Double Hybrid Heat Pump

Installation and Operation Manual

Variable Speed Ground Source Heat Pump

Simultaneous Hydronic Heating, Forced Hot Air, and Domestic Hot Water

5-Ton and 7-Ton Models Available

Closed Loop Systems Only

Vertical or Horizontal Orientation

ENERGY CATALYST

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Important Safety Information

Safety Symbols Explanation

Warnings, cautions, and notices appear throughout this manual. Read these items carefully before attempting any installation, service, or troubleshooting of the equipment.

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

CAUTION: Indicate a potentially hazardous situation or an unsafe practice, which if not avoided could result in minor or moderate injury or product or property damage.

IMPORTANT! Notification of installation, operation, or maintenance information, which is important, but which is not hazard-related.

General Safety Messages

WARNING: Do not install, operate, or maintain this equipment before carefully reading this instruction manual.

WARNING: The Double Hybrid Heat Pump is not a toy, and children should not play with the appliance.

WARNING: Do not use means to accelerate the defrosting process or to clean, other than those recommended by Energy Catalyst Technologies.

WARNING: The appliance shall be stored in a room, no smaller than the minimum room area for operation, without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).

WARNING: Do not pierce or burn.

WARNING: Be aware that refrigerants may not contain an odor.

CAUTION: Never operate the Double Hybrid Heat Pump without an air filter.

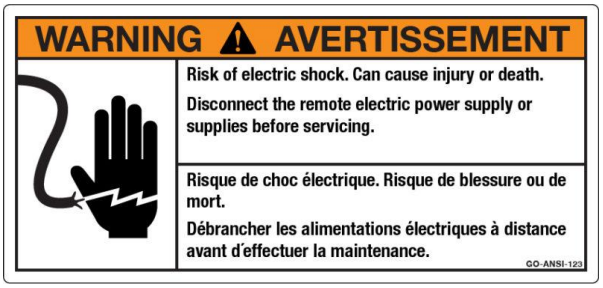
IMPORTANT!

- Save this manual and any other operating instructions for yourself and any future owners of this appliance.
- Additional copies of this manual are available from the installer or by contacting Energy Catalyst Technologies.
- An Energy Catalyst Technologies trained, or otherwise qualified installer must perform all installation practices.
- A licensed refrigeration technician must perform all A2L refrigeration repairs and modifications. Energy Catalyst Technologies must approve all service repairs if the system is covered under manufacturer warranty. (See *Warranty Explanation and Coverage*.)

Electrical Hazard Warnings

DANGER: ELECTRIC SHOCK CAN KILL!!

WARNING: The following is a general warning statement which should be read and understood before installing and/or operating your Double Hybrid Heat Pump.



WARNING: Install a means for disconnection from the main supply across all poles to provide full disconnection if the Double Hybrid Heat Pump is out of line of sight from the main breaker or if the unit is further than 50 ft (15 m) away from the main breaker panel.

WARNING: Always turn off the heat pump system power before removing panels to reduce the risk of electric shock.
NOTE: Some units may have more than one or two power supplies.

WARNING: DO NOT stick hands into return, supply, or any other opening. There is a sharp, spinning blade that could cause severe injury.

WARNING: The presence of water around the base of the unit constitutes an electrical hazard. Turn off the power to the Double Hybrid Heat Pump unit as soon as water leakage is discovered and call a service technician immediately.

CAUTION: The system contains refrigerant under very high pressure. The system must only be serviced by qualified persons only.

CAUTION: Always keep all covers and panels in place. Do not leave unattended with covers or panels off during installation or servicing.

CAUTION: All repairs, electrical or mechanical, should be attempted only by trained technicians. In the event of a problem with the unit, do not reset the unit until the problem has been fully corrected.
NOTE: Equipment failure due to resetting without first correcting the problem will not be covered by the warranty.

CAUTION: All breakers and fuses supplying power to this unit should be clearly labeled at the time of installation.

CAUTION: All wiring and plumbing should be done in strict accordance with local and national codes and ordinances.

A2L Warnings and Instructions

This appliance contains R-454B, an A2L mildly flammable refrigerant. The following UN GHS hazard pictograms apply and must be observed during installation, service, transportation, and storage:

Flammable

Health Hazard

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repairs to the refrigerating system, the following precautions must be taken before starting any work:

- **Area Ventilation:** Verify that the work area is well-ventilated. Use fans to disperse any leaked refrigerant and prevent the accumulation of flammable concentrations.
- **Ignition Sources**: Identify and remove all potential ignition sources from the work area, including open flames, electrical sparks, and hot surfaces. Use non-sparking tools and equipment where possible.
- **Refrigerant Recovery**: Use appropriate equipment to recover any refrigerant from the system before beginning repairs. Properly store and label recovered refrigerant in accordance with local regulations.

Work shall be undertaken under a controlled procedure to minimize the risk of flammable gas or vapor being present while the work is being performed. Take precautions to avoid setting off any fire alarm or fire suppression system when performing brazing.

All maintenance staff and others working in the local area shall be instructed on the nature of the work being carried out. Work in confined spaces shall be avoided. The area around the workspace shall be sectioned off. Ensure that the conditions within the area have been made safe by control of flammable material.

Refrigerant Leak Mitigation

All units come with a Refrigeration Detection System (RDS) pre-installed that will detect R-454B in the event of a leak when the unit is powered and operational. When a leak is detected by the RDS, the unit will issue an alert, turn off the compressor, and run the blower at full power until R-454B is no longer detected. Never place tools or objects near the discharge air outlet to avoid risk of injury or damage to the unit if the blower were to suddenly activate.

Replacing the Refrigerant Detection System (RDS)

Contact Energy Catalyst Technologies for a replacement. Take a photo of the wiring harness and connection to the factory board for reference when obtaining a new part. The photo may also be used when installing the new part.

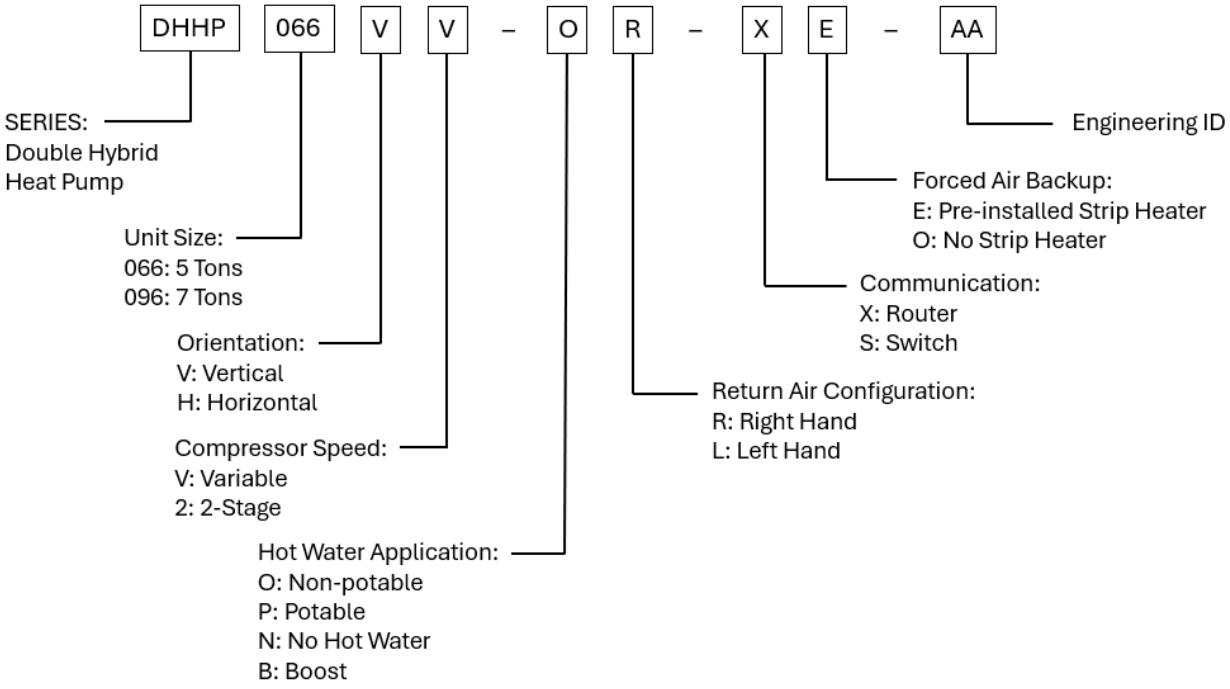
General Information

Warranty Explanation and Coverage

Energy Catalyst Technologies provides a standard 11-year warranty for residential heat pumps and 5-year warranty for commercial heat pumps from the date of manufacture. Covered components include the compressor, reversing valve, electronic expansion valves, select electrical components, air coil, and heat exchangers. Replacement parts will be provided to the servicing contractor free of charge. Integral accessories (such as auxiliary electric heaters, water storage tanks, pumping modules) also have an industry leading warranty which varies by component. See the Warranty Card for additional details.

The warranty includes a labor allowance, which will be credited to the service contractor depending on the type of repair made.

Model Nomenclature



Sample Double Hybrid Heat Pump Configuration

Below is an example of a common layout and associated piping for a Double Hybrid Heat Pump and Buffer Tank configuration.

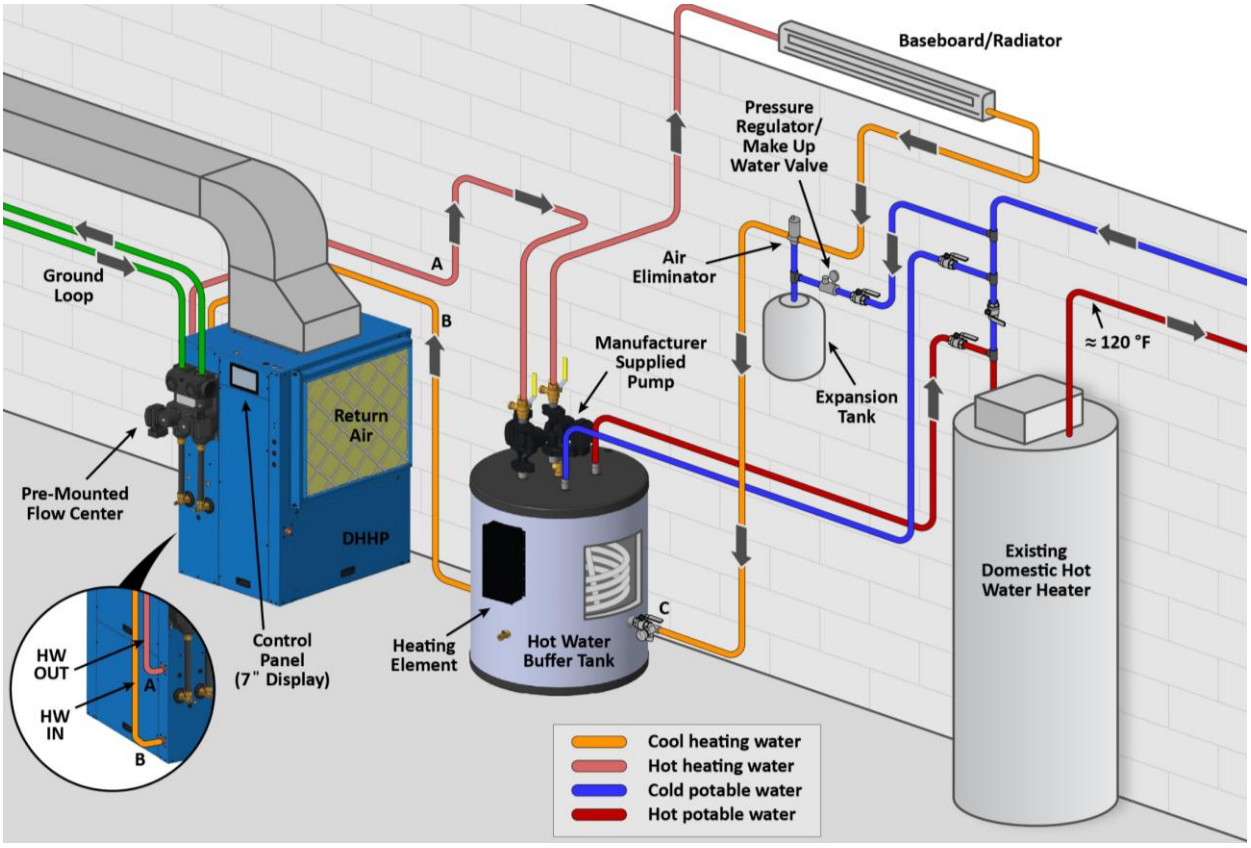


Figure 1: Sample Hybrid Configuration

Common Acronyms and Abbreviations

See Table 1 for definitions of common acronyms and abbreviations used in this manual.

Table 1: Common Acronyms and Abbreviations

Term	Definition	Term	Definition
BTU/Hr	Heating or cooling capacity; British thermal unit per hour	kW	Kilowatt
CFM	Cubic feet per minute, airflow	V	Volts
COP	Coefficient of performance (BTU/Hr out: BTU/Hr in)	DB	Dry-bulb temperature (normal ambient air temperature)
DHHP	Double Hybrid Heat Pump; also referred to as Heat Pump	WB	Wet-bulb temperature (temperature accounting for humidity/evaporation)
DHW	Domestic hot water	EER	Energy Efficient Ratio (Cooling BTU/Hr out divided by watts input)
GPM	Gallons per minute, water flow		

Performance Ratings

See Table 2 for performance ratings based on the Double Hybrid Heat Pump model installed. See Table 3 for AHRI performance ratings.

Table 2: Double Hybrid Heat Pump performance ratings

				Ground Loop Heat Pump[4]							
Heat Pump Model	Capacity Modulation	Ground Loop Flow Rate	CFM	Cooling (Forced Air only)[1]		Forced Air Heating[2]		Hybrid Water & Air Heating[3, 5]		Hot Water Only	
				Capacity (BTU/Hr)	EER	Capacity (BTU/Hr)	COP	Capacity (BTU/Hr)	COP	Capacity (BTU/Hr)	COP
66	Part	12/10	1275/1250	23,000	23.5	17,000	4.5	14,000	4.0	12,000	3.6
	Full	17	2100/2150	52,000	14.5	58,000	3.3	48,500	3.4	42,000	3.3
66 Boost	Part	16.5/10	1250	23,000	23.0	19,000	4.5	22,500	4.0	19,000	3.6
	Full	20	2200	55,000	12.5	58,000	3.3	55,000	3.4	49,000	3.3
96	Part	16.5/14	1500	32,000	23.0	26,000	4.8	22,500	4.0	19,000	3.8
	Full	20	2575	81,000	12.5	64,000	3.4	55,000	3.4	49,000	3.3

[1]Cooling capacities based upon 80.6°F (27°C) DB, 66.2°F (19°C) WB entering air temperature.
[2]Heating capacities based upon 68°F (20°C) DB, 59°F (15°C) WB entering air temperature.
[3]Hybrid Heating Capacity based on 115°F (56.1°C) hot water supply, 32°F/42°F (0°C /5.5°C) ground loop entering water temperature, 68°F (20°C) entering air temperature.
[4]All ratings based upon 240V operation.
[5]Only Hot Air and Cooling operations are validated by third parties. There is no standardized third-party test for Hybrid Mode.

Table 3: Air Conditioning, Heating, and Refrigeration Institute (AHRI) Ratings

				Ground Loop Heat Pump[3]			
Model	Capacity Modulation	Ground Loop Flow Rate (cool/heat)	CFM (cool/heat)	Cooling (Forced Air only)[1]		Forced Air Heating[2]	
				Capacity (BTU/Hr)	EER	Capacity (BTU/Hr)	COP
66	Part	12/10	1275/1250	23,000	23.5	17,000	4.5
	Full	17	2100/2150	52,000	14.5	58,000	3.3
96	Part	16.5/ 14	1500	32,000	23.0	26,000	4.8
	Full	20	2575	81,000	12.5	64,000	3.4

[1]Cooling capacities based upon 80.6°F (27°C) DB, 66.2°F (19°C) WB entering air temperature.
[2]Heating capacities based upon 68°F (20°C) DB, 59°F (15°C) WB entering air temperature.
[3] All ratings based upon 240V operation.

Important Installation Information

The following are important tips for installing the Heat Pump and Buffer Tank:

- **IMPORTANT! Do not use ferrous metals in the ground loop piping.** These include black iron and galvanized pipe and couplings. These will corrode over time and will foul the heat exchanger.
- **IMPORTANT! Do not run pumps dry.** The makeup water assembly (expansion tank, pressure regulator, air eliminator) may be in locations other than shown.
- **IMPORTANT!** Units must maintain a minimum anti-freeze solution at all times.
- Ensure proper duct sizing for design airflow. If zone dampers are added, ensure that the smallest zone achieves the required airflow rates. (See Table 4 and Table 5.)
- Be sure to properly remove air from the system before operating. Drawing water in the opposite direction with a ball valve and drain may help. (See Figure 2.)
- If the building contains radiators, they will need to be bled of air after retrofit.
- Using a pre-mounted, pressurized flow center is recommended but not required.
- Ensure ground loop water is free and clear of all debris.
- The ports at the bottom of the Buffer Tank are the same and can be interchanged as needed.

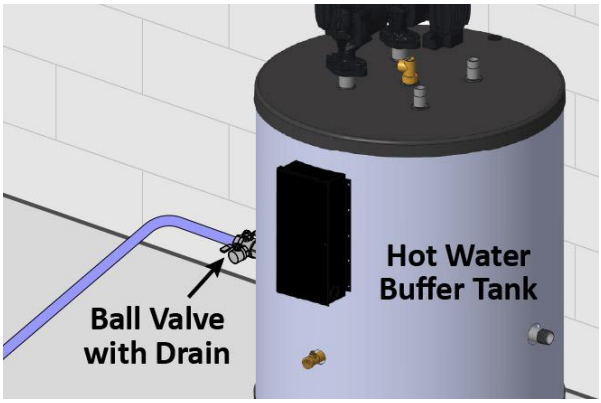


Figure 2: Purge air from the system

Heat Pump, Buffer Tank, and Dedicated DHW Description

Double Hybrid Heat Pump

The Double Hybrid Heat Pump (referred to as Heat Pump) is a plug-and-play geothermal heating system (see Figure 3) that is designed to be adaptable to a wide variety of existing heating systems, including buildings with hot water radiators, baseboards, radiant floors, forced air, or some combination thereof.

The Heat Pump has five modes of operation:

- Hybrid Mode
- Hot Air Mode
- Cooling Mode
- Cooling+ HW Mode
- Hot Water Mode

Figure 3: Energy Catalyst Heat Pump with pre-mounted flow center

When reusing existing, often high-temperature, heat emitters—such as baseboard or radiators—the Heat Pump produces relatively high temperature hot water (up to 140°F), and the energy that is released as hot air is recovered energy from the refrigeration cycle. The automatic controls balance the load between hydronic heat and forced air heat to achieve even greater efficiency, while often allowing ductwork to be minimally sized for summer cooling loads.

When used in Hybrid Mode, the unit's automatic controls maximize the use of the existing hot water heating infrastructure. In general, if an existing building can raise the temperature 5 degrees in 1 hour with their current boiler during a cold winter day, the building will typically have plenty of capacity. Some zones with undersized hot water heat emitters (baseboard, radiator, etc.) may require additional heat from the Heat Pump in the form of hot air (>20%).

Buffer Tank

The Heat Pump pairs perfectly with an Energy Catalyst Buffer Tank (see

Figure 4), which is used for thermal storage, thermal buffer, debris removal, hydronic backup heat, and indirect hot water production.

The Buffer Tank has a heat exchanger that is used for domestic hot water pre-heat. It also comes with electric resistance heater element(s) that can be used for backup heating or during peak load situations.

Figure 4: Energy Catalyst Buffer Tank

The pre-heat coil in the Buffer Tank can be plumbed to and from the cold-water supply from the existing hot water tank (see Figure 5). As hot water is used, new water passes through the pre-heat coil and enters the existing hot water tank pre-heated.

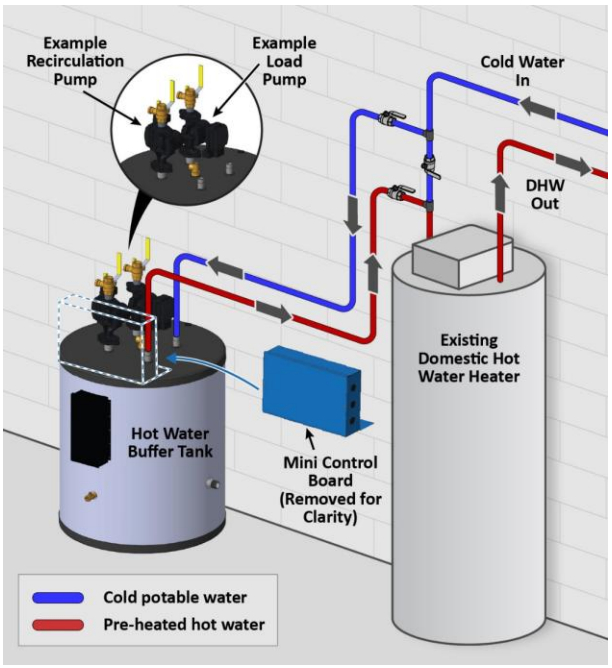


Figure 5: Recommended domestic hot water pre-heat plumbing arrangement with Buffer Tank

Dedicated Domestic Hot Water (DHW)

In systems that do not involve hydronic heating, there is an option for an Energy Catalyst Dedicated DHW (see Figure 6). This works with potable versions of the Heat Pump to directly provide domestic hot water. The stainless-steel unit comes equipped with electrical resistance heater elements that provide backup heating and accommodates peak loads.

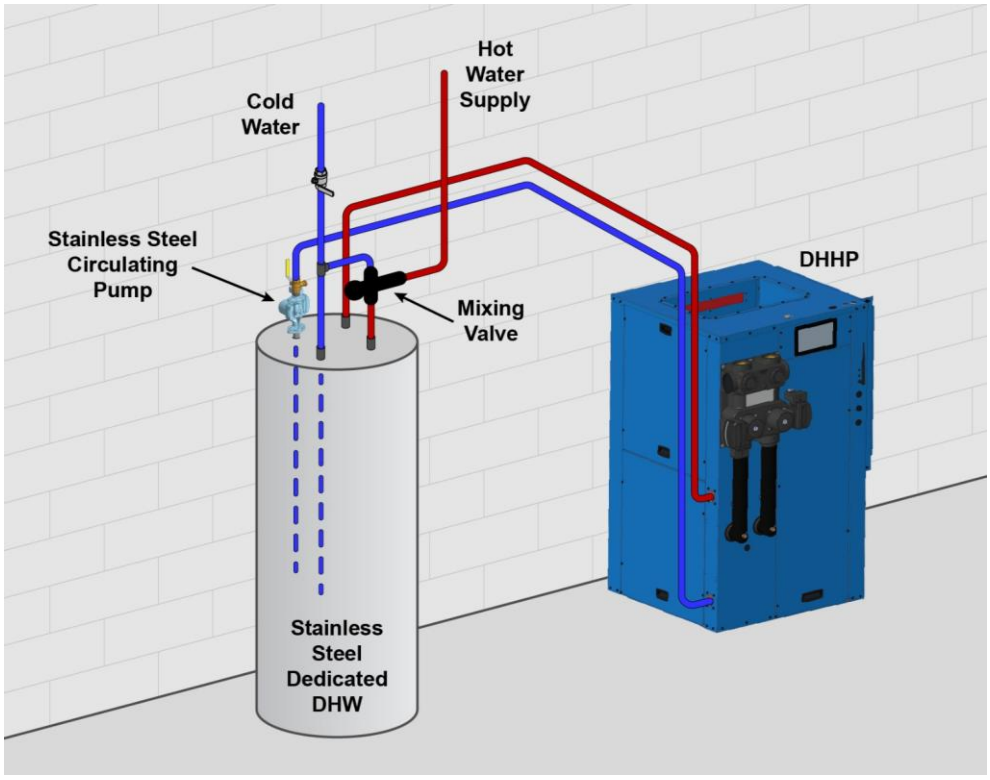


Figure 6: Dedicated DHW plumbing arrangement

Modes of Operation

There are as many as five modes of operation the Heat Pump will operate in to maintain thermal comfort (depending on the configuration). A building may require multiple heating methods, and the system will adjust between these modes automatically to satisfy each zone's requirements.

The five modes of operation are:

1. **Hybrid Mode:** In this mode, most heat is provided through a hydronic system. Residual heat from this process is recovered and supplied as hot air, improving efficiency by up to 40%.
2. **Hot Air Mode:** Air is used to heat the building in a manner similar to a traditional forced air heating system.
3. **Hot Water Mode:** Produces hot water, maintaining tank temperature setpoint at all times. Thermostat zones can be configured for hot water only as needed.
4. **Cooling Mode:** Air is cooled in a manner similar to traditional central air conditioning.
5. **Cooling+ HW Mode:** When cooling is needed and hot water is below the set temperature, waste heat will automatically be diverted to make hot water. Ground loop pumps do not run in this mode.

Modes of Operation Notes

The following are notes regarding the interaction of the Heat Pump in the various modes of operation.

- The Heat Pump will reject heat to the hot water tank while operating in Hot Air Mode, Cooling+ HW Mode and Hot Water Mode to maintain tank temperature for domestic hot water pre-heat (if configured for this).
- With non-potable water models, domestic hot water can be pre-heated by the system, but the system is not intended to be used as the exclusive domestic hot water provider. For this, use potable water models and Dedicated DHW options. (See *Forced Air* section for details.)

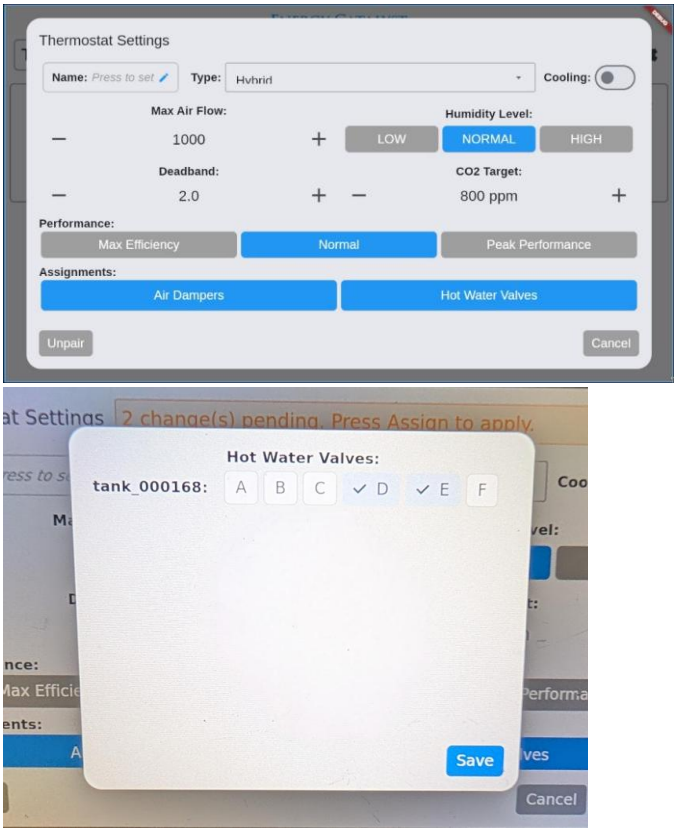


Figure 16: Heat Pump setup screen

Zoning with Dampers

Figure 17 represent an example of a multi-zone Hybrid configuration zoning with dampers. Zone dampers come with all Heat Pump models.

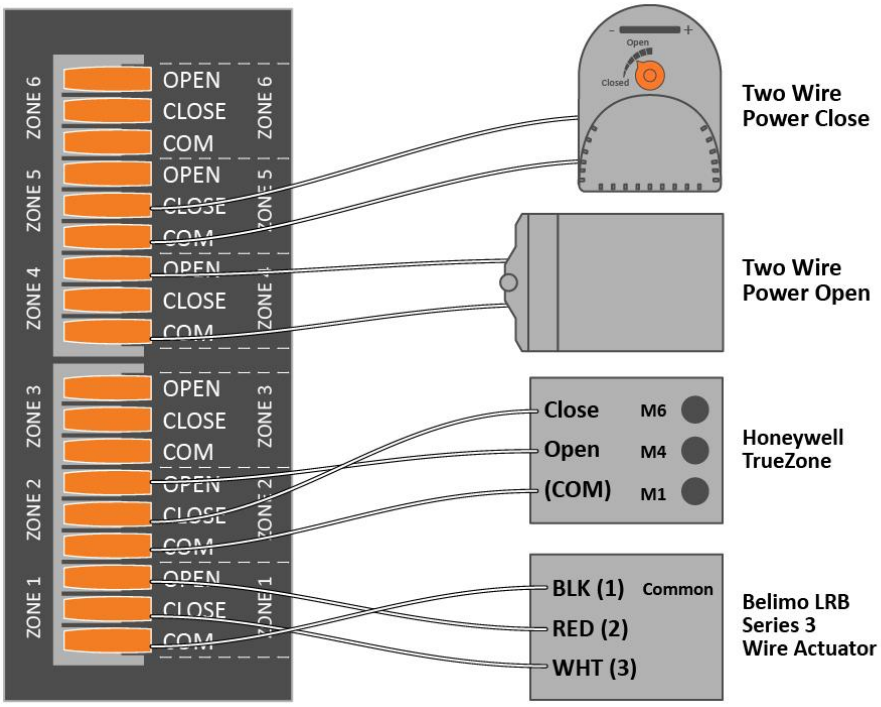
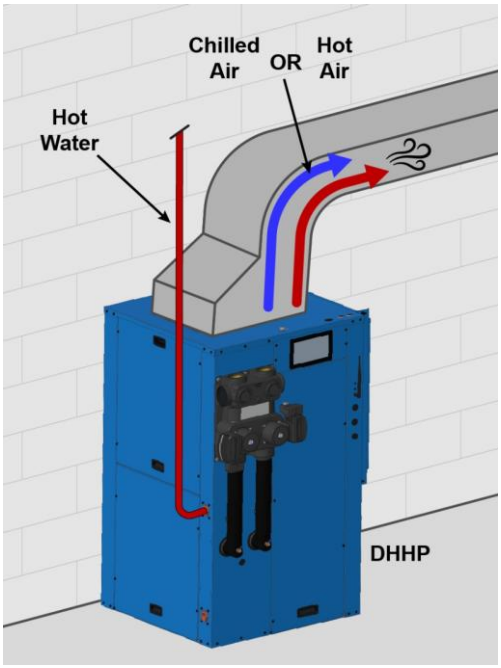


Figure 17: Example wiring for zone dampers

- Forced Air When producing chilled air, the Heat Pump will automatically turn off the ground loop pump and reject heat to the Buffer Tank until it reaches the set temperature.
- The Heat Pump will maintain a temperature setpoint in the hot water tank and can produce hot air or chilled air and hot water at the same time.



Hybrid Configuration

Hybrid configuration is often added to existing infrastructure and is the most common configuration. For buildings with existing hot water boilers, we recommend using the Hybrid configuration.

Figure 7 is an example of an existing infrastructure using a boiler, while Figure 8 shows the same infrastructure with the Heat Pump installed and the Buffer Tank replacing the boiler.

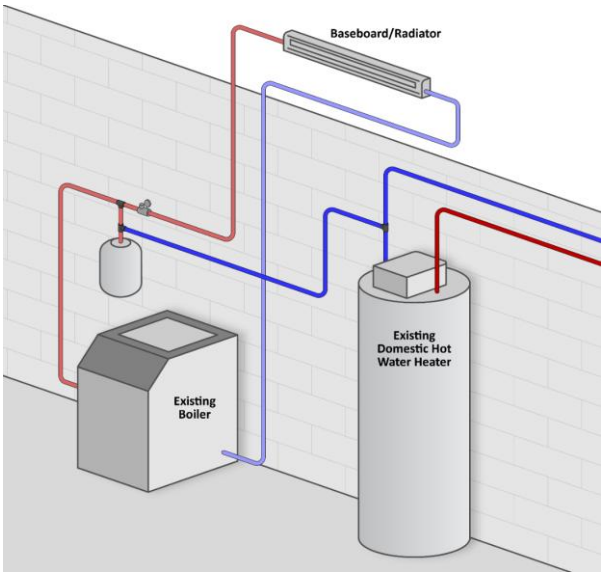


Figure 7: Existing infrastructure before Heat Pump Hybrid configuration installation

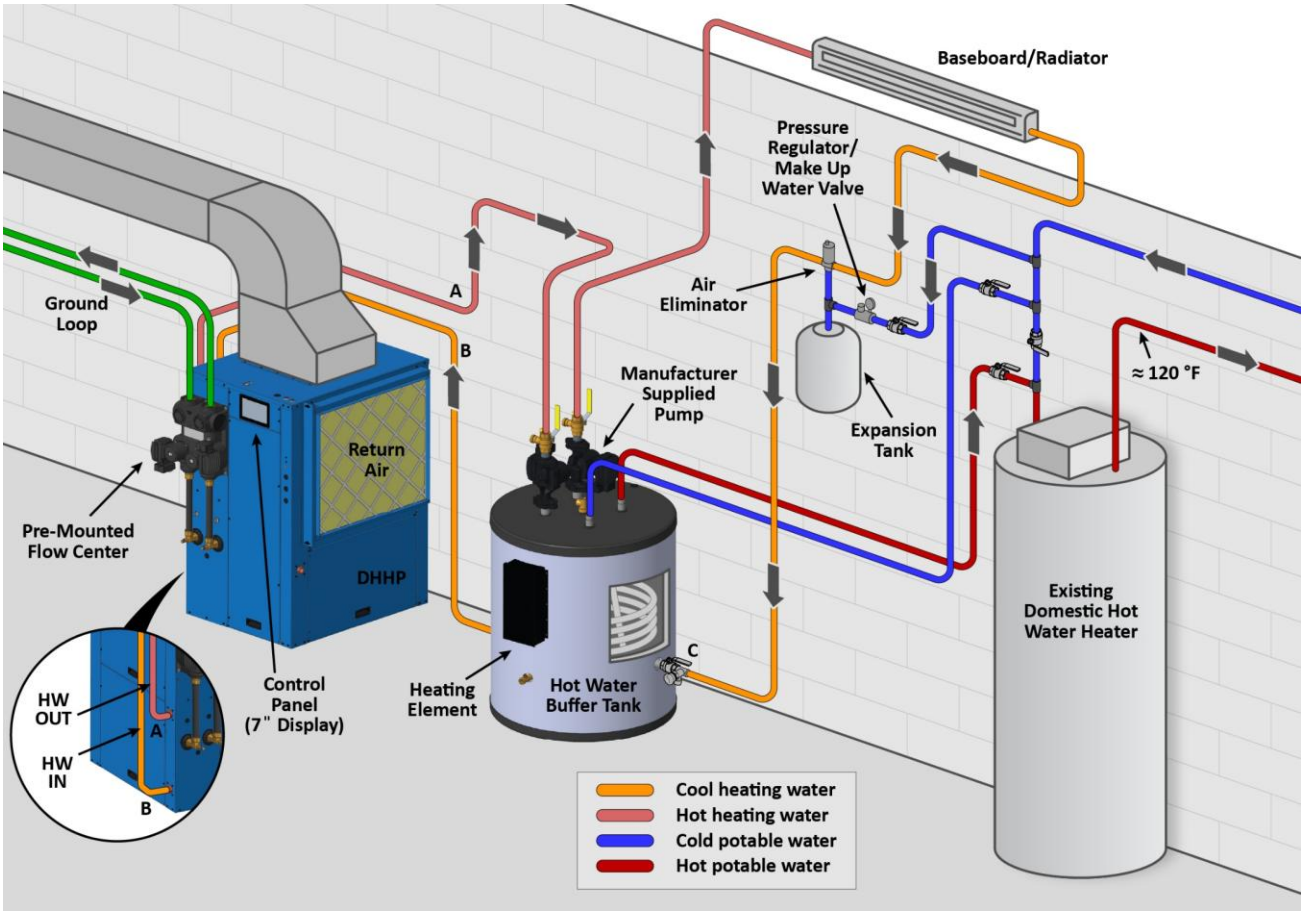


Figure 8: Single-zone Hybrid installation piping diagram

NOTE: See Table 4 for minimum duct sizing requirements based on the Heat Pump model installed.

*Table 4: Minimum system duct sizing requirements (CFM) for Hybrid Mode**

Model	Tons	Capacity Modulation	Min air volume @ .08" static pressure, for duct sizing (CFM)
66	5	Part	920
		Full	
		Full	
66 Boost	5/7	Part	920
		Full	
96	7	Part	1100
		Full	

**See Table 5 for the minimum size of an individual ducted zone.*

System Wiring

The Heat Pump is designed to reuse the control wiring often found with boiler/furnace systems. For hot water systems that have zones, an isolated end switch from the zone control board will tell a boiler when any zone is calling for heat. The Heat Pump can accept this same signal (called an X/X signal or isolated end switch), and if a thermostat is rewired to go to the Heat Pump instead of the zone control board, the Heat

Pump has output signals that can replace the thermostat wires on the zone control board. See Figure 9 and Figure 10 for wiring diagrams.

NOTE: If the home has several zones that all have two-wire thermostats, installers may benefit from using an Energy Catalyst Thermostat, which can reuse the two wires but provide a multitude of signal outputs.

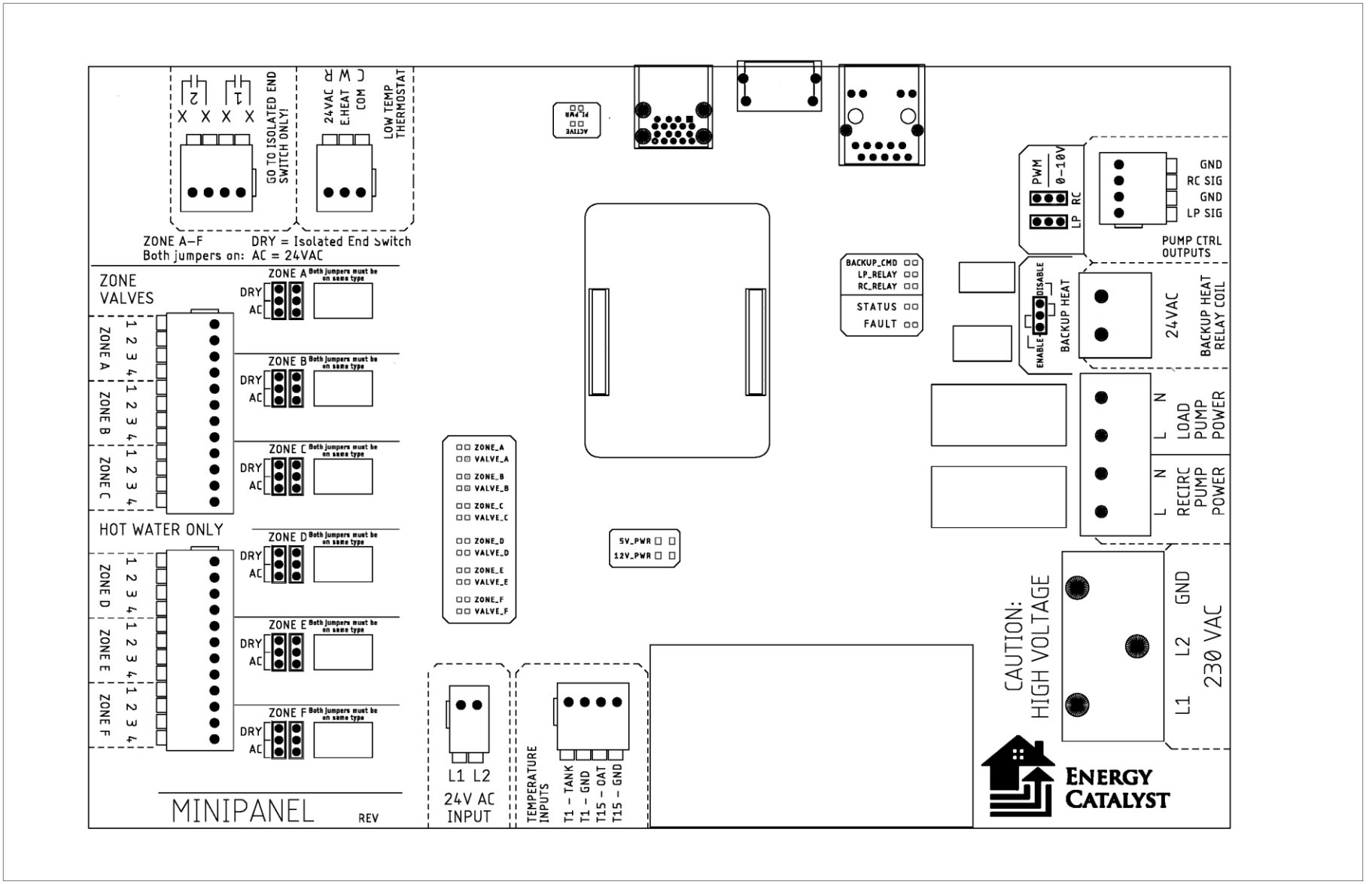


Figure 9: Mini Control Panel for hot water tanks

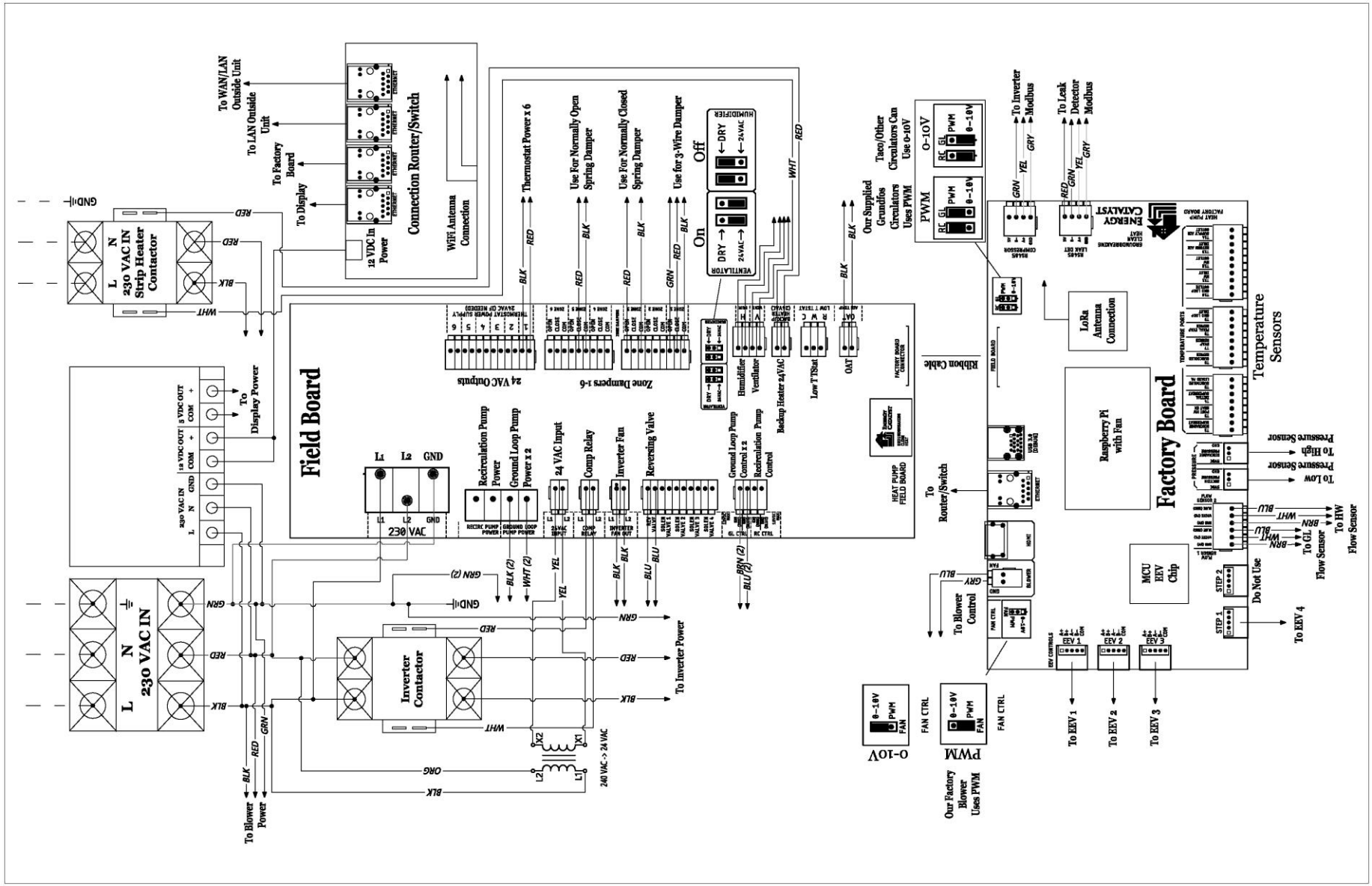


Figure 10: Main Control Panel wiring diagram

Multi-Zone Configurations

If a building has several zones, it may be helpful to have a zone control board. This board does not come with the Heat Pump system. It may either already be installed as part of the existing heating system or can be purchased separately and installed. Energy Catalyst products are designed to seamlessly integrate with TACO™, Argo™, and other major brands of zone control boards.

The Heat Pump is capable of replacing a hot water boiler. The Heat Pump should be connected to at least one thermostat and can accept an isolated end switch signal (X/X), like a hot water boiler. This signal, by default, will be interpreted as a call for hydronic heat.

- If zoning with **circulators**, the load pump can be excluded as shown in Figure 11. (See the *Zoning with* Circulators section for more information.)
- If zoning with **zone valves**, the load pump can be used as shown in Figure 13. If a load pump is used, it will activate when the isolated end switch is closed. (See the *Zon* section for more information.)
- If zoning with **dampers**, see Figure 17.

Zoning with Circulators

Figure 11 and Figure 12 represent an example of a multi-zone Hybrid configuration zoning with pump circulators.

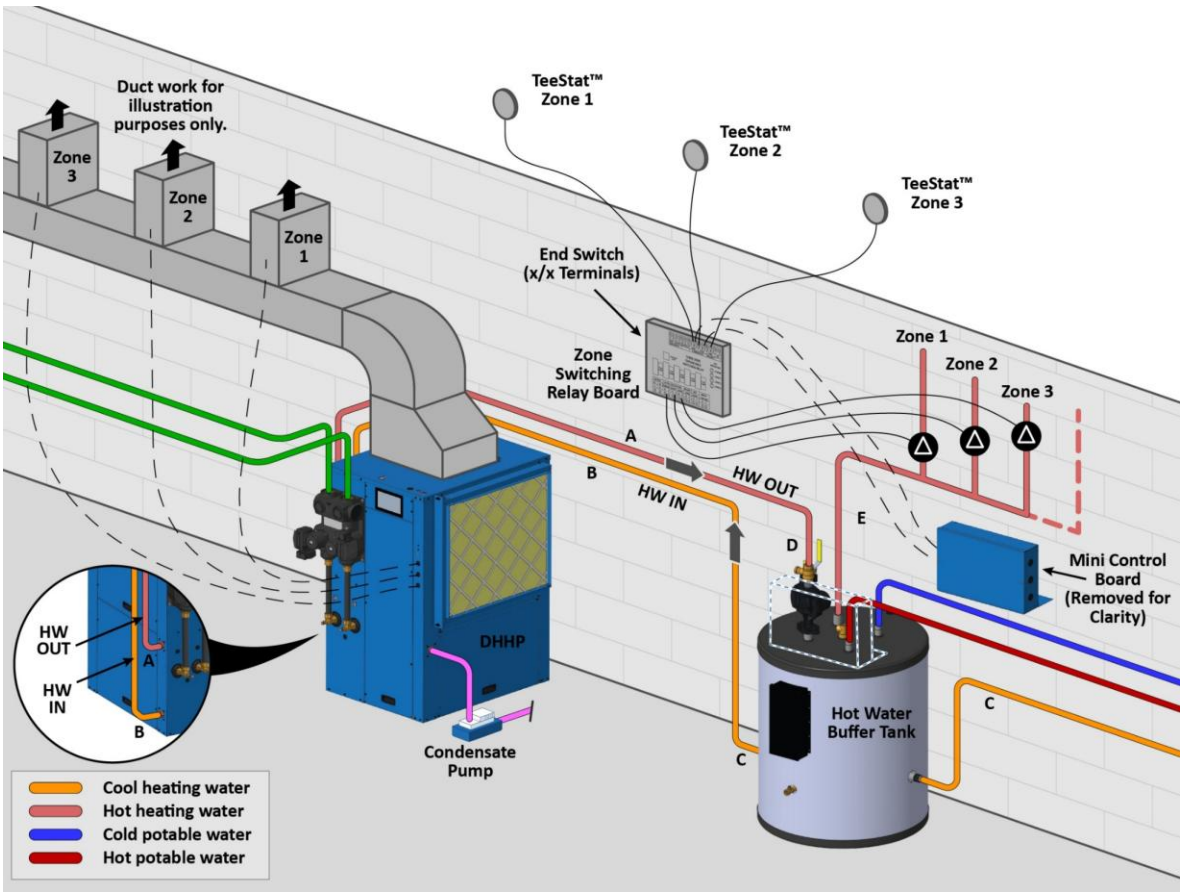


Figure 11: Multi-zone Hybrid configuration with zone pump circulators (makeup assembly not shown)

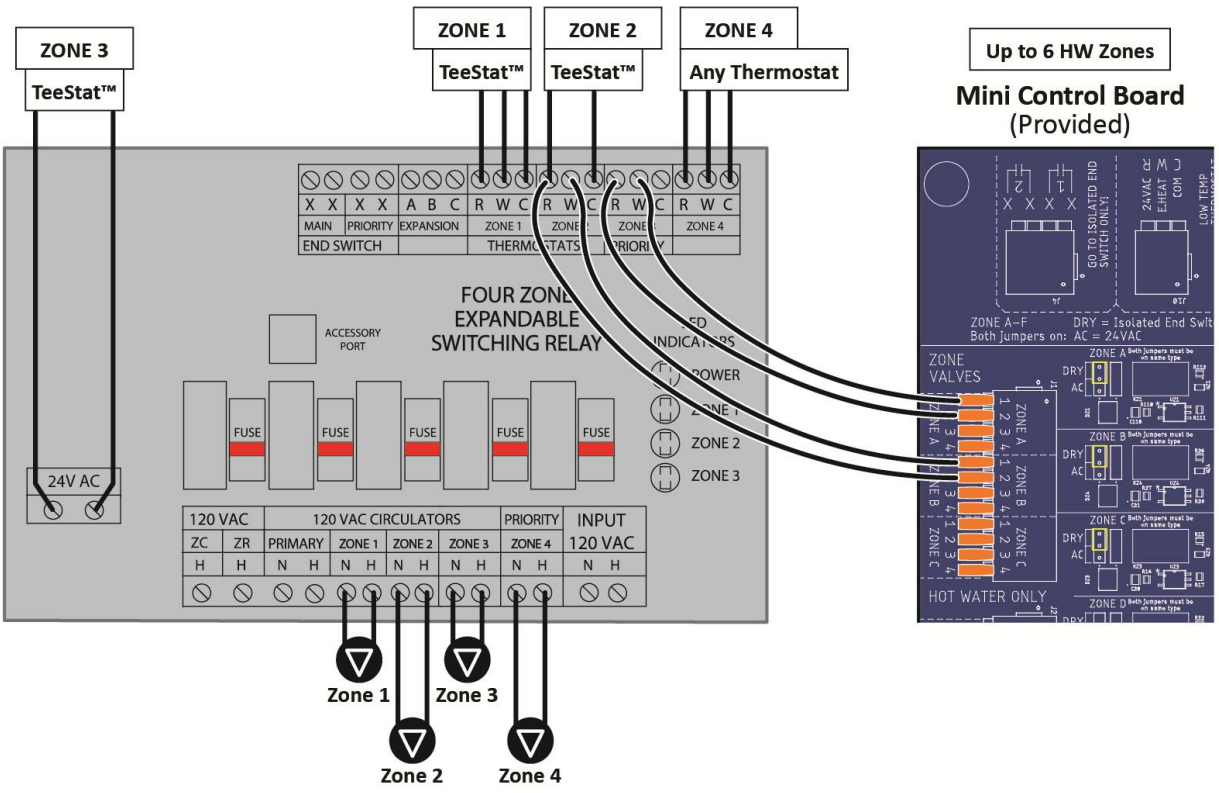


Figure 12: Wiring options for thermostats with zone switching relay board and mini control board

Circulator Zone Control Explanation

The zone examples in Figure 12 are:

- **Zone 1** is controlled by an Energy Catalyst TeeStat™ thermostat, which uses R and C to power itself and can turn on its corresponding circulator directly when there is a call for heat. The advantage of using a TeeStat thermostat is that it can also communicate its zone's temperature and have the Heat Pump deliver warmer water to the zone as needed.
- **Zone 2** has only two (2) wires and is controlled by an Energy Catalyst TeeStat thermostat, which uses R and C to power itself. Since this zone does not have a third wire (a common situation in retrofits), the TeeStat can be connected wirelessly to the Heat Pump and use the mini control board to jump power from R to W, activating the zone circulator. In the Heat Pump **Setup** screen for the TeeStat, **Hot Water Valve Zone B** will be selected for that TeeStat, and any time that thermostat calls for heat, Zone B on the mini control board will be triggered ON, jumping R and W together.
- **Zone 3** has only two (2) wires and is controlled by an Energy Catalyst TeeStat thermostat, which uses 24VAC terminals on the side of the board to power itself. Similar to Zone 2, it will use the mini control board to jump R and W. Often, older zone relay boards do not have R, W, and C terminals, only R and W terminals.
- **Zone 4** has three (3) wires and is controlled by any brand of thermostat. This is a good option for low priority hot water zones, such as spare bedrooms or garages. The Heat Pump will automatically maintain temperature in the tank as heat is drawn from it. Keep in mind that a zone with a third-party thermostat will not be able to turn on backup heat, turn on cooling, or request higher temperature hot water from the Heat Pump.

Zoning with Valves

Figure 13 and Figure 14 represent an example of a multi-zone Hybrid configuration zoning with valves.

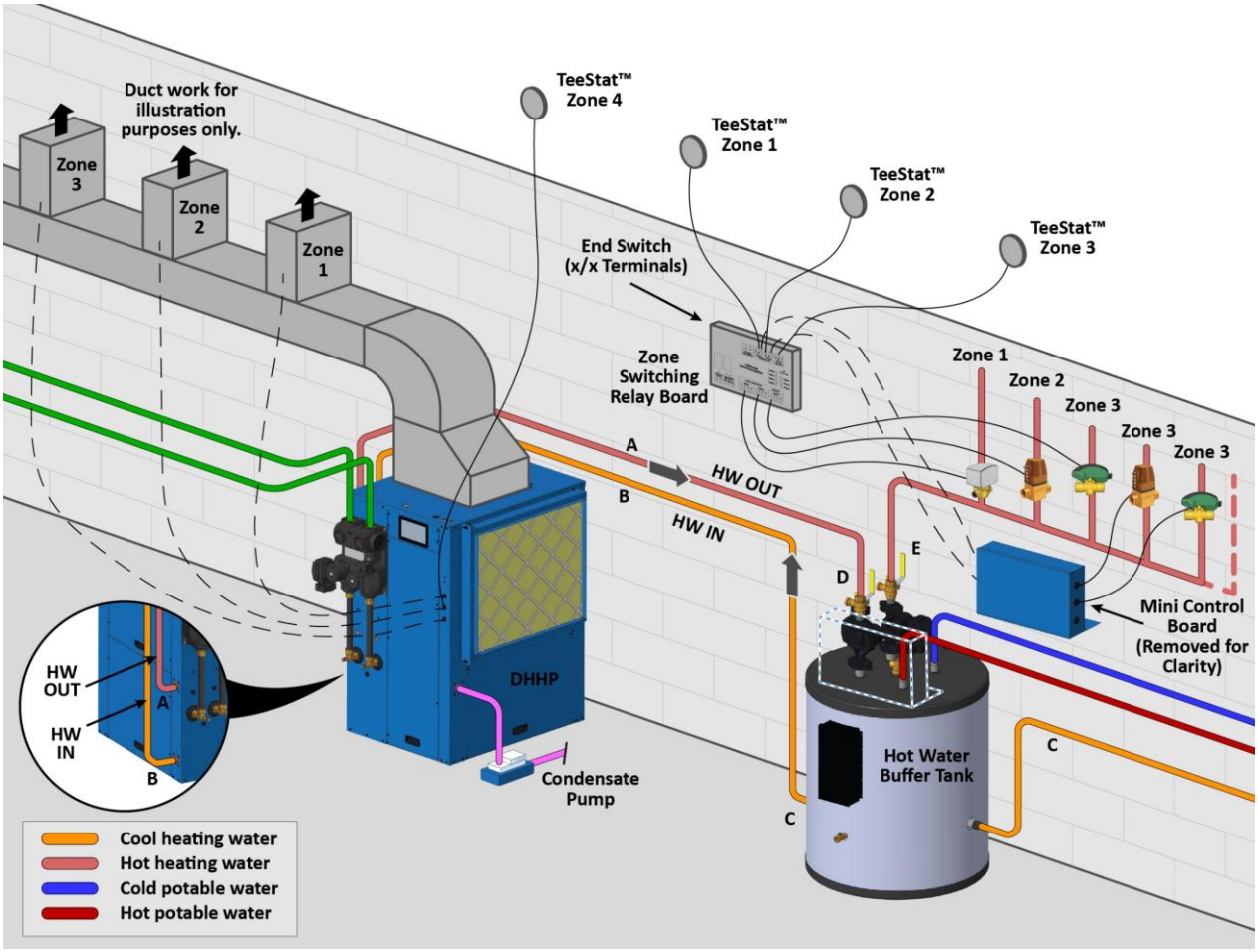


Figure 13: Multi-zone Hybrid configuration with zone valves (makeup assembly not shown)

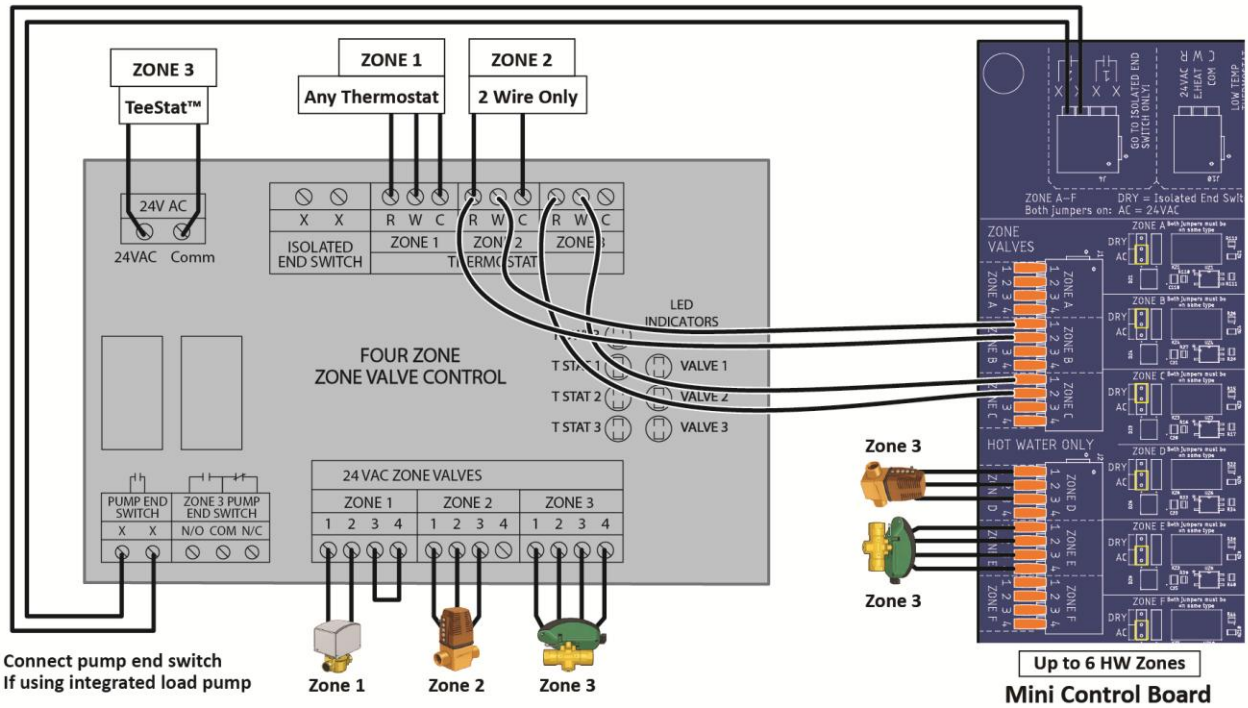


Figure 14: Wiring options for thermostats with zone valve control board and mini control board

NOTE: See Figure 15 for dedicated mini control board wiring.

Valve Zone Control Explanation

The zone examples in Figure 14 are:

- **Zone 1** has three (3) wires and a third-party thermostat. The Heat Pump will maintain temperature in the Buffer Tank and run the recirculation pump when the pump end switch (X/X) is closed. Keep in mind that a zone with a third-party thermostat will not be able to turn on backup heat, turn on cooling, or request higher temperature hot water from the Heat Pump.
- **Zone 2** has only two (2) wires and is controlled by an Energy Catalyst TeeStat thermostat, which uses R and C to power itself. Since this zone does not have a third wire (a common situation in retrofits), the TeeStat thermostat can be connected wirelessly to the Heat Pump and use the mini control board to jump power from R to W, activating the zone valve (and activating the load pump when the pump end switch closes). In the Heat Pump setup screen for the TeeStat, **Hot Water Valve Zone B** will be selected for that TeeStat, and any time that thermostat calls for heat, Zone B on the mini control board will be triggered ON, jumping R and W together.
- **Zone 3** has only two (2) wires and is controlled by an Energy Catalyst TeeStat thermostat, which uses 24VAC terminals on the side of the board to power itself. Similar to Zone 2, it will use the mini control board to jump R and W in order to trigger Zone 3 on the third-party zone control board. In this example, Zone 3 needs several zone valves to open at the same time. Additional zones can be activated and powered directly from the mini control board. As shown in Figure 14, Zones D and E power two different types of zone valves directly. Please note that the jumpers must be moved from “DRY” to “AC” to power the zone valves. An installer specifies the mini control zones to be activated in the Heat Pump setup screen (see Figure 16) for each respective TeeStat thermostat.

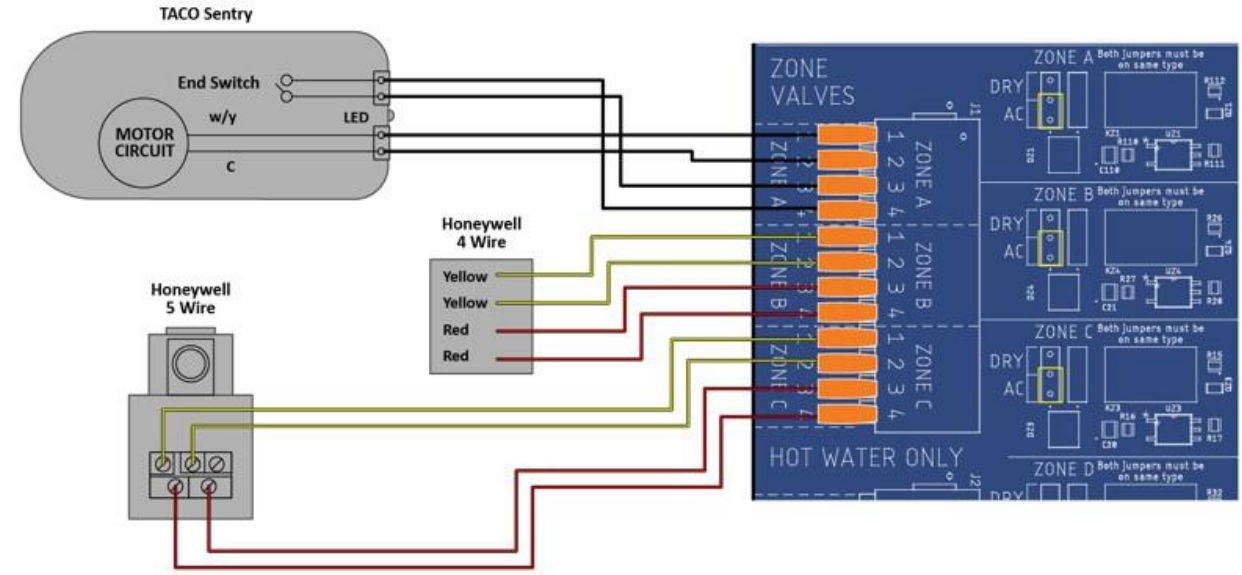


Figure 15: Using the mini control board to wire for outputs

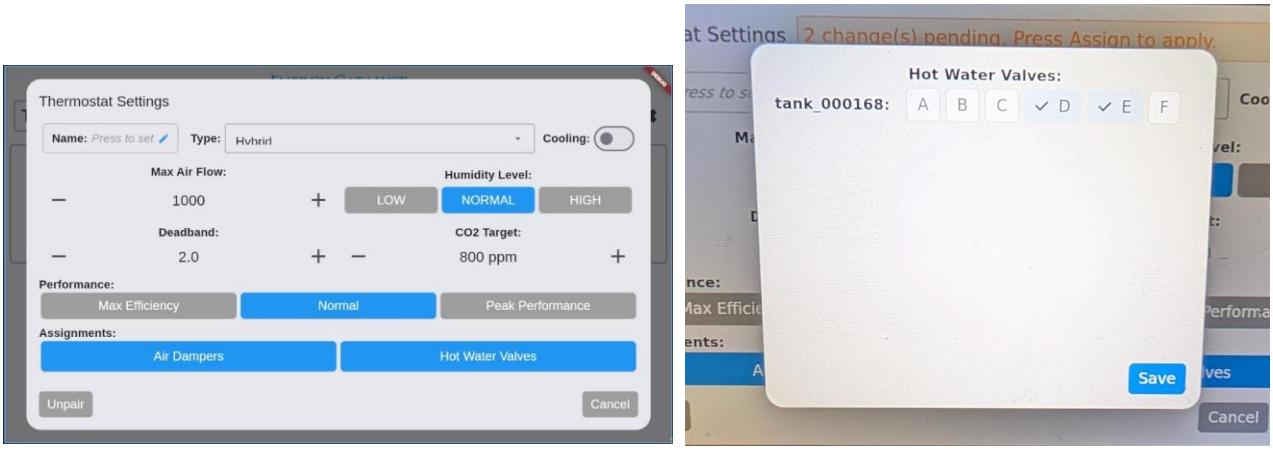


Figure 16: Heat Pump setup screen

Zoning with Dampers

Figure 17 represent an example of a multi-zone Hybrid configuration zoning with dampers. Zone dampers come with all Heat Pump models.

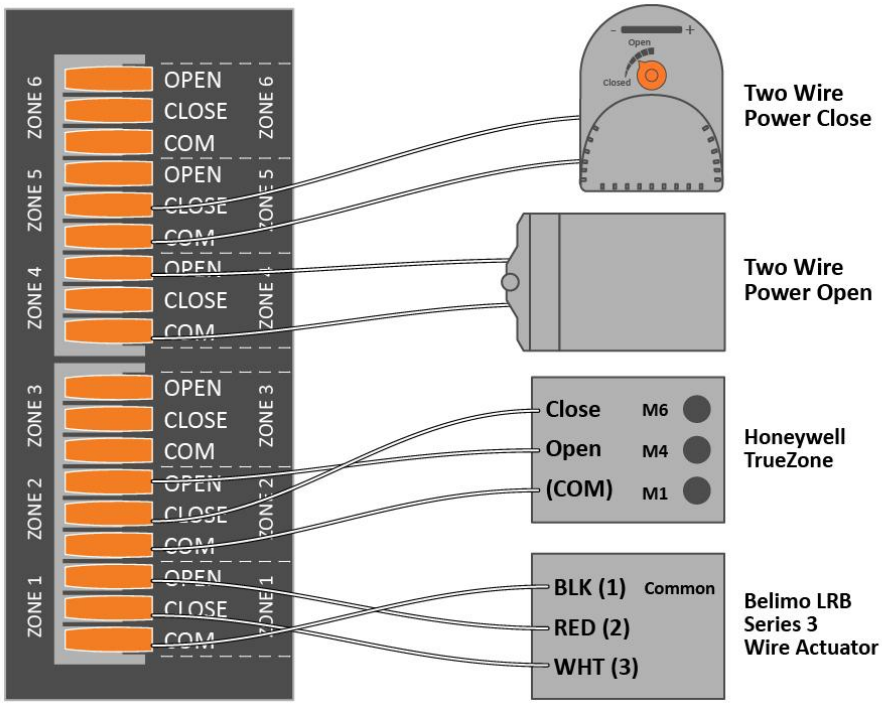


Figure 17: Example wiring for zone dampers

Forced Air

The Heat Pump can be configured with a potable or non-potable hot water heat exchanger. For buildings that are heated by forced air only, it is most common to use either the potable water option or no hot water condenser. The Heat Pump will reject heat to the hot water tank while operating in forced air heating and cooling modes. It will also maintain tank temperature for dedicated domestic hot water (DHW), if this option is selected.

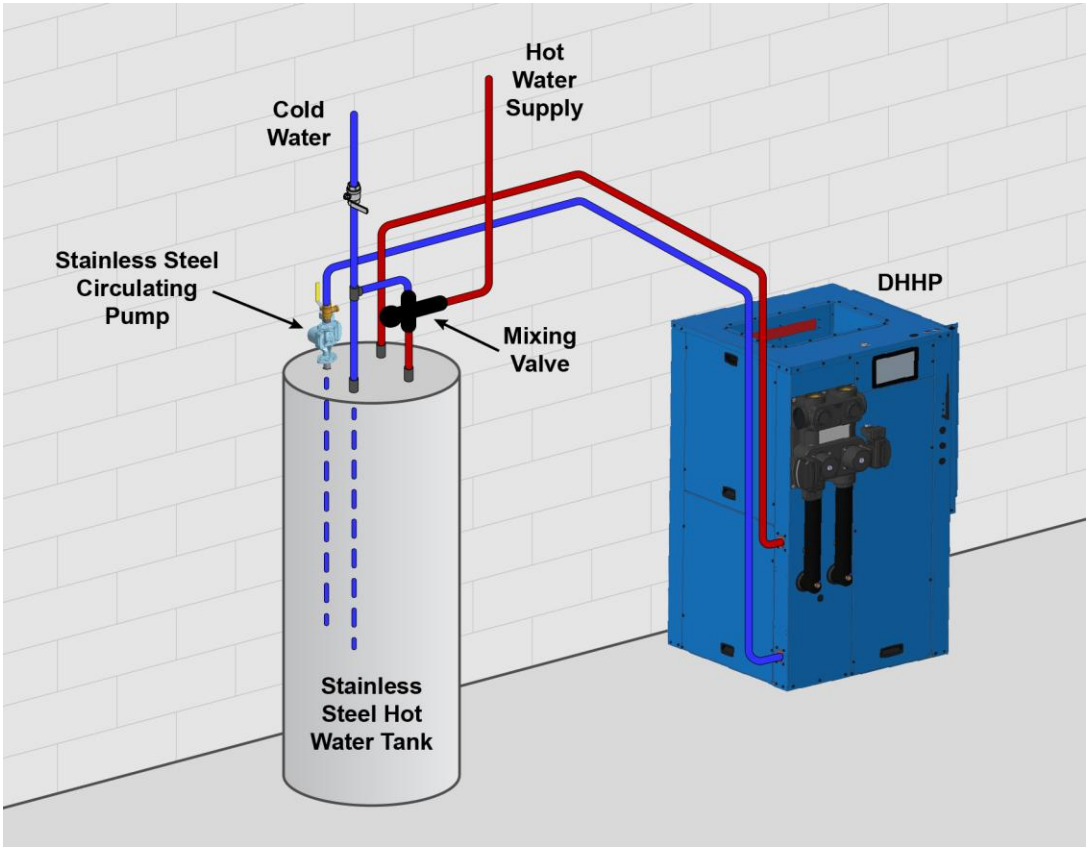


Figure 18: Forced air with Dedicated DHW plumbing diagram

NOTE: See Table 5 for the minimum size of an individual ducted zone based on the Heat Pump model installed.

Table 5: Minimum duct zone size (CFM)

Model	Tons	Capacity Modulation	Min air volume @ .08" static pressure, for duct sizing (CFM)*
66	5.5	Part	250
		Full	
66 Boost	8	Part	250
		Full	
96	8	Part	300
		Full	

Buffer Tank for Multiple Heat Pump Units

A benefit of an Energy Catalyst Buffer Tank is that it can be shared between multiple Heat Pump units. With Energy Catalyst's standard equipment, a second Heat Pump can be added through parallel T-connectors in the supply and return piping. (See Figure 19.) Larger custom-sized Buffer Tanks with larger fittings can allow dozens of Heat Pumps to be interconnected. Since each Heat Pump has variable speed pumps, it makes for easy balancing of flow between the units.

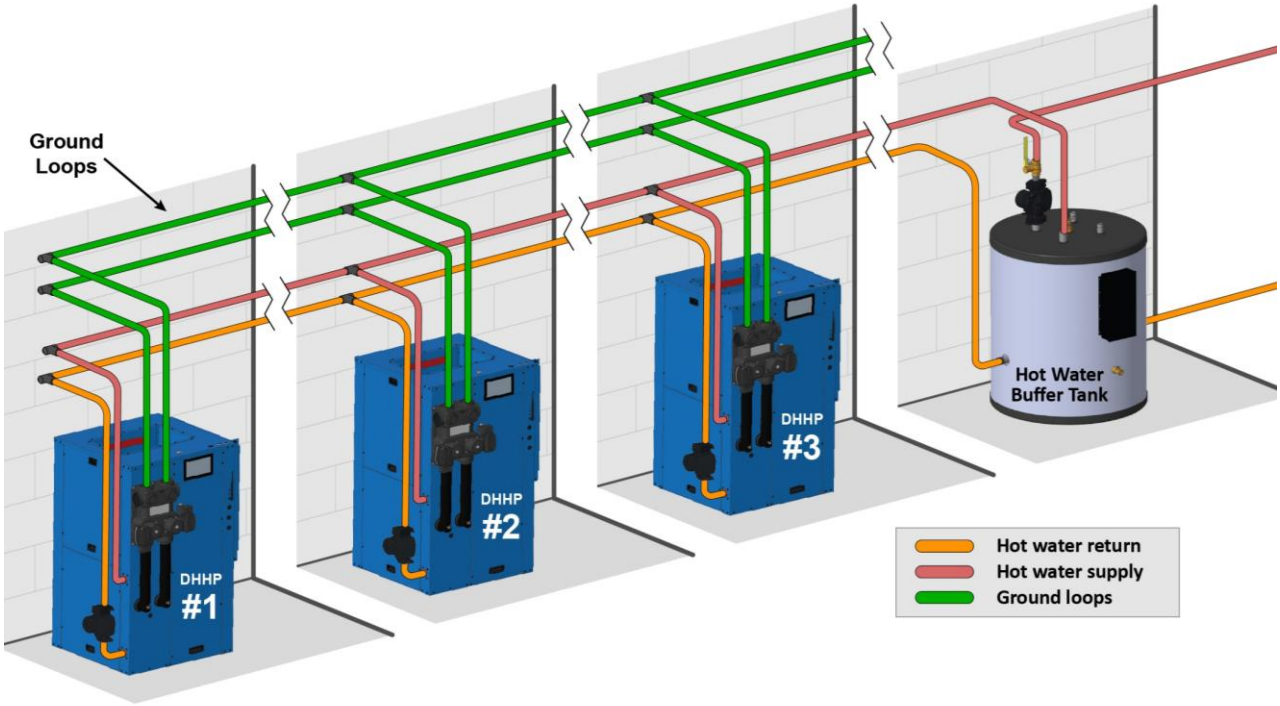


Figure 19: Layout for piping multiple Heat Pump units to a Buffer Tank

Thermostats and Hydronic Systems

The Energy Catalyst TeeStat thermostat is designed to allow for seamless integration with Energy Catalyst Heat Pumps for new construction or retrofit applications. The system needs at least one TeeStat thermostat to use Hybrid Mode, Hot Air Mode, Cooling Mode, or Cooling+ HW Mode. TeeStat thermostats can directly replace existing two-wire or three-wire thermostats. (See the *Multi-Zone Configuration* section for examples.)

Figure 20: Energy Catalyst TeeStat™ thermostat

Thermostats and Forced Air Systems

Energy Catalyst Heat Pumps can control up to six independent zones in a forced air heating system. The hardware will work with two-wire and three-wire dampers (see Figure 17). Thermostats can control multiple zones and can share control with other thermostats. The system will prioritize heating if both heating and cooling are called for at the same time.

If the power goes out, certain dampers may start in an undesired state. The state can be reset by changing the temperature on the thermostat which will trigger the damper to change position.

NOTE: See the

Pairing TeeStat™ Thermostats section for information on how to pair an Energy Catalyst TeeStat thermostat.

Pre-installation Information

Transportation and Storage

IMPORTANT! During transportation, special consideration must be taken to prevent exposing the Heat Pump unit to freezing conditions, as this can damage the unit. If a Heat Pump unit is taken to the job site or put in storage where it can be exposed to freezing conditions, antifreeze will need to be pumped into the water coils to prevent freezing. **Failure to do this will void the warranty.**

When transporting and storing:

- Move and store Heat Pump units in an upright position.
- Do not stack Heat Pump units.
- Inspect shipment for shipping damage. Any equipment or cartons in question should be removed from the packing and physically inspected. If any damage is detected, the carrier should make a note on the delivery slip acknowledging the damage.
- Check the packing slip for accuracy. In some cases, smaller items (such as temperature sensors) will be packed and shipped inside the Heat Pump unit.

Heat Pump Specifications – Vertical Unit

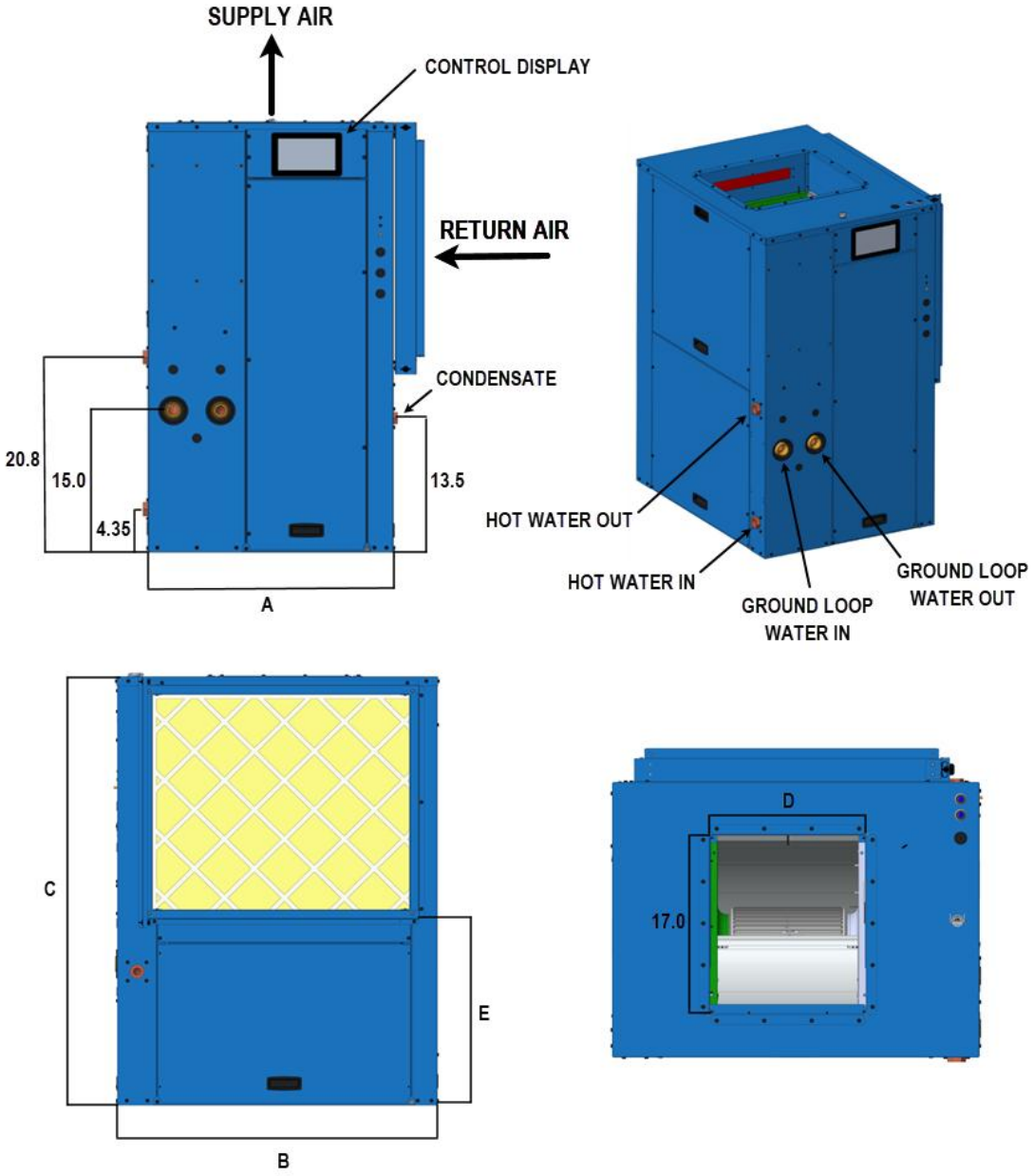


Figure 21: Heat Pump vertical unit specifications

Table 6: Heat Pump vertical unit specifications based on model

Model	A (in.)	B (in.)	C (in.)	D (Supply Air) (in.)	E (in.)	Return Air Size (L X W) (in.)	Filter Size (L X W) (in.)
66	26.0	34.0	46.5	14.5	21.1	27.375 x 23.500	29 x 25
96	28.0	34.0	54.0	16.0	18.3	28.625 x 32.625	34 x 30

Heat Pump Location Considerations

Care should be taken to ensure that the installation of the unit is successful:

CAUTION: Do not locate the Heat Pump unit in an area that is subject to freezing.

- Locate the Heat Pump unit in an indoor area that allows for easy servicing.
- Locate the Heat Pump unit where there is adequate ventilation and room for servicing.
- Heat Pump units should be placed on a level surface on a vibration-absorbing pad slightly larger than the base of the unit.
- Care should be taken to use the proper duct size.
- Make sure that the air filter and electrical access panels are easily accessible. (See Figure 22.)
- Provide sufficient room to make all ground loop, well water, domestic hot water, condensate, and electrical connections as needed. (See **Error! Reference source not found.**.)
- A condensate pump is needed for any system that uses cooling to take the condensate to a suitable drain location.
- If the Heat Pump unit is placed in a closet, make provision for adequate service access and proper return air flow to the unit.

Supplemental Heat

CAUTION: Only the factory-installed supplementary electric heater may be used. Field-added heaters or third-party heating elements are not permitted.

This appliance includes an integrated supplementary electric heater. Maintain the minimum clearances to combustible materials shown in Figure 22. Adhere to the minimum area requirements given in

Minimum Permissible Distance to Adjacent Structures

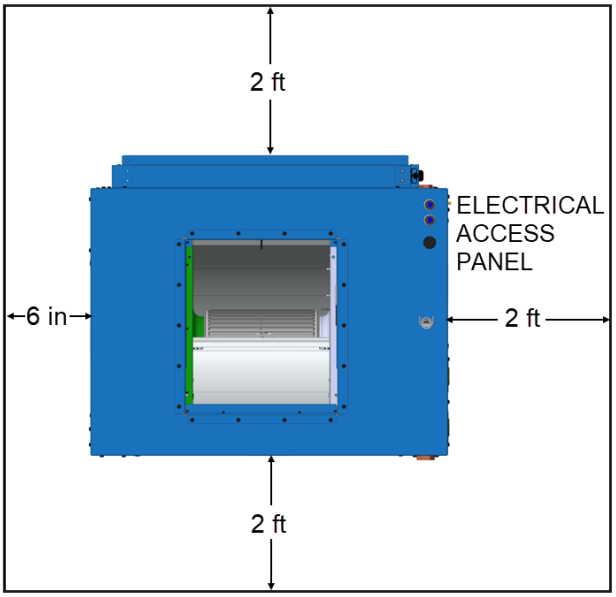


Figure 22: Top view with external clearances to unit

Table 7: Minimum area requirements

NOTE: Clearances were evaluated at an external static pressure of 0.4 in.

Minimum Permissible Distance to Adjacent Structures

Model	Minimum Room Area (ft^2)	Minimum Room Height (ft)	Unit Refrigerant Factory Charge (lb)
66	352	5.5	18
66 Boost	361	5.5	18.5
96	369	6.2	21

Air Filtering

To maintain good indoor air quality in a tight building, the air distribution system should have a high-efficiency air filter. To ensure proper Heat Pump operation, be sure to inform the building owner of the importance of proper maintenance and the maintenance schedule for checking/changing the filter installed. Most air filters require quarterly attention.

Construction or Remodeling

CAUTION: The Heat Pump should NEVER be run during any kind of construction or remodeling that would allow drywall, hard wood, or any kind of dust to be pulled into the system. Running the system during construction or remodeling will void the system warranty. Never operate without an air filter.

Even with extra filtering dust particles can accumulate in the duct system causing unwanted dust for years to come. It can also cause air coil clogging, condensate drain clogging, blower dust accumulation, and many other problems to the system.

If installing this system in a building that is under construction, cover the unit with a plastic bag (especially the air inlet and outlet) until the project is complete.

Water Quality Information

Energy Catalyst units use stainless-steel, brazed-plate heat exchangers which have an increased resistance to ground water chemicals, but are still susceptible to fouling and scale. Ensure that all water has been filtered and softened. If needed, install a carbon filter between the ground loop and the house.

In addition, we strongly recommend using non-ferrous materials, such as plastic, High-Density Polyethylene (HDPE), copper, or brass when connecting the ground loop to the Heat Pump. Materials like galvanized iron or black iron will rust over time, and the dissimilar metals could cause a cathodic reaction over time.

Condensate Drain Considerations

Make provisions for a condensate drain connection. Some installations require a condensate pump to take the condensate to a suitable drain. A condensate pump will be needed for any system that uses cooling.

All Energy Catalyst vertical Heat Pumps have P-traps built internally in the units. (See Figure 23.) These Heat Pumps require a vent to be installed downstream and outside of the unit. Excess condensate may trigger the condensate alarm and turn off the unit.

Figure 23: P-trap preinstalled inside the Heat Pump unit

IMPORTANT! Installation of a second P-Trap is not necessary and if installed, will not allow the unit's condensate pan to drain properly.

Installation

System Noise and Vibration Isolation

A quality installation should be one where noise is not a complaint. The following are recommendations to achieve a quality install.

Flexible Hose Kit

Installing flexible hose kits to the hot water ground loop will make for an easy connection to the Heat Pump and the hot water tank. It will also reduce any noise being transmitted from the Heat Pump to the indoor plumbing.

Vibration-Absorbing Pad

We recommend that the Heat Pump and all associated water pumps be installed on a vibration absorbing pad to isolate them from the floor. This pad will help prevent the cabinet from being rusted out by trapped moisture under the unit.

Basement Installation Recommendations

If installing the Heat Pump in a basement, we recommend placing the Heat Pump and Buffer Tank on blocks (2–4 inches tall) to protect against minor flooding. With a vibration dampening pad and blocks, the unit will be approximately 3–6 inches above the floor.

Flexible Duct Connections

Flexible duct connections help to reduce noise being transmitted from the Heat Pump through the metal ductwork. This collar also makes the connection of the Heat Pump to the ductwork a much simpler task.

Closed Loop Systems Plumbing

IMPORTANT! Do not use PVC or CPVC piping in any connections to the Energy Catalyst Heat Pump. The only exception where PVC or CPVC piping may be used is on the condensate lines.

IMPORTANT! Do not use ferrous metals in the ground loop piping. These include black iron and galvanized pipe and couplings. These will corrode over time and will foul the heat exchanger.

Minimum and maximum temperatures and pressures:

- Max ground loop operating temperatures: 90°F (32°C)
- Min ground loop operating temperatures: 22°F (-5°C)
- Max ground loop operating pressures: 100 PSI
- Min ground loop operating pressures: 10 PSI

Closed loop systems should be designed to allow at least 2.5 GPM per ton and should maintain a loop temperature above 32°F (0°C) and below 90°F (32°C).

IMPORTANT! Anti-freeze solutions will impart a higher pressure drop when the temperature of the solution decreases. Do not forget to account for this when calculating pumping requirements.

On residential units, a pump is typically required for each unit. The loop pump requirement will depend upon the loop design for a given application. The ground loop piping system must provide suitable access for purging air and debris from the ground loop and Heat Pump.

Purge a Closed Loop System

Purging of the closed loop and Heat Pump unit should be performed after it has passed the air pressure check. Purging requires a high velocity pump (flush cart) to purge air and dirt particles from the loop itself (see Figure 24).

NOTE: Purging should only be done by a qualified installer.

To properly purge a closed loop system, a minimum velocity of 2 feet per second in every branch of the ground loop must be achieved. The purge ports can also be used for anti-freeze charging.

If a Y-strainer is used on the ground loop inlet, flush the system in reverse direction to avoid collecting debris in the Y-strainer. Before concluding the flush, we recommend cleaning the Y-strainer.

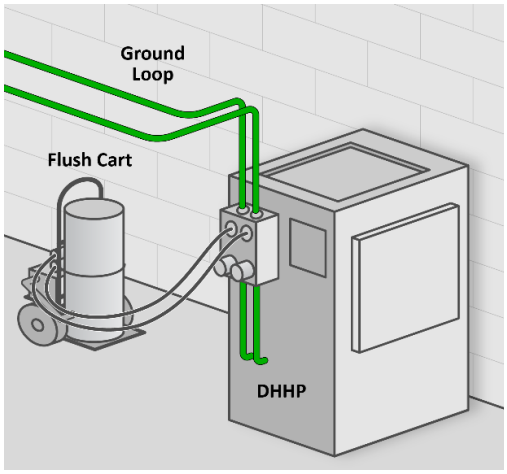


Figure 24: Typical ground loop flushing

Anti-freeze

All Energy Catalyst Heat Pump units use oversized, brazed-plate heat exchangers that are sensitive to failure by freezing. Anti-freeze should be added for all systems that have a design temperature below 50°F (10°C). Additionally, placing a Heat Pump in an attic or any other cold location without anti-freeze could cause the heat exchanger to freeze when the unit is off. Ensure the anti-freeze solution is well mixed.

IMPORTANT! Heat Pump units must maintain a minimum anti-freeze solution at all times.

IMPORTANT! All Energy Catalyst Heat Pumps use brazed-plate exchangers that are sensitive to freezing. Failure to use minimum anti-freeze solutions will cause severe damage to the unit. Damage to the Heat Pump caused by the failure to maintain proper anti-freeze levels is not covered under the warranty.

Minimum Anti-freeze Solutions (by mass):

Choose one of the following solution mixes for the anti-freeze:

- 10% Methanol
- 20% Propylene Glycol
- 10–20% Ethanol
- 20% Propylene Glycol and 5% Ethanol

The anti-freeze solution is added to the system through the flush cart.

IMPORTANT! The Heat Pump system is not intended for use with an open loop system. Using the Heat Pump with an open loop system will automatically void the warranty.

If using an open loop system, use an intermediary heat exchanger and connect one side to the unit with an anti-freeze solution.

Install the Ductwork

CAUTION: Observe the location where your ductwork is being attached to the unit. Ensure that drilling and screws do not penetrate and damage the air coil, wires, or pipes.

IMPORTANT!

- Always check register CFM requirements against register manufacturer's data for register performance.

- It is extremely important to ensure that duct system return air is not undersized. Undersized return air can cause poor system performance and, in some cases, can cause the blower to "pulse".
- Provide adequately sized supply air plenums and ductwork.
- Make all turns as smooth as possible, avoiding any restrictions.
- For residential design, the target static pressure should not be greater than 0.08 inches.
- In many areas in the northeast, code requires that ductwork must be insulated with R-8 insulation. Always install ductwork to local, state, and federal guidelines.

Ductwork should be designed to handle the CFM delivery for the unit while running at high speed. Manufacturer's recommendations for a supply duct are 0.08 inches static pressure on the supply and return ducts.

In the USA, ductwork sizing methods should follow *Air Conditioning Contractors of America (ACCA) Manual D* recommendations. Install ductwork within the conditioned space of the building to minimize duct heat loss or gain, wherever possible.

Installing Ductwork in an Attic Area

IMPORTANT! If ductwork is installed in an attic area, the ductwork needs to be built low profile and laid directly on the ceiling joist (code permitting).

After being installed and wrapped in insulation, it is recommended the ductwork be covered with 6 to 8 inches of cellulose. If the attic ductwork is not covered with cellulose, it can lose a significant amount of its heating and cooling capacity into the attic area. Ductwork that is inadequately insulated will cause poor system performance and customer dissatisfaction.

Installing in Heating Dominant Climates

For homes that use a Hybrid configuration in heating dominant climates, where full load cooling is not necessary, installers may opt to lower the **Max Compressor Speed in Cooling Mode** under **System Parameters** in **Heat Pump Settings**. (See the *Control System* section for more details.) Lowering the maximum compressor speed in cooling mode will allow the installer to size the duct work only for the expected cooling load, as long as the full heating load can still be met with a combination of forced air and hydronic heating.

Install the Plumbing

The Heat Pump will include a pre-mounted, pre-plumbed, and pre-wired flow center to circulate water from the unit to the ground loop (see

Figure 25: Heat Pump with flow center

).

This flow center allows a contractor to plumb supply and return lines directly to the Heat Pump unit without needing to mount an external circulator nearby.

Figure 25: Heat Pump with flow center

See Figure 8 for additional information regarding plumbing in a Hybrid configuration. See Figure 18 for additional information regarding plumbing in forced air systems.

Install Condensation Piping

The condensate drain should be piped to a drain or condensate pump. The Heat Pump unit has an internal P-trap and can be directly piped. (See Figure 23.)

Electrical Connections

Size all wires in accordance with local electrical code. Connect the incoming line voltage wires to L1, L2, and ground of the power block. (See Figure 26 and Figure 27.)

Based on the Heat Pump size and the current draw, install appropriately sized wire through the pre-punched ¾-inch access points. Secure the wires to the unit with non-metallic connectors. (See

Table 8 for electrical requirements.)

Figure 26: Electrical Main Outlets

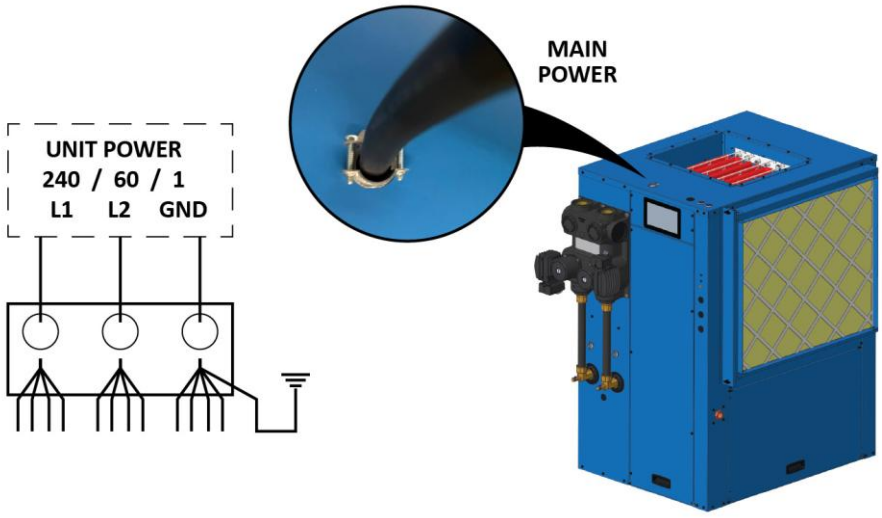


Figure 27: Main High Voltage wiring installation location on Heat Pump

Table 8: Electrical Requirements

HP Model	Heat Pump Breaker Size	40g Low Tank Backup Heat Breaker Size (4.5 kW)	60g Domestic Tank Backup Heat Breaker Size (4.5 kW)	60g Low Tank Backup Heat Breaker Size (9 kW)	Strip Heater in Heat Pump (7.5 kW)
66	60 A	30 A	30 A	50 A	40 A
66 Boost	60 A	30 A	30 A	50A	40A
96	60 A	30 A	30 A	50A	40A

Pairing TeeStat™ Thermostats

To pair an Energy Catalyst TeeStat thermostat:

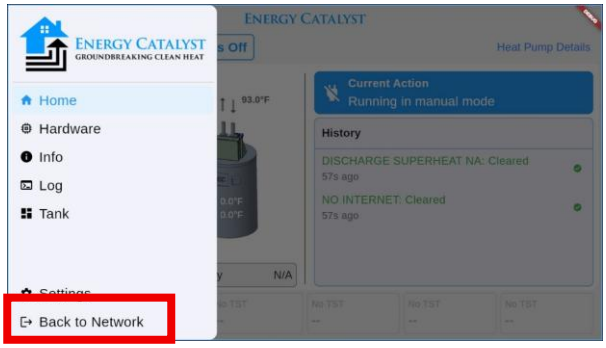
1. Tap the **Energy Catalyst** logo on the thermostat screen to enter the **Set Mode**.

2. Tap the **Admin** button slowly four times. Note the **Device ID** if pairing multiple thermostats.

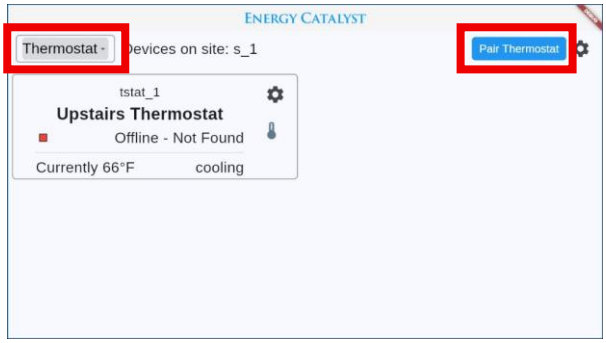
3. Tap **Send Pairing Signal**.

4. On the Heat Pump control panel, select the **Menu** button in the upper left corner of the screen.

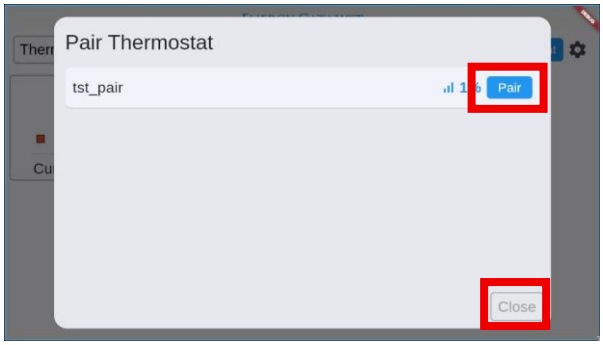
5. Select **Back to Network**.



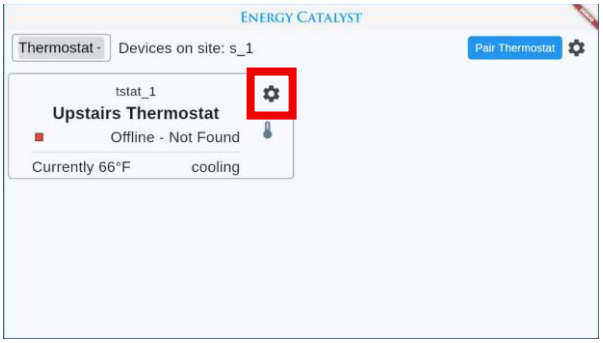
6. In the dropdown menu at the upper left, select **Thermostats**, and then tap the **Pair Thermostat** button on the upper right.



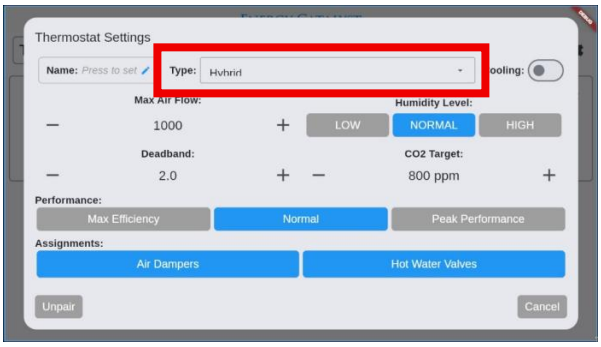
7. Select your thermostat from the list and tap **Pair**, and then **Close**.



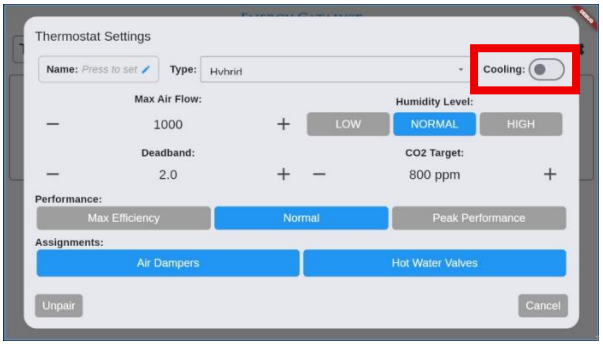
8. Select the gear icon on your thermostat listing.



9. The **Thermostat Settings** window displays. Select an appropriate type from the dropdown menu. For example, don't select Hybrid mode if there is no hydronic system.

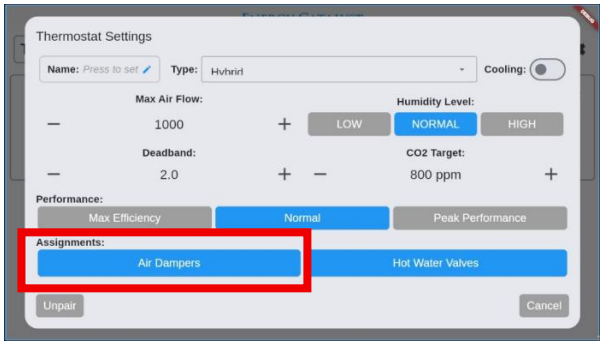


10. If there is ductwork to accommodate it, enable the **Cooling** toggle. This enables cooling as an option on the thermostat.



11. Select the **Air Dampers** button and assign the appropriate dampers.

NOTE: If the system has no dampers, you must still select at least one for the thermostat to work. An actual damper is unnecessary.



Control System

The control system is based around Raspberry Pi™ Compute Module 5s on the factory board and on Buffer Tank that handles processing at the display. Communications between the Raspberry Pi modules are mediated by a supplied router. It is vital that every “site” has exactly one Energy Catalyst-provided router connected. (A “site” is defined by all Heat Pumps connected to a shared hot water tank.) The sensors interface with these through the factory board and the Buffer Tank mini control board. Communications with the Refrigerant Detection System and the variable frequency drive is performed using Modbus RTU RS-485.

Sequence of Operations

There is a total of 14 temperature sensors throughout the system. See Figure 28 and Table 9 for information on sensor locations and functions.

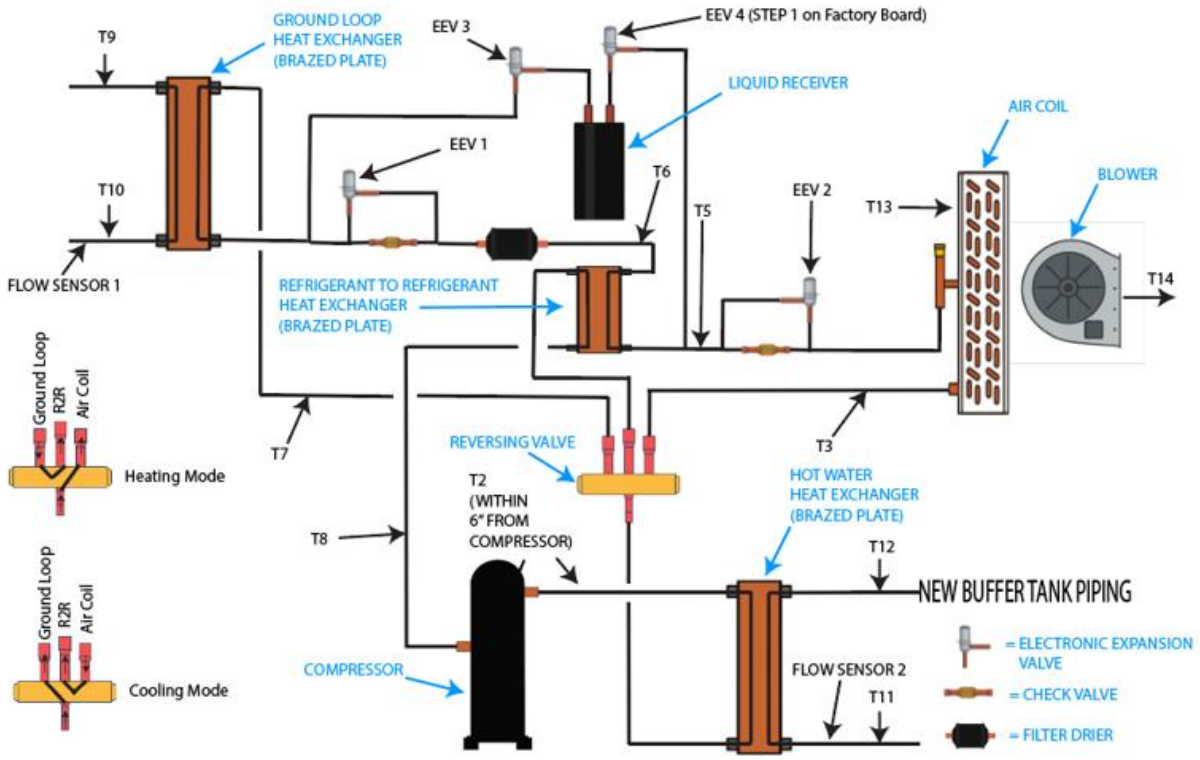


Figure 28: Temperature sensor locations

Table 9: How sensors in the system are used

Name	Description	How the Sensor is Used	Included in Heat Pump Package
T1	Tank temperature [°F]	T1 is used to compare the tank temperature to the tank temperature setpoint. In most modes, if T1 is below setpoint, it will turn on the compressor.	Yes
T2	Discharge superheat temperature [°F]	Service technician parameter.	Yes

T3	Post HW heat exchanger temperature [°F]	Service technician parameter.	Yes
T5	Cooling sub temperature [°F]	Service technician parameter.	Yes
T6	Subcooled refrigerant temperature [°F]	Service technician parameter.	Yes
T7	Evaporator refrigerant temperature [°F]	Service technician parameter.	Yes
T8	Compressor CP1 suction temperature [°F]	Service technician parameter.	Yes
T9	Ground loop inlet temperature [°F]	Ground loop (GL) inlet temperature is used for safety cutouts and for service technicians to determine performance.	Yes
T10	Ground loop outlet temperature [°F]	Ground loop (GL) outlet temperature is used for safety cutouts and for service technicians to determine performance.	Yes
T11	Hot water return temperature [°F]	Hot water return (HWR) temperature is used for a high temperature cutoff, for performance verification, and will raise the fan speed if the building is calling for heat beyond the maximum temperature range of the heat pump.	Yes
T12	Hot water supply temperature [°F]	Hot water supply (HWS) temperature is used for high temperature cutoff, for performance verification, and will raise fan speed if the building is calling for heat beyond the maximum temperature range of the heat pump.	Yes
T13	Return air temperature [°F]	Return air temperature (RAT) is used to compare for measuring differential temperature across the air coil.	Yes
T14	Supply air temperature [°F]	Supply air temperature (SAT) is used to adjust the speed of the blower while producing forced air.	Yes
OAT	Outside air temperature [°F]	Outside air temperature (OAT) is used to adjust the tank temperature setpoint to improve efficiency during mild weather conditions. On a mild winter day, the tank temperature setpoint is decreased. As it gets colder outside, the tank temperature setpoint increases. (Tank temperature setpoint is also known as hot water reset parameter.)	Yes
P1	Condensing pressure	Displays the discharge pressure and will cut off if the pressure gets too high. Useful for service technicians.	Yes
P2	Evaporating pressure	Displays the suction pressure and will cut off if the pressure gets too high. Useful for service technicians.	Yes

NOTE: The setpoint will not cause an action until it reaches hysteresis.

Backup Heat

There are two methods for providing backup heat:

1. Backup heat inside the Heat Pump unit. (See Figure 29.)
2. Backup heat on the Buffer Tank. (See Figure 30.)

The wiring for these two methods is different.

In most areas, electrical code requires 1.25 times the wire capacity as the backup power nominal draw. For instance, a backup element that uses 25 amps will need to use a wire capable of at least 31.25 amps and a 40-amp circuit breaker.

Backup Heat on the Heat Pump

The contactor for the strip heater for backup heat is inside the Heat Pump. Using wire from a second circuit breaker, connect power to the backup heat contactor.

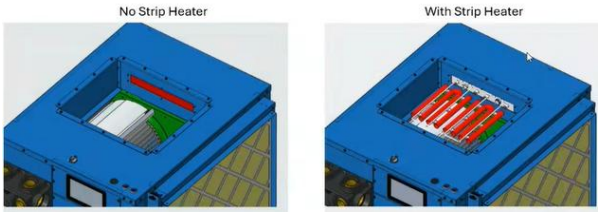


Figure 29: Backup heat on Heat Pump

Backup Heat on the Buffer Tank

IMPORTANT!
The Buffer Tank has two 4.5-kW, 41,000 BTU electric heating elements pre-installed for backup heat.

Each 4.5-kW heating element has a pair of pre-installed wires that go to an 11 x 17 electrical box on the side of the Buffer Tank. To utilize backup heating elements, run two 240VAC wires (30 amp for 40 gallon Low or 60 gallon Domestic, 50 amp for 60 gallon Low) from the Buffer Tank mini control board to the associated heating element wires and junction inside the electrical box. (See Figure 30.)

NOTE: If you only want to use one backup heat element, a 40-amp wire to the mini control board is sufficient.

NOTE: If you do not want to use either backup heat element, a 15-amp wire is sufficient.

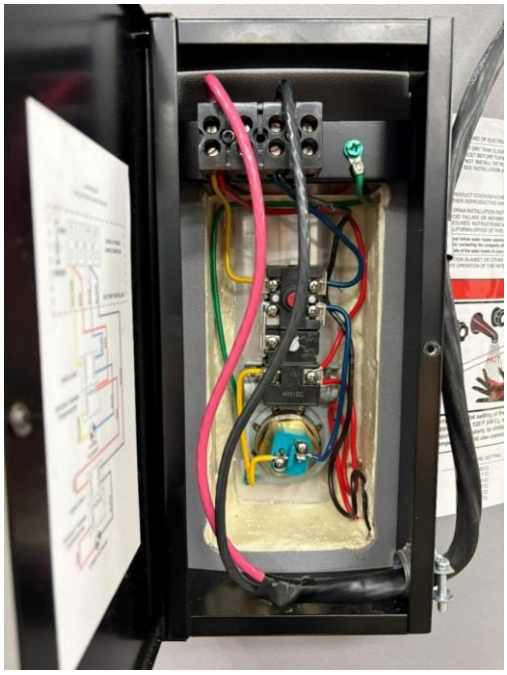


Figure 30: Backup heat wiring on Buffer Tank

For safety, each wire that goes into the Buffer Tank goes through a high temperature shut-off switch before going to the heating element.

The Buffer Tank has a separate power supply from the Heat Pump. This ensures the electric heating elements in the Buffer Tank continue to work in the event of Heat Pump failure.

During Heat Pump setup and by using the **Setting** menu, you can select either:

- No backup heat
- Separate hydronic source
- Additional forced air electric heater
- Integrated electric elements in hot water Buffer Tank
- Separate unconnected source (e.g. wood stove)
- Forced air electric heater and hot water element

Program the Control Panel Display

- The **Hydronic Hot Water Reset Schedule** should be adjusted in the **Heat Pump Settings** menu**,** depending on if it is attached to a domestic hot water heater, Butter Tank with domestic hot water preheat, or Buffer Tank solely used for hydronic heating.
- If anti-freeze was added, set the **Minimum Ground Loop Temperature** in **System Parameters** to match the level of anti-freeze protection that was provided. By changing this value, the installer takes full responsibility for the anti-freeze.
- Select the proper type in **Thermostat Settings**.
- Select the **Backup Heat Configuration** in **Heat Pump Settings**.

Troubleshooting

Problem	Possible Cause	Checks and Corrections
Compressor won't start	• Ground loop pump is OFF. The control system will prevent compressor from starting if the ground loop pump isn't running and issue a warning on the screen. • Temperature setpoint has been reached.	• Verify proper fluid flow through ground loop. Ensure that ground loop does not have entrapped air. • Check **Current Action** on the **Home** screen to see which calls have been received by the heat pump. • In Hybrid Mode, the compressor will not start until the temperature is below the setpoint plus hysteresis value. • Check faults/error screen.
Display screen does not load properly	• Ethernet connection between screen and router • Heat Pump controller disconnected	Verify Ethernet connections (lights should be blinking on the router).
Heat Pump is turning off too soon	• Check for any error codes. Check whether the Heat Pump is shutting down on low ground temperature. • Buffer Tank temperature setpoint too low.	• Installers must change the ground loop temperature minimum cutoff value to match the level of anti-freeze protection that was used. • The error code displays the sensor that caused the error. Check the high and low temperature warning and cutout temperatures by opening the **Hardware** screen and then finding the corresponding temperature sensor. • Check the Buffer Tank temperature setpoint.
Heat Pump was running, but now won't turn back on	Check for any error codes.	The Heat Pump requires a manual reset for certain safety limits.

Problem	Possible Cause	Checks and Corrections
Alarm: High/low pressure, condensate cutoff	• High pressure cutoff triggered. • Low pressure cutoff triggered. • Condensate cutoff triggered. • Problem with the cutoff circuit.	Turning off power for a moment may help to clear this fault.
Alarm: No flow rate in ground loop on start		
Alarm: No flow rate in ground loop		Purge the ground loop.
Alarm: Ground loop temperature too cold		
Alarm: High pressure cutoff	Referigerant is getting too hot.	
Alarm: Loss of charge	• There may be a leak in the refrigerant line. • The heat exchanger may be damaged.	• Check the **Hardware** screen to see if the Refrigerant Detection System was triggered. This would indicate a refrigerant line leak. • Find the lowest water temperature on the **Hardware** screen. Check to ensure the water flowing through that area has adequate anti-freeze protection. Frozen water in a heat exchanger can result in a crack where refrigerant can leak without being detected.
Alarm: Low pressure cutoff	Refrigerant is getting too cold.	
Alarm: No flowrate in recirculation hot water on startup		
Alarm: Refrigerant leak detected		
Alarm: No flow rate in recirculation hot water		
Alarm: Compressor fault		
Alarm: Discharge superheat temperature is too high		

Problem	Possible Cause	Checks and Corrections
Alarm: Discharge superheat temperature is not available	Wiring may be disconnected or damaged.	
Alarm: Frequent cutoffs in Hybrid Mode	Check for other error codes.	
Alarm: Frequent cutoffs in Hot Water Mode	Check for other error codes.	
Alarm: Frequent cutoffs in Cooling+ HW Mode	Check for other error codes.	
Alarm: Frequent cutoffs in Forced Air Mode	Check for other error codes.	
Alarm: Frequent cutoffs in Cooling Mode	Check for other error codes.	
Alarm: No internet connectivity	• Internet may be out. • Ethernet cable may be attached to the wrong port. • Wireless connection may be configured incorrectly.	

Maintenance

Refer to the following for maintenance tasks:

- This system is designed for closed loops only. If using an unpressurized flow center, check the water level every three months and anti-freeze level annually.
- If using a pre-mounted, pressurize flow center, as long as the system is operating properly, we do not recommend probing the water lines. Feel the pumps and connected piping to verify water movement. Ensure pressure is between 10–100 psi at all times.
- Replace filters as needed. In most homes, this is either quarterly or semi-annually. Ensure that filter rack is properly reattached.
- It is recommended to fill out a *Startup Worksheet* every 2 years to track any variations in performance. (See Appendix A: Startup Worksheets.)

Customer Care

How to Replace the Heat Pump Filter and Frequency

- Air filters must be clean to obtain maximum performance. They should be inspected quarterly under normal operating conditions and be replaced when necessary.
- Heat Pumps should never be operated without a filter.
- The Heat Pump uses 2-inch-thick filters with ratings up to MERV 13.

Annual/Bi-Annual Check

It is good practice to have a service technician check the system and sensors at least once every two (2) years. Be sure to fill out a copy of the *Startup Worksheet* (Appendix A: Startup Worksheets) with temperature and pressure values to keep a historical record.

Unit Startup Checklist

Before powering on the unit, check the following:

- ☐ Attached pressure relief valve and drop tube from top of hot water tank, if applicable.
- ☐ High voltage wires are tightly attached; no loose or exposed wires in the control panel.
- ☐ Strip heater wires are firmly attached to the heating elements. These are prone to disconnection during transit.
- ☐ Piping completed and water system cleaned and flushed.
- ☐ Hot water tank is full and holding pressure.
- ☐ No water leaks visible anywhere.
- ☐ Condensate pump is connected, pitched as needed, and powered.
- ☐ Air is purged from closed loop system.
- ☐ Air filter is clean and in position. Filter rack cover is tightly attached.
- ☐ Service/access panels are in place. This is especially important for any panels that cover the airside of the Heat Pump.
- ☐ Ensure the outdoor air temperature sensor is wired into the unit. The sensor should be placed in a location that receives minimal direct sun exposure.

Power on the unit. Now check the following:

- ☐ Set up settings, thermostats, and zones per heating design.
- ☐ Turn Heat Pump to manual mode and test ground loop, recirculation pumps, and blower. No air should be in the lines. Purge air as needed.
- ☐ Confirm appropriate flowrates for ground loop and recirculation loops at full pump speed.
- ☐ During all testing, check for excessive vibration, noise, or water leaks. Correct or repair as required.
- ☐ Fill out the *Startup Worksheet*. (See Appendix A: Startup Worksheets.)

Appendix A: Startup Worksheets

STARTUP WORKSHEET

Heat Pump Startup/Check Worksheet (Circle Startup or Check)

Date: _____

Service Tech: _____

Location: _____

City and Zip: _____

Mode of Operation (Check one)

HY – Heating Mode with HW Hybrid selected ☐

FA – Heating Mode with Hot Air selected ☐

C – Regular Cooling Mode ☐

Purpose of Visit:

_____

_____

SYSTEM TEMPERATURES & PRESSURES

Hardware Screen

DAT (Supply Air Temperature, T14) _____ °F

RAT (Return Air Temperature, T13) _____ °F

Air-side Delta T (DAT-RAT) _____ **°F**

GL Inlet (Ground Loop Inlet, T9) _____ °F

GL Outlet (Ground Loop Outlet, T10) _____ °F

Ground Loop Delta T (GL Inlet-Outlet) _____ **°F**

Tank temp (T1 Tank Temperature) _____ °F

HWS (Hot Water Supply, T12) _____ °F

HWR (Hot Water Return, T11) _____ °F

Hot Water Delta T (HW Inlet-Outlet) _____ **°F**

Heat of Extraction:
(GL Delta T x 475 x Flow Rate (GPM) _____

Electrical Input: _____ Amps _____Volts

Heat of Rejection (BTU/Hr):
(Heat of extraction + Electrical Input x 3.41) _____

EFFICIENCY

Condensing temperature _____ **°F**

Hot water supply/ Discharge Air Temperature _____ **°F**

Approach Temperature (Condensing – Hot Water/Discharge Air temperature) _____ **°F**

Superheat (Should be around 10°F) _____ **°F**

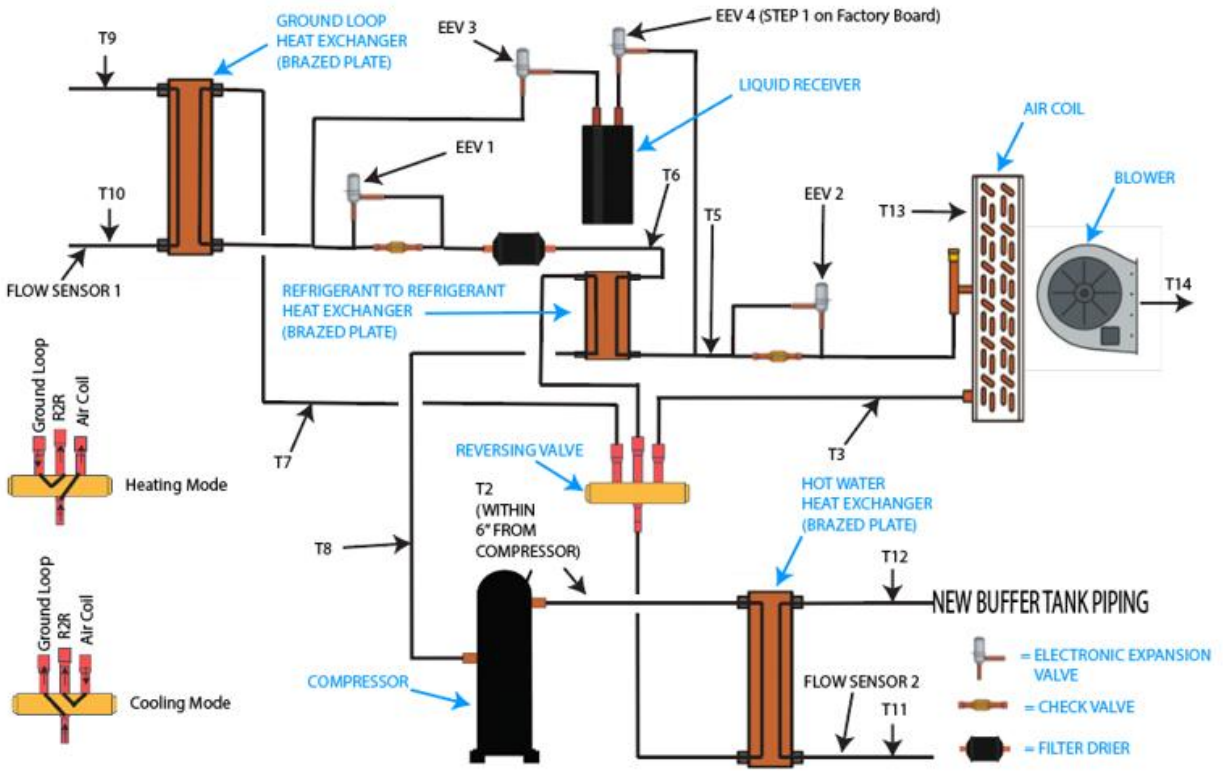
SPEEDS

RC Speed (%) _____

FAN Speed (%) _____

Estimated Flow rate (GPM) _____

Ground Loop Speed (%) _____



Revision History

Revision	Date	Page(s)	Description	Revised By
A	9/7/2023	All	Total redesign of the manual	Matt Desmarais
B	5/19/2026	All	Complete update for DHHP Gen 4	Matt Desmarais/ Sue Birkbeck
C	5/26/2026	All	Updated specs and mini panel figure	Randy Soldevilla

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