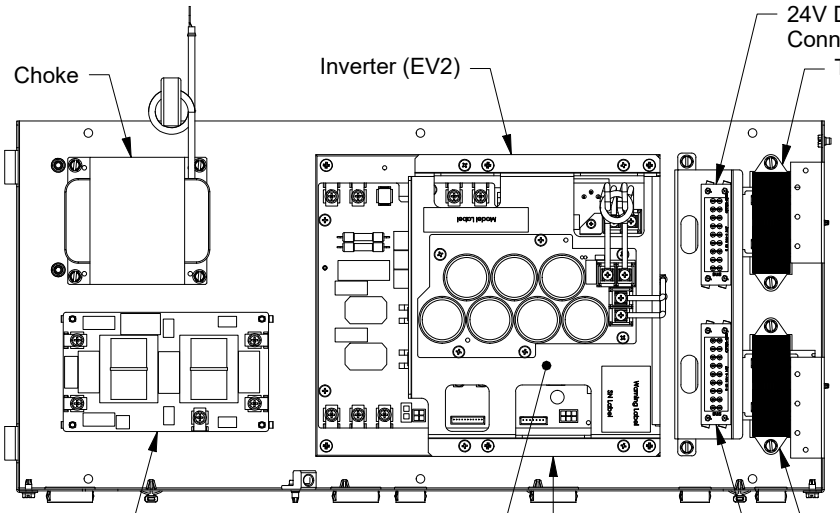
EXV Valve Driver Module



EXV Valve Driver Module

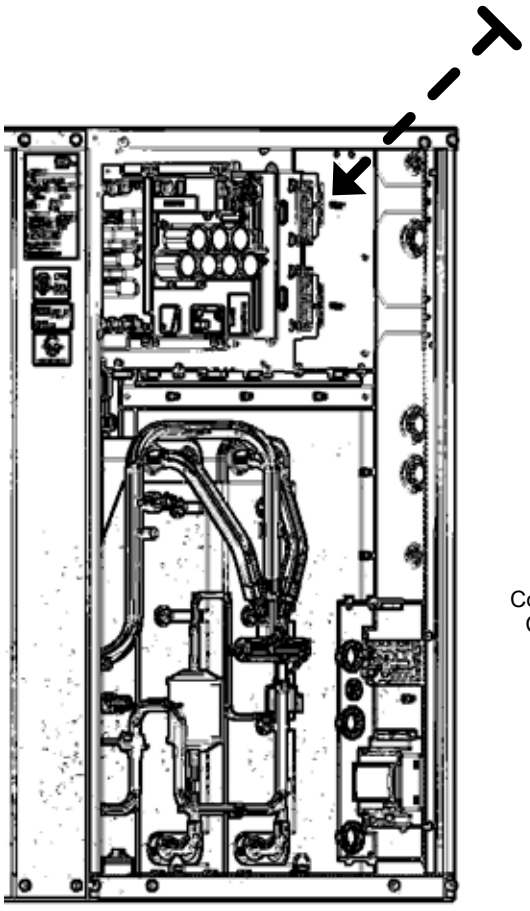
Inverter Control Box

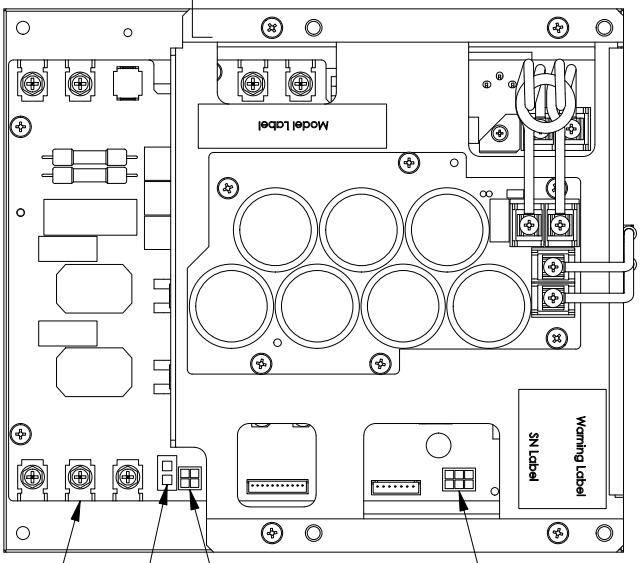
**Located behind Main (Upper) Control Box*



Notes:
-No field wiring connections need to be made in this box, so it should only be accessed for troubleshooting purposes.
-The HMI has separate alarm menus, one of which is labeled 'EV2'. This menu displays the variable speed drive faults and alarms.
-The inverter status LED's should only be viewed/accessed if the HMI displays and 'EV2' alarm.

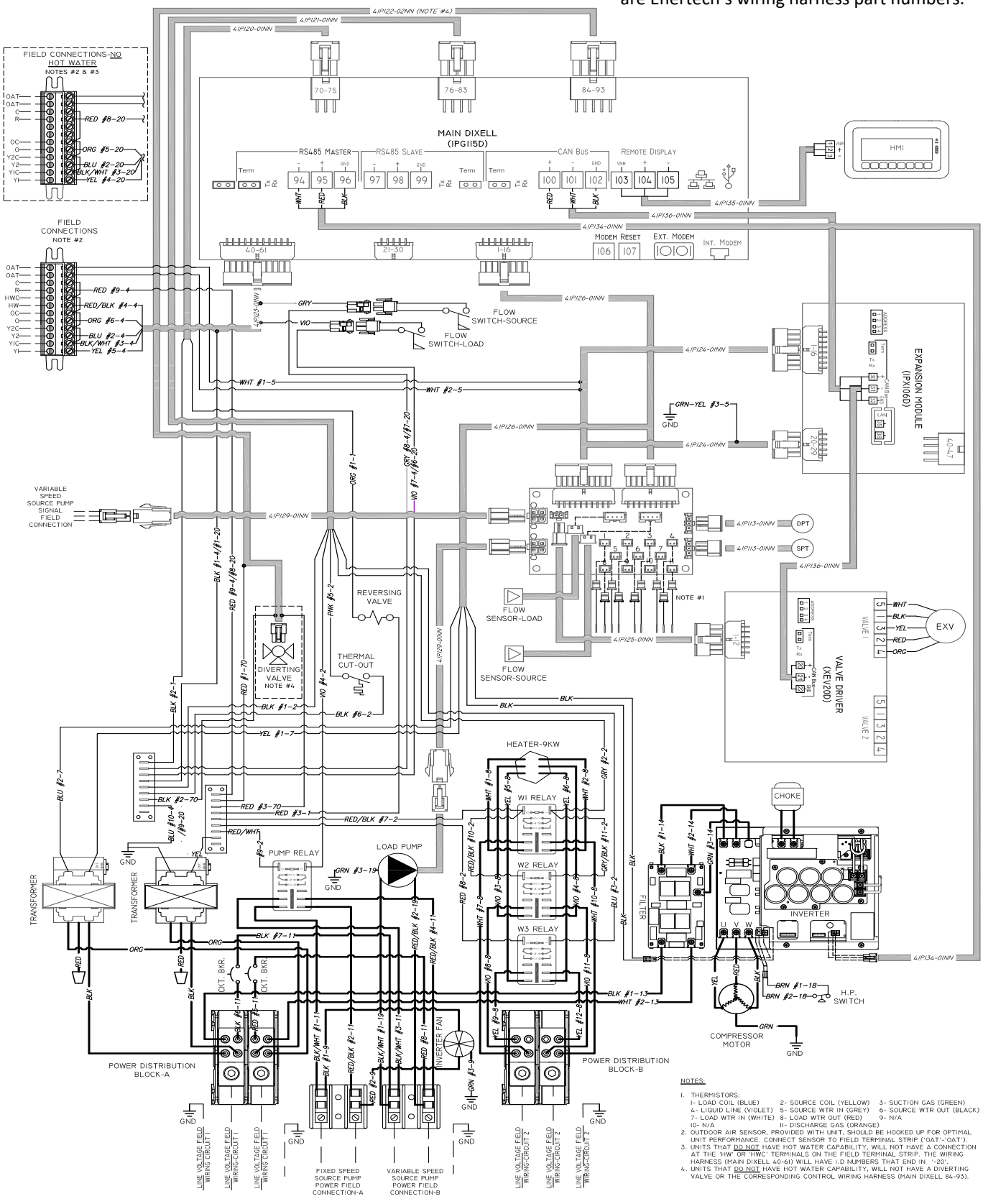
Inverter (EV2)





Wiring Diagram

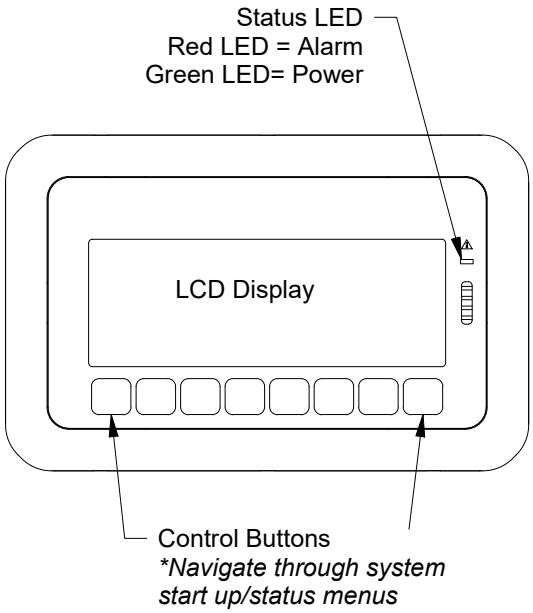
NOTE: The 41P* numbers called out in italics are Enertech's wiring harness part numbers.

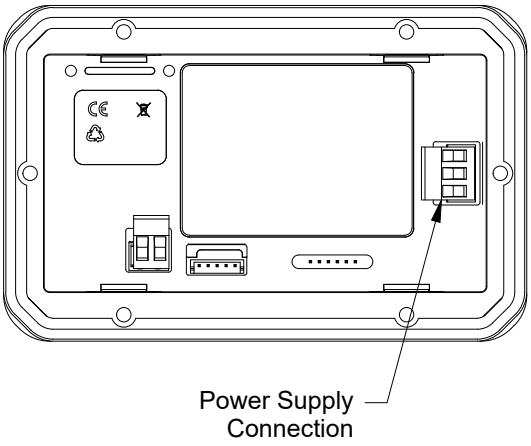


Section 9: Controls

User Interface

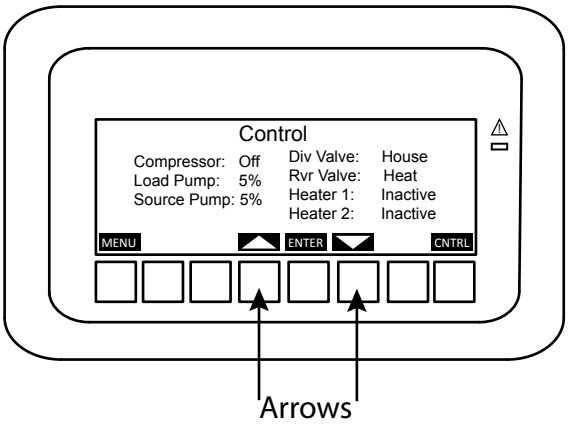
The WV includes a Human Machine Interface (HMI) on the front of the unit for immediate access to information such as system activity, sensor data, and faults. The buttons along the bottom of the screen allow navigation through screens, menus, and settings. A set of status lights indicate green for normal operation and red for alarms.





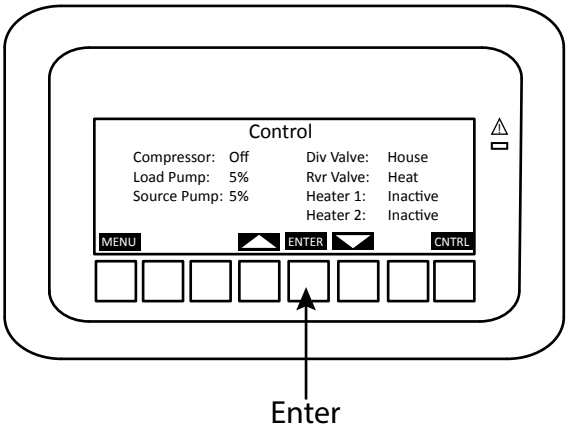
NOTE: The 41P* numbers called out in italics are Enertech's wiring harness part numbers.

When changing settings, use the "arrow" buttons to navigate to the appropriate setting.



Press the "ENTER" button and the setting will begin to flash. Use the arrow buttons again to proceed through the available options.

NOTE: Different settings are available in the up and down direction. The menu will not wrap around. You must explore both directions.



Manual Mode

In manual mode, the WV allows the technician to control the pumps, compressor, valves, and immersion heaters. This is useful for validating the system components. An example would be to move the diverting valve and verify flow is achieved to the hot water tank.

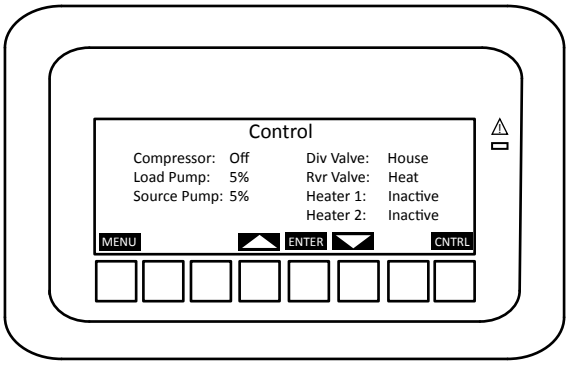
NOTE: Manual mode times out after 1 hour.

After completing a verification of the system and installation, the mode can be changed back to "normal" in the system settings. See menu settings, below for additional information on settings.

⚠ CAUTION ⚠

EXTREMELY COLD STARTUPS REQUIRE SPECIAL ATTENTION. IF THE ENTERING SOURCE WATER TEMPERATURE IS BELOW 25°F AND THE ENTERING LOAD WATER TEMPERATURE IS BELOW 70°F, IT IS REQUIRED TO TAKE THE FOLLOWING SEQUENTIAL ACTIONS:

1. Set the system to operate in "Manual" mode.
2. Ensure the source-side water flow rate is at or above 12 GPM.
3. Ensure the load-side water flow rate is between 4 and 6 GPM.
4. Turn on the compressor and set the speed to 1650 RPM.
5. If the system trips on "Low Pressure (C01)" and/or "Source Coil Min Temp (C20)" faults after compressor is turned on, clear the fault by resetting power and repeat the above procedures but turn on the electric heat between STEP 3 and STEP 4 to heat the load water above 70°F.
6. After ensuring the system is operating properly, set the system to "Normal" mode.



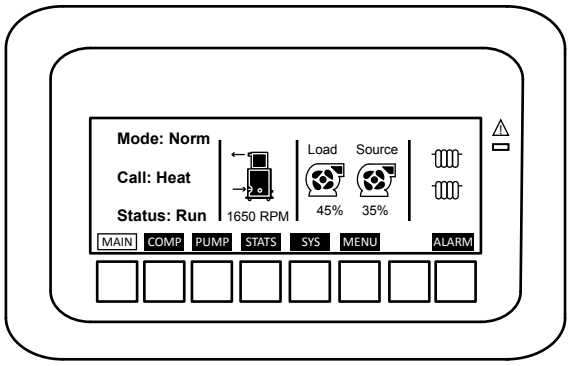
Screens

The HMI has several screens that show critical information. Access to each screen is available by pressing the button below the screen name. The following is a brief description of the data available on each screen. The "MENU" and "ALARM" screens will be described in more detail in following sections.

Main

Current activity of the system:

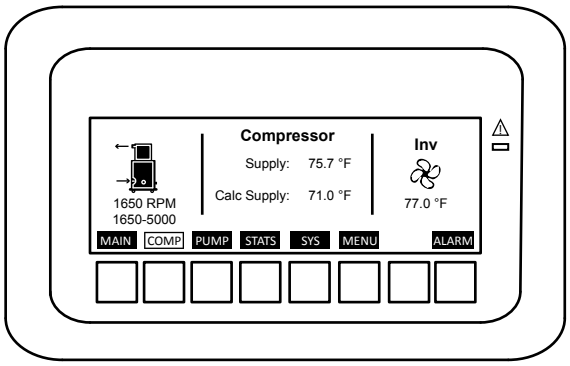
- Mode: Normal, Test, Manual, Emergency Call: Heat, Cool, HW
- Status: Startup, Equalize, Run, Shutdown, ASC, Idle, Lockout
- Compressor Speed (RPMs 1650- 7000)
- Load and Source pump command (0-100%)
- Immersion Heat (Stage On/Off)



Compressor

Shows current compressor speed (RPMs) and the allowable range in current conditions:

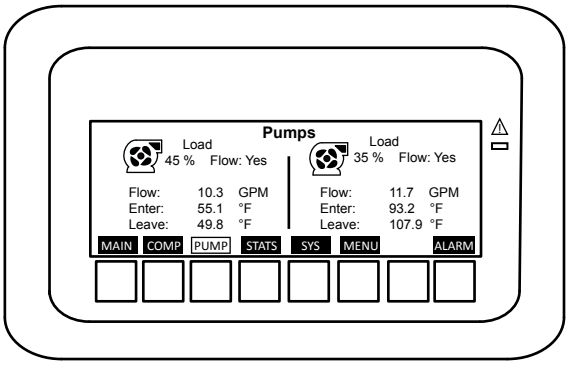
- Calc Supply indicates the target outlet temperature
- Supply indicates the current outlet temperature
- Inverter displays the current temperature of the variable speed drive



Pumps

Load and Source pump information:

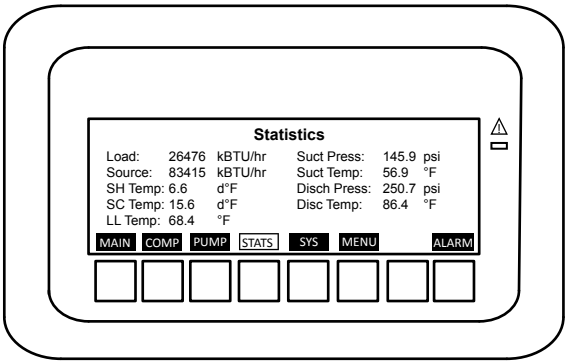
- Commanded speed (%)
- Flow switch contact (Yes/No)
- Flow rate (GPM)
- Temperatures entering/leaving



Statistics

More detailed statistics of current operation

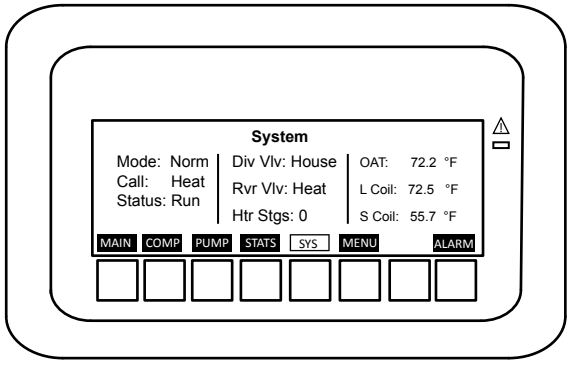
- Load and Source HE/HR
- Superheat and Subcooling
- Liquid Line temperature
- Suction Pressure
- Suction Temperature
- Discharge Pressure
- Discharge Temperature



System

Additional current system information

- Mode: Normal, Test, Manual, Emergency
- Call: Heat, Cool, HW
- Status: Startup, Equalize, Run, Shutdown, ASC, Idle, Lockout
- Diverting valve position (House, HW)
- Reversing valve position (Heat, Cool)
- Immersion heat stages active (0, 1, 2)
- Outdoor air temperature
- Load coil temperature
- Source coil temperature

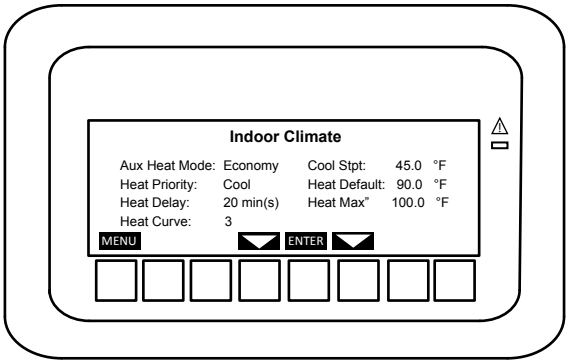


Interface: Menu Settings

Within the "MENU" button, there are four submenus that contain all adjustable parameters for the system: Indoor Climate, Hot Water (DHW), Pumps, and System.

1. Indoor Climate (Space Heating and Cooling)

These settings control how the system behaves in heating and cooling the space.



Aux Heat Mode:

- Economy – No electric heat will be used
- Normal – Electric immersion heat is used under high load conditions (after compressor runs at maximum RPMs for an adjustable period of time – 20 minutes by default). With an Aux call, 6 KW energizes first and then after 1 Min. the remaining 3 KW energizes.

Heat Priority: The prioritization of heating or cooling. (Cool is default)

Aux Heat Delay: Adjust the amount of time the unit must run full speed before the electric immersion heat is engaged (Normal mode only) (Default is 20 minutes).

Heat Curve: Sets the curve used with outdoor reset. Please refer to **Section 8, Figure 9** for additional information. (The default is curve #3)

Cool Setpoint: Outlet temperature used when cooling call is received (Default 45°F, minimum allowable 42°F).

NOTE: High Heating (Y2,Y2C) setpoint is always set to 120°F outlet temperature.

Heat Default:

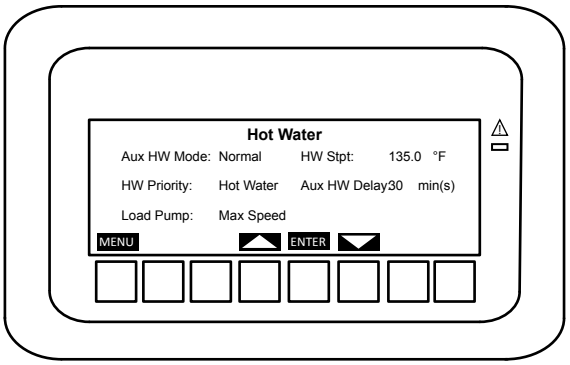
- Temperature the system will target if no outdoor air temperature is connected (no outdoor reset). (Default 90°F)

Heating Maximum Temperature:

- Maximum temperature allowed in heating mode. This is used to ensure flooring manufacturer's specifications for radiant heating.

2. Hot Water (Domestic Hot Water) - if equipped:

These settings allow changes to how the system generates Domestic Hot Water.



Aux HW Mode (DHW):

- Normal (Default) – Electric immersion heat is used under high demand situations. Immersion heat is engaged after adjustable HW Delay timer (Default is 5 Minutes). With an Aux call, 6 KW energizes first and then after 1 min the remaining 3 KW energizes.
- Economy – Compressor only hot water, no electric immersion heat is used.

Hot Water Priority: Allows the priority setting for domestic hot water (default) or house heat/cool.

Load Pump: Identifies the load pump control mode in DHW generation. "Max Speed" is recommended to achieve higher temperatures.

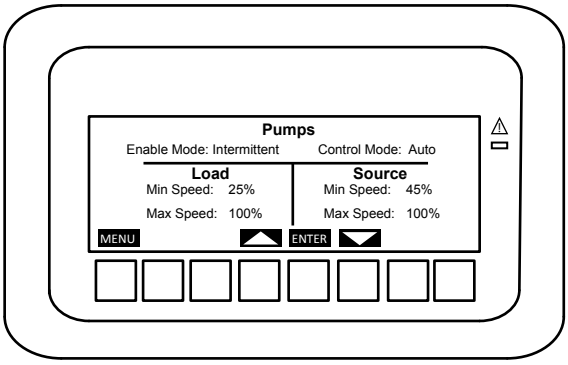
Hot Water Setpoint: Target temperature of DHW generation. (130°F is the default, maximum allowable 135°F)

NOTER: The aquastat needs to be set below the load leaving temperature (LLT default = 130°F). If the aquastat is set above the load leaving temperature, the system may not be able to satisfy the demand. The hot water settings of the WV are described in Section 3 - Operations Considerations.

Aux HW Delay: This is the delay for immersion heat when operating in "normal" (DHW) mode. (Default is 5 minutes)

3. Water Pumps

These settings allow additional control of how the water pumps operate.



Enable Mode: Intermittent mode (default) turns the pumps on and off with calls for heat/cool/HW. Continuous mode always circulates the pumps, regardless of the call.

Control Mode: Auto uses ΔT control of the pumps (default). Manual allows setting a specific speed.

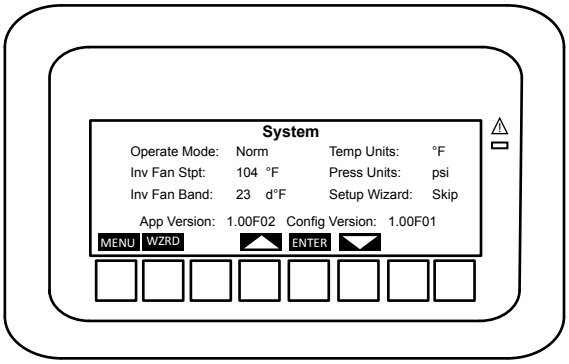
Minimum Speed: The minimum speed the pumps should run in all modes. Default Load is 60% and default source is 45%. These are configured during the startup wizard.

Maximum Speed: The maximum speed the pumps should run in all modes. (Default is 100%)

Setpoint: The targeted ΔT for the pump automatic control. (default ΔT =5°F)

NOTE: If, after setup, the WV detects the minimum flow rate allows less than 4.0 GPM, it will attempt to increase the minimum flow percentage until 4.0 GPM is achieved. This will overwrite the previous minimum setting. The minimum recommended setting is 5.0 gpm to provide some room for error as the viscosity of the fluid changes with temperature.

4. System
Overall system settings can be changed here.



Operating Mode:
- Normal (Default) – Run based on call inputs for heat/cool/HW
- Off – The unit will not run
- Test – Provides shortened ASC times for rapid troubleshooting
- Manual – Allows for running the pumps and compressor without call inputs for rapid troubleshooting.
- Emergency – Uses only electric immersion heat for heating and hot water.

NOTICE:
- Test and Manual mode time-out after one hour.
- In an Emergency call, 6 KW energizes first and then after 30 sec the remaining 3 KW energizes

Inverter Fan Setpoint: (Not used)

Inverter Fan Band: (Not used)

Temperature Units: Display setting for temperatures throughout the HMI (Fahrenheit is default).

Pressure Units: Display setting for pressures throughout the system (PSI is default).

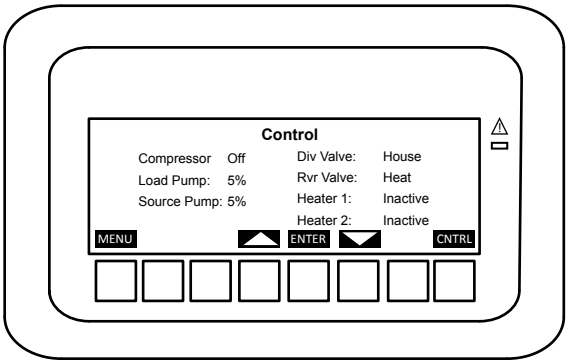
Setup Wizard: If changed to true and the "WZRD" button is held, the startup wizard will run.

App Version: Versioning information for the program.

Configuration Version: Versioning information for the configuration.

5. Control
When the system operating mode is changed to "Manual", the WV allows the technician to control the pumps, compressor, valves, and immersion heaters. This is useful for validating all of the system components.

N**OTE**: Manual mode times out after 1 hour.



Compressor: Speed selection in RPM (Off, 1800, 2600, 6000)

Load/Source Pump: Commanded speed (10% intervals)

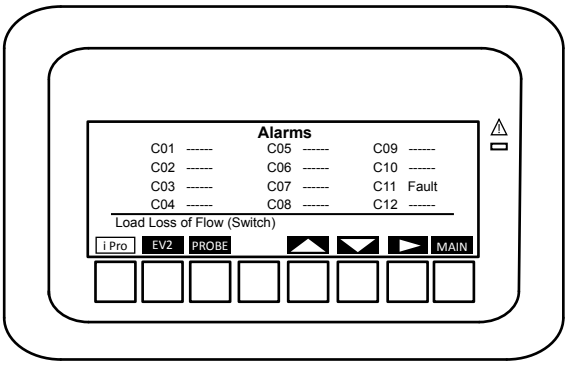
Div Valve (if equipped): Load water outlet (House or HW)

Rev Valve: Reversing valve (Heat or Cool)

Heater 1/2: Electric heat stage (Active or Inactive)

Interface: Alarms

The WV contains an advanced suite of sensors for system monitoring of optimal running conditions. If a problem should occur, these sensors will quickly identify the issue. In such a situation, the HMI presents an audible alarm, red LED, and a flashing "ALARM" menu on the screen.



When the user selects the button for the "ALARM" menu, they are presented with a list of faults and alarms with the active alarm indicated on the screen.

The arrow buttons can be utilized to browse the built in alarms. There are three sub-menus showing separate categories of alarms:

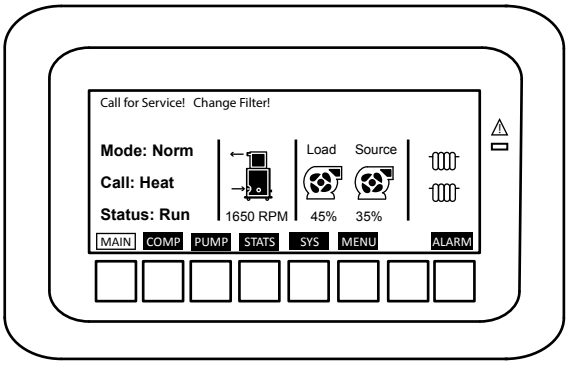
- The iPro menu shows system faults
- The EV2 (inverter drive) menu shows faults detected by the variable speed drive
- The PROBE menu shows failed sensors (such as unplugged or bad thermistors)

Any sub-menu that is currently in fault condition will be indicated by that menu name flashing.

Section 9: Controls

NOTICE:

- **Call for Service!** will show during lockout.
- **Change Filter!** will show when High Heat or Cooling reaches 200 hours. This requires a “reset” to clear alert.



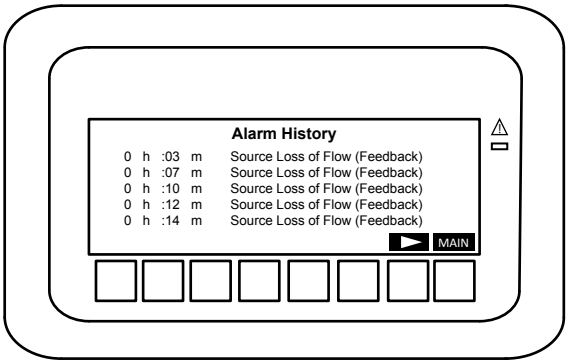
After selecting iPro (default), EV2 (inverter drive), or PROBE sub-menus, the user is presented a full list of faults. Moving the cursor to the active fault will display the problem in plain text.

For example, C11 fault shows “Load Loss of Flow (Switch)”. Also note that each menu can be multiple pages and navigating to the right for the next page may be necessary.

In addition to the display of current faults and alarms, a history of alarms is available.

By pressing the “iPro” button again within the alarm screen, a list of the ten most recent faults will be displayed. This will show the time elapsed in hours and minutes since the alarm was triggered.

After three of the same fault occurrences within 30 minutes, the system will be locked out and go into “Emergency Mode”. This will provide heating and hot water using the electric immersion heater.



The following tables provide a listing and description of the possible fault codes.

Section 10: Troubleshooting

Fault Codes : Alarm

Alarm Number	Text Displayed	Sensor Condition for Fault	Possible Cause	
C01	Low Pressure (SPT Transducer)	Suction pressure transducer detects pressure below 50 PSI for 15 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Cold Source Loop Under Antifreezed No Source Water Flow Low On Refrigerant Low Pressure Transducer Problem Expansion Valve Problem Water Quality Problem Dirty Y Strainer	**Cooling Mode:** Cold Load Loop Under Antifreezed No Load Water Flow Low On Refrigerant Low Pressure Transducer Problem Expansion Valve Problem Water Quality Problem Dirty Y Strainer
C02	High Pressure (Switch)	High pressure switch (rated at 620 PSI) connected to the EV2 (inverter drive) has opened (no delay). Will also show a D04 in the EV2 Faults. Locks out first time, no warnings.	**Heating or DHW Mode:** HMI or DHW Aquastat set to high HMI Delta T set to High (Default 5 deg) Over Antifreezed No Load Water Flow Overcharged On Refrigerant High Pressure Switch Problem Water Quality Problem Dirty Y Strainer	**Cooling Mode:** Hot Ground Loop Over Antifreezed No Source Water Flow Overcharged On Refrigerant High Pressure Switch Problem Water Quality Problem Dirty Y Strainer
C03	High Pressure (DPT Transducer)	Discharge pressure transducer has sensed greater than 625 PSI (no delay). Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** HMI or DHW Aquastat set to high HMI Delta T set to High (Default 5 deg) Over Antifreezed No Load Water Flow Overcharged On Refrigerant High Pressure Transducer Problem Water Quality Problem Dirty Y Strainer	**Cooling Mode:** Hot Ground Loop Over Antifreezed No Source Water Flow Overcharged On Refrigerant High Pressure Switch Problem Water Quality Problem Dirty Y Strainer
C04	High Entering/Leaving Source Temperature	Source entering or source leaving (T5/T6) thermistor above 140°F for 30 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** N/A	**Cooling Mode:** Low Source water flow (5 GPM Minimum) Air in Source Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit Pumps are under sized Undersized Source Loop Check Thermistors
C05	High Entering/Leaving Load Temperature	Load entering or load leaving (T7/T8) thermistor above 150°F for 10 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Low Load water flow (5 GPM Minimum) Air in Load Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit HMI or DHW Aquastat Set to High Check Electric heat Check Thermistors	**Cooling Mode:** Check Power to the Reversing Valve Solenoid Check upper Transformer for 24V and Transformer Circuit Breaker Check Thermistors
C06	Low Entering/Leaving Source Temperature	Source entering or source leaving (T5/T6) thermistor below 17°F for 30 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Low Source water flow (5 GPM Minimum) Air in Source Loop Dirty Y Strainer Undersized Loop Pumps not running Check Pump Circuit Breaker in unit Pumps are under sized Check Antifreeze Mixture Check Thermistors	**Cooling Mode:** N/A

Section 10: Troubleshooting

Fault Codes : Alarm

Alarm Number	Text Displayed	Sensor Condition for Fault	Possible Cause	
C07	Low Entering/Leaving Load Temperature	Load entering or load leaving (T7/T8) thermistor below 37°F for 10 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** N/A	**Cooling Mode:** Low Load Water Flow (5 gpm minimum) Air in Load Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit Aquastat Set To Low Cooling HMI Delta T set to High (Default 5 deg) Check Antifreeze Check Thermistors
C08	High Discharge Gas Temperatrue	Discharge gas thermistor (connected to the EV2, (inverter drive)) has sensed above 220 F°. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** **Low Suction with High Head Pressure** **Source too Cold**, Poor performing Source Loop, Low water flow (Check Pump Speed & Y Strainer), Under antifreeze (slushing or Fowling), **With Load too Hot**, Load Set point too high, Low Hydronic water flow (Check Pump Speed & Y Strainer), Too much antifreeze or Fowling. Expansion Valve Problem Check Thermistors	**Cooling Mode:** **Low Suction with High Head Pressure** **Load too Cold**, Load Set point too Low, Low water flow (Check Pump Speed & Y Strainer), Under antifreeze (slushing or Fowling). **With Source too Hot**, Poor performing Source Loop, Low Source water flow (Check Pump Speed & Y Strainer), Too much antifreeze or Fowling. Expansion Valve Problem Check Thermistors
C09	Source Loss of Flow (Switch)	Source flow switch has been open for 10 seconds (Opens at 3 GPM). Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Low Source water flow (5 GPM Minimum) Air in Source Loop Dirty Y Stainer Pumps not running Check Pump Circuit Breaker in unit Water temperature too low & freezing Check Antifreeze Check Flow switch	**Cooling Mode:** Low Source water flow (5 GPM Minimum) Air in Source Loop Dirty Y Stainer Pumps not running Check Pump Circuit Breaker in unit Check Flow switch
C10	Source Loss of Flow (PWM Feedback) or (Meter)	Source Pump, (PWM Feedback) Source Pump is in fault or connector is disconnected. (Meter) Source Flow Sensor senses that the waterflow is below 4 GPM for 10 sec. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Air in Source Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit Water temperature too low & freezing Check Antifreeze	**Cooling Mode:** Air in Source Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit Check Antifreeze
C11	Load Loss of Flow (Switch)	Load flow switch has been open for 10 seconds (Opens at 3 GPM). Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Low Load water flow (5 GPM Minimum) Air in Load Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit Check Flow switch	**Cooling Mode:** Low Load water flow (5 GPM Minimum) Air in Load Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit Water temperature too low & freezing Check Antifreeze Check Flow switch
C12	Load Loss of Flow (PWM Feedback) or (Meter)	Load Pump, (PWM Feedback) Load Pump is in fault or connector is disconnected. (Meter) Load Flow Sensor senses that the waterflow is below 4 GPM for 10 sec. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Air in Source Loop Dirty Y Strainer Pumps not running Check Pump Circuit breaker in unit Check Antifreeze	**Cooling Mode:** Air in Source Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit Water temperature too low & freezing Check Antifreeze
C13	Low Superheat	The superheat (T3) Thermistor is below 3°F for 30 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Low Source Water Flow Check Source Anitfreeze EXV Stuck Open Unit Over Charged	**Cooling Mode:** Low Load Water Flow Under Load Antifreezed EXV Stuck Open Unit Over Charged

Section 10: Troubleshooting

Fault Codes : Alarm

Alarm Number	Text Displayed	Sensor Condition for Fault	Possible Cause	
C14	System Equalization	System pressures are not equalized on startup. Warning only.	**Heating or DHW Mode:** Equalizer Tube Restricted Heat Mode, Unit shortcyling on small zone, adjust Delta T Higher (Default 5 degee). DHW Mode, Check tank Aquastat setting, Tank Aquastat needs to be set min of 5 degrees below the HMI DHW set point.	**Cooling or DHW Mode:** Equalizer Tube Restricted Cool Mode, Unit shortcyling on small zone, adjust Delta T Higher (Default 5 degee). DHW Mode, Check tank Aquastat setting, Tank Aquastat needs to be set min of 5 degrees below the HMI DHW set point.
C15	Compressor Out Of Envelope	The compressor is operating outside of the allowable evaporating and condensing temperatures for 1 minute.	**Heating or DHW Mode:** Low Source or Load Water Flow Source Loop to Cold Load Loop to Hot Check Antifreeze EXV Stuck Open	**Cooling Mode:** Low Source or Load Water Flow Source Loop to Hot Load Loop to Cold Check Antifreeze EXV Stuck Open
C16	Compressor Failed To Start	Communication to the EV2 (inverter drive) has failed to start the compressor.	**Heating or DHW Mode:** Check for Proper Voltage to unit Compressor Harness loose or defective Check for proper voltage to Inverter	**Cooling Mode:** Check for Proper Voltage to unit Compressor Harness loose or defective Check for proper voltage to Inverter
C17	Load Coil Max Temp (Refrigerant)	Load coil (T1) thermistor above 150°F for 30 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Low Load water flow (5 GPM Minimum) Air in Load Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit HMI or Aquastat Setting too High Check Antifreeze Check Electric heat Check Thermistor	**Cooling Mode:** Check Power to the Reversing Valve Solenoid Check upper Transformer for 24V and Transformer Circuit Breaker Check Thermistor
C18	Load Coil Min Temp (Refrigerant)	Load coil (T1) thermistor below 17°F for 30 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** N/A	**Cooling Mode:** Low Load Water Flow (5 gpm minimum) Air in Load Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit Aquastat Set Too Low Cooling Check Antifreeze
C19	Source Coil Max Temp (Refrigerant)	Source coil (T2) thermistor above 150°F for 30 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** N/A	**Cooling Mode:** Low Source water flow (5 GPM Minimum) Air in Source Loop Dirty Y Strainer Pumps not running Check Pump Circuit Breaker in unit Pumps are under sized Undersized Loop Check Antifreeze Check Thermistor
C20	Source Coil Min Temp (Refrigerant)	Source coil (T2) thermistor below 15°F for 30 seconds. Cycles two times on warnings, Third time it locks out.	**Heating or DHW Mode:** Low Source water flow (5 GPM Minimum) Air in Source Loop Dirty Y Strainer Undersized Loop Pumps not running Check Pump Circuit Breaker in unit Pumps are under sized Check Antifreeze Check Thermistor	**Cooling Mode:** N/A
C21	Reversing Valve Failure	The system has been running for at least 60 seconds of the same call. The load coil (T1) and source coil (T2) thermistors indicate the refrigerant temperatures in the wrong orientation for the requested call.	**Heating or DHW Mode:** Check Voltage to the Reversing Valve Solenoid Should be 0 Volts	**Cooling Mode:** Check Voltage to the reversing Valve Solenoid Should be 24 Volts Check upper Transformer for 24V and Transformer Circuit Breaker

Section 10: Troubleshooting

Fault Codes : Inverter (Variable Speed) Drive

Alarm	Text Displayed	Condition	Possible Cause
D01	Over Current	Compressor not running.	Check the compressor U/V/W and the PIM module. Check compressor motor windings.
D02	PFC Over Current	Improper Voltage to the Compressor.	Possibly caused by line noise or internal drive failure. Verify power source is to specification. Check line voltage, this can occur if it's < 200 VAC. Also verify the condition system is running in, and that it is to specification. Possible drive component issue. If problem persists replace the drive.
D03	AC/DC Over/Under Voltage	Improper Voltage to the Compressor.	Check the AC power supply. Verify the compressor is operating with specified limits. Check the AC power supply, verify it is within specified limits. Check the AC power supply, from the terminal block to the Inverter Control Board.
D04	High Pressure Switch	Condensing Pressure beyond limit, system issue. Will also show a C02 Fault in the iPro Faults.	See C02 for Possible Causes.
D05	Inverter Over Temperature	Inverter is getting to Hot.	Clean Air Filter. Verify proper airflow over the heat sink of the drive. Remove any obstructions. If problem persists, replace the drive.
D06	Lost Rotor	Compressor not running	Check Compressor and connections.
D07	Inverter Current Imbalance	Loose or Poor Wire Connections	Check the compressor U/V/W connection; make sure that they are properly connected.
D08	EEPROM	EEPROM not working Properly	Power cycle the drive. If problem persists, replace drive.
D09	High Pressure Sensor	Condensing Pressure beyond limit, system issue. Will also show a C02 Fault in the iPro Faults.	See C02 for Possible Causes.
D10	Model Configuration	Compressor model and configuration code do not match.	Contact Technical Services
D11	Sensor Configuration	Pressure sensor and configuration code do not match.	
D12	DC Low Voltage	Improper Voltage	Check the AC power supply, from the terminal block to the Inverter Control Board.
D13	Envelope Torque	Compressor current indicates it's operating outside the specified limit.	Check All temperature settings, Source and Load temperatures, Thermistor temperature readings. One of these readings is too hot or too cold.
D14	PIM Foldback	PIM is getting to Hot.	Clean Air Filter. Verify proper airflow over the heatsink of the drive. Remove any obstructions. If problem persists, replace the drive.
D15	Input Voltage Foldback	Improper Voltage	Verify the Input Voltage if is at range of operating voltage and load is in proper of Drive Power Limit. If problem persists, replace the drive.
D16	No Communication	The Inverter Control Board is not Comunicating with the iPro Genuis.	Check the communication wire connection. Check the communication parameters are set right. Check Fuse at iPro Genius.
D17	Sensor 2 (High Discharge	Compressor Discharge Temperature is higher than allowed.	Check the compressor and the system.
D18	Inverter High Temperature	Inverter is getting to Hot.	Clean Air Filter. Verify proper airflow over the heatsink of the drive. Remove any obstructions. If problem persists, replace the drive.

Section 10: Troubleshooting

Fault Codes : Inverter (Variable Speed) Drive

Alarm	Text Displayed	Condition	Possible Cause
D19	PFC High Temperature	PFC is getting to Hot.	Clean Air Filter. Verify proper airflow over the heatsink of the drive. Remove any obstructions. If problem persists, replace the drive.
D20	DSP PFC Communication	Improper Comunication	Check the drive running condition makes sure that there is no electro-magnetic interference. Restart the drive, if the problem persists, replace the drive.
D21	DSP Communication	Improper Comunication	Check the drive running condition makes sure that there is no electro-magnetic interference. Restart the drive, if the problem persists, replace the drive.
D22	Sensor 2 Fault	Temperature sensing devices on the drive are possibly defective.	Perform resistance check on the sensor to ensure values are within limits.
D23	Inverter Temperature	Temperature sensing devices on the drive are possibly defective.	If problem persists, replace the drive.
D24	PFC Temperature Sensor	Temperature sensing device on the drive are possibly defective.	If problem persists, replace the drive.
D25	Fault Limit	The maximum number of faults has been reached.	If problem persists, replace the drive.

Fault Codes : HMI Display

HMI Overview	
Display	**Notes**
Faults, Alarms, Lockouts, Warnings	Faults (also called a Warning) occur when unit is not operating within the limits (for example low pressure). An alarm is also called a Lockout. Depending upon the fault, it will either result in an alarm (lockout) after 3 tries or will lockout immediately).
Orange triangle: Will light up with no lock out on the unit. The unit may cycle on a warning 2 times and then lockout on the 3rd time. If the call satifies before it hits 3 times the lockout count will start over.	Refer to Codes to see what the issue is.
A Lockout will show an Orange triangle and sound the Buzzer.	Refer to Codes to see what the issue is. Cycle power to reset the Lockout.
How to turn off the Alarm during a lockout	Push the Alarm Button (typically 2 to 4 times) until the hour glass is displayed.
Having a problem changing set points during ASC?	Adjustments cannot be made at the HMI while the unit is in ASC (Time Delay).
HMI, Human Machine Interface	This is the Screen on the Heat Pump where where unit status can be reviewed.
Main Screen, Status Button	OFF - There is not call Strt - Compressor is starting ASC - Anti Short Cycle (Compressor is in time delay) Run - Compressor is on Shdn - Compressor is shutting down Lkout - Compressor has locked out
DHW	Domestic Hot Water

Section 11: Extended Data Tables

WV040 - Heating Full Load

SOURCE				WV040, LOAD SIDE, HEATING MODE, FULL LOAD (6000 RPM COMPRESSOR SPEED)															
EST	Source Flow			ELT	Load Flow 6 GPM					Load Flow 9 GPM					Load Flow 12 GPM				
	GPM	Source Flow WPD			LLT	HC	HE	kW	COP	LLT	HC	HE	kW	COP	LLT	HC	HE	kW	COP
°F		PSI	FT	°F	°F	MBtuh	MBtuh		W/W	°F	MBtuh	MBtuh		W/W	°F	MBtuh	MBtuh		W/W
25	12	4.6	10.7	50	Operation Not Recommended					Operation Not Recommended					Operation Not Recommended				
		4.6	10.7	80	90.4	31.1	22.4	2.57	3.55	86.7	30.2	21.5	2.57	3.45	84.9	29.6	20.9	2.57	3.38
		4.6	10.7	100	111.0	32.9	22.1	3.15	3.06	107.1	31.9	21.2	3.15	2.97	105.2	31.3	20.6	3.15	2.91
		4.6	10.7	110	120.9	32.8	21.0	3.47	2.77	117.1	31.9	20.0	3.47	2.69	115.2	31.3	19.4	3.47	2.64
		4.6	10.7	130	139.9	29.8	15.6	4.16	2.10	136.4	29.0	14.8	4.16	2.04	134.7	28.4	14.2	4.16	2.00
30	6	1.1	2.6	50	59.4	28.1	21.7	1.86	4.42	56.1	27.3	20.9	1.86	4.29	54.5	26.8	20.4	1.86	4.21
		1.1	2.6	80	90.8	32.5	23.7	2.59	3.67	87.0	31.6	22.7	2.59	3.57	85.2	31.0	22.1	2.59	3.50
		1.1	2.6	100	111.5	34.4	23.5	3.19	3.16	107.4	33.4	22.5	3.19	3.07	105.5	32.7	21.9	3.19	3.01
		1.1	2.6	110	121.4	34.3	22.3	3.51	2.87	117.4	33.3	21.3	3.51	2.78	115.4	32.7	20.7	3.51	2.73
		1.1	2.6	130	140.4	31.2	16.8	4.20	2.17	136.7	30.3	15.9	4.20	2.11	134.9	29.7	15.3	4.20	2.07
	9	2.6	6.1	50	59.5	28.5	22.1	1.86	4.48	56.1	27.7	21.3	1.86	4.35	54.5	27.1	20.8	1.86	4.26
		2.6	6.1	80	91.0	32.9	24.1	2.59	3.72	87.1	32.0	23.1	2.59	3.61	85.2	31.4	22.5	2.59	3.54
		2.6	6.1	100	111.6	34.8	23.9	3.19	3.20	107.5	33.8	22.9	3.19	3.11	105.5	33.2	22.3	3.19	3.05
		2.6	6.1	110	121.6	34.8	22.8	3.51	2.90	117.5	33.8	21.8	3.51	2.82	115.5	33.1	21.1	3.51	2.76
		2.6	6.1	130	140.5	31.6	17.2	4.20	2.20	136.8	30.7	16.3	4.20	2.14	135.0	30.1	15.7	4.20	2.10
	12	4.5	10.5	50	59.5	28.6	22.2	1.86	4.49	56.2	27.8	21.4	1.86	4.36	54.5	27.2	20.9	1.86	4.28
		4.6	10.5	80	91.0	33.1	24.2	2.59	3.74	87.1	32.1	23.3	2.59	3.63	85.2	31.5	22.6	2.59	3.56
		4.6	10.5	100	111.6	34.9	24.1	3.19	3.21	107.5	33.9	23.1	3.19	3.12	105.5	33.3	22.4	3.19	3.06
		4.5	10.5	110	121.6	34.9	22.9	3.51	2.91	117.5	33.9	21.9	3.51	2.83	115.5	33.2	21.3	3.51	2.78
		4.5	10.5	130	140.6	31.7	17.3	4.20	2.21	136.8	30.8	16.4	4.20	2.15	135.0	30.2	15.8	4.20	2.10
50	6	1.1	2.5	50	60.8	32.5	25.8	1.95	4.89	57.0	31.5	24.9	1.95	4.74	55.2	30.9	24.2	1.96	4.62
		1.1	2.5	80	92.5	37.6	28.3	2.71	4.06	88.1	36.5	27.2	2.71	3.94	86.0	35.8	26.5	2.73	3.84
		1.1	2.5	100	113.2	39.7	28.4	3.33	3.50	108.6	38.6	27.2	3.33	3.39	106.3	37.8	26.4	3.35	3.31
		1.1	2.5	110	123.2	39.6	27.1	3.67	3.17	118.6	38.5	26.0	3.67	3.07	116.3	37.8	25.2	3.69	3.00
		1.1	2.4	130	Operation Not Recommended					137.8	35.0	20.0	4.39	2.33	135.7	34.3	19.2	4.42	2.27
	9	2.4	5.6	50	61.0	32.9	26.3	1.95	4.95	57.1	32.0	25.3	1.95	4.80	55.2	31.3	24.6	1.96	4.68
		2.5	5.7	80	92.7	38.1	28.8	2.71	4.11	88.2	37.0	27.7	2.72	3.99	86.0	36.3	26.9	2.73	3.89
		2.5	5.7	100	113.4	40.2	28.9	3.33	3.54	108.7	39.1	27.7	3.34	3.43	106.4	38.3	26.9	3.36	3.35
		2.4	5.6	110	123.4	40.2	27.6	3.67	3.21	118.7	39.0	26.5	3.67	3.11	116.4	38.2	25.6	3.70	3.03
		2.4	5.6	130	Operation Not Recommended					137.9	35.4	20.4	4.40	2.36	135.8	34.7	19.6	4.42	2.30
	12	4.2	9.8	50	61.0	33.0	26.4	1.95	4.97	57.1	32.1	25.4	1.95	4.82	55.2	31.5	24.8	1.96	4.70
		4.2	9.8	80	92.7	38.2	29.0	2.71	4.13	88.2	37.1	27.8	2.72	4.00	86.1	36.4	27.1	2.73	3.90
		4.2	9.8	100	113.5	40.4	29.0	3.33	3.55	108.7	39.2	27.8	3.34	3.45	106.4	38.5	27.0	3.36	3.36
		4.2	9.8	110	123.4	40.3	27.8	3.67	3.22	118.7	39.2	26.6	3.67	3.12	116.4	38.4	25.8	3.70	3.04
		4.2	9.7	130	Operation Not Recommended					137.9	35.6	20.5	4.40	2.37	135.8	34.9	19.8	4.43	2.31
70	6	1.0	2.3	50	61.6	34.7	28.2	1.92	5.30	57.5	33.7	27.2	1.92	5.15	55.5	33.1	26.5	1.92	5.05
		1.0	2.3	80	93.4	40.2	31.0	2.67	4.40	88.7	39.0	29.9	2.67	4.28	86.4	38.2	29.1	2.67	4.19
		1.0	2.3	100	114.1	42.4	31.2	3.28	3.79	109.2	41.2	30.0	3.28	3.68	106.7	40.4	29.2	3.28	3.61
		1.0	2.3	110	124.1	42.4	30.0	3.62	3.43	119.1	41.1	28.8	3.62	3.34	116.7	40.3	28.0	3.62	3.27
		1.0	2.3	130	Operation Not Recommended					138.3	37.4	22.6	4.33	2.53	136.1	36.6	21.9	4.33	2.48
	9	2.3	5.3	50	61.7	35.2	28.6	1.92	5.37	57.6	34.2	27.6	1.92	5.21	55.6	33.5	26.9	1.92	5.11
		2.3	5.3	80	93.6	40.7	31.6	2.67	4.46	88.8	39.5	30.4	2.67	4.33	86.5	38.7	29.6	2.67	4.25
		2.3	5.3	100	114.3	43.0	31.8	3.28	3.84	109.3	41.8	30.6	3.28	3.73	106.8	40.9	29.7	3.28	3.66
		2.3	5.3	110	124.3	42.9	30.6	3.62	3.48	119.3	41.7	29.3	3.62	3.38	116.8	40.9	28.5	3.62	3.31
		2.3	5.3	130	Operation Not Recommended					138.4	37.9	23.1	4.33	2.56	136.2	37.1	22.4	4.33	2.51
	12	4.0	9.2	50	61.8	35.3	28.7	1.92	5.39	57.6	34.3	27.7	1.92	5.23	55.6	33.6	27.1	1.92	5.13
		4.0	9.2	80	93.6	40.8	31.7	2.67	4.48	88.8	39.7	30.5	2.67	4.35	86.5	38.9	29.8	2.67	4.27
		4.0	9.2	100	114.4	43.2	32.0	3.28	3.85	109.3	41.9	30.7	3.28	3.74	106.9	41.1	29.9	3.28	3.67
		4.0	9.2	110	124.4	43.1	30.8	3.62	3.49	119.3	41.8	29.5	3.62	3.39	116.8	41.0	28.7	3.62	3.33
		4.0	9.2	130	Operation Not Recommended					138.4	38.0	23.2	4.33	2.57	136.2	37.3	22.5	4.33	2.52
90	6	1.0	2.2	50	62.2	36.7	30.1	1.93	5.58	57.9	35.6	29.1	1.93	5.42	55.8	35.0	28.4	1.93	5.32
		1.0	2.2	80	94.2	42.5	33.3	2.68	4.64	89.2	41.2	32.1	2.68	4.51	86.7	40.4	31.3	2.68	4.42
		1.0	2.2	100	115.0	44.9	33.6	3.29	3.99	109.7	43.6	32.3	3.29	3.88	107.1	42.7	31.5	3.29	3.80
		1.0	2.2	110	124.9	44.8	32.4	3.63	3.62	119.7	43.5	31.1	3.63	3.51	117.1	42.7	30.3	3.63	3.45
		1.0	2.2	130	Operation Not Recommended					138.8	39.5	24.7	4.34	2.67	136.5	38.8	23.9	4.34	2.61
	9	2.2	5.1	50	62.4	37.2	30.6	1.93	5.66	58.0	36.1	29.5	1.93	5.49	55.9	35.4	28.8	1.93	5.39
		2.2	5.1	80	94.3	43.0	33.9	2.68	4.70	89.3	41.8	32.6	2.68	4.57	86.8	41.0	31.8	2.68	4.48
		2.2	5.1	100	115.2	45.5	34.2	3.29	4.05	109.8	44.2	32.9	3.29	3.93	107.2	43.3	32.1	3.29	3.85
		2.2	5.1	110	125.1	45.4	33.0	3.63	3.67	119.8	44.1	31.7	3.63	3.56	117.2	43.2	30.9	3.63	3.49
		2.2	5.1	130	Operation Not Recommended					138.9	40.0	25.2	4.34	2.70	136.5	39.3	24.4	4.34	2.65
	12	3.8	8.9	50	62.4	37.3	30.8	1.93	5.68	58.1	36.3	29.7	1.93	5.51	55.9	35.6	29.0	1.93	5.41
		3.9	8.9	80	94.4	43.2	34.0	2.68	4.72	89.3	41.9	32.8	2.68	4.58	86.9	41.1	32.0	2.68	4.49
		3.9	8.9	100	115.2	45.6	34.4	3.29	4.06	109.9	44.3	33.1	3.29	3.94	107.2	43.5	32.2	3.29	3.87
		3.8	8.9	110	125.2	45.6	33.2	3.63	3.68	119.8	44.3	31.9	3.63	3.57	117.2	43.4	31.0	3.63	3.51
		3.8	8.8	130	Operation Not Recommended					138.9	40.2	25.4	4.34	2.71	136.6	39.4	24.6	4.34	2.66

See page 34 for Application Notes for Performance Data

Section 11: Extended Data Tables

WV040 - Heating Part Load

SOURCE				WV040, LOAD SIDE, HEATING MODE, PART LOAD (2700 RPM COMPRESSOR SPEED)															
EST	Source Flow			ELT	Load Flow 4 GPM					Load Flow 5 GPM					Load Flow 6 GPM				
	GPM	Source Flow WPD			LLT	HC	HE	kW	COP	LLT	HC	HE	kW	COP	LLT	HC	HE	kW	COP
°F		PSI	FT	°F	°F	MBtuh	MBtuh		W/W	°F	MBtuh	MBtuh		W/W	°F	MBtuh	MBtuh		W/W
25	6	1.3	3.0	50	57.3	14.7	12.5	0.63	6.83	55.9	14.7	12.6	0.62	6.91	54.9	14.8	12.6	0.62	6.97
		1.3	2.9	80	87.3	14.6	11.1	1.02	4.20	85.8	14.6	11.2	1.01	4.25	84.9	14.6	11.2	1.00	4.28
		1.2	2.9	100	107.2	14.4	9.9	1.33	3.19	105.8	14.5	10.0	1.32	3.23	104.8	14.5	10.0	1.31	3.25
		1.2	2.8	110	117.2	14.4	9.3	1.50	2.81	115.8	14.4	9.4	1.49	2.85	114.8	14.5	9.4	1.48	2.87
		1.2	2.8	130	137.1	14.3	7.9	1.88	2.23	135.7	14.3	8.0	1.86	2.26	134.8	14.4	8.1	1.85	2.28
30	4	0.5	1.2	50	57.5	14.9	12.8	0.63	6.92	56.0	15.0	12.8	0.63	7.00	55.0	15.0	12.9	0.62	7.05
		0.5	1.2	80	87.4	14.8	11.3	1.02	4.25	85.9	14.8	11.4	1.01	4.30	85.0	14.9	11.4	1.01	4.33
		0.5	1.2	100	107.3	14.7	10.1	1.33	3.23	105.9	14.7	10.2	1.32	3.26	104.9	14.7	10.3	1.31	3.29
		0.5	1.2	110	117.3	14.6	9.5	1.50	2.85	115.9	14.6	9.6	1.49	2.88	114.9	14.7	9.6	1.48	2.90
		0.5	1.2	130	137.3	14.5	8.1	1.88	2.26	135.8	14.5	8.2	1.86	2.29	134.9	14.6	8.3	1.85	2.31
	5	0.9	2.0	50	57.7	15.3	13.1	0.63	7.07	56.1	15.3	13.2	0.63	7.16	55.1	15.4	13.2	0.63	7.21
		0.8	1.9	80	87.6	15.2	11.7	1.02	4.35	86.1	15.2	11.7	1.01	4.40	85.1	15.2	11.8	1.01	4.43
		0.8	1.9	100	107.5	15.1	10.5	1.34	3.30	106.0	15.1	10.6	1.32	3.34	105.0	15.1	10.6	1.32	3.36
		0.8	1.9	110	117.5	15.0	9.8	1.51	2.91	116.0	15.0	9.9	1.50	2.95	115.0	15.1	10.0	1.49	2.97
		0.8	1.9	130	137.4	14.9	8.5	1.89	2.31	136.0	14.9	8.5	1.87	2.34	135.0	15.0	8.6	1.86	2.36
	6	1.3	2.9	50	57.8	15.6	13.4	0.64	7.19	56.2	15.6	13.5	0.63	7.27	55.2	15.7	13.5	0.63	7.33
		1.2	2.8	80	87.7	15.4	11.9	1.03	4.41	86.2	15.5	12.0	1.02	4.47	85.2	15.5	12.1	1.01	4.50
		1.2	2.8	100	107.7	15.3	10.8	1.34	3.35	106.1	15.4	10.8	1.33	3.39	105.1	15.4	10.9	1.32	3.42
		1.2	2.8	110	117.6	15.3	10.1	1.51	2.96	116.1	15.3	10.2	1.50	2.99	115.1	15.3	10.2	1.49	3.02
		1.2	2.7	130	137.6	15.2	8.7	1.89	2.35	136.1	15.2	8.8	1.87	2.38	135.1	15.2	8.9	1.86	2.39
50	4	0.5	1.1	50	59.5	19.0	16.8	0.65	8.59	57.6	19.1	16.9	0.64	8.69	56.4	19.1	16.9	0.64	8.75
		0.5	1.1	80	89.4	18.8	15.3	1.05	5.28	87.6	18.9	15.4	1.04	5.33	86.3	18.9	15.4	1.03	5.37
		0.5	1.1	100	109.4	18.7	14.0	1.37	4.01	107.5	18.7	14.1	1.36	4.05	106.3	18.8	14.2	1.35	4.08
		0.5	1.1	110	119.3	18.6	13.4	1.55	3.53	117.5	18.7	13.4	1.53	3.57	116.2	18.7	13.5	1.52	3.60
		0.5	1.1	130	139.3	18.5	11.9	1.93	2.81	137.4	18.5	12.0	1.91	2.84	136.2	18.6	12.1	1.91	2.86
	5	0.8	1.8	50	59.8	19.5	17.3	0.65	8.78	57.8	19.6	17.4	0.65	8.88	56.5	19.6	17.4	0.64	8.95
		0.8	1.8	80	89.7	19.3	15.8	1.05	5.39	87.8	19.4	15.8	1.04	5.46	86.5	19.4	15.9	1.04	5.50
		0.8	1.7	100	109.6	19.2	14.5	1.37	4.10	107.7	19.2	14.6	1.36	4.14	106.4	19.3	14.7	1.35	4.18
		0.7	1.7	110	119.6	19.1	13.8	1.55	3.61	117.7	19.2	13.9	1.54	3.65	116.4	19.2	14.0	1.53	3.68
		0.7	1.7	130	139.5	19.0	12.4	1.94	2.87	137.6	19.0	12.5	1.92	2.90	136.4	19.1	12.6	1.91	2.93
	6	1.1	2.6	50	59.9	19.9	17.6	0.65	8.92	58.0	19.9	17.7	0.65	9.03	56.7	20.0	17.8	0.64	9.09
		1.1	2.6	80	89.8	19.7	16.1	1.05	5.48	87.9	19.7	16.2	1.04	5.54	86.6	19.8	16.2	1.04	5.58
		1.1	2.5	100	109.8	19.5	14.8	1.38	4.16	107.8	19.6	14.9	1.36	4.21	106.5	19.6	15.0	1.36	4.24
		1.1	2.5	110	119.7	19.4	14.2	1.55	3.67	117.8	19.5	14.2	1.54	3.71	116.5	19.5	14.3	1.53	3.74
		1.1	2.5	130	139.7	19.3	12.7	1.94	2.92	137.7	19.4	12.8	1.92	2.95	136.5	19.4	12.9	1.91	2.97
70	4	0.4	1.0	50	62.1	24.2	22.0	0.66	10.76	59.7	24.3	22.0	0.65	10.88	58.1	24.3	22.1	0.65	10.96
		0.4	1.0	80	92.0	24.0	20.4	1.07	6.60	89.6	24.1	20.5	1.06	6.68	88.0	24.1	20.5	1.05	6.73
		0.4	1.0	100	111.9	23.8	19.1	1.39	5.02	109.6	23.9	19.2	1.38	5.07	108.0	23.9	19.3	1.37	5.11
		0.4	1.0	110	121.9	23.7	18.4	1.57	4.42	119.5	23.8	18.5	1.56	4.47	118.0	23.9	18.6	1.55	4.51
		0.4	1.0	130	141.8	23.6	16.9	1.97	3.51	139.5	23.6	17.0	1.95	3.55	137.9	23.7	17.1	1.94	3.58
	5	0.7	1.7	50	62.4	24.9	22.6	0.66	10.99	60.0	24.9	22.7	0.66	11.11	58.3	25.0	22.8	0.65	11.21
		0.7	1.6	80	92.3	24.6	21.0	1.07	6.75	89.9	24.7	21.1	1.06	6.83	88.3	24.8	21.2	1.05	6.89
		0.7	1.6	100	112.2	24.4	19.7	1.40	5.13	109.8	24.5	19.8	1.38	5.19	108.2	24.6	19.9	1.38	5.23
		0.7	1.6	110	122.2	24.3	19.0	1.58	4.52	119.8	24.4	19.1	1.56	4.58	118.2	24.5	19.2	1.56	4.61
		0.7	1.6	130	142.1	24.2	17.5	1.97	3.59	139.7	24.2	17.6	1.95	3.64	138.1	24.3	17.7	1.95	3.66
	6	1.1	2.4	50	62.6	25.3	23.0	0.66	11.16	60.1	25.3	23.1	0.66	11.29	58.5	25.4	23.2	0.65	11.39
		1.0	2.4	80	92.5	25.1	21.4	1.07	6.86	90.1	25.1	21.5	1.06	6.94	88.4	25.2	21.6	1.06	6.99
		1.0	2.3	100	112.4	24.9	20.1	1.40	5.21	110.0	24.9	20.2	1.39	5.27	108.3	25.0	20.3	1.38	5.31
		1.0	2.3	110	122.4	24.8	19.4	1.58	4.60	119.9	24.8	19.5	1.57	4.65	118.3	24.9	19.6	1.56	4.68
		1.0	2.3	130	141.7	23.4	16.7	1.98	3.48	139.4	23.4	16.8	1.96	3.51	137.8	23.4	16.8	1.95	3.53
90	4	0.4	1.0	50	65.3	30.5	28.3	0.67	13.44	62.2	30.6	28.4	0.66	13.59	60.2	30.7	28.5	0.66	13.69
		0.4	0.9	80	95.1	30.3	26.6	1.08	8.26	92.1	30.4	26.7	1.07	8.35	90.1	30.4	26.8	1.06	8.41
		0.4	0.9	100	115.0	30.0	25.3	1.40	6.27	112.0	30.1	25.4	1.39	6.34	110.1	30.2	25.5	1.39	6.39
		0.4	0.9	110	125.0	29.9	24.5	1.59	5.53	122.0	30.0	24.6	1.57	5.60	120.0	30.1	24.7	1.56	5.64
		0.4	0.9	130	144.9	29.7	23.0	1.98	4.39	141.9	29.8	23.1	1.97	4.44	140.0	29.9	23.2	1.96	4.48
	5	0.7	1.6	50	65.7	31.3	29.1	0.67	13.75	62.6	31.4	29.2	0.66	13.91	60.5	31.5	29.3	0.66	14.01
		0.7	1.5	80	95.5	31.1	27.4	1.08	8.44	92.5	31.1	27.5	1.07	8.54	90.4	31.2	27.6	1.06	8.60
		0.6	1.5	100	115.4	30.8	26.0	1.41	6.41	112.4	30.9	26.1	1.40	6.49	110.3	31.0	26.2	1.39	6.54
		0.6	1.5	110	125.4	30.7	25.3	1.59	5.66	122.3	30.8	25.4	1.58	5.72	120.3	30.9	25.5	1.57	5.76
		0.6	1.5	130	Operation Not Recommended					142.2	30.6	23.8	1.97	4.55	140.2	30.7	24.0	1.96	4.58
	6	1.0	2.3	50	65.9	31.9	29.6	0.67	13.97	62.8	32.0	29.7	0.66	14.13	60.7	32.1	29.8	0.66	14.23
		1.0	2.2	80	95.8	31.6	27.9	1.08	8.58	92.7	31.7	28.0	1.07	8.68	90.6	31.8	28.1	1.07	8.74
		0.9	2.2	100	115.7	31.4	26.6	1.41	6.51	112.6	31.4	26.7	1.40	6.59	110.5	31.5	26.8	1.39	6.64
		0.9	2.2	110	125.6	31.2	25.8	1.59	5.74	122.5	31.3	25.9	1.58	5.81	120.5	31.4	26.0	1.57	5.86
		0.9	2.1	130	Operation Not Recommended					141.8	29.6	22.8	1.98	4.39	139.9	29.6	22.9	1.97	4.41

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Section 11: Extended Data Tables

WV040 - Cooling Full Load

SOURCE				WV040, LOAD SIDE, COOLING MODE, FULL LOAD (3325 RPM COMPRESSOR SPEED)															
EST	Source Flow			ELT	Load Flow 5 GPM					Load Flow 6 GPM					Load Flow 8 GPM				
	GPM	Source Flow WPD			LLT	TC	HR	kW	EER	LLT	TC	HR	kW	EER	LLT	TC	HR	kW	EER
°F		PSI	FT	°F	°F	MBtuh	MBtuh		Btuh/W	°F	MBtuh	MBtuh		Btuh/W	°F	MBtuh	MBtuh		Btuh/W
40	5	0.8	1.8	40	Operation Not Recommended					Operation Not Recommended					Operation Not Recommended				
		0.8	1.7	50															
		0.7	1.7	60	51.9	20.2	22.5	0.69	29.3	53.1	20.8	23.1	0.69	29.9	54.6	21.6	24.0	0.71	30.4
		0.7	1.7	70	61.9	20.2	22.6	0.70	28.8	63.1	20.8	23.2	0.71	29.4	64.6	21.6	24.1	0.72	29.9
		0.7	1.6	90	81.9	20.2	22.6	0.70	28.8	83.1	20.8	23.2	0.71	29.4	84.6	21.6	24.1	0.72	29.9
50	5	0.7	1.7	40	32.8	18.1	20.8	0.81	22.4	33.8	18.6	21.4	0.81	22.9	35.2	19.3	22.2	0.83	23.3
		0.7	1.7	50	41.5	21.3	24.0	0.81	26.2	42.7	21.9	24.7	0.82	26.8	44.3	22.7	25.6	0.84	27.2
		0.7	1.7	60	50.5	23.7	26.5	0.82	28.9	51.9	24.4	27.2	0.83	29.6	53.6	25.4	28.3	0.85	30.0
		0.7	1.6	70	59.8	25.5	28.4	0.83	30.6	61.2	26.3	29.1	0.84	31.3	63.2	27.3	30.3	0.86	31.8
		0.7	1.5	90	79.2	27.0	29.9	0.86	31.6	80.7	27.8	30.7	0.86	32.3	82.8	28.9	31.9	0.88	32.8
	6	1.1	2.5	40	32.8	18.1	20.8	0.79	23.0	33.8	18.6	21.3	0.79	23.5	35.2	19.4	22.1	0.81	23.9
		1.1	2.5	50	41.5	21.3	24.0	0.79	26.9	42.7	21.9	24.6	0.80	27.5	44.3	22.8	25.6	0.82	27.9
		1.1	2.4	60	50.5	23.8	26.5	0.80	29.7	51.8	24.5	27.2	0.81	30.3	53.6	25.4	28.3	0.83	30.8
		1.0	2.4	70	59.8	25.6	28.3	0.81	31.4	61.2	26.3	29.1	0.82	32.1	63.2	27.4	30.2	0.84	32.6
		1.0	2.3	90	79.2	27.1	29.9	0.84	32.4	80.7	27.8	30.7	0.84	33.1	82.8	29.0	31.9	0.86	33.7
	8	1.9	4.4	40	32.7	18.2	20.8	0.76	23.9	33.8	18.7	21.3	0.77	24.4	35.1	19.5	22.2	0.79	24.8
		1.9	4.4	50	41.4	21.4	24.0	0.77	27.9	42.7	22.0	24.6	0.77	28.5	44.3	22.9	25.6	0.79	29.0
		1.9	4.4	60	50.4	23.9	26.5	0.78	30.8	51.8	24.6	27.2	0.78	31.5	53.6	25.6	28.3	0.80	32.0
		1.9	4.3	70	59.7	25.7	28.4	0.79	32.6	61.2	26.4	29.1	0.79	33.3	63.1	27.5	30.3	0.81	33.9
		1.7	4.0	90	79.1	27.2	30.0	0.81	33.6	80.7	28.0	30.8	0.82	34.3	82.7	29.1	32.0	0.83	34.9
70	5	0.7	1.6	40	32.9	17.8	21.5	1.11	16.0	33.9	18.3	22.1	1.12	16.3	35.3	19.0	22.9	1.14	16.6
		0.7	1.6	50	41.6	20.9	24.7	1.12	18.7	42.8	21.5	25.3	1.12	19.1	44.4	22.3	26.3	1.15	19.4
		0.7	1.6	60	50.7	23.3	27.2	1.13	20.6	52.0	24.0	27.9	1.14	21.1	53.8	25.0	28.9	1.17	21.4
		0.7	1.5	70	60.0	25.1	29.0	1.15	21.8	61.4	25.8	29.7	1.16	22.3	63.3	26.8	30.9	1.18	22.7
		0.6	1.5	90	79.4	26.5	30.6	1.18	22.5	80.9	27.3	31.4	1.19	23.0	82.9	28.4	32.6	1.22	23.4
	6	1.0	2.4	40	32.9	17.8	21.5	1.08	16.4	33.9	18.3	22.0	1.09	16.8	35.2	19.0	22.8	1.12	17.0
		1.0	2.3	50	41.6	20.9	24.6	1.09	19.2	42.8	21.5	25.2	1.10	19.6	44.4	22.4	26.2	1.12	19.9
		1.0	2.3	60	50.7	23.3	27.1	1.10	21.2	52.0	24.0	27.8	1.11	21.6	53.8	25.0	28.9	1.14	22.0
		1.0	2.3	70	60.0	25.1	28.9	1.12	22.4	61.4	25.8	29.7	1.13	22.9	63.3	26.9	30.8	1.16	23.3
		0.9	2.1	90	79.4	26.6	30.5	1.15	23.1	80.9	27.3	31.3	1.16	23.6	82.9	28.4	32.5	1.19	24.0
	8	1.8	4.2	40	32.9	17.9	21.5	1.05	17.0	33.9	18.4	22.0	1.06	17.4	35.2	19.1	22.8	1.08	17.7
		1.8	4.2	50	41.6	21.0	24.6	1.06	19.9	42.8	21.6	25.2	1.06	20.4	44.4	22.5	26.2	1.09	20.7
		1.8	4.1	60	50.6	23.5	27.1	1.07	22.0	52.0	24.1	27.8	1.08	22.4	53.7	25.1	28.9	1.10	22.8
		1.8	4.1	70	59.9	25.2	28.9	1.09	23.2	61.3	26.0	29.7	1.09	23.8	63.2	27.0	30.8	1.12	24.1
		1.7	3.8	90	79.3	26.7	30.5	1.11	24.0	80.8	27.5	31.3	1.12	24.5	82.9	28.6	32.5	1.15	24.9
90	5	0.7	1.5	40	33.7	15.9	20.9	1.48	10.8	34.6	16.3	21.4	1.49	11.0	35.8	17.0	22.2	1.52	11.2
		0.7	1.5	50	42.5	18.7	23.7	1.48	12.6	43.6	19.2	24.3	1.49	12.9	45.0	20.0	25.2	1.53	13.1
		0.7	1.5	60	51.7	20.8	26.0	1.50	13.9	52.9	21.4	26.6	1.51	14.2	54.4	22.3	27.6	1.55	14.4
		0.6	1.5	70	61.0	22.4	27.6	1.53	14.7	62.3	23.1	28.3	1.54	15.0	64.0	24.0	29.4	1.57	15.2
		0.6	1.4	90	80.5	23.7	29.1	1.57	15.1	81.9	24.4	29.8	1.58	15.5	83.7	25.4	30.9	1.62	15.7
	6	1.0	2.3	40	33.6	15.9	20.8	1.44	11.0	34.6	16.3	21.3	1.45	11.3	35.7	17.0	22.1	1.48	11.5
		1.0	2.3	50	42.5	18.7	23.6	1.45	12.9	43.6	19.2	24.2	1.46	13.2	45.0	20.0	25.1	1.49	13.4
		1.0	2.2	60	51.7	20.9	25.9	1.47	14.2	52.8	21.5	26.5	1.48	14.6	54.4	22.3	27.5	1.51	14.8
		1.0	2.2	70	61.0	22.4	27.5	1.49	15.1	62.3	23.1	28.2	1.50	15.4	64.0	24.0	29.3	1.54	15.6
		0.9	2.1	90	80.5	23.8	29.0	1.53	15.5	81.9	24.4	29.7	1.54	15.9	83.6	25.4	30.8	1.58	16.1
	8	1.8	4.1	40	33.6	16.0	20.7	1.39	11.5	34.5	16.4	21.2	1.40	11.7	35.7	17.1	22.0	1.44	11.9
		1.8	4.0	50	42.5	18.8	23.6	1.40	13.4	43.6	19.3	24.1	1.41	13.7	45.0	20.1	25.0	1.45	13.9
		1.7	4.0	60	51.6	21.0	25.8	1.42	14.8	52.8	21.6	26.5	1.43	15.1	54.4	22.5	27.5	1.46	15.3
		1.7	3.9	70	61.0	22.6	27.5	1.44	15.6	62.3	23.2	28.2	1.45	16.0	64.0	24.1	29.2	1.49	16.2
		1.6	3.7	90	80.4	23.9	28.9	1.48	16.1	81.8	24.6	29.7	1.49	16.5	83.6	25.6	30.8	1.53	16.7
110	5	0.7	1.5	40	34.2	14.4	20.9	1.90	7.6	35.1	14.8	21.4	1.91	7.8	36.1	15.4	22.1	1.96	7.9
		0.6	1.5	50	43.2	17.0	23.5	1.91	8.9	44.2	17.5	24.0	1.93	9.1	45.5	18.2	24.9	1.97	9.2
		0.6	1.5	60	52.4	19.0	25.6	1.94	9.8	53.5	19.5	26.2	1.95	10.0	54.9	20.3	27.1	2.00	10.2
		0.6	1.5	70	61.8	20.4	27.1	1.97	10.4	63.0	21.0	27.7	1.98	10.6	64.5	21.8	28.7	2.03	10.8
		0.6	1.4	90	81.4	21.6	28.5	2.02	10.7	82.6	22.2	29.1	2.03	10.9	84.2	23.1	30.2	2.08	11.1
	6	1.0	2.2	40	34.2	14.4	20.8	1.85	7.8	35.0	14.9	21.2	1.87	8.0	36.1	15.5	22.0	1.91	8.1
		1.0	2.2	50	43.2	17.0	23.4	1.87	9.1	44.2	17.5	23.9	1.88	9.3	45.5	18.2	24.7	1.92	9.5
		0.9	2.2	60	52.4	19.0	25.4	1.89	10.0	53.5	19.5	26.0	1.90	10.3	54.9	20.3	27.0	1.95	10.4
		0.9	2.1	70	61.8	20.4	27.0	1.92	10.6	63.0	21.0	27.6	1.93	10.9	64.5	21.8	28.6	1.98	11.0
		0.9	2.0	90	81.4	21.6	28.3	1.97	11.0	82.6	22.2	29.0	1.98	11.2	84.2	23.1	30.0	2.03	11.4
	8	1.7	4.0	40	34.2	14.5	20.7	1.80	8.1	35.0	14.9	21.1	1.81	8.3	36.1	15.5	21.9	1.85	8.4
		1.7	3.9	50	43.2	17.1	23.2	1.81	9.5	44.1	17.6	23.8	1.82	9.7	45.4	18.3	24.6	1.86	9.8
		1.7	3.9	60	52.4	19.1	25.3	1.83	10.4	53.5	19.6	25.9	1.84	10.6	54.9	20.4	26.9	1.89	10.8
		1.7	3.8	70	61.8	20.5	26.9	1.86	11.0	63.0	21.1	27.5	1.87	11.3	64.5	22.0	28.5	1.92	11.5
		1.6	3.6	90	81.3	21.7	28.2	1.91	11.4	82.6	22.3	28.9	1.92	11.6	84.2	23.2	29.9	1.97	11.8

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Section 11: Extended Data Tables

WV040 - Cooling Part Load

SOURCE				WV040, LOAD SIDE, COOLING MODE, PART LOAD (1650 RPM COMPRESSOR SPEED)															
EST	Source Flow			ELT	Load Flow 4 GPM					Load Flow 5 GPM					Load Flow 6 GPM				
	GPM	Source Flow WPD			LLT	TC	HR	kW	EER	LLT	TC	HR	kW	EER	LLT	TC	HR	kW	EER
°F		PSI	FT	°F	°F	MBtuh	MBtuh		Btuh/W	°F	MBtuh	MBtuh		Btuh/W	°F	MBtuh	MBtuh		Btuh/W
40	4	0.4	0.9	40	Operation Not Recommended					Operation Not Recommended					Operation Not Recommended				
		0.4	0.9	50															
		0.4	0.9	60															
		0.4	0.9	70	63.9	12.2	13.1	0.26	46.8	65.0	12.5	13.4	0.27	47.2	65.8	12.7	13.6	0.27	48.0
		0.4	0.9	90	83.9	12.2	13.1	0.26	46.8	85.0	12.5	13.4	0.27	47.2	85.8	12.7	13.6	0.27	48.0
50	4	0.4	0.9	40	Operation Not Recommended					Operation Not Recommended					Operation Not Recommended				
		0.4	0.9	50	44.0	12.0	13.2	0.35	34.6	45.1	12.3	13.5	0.35	34.8	45.8	12.5	13.7	0.35	35.4
		0.4	0.8	60	52.8	14.4	15.6	0.34	41.9	54.1	14.8	16.0	0.35	42.3	55.0	15.0	16.2	0.35	43.1
		0.4	0.8	70	61.6	16.7	17.9	0.34	48.6	63.2	17.1	18.3	0.35	49.0	64.2	17.4	18.6	0.35	49.9
		0.4	0.8	90	79.5	21.0	22.1	0.34	60.9	81.4	21.5	22.7	0.35	61.5	82.7	21.8	23.0	0.35	62.6
	5	0.6	1.4	40	Operation Not Recommended					Operation Not Recommended					Operation Not Recommended				
		0.6	1.4	50															
		0.6	1.4	60	52.8	14.4	15.6	0.34	42.0	54.1	14.8	16.0	0.35	42.4	55.0	15.1	16.2	0.35	43.1
		0.6	1.4	70	61.6	16.7	17.9	0.34	48.7	63.1	17.1	18.3	0.35	49.1	64.2	17.4	18.6	0.35	50.0
		0.6	1.3	90	79.5	21.0	22.2	0.34	61.1	81.4	21.5	22.7	0.35	61.6	82.7	21.9	23.1	0.35	62.7
	6	0.9	2.1	40															
		0.9	2.0	50	Operation Not Recommended					Operation Not Recommended					Operation Not Recommended				
		0.9	2.0	60															
		0.9	2.0	70	61.6	16.8	17.9	0.34	49.0	63.1	17.2	18.3	0.35	49.3	64.2	17.5	18.6	0.35	50.2
		0.8	1.9	90	79.5	21.0	22.2	0.34	61.5	81.4	21.5	22.7	0.35	61.9	82.7	21.9	23.1	0.35	63.0
70	4	0.3	0.8	40	35.7	8.6	10.5	0.54	15.9	36.5	8.8	10.7	0.56	15.8	37.0	9.0	10.9	0.57	15.8
		0.3	0.8	50	44.6	10.9	12.7	0.53	20.5	45.5	11.1	13.0	0.54	20.5	46.2	11.3	13.2	0.56	20.3
		0.3	0.8	60	53.5	13.0	14.7	0.49	26.5	54.7	13.3	15.1	0.50	26.5	55.5	13.6	15.3	0.52	26.3
		0.3	0.7	70	62.5	15.1	16.6	0.44	34.1	63.8	15.5	17.0	0.45	34.0	64.8	15.7	17.3	0.46	33.9
		0.3	0.7	90	80.5	18.9	20.2	0.38	50.3	82.2	19.4	20.7	0.39	50.1	83.4	19.7	21.1	0.40	49.9
	5	0.6	1.3	40	35.7	8.6	10.5	0.54	15.9	36.5	8.8	10.7	0.56	15.9	37.0	9.0	11.0	0.57	15.8
		0.5	1.3	50	44.6	10.9	12.7	0.53	20.5	45.5	11.2	13.0	0.54	20.5	46.2	11.4	13.3	0.56	20.4
		0.5	1.2	60	53.5	13.1	14.7	0.49	26.5	54.7	13.4	15.1	0.50	26.5	55.5	13.6	15.4	0.52	26.4
		0.5	1.2	70	62.4	15.1	16.6	0.44	34.1	63.8	15.5	17.0	0.45	34.1	64.7	15.8	17.3	0.46	34.0
		0.5	1.2	90	80.5	19.0	20.3	0.38	50.4	82.2	19.4	20.8	0.39	50.2	83.4	19.8	21.1	0.40	50.0
	6	0.8	1.9	40	35.7	8.7	10.5	0.54	16.0	36.5	8.9	10.8	0.56	16.0	37.0	9.0	11.0	0.57	15.9
		0.8	1.8	50	44.5	10.9	12.7	0.53	20.6	45.5	11.2	13.0	0.54	20.6	46.2	11.4	13.3	0.56	20.5
		0.8	1.8	60	53.5	13.1	14.7	0.49	26.7	54.6	13.4	15.1	0.50	26.7	55.5	13.6	15.4	0.51	26.5
		0.8	1.8	70	62.4	15.1	16.6	0.44	34.3	63.8	15.5	17.0	0.45	34.3	64.7	15.8	17.4	0.46	34.1
		0.8	1.7	90	80.5	19.0	20.3	0.38	50.6	82.2	19.5	20.8	0.39	50.5	83.4	19.8	21.2	0.40	50.1
90	4	0.3	0.7	40	36.0	8.0	10.5	0.75	10.7	36.7	8.2	10.8	0.76	10.7	37.2	8.3	10.9	0.76	10.9
		0.3	0.7	50	45.0	10.1	12.6	0.73	13.8	45.9	10.3	12.8	0.74	13.9	46.5	10.5	13.0	0.74	14.1
		0.3	0.7	60	54.0	12.1	14.5	0.72	16.7	55.1	12.3	14.8	0.73	16.8	55.8	12.6	15.1	0.73	17.1
		0.3	0.7	70	63.0	14.0	16.4	0.72	19.4	64.3	14.3	16.8	0.73	19.5	65.1	14.6	17.1	0.73	19.9
		0.3	0.7	90	81.2	17.5	20.0	0.72	24.3	82.8	17.9	20.4	0.73	24.5	83.9	18.3	20.8	0.73	24.9
	5	0.5	1.2	40	36.0	8.0	10.6	0.75	10.7	36.7	8.2	10.8	0.76	10.8	37.2	8.3	10.9	0.76	11.0
		0.5	1.2	50	45.0	10.1	12.6	0.73	13.8	45.9	10.3	12.9	0.74	13.9	46.5	10.5	13.0	0.74	14.1
		0.5	1.1	60	54.0	12.1	14.5	0.72	16.8	55.1	12.4	14.9	0.73	16.9	55.8	12.6	15.1	0.73	17.2
		0.5	1.1	70	63.0	14.0	16.5	0.72	19.4	64.3	14.3	16.8	0.73	19.5	65.1	14.6	17.1	0.73	19.9
		0.5	1.1	90	81.2	17.6	20.0	0.72	24.4	82.8	18.0	20.5	0.73	24.5	83.9	18.3	20.8	0.73	25.0
	6	0.7	1.7	40	36.0	8.0	10.6	0.75	10.7	36.7	8.2	10.8	0.76	10.8	37.2	8.3	10.9	0.76	11.0
		0.7	1.7	50	45.0	10.1	12.6	0.73	13.8	45.9	10.3	12.9	0.74	14.0	46.5	10.5	13.0	0.74	14.2
		0.7	1.7	60	54.0	12.1	14.5	0.72	16.8	55.0	12.4	14.9	0.73	17.0	55.8	12.6	15.1	0.73	17.3
		0.7	1.6	70	63.0	14.0	16.5	0.72	19.5	64.3	14.3	16.8	0.73	19.6	65.1	14.6	17.1	0.73	20.0
		0.7	1.6	90	81.2	17.6	20.0	0.72	24.5	82.8	18.0	20.5	0.73	24.7	83.9	18.3	20.8	0.73	25.1
110	4	0.3	0.7	40	36.6	6.9	10.2	0.97	7.1	37.2	7.0	10.4	0.99	7.1	37.6	7.2	10.5	0.99	7.2
		0.3	0.7	50	45.7	8.7	11.9	0.95	9.1	46.5	8.9	12.2	0.97	9.2	47.0	9.0	12.3	0.97	9.3
		0.3	0.7	60	54.8	10.4	13.6	0.94	11.1	55.8	10.6	13.9	0.95	11.1	56.4	10.8	14.1	0.95	11.4
		0.3	0.7	70	64.0	12.0	15.2	0.94	12.8	65.1	12.3	15.6	0.95	12.9	65.8	12.5	15.8	0.95	13.1
		0.3	0.6	90	82.5	15.1	18.3	0.94	16.1	83.8	15.5	18.7	0.95	16.2	84.8	15.7	19.0	0.95	16.5
	5	0.5	1.1	40	36.6	6.9	10.2	0.97	7.1	37.2	7.0	10.4	0.99	7.1	37.6	7.2	10.5	0.99	7.3
		0.5	1.1	50	45.7	8.7	11.9	0.95	9.1	46.4	8.9	12.2	0.97	9.2	47.0	9.0	12.3	0.97	9.4
		0.5	1.1	60	54.8	10.4	13.6	0.94	11.1	55.7	10.6	13.9	0.95	11.2	56.4	10.8	14.1	0.95	11.4
		0.5	1.1	70	64.0	12.1	15.3	0.94	12.8	65.1	12.3	15.6	0.95	12.9	65.8	12.6	15.8	0.95	13.2
		0.5	1.0	90	82.4	15.1	18.3	0.94	16.1	83.8	15.5	18.7	0.95	16.2	84.7	15.8	19.0	0.95	16.5
	6	0.7	1.6	40	36.6	6.9	10.2	0.97	7.1	37.2	7.1	10.4	0.99	7.2	37.6	7.2	10.5	0.99	7.3
		0.7	1.6	50	45.7	8.7	11.9	0.95	9.2	46.4	8.9	12.2	0.96	9.2	47.0	9.1	12.3	0.96	9.4
		0.7	1.6	60	54.8	10.4	13.6	0.93	11.1	55.7	10.7	13.9	0.95	11.2	56.4	10.9	14.1	0.95	11.4
		0.7	1.6	70	64.0	12.1	15.2	0.93	12.9	65.1	12.3	15.6	0.95	13.0	65.8	12.6	15.8	0.95	13.2
		0.7	1.5	90	82.4	15.1	18.3	0.93	16.2	83.8	15.5	18.7	0.95	16.3	84.7	15.8	19.0	0.95	16.6

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Section 11: Extended Data Tables

WV060 - Heating Full Load

SOURCE				WV060, LOAD SIDE, HEATING MODE, FULL LOAD (6000 RPM COMPRESSOR SPEED)															
EST	Source Flow			ELT	Load Flow 10 GPM					Load Flow 11.3 GPM					Load Flow 15 GPM				
	GPM	Source Flow WPD			LLT	HC	HE	kW	COP	LLT	HC	HE	kW	COP	LLT	HC	HE	kW	COP
°F		PSI	FT	°F	°F	MBtuh	MBtuh		W/W	°F	MBtuh	MBtuh		W/W	°F	MBtuh	MBtuh		W/W
25	15	4.9	11.3	50	59.4	46.9	36.3	3.10	4.43	58.2	46.5	36.0	3.08	4.42	56.1	45.6	35.2	3.04	4.40
		4.9	11.3	80	90.4	52.0	37.7	4.20	3.63	89.1	51.6	37.4	4.18	3.62	86.8	50.7	36.6	4.12	3.60
		4.9	11.4	100	110.5	52.4	35.1	5.09	3.02	109.2	52.0	34.8	5.06	3.01	106.8	51.1	34.0	4.99	3.00
		4.9	11.4	110	120.5	52.4	33.5	5.57	2.76	119.2	52.0	33.1	5.54	2.75	116.8	51.1	32.4	5.46	2.74
		4.9	11.2	130	139.9	49.6	27.2	6.58	2.21	138.7	49.2	26.9	6.55	2.20	136.4	48.3	26.3	6.45	2.19
30	10	2.2	5.2	50	59.9	49.4	38.7	3.12	4.63	58.7	49.0	38.4	3.10	4.62	56.4	48.0	37.6	3.06	4.60
		2.3	5.2	80	91.0	54.8	40.4	4.23	3.79	89.6	54.4	40.0	4.21	3.79	87.1	53.3	39.2	4.15	3.77
		2.3	5.2	100	111.0	55.2	37.8	5.12	3.16	109.7	54.8	37.4	5.09	3.15	107.2	53.8	36.6	5.02	3.14
		2.3	5.2	110	121.0	55.2	36.1	5.60	2.89	119.7	54.8	35.8	5.57	2.88	117.2	53.8	35.0	5.49	2.87
		2.2	5.2	130	140.5	52.3	29.7	6.62	2.31	139.2	51.9	29.4	6.59	2.31	136.8	50.9	28.7	6.49	2.30
	11.3	2.9	6.6	50	60.0	49.9	39.2	3.14	4.67	58.8	49.5	38.9	3.12	4.66	56.5	48.6	38.1	3.07	4.63
		2.9	6.6	80	91.1	55.4	40.9	4.25	3.82	89.7	55.0	40.6	4.23	3.81	87.2	54.0	39.8	4.17	3.80
		2.9	6.7	100	111.2	55.9	38.3	5.14	3.18	109.8	55.5	38.0	5.12	3.18	107.3	54.4	37.2	5.04	3.16
		2.9	6.7	110	121.2	55.9	36.7	5.63	2.91	119.8	55.5	36.4	5.60	2.90	117.3	54.4	35.6	5.52	2.89
		2.8	6.6	130	140.6	52.9	30.2	6.65	2.33	139.3	52.5	29.9	6.62	2.32	136.9	51.5	29.2	6.52	2.31
	15	4.8	11.1	50	60.2	51.2	40.4	3.17	4.73	59.0	50.8	40.0	3.15	4.72	56.6	49.8	39.2	3.11	4.70
		4.9	11.2	80	91.4	56.8	42.2	4.30	3.87	90.0	56.4	41.8	4.28	3.87	87.4	55.3	40.9	4.21	3.85
		4.9	11.3	100	111.5	57.3	39.5	5.20	3.23	110.1	56.8	39.2	5.17	3.22	107.4	55.8	38.4	5.10	3.20
		4.9	11.3	110	121.5	57.3	37.9	5.69	2.95	120.1	56.8	37.5	5.66	2.94	117.4	55.8	36.7	5.58	2.93
		4.8	11.1	130	140.8	54.2	31.2	6.73	2.36	139.5	53.8	30.9	6.69	2.36	137.0	52.8	30.3	6.60	2.34
50	10	2.1	4.9	50	62.2	61.1	49.8	3.32	5.40	60.7	60.6	49.4	3.30	5.38	57.9	59.5	48.4	3.25	5.36
		2.2	5.0	80	93.6	67.9	52.5	4.50	4.42	91.9	67.3	52.1	4.48	4.41	88.8	66.1	51.0	4.41	4.39
		2.2	5.0	100	113.7	68.4	49.8	5.45	3.68	112.0	67.9	49.4	5.42	3.67	108.9	66.6	48.4	5.34	3.66
		2.2	5.0	110	123.7	68.4	48.1	5.96	3.37	122.0	67.9	47.6	5.92	3.36	118.9	66.6	46.7	5.84	3.34
		2.1	4.9	130	Operation Not Recommended					Operation Not Recommended					138.4	63.0	39.4	6.90	2.67
	11.3	2.7	6.3	50	62.4	61.8	50.5	3.33	5.44	60.9	61.3	50.0	3.32	5.42	58.0	60.2	49.0	3.27	5.40
		2.7	6.3	80	93.7	68.7	53.2	4.52	4.45	92.1	68.1	52.8	4.50	4.44	88.9	66.8	51.7	4.43	4.42
		2.8	6.4	100	113.8	69.2	50.5	5.47	3.71	112.2	68.7	50.1	5.44	3.70	109.0	67.4	49.1	5.36	3.68
		2.8	6.3	110	123.8	69.2	48.8	5.98	3.39	122.2	68.7	48.4	5.95	3.38	119.0	67.4	47.4	5.87	3.37
		2.7	6.2	130	Operation Not Recommended					Operation Not Recommended					138.5	63.7	40.1	6.94	2.69
	15	4.6	10.6	50	62.7	63.4	51.9	3.37	5.51	61.1	62.9	51.4	3.35	5.50	58.2	61.7	50.4	3.30	5.47
		4.6	10.7	80	94.1	70.4	54.8	4.57	4.51	92.4	69.8	54.3	4.55	4.50	89.1	68.5	53.2	4.48	4.48
		4.7	10.7	100	114.2	70.9	52.1	5.53	3.76	112.5	70.4	51.6	5.50	3.75	109.2	69.0	50.5	5.42	3.73
		4.6	10.7	110	124.2	70.9	50.3	6.05	3.44	122.5	70.4	49.8	6.02	3.43	119.2	69.0	48.8	5.93	3.41
		4.6	10.6	130	Operation Not Recommended					Operation Not Recommended					138.7	65.3	41.4	7.01	2.73
70	10	2.0	4.7	50	63.4	67.2	55.5	3.43	5.74	61.8	66.7	55.0	3.41	5.73	58.7	65.4	53.9	3.36	5.70
		2.1	4.8	80	94.9	74.6	58.7	4.65	4.70	93.1	74.0	58.2	4.62	4.69	89.7	72.6	57.1	4.56	4.67
		2.1	4.8	100	115.0	75.2	56.0	5.63	3.92	113.2	74.6	55.5	5.60	3.91	109.8	73.2	54.4	5.52	3.89
		2.1	4.8	110	125.0	75.2	54.2	6.15	3.58	123.2	74.6	53.7	6.12	3.57	119.8	73.2	52.6	6.03	3.56
		2.0	4.7	130	Operation Not Recommended					Operation Not Recommended					139.2	69.3	44.9	7.13	2.85
	11.3	2.6	6.0	50	63.6	68.0	56.2	3.44	5.79	61.9	67.5	55.8	3.43	5.77	58.8	66.2	54.7	3.38	5.75
		2.6	6.0	80	95.1	75.5	59.6	4.67	4.74	93.3	74.9	59.1	4.64	4.73	89.8	73.5	57.9	4.58	4.70
		2.6	6.1	100	115.2	76.1	56.8	5.65	3.95	113.4	75.5	56.3	5.62	3.94	109.9	74.1	55.2	5.54	3.92
		2.6	6.1	110	125.2	76.1	55.0	6.18	3.61	123.4	75.5	54.5	6.15	3.60	119.9	74.1	53.4	6.06	3.58
		2.6	6.0	130	Operation Not Recommended					Operation Not Recommended					139.3	70.1	45.6	7.17	2.87
	15	4.4	10.1	50	63.9	69.7	57.8	3.48	5.86	62.2	69.1	57.3	3.46	5.85	59.0	67.8	56.2	3.41	5.82
		4.4	10.2	80	95.5	77.4	61.3	4.72	4.80	93.6	76.8	60.7	4.70	4.79	90.0	75.3	59.5	4.63	4.77
		4.5	10.3	100	115.6	78.0	58.5	5.71	4.00	113.7	77.4	58.0	5.68	3.99	110.1	75.9	56.8	5.60	3.97
		4.5	10.3	110	125.6	78.0	56.7	6.25	3.66	123.7	77.4	56.2	6.22	3.65	120.1	75.9	55.0	6.13	3.63
		4.4	10.1	130	Operation Not Recommended					Operation Not Recommended					139.6	71.8	47.1	7.25	2.91
90	10	2.0	4.6	50	64.1	70.5	58.6	3.50	5.91	62.4	70.0	58.1	3.48	5.89	59.2	68.6	56.9	3.43	5.87
		2.0	4.6	80	95.7	78.3	62.1	4.74	4.84	93.7	77.7	61.6	4.72	4.83	90.2	76.2	60.3	4.65	4.81
		2.0	4.6	100	115.8	78.9	59.3	5.74	4.03	113.9	78.3	58.8	5.71	4.02	110.2	76.8	57.6	5.63	4.00
		2.0	4.6	110	125.8	78.9	57.5	6.28	3.68	123.9	78.3	57.0	6.24	3.68	120.2	76.8	55.8	6.15	3.66
		2.0	4.5	130	Operation Not Recommended					Operation Not Recommended					139.7	72.7	47.9	7.28	2.93
	11.3	2.5	5.8	50	64.3	71.3	59.4	3.51	5.95	62.5	70.8	58.9	3.49	5.94	59.3	69.4	57.7	3.44	5.91
		2.5	5.8	80	95.8	79.2	63.0	4.76	4.87	93.9	78.6	62.4	4.74	4.86	90.3	77.1	61.2	4.67	4.84
		2.5	5.9	100	116.0	79.8	60.2	5.76	4.06	114.0	79.2	59.7	5.73	4.05	110.4	77.7	58.4	5.65	4.03
		2.5	5.9	110	126.0	79.8	58.3	6.31	3.71	124.0	79.2	57.8	6.27	3.70	120.4	77.7	56.6	6.18	3.68
		2.5	5.8	130	Operation Not Recommended					Operation Not Recommended					139.8	73.5	48.6	7.31	2.95
	15	4.2	9.8	50	64.6	73.1	61.0	3.55	6.03	62.8	72.5	60.5	3.53	6.02	59.5	71.2	59.3	3.48	5.99
		4.3	9.8	80	96.2	81.2	64.7	4.82	4.94	94.3	80.5	64.2	4.79	4.93	90.5	79.0	62.9	4.72	4.91
		4.3	9.9	100	116.4	81.8	61.9	5.83	4.11	114.4	81.2	61.4	5.80	4.10	110.6	79.7	60.2	5.71	4.09
		4.3	9.9	110	126.4	81.8	60.1	6.38	3.76	124.4	81.2	59.5	6.34	3.75	120.6	79.7	58.3	6.25	3.74
		4.2	9.7	130	Operation Not Recommended					Operation Not Recommended					140.1	75.4	50.2	7.39	2.99

See page 34 for Application Notes for Performance Data

Section 11: Extended Data Tables

WV060 - Heating Part Load

SOURCE				WV060, LOAD SIDE, HEATING MODE, PART LOAD (2600 RPM COMPRESSOR SPEED)															
EST	Source Flow			ELT	Load Flow 4 GPM					Load Flow 5 GPM					Load Flow 6 GPM				
	GPM	Source Flow WPD			LLT	HC	HE	kW	COP	LLT	HC	HE	kW	COP	LLT	HC	HE	kW	COP
°F		PSI	FT	°F	°F	MBtuh	MBtuh		W/W	°F	MBtuh	MBtuh		W/W	°F	MBtuh	MBtuh		W/W
25	6	0.8	1.9	50	60.9	21.8	18.5	0.96	6.67	58.7	21.9	18.7	0.93	6.86	57.3	21.9	18.8	0.92	7.00
		0.8	1.9	80	91.6	23.3	18.2	1.50	4.56	89.3	23.3	18.4	1.46	4.68	87.8	23.4	18.5	1.43	4.78
		0.8	1.8	100	110.8	21.7	15.0	1.96	3.24	108.7	21.7	15.2	1.91	3.34	107.3	21.8	15.4	1.88	3.40
		0.8	1.8	110	120.4	20.8	13.2	2.22	2.74	118.3	20.8	13.4	2.17	2.82	117.0	20.9	13.6	2.13	2.87
		0.8	1.8	130	139.8	19.7	10.1	2.81	2.05	137.9	19.7	10.4	2.74	2.11	136.6	19.8	10.6	2.69	2.15
30	4	0.3	0.7	50	61.0	22.0	18.7	0.96	6.70	58.8	22.1	18.9	0.94	6.89	57.4	22.1	19.0	0.92	7.03
		0.3	0.7	80	91.8	23.5	18.4	1.51	4.58	89.4	23.6	18.6	1.47	4.71	87.9	23.6	18.7	1.44	4.80
		0.3	0.7	100	111.0	21.9	15.2	1.97	3.26	108.8	22.0	15.4	1.92	3.35	107.3	22.0	15.6	1.89	3.42
		0.3	0.7	110	120.5	21.0	13.3	2.23	2.75	118.4	21.0	13.6	2.18	2.83	117.0	21.1	13.8	2.14	2.89
		0.3	0.7	130	139.9	19.9	10.2	2.82	2.06	138.0	19.9	10.5	2.75	2.12	136.6	19.9	10.7	2.70	2.16
	5	0.5	1.2	50	61.4	22.8	19.5	0.97	6.90	59.1	22.8	19.6	0.94	7.10	57.6	22.9	19.7	0.93	7.24
		0.5	1.2	80	92.2	24.3	19.2	1.51	4.71	89.8	24.4	19.4	1.48	4.85	88.1	24.4	19.5	1.45	4.94
		0.5	1.2	100	111.3	22.7	15.9	1.98	3.36	109.1	22.7	16.1	1.93	3.45	107.6	22.8	16.3	1.90	3.52
		0.5	1.2	110	120.8	21.7	14.0	2.24	2.83	118.7	21.7	14.3	2.19	2.91	117.3	21.8	14.5	2.15	2.97
		0.5	1.1	130	140.3	20.6	10.9	2.84	2.12	138.2	20.6	11.2	2.76	2.18	136.9	20.6	11.4	2.72	2.23
	6	0.8	1.8	50	61.7	23.4	20.1	0.97	7.06	59.4	23.5	20.2	0.95	7.26	57.8	23.5	20.3	0.93	7.41
		0.8	1.8	80	92.5	25.0	19.8	1.52	4.82	90.0	25.1	20.0	1.48	4.96	88.4	25.1	20.1	1.46	5.06
		0.8	1.8	100	111.6	23.3	16.5	1.99	3.43	109.3	23.3	16.7	1.94	3.53	107.8	23.4	16.9	1.90	3.60
		0.8	1.8	110	121.1	22.3	14.6	2.25	2.90	118.9	22.3	14.8	2.20	2.98	117.5	22.4	15.0	2.16	3.04
		0.7	1.7	130	140.6	21.1	11.4	2.85	2.17	138.5	21.2	11.7	2.78	2.24	137.1	21.2	11.9	2.73	2.28
50	4	0.3	0.6	50	64.4	28.8	25.4	1.01	8.38	61.5	28.9	25.5	0.98	8.62	59.6	28.9	25.6	0.97	8.79
		0.3	0.6	80	95.4	30.8	25.4	1.58	5.72	92.3	30.8	25.6	1.54	5.89	90.3	30.9	25.7	1.51	6.00
		0.3	0.6	100	114.3	28.7	21.6	2.06	4.08	111.5	28.7	21.9	2.01	4.19	109.6	28.8	22.0	1.97	4.28
		0.3	0.6	110	123.7	27.4	19.5	2.34	3.44	121.0	27.5	19.7	2.28	3.54	119.2	27.5	19.9	2.24	3.61
		0.3	0.6	130	143.0	26.0	15.9	2.95	2.58	140.4	26.0	16.2	2.88	2.65	138.7	26.1	16.4	2.83	2.71
	5	0.5	1.0	50	64.9	29.8	26.4	1.01	8.63	62.0	29.9	26.5	0.99	8.87	60.0	29.9	26.6	0.97	9.05
		0.5	1.0	80	95.9	31.8	26.4	1.58	5.89	92.8	31.9	26.6	1.54	6.06	90.7	32.0	26.8	1.52	6.18
		0.4	1.0	100	114.8	29.7	22.6	2.07	4.20	111.9	29.7	22.8	2.02	4.32	109.9	29.8	23.0	1.98	4.40
		0.4	1.0	110	124.2	28.4	20.4	2.35	3.54	121.4	28.5	20.6	2.29	3.64	119.5	28.5	20.8	2.25	3.72
		0.4	1.0	130	143.4	26.9	16.8	2.97	2.66	140.8	27.0	17.1	2.89	2.73	139.0	27.0	17.3	2.84	2.79
	6	0.7	1.6	50	65.3	30.6	27.2	1.02	8.83	62.3	30.7	27.3	0.99	9.08	60.3	30.8	27.4	0.97	9.27
		0.7	1.6	80	96.4	32.7	27.3	1.59	6.03	93.1	32.8	27.5	1.55	6.20	90.9	32.8	27.7	1.52	6.32
		0.7	1.6	100	115.2	30.5	23.4	2.08	4.29	112.2	30.5	23.6	2.03	4.42	110.2	30.6	23.8	1.99	4.50
		0.7	1.5	110	124.6	29.2	21.1	2.36	3.62	121.7	29.2	21.4	2.30	3.73	119.8	29.3	21.6	2.26	3.80
		0.7	1.5	130	143.8	27.6	17.5	2.98	2.72	141.1	27.7	17.8	2.90	2.79	139.2	27.7	18.0	2.85	2.85
70	4	0.2	0.6	50	68.4	36.8	33.3	1.04	10.40	64.8	36.9	33.4	1.01	10.69	62.3	37.0	33.6	0.99	10.91
		0.2	0.6	80	99.6	39.3	33.8	1.62	7.10	95.8	39.4	34.0	1.58	7.30	93.2	39.5	34.2	1.55	7.45
		0.2	0.5	100	118.3	36.6	29.4	2.12	5.06	114.7	36.7	29.6	2.07	5.20	112.3	36.8	29.8	2.03	5.30
		0.2	0.5	110	127.5	35.0	26.8	2.41	4.27	124.0	35.1	27.1	2.35	4.39	121.7	35.2	27.3	2.30	4.48
		0.2	0.5	130	Operation Not Recommended					143.3	33.3	23.2	2.96	3.29	141.1	33.3	23.4	2.91	3.36
	5	0.4	0.9	50	69.0	38.1	34.5	1.04	10.70	65.3	38.2	34.7	1.02	11.01	62.8	38.3	34.9	1.00	11.23
		0.4	0.9	80	100.3	40.7	35.1	1.63	7.31	96.3	40.8	35.3	1.59	7.52	93.6	40.8	35.5	1.56	7.67
		0.4	0.9	100	119.0	37.9	30.6	2.13	5.21	115.2	38.0	30.9	2.08	5.36	112.7	38.1	31.1	2.04	5.46
		0.4	0.9	110	128.1	36.3	28.0	2.42	4.40	124.5	36.4	28.3	2.36	4.52	122.1	36.4	28.5	2.32	4.61
		0.4	0.9	130	Operation Not Recommended					143.8	34.4	24.3	2.98	3.39	141.5	34.5	24.5	2.93	3.46
	6	0.6	1.4	50	69.6	39.1	35.6	1.05	10.96	65.7	39.2	35.7	1.02	11.27	63.1	39.3	35.9	1.00	11.50
		0.6	1.4	80	100.9	41.8	36.2	1.64	7.49	96.8	41.9	36.4	1.60	7.70	94.0	42.0	36.6	1.57	7.85
		0.6	1.4	100	119.5	38.9	31.6	2.14	5.33	115.6	39.0	31.9	2.09	5.48	113.0	39.1	32.1	2.05	5.59
		0.6	1.4	110	128.6	37.3	29.0	2.43	4.50	124.9	37.3	29.3	2.37	4.63	122.5	37.4	29.5	2.33	4.72
		0.6	1.4	130	Operation Not Recommended					144.2	35.4	25.2	2.99	3.47	141.8	35.4	25.4	2.94	3.54
90	4	0.2	0.5	50	73.0	46.0	42.4	1.05	12.82	68.4	46.1	42.6	1.03	13.17	65.4	46.2	42.8	1.01	13.43
		0.2	0.5	80	104.6	49.1	43.5	1.65	8.75	99.7	49.2	43.8	1.60	9.00	96.4	49.3	44.0	1.58	9.18
		0.2	0.5	100	122.9	45.8	38.4	2.15	6.23	118.4	45.9	38.7	2.10	6.41	115.3	46.0	38.9	2.06	6.54
		0.2	0.5	110	131.9	43.8	35.5	2.44	5.26	127.6	43.9	35.8	2.38	5.41	124.7	44.0	36.0	2.34	5.52
		0.2	0.5	130	Operation Not Recommended					Operation Not Recommended					143.9	41.7	31.6	2.95	4.14
	5	0.4	0.9	50	73.8	47.6	44.0	1.06	13.19	69.1	47.7	44.2	1.03	13.57	65.9	47.8	44.4	1.01	13.84
		0.4	0.9	80	105.4	50.8	45.2	1.65	9.01	100.4	51.0	45.5	1.61	9.27	97.0	51.1	45.7	1.58	9.45
		0.4	0.9	100	123.7	47.4	40.0	2.16	6.42	119.0	47.5	40.3	2.11	6.60	115.9	47.6	40.5	2.07	6.73
		0.4	0.9	110	132.7	45.3	37.0	2.45	5.42	128.2	45.4	37.3	2.39	5.57	125.2	45.5	37.5	2.35	5.68
		0.4	0.9	130	Operation Not Recommended					Operation Not Recommended					144.4	43.1	33.0	2.97	4.26
	6	0.6	1.4	50	74.5	48.9	45.3	1.06	13.50	69.6	49.0	45.5	1.04	13.89	66.4	49.1	45.7	1.02	14.16
		0.6	1.4	80	106.1	52.2	46.6	1.66	9.22	100.9	52.4	46.8	1.62	9.48	97.5	52.5	47.0	1.59	9.67
		0.6	1.4	100	124.3	48.7	41.3	2.17	6.56	119.5	48.8	41.6	2.12	6.75	116.3	48.9	41.8	2.08	6.89
		0.6	1.3	110	133.3	46.6	38.2	2.46	5.54	128.7	46.7	38.5	2.40	5.70	125.6	46.8	38.7	2.36	5.81
		0.6	1.3	130	Operation Not Recommended					Operation Not Recommended					144.8	44.3	34.1	2.98	4.36

See page 34 for Application Notes for Performance Data

Section 11: Extended Data Tables

WV060 - Cooling Full Load

SOURCE				WV060, LOAD SIDE, COOLING MODE, FULL LOAD (3750 RPM COMPRESSOR SPEED)															
EST	Source Flow			ELT	Load Flow 7 GPM					Load Flow 8 GPM					Load Flow 10.5 GPM				
	GPM	Source Flow WPD			LLT	TC	HR	kW	EER	LLT	TC	HR	kW	EER	LLT	TC	HR	kW	EER
°F		PSI	FT	°F	°F	MBtuh	MBtuh		Btuh/W	°F	MBtuh	MBtuh		Btuh/W	°F	MBtuh	MBtuh		Btuh/W
40	7	1.0	2.4	40	Operation Not Recommended					Operation Not Recommended					Operation Not Recommended				
		1.0	2.4	50	39.1	38.3	43.0	1.37	27.9	40.2	39.2	43.9	1.39	28.3	42.2	41.1	46.0	1.42	29.0
		1.0	2.4	60	47.6	43.4	48.1	1.38	31.4	48.9	44.4	49.2	1.39	31.9	51.1	46.6	51.5	1.43	32.6
		1.0	2.4	70	56.6	47.0	51.7	1.39	33.8	58.0	48.1	52.9	1.40	34.3	60.4	50.5	55.4	1.44	35.1
		1.0	2.3	90	75.8	49.8	54.6	1.40	35.6	77.2	51.0	55.8	1.41	36.1	79.8	53.5	58.5	1.45	37.0
50	7	1.0	2.3	40	30.6	33.0	38.5	1.63	20.3	31.6	33.8	39.4	1.64	20.6	33.3	35.4	41.2	1.68	21.1
		1.0	3.2	50	51.1	47.0	54.3	2.15	21.8	39.8	40.8	46.4	1.65	24.7	41.8	42.8	48.6	1.69	25.3
		1.0	2.3	60	47.1	45.1	50.8	1.64	27.5	48.4	46.2	51.9	1.66	27.9	50.8	48.5	54.3	1.70	28.5
		1.0	2.3	70	56.0	48.9	54.6	1.65	29.6	57.5	50.1	55.8	1.67	30.0	60.0	52.6	58.4	1.71	30.7
		1.0	2.3	90	75.2	51.8	57.5	1.67	31.1	76.7	53.1	58.8	1.68	31.6	79.4	55.7	61.6	1.72	32.3
	8	1.3	3.1	40	30.6	33.0	38.4	1.59	20.7	31.6	33.8	39.3	1.61	21.0	33.2	35.4	41.1	1.65	21.5
		1.3	3.1	50	38.6	39.8	45.3	1.60	24.9	39.8	40.8	46.3	1.61	25.3	41.8	42.8	48.5	1.65	25.9
		1.3	3.0	60	47.1	45.2	50.6	1.61	28.1	48.4	46.2	51.8	1.62	28.5	50.8	48.5	54.2	1.66	29.2
		1.3	3.0	70	56.0	48.9	54.4	1.62	30.2	57.5	50.1	55.7	1.63	30.7	60.0	52.6	58.3	1.67	31.4
		1.3	3.0	90	75.2	51.9	57.4	1.63	31.8	76.7	53.1	58.7	1.65	32.3	79.4	55.7	61.5	1.69	33.0
	10.5	2.3	5.3	40	30.6	33.0	38.2	1.52	21.7	31.6	33.8	39.0	1.53	22.0	33.2	35.5	40.8	1.57	22.6
		2.3	5.3	50	38.6	39.9	45.1	1.53	26.1	39.8	40.8	46.1	1.54	26.5	41.8	42.8	48.2	1.58	27.2
		2.3	5.3	60	47.1	45.2	50.4	1.53	29.4	48.4	46.2	51.5	1.55	29.9	50.8	48.5	53.9	1.59	30.6
		2.3	5.2	70	56.0	48.9	54.2	1.54	31.7	57.5	50.1	55.4	1.56	32.2	60.0	52.6	58.0	1.60	33.0
		2.3	5.2	90	75.2	51.9	57.2	1.55	33.4	76.7	53.1	58.5	1.57	33.9	79.4	55.7	61.2	1.61	34.7
70	7	1.0	2.2	40	30.9	31.9	39.4	2.21	14.5	31.8	32.7	40.3	2.23	14.7	33.5	34.3	42.1	2.28	15.0
		0.9	2.2	50	39.0	38.5	46.1	2.22	17.4	40.1	39.4	47.1	2.24	17.6	42.1	41.4	49.2	2.29	18.1
		0.9	2.2	60	47.5	43.7	51.3	2.23	19.6	48.8	44.7	52.4	2.25	19.9	51.1	46.9	54.8	2.31	20.3
		0.9	2.2	70	56.5	47.3	55.0	2.24	21.1	57.9	48.4	56.2	2.26	21.4	60.3	50.8	58.8	2.32	21.9
		0.9	2.1	90	75.7	50.2	57.9	2.26	22.2	77.2	51.3	59.1	2.28	22.5	79.7	53.9	61.9	2.34	23.1
	8	1.3	2.9	40	30.9	31.9	39.3	2.16	14.8	31.8	32.7	40.1	2.18	15.0	33.5	34.3	41.9	2.23	15.3
		1.3	2.9	50	39.0	38.5	45.9	2.17	17.8	40.1	39.5	46.9	2.19	18.0	42.1	41.4	49.1	2.24	18.5
		1.3	2.9	60	47.5	43.7	51.1	2.18	20.0	48.8	44.7	52.2	2.20	20.3	51.1	46.9	54.6	2.26	20.8
		1.2	2.9	70	56.5	47.3	54.8	2.20	21.6	57.9	48.5	56.0	2.22	21.9	60.3	50.9	58.6	2.27	22.4
		1.2	2.9	90	75.7	50.2	57.7	2.21	22.7	77.2	51.4	59.0	2.23	23.0	79.7	53.9	61.7	2.29	23.6
	10.5	2.2	5.1	40	30.9	31.9	39.0	2.06	15.5	31.8	32.7	39.8	2.08	15.7	33.5	34.3	41.6	2.13	16.1
		2.2	5.0	50	39.0	38.6	45.6	2.07	18.6	40.1	39.5	46.6	2.09	18.9	42.1	41.4	48.7	2.14	19.4
		2.2	5.0	60	47.5	43.7	50.8	2.08	21.0	48.8	44.7	51.9	2.10	21.3	51.1	47.0	54.3	2.15	21.8
		2.2	5.0	70	56.5	47.4	54.5	2.09	22.6	57.9	48.5	55.7	2.11	23.0	60.3	50.9	58.3	2.16	23.5
		2.1	4.9	90	75.7	50.2	57.4	2.11	23.8	77.2	51.4	58.6	2.13	24.1	79.7	53.9	61.4	2.18	24.7
90	7	0.9	2.1	40	31.8	28.8	38.6	2.87	10.0	32.6	29.5	39.3	2.89	10.2	34.1	30.9	41.0	2.97	10.4
		0.9	2.1	50	40.1	34.8	44.6	2.88	12.1	41.1	35.6	45.5	2.91	12.2	42.9	37.4	47.5	2.98	12.5
		0.9	2.1	60	48.7	39.4	49.3	2.90	13.6	49.9	40.3	50.3	2.92	13.8	51.9	42.3	52.5	2.99	14.1
		0.9	2.1	70	57.8	42.7	52.6	2.91	14.7	59.1	43.7	53.7	2.94	14.9	61.3	45.9	56.1	3.01	15.2
		0.9	2.1	90	77.1	45.3	55.3	2.94	15.4	78.4	46.3	56.4	2.96	15.6	80.7	48.6	59.0	3.04	16.0
	8	1.2	2.8	40	31.8	28.8	38.4	2.81	10.3	32.6	29.5	39.1	2.83	10.4	34.1	30.9	40.8	2.90	10.7
		1.2	2.8	50	40.1	34.8	44.4	2.82	12.3	41.1	35.6	45.3	2.84	12.5	42.9	37.4	47.3	2.91	12.8
		1.2	2.8	60	48.7	39.4	49.1	2.83	13.9	49.9	40.3	50.1	2.86	14.1	51.9	42.3	52.3	2.93	14.5
		1.2	2.8	70	57.8	42.7	52.4	2.85	15.0	59.1	43.7	53.5	2.88	15.2	61.3	45.9	55.9	2.95	15.6
		1.2	2.8	90	77.1	45.3	55.1	2.87	15.8	78.4	46.3	56.2	2.90	16.0	80.7	48.6	58.8	2.97	16.4
	10.5	2.1	4.9	40	31.8	28.8	37.9	2.68	10.8	32.6	29.5	38.7	2.70	10.9	34.1	31.0	40.4	2.77	11.2
		2.1	4.8	50	40.1	34.8	44.0	2.69	13.0	41.1	35.6	44.9	2.71	13.1	42.9	37.4	46.9	2.78	13.5
		2.1	4.8	60	48.7	39.4	48.6	2.70	14.6	49.9	40.4	49.7	2.73	14.8	51.9	42.4	51.9	2.79	15.2
		2.1	4.8	70	57.8	42.7	52.0	2.72	15.7	59.1	43.7	53.1	2.74	16.0	61.3	45.9	55.5	2.81	16.3
		2.1	4.8	90	77.1	45.3	54.6	2.74	16.5	78.4	46.4	55.8	2.76	16.8	80.7	48.7	58.3	2.83	17.2
110	7	0.9	2.1	40	32.6	25.8	38.1	3.61	7.2	33.4	26.4	38.9	3.64	7.3	34.7	27.8	40.5	3.73	7.4
		0.9	2.1	50	41.1	31.2	43.6	3.62	8.6	42.0	31.9	44.4	3.66	8.7	43.6	33.5	46.3	3.75	9.0
		0.9	2.0	60	49.9	35.4	47.8	3.64	9.7	51.0	36.2	48.7	3.68	9.8	52.8	38.0	50.8	3.77	10.1
		0.9	2.0	70	59.1	38.3	50.8	3.66	10.5	60.2	39.2	51.8	3.70	10.6	62.2	41.2	54.1	3.79	10.9
		0.9	2.0	90	78.4	40.6	53.2	3.69	11.0	79.6	41.6	54.3	3.73	11.2	81.7	43.6	56.7	3.82	11.4
	8	1.2	2.8	40	32.6	25.8	37.9	3.53	7.3	33.4	26.5	38.6	3.56	7.4	34.7	27.8	40.2	3.65	7.6
		1.2	2.7	50	41.1	31.2	43.3	3.54	8.8	42.0	31.9	44.1	3.58	8.9	43.6	33.5	46.0	3.66	9.2
		1.2	2.7	60	49.9	35.4	47.5	3.56	9.9	51.0	36.2	48.5	3.60	10.1	52.8	38.0	50.6	3.69	10.3
		1.2	2.7	70	59.1	38.3	50.5	3.59	10.7	60.2	39.2	51.6	3.62	10.8	62.2	41.2	53.8	3.71	11.1
		1.2	2.7	90	78.4	40.6	52.9	3.61	11.2	79.6	41.6	54.0	3.65	11.4	81.7	43.6	56.4	3.74	11.7
	10.5	2.1	4.7	40	32.6	25.8	37.3	3.37	7.7	33.4	26.5	38.1	3.40	7.8	34.7	27.8	39.6	3.48	8.0
		2.0	4.7	50	41.1	31.2	42.7	3.38	9.2	42.0	32.0	43.6	3.41	9.4	43.6	33.5	45.5	3.49	9.6
		2.0	4.7	60	49.9	35.4	47.0	3.40	10.4	50.9	36.2	47.9	3.43	10.6	52.8	38.0	50.0	3.51	10.8
		2.0	4.7	70	59.0	38.3	50.0	3.42	11.2	60.2	39.2	51.0	3.45	11.4	62.2	41.2	53.2	3.53	11.7
		2.0	4.6	90	78.4	40.6	52.4	3.44	11.8	79.6	41.6	53.5	3.48	12.0	81.7	43.7	55.8	3.56	12.3

See page 34 for Application Notes for Performance Data

WV060 - Cooling Part Load

SOURCE				WV060, LOAD SIDE, COOLING MODE, PART LOAD (1800 RPM COMPRESSOR SPEED)															
EST	Source Flow			ELT	Load Flow 4 GPM					Load Flow 5 GPM					Load Flow 6 GPM				
	GPM	Source Flow WPD			LLT	TC	HR	kW	EER	LLT	TC	HR	kW	EER	LLT	TC	HR	kW	EER
°F		PSI	FT	°F	°F	MBtuh	MBtuh		Btuh/W	°F	MBtuh	MBtuh		Btuh/W	°F	MBtuh	MBtuh		Btuh/W
40	4	0.4	0.9	40	Operation Not Recommended					Operation Not Recommended					Operation Not Recommended				
		0.4	0.9	50	39.7	20.6	22.3	0.48	42.6	41.3	21.8	23.4	0.49	44.5	42.4	22.7	24.4	0.50	45.8
		0.4	0.9	60	49.7	20.6	22.2	0.46	44.4	51.3	21.8	23.4	0.47	46.4	52.4	22.7	24.3	0.48	47.7
		0.4	0.9	70	59.7	20.6	22.1	0.43	47.8	61.3	21.8	23.2	0.44	49.9	62.4	22.7	24.2	0.44	51.3
		0.4	0.9	90	79.7	20.6	21.7	0.32	65.2	81.3	21.8	22.8	0.32	68.2	82.4	22.7	23.8	0.32	70.2
50	4	0.4	0.9	40	31.4	17.3	19.6	0.67	25.8	32.7	18.3	20.6	0.68	26.9	33.7	19.0	21.4	0.69	27.7
		0.4	0.9	50	39.8	20.3	22.6	0.66	30.8	41.4	21.5	23.7	0.67	32.2	42.5	22.4	24.7	0.67	33.2
		0.4	0.8	60	49.8	20.3	22.5	0.63	32.2	51.4	21.5	23.6	0.64	33.6	52.5	22.4	24.6	0.65	34.6
		0.4	0.8	70	59.8	20.3	22.3	0.59	34.6	61.4	21.5	23.5	0.59	36.1	62.5	22.4	24.4	0.60	37.2
		0.4	0.8	90	79.8	20.3	21.8	0.43	47.3	81.4	21.5	23.0	0.44	49.3	82.5	22.4	23.9	0.44	50.8
	5	0.6	1.4	40	31.4	17.3	19.5	0.65	26.8	32.7	18.3	20.5	0.65	28.0	33.7	19.0	21.3	0.66	28.8
		0.6	1.4	50	39.8	20.3	22.5	0.63	32.1	41.4	21.5	23.7	0.64	33.5	42.5	22.4	24.6	0.65	34.5
		0.6	1.4	60	49.8	20.3	22.4	0.61	33.4	51.4	21.5	23.6	0.62	34.9	52.5	22.4	24.5	0.62	36.0
		0.6	1.4	70	59.8	20.3	22.2	0.57	36.0	61.4	21.5	23.4	0.57	37.5	62.5	22.4	24.3	0.58	38.6
		0.6	1.3	90	79.8	20.3	21.7	0.41	49.1	81.4	21.5	22.9	0.42	51.2	82.5	22.4	23.8	0.42	52.8
	6	0.9	2.1	40	31.4	17.3	19.4	0.63	27.6	32.7	18.3	20.4	0.63	28.9	33.7	19.0	21.2	0.64	29.7
		0.9	2.0	50	39.8	20.3	22.4	0.61	33.1	41.4	21.5	23.6	0.62	34.6	42.5	22.4	24.5	0.63	35.6
		0.9	2.0	60	49.8	20.3	22.3	0.59	34.5	51.4	21.5	23.5	0.60	36.1	52.5	22.4	24.4	0.60	37.1
		0.9	2.0	70	59.8	20.3	22.2	0.55	37.2	61.4	21.5	23.4	0.55	38.8	62.5	22.4	24.3	0.56	39.9
		0.8	1.9	90	79.8	20.3	21.7	0.40	50.7	81.4	21.5	22.8	0.41	53.0	82.5	22.4	23.8	0.41	54.6
70	4	0.3	0.8	40	32.3	15.3	18.9	1.05	14.6	33.5	16.2	19.8	1.06	15.2	34.4	16.9	20.6	1.08	15.7
		0.3	0.8	50	40.8	18.3	21.9	1.03	17.8	42.3	19.4	22.9	1.04	18.6	43.3	20.2	23.8	1.06	19.1
		0.3	0.8	60	49.2	21.6	25.0	0.99	21.9	50.9	22.8	26.3	1.00	22.8	52.1	23.8	27.3	1.01	23.5
		0.3	0.7	70	57.4	25.2	28.4	0.92	27.4	59.3	26.6	29.8	0.93	28.7	60.7	27.8	31.0	0.94	29.5
		0.3	0.7	90	73.3	33.3	35.6	0.67	49.4	75.9	35.2	37.5	0.68	51.7	77.8	36.7	39.0	0.69	53.2
	5	0.6	1.3	40	32.3	15.3	18.8	1.01	15.2	33.5	16.2	19.7	1.02	15.8	34.4	16.9	20.4	1.04	16.3
		0.5	1.3	50	40.8	18.3	21.7	0.99	18.5	42.3	19.4	22.8	1.00	19.3	43.3	20.2	23.6	1.02	19.9
		0.5	1.2	60	49.2	21.6	24.9	0.95	22.7	50.9	22.8	26.1	0.96	23.7	52.1	23.8	27.1	0.98	24.4
		0.5	1.2	70	57.4	25.2	28.2	0.89	28.5	59.3	26.6	29.7	0.90	29.8	60.7	27.8	30.9	0.91	30.6
		0.5	1.2	90	73.3	33.3	35.5	0.65	51.4	75.9	35.2	37.4	0.66	53.7	77.8	36.7	38.9	0.66	55.2
	6	0.8	1.9	40	32.3	15.3	18.7	0.98	15.7	33.5	16.2	19.6	0.99	16.3	34.4	16.9	20.3	1.00	16.8
		0.8	1.8	50	40.8	18.3	21.6	0.96	19.1	42.3	19.4	22.7	0.97	19.9	43.3	20.2	23.5	0.98	20.5
		0.8	1.8	60	49.2	21.6	24.8	0.92	23.5	50.9	22.8	26.0	0.93	24.5	52.1	23.8	27.0	0.94	25.2
		0.8	1.8	70	57.4	25.2	28.2	0.86	29.4	59.3	26.6	29.6	0.87	30.7	60.7	27.8	30.8	0.88	31.7
		0.8	1.7	90	73.3	33.3	35.5	0.63	53.1	75.9	35.2	37.4	0.64	55.4	77.8	36.7	38.9	0.64	57.0
90	4	0.3	0.7	40	33.0	14.0	19.0	1.46	9.6	34.1	14.8	19.8	1.48	10.0	34.9	15.4	20.5	1.50	10.3
		0.3	0.7	50	41.8	16.4	21.3	1.44	11.5	43.1	17.4	22.3	1.45	12.0	44.0	18.1	23.1	1.47	12.3
		0.3	0.7	60	51.8	16.4	21.1	1.38	11.9	53.1	17.4	22.1	1.39	12.5	54.0	18.1	22.9	1.41	12.8
		0.3	0.7	70	61.8	16.4	20.8	1.28	12.8	63.1	17.4	21.8	1.29	13.4	64.0	18.1	22.6	1.31	13.8
		0.3	0.7	90	81.8	16.4	19.6	0.94	17.5	83.1	17.4	20.6	0.95	18.3	84.0	18.1	21.4	0.96	18.9
	5	0.5	1.2	40	33.0	14.0	18.8	1.41	9.9	34.1	14.8	19.6	1.42	10.4	34.9	15.4	20.3	1.44	10.7
		0.5	1.2	50	41.8	16.4	21.2	1.38	11.9	43.1	17.4	22.1	1.40	12.4	44.0	18.1	22.9	1.41	12.8
		0.5	1.1	60	51.8	16.4	21.0	1.33	12.4	53.1	17.4	21.9	1.34	13.0	54.0	18.1	22.7	1.36	13.3
		0.5	1.1	70	61.8	16.4	20.6	1.23	13.3	63.1	17.4	21.6	1.25	13.9	64.0	18.1	22.4	1.26	14.4
		0.5	1.1	90	81.8	16.4	19.5	0.90	18.2	83.1	17.4	20.5	0.91	19.0	84.0	18.1	21.3	0.92	19.6
	6	0.7	1.7	40	33.0	14.0	18.7	1.36	10.3	34.1	14.8	19.5	1.38	10.7	34.9	15.4	20.2	1.40	11.0
		0.7	1.7	50	41.8	16.4	21.0	1.34	12.3	43.1	17.4	22.0	1.35	12.8	44.0	18.1	22.8	1.37	13.2
		0.7	1.7	60	51.8	16.4	20.8	1.28	12.8	53.1	17.4	21.8	1.30	13.4	54.0	18.1	22.6	1.31	13.8
		0.7	1.6	70	61.8	16.4	20.5	1.19	13.8	63.1	17.4	21.5	1.21	14.4	64.0	18.1	22.3	1.22	14.8
		0.7	1.6	90	81.8	16.4	19.4	0.87	18.8	83.1	17.4	20.4	0.88	19.7	84.0	18.1	21.2	0.89	20.2
110	4	0.3	0.7	40	33.9	12.2	18.7	1.91	6.4	34.8	12.9	19.5	1.93	6.7	35.5	13.5	20.1	1.95	6.9
		0.3	0.7	50	42.8	14.4	20.7	1.87	7.7	43.9	15.2	21.6	1.89	8.0	44.7	15.8	22.3	1.91	8.3
		0.3	0.7	60	52.8	14.4	20.5	1.79	8.0	53.9	15.2	21.4	1.81	8.4	54.7	15.8	22.1	1.84	8.6
		0.3	0.7	70	62.8	14.4	20.1	1.67	8.6	63.9	15.2	20.9	1.69	9.0	64.7	15.8	21.6	1.71	9.3
		0.3	0.6	90	82.8	14.4	18.5	1.22	11.8	83.9	15.2	19.4	1.24	12.3	84.7	15.8	20.1	1.25	12.7
	5	0.5	1.1	40	33.9	12.2	18.5	1.84	6.7	34.8	12.9	19.2	1.86	7.0	35.5	13.5	19.9	1.88	7.2
		0.5	1.1	50	42.8	14.4	20.5	1.80	8.0	43.9	15.2	21.4	1.82	8.3	44.7	15.8	22.1	1.84	8.6
		0.5	1.1	60	52.8	14.4	20.3	1.73	8.3	53.9	15.2	21.1	1.75	8.7	54.7	15.8	21.8	1.77	8.9
		0.5	1.1	70	62.8	14.4	19.8	1.61	8.9	63.9	15.2	20.7	1.62	9.4	64.7	15.8	21.4	1.64	9.6
		0.5	1.0	90	82.8	14.4	18.4	1.18	12.2	83.9	15.2	19.2	1.19	12.8	84.7	15.8	19.9	1.20	13.1
	6	0.7	1.6	40	33.9	12.2	18.3	1.78	6.9	34.8	12.9	19.0	1.80	7.2	35.5	13.5	19.7	1.82	7.4
		0.7	1.6	50	42.8	14.4	20.3	1.74	8.2	43.9	15.2	21.2	1.76	8.6	44.7	15.8	21.9	1.78	8.9
		0.7	1.6	60	52.8	14.4	20.1	1.67	8.6	53.9	15.2	20.9	1.69	9.0	54.7	15.8	21.7	1.71	9.2
		0.7	1.6	70	62.8	14.4	19.7	1.55	9.2	63.9	15.2	20.5	1.57	9.7	64.7	15.8	21.2	1.59	9.9
		0.7	1.5	90	82.8	14.4	18.3	1.14	12.6	83.9	15.2	19.1	1.15	13.2	84.7	15.8	19.8	1.17	13.6

See page 34 for Application Notes for Performance Data

Section 12: Warranty Form and Revision table

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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Warranty Claim(s)
For warranty claims, the Installer/Dealer can visit: **http://warranty-claim.enertechgeo.com**

Revision Table

Date	Description of Revision	Page
13JUNE2024	Updated Wiring Diagram	44
5APRIL2024	Added Extended Data Tables	55-62
10JAN2024	Revamped	ALL
24AUG2022	Updated Alarm Code (C21) & Fixed Table of Contents	76, 3
8JULY2022	Updated Wiring Diagram	66
22DEC2020	Minor adjustment to AHRI table	86
25AUG2020	Formatting changes, verbiage updates, additional guidance on pipe sizing/applications	Various
	Section 3 (Installation Considerations): New application/design considerations added	10
	Section 6 (Unit Piping Installation): All new drawings to reflect changes in applications	19-31
	Section 8 (Field Wiring): All new wiring diagrams to reflect changes in applications	37-49
	Section 12 (Equipment Startup Forms and Tables): Updated Table 11 (Load Pressure Drop) for new 3-way valve	72
	Section 13 (Troubleshooting Tables): New tables and format for ease of troubleshooting and diagnosis	73-80
25MAR2020	Installation Diagrams 6a, 6c, and 6c updated to include new flush valves, shipped with unit	18-20
	Hydro-Connect relay wiring diagrams added	37, 38
	Flushing Valve Assembly Diagram updated to include new flush valves, shipped with unit	16
24MAR2020	Layout and verbiage updates.	Various
26FEB2020	Wiring Diagram updated (Source and Load Sensor labels updated)	53
	Layout changes made	Various
18SEP2019	Verbiage changes made to On-Board Controls	48
13SEP2019	WV Electrical Data Table updated	54
18JUL2019	Wiring Diagram updated.	55
09JUL2019	Layout and verbiage changes	ALL
	HC4 Diagram updated	35
	H2 Diagram updated	29
	Control Box images updated	41-43
	Wiring Diagram updated	55
23MAY2019	HC3, HC4, and HC5 diagrams updated	34-36
	Heating Curve Table updated	37
	Energy Star “Most Efficient” Information added	66-67
	Control Panel Updates made for Software Update 1.01	41-47
	Heating Curves Table updated	34
	Verbiage and layout changes made	All
09MAY2019	Verbiage and layout changes made	All
	Diagram H2 - HCC-NN-WVH-ZM: Radiant Heat Only	33
	Diagram H1 - HBX-550 Radiant only diagram updated	28
	Hot Water Capabilities and Physical Data updated	10
	Hydro-Connect Zone Panels information added	26
	Wiring Diagram Selection Chart updated.	27
15MAR2019	Updated verbiage on load side antifreeze	14
	Updated inspection information	5

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