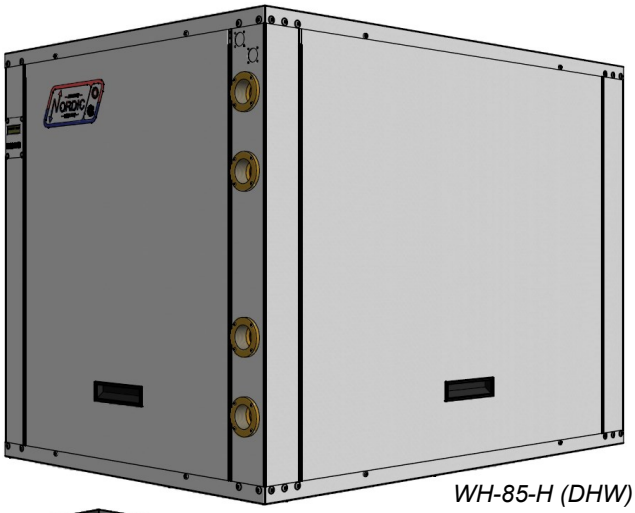
Application, Installation, & Service Manual

Water-to-Water Heat Pumps:
W-Series (Standard Range),
WH-Series (High Temperature),
WP-Series (Pool Heating)

Model Sizes 25-80 (Heating/Cooling)
Model Sizes 45-80 (Pool Heating)
Model Size 85 (Domestic Hot Water)

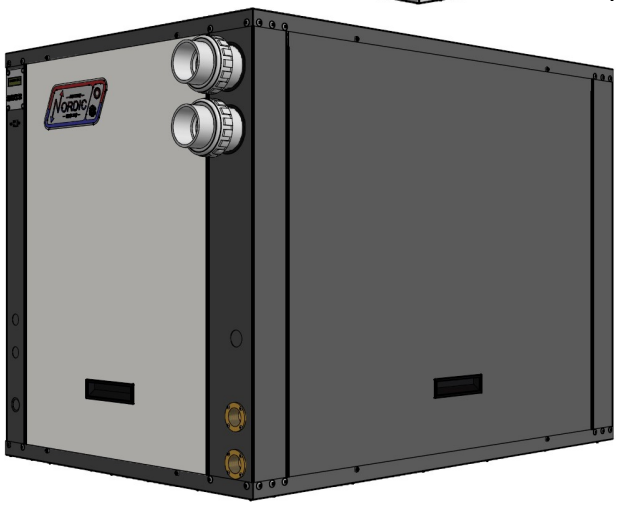
W/WH-25/45/55

W/WH-65/75/80



WH-85-H (DHW)

WP-45/55/65/75/80



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SAFETY PRECAUTIONS

WARNING: **Ensure all access panels are in place and properly secured before applying power to the unit. Failure to do so may cause electrical shock.**

WARNING: **Before performing service or maintenance on the heat pump system, ensure all power sources are DISCONNECTED. Electrical shock can cause serious personal injury or death.**

WARNING: **Heat pump systems contain refrigerant under high pressure and as such can be hazardous to work on. Only qualified service personnel should install, repair, or service the heat pump.**

CAUTION: **Safety glasses and work gloves should be worn at all times whenever a heat pump is serviced. A fire extinguisher and proper ventilation should be present whenever brazing is performed.**

CAUTION: **Venting refrigerant to atmosphere is illegal. A proper refrigerant recovery system must be employed whenever repairs require removal of refrigerant from the heat pump.**

Model Nomenclature

WH - 65 - HACW - B - 1S - CC - xx

Series:
W = standard temperature water to water
WH = high temperature water to water
WP = pool heating water to water

Nominal Size:
25 = 020/21 compressor
45 = 030/32 compressor
55 = 040/42 compressor
65 = 051/54 compressor
75 = 060/61 compressor
80 = 068/70 compressor
85 = 094 compressor

Functions:
H = heating
AC = active cooling
(reversing valve)
W = DHW desuperheater

Refrigerant:
P = R410a
B = R134a

Revision:
01, 02 etc.

Indoor Loop Exchanger:
C = copper coaxial
Y = CuNi coaxial & piping
Z = CuNi coaxial coil only
T = titanium/PVC coaxial
P = brazed plate
D = double wall brazed plate

Outdoor Loop Exchanger:
C = copper coaxial
Y = CuNi coil & piping
Z = CuNi coil only
P = brazed plate

Compressor:
T = 2-stage scroll
S = single stage scroll

Voltage Code:
1 = 208/230-1-60
2 = 208-3-60
3 = 265/277-1-60
4 = 460-3-60
5 = 575-3-60
6 = 220-1-50
7 = 380-3-50

APPLICATION TABLE: W-SERIES									
MODEL	**FUNCTION**	**REFRIGERANT**	**VOLTAGE**	**COMPRESOR**	**OUTDOOR COIL**	**INDOOR COIL**	**REVISIONS**		
W-25	HACW	P	1 2 4 6 7	T	C Y Z	C Y Z	11		
W-45	HACW	P	1 2 4 5 6 7	T	C Y Z	C Y Z	11		
W-55	HACW	P	1 2 4 5 6 7	T	C Y Z	C Y Z	11		
W-65	HACW	P	1 2 4 5 6 7	T	C Y Z	C Y Z	11		
W-75	HACW	P	1 2 4 5 6 7	T T T T S T	C Y Z	C Y Z	11		
W-80	HACW	P	1 2 4 5 7	S	C Y Z	C Y Z	11		
This manual applies only to the models and revisions listed in this table									

APPLICATION TABLE - FIRMWARE AND PC APP			
Firmware	**Version***	**Associated PC APP**	**Version**
MGT GEN2 Bootload Firmware	V3.60+	MGT GEN2 PC APP	V2.00+

APPLICATION TABLE: WH-SERIES										
SIZE	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESSOR	OUTDOOR COIL	INDOOR COIL	REVISIONS			
WH-25	H	B	1 2 4 6 7	S	C Y Z	C Y Z	04			
	HACW	B	1 2 4 6 7	S	C Y Z	C Y Z	02			
WH-45 WH-55 WH-65	H	B	1 2 4 5 6 7	S	C Y Z	C Y Z	04			
	HACW	B	1 2 4 5 6 7	S	C Y Z	C Y Z	02			
WH-75	H	B	1 2 4 5 7	S	C Y Z	C Y Z	04			
	HACW	B	1 2 4 5 7	S	C Y Z	C Y Z	02			
WH-80	H	B	1 2 4 5 6 7	S	C Y Z	C Y Z	04			
	HACW	B	1 2 4 5 6 7	S	C Y Z	C Y Z	02			
WH-85	H	B	2 4 5 7	S	P	D	04			
This manual applies only to the models and revisions listed in this table										

APPLICATION TABLE - FIRMWARE AND PC APP			
Firmware	Version*	Associated PC APP	Version
MGT GEN2 Bootload Firmware	V3.60+	MGT GEN2 PC APP	V2.00+

Maritime Geothermal Ltd. has a continuous improvement policy and reserves the right to modify specification data at any time without prior notice .

APPLICATION TABLE: WP-SERIES									
MODEL	**FUNCTION**	**REFRIGERANT**	**VOLTAGE**	**COMPRESOR**	**OUTDOOR COIL**	**INDOOR COIL**	**REVISIONS**		
WP-45	H	P	1 2 4 5 6 7	S	C Y Z	T	03		
WP-55	H	P	1 2 4 5 6 7	S	C Y Z	T	03		
WP-65	H	P	1 2 4 5 6 7	S	C Y Z	T	03		
WP-75	H	P	1 2 4 5 7	S	C Y Z	T	03		
WP-80	H	P	1 2 4 5 6 7	S	C Y Z	T	03		
This manual applies only to the models and revisions listed in this table									

APPLICATION TABLE - FIRMWARE AND PC APP			
Firmware	**Version***	**Associated PC APP**	**Version**
MGT GEN2 Bootload Firmware	V3.60+	MGT GEN2 PC APP	V2.00+

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Series Description

Maritime Geothermal Ltd. has made NORDIC brand package water-to-water heat pumps in residential sizes (nominal 2 to 6 tons) for almost 40 years. They are used for residential heating through hydronic distribution systems like radiant in-floor piping, radiant ceiling panels, radiators, hydronic baseboards, or hydronic air handlers/fan coils. Reversing units (-HAC/HACW) can also chill water for hydronic cooling applications.

Being a water source, 'geoexchange', or 'geothermal' heat pumps, these types of heat pumps do require a heat source in heating mode, or a place to reject heat in cooling mode. This can be:

a) a closed ground loop with a circulating water/ antifreeze solution; or
b) an open loop water well, with water re-injected in a second well or otherwise run off.

1. Heating Mode

In heating mode, the heat pump heats water in a buffer tank (or swimming pool) to a user-adjustable setpoint temperature, while extracting heat from the outdoor loop. If a closed ground loop is used, the pumps are powered and controlled by the heat pump; if open loop, a water valve is opened by the heat pump during heating operation and closed when the heat pump is idle.

Hydronic heating systems are easily zoned, and zones may be in-floor heating, hydronic air handlers, or other hydronic devices suitable for the water temperature capability of the heat pump series. When a zone requires heat, its zone thermostat calls for a zone circulator pump or zone valve to activate, so that hot water from the buffer tank is sent to the zone requiring heat. Note that there is no direct connection between the zone thermostat and the heat pump, the functions of each being separated by the buffer tank.

2. Cooling Mode *(Reversing models **HACW/HAC** only)*

In cooling mode, the heat pump cools water in the buffer tank. Heat is rejected to the outdoor loop.

Hydronic cooling is usually done through hydronic air handlers, which have condensate drains to remove water that is removed while dehumidifying the air. In less humid climates, in-floor or radiant ceiling cooling is sometimes performed; such systems can't remove humidity from the air. In this case, care must be taken to ensure the cooling surface does not fall below the dew point temperature in order to prevent condensation on floor surfaces.

There are several types of NORDIC water to water heat pumps:

W-series

This is the standard temperature geothermal space heating/cooling series, using R410a refrigerant. They can extract heat from cold northern ground loops, and heat water on the indoor side up to **120°F (49°C),** using a dual-capacity (2-stage) compressor.

WH-series

The WH-series is a high-temperature-range version of the W-series, using R134a refrigerant. They can heat water on the indoor side up to **160°F (71°C),** but require a **minimum heat source fluid temperature 45°F (7°C)**.

For both W and WH series, the indoor and outdoor loop heat exchangers are heavy duty coaxial copper / steel models with optional CuNi inner tube. Scroll compressors and Electronic Expansion Valves (EEVs) are standard. The electronic control board has full hydronic temperature control, laptop connectivity via USB with free PC App, LCD interface, electronic readout of all pressures and temperatures, data logging & graphing, and BACnet.

The Nordic **WH-85-H** is a special purpose model with a brazed plate evaporator and double wall brazed plate condenser for direct domestic hot water heating in commercial applications. (Other W/WH model sizes may be used for DHW heating or pre-heating, but normally must be used with a secondary heat exchanger or indirect tank with coil to satisfy codes.)

WP-series

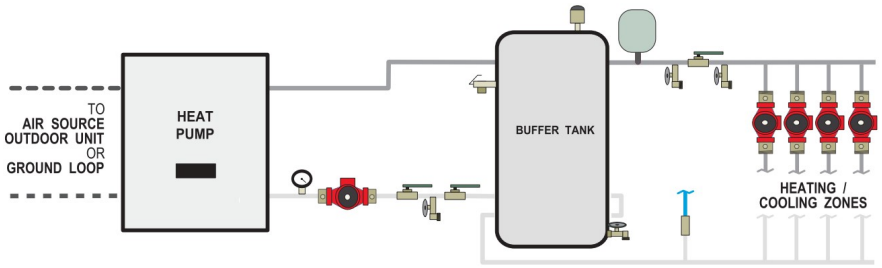
This is the dedicated pool heating version of the standard temperature R410a W-series. Normally used for outdoor pools, it has a titanium/PVC indoor loop coil, single stage compressor, and no reversing valve. It can heat pool water to as high as 105°F (41°C), which is a suitable temperature for a hot tub or spa.

One or Two Buffer Tanks?

This is an important design choice that needs to be made when planning an installation. These systems are described more fully in the following chapters.

Single Buffer Tank Systems

By far, this is how most systems are configured. The heat pump either heats water in the buffer tank for zone use during heating season, or chills water in the buffer tank for zone use during cooling season. Note that a single tank is always all that is required for heating-only systems that don't do cooling.

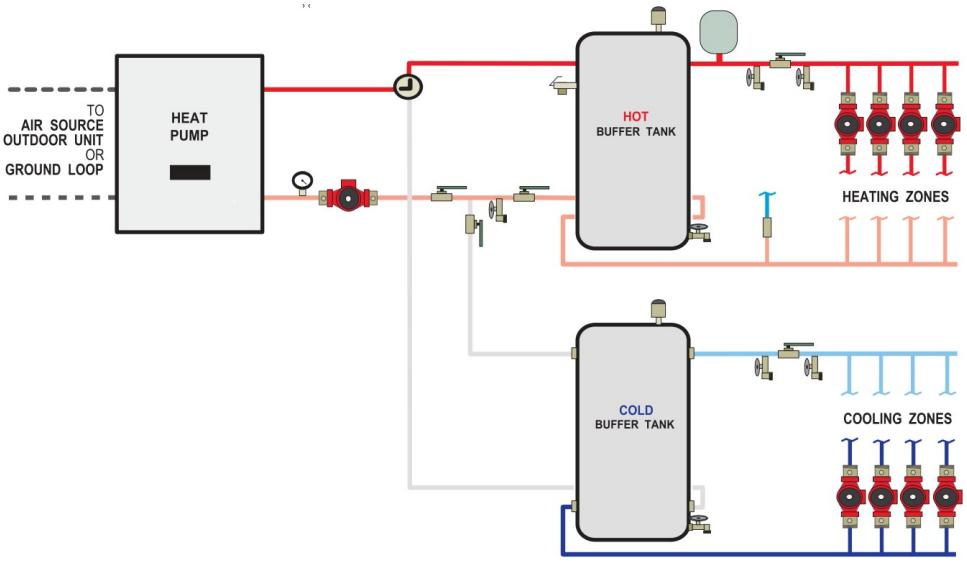


Advantages	Drawbacks
Simplest piping and control.	Seasonal switchover from heating to cooling required, either automatically through a zone controller or via a manual switch.
Is the go-to option for heating-only systems.	Simultaneous heating and cooling is not possible; heating and cooling in close proximity is not practical.
Works well for heating and cooling using **2-pipe** air handlers (and in-floor heating).	Dedicated domestic hot water preheating is not possible in summer due to no hot tank being available.
Takes the least amount of mechanical room space.	
Lower equipment cost than a 2-tank system.	

Dual Buffer Tank Systems

There are some situations in which it is advantageous to use two tanks, one always heated and one always chilled. The heat pump has a built in routine to automatically maintain both the hot and cold tank temperatures.

In this system, hot and cold water are available for use at any time. In the setup described here, the heat pump switches back and forth using a 3-way valve to heat one tank or cool the other. (With a water to water heat pump, it is also possible to pump heat from one tank to the other for true "simultaneous" heating and cooling, although such a system is more complex to install.)



Advantages	Drawbacks
No seasonal switchover is required.	Heating and cooling distribution devices need to be separate devices or flow directed with the addition of zone 3-way valves.
Simultaneous heating and cooling *is* possible; heating and cooling in close proximity *is* practical	Plumbing and control may get complicated for multiple heat pumps connected to same buffer tanks.
Year-round dedicated domestic hot water preheating is possible.	Plumbing and control may get complicated if using a standalone heating device (like a boiler) for auxiliary heat.
Works well for heating and cooling using **4-pipe** air handlers(and in-floor heating).	Takes more mechanical room space.
	Higher equipment cost than a 1-tank system.

Sizing for Space Heating/Cooling

W/WH-Series Heat Pump Sizing

Table 1 shows the above grade size of building that can typically be heated/cooled in northern climates for:

- W-series on a closed ground loop
- WH-series when indoor loop is normally being heated to near its maximum temperature **(160°F / 71°C)**.

TABLE 1 - Heat Pump Size vs. Heated Area		
Model	**ft^2**	**m^2**
W/WH-25	**800**	**75**
W/WH-45	**1400**	**130**
W/WH-55	**2000**	**185**
W/WH-65	**2600**	**240**
W/WH-75	**3100**	**290**
W/WH-80	**3500**	**325**

Table 2 shows the above grade size of building that can typically be heated/cooled in northern climates for:

- W-series on an open loop (well water)
- WH-series when indoor loop is normally being heated to a more moderate temperature **(~130°F / 54°C)**.

TABLE 2 - Heat Pump Size vs. Heated Area		
Model	**ft^2**	**m^2**
W/WH-25	**1000**	**95**
W/WH-45	**1800**	**165**
W/WH-55	**2500**	**230**
W/WH-65	**3200**	**295**
W/WH-75	**3800**	**355**
W/WH-80	**4200**	**390**

THE TABLES ABOVE ARE FOR ESTIMATION ONLY. THEY SHOULD NOT BE USED TO SELECT A FINAL UNIT SIZE. They simply show what size unit is required for a northern home with typical construction: R20 walls, R40 ceiling, and average size and number of windows. The heated area is the area of the above grade main level; the tables account for a basement the same size as the heated area.

MARITME GEOTHERMAL LTD. HIGHLY RECOMMENDS THAT A PROPER HEAT LOSS/GAIN ANALYSIS BE PERFORMED BY A PROFESSIONAL WITH APPROVED CSA F-280 SOFTWARE BEFORE SELECTING THE HEAT PUMP SIZE. For heating dominant climates, we recommend sizing the unit to 100% of the heating design load for maximum long term efficiency with minimal supplementary heat. The unit should be installed as per CSA standard 448.2-02. For ground loop applications, the ground loop should be designed using suitable software with a multi-year analysis.

The analysis will result in a heat load for the coldest day, which is influenced by, for example, the number of levels, the size of the windows, the orientation of the home, attached garage, bonus rooms, walk-in basement, and coldest outdoor temperature for the region.

A heat pump model size can then be selected by comparing the calculated heat load to the heat pump capacity at the design indoor loop temperature, which can be found in the performance tables in the **Model Specific Information** section. For W-series, the *Standard Capacity Ratings* rather than detailed performance tables can be used for simplicity. For 100% heat pump sizing, choose a heat pump with a standard capacity rating that matches or just slightly exceeds the calculated heat load.

Some background on *Standard Capacity Ratings*: closed ground loops are normally designed to reach a minimum temperature of just below freezing at the end of the heating season, in order to take advantage of the latent heat of groundwater (at least in northern climates). Hence, the Standard Capacity Ratings for Ground Loop Heating should apply in all northern climates. Conversely, the Standard Capacity Ratings for Ground Water (open loop) heat pumps assume a well water temperature of 50°F (10° C). In more southerly climates, the groundwater or ground loop will probably be at a warmer minimum temperature, and it will be necessary to consult the more detailed performance tables for heat pump output at a different ELT.

In cooling dominant climates, the heat pump should be similarly sized using the Ground Loop Cooling or Ground Water Cooling Standard Capacity Ratings. **Even in northern heating dominant climates, it should be ensured that 100% of the cooling load will be covered when sizing the heat pump, since there is normally no auxiliary or backup cooling available.**

Auxiliary Heat Sizing

The easiest way to provide auxiliary or backup heat for new installations is by installing a buffer tank that has electric elements. Buffer tanks with elements that are certified for space heating use are available as accessories from Maritime Geothermal Ltd., or others may be used. For retrofits, often an existing heat device can be used for auxiliary heat. Note that if the geothermal heat pump is sized for 100% of the coldest day heat load, auxiliary heat is not strictly required (unlike with an air source heat pump).

For full backup, an option which is good for peace of mind (should the heat pump experience a problem) but can require significant electrical service capacity, an element size can be chosen that covers 100% of the coldest day heat load, according to the heat loss analysis mentioned in the last section. If a heat loss analysis is not available, the following table may be used as a guide.

TABLE 3 - Auxiliary Heat Sizing		
Model Size	**Tank Element Size**	
	Recommended	**EcoUltra Tank Available**
25	**7 kW**	**12 kW (50 gal)**
45	**10 kW**	**12 kW (50 gal)**
55	**12 kW**	**15 kW (70 gal)**
65	**15 kW**	**15 kW (70 gal)**
75	**20 kW**	**20 kW (70 gal)**
80	**20 kW**	**20 kW (70 gal)**

For heat pumps that are sized to cover less than 100% of the coldest day heat load, the elements can be sized to make up the coldest-day difference. The CSA installation standard allows geothermal heat pumps to be sized to as little as 75% of the coldest day heat load.

For retrofits, the existing heating device (e.g. an electric or gas boiler) may be used for auxiliary heat. It should be wired as described in the **Wiring** section, and piped in a parallel arrangement as per the diagram in the **Piping** section.

Sizing for Pool Heating

Indoor Pools

While both indoor and outdoor pools normally need to be heated, indoor pools have the additional consideration of requiring dehumidification of the pool room air, to avoid moisture damage to the building envelope.

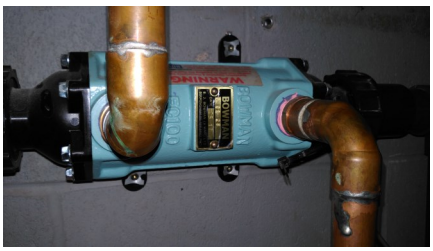
A NORDIC ***PC-series*** indoor pool room dehumidifier rejects its heat into the pool room air or pool water, and can provide all the heat needed for the water in a typical indoor pool while dehumidifying. Because it fulfills both purposes, it is the preferred way to heat indoor pools. It is sized according to the surface area of the indoor pool; see the PC-series manual for detailed sizing method.

Outdoor Pools / Hot Tubs

On the other hand, outdoor pools or hot tubs have no air dehumidification requirement. They may be economically heated by a water source heat pump, which may be:

a) A dedicated ***WP-series*** heat pump, which directly heats pool water circulated by the pool filter pump through its titanium/PVC heat exchanger; and extracts its heat from a closed ground loop / open loop water well that may or may not be shared with a heat pump that heats or cools the house.

b) A heating zone from a zoned hydronic heating system in the house, using a hydronic water to pool water heat exchanger.



Note that any water to water heat pump is designed to be installed in an indoor mechanical room, rather than outdoors near the pool like an air source pool heat pump.

Outdoor Pool/Hot Tub Heat Load

The heat load from an outdoor pool or hot tub is influenced by many factors:

- Difference between desired pool temperature and outdoor temperature during coldest month of use
- Wind exposure
- Humidity
- Covered vs. not covered

To calculate an approximate heat load for an outdoor swimming pool or spa, follow these steps:

1. Determine your desired swimming pool or hot tub temperature in °F. Pools are often kept at **80°F (27°C)** and hot tubs are often kept at **104°F (40°C)**.
2. Determine the average outdoor temperature in °F for the coldest month of pool use.
3. Subtract the average temperature for the coldest month from the desired pool temperature. This will give you the ***Temperature Rise*** needed in °F.
4. Calculate the ***Pool Surface Area*** in square feet.
5. Use the following formula to determine the pool heat load in Btu/hr:

   Pool Surface Area x ***Temperature Rise*** x **12**

This formula is based on a 1° to 1.25ºF temperature rise per hour and a 3.5 mph (5.5 km/h) average wind at the pool surface. Temperature rise is a function of the heat pump's output and depth of the pool, or how much water is in it; this can be checked after a model size is selected, below. For a 1.5ºF rise multiply by **1.5**. For a 2ºF rise multiply by **2.0**.

WP-Series Heat Pump Sizing

Once you have determined the pool's heat load, you can match it to a WP-Series model size in the **Capacity Ratings** table in the **Model Specific Information: WP-Series** section. The table shows the heating capacity at two water temperatures: **80°F (27°C)** for a pool, and **104°F (40°C)** for a hot tub. The table also lists two ground loop temperatures; normally in the summer (when heat is being rejected into a shared ground loop due to air conditioning) the higher of the two (50°F / 10°C) can be counted on, regardless of whether an open or closed loop is used.

Note that heat load from an outdoor pool can be very high, and even the largest model size **WP-80** might not meet the heat load. In this case, an auxiliary heater could be considered; or another approach would be to expect the pool to be cooler than the setpoint temperature during colder weather. The heating shortfall on colder days can be mitigated through consistent use of an insulated pool cover.

Installation Basics

Unpacking the Unit

When the heat pump reaches its destination it should be unpacked to determine if any damage has occurred during shipment. Any visible damage should be noted on the carrier's freight bill and a claim filed.

Unit Placement

The placement of a hydronic heat pump has negligible effects on the efficiency and operation of the system. The buffer tank should be placed next to the heat pump. For open loop systems, the unit can be placed near the well water system. Ground loop system units can be placed near where the ground loop pipes enter the structure to keep the ground loop piping, heat pump and circulator pump module in one location. The hydronic layout may make a particular location ideal for the unit installation.

Looking at the side of the heat pump where the pipes come out, the front and right side access panels should remain clear of obstruction for a distance of **2 feet** to facilitate servicing. Two units may be stacked, with a **continuous** rubber pad (not just point supports) or pink/blue styrofoam between them.

It is recommended that the heat pump be placed on a piece of 2" Styrofoam, or the rubber pad available as an accessory from Maritime Geothermal. This will deaden compressor noise emitted from the bottom of the cabinet, and prevent cabinet corrosion.

Sample Bill of Materials - W/WH Series on Ground Loop

FROM MARITIME GEOTHERMAL
- W/WH SERIES HEAT PUMP
- BUFFER TANK W/ELEMENTS __kW
  (or INDIRECT TANK FOR DEDICATED DHW)
- P/T PORTS AND HOSE ADAPTERS (2)
- 1 OR 2 PUMP PACK
- PIPE ADAPTERS FOR PUMP PACK

OPTIONAL FROM MARITIME GEOTHERMAL
- ANTI-VIBRATION PAD
- SOUND JACKET
- SECURE START
- AHW-65 AIR HANDLER(S)
- MODULATING WATER VALVE FOR OUTDOOR LOOP

DHW
- PREHEAT TANK, 40 OR 60 GAL
- ½" COPPER PIPE
- ½" FITTINGS, BALL VALVES, BOILER DRAINS, CV

GROUND LOOP
- ¾" PE PIPE
- 1-1/4" PE PIPE
- PE PIPE FITTINGS
- 1" CLEAR HOSE (HEAT PUMP TO PUMP PACK)
- HOSE CLAMPS
- ANTIFREEZE: METHANOL OR PROP. GLYCOL

ZONES
- CIRCULATOR: HEAT PUMP TO TANK
- 1" PIPE & FITTINGS: HEAT PUMP TO TANK
- ZONES CIRCULATOR(S)
- ZONE TRANSFORMER & CIRC CONTACTOR
- ZONE VALVES (IF NOT INDIVIDUAL PUMPS)
- IN-FLOOR PIPING
- OTHER AIR HANDLERS, DUCTING
- ZONE THERMOSTATS
- ZONE SUPPLY & RETURN HEADERS
- PIPE & FITTINGS TO ZONES
- EXPANSION TANK

ELECTRICAL
- HEAT PUMP SERVICE WIRE 6-3 OR 8-3
- BUFFER TANK ELEMENT SERVICE WIRE
- HEAT PUMP BREAKER
- BUFFER TANK ELEMENT BREAKER
- ELEMENT CONTACTOR & ELEC. BOX (IF NOT WITH TANK)
- THERMOSTAT WIRE 18-4
- THERMOSTAT WIRE 18-2
- FORK TERMINALS FOR TSTAT WIRE (6)
- 2" STYROFOAM INSUL. (IF PAD NOT PURCHASED)

Sample Bill of Materials - W/WH Series on Open Loop

FROM MARITIME GEOTHERMAL
- W/WH SERIES HEAT PUMP
- BUFFER TANK W/ELEMENTS __kW
  (or INDIRECT TANK FOR DEDICATED DHW)
- P/T PORTS AND HOSE ADAPTERS (2)
- DOLE VALVE
- MOTORIZED WATER VALVE

OPTIONAL FROM MARITIME GEOTHERMAL
- ANTI-VIBRATION PAD
- SOUND JACKET
- SECURE START
- AHW-65 AIR HANDLER(S)

DHW
- PREHEAT TANK, 40 OR 60 GAL
- ½" COPPER PIPE
- ½" FITTINGS, BALL VALVES, BOILER DRAINS, CV

WATER SYSTEM
- 1" BLACK PLASTIC WATER PIPE
- 1" BARBED FITTINGS & HOSE CLAMPS
- SUBMERSIBLE PUMP (IF NOT EXISTING)
- PRESSURE TANK (IF NOT EXISTING)
- CYCLE STOP VALVE (OPTIONAL)

ZONES
- CIRCULATOR: HEAT PUMP TO TANK
- 1" PIPE & FITTINGS: HEAT PUMP TO TANK
- ZONES CIRCULATOR(S)
- ZONE TRANSFORMER & CIRC CONTACTOR
- ZONE VALVES (IF NOT INDIVIDUAL PUMPS)
- IN-FLOOR PIPING
- OTHER AIR HANDLERS, DUCTING
- ZONE THERMOSTATS
- ZONE SUPPLY & RETURN HEADERS
- PIPE & FITTINGS TO ZONES
- EXPANSION TANK

ELECTRICAL
- HEAT PUMP SERVICE WIRE 6-3 OR 8-3
- BUFFER TANK ELEMENT SERVICE WIRE
- HEAT PUMP BREAKER
- BUFFER TANK ELEMENT BREAKER
- ELEMENT CONTACTOR & ELEC. BOX (IF NOT WITH TANK)
- THERMOSTAT WIRE 18-4
- THERMOSTAT WIRE 18-2
- FORK TERMINALS FOR TSTAT WIRE (6)
- 2" STYROFOAM INSUL. (IF PAD NOT PURCHASED)

Wiring

Power Supply Connections

Power supply for the heat pump from the breaker panel is supplied to the unit via concentric 1.093" / 0.875" knockouts. There are also several 0.875" knockouts and a 3/8" plastic grommet for electrical connections to the indoor circulator, ground loop circulator pump, and controls.

A schematic diagram (SCH) and electrical box layout diagram (ELB) can be found on the electrical box cover of the unit as well as in the **Model Specific Information** section of this manual. The Electrical Tables in the **Model Specific Information** section contain information about the wire and breaker

NOTE: A properly qualified electrician should be retained for all connections to the heat pump and associated controls.

IMPORTANT NOTE FOR 3-PHASE UNITS: If on startup compressor is noisy and not pumping, reverse L1 and L2 supply wires.

TABLE 4 - Power Supply Connections

Line	Description	Voltages
L1	Line 1	All
L2	Line 2	All
L3	Line 3	3-phase only
N**	Neutral	208/230-1-60, 208-3-60, 380-3-50
GND	Ground	All (connect to ground lug)

** For 208/230-1-60 and 208-3-60, **N** is required only if connecting 115VAC circulators to the unit. The heat pump itself does not require a neutral.

For 380-3-50, **N** is not required if not using desuperheater ***and*** not connecting 220V circulators to the unit.

Indoor Circulator Pump Wiring

The indoor loop circulator provides flow between the heat pump and the buffer tank, and is powered from the heat pump. The heat pump has provisions for connecting the indoor circulator pump so that it will be turned on whenever the compressor operates, and also when sampling water temperature during the use of the *Setpoint Control* feature.

Connect the circulator pump to the appropriate two terminals (115VAC or 230VAC) of the terminal strip marked **INDOOR CIRCULATORS** in the heat pump, as per the voltage of the circulator pump. Ground wire should be connected to the ground lug in the electrical box. Ensure that the total current draw does not exceed the value indicated on the label in the heat pump electrical box.

For **460/575VAC models**, 24VAC and ground are provided on the terminal strip for use with an external contactor to control the circulator. Refer to the schematic and electrical box drawings in the **Model Specific Information** section and on the electrical box cover for more information.

Outdoor Loop Pump Module Wiring (Ground Loop Only)

The heat pump has provisions for connecting the circulator pump module so that the pumps will be turned on whenever the compressor operates. Connect the circulator pump module to the appropriate two terminals (115V or 230V) of the terminal strip marked **OUTDOOR CIRCULATORS** in the heat pump, as per the voltage of the circulator pump module. Ground wire should be connected to the ground lug in the electrical box. Ensure that the total current draw does not exceed the value indicated on the label in the heat pump electrical box.

For **460/575VAC models**, 24VAC and ground are provided on the terminal strip for use with an external contactor to control the circulator pump module.

TABLE 5 - Indoor & Outdoor Circulator Connections

Terminal	Description
115V	Connection for 115V circulator
115V	
230V	Connection for 230V circulator
230V	
Use a 2-conductor 14ga cable.	

Control Transformer

The low voltage controls for 208/230-1-60 and 208-3-60 models are powered by a class II transformer with resettable breaker on the secondary side for circuit protection. Should the breaker trip, locate and correct the problem and then reset the breaker by pressing in on it.

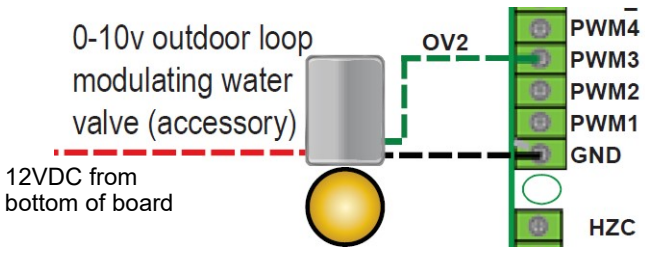
All other voltage models have a transformer with primary and secondary fuses for circuit protection.

IMPORTANT NOTE: For 208/230VAC-1-60 units, if connecting to 208VAC power supply move the red wire connected to the 240 terminal of the transformer to the 208 terminal of the transformer.

Open/Closed Loop Wiring

The heat pump is provided configured for closed loop operation. For open loop operation, the jumper plug **must** be removed from the wiring harness found behind the pipe post and the water valve harness plugged in. This will select the proper temperature limit settings (although there may be no difference between the open/closed loop settings for WH). See the "Water Valve" section in the Open Loop Installations chapter for details.

A modulating water valve may be required; see **Piping** & **Open Loop Installation** chapters, and wiring diagram in **Model Specific Information** section.



Domestic Hot Water (Desuperheater)

The desuperheater function on HACW/HW models is prewired and no field connections are necessary.

After the desuperheater is filled with water and purged of air, activate the built-in DHW circulator by connecting the brown wire with the blue insulated terminal to L1 of the compressor contactor as shown on the wiring diagram in the **Model Specific Information** section. **Ensure the power is off when connecting the wire.** Also, turn on the DHW ON/OFF switch.

BACnet Connections

If using BACnet for external control of heating/cooling demand and/or monitoring of status, use a shielded twisted pair to the connector at the bottom left of control board. There is an optional termination jumper located above the connector.

See the **BACnet Interface** section for details.

TABLE 6 - BACnet Connections	
Line	**Description**
A	**Communication +**
B	**Communication -**
GND	**Ground**
Use a shielded twisted pair cable.	

Setpoint Control Connections

If using the on-board Setpoint Control routine with sampling option (ICR) to control buffer tank temperature, no external temperature probe or aquastat is required. For either Setpoint Control option (ICR or HTS/CTS), only one control connection is required, and only for reversing models: a dry contact from **R** (24VAC) to **O** on the terminal strip to switch the heat pump into cooling mode. **C** (ground) may be used in powering relays as shown in diagrams on following pages.

Note that in a one tank heating/cooling system, the* O *signal must be continuously provided during cooling season. If it toggles with demand, the tank will be repeatedly heated and cooled, resulting in high power usage.

TABLE 7 - Setpoint Control Connections	
Signal	**Description**
C	**24VAC common (ground)**
R	**24VAC hot**
O	**Cooling Mode (Reversing Valve)**
Use a 3-conductor 18ga cable.	

An external temperature probe may be used with the on-board Setpoint Control routine, or two probes (one for hot tank and one for cold tank) may be used. This is HTS/CTS Setpoint Control; see **Piping** and **Operation** sections for details.

Setpoint Control: Aux. Connections

When using Setpoint Control, there are 2 methods for activating hydronic auxiliary heat. See diagram on following page.

First, a dry contact on terminals **D1** and **D2** is available, to actuate a heating device that has its own temperature controller and transformer. Connection will be made to that device's **E-E** terminals or similar. **D1-D2** defaults to **ON** when heat pump is powered off. Therefore, it is necessary to set the temperature control on the external heating device to a limiting value, e.g. 125°F, and adjust its settings so it is only activated by the heat pump's controller. **This method should be used for the Thermo2000 AltSource tank that is available from Maritime Geothermal as an accessory;** see the setup instruction sheet that comes with tank and on a following page.

Second, a 24VAC signal can be used to power the coil of an external contactor to operate auxiliary heat. Choose this method if using a heating device that doesn't have its own electronic controller or control transformer, e.g. a bare heating element in the buffer tank. As per the diagram on the following page, connect a jumper between **R** and **D1** on the terminal strip, and use **D2** and **CD** to power the coil of the external contactor. Under this method, the auxiliary heat also defaults to ON (as long as the heat pump is powered ON to provide 24VAC), so the tank's temperature limiter must remain in operation.

Both D1-D2 and D2-CD default to ON and so must be used with an auxiliary heating device that has a HIGH TEMPERATURE LIMITER to avoid a serious safety hazard.

TABLE 8 - Setpoint Control: Aux. Connections	
Signal	**Description**
D1	**Hydronic Auxiliary dry contacts**
D2	
R	**Jumper R and D1**
D1	
D2	**24vac to actuate aux. heat contactor coil**
CD	**Contactor coil ground**
Use a 2-conductor 18ga cable.	

Aquastat Connections (Optional)

Most installations will use the internal ***Setpoint Control*** routine to control buffer tank temperature. However, an aquastat or external controller can be used if required, for example if heating two loops with different setpoint temperatures, or using a time-of-day or lead/lag third-party programmable controller. This is ***Signals*** or ***Hardwired Control***.

The **CA, RA, Y1A,** & **Y2A** connections are located on the right side towards the top of the control board, as shown on the wiring diagram in the **Model Specific Information** section. The external device needs to send the 24VAC signal from **RA** back to the **Y1A/Y2A** terminals to call for compressor. **CA** is the common terminal for use in powering the external device.

TABLE 9 - Aquastat (Signals Control) Connections	
Signal	**Description**
CA	**24VAC common (ground)**
RA	**24VAC hot**
Y1A	**Compressor ON**
Y2A	**Compressor stage 2** (not present for WH)
Use an 18ga cable.	

Disable Switch (field installed)

A switch or dry contact to disable demand from the control system may be installed. On control board, jumper **COM_IN** to **GND**, and toggle **12VDC** to **IN_SPARE** to disable. See wiring diagrams in the **Model Specific Information** section.

Summer Setback Switch (field installed)

A switch to enable *summer setback* mode may be installed. On control board, toggle **R** to **PM2** to enable. See wiring diagrams in the **Model Specific Information** section.

Summer setback disables stage 3 (AUX), drops setpoints to 70°F (21°C), and decreases temperature sampling frequency to 2 days. Can also be enabled through PC App or LCD.

Other Connections

Hot tank and/or cold tank temperature sensors can be used in place of the **ICR** sampling routine with Setpoint Control. This is the **HTS/CTS** option.

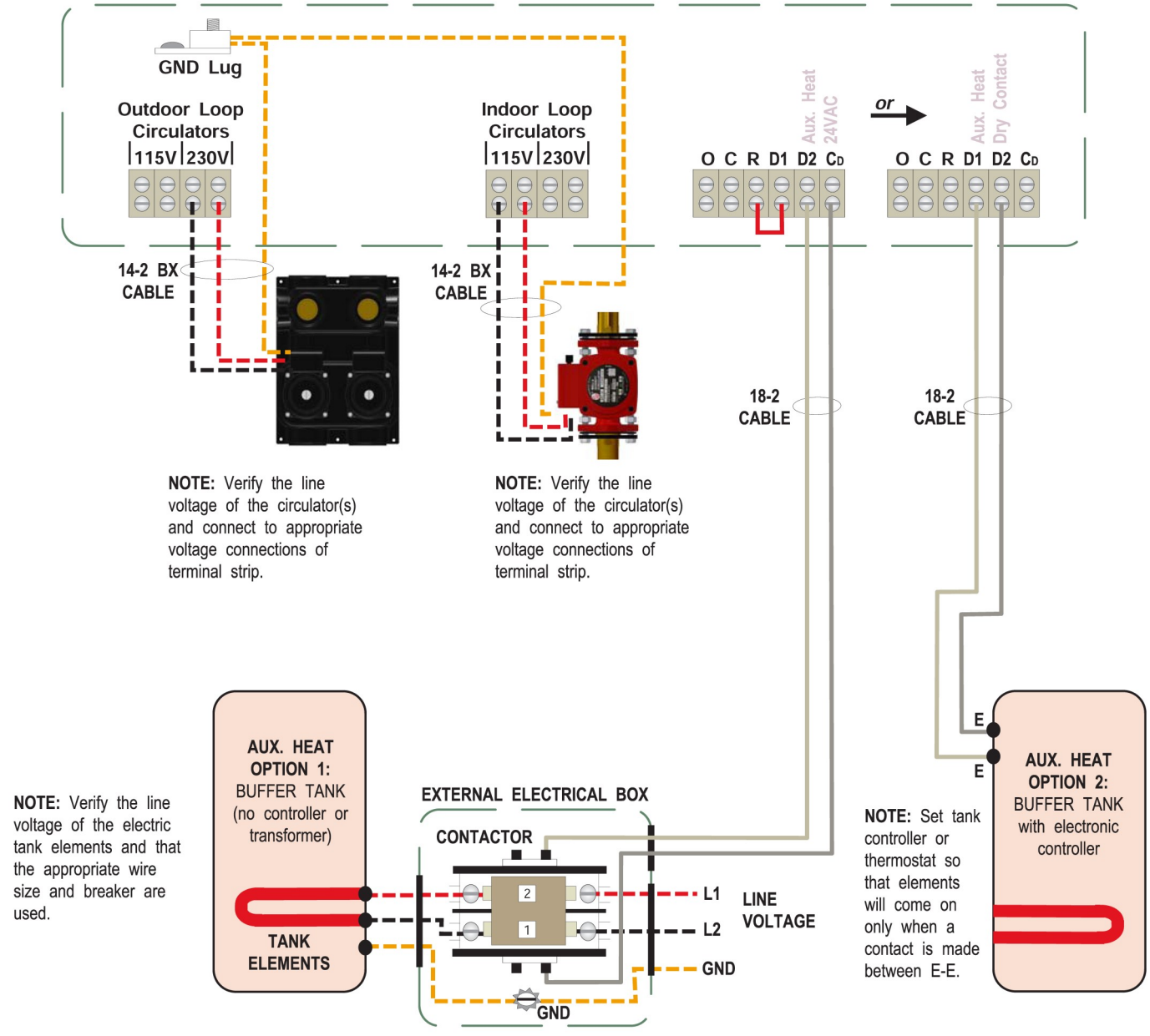
A 3-way valve can be controlled from the heat pump's L3 output, for use with the HTS/CTS 2-tank auto-maintain feature.

An accessory current sensor can be installed, for compressor status monitoring.

An accessory outdoor temperature sensor, to enable Outdoor Reset functionality.

See the following chapters and the schematic (wiring) diagram in the **Model Specific Information** section for details.

Typical GEN2 Auxiliary Heat & Circulator Wiring



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02	000282	Dan Rheault	Dan Rheault	1-Feb-2021
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Approved By (MFG)	Date	
Approved By	Date	

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Drawing Name: Typical GEN2 Auxiliary Heat & Circulator Wiring

Size	Drawing Number	Drawing Rev	Sheet
A	002241CDG	02	1 of 1

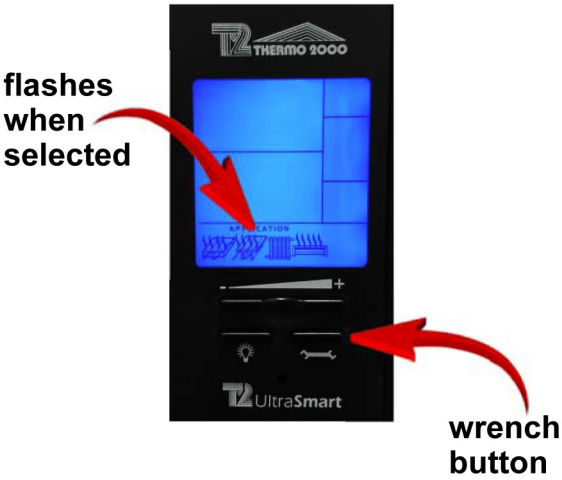
AltSource Tanks: Getting Started

A full product manual from Thermo2000 is included with the AltSource tank.
This sheet describes how to set the tank to work in conjunction with ***NORDIC*** heat pumps that are equipped with **D1-D2** terminals. *(Some W-series models may not have D1-D2 terminals; in this case the tank can instead be set up run under its own control with a setpoint lower than that of the heat pump.)*

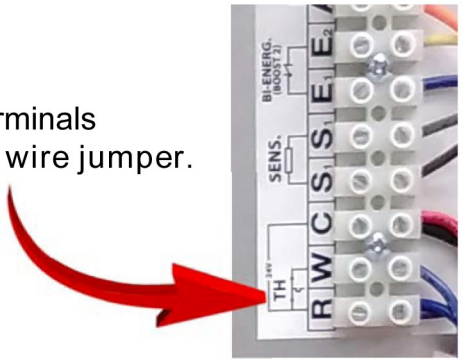
1. Put the tank in “Bi-Energy” rather than “Electric” mode, with switch on back of controller.

2. Set the tank to “joist heat” mode by holding the **wrench** button to display the **°F/°C** setting, press again to go to heating types, then toggle to second setting which is a picture of joists. Press wrench button three more times to exit.

(This doesn’t mean that joist heating is being done, it just sets a 125°F high temperature limit that works well with standard temperature range heat pumps.)



3. Connect tank terminals **R** and **W** with a wire jumper.



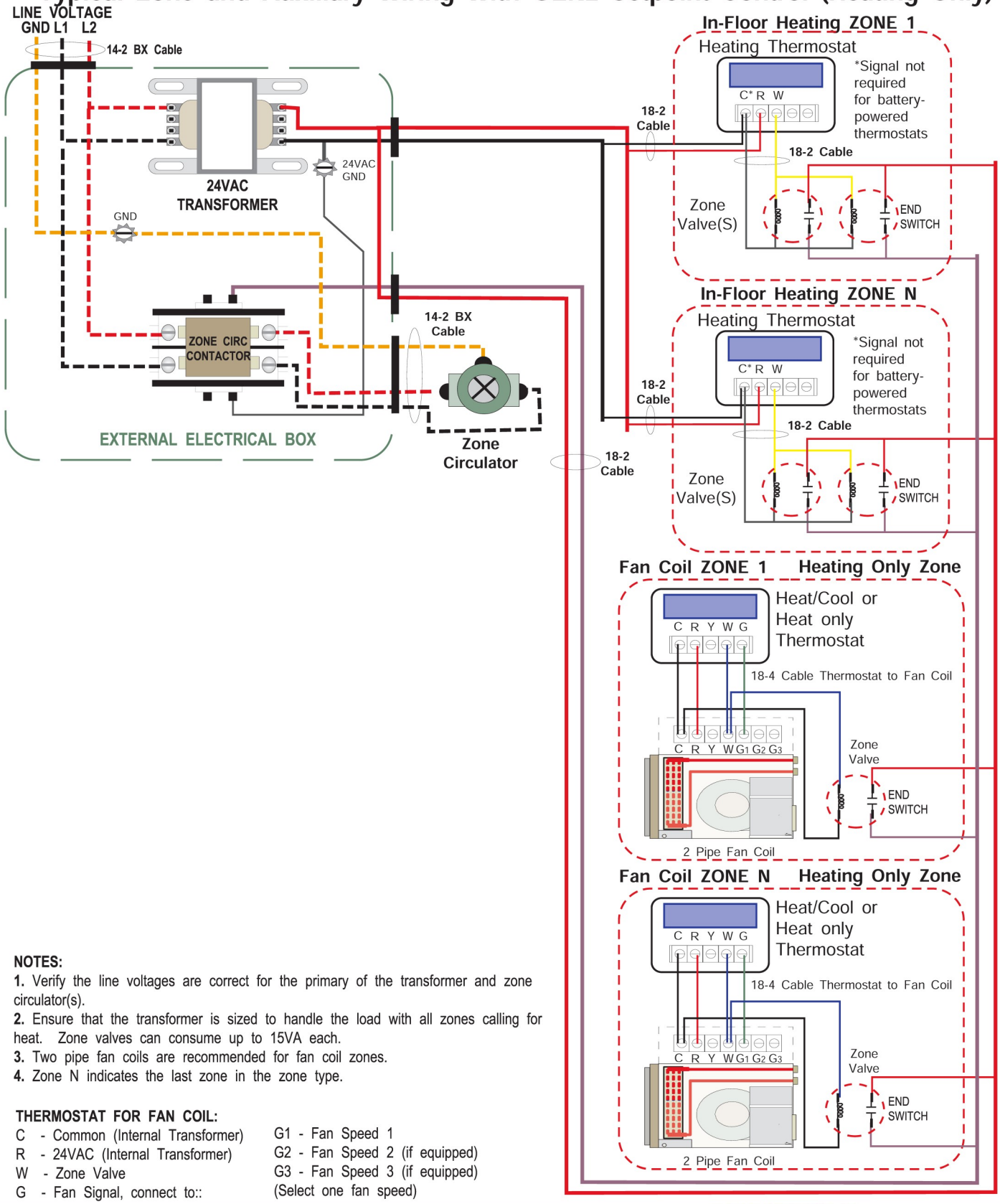
4. Now the tank elements will only be activated by a connection between the E_1-E_2 tank terminals, up to the 125°F maximum. This will be done by an 18-2 wire to the **D1-D2** terminals in the heat pump, activating the elements only when ***AUX*** heat is required.

See heat pump manual for further explanation.

With E_1 and E_2 *disconnected* (not connected by the heat pump’s **D1-D2** terminals), the tank’s screen will look like this.

With E_1 and E_2 *connected* by the heat pump, a temperature setpoint of **125°F** corresponding to “joist heat” will appear. This is fine for a high limit.

Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating Only)



NOTES:

1. Verify the line voltages are correct for the primary of the transformer and zone circulator(s).

2. Ensure that the transformer is sized to handle the load with all zones calling for heat. Zone valves can consume up to 15VA each.

3. Two pipe fan coils are recommended for fan coil zones.

4. Zone N indicates the last zone in the zone type.

THERMOSTAT FOR FAN COIL:

C - Common (Internal Transformer)
R - 24VAC (Internal Transformer)
W - Zone Valve
G - Fan Signal, connect to::

G1 - Fan Speed 1
G2 - Fan Speed 2 (if equipped)
G3 - Fan Speed 3 (if equipped)
(Select one fan speed)

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02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
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Approved By C. Geddes	(ENG)	Date 04-APR-2016
Approved By	(MFG)	Date
Approved By		Date

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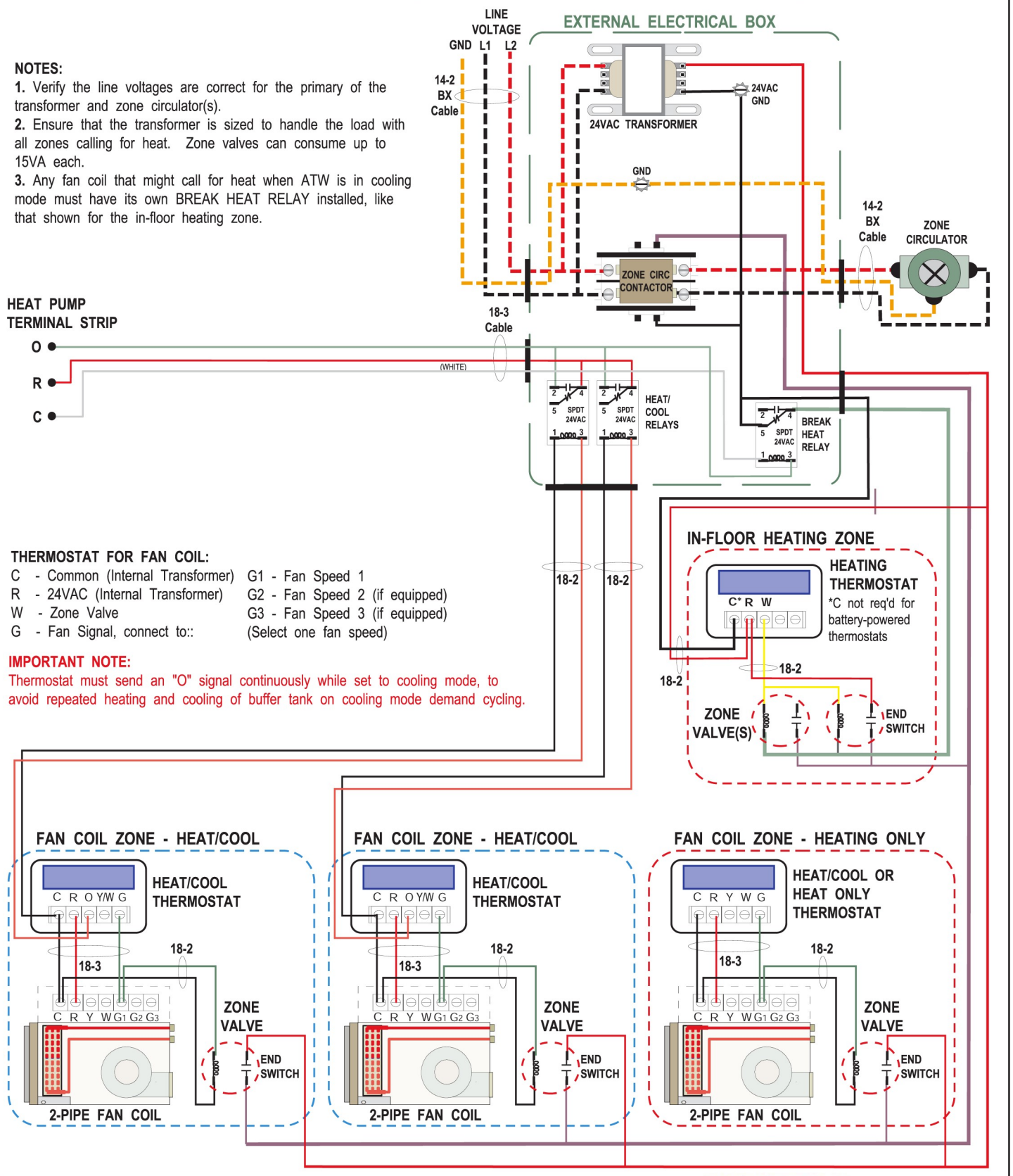
Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating Only)

Size	Drawing Number	Drawing Rev	Sheet
A	002067CDG	02	1 of 1

Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating & Cooling)



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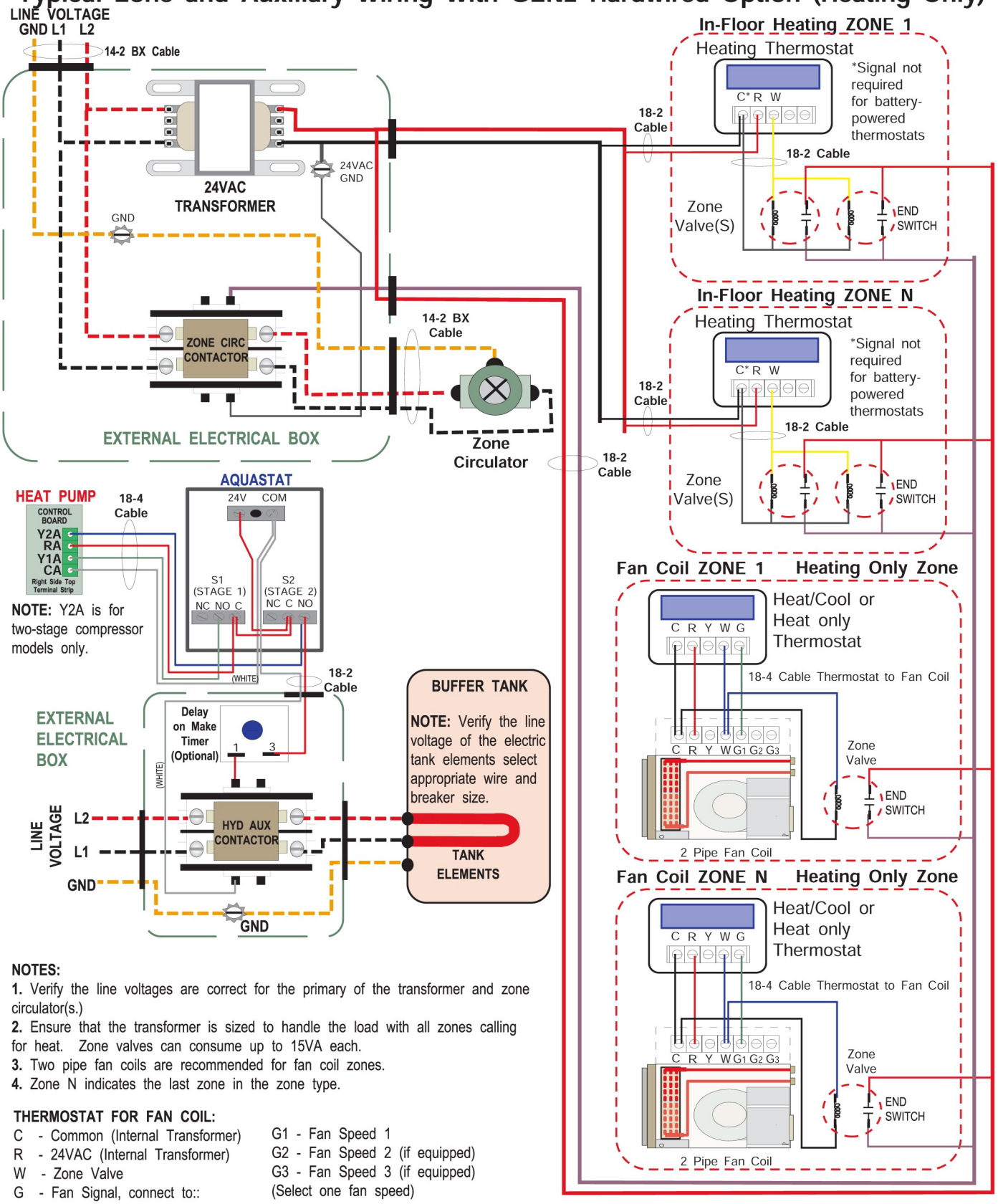
Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating & Cooling)

Size	Drawing Number	Drawing Rev	Sheet
A	002068CDG	02	1 of 1

Typical Zone and Auxiliary Wiring With GEN2 Hardwired Option (Heating Only)



NOTES:

1. Verify the line voltages are correct for the primary of the transformer and zone circulator(s.)
2. Ensure that the transformer is sized to handle the load with all zones calling for heat. Zone valves can consume up to 15VA each.
3. Two pipe fan coils are recommended for fan coil zones.
4. Zone N indicates the last zone in the zone type.

THERMOSTAT FOR FAN COIL:

C - Common (Internal Transformer)
R - 24VAC (Internal Transformer)
W - Zone Valve
G - Fan Signal, connect to::
G1 - Fan Speed 1
G2 - Fan Speed 2 (if equipped)
G3 - Fan Speed 3 (if equipped)
(Select one fan speed)

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Approved By (ENG) C. Geddes	Date 04-APR-2016	
Approved By (MFG)	Date	
Approved By	Date	

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Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Hardwired Option (Heating Only)

Size	Drawing Number	Drawing Rev	Sheet
A	002069CDG	02	1 of 1

Typical Zone and Auxiliary Wiring With GEN2 Hardwired Option (Heating & Cooling)

NOTES:

1. Verify the line voltages are correct for the primary of the transformer and zone circulator(s).

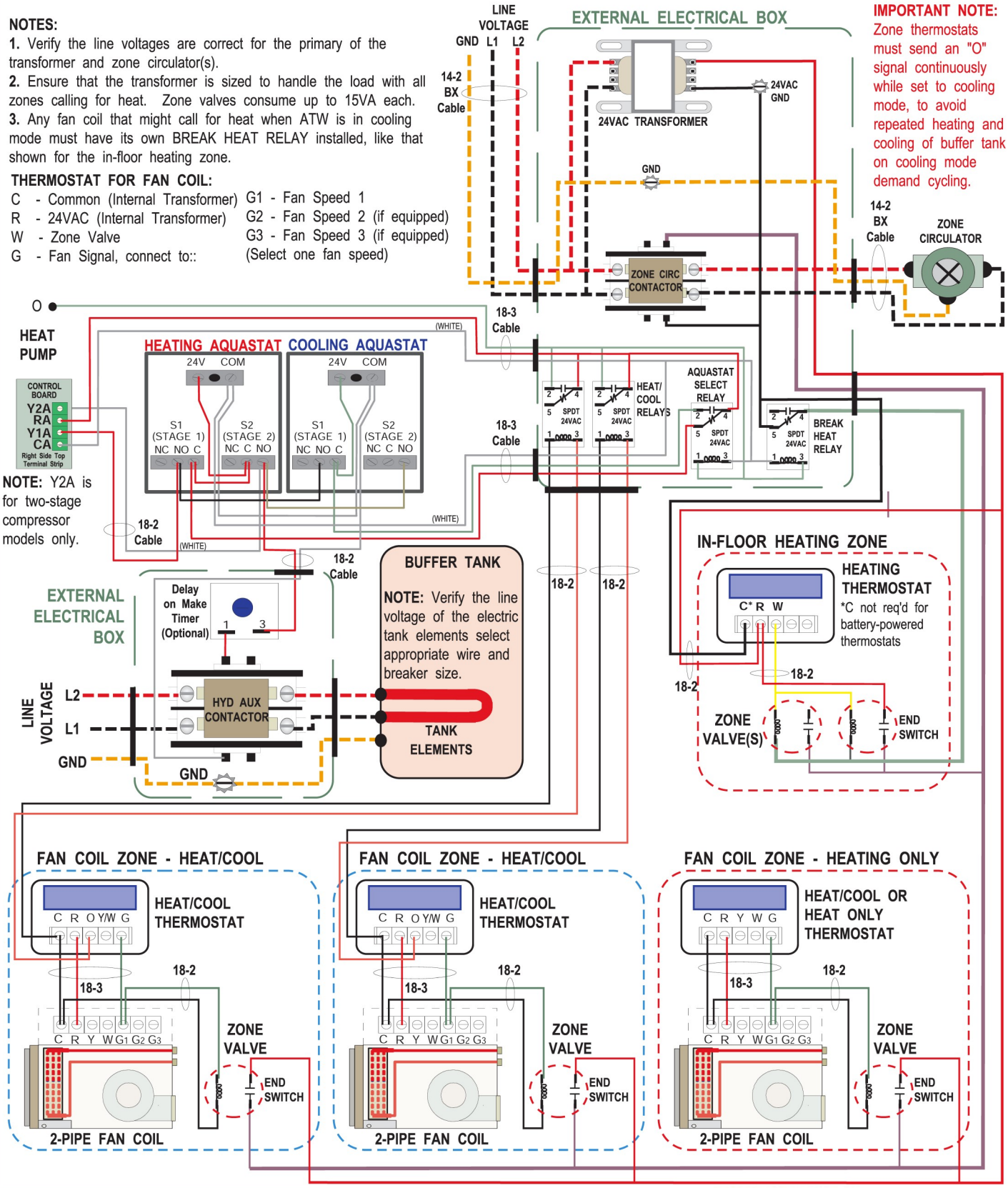
2. Ensure that the transformer is sized to handle the load with all zones calling for heat. Zone valves consume up to 15VA each.

3. Any fan coil that might call for heat when ATW is in cooling mode must have its own BREAK HEAT RELAY installed, like that shown for the in-floor heating zone.

THERMOSTAT FOR FAN COIL:

C - Common (Internal Transformer)
R - 24VAC (Internal Transformer)
W - Zone Valve
G - Fan Signal, connect to::
G1 - Fan Speed 1
G2 - Fan Speed 2 (if equipped)
G3 - Fan Speed 3 (if equipped)
(Select one fan speed)

IMPORTANT NOTE: Zone thermostats must send an "O" signal continuously while set to cooling mode, to avoid repeated heating and cooling of buffer tank on cooling mode demand cycling.



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02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
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Approved By (ENG) C. Geddes	Date 04-APR-2016	
Approved By (MFG)	Date	
Approved By	Date	

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Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Hardwired Option (Heating & Cooling)

Size	Drawing Number	Drawing Rev	Sheet
A	002070CDG	02	1 of 1

Piping

W/WH-Series: Number of Tanks

All **W/WH-series** systems will require at least **one buffer tank**. If there is one buffer tank, it will contain the heated or chilled water. Note that references to chilled water are only applicable to -HACW/HAC models, which have a reversing valve; or -H models in operating in *Chiller* mode (see **Operation** chapter). W/WH-H models in *Heat Pump* mode can still do cooling, using a simultaneous setup with external controller as shown on diagram **002288PDG**. A reversing rather than simultaneous setup is described here.

For reversing models, water in the tank will be chilled when the "**O**" signal is activated. This buffer tank may have electric elements for auxiliary heat, or an existing boiler may be used. See piping diagrams on following pages.

If there is need for heating and cooling in close time proximity, for year-round DHW preheating using an indirect tank, or if a seasonal switchover is to be avoided, **two buffer tanks** maybe installed. One will be always be heated, and one will be always be chilled, controlled using the on-board **Setpoint Control** routine. This routine has two options: the "**O**" signal from an external controller maybe be used to tell the heat pump to switch to cooling mode and cool the cold tank, or the "**Auto Maintain**" function may be used to automatically maintain both the hot and cold tanks without external input. See **Operation** chapter, and piping diagrams on following pages.

In addition to buffer tanks, domestic hot water **preheat** and **final** tanks are recommended, for use with the desuperheater (if present). These are part of the building's domestic water system, which is totally separate from the closed loop hydronic heating/cooling system. See diagram at end of this section.

Indoor Loop & Buffer Tank

W/WH-series connections for the indoor loop are 1" or 1-1/4" brass female NPT. They are labelled INDOOR IN and INDOOR OUT, and are located on the front of the unit.

Recommended buffer tank piping is shown in diagrams on following pages. They show all of the recommended components as well as where they should be placed. If other types of components are used or connected differently, this is done at user's discretion with the caution that heat pump may or may not work properly.

NOTE: The water lines between the heat pump and the buffer tank should be copper or other high temperature piping.

NOTE: Care should be taken when routing the water lines to ensure that adequate access to the heat pump is maintained.

The minimum buffer tank size should follow the rule of 8 US gallons per ton of heat pump capacity. The following table shows the minimum buffer tank size for each heat pump along with the recommended size. The recommended size will minimize the number of starts per hour and provide longer runtimes for improved efficiency.

TABLE 10 - Buffer Tank Size

Heat Pump Size	Minimum Size gal (L)	Recommended Size gal (L)
25	16 (60)	50 (190)
45	24 (90)	50 (190)
55	32 (120)	70 (265)
65	40 (150)	70 (265)
75	48 (180)	70 (265)
80	52 (200)	70 (265)
If a tank size is not available, use the next size larger tank.		

Outdoor Loop

W/WH-series connections for the outdoor loop are 1" or 1-1/4" brass female NPT. They are labelled OUTDOOR IN and OUTDOOR OUT.

See the following chapters for details on ground loop and open loop installations.

Domestic Hot Water (Desuperheater) Connections

The connections for the DHW circuit (if present) are 1/2" brass FPT fittings. They are marked as DHW IN and DHW OUT.

A typical piping diagram for a pre-heat tank configuration can be found in document **000970PDG** at the end of this section. Be sure to note the position of the check valve and the direction of water flow. Other configurations are possible, and there may be multiple units piped together in larger buildings.

WARNING: USE ONLY COPPER LINES TO CONNECT THE DESUPERHEATER. TEMPERATURES CAN BE >200°F NEAR THE UNIT WITH DESUPERHEATER TURNED OFF, POTENTIALLY MELTING & RUPTURING PLASTIC PIPING.

Ensure the tank is filled with water and under pressure before activating the built-in DHW circulator as described below. First, slightly loosen the boiler drain on the DHW Out pipe to allow air to escape from the system. This step will make certain that the domestic hot water circulator in the unit is flooded with water when it is started.

CAUTION: the domestic hot water pump is water lubricated; damage will occur to the pump if it is run dry for even a short period of time.

Activate the built-in DHW circulator by connecting the brown wire with the blue insulated terminal to L1 of the compressor contactor. **Ensure the power is off when connecting the wire.** Once connected the DHW switch on the front of the unit may be used to enable/disable the domestic hot water circulator.

The DHW loop may have to be purged of air several times before good circulation is obtained. A temperature difference between the DHW In and DHW Out can be felt by hand when the circulator pump is operating properly.

For the pre-heat tank setup, the final tank should be set to **140°F (60°C),** which is required by most codes. The pre-heat tank does not require electric elements. This setup takes full advantage of the desuperheater as it is the sole heat provider to the pre-heat tank. The desuperheater remains active during the compressor runtime until the pre-heat tank has been completely heated by the desuperheater alone. This setup is more energy efficient than a single tank setup, and eliminates the possibility of reverse heating of the refrigerant gas in cooling mode.

CAUTION: If two (2) shut-off valves are located on the domestic hot water ines as shown in the diagram, a pressure relief valve must be installed to prevent possible damage to the domestic hot water circulator pump should both valves be closed.

WH-HAC: Modulating Water Valve

A high temperature heat pump may typically be heating the indoor loop to 130-160°F (54-71°C) using a cold (outdoor) loop temperature of 50-80°F (10-27°C). The amount of refrigerant in the system is appropriate for typical heating conditions.

If equipped with a reversing valve for cooling duty (models HAC/HACW), the hot loop becomes the outdoor loop at 50-80°F (10-27°C), and the indoor loop becomes the cold loop at 45-54° F (7-12°C). The close proximity of the loop temperatures will cause the refrigerating capacity to rise significantly. More capacity requires more refrigerant, and there may be an insufficient amount of refrigerant to avoid a low pressure safety control trip.

The solution is to reduce the outdoor loop flow under such conditions in order to raise the discharge pressure and lower the refrigerating capacity, using an electronic modulating water valve controlled by the Gen2 control board in the heat pump.

A suitable 1" NPT modulating water valve is available as an accessory from Maritime Geothermal Ltd, and should be installed on the **OUTDOOR OUT** connection of the heat pump using a short 1" NPT nipple. ***This valve should be installed for all reversing WH-series heat pumps that will be operated in cooling mode with outdoor loop temperatures of 80°F (27°C) or less.***

CAUTION: if a modulating water valve is not installed in the outdoor loop of a reversing WH-series heat pump, nuisance low pressure control trips may occur.

Note that on open loop installations, the modulating water valve will act as the water shutoff valve, and no additional solenoid or slow-closing valve is required.

The WH's control board has an output (signal **OV2**) to run the valve on terminal **PWM3**. The valve is powered by 12VDC from the control board. See wiring diagram (SCH) in the **Model Specific Information** section for valve wiring.

WP-Series Pool Piping Connections

WP-series connections for the outdoor loop are the same type as W/WH series: 1" brass female NPT. They are labelled OUTDOOR IN and OUTDOOR OUT.

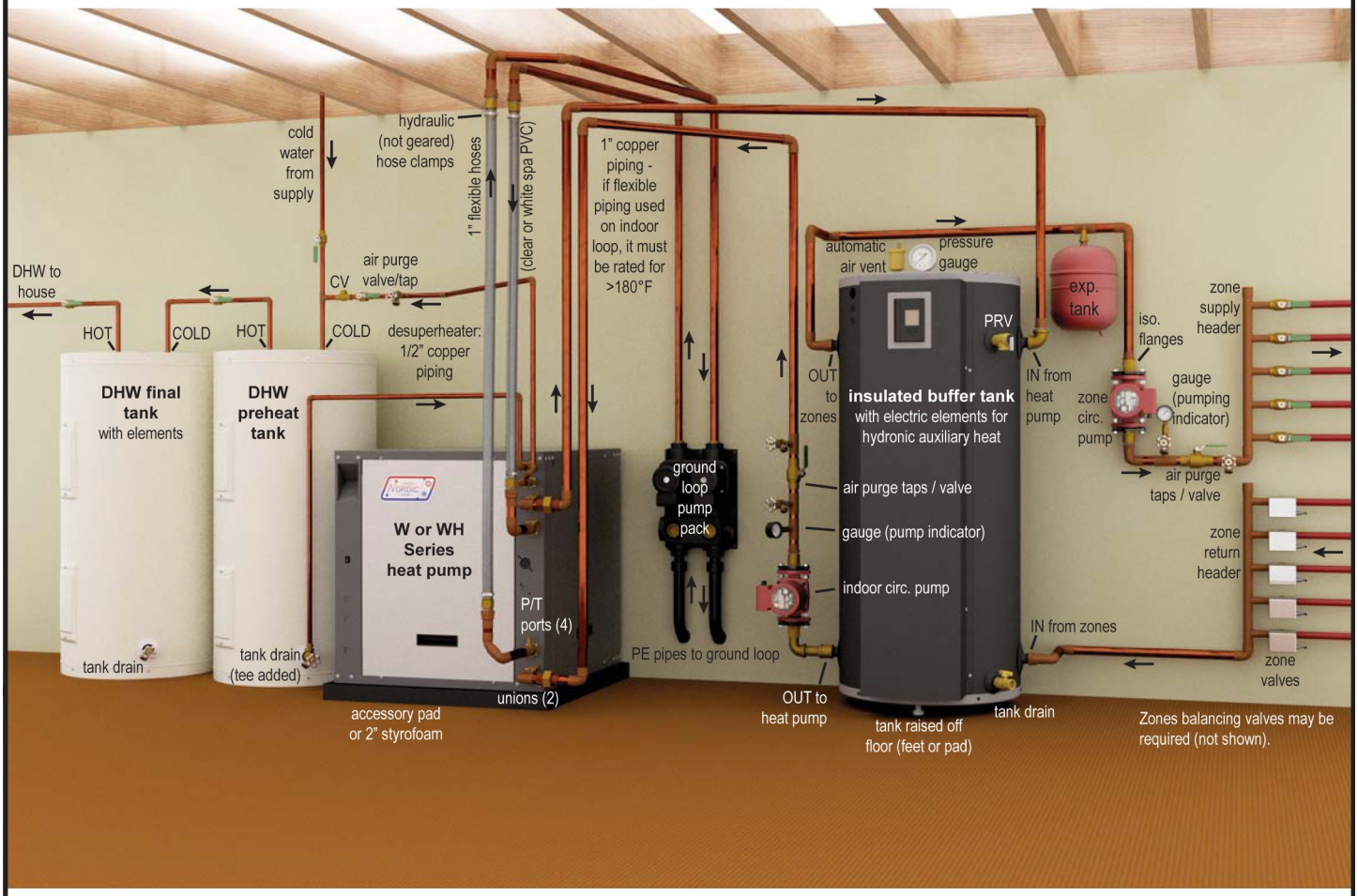
WP-series connections for the indoor loop are 2" PVC unions. They are labelled INDOOR IN and INDOOR OUT.

Dedicated pool heating heat pumps don't need a buffer tank, since the pool provides a very large volume to be heated that prevents frequent ON/OFF cycling.

The pool filter pump is often run continuously, and in this case can circulate water continuously through the heat pump. Using its **Setpoint Control / ICR** method, the heat pump will sense the water temperature every 8 minutes and come on when necessary to heat the water. The sampling routine logic will run, but since the pool water is always circulating it will not have any effect on the pool water pump.

If an existing pool water filter pump is not run continuously, e.g. if it is run on a timer, it will need to be re-wired so that it is powered from or controlled by the heat pump (as with the W/WH -series). This is necessary so the pool pump can be turned on by the heat pump when needed for sampling or water heating.

Typical Piping Connections - W/WH 25-80



See other diagrams and instructions in the manual for design, selection, and installation details of ground loop and hydronic heating accessories.

Many of the items illustrated in this diagram are available as accessories from Maritime Geothermal Ltd.. Other items are commonly available from plumbing or HVAC wholesalers.

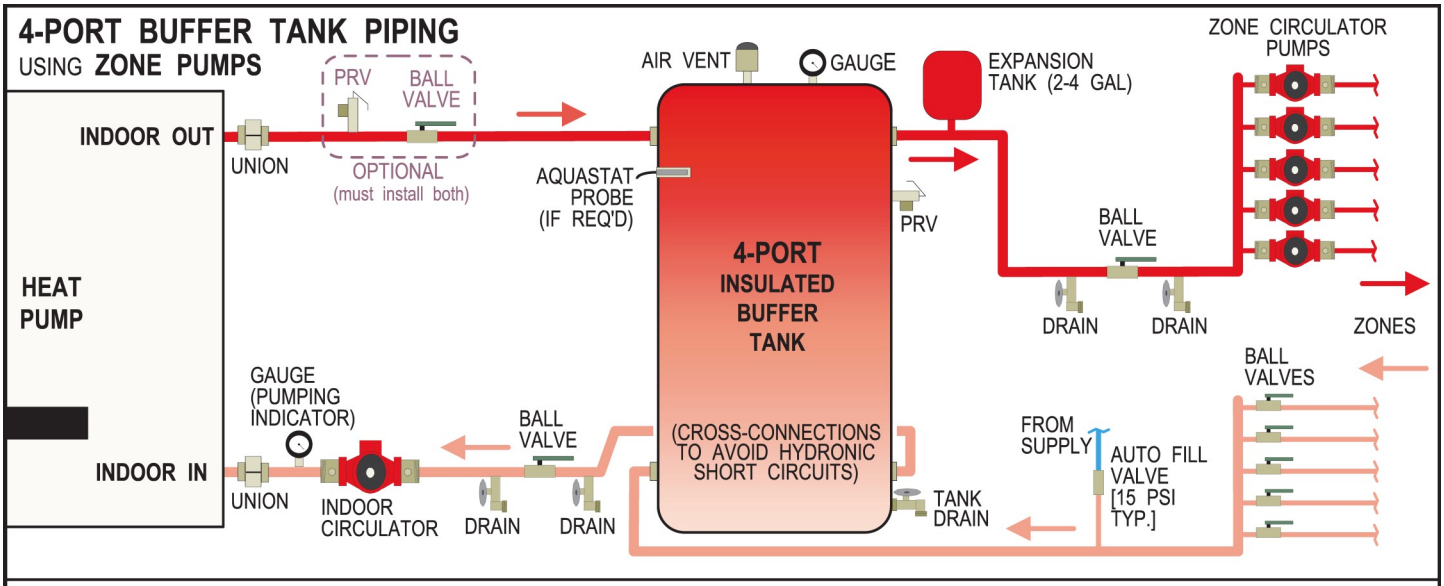
There are multiple valid connection methods or details which differ from those shown, including:

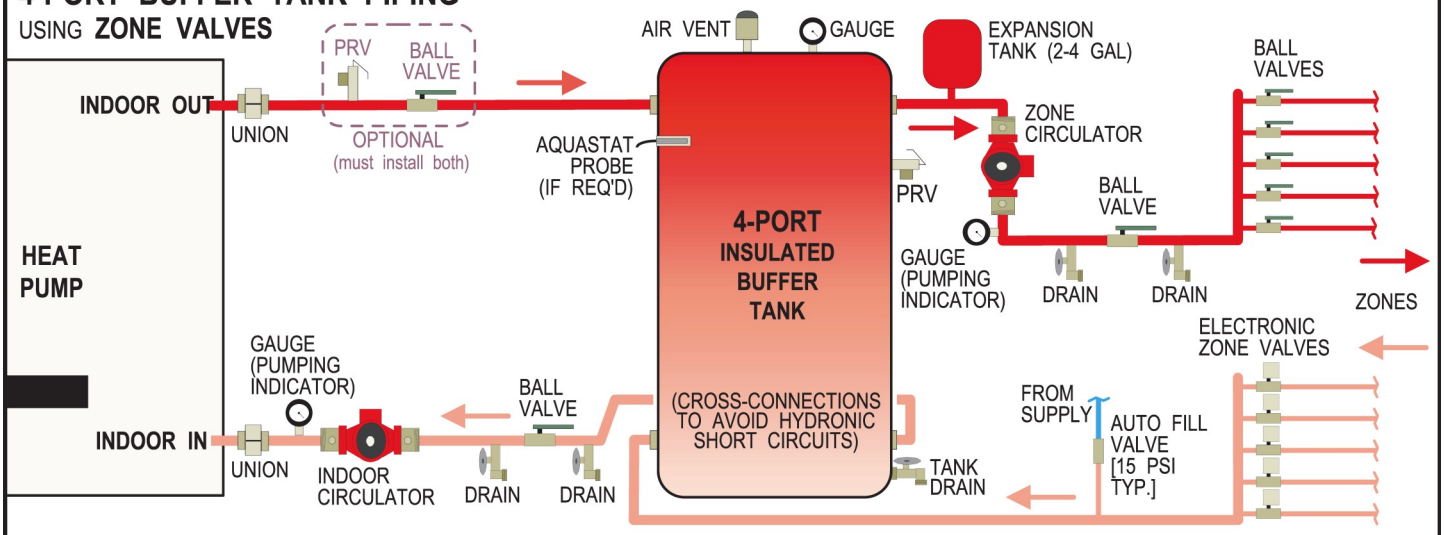
- Open loop installation, which uses a well water system in place of a ground loop.
- Hydronic heating zones that use one pump per zone instead of zone valves.
- Piping routed differently from that shown, or different piping & component types.

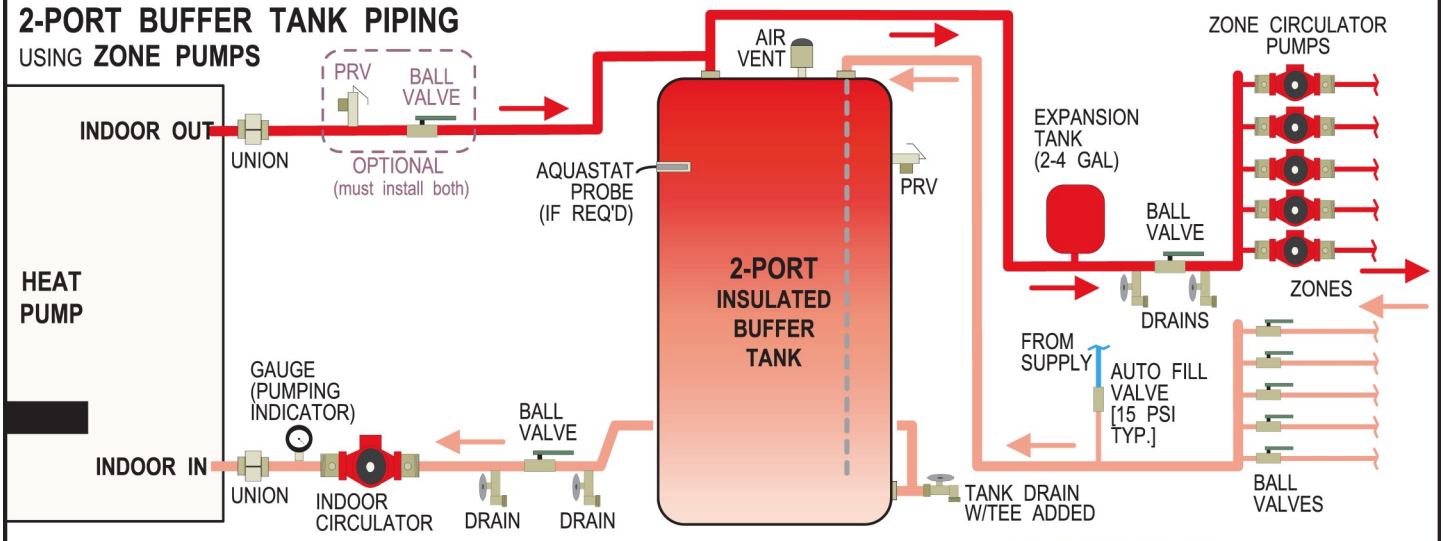
REV	ECO#	IMPL BY	APVD BY	DATE
02	-	Dan Rheault	Dan Rheault	1-May-2019
01	Initial Rel.	Dan Rheault	Dan Rheault	1-Mar-2018

Drawn By: Dan Rheault	Date: 1-Mar-2018	MARITIME GEOTHERMAL LTD.	P.O. Box 2555, 170 Plantation Rd., Petitcodiac, NB CANADA E4Z 6H4
Checked By: Dan Rheault	Date: 1-Mar-2018	Drawing Name: Typical Piping Connections - W/WH 25-80	
Eng. Approved By	Date		
Mfg. Approved By	Date		
Approved By	Date		

Size	Drawing Number	Revision	Sheet
LET	002287PDG	02	1 / 2







REV	ECO #	IMPL BY	APVD BY	DATE
02	(add fill valve)	D. RHEAULT	D. RHEAULT	1-Feb-2021
01	Initial Release	D. RHEAULT	D. RHEAULT	14-Dec-2018

Drawn By: Dan Rheault	Date: 14-Dec-2018	
Checked By: Dan Rheault	Date: 14-Dec-2018	
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

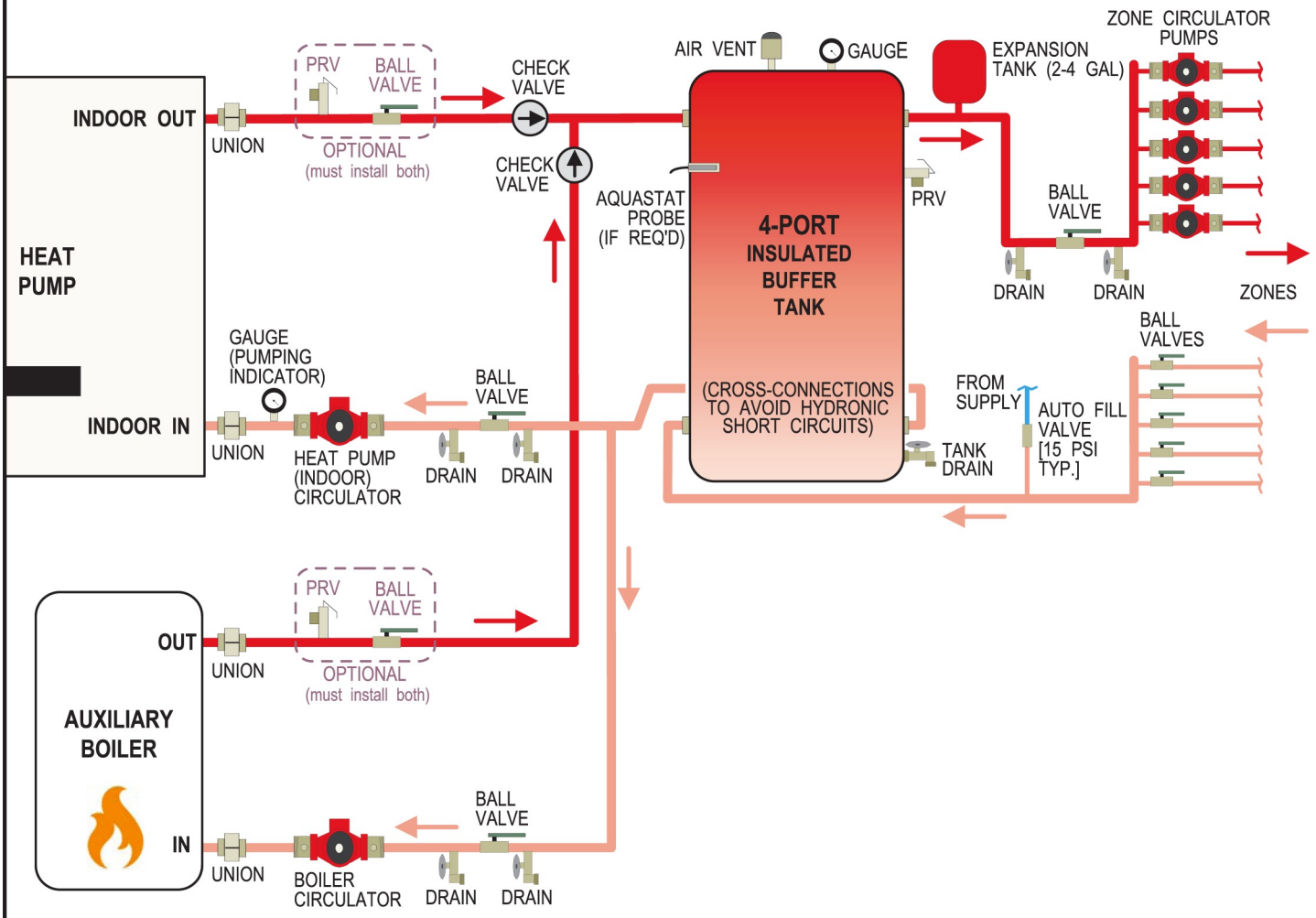
Drawing Name: **Recommended Hydronic Buffer Tank Piping**

Size	Drawing Number	REV	SHEET
A	002366PDG	02	1 of 1

Auxiliary Boiler Piping

SYSTEM WITH 4-PORT TANK & ZONE PUMPS SHOWN; SEE DIAGRAM **002366PDG** FOR SYSTEM USING 2-PORT TANK OR ZONE VALVES.

NOTE: CHECK VALVES SHOULD BE SPRING TYPE, OTHERWISE UNINTENDED FLOW MAY OCCUR. SIZE CIRCULATORS INCLUDING PRESSURE DROP THROUGH SPRING CHECK VALVES.



USING THIS PARALLEL ARRANGEMENT, BOILER MAY OPERATE ALONE (TO PROVIDE BACKUP HEAT) OR IN CONJUNCTION WITH HEAT PUMP (TO PROVIDE AUXILIARY HEAT).

BOILER MUST BE CONTROLLED AS 3RD STAGE OF HEAT BY HEAT PUMP CONTROL BOARD OR EXTERNAL CONTROLLER. BOILER MAY THEN OPERATE AT A HIGHER OUTPUT TEMPERATURE THAN HEAT PUMP WITHOUT CAUSING HIGH TEMPERATURE/HIGH PRESSURE PROBLEMS AT THE HEAT PUMP.

REV	ECO #	IMPL BY	APVD BY	DATE
02	(add fill valve)	D. RHEAULT	D. RHEAULT	1-Feb-2021
01	Initial Release	D. RHEAULT	D. RHEAULT	14-Dec-2018

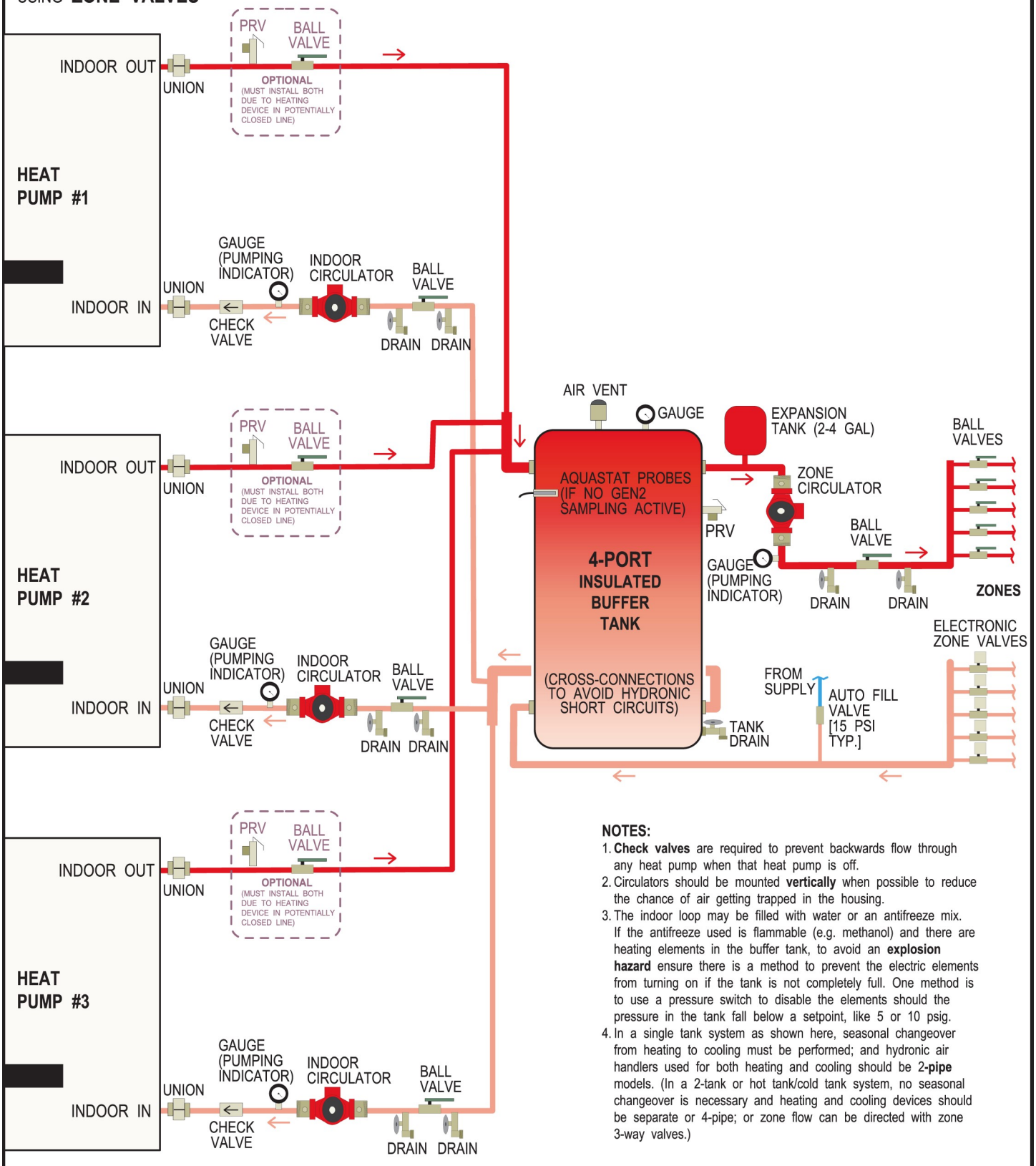
Drawn By: Dan Rheault	Date: 14-Dec-2018	
Checked By: Dan Rheault	Date: 14-Dec-2018	
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: **Auxiliary Boiler Piping**

Size	Drawing Number	REV	SHEET
A	**002367PDG**	**02**	1 of 1

4-PORT BUFFER TANK PIPING FOR MULTIPLE HEAT PUMPS
USING **ZONE VALVES**



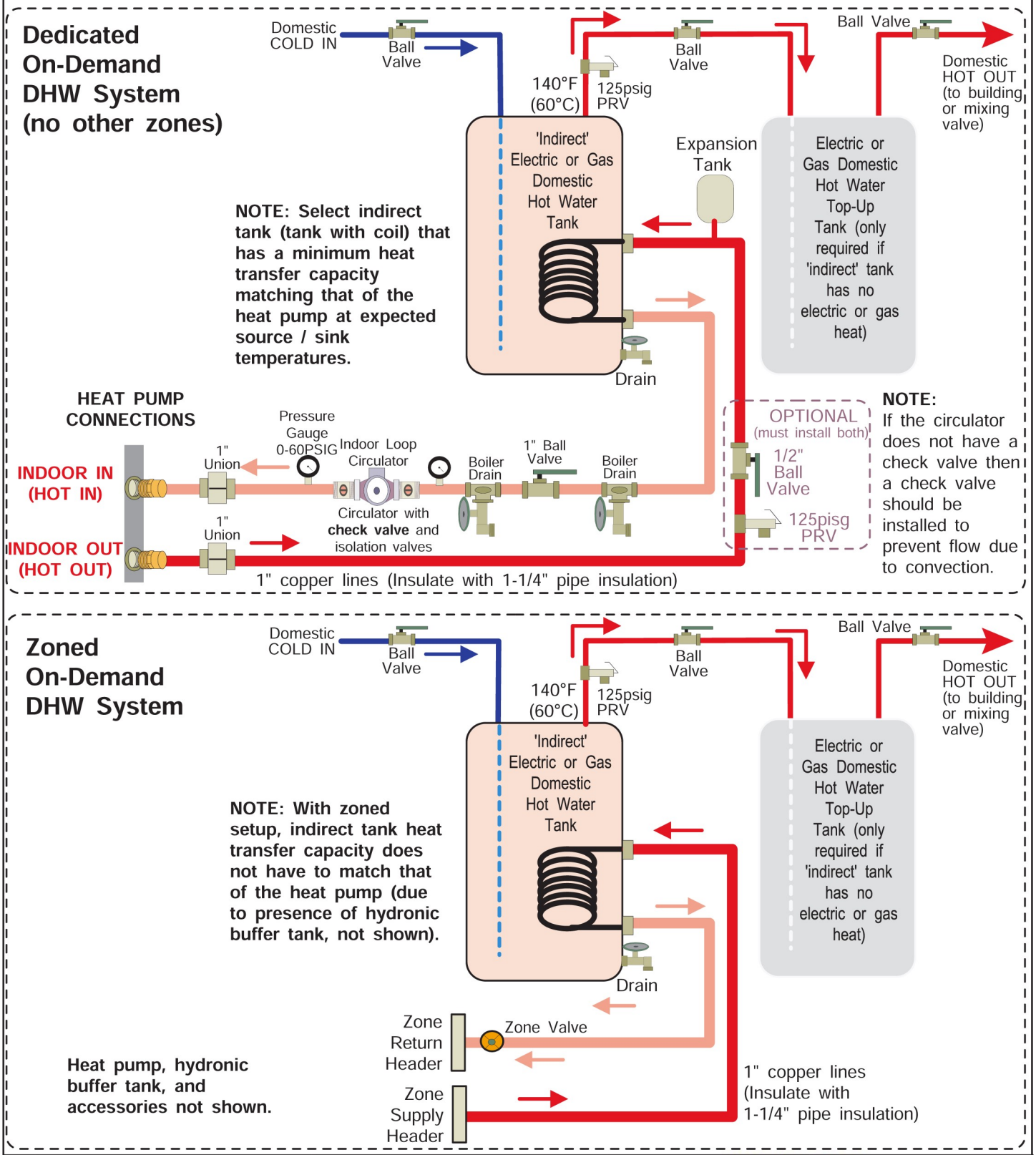
NOTES:

1. **Check valves** are required to prevent backwards flow through any heat pump when that heat pump is off.
2. Circulators should be mounted **vertically** when possible to reduce the chance of air getting trapped in the housing.
3. The indoor loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (e.g. methanol) and there are heating elements in the buffer tank, to avoid an **explosion hazard** ensure there is a method to prevent the electric elements from turning on if the tank is not completely full. One method is to use a pressure switch to disable the elements should the pressure in the tank fall below a setpoint, like 5 or 10 psig.
4. In a single tank system as shown here, seasonal changeover from heating to cooling must be performed; and hydronic air handlers used for both heating and cooling should be 2-**pipe** models. (In a 2-tank or hot tank/cold tank system, no seasonal changeover is necessary and heating and cooling devices should be separate or 4-pipe; or zone flow can be directed with zone 3-way valves.)

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	9-Aug-2021

Drawn By: Dan Rheault	Date: 9-Aug-2021	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 9-Aug-2021	Drawing Name: **Buffer Tank Piping - Multiple Units**
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	Size: A; Drawing Number: **002528PDG**; REV: **01**; SHEET: 1 of 1

High Temperature Heat Pump *with Single Wall Condenser* : Dedicated Domestic Hot Water Heating



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	1-Sep-2017

Drawn By	Dan Rheault	Date 1-Sep-2017
Checked By	Dan Rheault	Date 1-Sep-2017
Approved By (ENG)	Dan Rheault	Date 1-Sep-2017
Approved By (MFG)		Date
Approved By		Date

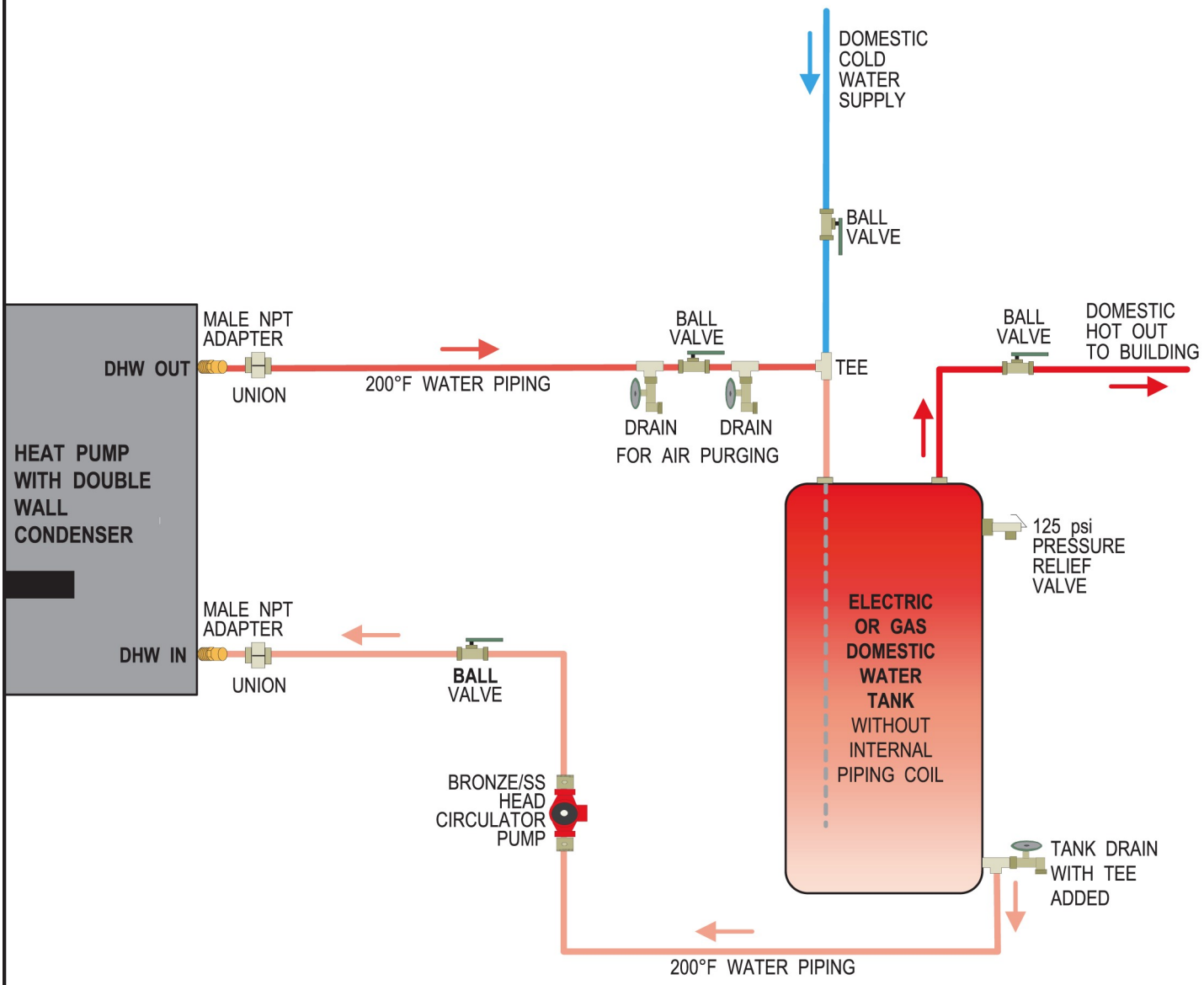
MARITIME GEOTHERMAL LTD.
170 Plantation Rd. Petitcodiac, NB E4Z 6H4

Drawing Name: High Temperature Single Wall Unit Connection to DHW Tank

Size	Drawing Number	REV	SHEET
A	002240PDG	01	1 of 1

DHW Tank Piping for Direct Domestic Water Heating

For Heat Pumps with Double Wall Condenser



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	22-Sep-2021

Drawn By: Dan Rheault	Date: 22-Sep-2021	
Checked By: Dan Rheault	Date: 22-Sep-2021	
Approved By (ENG): Dan Rheault	Date: 22-Sep-2021	
Approved By (MFG):	Date:	
Approved By:	Date:	

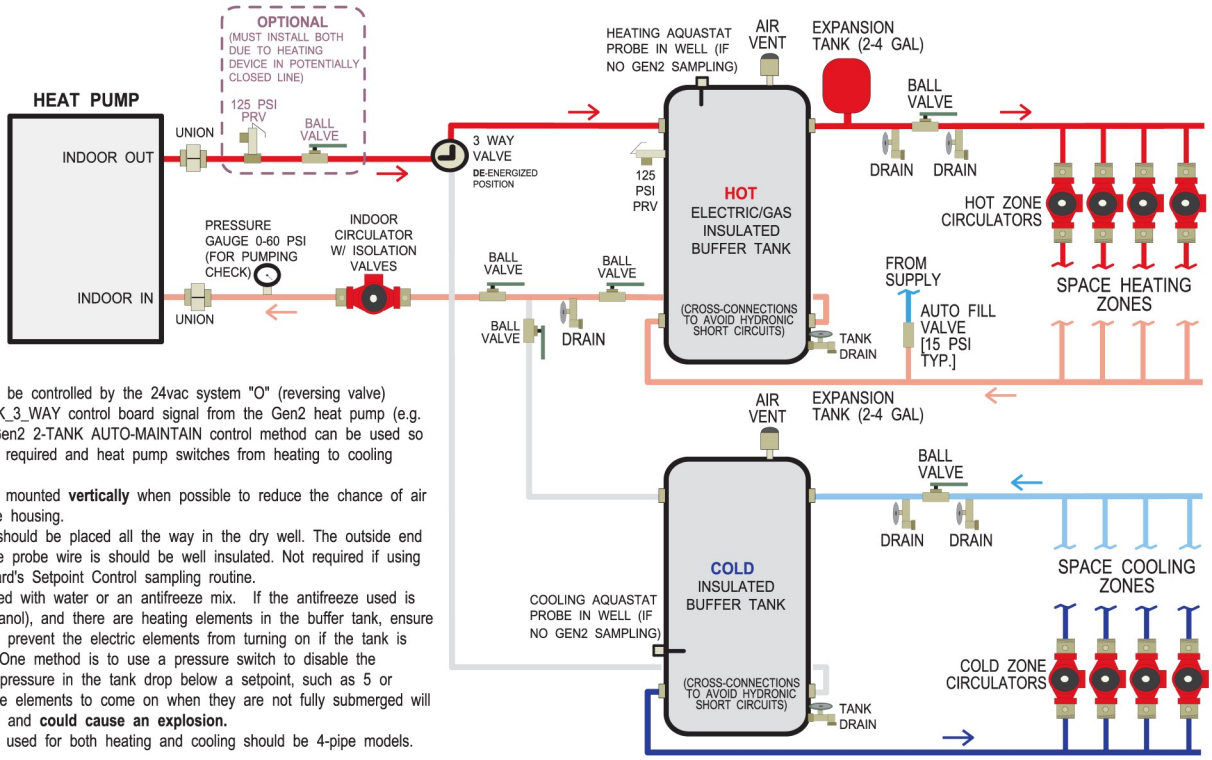
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Piping for Direct DHW Heating

Size	Drawing Number	REV	SHEET
A	002545PDG	01	1 of 1

Two Tank System Piping with a Reversing Heat Pump

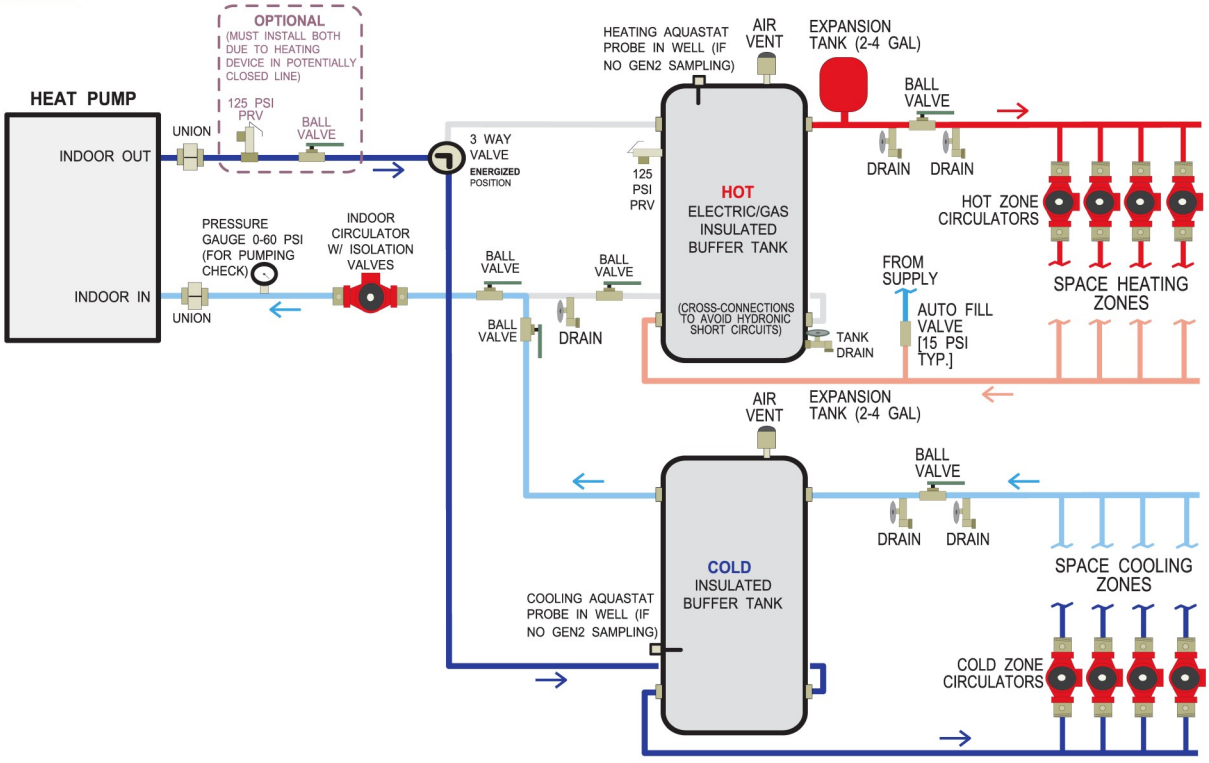
HEATING MODE



NOTES:

1. The 3-way valve can be controlled by the 24vac system "O" (reversing valve) signal, or TWO_TANK_3_WAY control board signal from the Gen2 heat pump (e.g. ATW-Series). The Gen2 2-TANK AUTO-MAINTAIN control method can be used so that no "O" signal is required and heat pump switches from heating to cooling automatically.
2. Circulators should be mounted **vertically** when possible to reduce the chance of air getting trapped in the housing.
3. The aquastat probe should be placed all the way in the dry well. The outside end of the well where the probe wire is should be well insulated. Not required if using the Gen2 control board's Setpoint Control sampling routine.
4. The loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (e.g. methanol), and there are heating elements in the buffer tank, ensure there is a method to prevent the electric elements from turning on if the tank is not completely full. One method is to use a pressure switch to disable the elements should the pressure in the tank drop below a setpoint, such as 5 or 10PSIG. Allowing the elements to come on when they are not fully submerged will burn the element out and **could cause an explosion.**
5. Hydronic air handlers used for both heating and cooling should be 4-pipe models.

COOLING MODE



REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D. RHEAULT	D. RHEAULT	6-Aug-2021
02	-	D. RHEAULT	D. RHEAULT	1-Mar-2018
01	Initial Release	D. RHEAULT	D. RHEAULT	25-Oct-2017

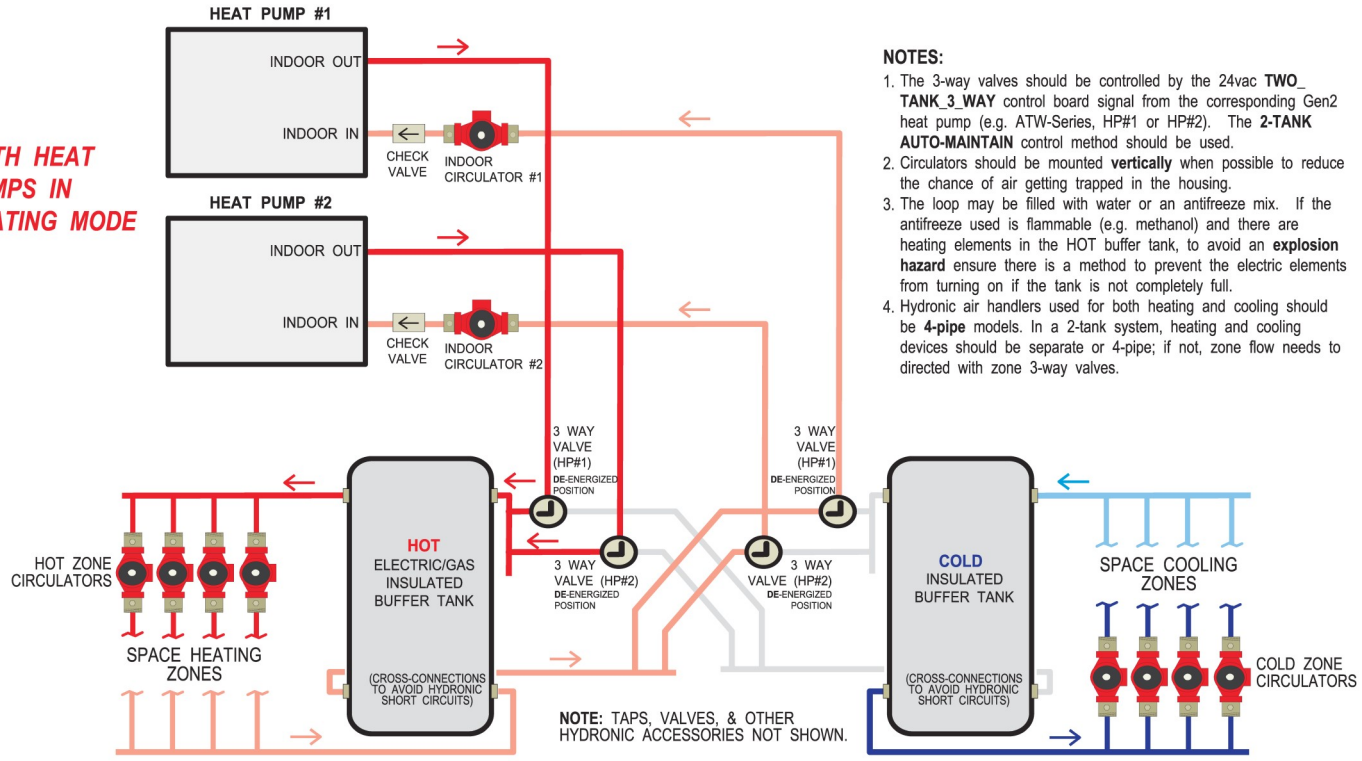
Drawn By: Dan Rheault	Date: 25-Oct-2017	
Checked By: Dan Rheault	Date: 25-Oct-2017	
Approved By (ENG): Dan Rheault	Date: 25-Oct-2017	
Approved By (MFG):	Date:	
Approved By:	Date:	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Two Tank System Piping with a Reversing Heat Pump

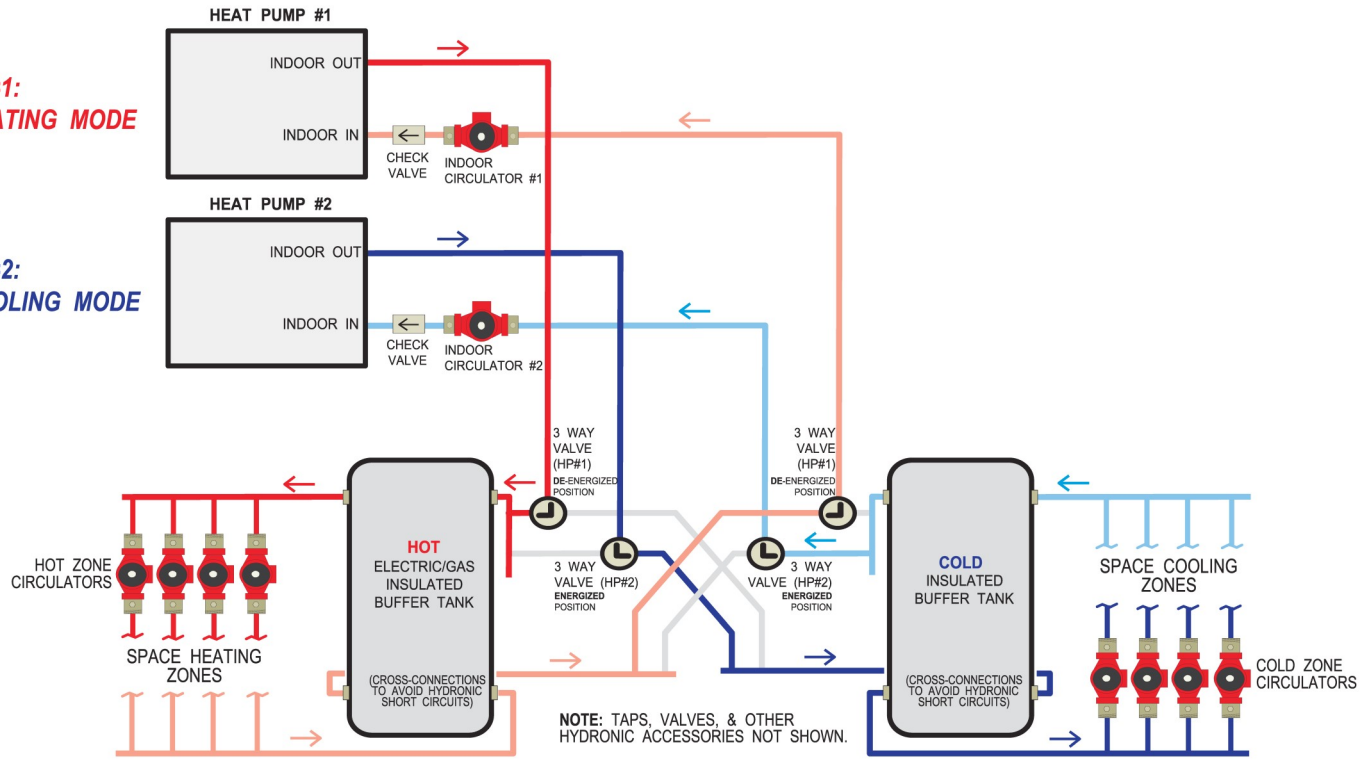
Size	Drawing Number	REV	SHEET
A	002252PDG	03	1 of 1

Two Tank System Piping with Multiple Reversing Heat Pumps



NOTES:

1. The 3-way valves should be controlled by the 24vac **TWO_ TANK_3_WAY** control board signal from the corresponding Gen2 heat pump (e.g. ATW-Series, HP#1 or HP#2). The **2-TANK AUTO-MAINTAIN** control method should be used.
2. Circulators should be mounted **vertically** when possible to reduce the chance of air getting trapped in the housing.
3. The loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (e.g. methanol) and there are heating elements in the HOT buffer tank, to avoid an **explosion hazard** ensure there is a method to prevent the electric elements from turning on if the tank is not completely full.
4. Hydronic air handlers used for both heating and cooling should be **4-pipe** models. In a 2-tank system, heating and cooling devices should be separate or 4-pipe; if not, zone flow needs to directed with zone 3-way valves.



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	6-Aug-2021

Drawn By: Dan Rheault	Date: 6-Aug-2021	
Checked By: Dan Rheault	Date: 6-Aug-2021	
Approved By (ENG): Dan Rheault	Date: 6-Aug-2021	
Approved By (MFG):	Date:	
Approved By:	Date:	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Two Tank System Piping with Multiple Reversing Heat Pumps

Size	Drawing Number	REV	SHEET
A	002527PDG	01	1 of 1

Two Tank Simultaneous Heating / Cooling

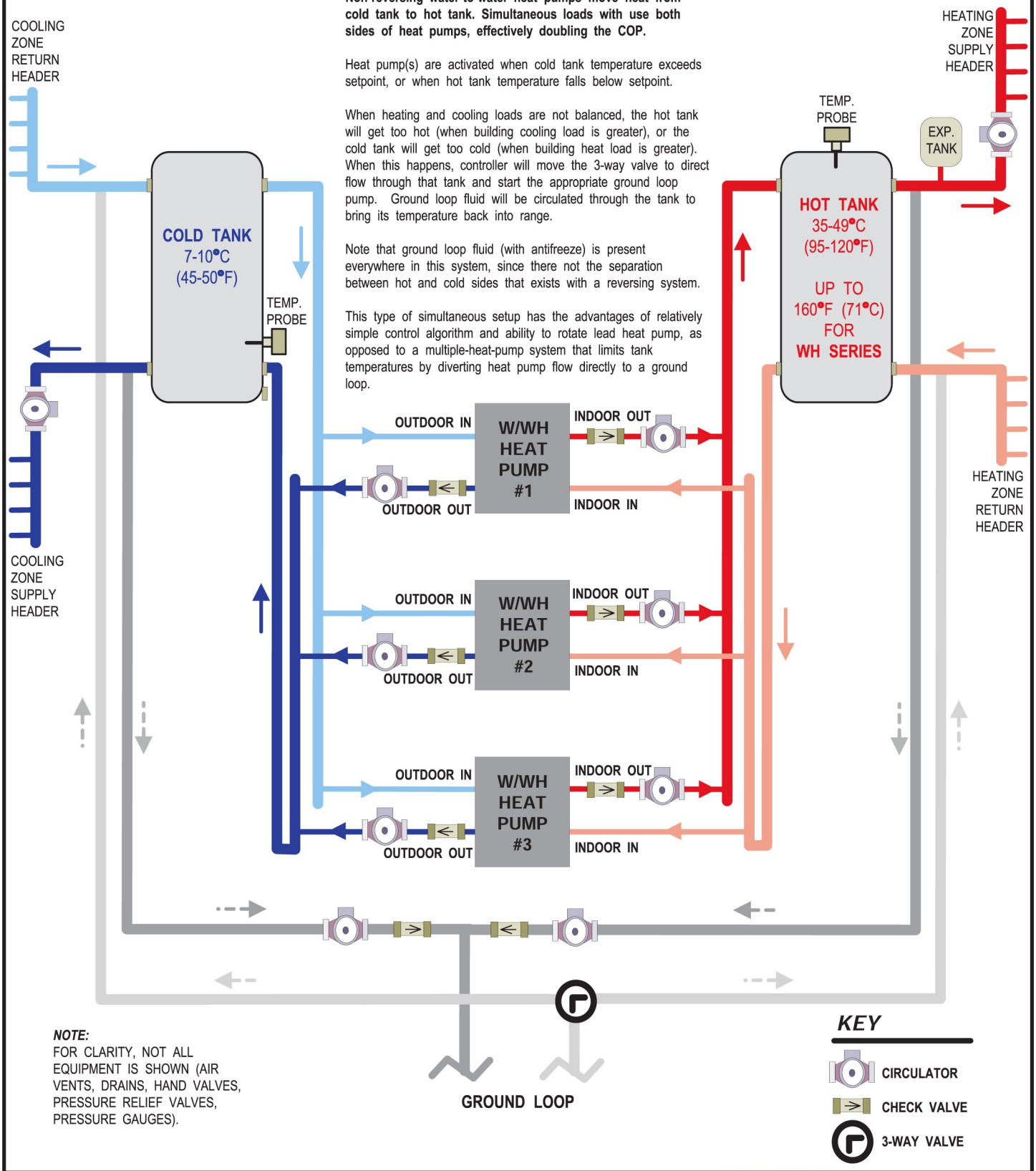
Non-reversing water-to-water heat pumps move heat from cold tank to hot tank. Simultaneous loads with use both sides of heat pumps, effectively doubling the COP.

Heat pump(s) are activated when cold tank temperature exceeds setpoint, or when hot tank temperature falls below setpoint.

When heating and cooling loads are not balanced, the hot tank will get too hot (when building cooling load is greater), or the cold tank will get too cold (when building heat load is greater). When this happens, controller will move the 3-way valve to direct flow through that tank and start the appropriate ground loop pump. Ground loop fluid will be circulated through the tank to bring its temperature back into range.

Note that ground loop fluid (with antifreeze) is present everywhere in this system, since there not the separation between hot and cold sides that exists with a reversing system.

This type of simultaneous setup has the advantages of relatively simple control algorithm and ability to rotate lead heat pump, as opposed to a multiple-heat-pump system that limits tank temperatures by diverting heat pump flow directly to a ground loop.



NOTE:
FOR CLARITY, NOT ALL EQUIPMENT IS SHOWN (AIR VENTS, DRAINS, HAND VALVES, PRESSURE RELIEF VALVES, PRESSURE GAUGES).

KEY

- CIRCULATOR
- CHECK VALVE
- 3-WAY VALVE

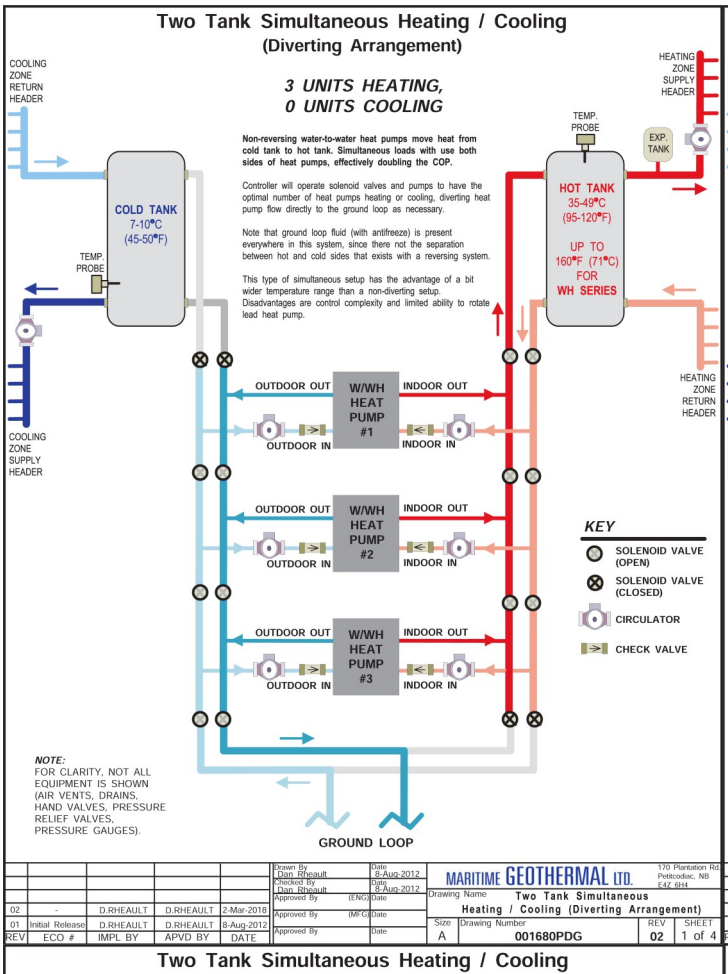
REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	2-Mar-2018

Drawn By	Dan Rheault	Date	2-Mar-2018
Checked By	Dan Rheault	Date	2-Mar-2018
Approved By	(ENG)	Date	
Approved By	(MFG)	Date	
Approved By		Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Two Tank Simultaneous Heating / Cooling

Size	Drawing Number	REV	SHEET
A	002288PDG	01	1 of 1

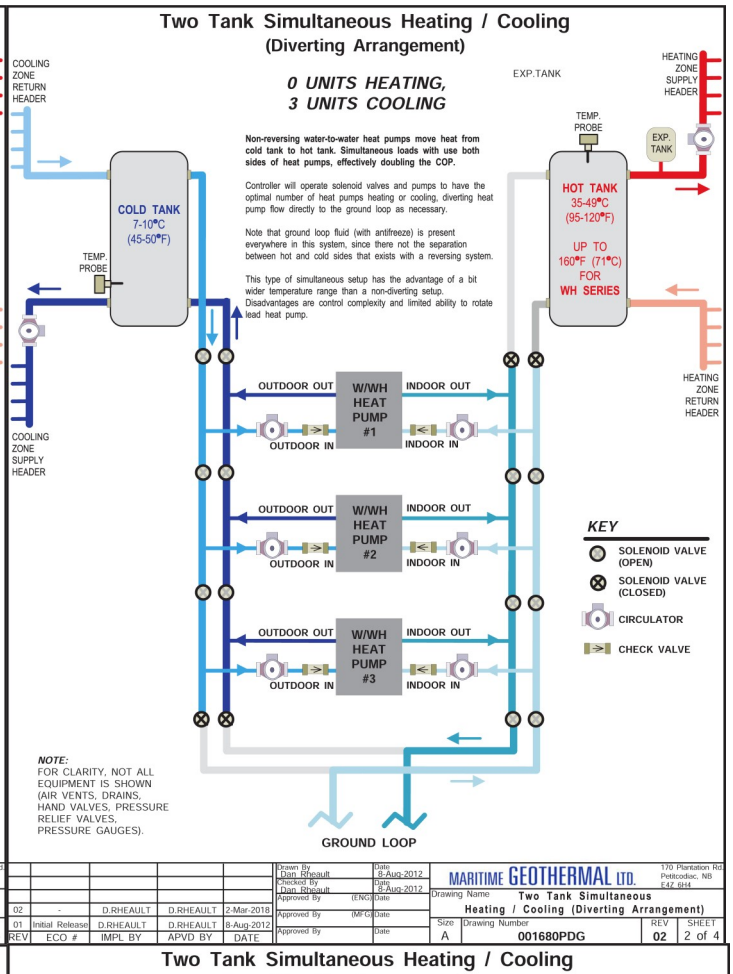


REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

Drawn By: Dan Rheault — Date: 8-Aug-2012
Checked By: Dan Rheault — Date: 8-Aug-2012
Approved By (ENG): Date
Approved By (MFG): Date
Approved By: Date

MARITIME GEOTHERMAL LTD. — 170 Plantation Rd, Petitcodiac, NB E4Z 6H4

Drawing Name: Two Tank Simultaneous Heating / Cooling (Diverting Arrangement)
Size: A | Drawing Number: 001680PDG | REV: 02 | SHEET: 1 of 4

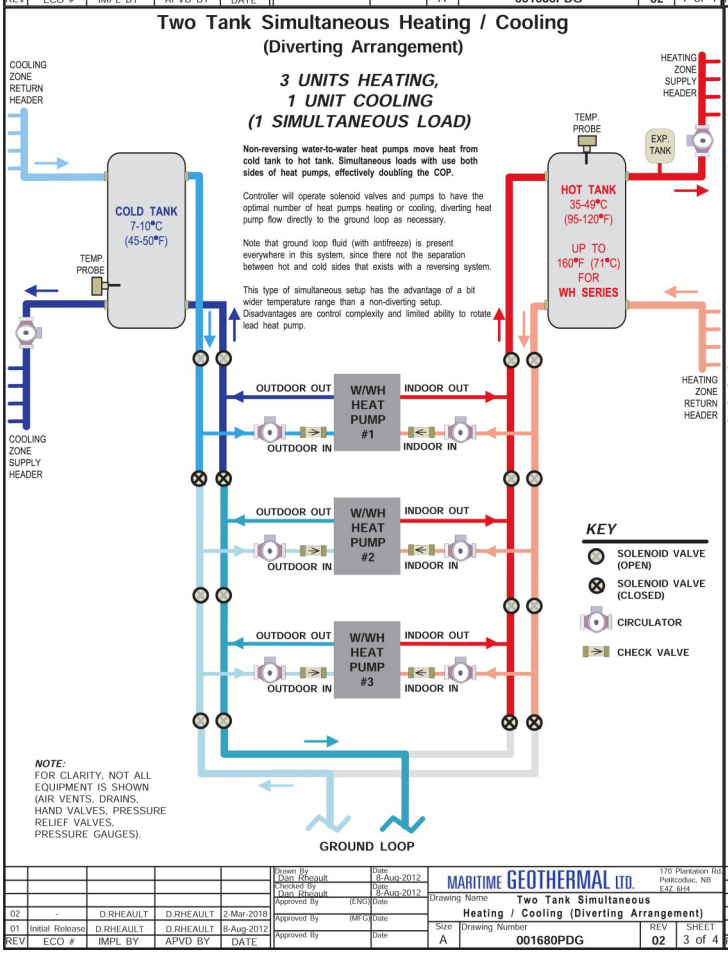


REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

Drawn By: Dan Rheault — Date: 8-Aug-2012
Checked By: Dan Rheault — Date: 8-Aug-2012
Approved By (ENG): Date
Approved By (MFG): Date
Approved By: Date

MARITIME GEOTHERMAL LTD. — 170 Plantation Rd, Petitcodiac, NB E4Z 6H4

Drawing Name: Two Tank Simultaneous Heating / Cooling (Diverting Arrangement)
Size: A | Drawing Number: 001680PDG | REV: 02 | SHEET: 2 of 4

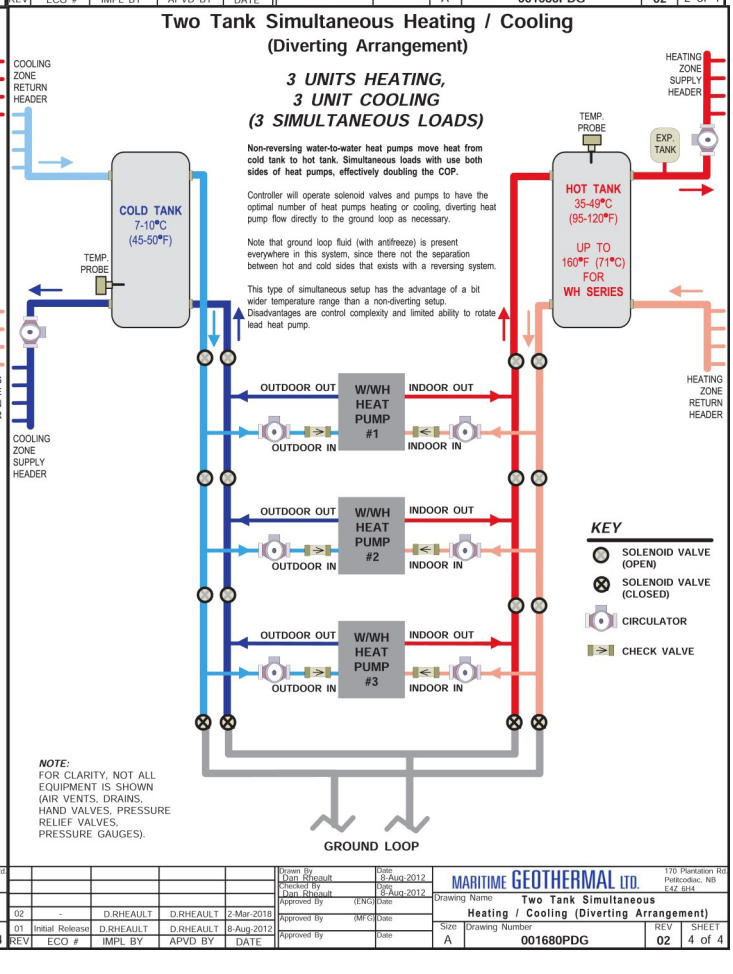


REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

Drawn By: Dan Rheault — Date: 8-Aug-2012
Checked By: Dan Rheault — Date: 8-Aug-2012
Approved By (ENG): Date
Approved By (MFG): Date
Approved By: Date

MARITIME GEOTHERMAL LTD. — 170 Plantation Rd, Petitcodiac, NB E4Z 6H4

Drawing Name: Two Tank Simultaneous Heating / Cooling (Diverting Arrangement)
Size: A | Drawing Number: 001680PDG | REV: 02 | SHEET: 3 of 4



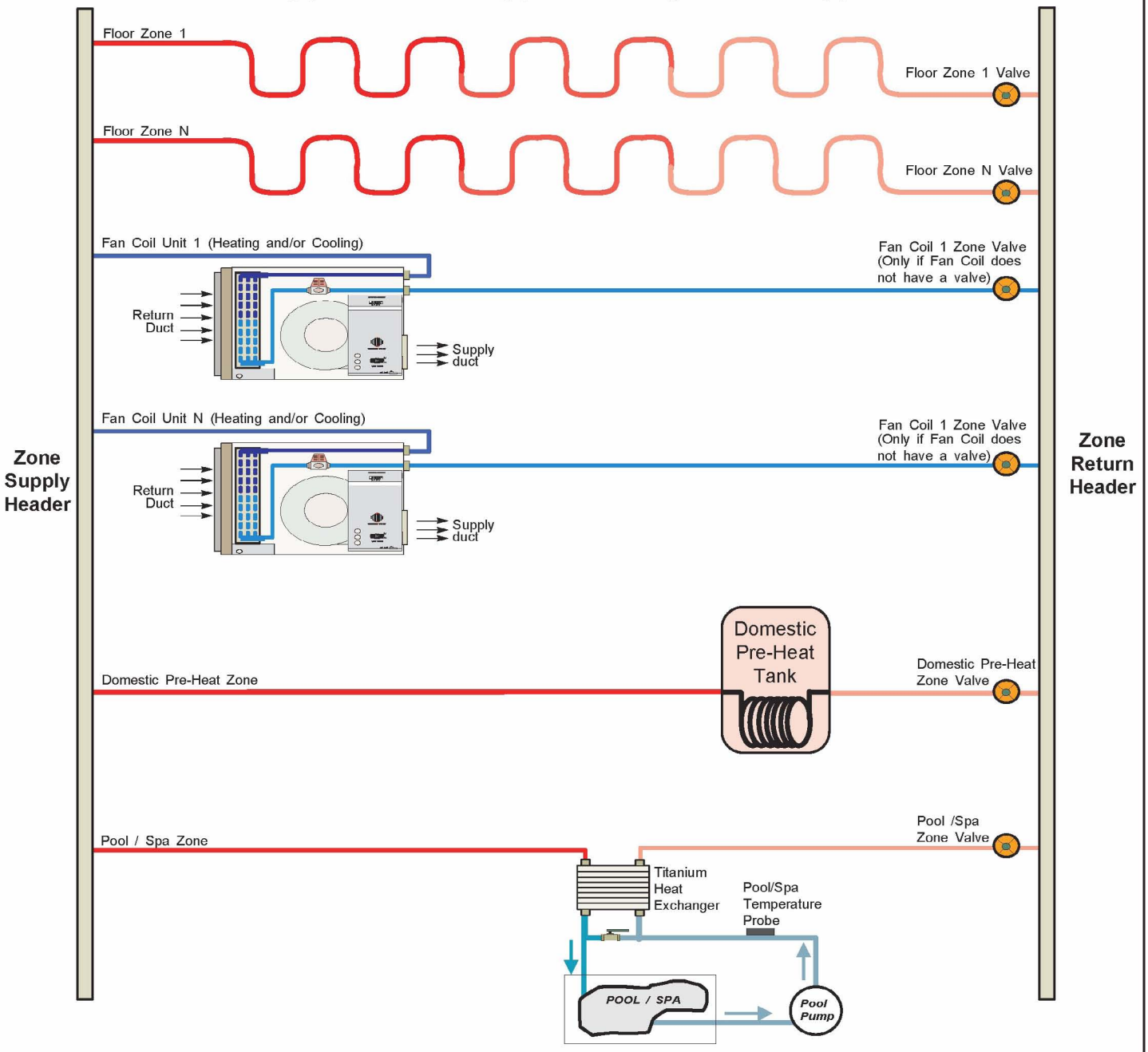
REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

Drawn By: Dan Rheault — Date: 8-Aug-2012
Checked By: Dan Rheault — Date: 8-Aug-2012
Approved By (ENG): Date
Approved By (MFG): Date
Approved By: Date

MARITIME GEOTHERMAL LTD. — 170 Plantation Rd, Petitcodiac, NB E4Z 6H4

Drawing Name: Two Tank Simultaneous Heating / Cooling (Diverting Arrangement)
Size: A | Drawing Number: 001680PDG | REV: 02 | SHEET: 4 of 4

Typical Zone Types for Hydronic Applications



NOTES:

1. Floor zones are heating only. Cooling a floor zone will cause condensation in the floor. Floor zone valves should be wired through a relay that is controlled by the cooling signal (O) that breaks the signal when in cooling mode to ensure that they cannot accidentally be energized.
2. There may be multiple floor zones.
3. There may be multiple fan coil units, (heating and /or cooling). A zone valve is not required if the unit has a internal valve.
4. Domestic Pre-Heat Tank is for on-demand apllications. The tank must have a heat eaxchanger in it or an external one must be used to separate the zone loop from the potable water supply.
5. Ensure the floor circulator is adequately sized to accomodate the type and number of zones connected to the system.
6. The pool aquastat will operate the Pool/Spa Zone Valve.

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	06 SEP 07

Drawn By: Chris Geddes	Date: 06 SEP 07	
Checked By: Chris Geddes	Date: 06 SEP 07	
Approved By (ENG): Chris Geddes	Date: 06 SEP 07	
Approved By (MFG):	Date:	
Approved By:	Date:	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Zone Types for Hydronic Applications

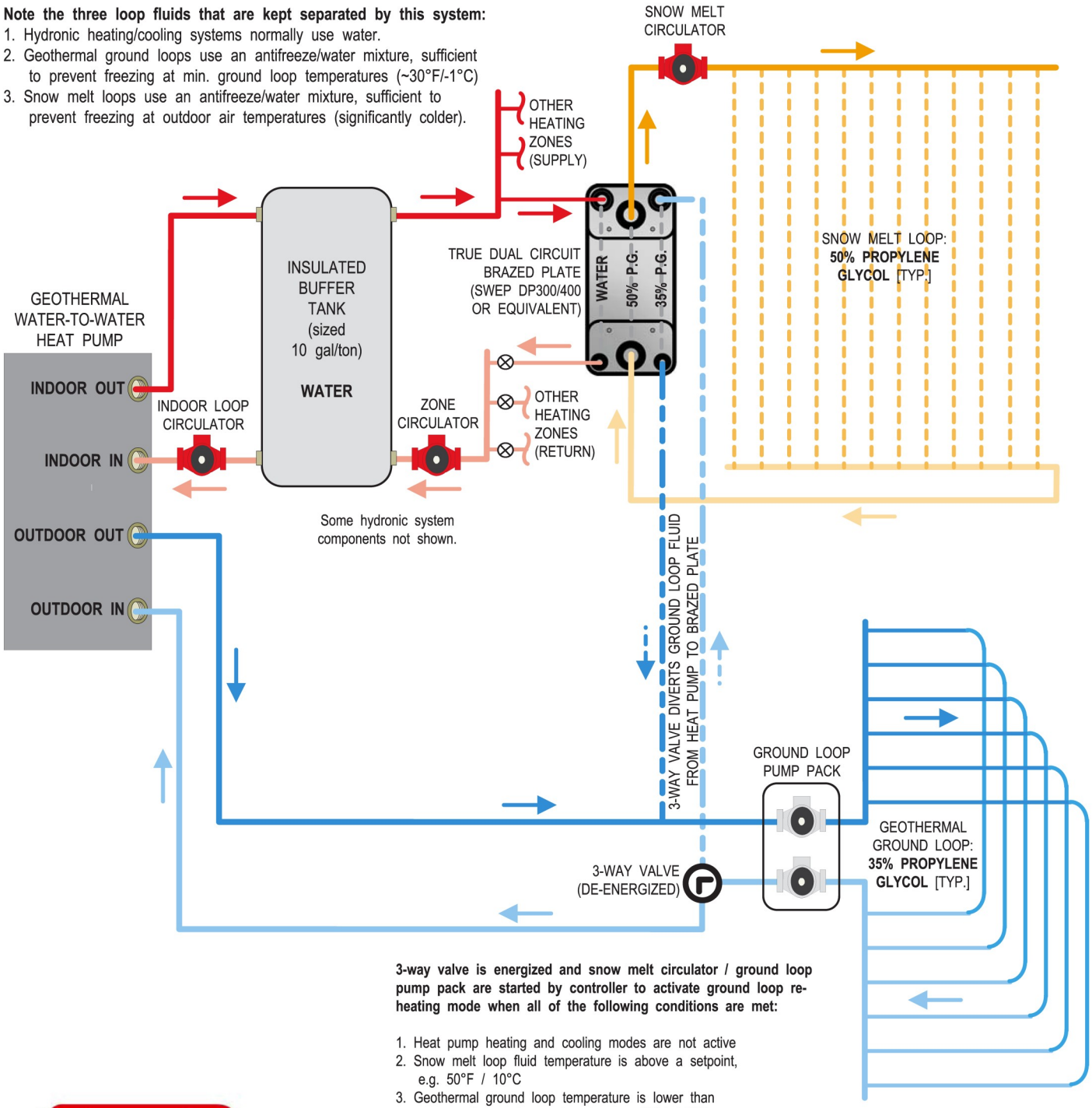
Size	Drawing Number	REV	SHEET
A	000530PDG	01	1 of 1

Geothermal Snow Melt System with Warm-Weather Ground Loop Re-heating

The geothermal snow melt system, designed according to ASHRAE guidelines, will efficiently **melt snow and ice** in the winter, and will act as a **solar collector** during warn weather to re-heat the geothermal ground loop and increase its cold-weather performance.

Note the three loop fluids that are kept separated by this system:

1. Hydronic heating/cooling systems normally use water.
2. Geothermal ground loops use an antifreeze/water mixture, sufficient to prevent freezing at min. ground loop temperatures (~30°F/-1°C)
3. Snow melt loops use an antifreeze/water mixture, sufficient to prevent freezing at outdoor air temperatures (significantly colder).



3-way valve is energized and snow melt circulator / ground loop pump pack are started by controller to activate ground loop re-heating mode when all of the following conditions are met:

1. Heat pump heating and cooling modes are not active
2. Snow melt loop fluid temperature is above a setpoint, e.g. 50°F / 10°C
3. Geothermal ground loop temperature is lower than snow melt loop temperature by e.g. 10°F / 5°C

When 3-way valve is energized, snow melt hydronic heating zone is locked out.

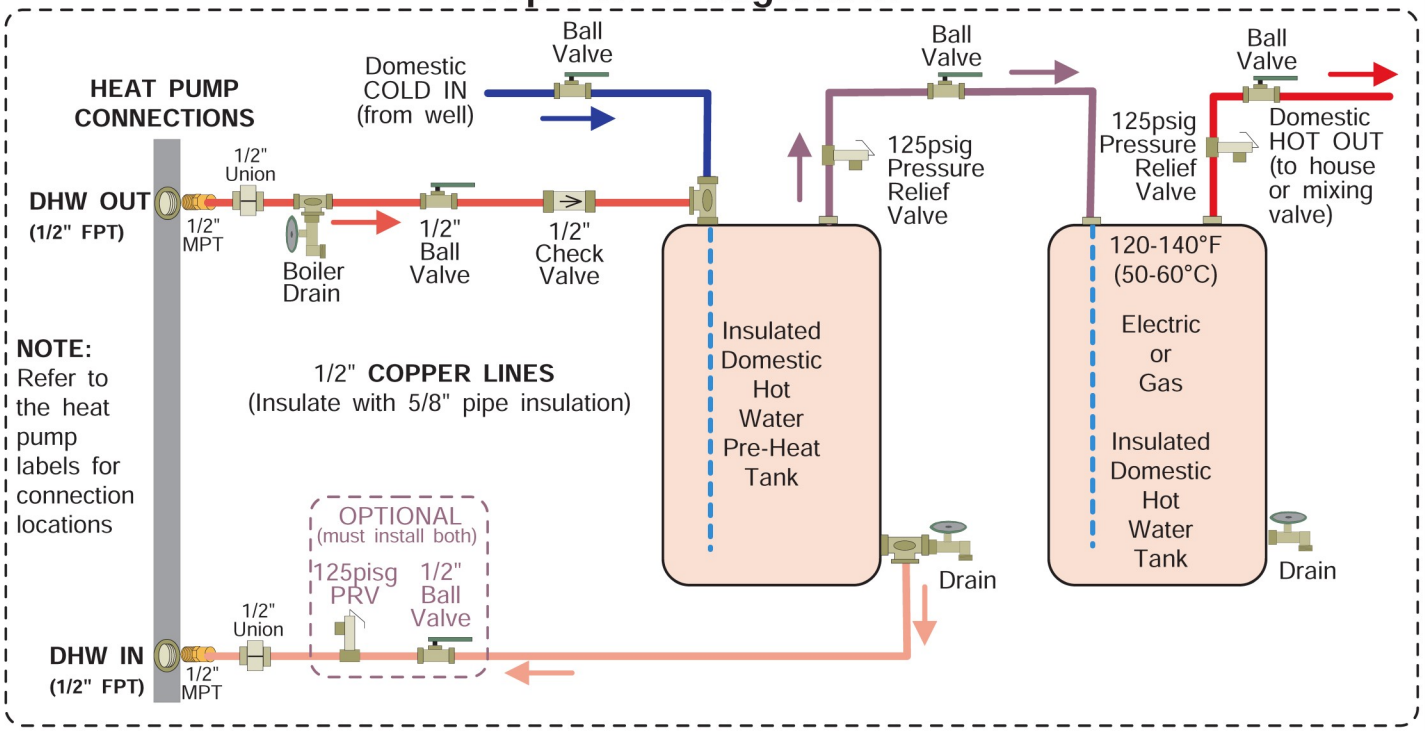
REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	31-Jan-2018

Drawn By: Dan Rheault	Date: 31-Jan-2018	MARITIME GEOTHERMAL LTD. www.nordicghp.com
Checked By: Dan Rheault	Date: 31-Jan-2018	Drawing Name: Piping for Snow Melt with Ground Loop Re-heating
Approved By (ENG): Dan Rheault	Date: 31-Jan-2018	
Approved By (MFG):	Date:	
Approved By:	Date:	

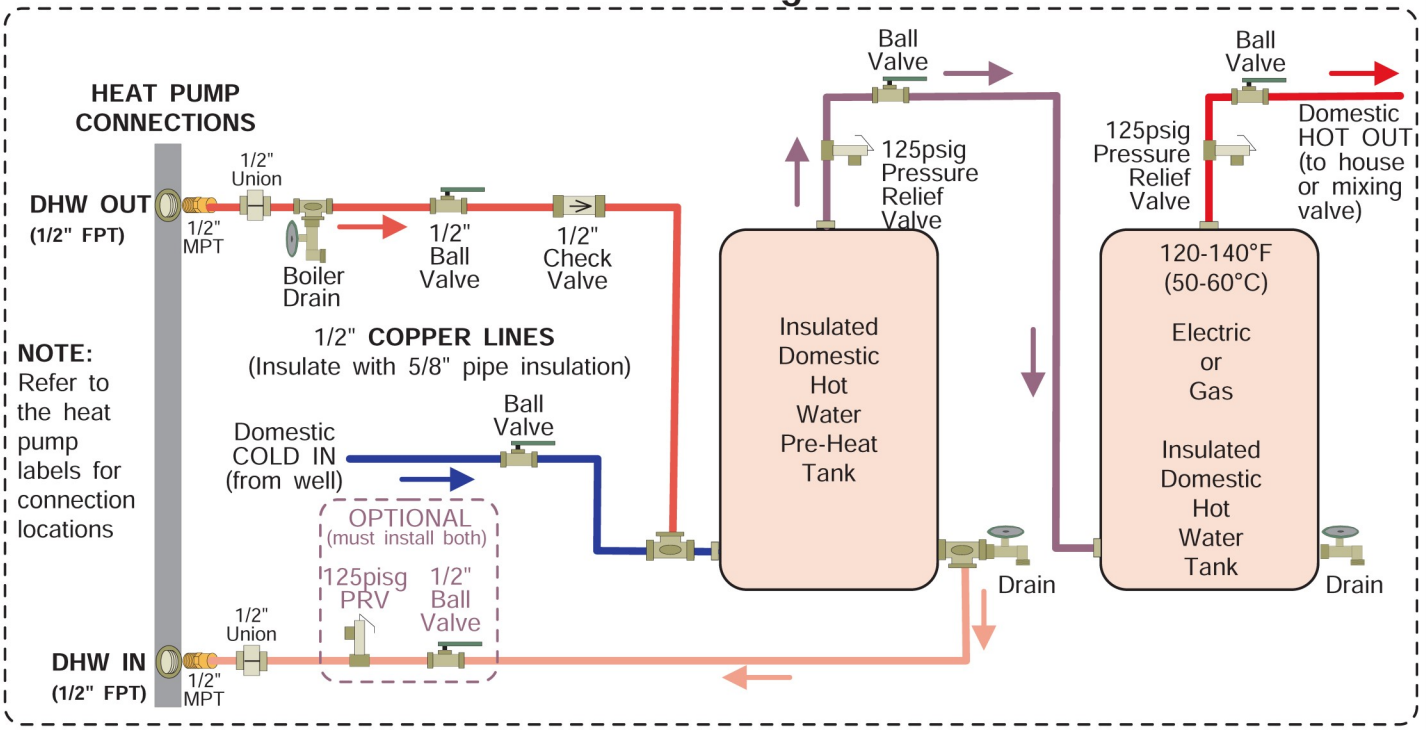
Size	Drawing Number	REV	SHEET
A	002286PDG	01	1 of 1

Desuperheater Connection to DHW Pre-Heat Tank

Top Port Configuration



Side Port Configuration



REV	ECO #	IMPL BY	APVD BY	DATE
01a	Re-titled	D. RHEAULT	D. RHEAULT	15 JAN 19
01	Initial Release	C. GEDDES	C. GEDDES	10 MAR 09

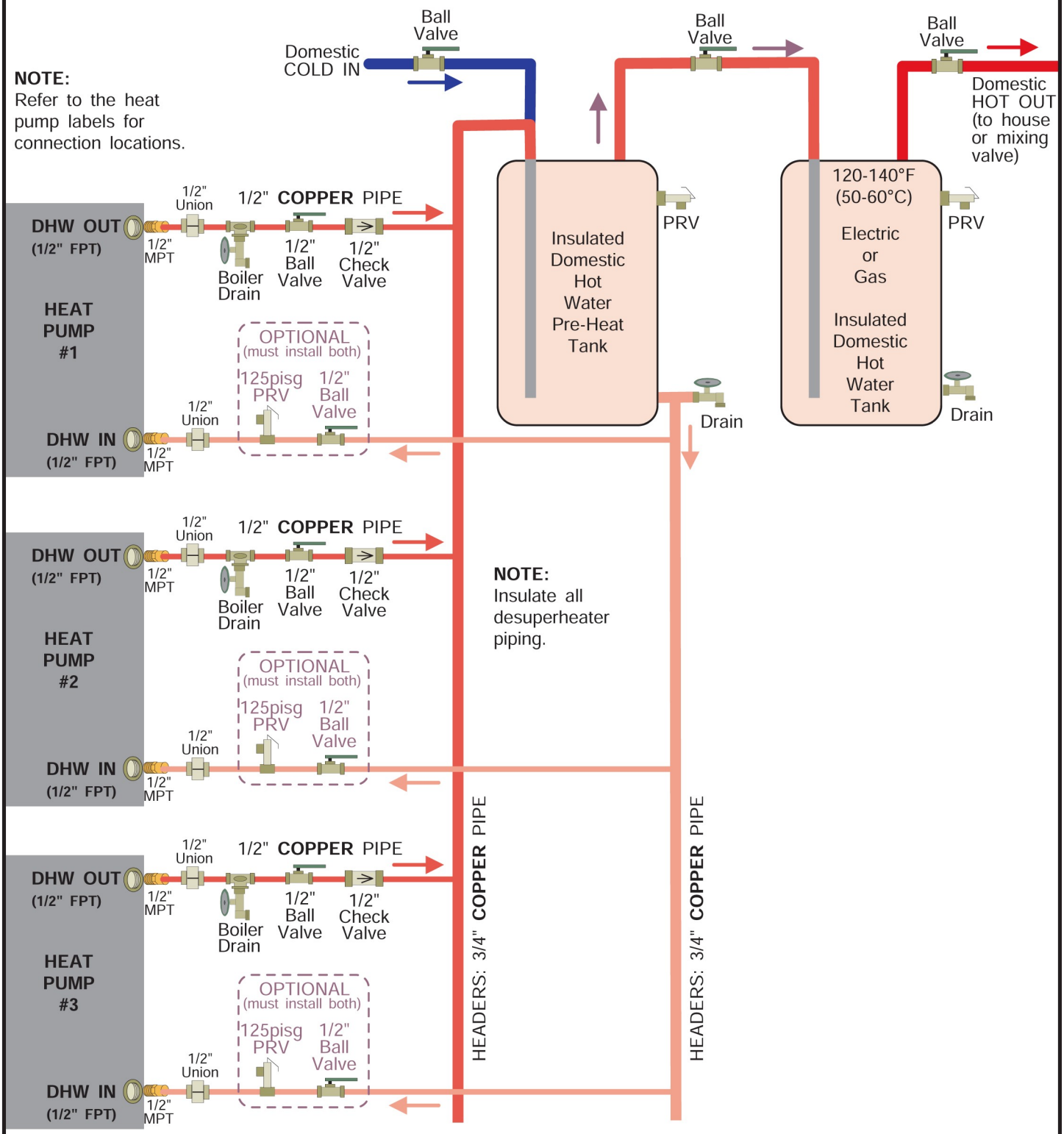
Drawn By: Chris Geddes	Date: 10 MAR 09	
Checked By: Chris Geddes	Date: 10 MAR 09	
Approved By (ENG): Chris Geddes	Date: 10 MAR 09	
Approved By (MFG):	Date:	
Approved By:	Date:	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Single Unit Connection to DHW Pre-Heat Tank (Brass FPT)

Size	Drawing Number	REV	SHEET
A	000970PDG	01a	1 of 1

Desuperheater Connection to DHW Pre-Heat Tank - Multiple Units



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	24-Apr-2019

Drawn By: Dan Rheault	Date: 24-Apr-2019	
Checked By: Dan Rheault	Date: 24-Apr-2019	
Approved By (ENG): Dan Rheault	Date: 24-Apr-2019	
Approved By (MFG):	Date:	
Approved By:	Date:	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Multiple Unit Desuperheater Connection to DHW Pre-Heat Tank (Brass FPT)

Size	Drawing Number	REV	SHEET
A	002384PDG	01	1 of 1

Ground Loop Installations

WARNING: The R134a WH-series requires a source fluid temperature of 45°F (7°C) or greater. Therefore, the WH series may not use a ground loop except in suitably warm climates.

WARNING: Heating-only W/WH-H units only extract heat from (never reject heat to) the ground loop. This must be taken into account during ground loop design.

Refer to diagrams **000608INF** & **000609INF** at the end of this section for typical ground loop configurations. They are for reference only, and should not be used to replace formal training and computerized loop design.

Once the ground loop has been pressure tested and the header pipes have been connected to the circulator pump module, the heat pump can be connected to the circulator pump module. **The port connections for the Outdoor Loop are brass FPT fittings. They are marked as OUTDOOR IN and OUTDOOR OUT.**

Circulator Pump Module

Maritime Geothermal Ltd. offers compact pump modules with built in three way valves to facilitate filling and purging the ground loop. Refer to drawing **000906CDG** at the end of this section. Alternatively, Grundfoss Model UPS 26-99 or Taco Model 0011 pumps or other brands with similar pumping capability may be used. The single pump module will typically handle systems up to 3 tons (model sizes 25, 35, and 45); the two pump module will typically handle 4 to 6 ton systems (model sizes 55, 65, 75, 80). This is based on a typical parallel system with one circuit per ton.

Maritime Geothermal recommends calculating the total pressure drop of the ground loop (including headers, indoor piping and heat pump exchanger drop) based on the antifreeze type and concentration at the desired minimum loop temperature. A pump module that can deliver the flow required for the unit at the calculated total pressure drop should be selected. Refer to the **Model Specific Information** section for unit flow requirements.

Loop pressure drops can be calculated using software such as those mentioned in the Horizontal Ground loops section, or can be calculated in a spreadsheet using the pipe manufacturer's pressure drop tables for pipe diameter and fittings.

The circulator pump module must be connected to the heat pump Outdoor Loop ports with a lineset suitable for the flow required with minimum pressure drop. 1" rubber or plastic lines should be used.

The installation of P/T plugs/ports (pressure / temperature, pronounced "*Pete's plugs"*) is recommended on both the entering and leaving lines at the heat pump. This will allow the installer or homeowner to check water flow through the loop by measuring the pressure difference through the heat exchanger and comparing it to that listed in the **Model Specific Information** section. P/T ports, adapters, and gauge adapters and are available as accessories from Maritime Geothermal Ltd..

Flushing & Purging

Once the groundloop has been installed and all connections are completed between the heat pump, circulator pump module and ground loop, the entire ground loop system should be **pressure tested with air to 100 PSIG** to make sure there are no leaks on any of the inside fittings. Soap all joints and observe that the pressure remains constant for 1 hour.

When satisfied that all connections are leak free, release the air pressure and connect a purge cart **(see Figure 1)** to the flushing access ports at the pump module **(refer to drawing 000906CDG)**. A temporary flushing system can alternately be constructed using a 45 gal. barrel and a pump with sufficient volume and head capability to circulate fluid at a **velocity of at least 2 ft/min** through all parts of the loop.

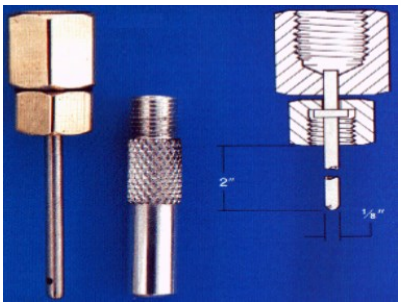
Figure 1: Ground Loop Accessories & Tools

2-pump module

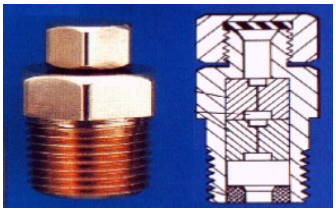
Barbed Adapters

PE Adapters

Purge Cart



Gauge adapter for P/T port



P/T port

P/T adapters for heat pump (1" NPT to barb)

Adjust the circulator pump module valves to connect the purge cart to the ground loop. Begin pumping water through the ground loop, ensuring that the intake of the pump stays submerged at all times by continuously adding water. Water flowing back from the return line should be directed below the water level in the barrel or flush tank to prevent air being mixed with the outgoing water.

Once the lines have been filled and no more air bubbles are appearing in the line, adjust the circulator pump module valves to circulate water through the heat pump using the same technique as described above. When all air is removed reverse the flow of water through the lines by interchanging the flush cart lines and purge again. You will be able to visibly tell when all air is removed.

Adding Antifreeze Solution

In most mid and northern areas of the US and in all of Canada it is necessary to condition the loop fluid by the addition of some type of antifreeze solution so that it will not freeze during operation in the winter months. This antifreeze is required because the loop fluid will typically reach a low entering temperature of **28°F to 32°F (-2°C to 0°C)** and refrigerant temperatures inside the heat pump's heat exchanger may be as low as **20°F (11°C)** cooler. See table for details of freeze protection provided by different concentrations.

TABLE 11 - Antifreeze Percentages

BY VOLUME				
Protection to:	**10°F**	**15°F**	**20°F**	**25°F**
Methanol	25%	21%	16%	10%
Propylene Glycol	38%	30%	22%	15%
BY WEIGHT				
Protection to:	**10°F**	**15°F**	**20°F**	**25°F**
Methanol	16.8%	13.6%	10%	6.3%
Propylene Glycol	30%	23.5%	18.3%	12.9%

WARNING: Add enough antifreeze to allow for a temperature 20°F (11°C) lower than the expected lowest loop fluid temperature entering the heat pump. Insufficient anti-freeze concentration could cause the heat exchanger to freeze and rupture, voiding the warranty.

Although many different antifreeze solutions have been employed in geothermal systems, the alcohols such as methanol or ethanol have the most desirable characteristics for groundloop applications. The overall heat transfer characteristics of these fluids remain high although care must be taken when handling pure alcohols since they are extremely flammable. Once mixed in a typical 25% by volume ratio with water the solution is not flammable. In situations where alcohols are not allowed as a loop fluid due to local regulations then propylene glycol is a non-toxic alternative which can be substituted . Propylene glycol should only be used in cases where alcohols are not permitted since the heat transfer characteristics are less desirable and it becomes more viscous at low temperatures, increasing pumping power.

The volume of fluid that the loop system holds can be closely estimated by totaling the number of ft. of each size pipe in the system and referencing table the for approximate volume per 100 ft.

TABLE 12 - Volume of fluid per 100 ft. of pipe

		Volume /100ft.		
Type of Pipe	**Diameter**	**l.gal**	**gal**	**L**
Copper	**1"**	**3.4**	**4.1**	**15.5**
	1-1/4"	**5.3**	**6.4**	**24.2**
	1-1/2"	**7.7**	**9.2**	**34.8**
Rubber Hose	**1"**	**3.2**	**3.9**	**14.8**
Polyethylene	**3/4" IPS SDR11**	**2.3**	**2.8**	**10.6**
	1" IPS SDR11	**3.7**	**4.5**	**17.0**
	1-1/4" IPS SDR11	**6.7**	**8.0**	**30.3**
	1-1/2" IPS SDR11	**9.1**	**10.9**	**41.3**
	2" IPS SDR11	**15.0**	**18.0**	**68.1**
Other Item Volumes				
Heat Exchanger	**Average**	**1.2**	**1.5**	**5.7**
Purge Cart Tank	**See cart manual**	**TBD**		

When the volume of the loop has been calculated and the appropriate amount of antifreeze is ready for addition by referencing table; drain the equivalent amount of water from the flush cart or mixing barrel and replace it with the antifreeze.

When using alcohols, be sure to inject below the water line to reduce initial volatility of the pure antifreeze. If the loop is large it may be necessary to refill the tank with antifreeze several times to get all the antifreeze into the loop. Pump the loop for 5 to 10 minutes longer to ensure the remaining fluid has been well mixed.

Initial Pressurization

At this point open all valves in the flow circuit and slowly close off the supply and return flush cart valves in a manner that leaves about **20-30 psig** on the system. If an air bladder expansion tank is used it should be charged to the above pressure before actual water pressure is put on the system . Systems without an expansion tank will experience greater fluctuations in pressure between the heating and cooling seasons, causing pressure gauges to have different values as the loop temperature changes. This fluctuation is normal since expansion and contraction of the loop fluid must be handled by the elasticity of the plastic loop.

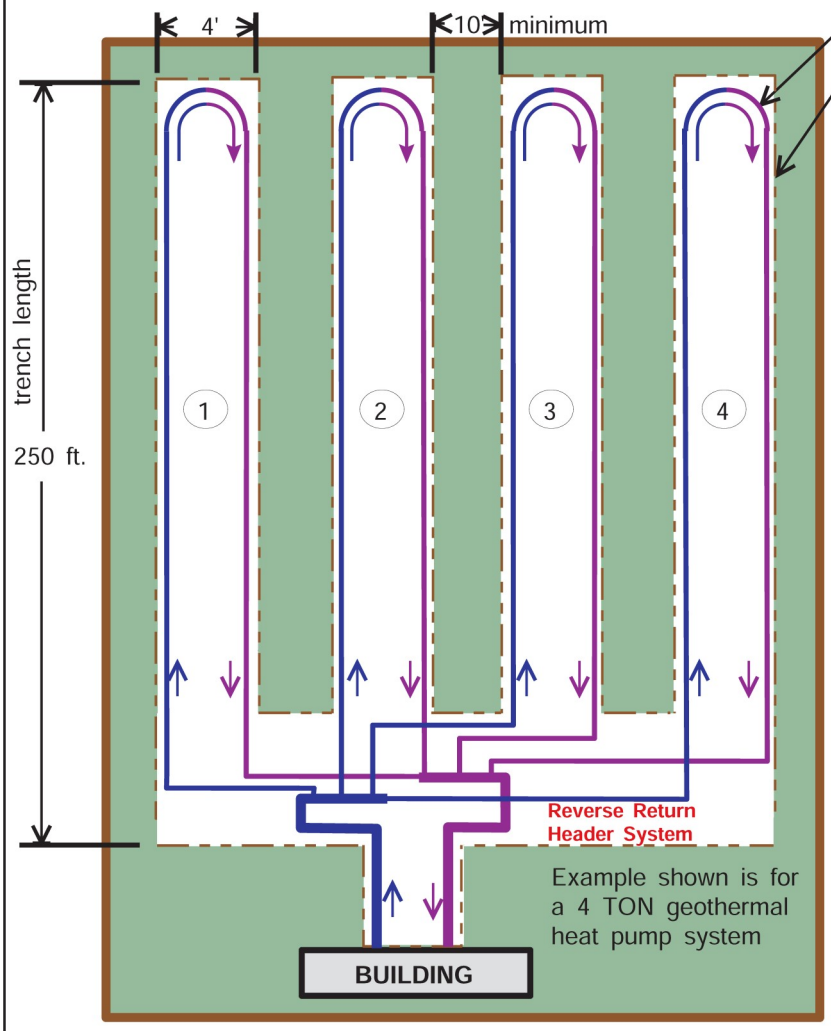
- Pressurize the loop to a static pressure of **45 psig**. when installing a system in the fall going into the heating season.
- Pressurize the loop to a static pressure of **25 psig**. when installing a system in the spring or summer going into the cooling season.

After operating the heat pump for a period of time, any residual air in the system should be bled off and the static pressure should be verified and adjusted if necessary. Add additional water / antifreeze mix with the purge cart to bring the pressure back to the original setting if required.

Pipe Insulation

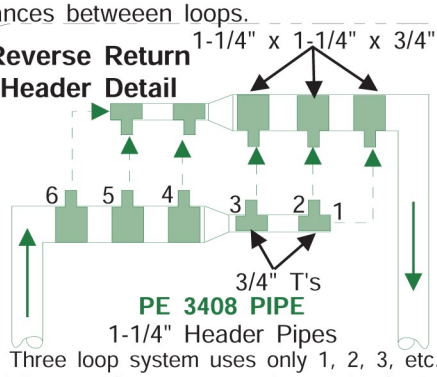
All ground loop piping inside the structure (between the structure entry point and the heat pump) should be insulated with 3/8" thick closed cell pipe insulation to prevent condensation and dripping onto floors or walls.

TYPICAL HORIZONTAL GROUND LOOP CONFIGURATION



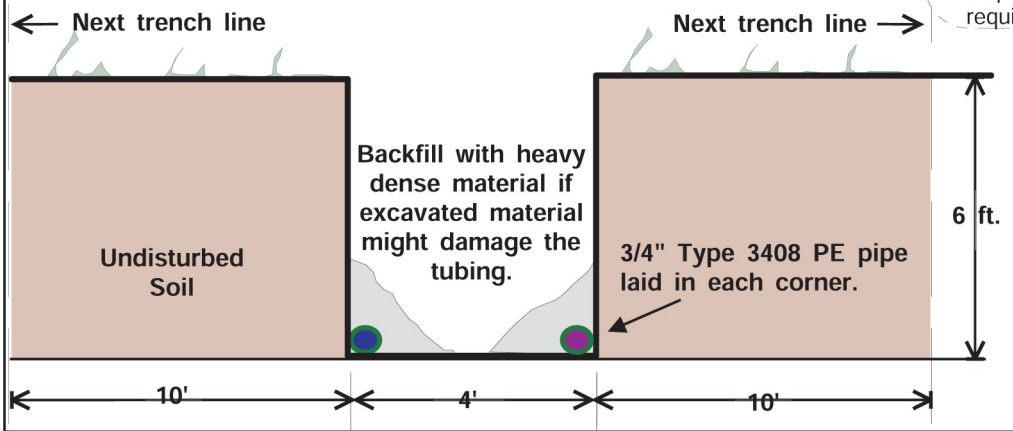
- Type PE 3408 Pipe
- Excavated trenches minimum 4' wide x 6' deep
- Trenches will be backfilled with material which will maximize the thermal conductivity of the adjacent earth.
- Each loop consists of 500ft. of 3/4" type 3408 PE 160 psig (SDR 11) geothermal heat pump polyethelene tubing.
- Each trench is 250ft. begining from the header. This allows one 500ft. rool of pipe to be used with only two fusion connections (one at each header).
- Allow a minimum of 10 ft. between each trench and preferably 15 - 20 ft. if space is available.
- Insulate all tubing within 12ft. of the structure with 1/2" thick closed cell armaflex insulation.
- Piping that is laid in a header trench should be insulated to a point where each loop branches to it's individual trench.
- The loop with the most pipe in the header trench could be left uninsulated to pick up heat from the header trench as long as the header trench is more than 12' out from the building.
- Reverse return headers minimize flow imbalances betweeen loops.

Reverse Return Header Detail



Three loop system uses only 1, 2, 3, etc. Minimum 2ft/sec to purge air. Each 3/4" loop requires 4USPGM to purge. 24USGPM to purge 6 loops, 20 for 5, 16 for 4, 12 for 3, 2 loops requires 10USGPM due to 1-1/4" header.

Elevation View of Trench



- Hand backfilling in the area just over the plastic pipe is recommended to prevent crushing or pinching of the pipe during backfilling operations.
- Horizontal style pipe runs should be placed 6' deep x minimum of 48" wide trench as shown above, with a minimum of 10ft. between trenches

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	17 JAN 08

Drawn By	Chris Geddes	Date 17 JAN 08
Checked By	Chris Geddes	Date 17 JAN 08
Approved By (ENG)	Chris Geddes	Date 17 JAN 08
Approved By (MFG)		Date
Approved By		Date

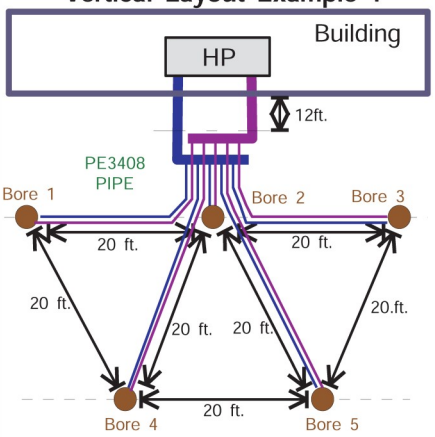
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Horizontal Ground Loop Configuration

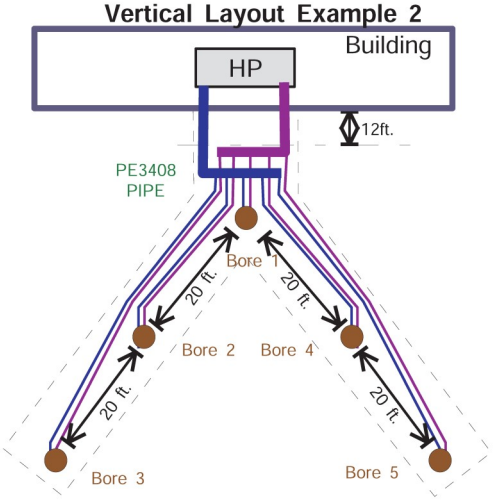
Size	Drawing Number	REV	SHEET
A	000608INF	01	1 of 1

TYPICAL VERTICAL GROUND LOOP CONFIGURATION

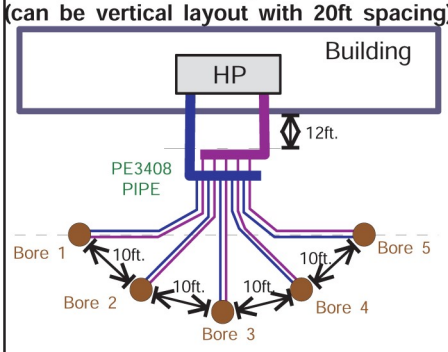
Vertical Layout Example 1



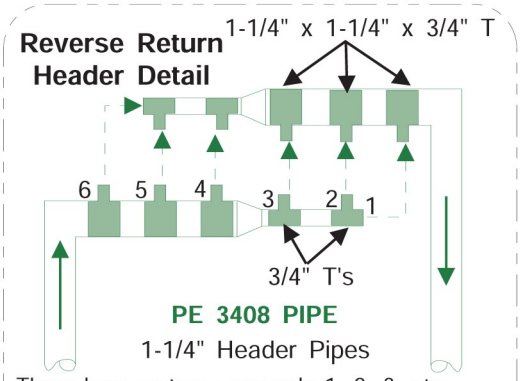
Vertical Layout Example 2



Angled Vertical Layout Example 1
(can be vertical layout with 20ft spacing)

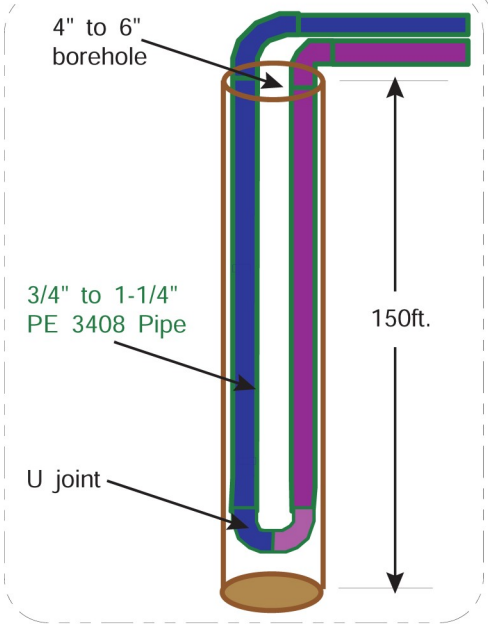


Reverse Return Header Detail



Three loop system uses only 1, 2, 3, etc. Minimum 2ft/sec to purge air. Each 3/4" loop requires 4USPGM to purge. 24USGPM to purge 6 loops, 20 for 5, 16 for 4, 12 for 3, 2 loops requires 10USGPM due to 1-1/4" header.

Borehole Detail



- Examples shown are for a 5 TON geothermal heat pump system
- Type PE 3408 Pipe
- Excavated trenches to boreholes minimum 4' wide x 6' deep
- Trenches should be backfilled with material which will maximize the thermal conductivity of the adjacent earth.
- Hand backfilling in the area just over the plastic pipe is recommended to prevent crushing or pinching of the pipe during backfilling operations.
- Allow a minimum of 20 ft. between each borehole for vertical boreholes and 10ft for vertical angled boreholes.
- Piping that is laid in a header trench should be insulated up to the individual trench to the borehole.
- Insulate all tubing within 12ft. of the structure with 1/2" thick closed cell armaflex insulation.
- Reverse return headers minimize flow imbalances betweeen loops.
- The number of boreholes can be reduced by increasing the depth of the boreholes. Do not exceed 300ft depth and care must be taken to size the circulator pump module accordingly.
- Be sure to obtain permission prior to drilling if angled boreholes enter neighbouring properties.

- Each loop consists of minimum 300ft. of 3/4" type 3408 PE 160 psig (SDR 11) geothermal heat pump polyethelene tubing.
- Each borehole is 4-6" diameter and 150ft deep for 1 loop per ton applications.
- Allow enough exra pipe to be able to reach the headers to minimize the number of fusion joints.
- "U" tubes should be taped together every 10ft. A heavy piece of rebar or galvanized pipe can be taped to the last 10ft. to help keep the end straight and also for added weight.
- Fill each "U" tube with water and pressurize to 100PSIG before insertion. The added weight of the water will help with the insertion process
- Tremie grout from the bottom to within 10ft of the top of the borehole. Use neat cement or a mixture of neat cement and bentonite. Check local codes, there may be regulations that must be adhered to.

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01	Initial Release	C. GEDDES	C. GEDDES	22 JAN 08

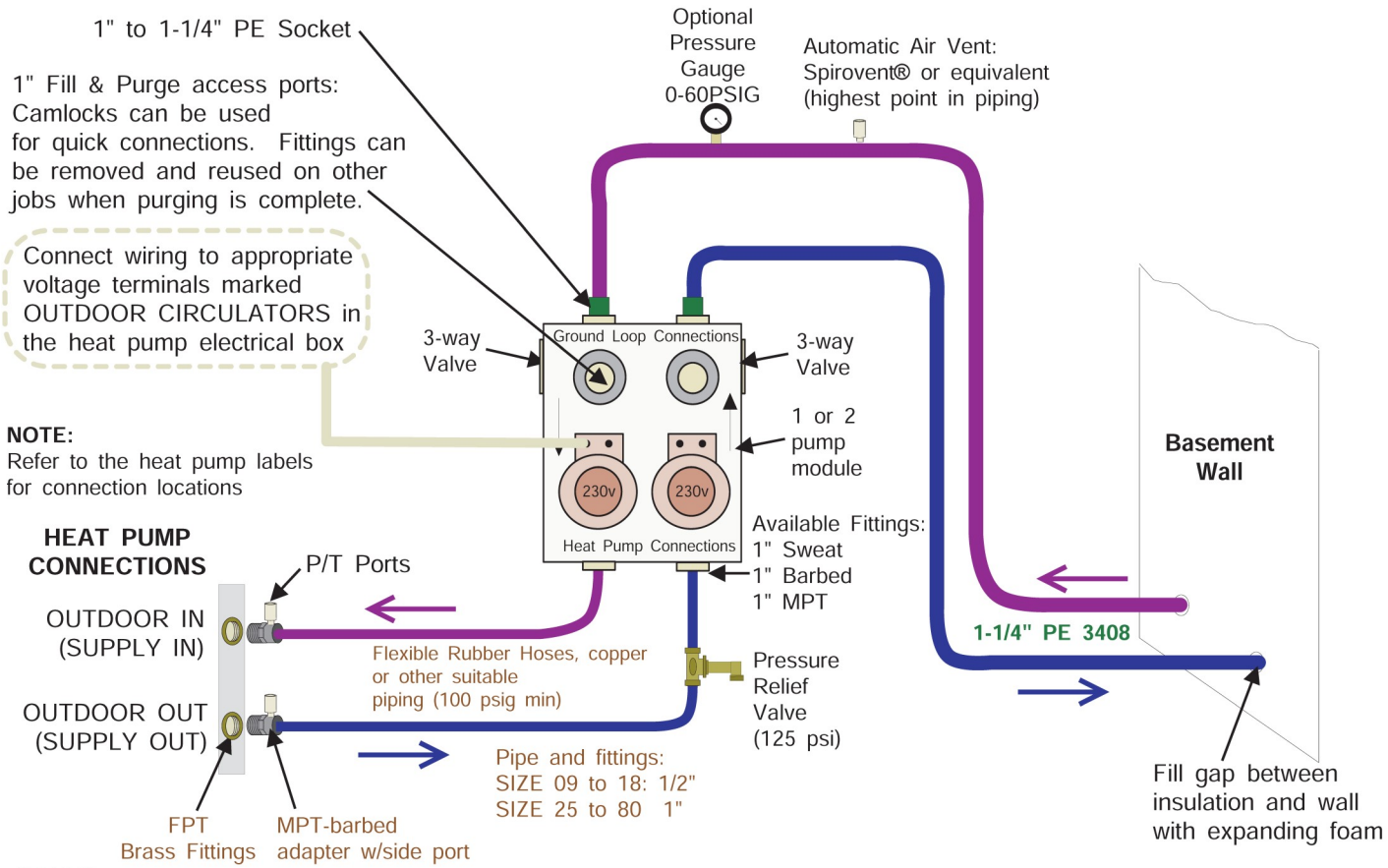
Drawn By Chris Geddes	Date 22 JAN 08	
Checked By Chris Geddes	Date 22 JAN 08	
Approved By (ENG) Chris Geddes	Date 22 JAN 08	
Approved By (MFG)	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Vertical Ground Loop Configuration

Size	Drawing Number	REV	SHEET
A	000609INF	01	1 of 1

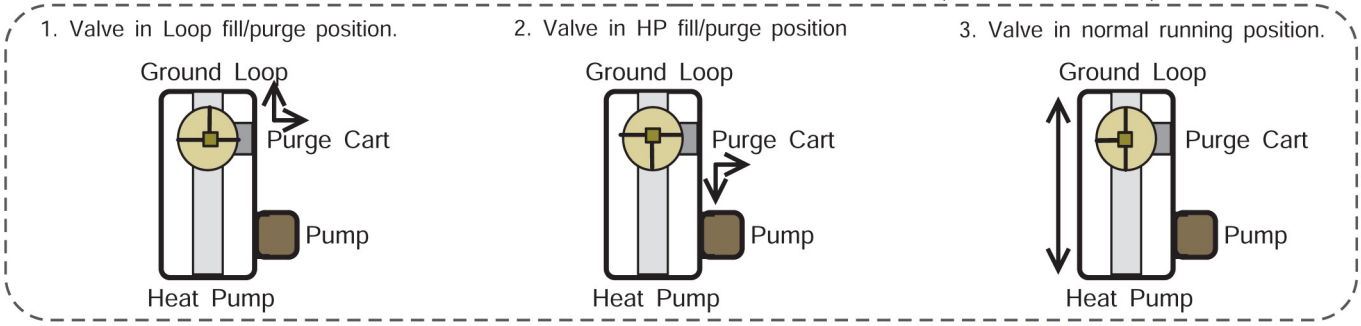
Geo-Flo Circulator Pump Module Installation
(Units with Brass FPT Fittings)



NOTES:

- Circulator Pump Module should be mounted vertically to minimize the possibility of air locking the circulators.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Holes through the foundation / structure should be filled with expanding foam from both sides to prevent leakage.
- Proper drainage material should be used on the outside of the wall to prevent water buildup.
- Pump module fittings are available from Maritime Geothermal Ltd.
- A pressure gauge is recommended if P/T plugs are not installed.
- For most applications, a 1 pump module will accomodate model sizes 09 to 45, and a 2 pump module will accomodate sizes 55 to 80. The total loop pressure drop including the headers, inside piping and heat exchanger drop should be calculated based on the antifreeze mixture and lowest desired entering water temperature. The pump module selected must provide the required flow at this calculated pressure drop value.

CIRCULATOR PUMP MODULE 3-WAY VALVE POSITONS (LEFT SIDE VIEW)



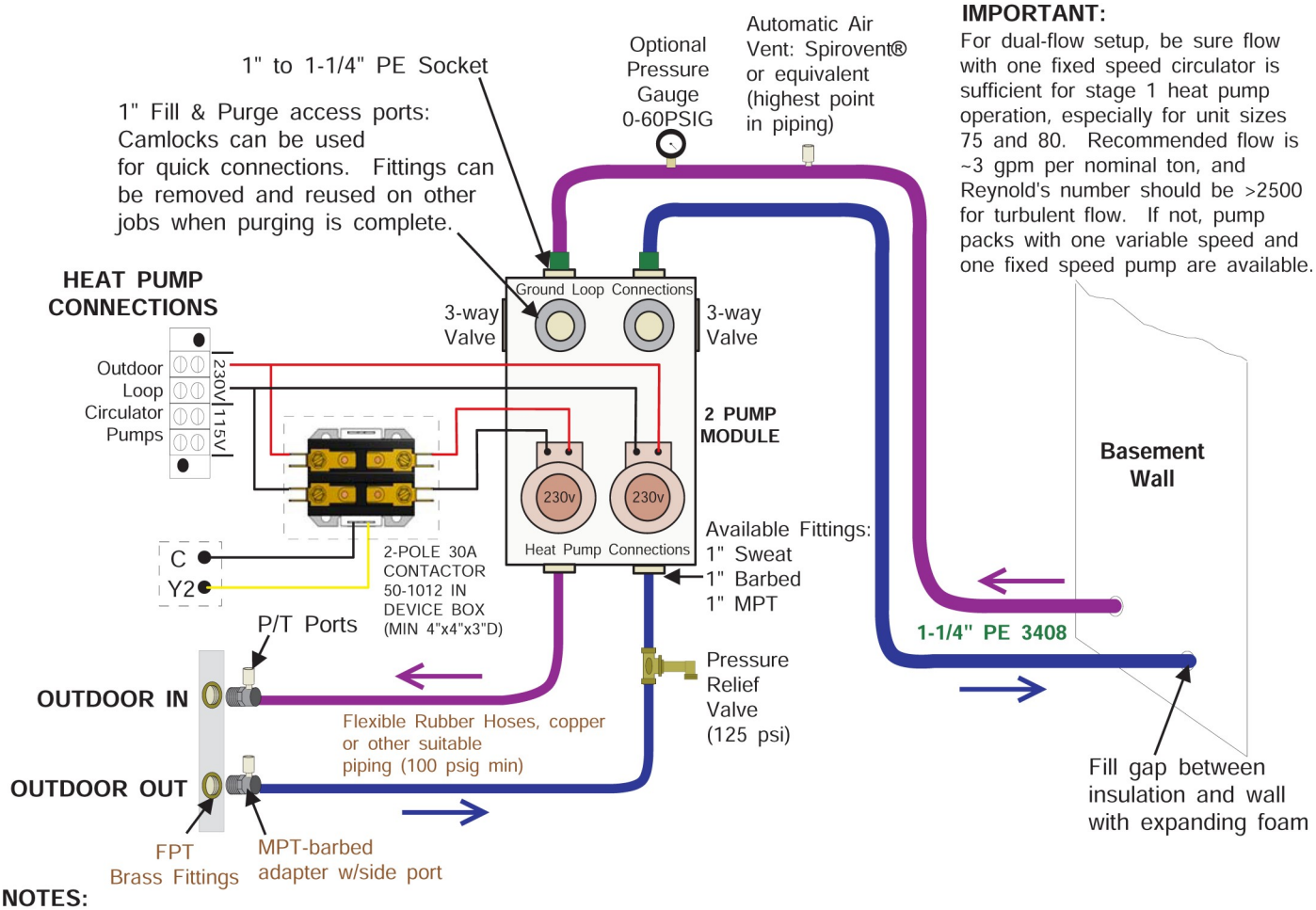
REV	ECO #	IMPL BY	APVD BY	DATE
03	000264	D. RHEAULT	D. RHEAULT	21-Aug-2018
02	000213	C. GEDDES	C. GEDDES	21-May-2013
01	Initial Release	C. GEDDES	C. GEDDES	9-Dec-2008

Drawn By	Chris Geddes	Date 09 DEC 08
Checked By	Chris Geddes	Date 09 DEC 08
Approved By (ENG)	Chris Geddes	Date 09 DEC 08
Approved By (MFG)		Date
Approved By		Date

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name	Size	Drawing Number	Drawing Rev	SHEET
Geo-Flo Circulator Pump Module Installation (Brass FPT)	A	000906PDG	03	1 of 1

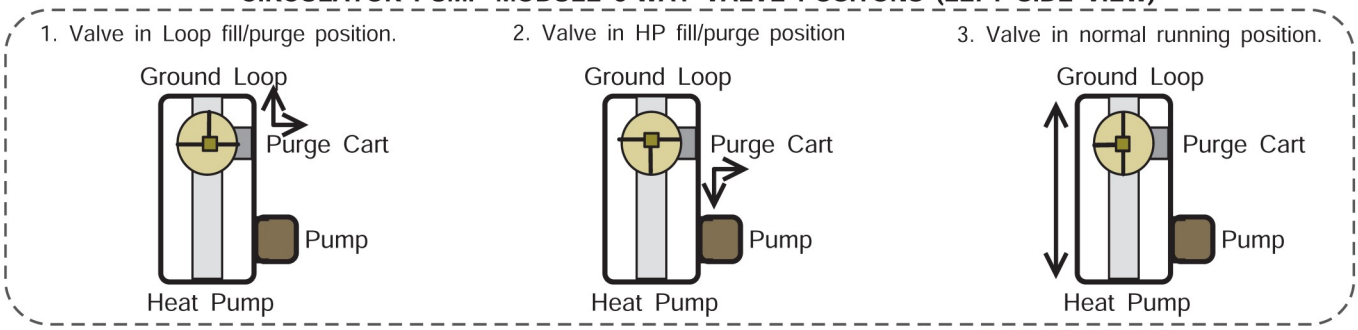
Dual Flow Circulator Pump Module Installation for 2-Stage Heat Pumps



NOTES:

- Circulator Pump Module should be mounted vertically to minimize the possibility of air locking the circulators.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Holes through the foundation / structure should be filled with expanding foam from both sides to prevent leakage.
- Proper drainage material should be used on the outside of the wall to prevent water buildup.
- Pump module fittings are available from Maritime Geothermal Ltd.
- A pressure gauge is recommended if P/T plugs are not installed.
- For most applications, a 1 pump module will accomodate model sizes 09 to 45, and a 2 pump module will accomodate sizes 55 to 80. The total loop pressure drop including the headers, inside piping and heat exchanger drop should be calculated based on the antifreeze mixture and lowest desired entering water temperature. The pump module selected must provide the required flow at this calculated pressure drop value.

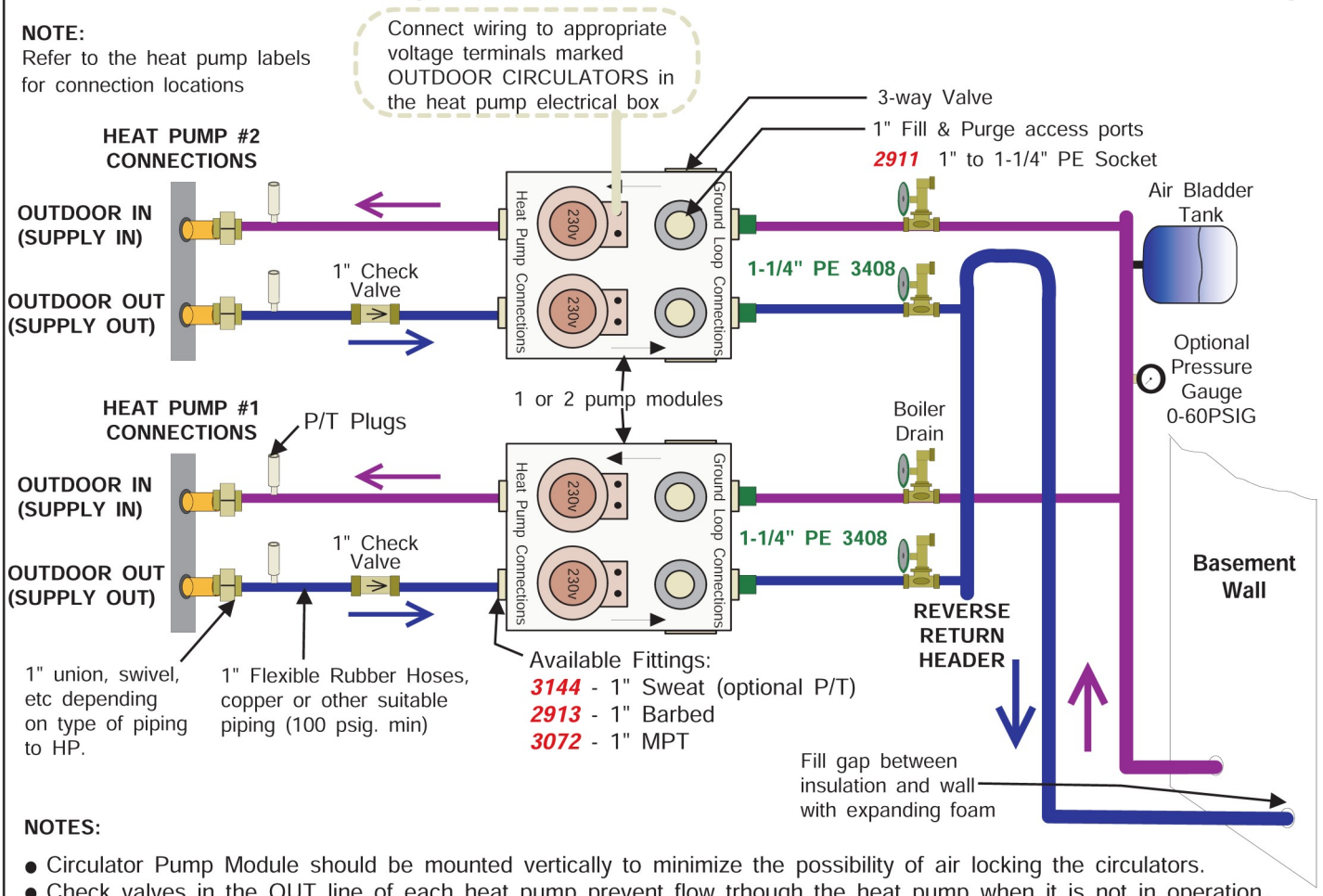
CIRCULATOR PUMP MODULE 3-WAY VALVE POSITONS (LEFT SIDE VIEW)



REV	ECO #	IMPL BY	APVD BY	DATE
03	000264	D. RHEAULT	D. RHEAULT	21-Aug-2018
02	-	D. RHEAULT	D. RHEAULT	20-May-2014
01	Initial Release	D. RHEAULT	D. RHEAULT	22-Nov-2013

Drawn By Dan Rheault	Date 22-Nov-2013	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By Dan Rheault	Date 22-Nov-2013	Drawing Name: Dual Flow Circulator Pump Module Installation for 2-Stage Heat Pumps
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	Size: A; Drawing Number: 001823CDG; REV: 03; SHEET: 1 of 1

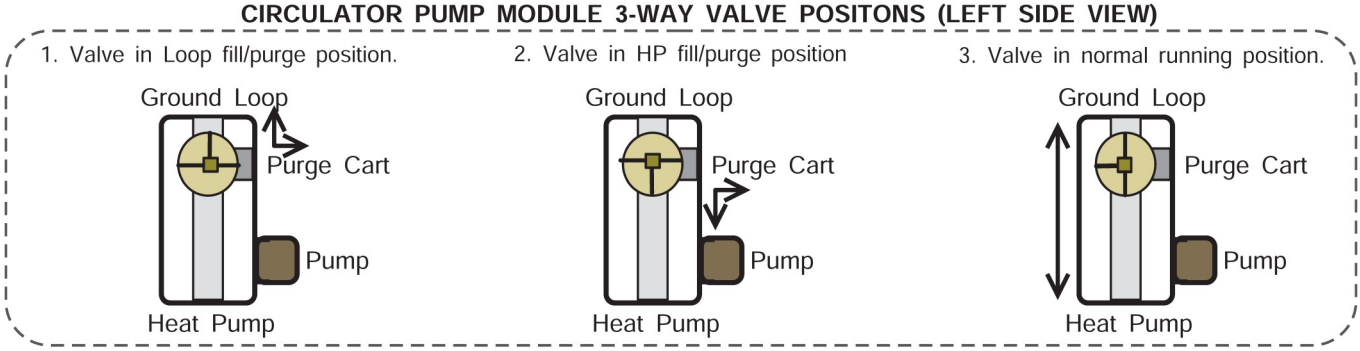
Geo-Flo Circulator Pump Module Installation - Two Units On One Ground Loop



NOTES:

- Circulator Pump Module should be mounted vertically to minimize the possibility of air locking the circulators.
- Check valves in the OUT line of each heat pump prevent flow trhough the heat pump when it is not in operation.
- Ensure that each pump module can provide the required flow to its heat pump when operating solo.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Holes through the foundation / structure should be filled with expanding foam from both sides to prevent leakage.
- Proper drainage material should be used on the outside of the wall to prevent water buildup.
- Pump module fittings are available from Maritime Geothermal Ltd., Geo-Flo Part Numbers are indicated above (italics).
- A pressure gauge is recommended if P/T plugs are not installed.
- The air bladder tank should be pressurized to the desired static pressure of the ground loop before installation.
- For most applications, a 1 pump module will accomodate NORDIC models sizes 25, 35, and 45, and a 2 pump module will accomodate sizes 55, 65 and 75. The total loop pressure drop including the headers, inside piping and heat exchanger drop should be calculated based on the antifreeze mixture and lowest desired entering water temperature. The pump module selected must provide the required flow at this calculated pressure drop value.

CIRCULATOR PUMP MODULE 3-WAY VALVE POSITONS (LEFT SIDE VIEW)



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	21 FEB 08

Drawn By Chris Geddes	Date 21 FEB 08	
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Approved By (ENG) Chris Geddes	Date 21 FEB 08	
Approved By (MFG)	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
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Drawing Name: Geo Flo Circulator Pump Module Installation-Two Units on One Ground Loop

Size	Drawing Number	REV	SHEET
A	000629PDG	01	1 of 1

Open Loop Installations

WARNING: The R134a WH-series absolutely requires a source water temperature of 45°F (7°C) or greater. Therefore, the WH series may not be installed using an open loop system except with suitably warm groundwater temperatures.

Well Water Temperature

The temperature of the well water should be a minimum of **41°F (5°C),** and should normally be **45°F+ (7°C+).** In general, groundwater temperatures across the Canadian prairie provinces and Northern Ontario may be close to the 41°F minimum, while in other parts of southern Canada it will probably be 46-50°F, although local exceptions will exist. In more southern locations, it will be warmer. The water temperature should be verified as the first step in a proposed open loop installation.

Well Water Flow

The water source is normally a drilled water well with submersible pump that is the same well which supplies domestic water needs. It must be able to supply the required water flow as listed under the Total Flow column in the table.

TABLE 13 - Required Flow (Open Loop)

Heat Pump Model Size	Heat Pump Flow* gpm (L/s)	Domestic Water Usage gpm (L/s)	Total Flow gpm (L/s)
25	8.0 (0.50)	4 (0.25)	12 (0.76)
45	10.0 (0.63)	4 (0.25)	14 (0.88)
55	12.0 (0.76)	4 (0.25)	16 (1.01)
65	14.0 (0.88)	4 (0.25)	18 (1.14)
75	16.0 (1.01)	4 (0.25)	20 (1.26)
80	17.0 (1.07)	4 (0.25)	21 (1.32)

* These are minimum water requirements based on an entering water temperature of 45° F.

For groundwater temperatures of 50°F or greater, these flows can be reduced by 25% if required.

Rather than being estimated by a well driller, the flow from a proposed source well should be measured by performing an extended flow test to be sure it is capable of supplying the required flow over an extended period of time. This is done by flowing the well at the highest possible rate, noting the static water level in the well, and monitoring the pumping fluid level until stable. Unless the fluid level is very high, fluid level monitoring will require a device called a water level sounder. The flow rate can then be measured either by a cumulative gallon meter, a flowmeter, or by timing the filling of a bucket of known size. The test data can be recorded as follows:

TIME	METER READING (USGAL)	TOTAL FLOW (USGAL)	FLOW RATE (USGPM)	WATER LEVEL (FT)	(IN)	WATER LEVEL (FT)
20:25	131735.5	0		20	6	20.5
20:27	131756	20.5	10.3	24	0	24.0
20:30	131779	23	6.0	26	0	26.0
20:42	131847	68	6.1	29	0	29.0
20:51	131906	59	6.6	29	0	29.0
21:03	131982	76	6.3	29	0	29.0
21:32	132156	174	6.0	29	0	29.0

It is best to flow the well for as long as possible (e.g. 12 hours) at the flow rate required by the proposed heat pump size. However, if the test is performed before a larger submersible pump is installed, it may be assumed that any unused water level drop during the test (that is, any distance remaining between the pumping fluid level and the pump intake) would contribute linearly to the flow rate should a larger pump be installed.

In the above example, it was recorded that the flow rate stabilized at 6 gpm, while the water level dropped from 20 to 29 feet (9 feet). If the intake of a larger pump could be placed so that a further pumping fluid level drop of 9 feet could be achieved (total 18 feet), it can be assumed that the flow would double to 12 gpm. Of course, it is best to verify this with a second test once the larger pump is actually installed.

Well Water Quality

The well water should be tested to be sure it meets minimum standards. Although the threat of poor water quality to open loop installations is often exaggerated, poor water quality can lead to rapid heat exchanger failure or frequent servicing.

First, the well should not produce any sand. Sand will physically erode heat exchanger surfaces, and quickly clog return (injection) wells. **Solids** or **TDS** should be less than **1 ppm (1 mg/L)** if a return well is used.

To avoid scale formation on the inside of the heat pump's outdoor loop coil, total **hardness** should be less than **350 ppm / 350 mg/L**. In practice, scaling is very rarely a problem at northern groundwater temperatures of 50°F or less because scale does not generally form at low well water temperatures (unlike, for example, in a domestic hot water tank). In more southern climates, the hardness guideline will be a more important consideration. Should scale form, heat pump performance will gradually deteriorate, and will require periodic flushing with a calcium/lime removing solution (see General Maintenance section). If the need for periodic flushing is anticipated, the optional Cupro-Nickel (CuNi) coil and piping should be ordered.

Corrosive (salty) water can cause failure of the inner tube of the heat exchanger, leading to loss of refrigerant and water entering the refrigeration circuit, which ruins the heat pump. If **chlorides** exceed **20 ppm (20 mg/L)**, the optional CuNi coil and piping should be ordered. If chlorides exceed **150 ppm (150 mg/L)**, or significant **Ammonia (>0.5 ppm)** or **H_2S (>0.2 ppm)** is present, the use of an open loop system should be reconsidered.

Water Discharge Methods

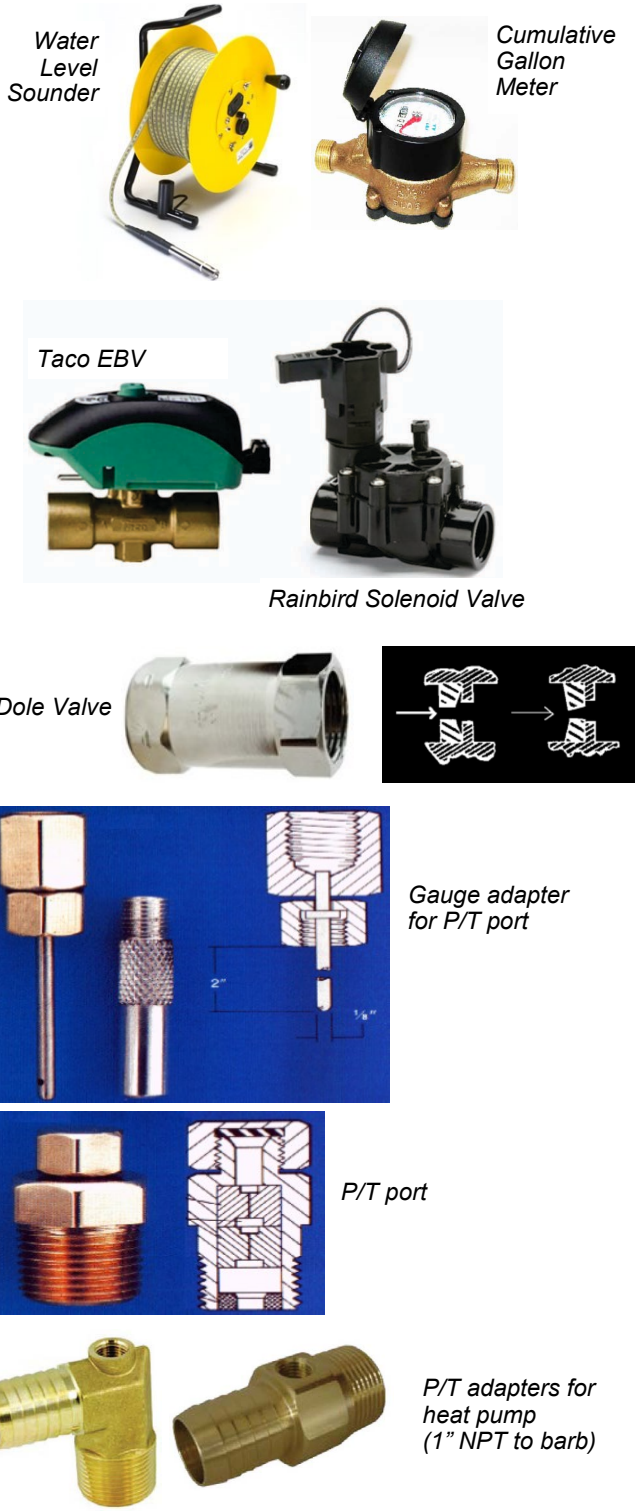
Water disposal methods vary from area to area. However, some consideration should be made to prevent the cooled discharge water from immediately coming in contact with the supply source. Attempting to return the water to the source well will eventually cool the water so much that the heat pump will shut off on its low pressure safety control.

Acceptable methods for disposing of the waste water are listed below. The waste water is clean; the heat pump has no effect other than reducing the temperature of the water. Refer to drawing **000907INF** for typical disposal method diagrams.

- Second well (return well)
- Percolation (Drain, ditch, leaching field)
- Pond, river or stream

ENSURE SELECTED METHOD CONFORMS TO LOCAL REGULATIONS.

Figure 3: Open Loop Accessories & Tools



A return well should be a minimum of **80 ft.** from the supply well for residential applications. The water returned to the well will not necessarily be pumped into the same aquifer, depending on underground conditions. The return well must be able to supply at least the same quantity of water as the amount you wish to inject into it, preferably much more, since injection capacity will tend to decrease over time due to clogging. It may be necessary to place a pressure-tight cap on the well to keep the return water from flowing out the top of the well. This cap is commonly required since a certain amount of pressure may be needed to force the return water back down the well in cases of limited injectivity.

Water discharged by percolation will generally soak into the ground within a distance of 50 to 100 ft. If suitable care is taken to ensure that the drain pipe runs downhill and the end of the pipe is protected by a bale of hay or spruce bows, the end of the pipe will not freeze as the pipe will empty out when the heat pump shuts off and the water valve closes. A screen should be installed on the end of large discharge pipes, to prevent animals from building nests inside during extended 'off' periods and causing a backflooding risk for open water drains.

When snow comes it will usually cover the entire process much like a small spring. It is recommended that the pipe be below the frost line when possible for maximum freeze protection.

When discharging into a river or stream, or above the surface of a pond, the same guidelines should be followed as described in the paragraph above for the percolation method.

When discharging the waste water below the surface of a pond or lake, the discharge pipe should be placed below the frost line to prevent the pipe from freezing. As opposed to the percolation method, water will remain in the end of the pipe. It is recommended that the surface of the pond be lower than the installation location of the heat pump. This reduces the back pressure generated by the weight of the water in the pond.

Water Valve

Water flow through the heat pump is turned on and off by a water valve, which is controlled by a 24VAC signal from the heat pump. It should be installed on the OUT pipe of the heat pump, so that the heat exchanger remains full of water at all times. There are 3 types of water valves available from Maritime Geothermal.

- **Hailin** or equivalent slow acting **motorized ball valve**, which is powered open and powered closed.
- **Taco** slow acting **motorized ball valve**, which is powered on and stores the energy required to close using a capacitor.
- **Rainbird** or equivalent fast acting **solenoid valve**.

Most installations use a slow closing motorized ball valve. These take 5-15 seconds to close, so avoid the water hammer which can occur with fast acting valves. A fast acting solenoid valve can be used for applications where water hammer is not expected.

All valves come from Maritime Geothermal Ltd. with a wiring harness, which plugs into a connector behind the pipe post of the heat pump. (If buying a water valve elsewhere, be sure to get the wiring harness from Maritime Geothermal.) This both allows the heat pump to properly control the valve, turning the water flow on and off with the compressor, and also tells the heat pump to select the higher low pressure safety setting for open loop operation (since there is no antifreeze present).

A modulating water valve may be required for reversing WH-series heat pumps; see **Piping** chapter. In this case, it will

act as the water valve and an additional valve is not required. The closed loop jumper plug can be left in place for WH-series.

Water Flow Control

A flow restricting ('Dole') valve is highly recommended, installed downstream of the water valve. This is a passive (non-electrical) device which automatically varies the size of its rubber orifice in order to restrict flow to its stamped gpm value, regardless of water pressure. This is important in order to provide some backpressure to the water system, which could otherwise be too low for the comfort of people taking showers or otherwise using the domestic water system. It also prevents excessively low refrigerant discharge pressure when in cooling mode. Dole valves are available as an accessory.

Dole valves can emit a 'whistling' sound if the pressure drop through them is high. Therefore, they should be placed where the noise will not cause a nuisance, e.g. outside the basement wall or perhaps in a well insulated box.

Submersible Pump Selection

Of course, the submersible pump must be large enough to supply the flow required by the heat pump. This is usually not a problem, pumps often being oversized by default.

However, if a conventional fixed speed pump is too large, its fixed capacity will exceed that of the Dole valve at reasonable pressure switch settings (<80 psi). This will cause the submersible pump to cycle on and off continuously while the heat pump is running, causing excessive wear to the submersible pump. The installation of a large air bladder tank will cause the cycles to have a longer duration, but will not solve the problem.

To avoid this problem, the fixed speed pump should be sized according to its head vs. flow curve. The required head should be calculated using height between the pumping fluid level in the well and the elevation of the heat pump, pipe pressure drop at nominal flow rate, desired system water pressure, and any back pressure from return well. Then a pump can be selected that delivers the nominal flow for the chosen heat pump size at that head. In case this calculation is not exact, a variety of Dole valves can be carried by the installer, and a larger Dole valve installed if submersible pump cycling is observed.

An alternate approach would be to install a variable speed submersible pump, which varies its speed to maintain a constant water system pressure. Or use a mechanical 'cycle stop' valve, which is installed upstream of the air bladder / pressure tank and varies its orifice to put backpressure on the pump during periods of low flow in order to keep it from cycling off.

Submersible Pump Power Draw

In an open loop installation, the submersible water pump draws significant power compared to the heat pump, especially for smaller heat pump sizes. This is particularly true when using a conventional fixed speed submersible pump. Under traditional usage, the efficiency of such a pump is not particularly important, due to its short run times in a domestic water system. But when used with a geothermal heat pump, which can run all day on the coldest days of the year, it is highly recommended that effort be made to select an energy efficient submersible pump. However, these may be hard to find.

For W-series heat pumps with a 2-stage/2-capacity compressor, the significant power draw of a fixed speed submersible pump will probably negate the COP benefit of running the heat pump on stage 1. In this case, it is recommended to jumper Y1 and Y2 together at the heat pump terminal strip, in order to satisfy the heating demand as quickly as possible and minimize run time. For the same reason, slightly oversizing the heat pump is acceptable on open loop applications, although this will require higher water flow.

Plumbing the Heat Pump

The port connections for the Outdoor Loop are 1" or 1-1/4" brass FPT fittings. They are marked OUTDOOR IN and OUT.

Plumbing lines, both IN (supply) and OUT (discharge), must be of adequate size to handle the water flow necessary for the heat pump. A 1" or 1-1/4" copper or plastic line should be run to the Outdoor IN (Supply IN) pipe of the heat pump. Similarly, a 1"' or 1-1/4" line should be run from the Outdoor OUT (Supply Out) pipe to the method of disposal. P/T plugs should be installed at each port. See diagram in the Ground Loop chapter for a description of P/T plugs. The water valve should be installed in the OUT (discharge) line. Refer to drawing **000907CDG** at the end of this section for the recommended setup. Placing the water valve in the discharge line ensures that the heat exchanger inside the heat pump remains full of water when the unit is not running. Unions or some other form of disconnect should be used so that the coaxial heat exchanger may be accessed should it required cleaning.

The heat pump has an electrical connector for the water valve just inside the case. After the water valve is installed, run the valve harness into the case through the hole provided. Remove the jumper plug from the Valve Connector and connect the harness in its place.

Optionally, a water flow meter can be installed in the discharge line so that the exact amount of water flowing can be determined at a glance. It should be placed between the Outdoor OUT (Supply OUT) pipe of the heat pump and the water valve.

With proper flow, there should be **5-7°F (3-4°C)** delta T between the IN and OUT water temperatures of the heat pump when operating in the heating mode.

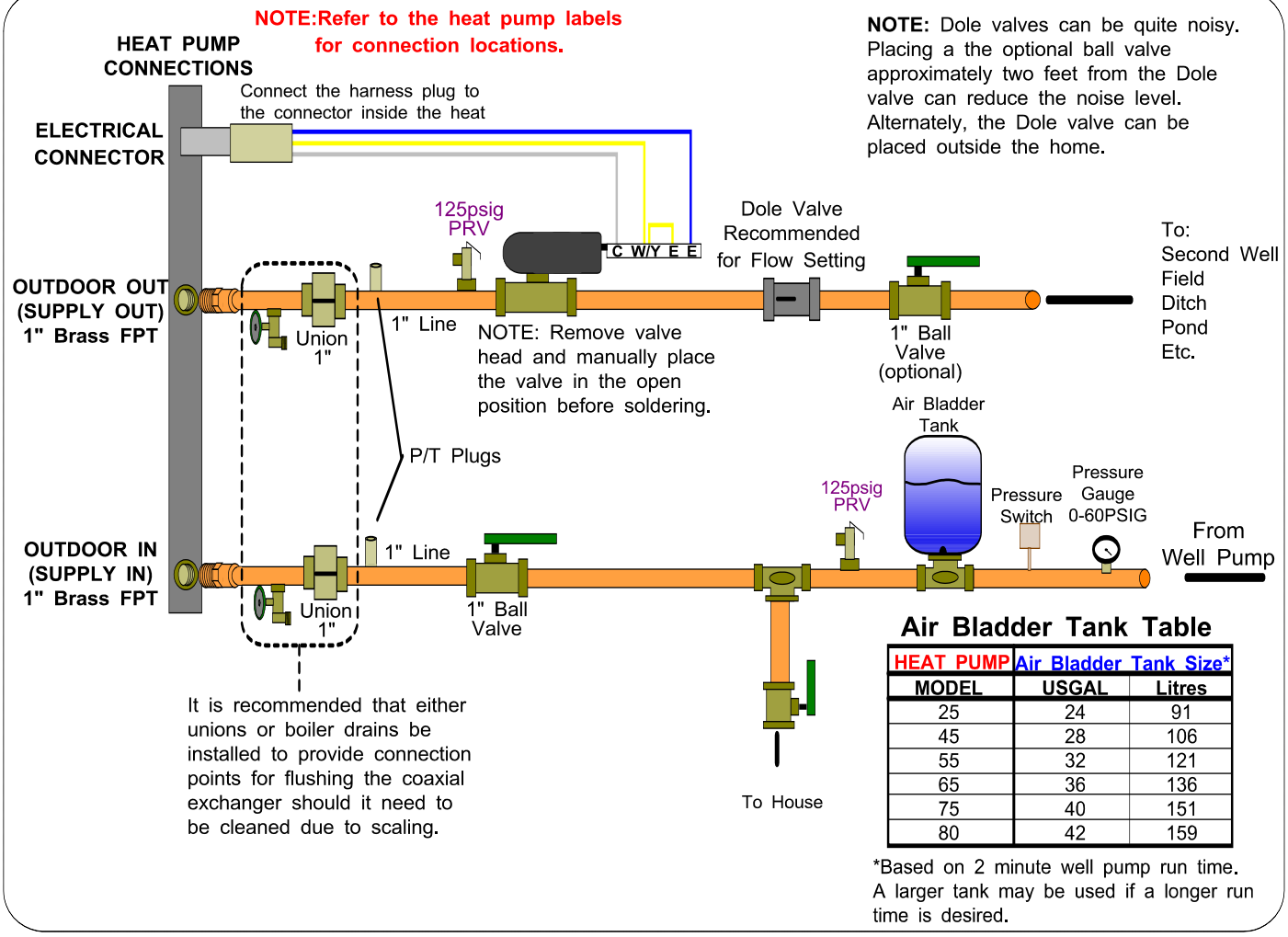
All water line valves on both the supply and discharge lines should be either BALL or GATE valves. GLOBE valves have a higher pressure drop, meaning more pumping power to maintain the required flow to the heat pump.

Pipe Insulation

All ground water piping to and from the Outdoor Loop ports on the heat pump should be insulated with 3/8" closed cell pipe insulation, to prevent condensation and dripping onto floors or walls.

Typical Ground Water Installation for Size 25-80 Heat Pumps for Units With Brass FPT Fittings

TACO 24VAC EBV (Electronic Ball Valve)



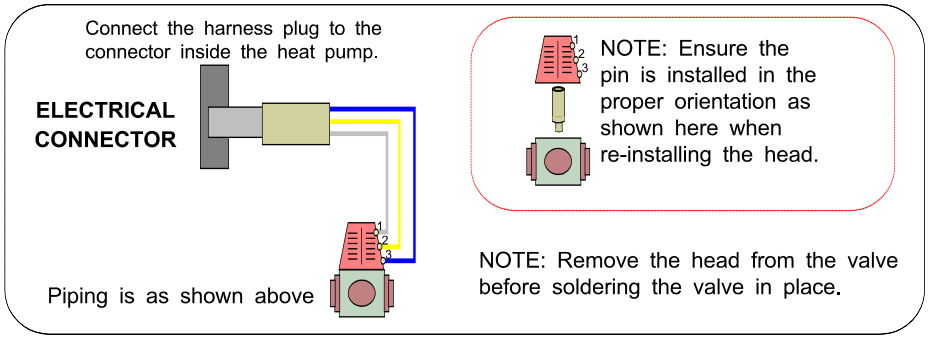
NOTE: Dole valves can be quite noisy. Placing a the optional ball valve approximately two feet from the Dole valve can reduce the noise level. Alternately, the Dole valve can be placed outside the home.

Air Bladder Tank Table

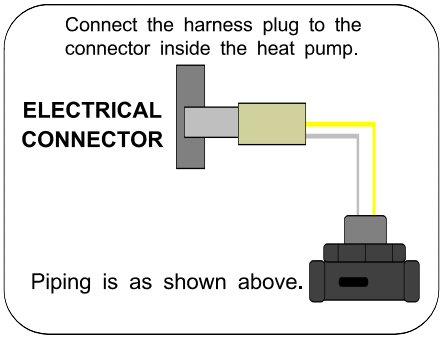
HEAT PUMP	Air Bladder Tank Size*	
MODEL	USGAL	Litres
25	24	91
45	28	106
55	32	121
65	36	136
75	40	151
80	42	159

*Based on 2 minute well pump run time. A larger tank may be used if a longer run time is desired.

TACO 24VAC Slow Close Water Valve



Generic 24VAC Solenoid Water Valve



REV	ECO #	IMPL BY	APVD BY	DATE
02	000228	C. GEDDES	C. GEDDES	21 MAY 2014
01	Initial Release	C. GEDDES	C. GEDDES	10 DEC 08

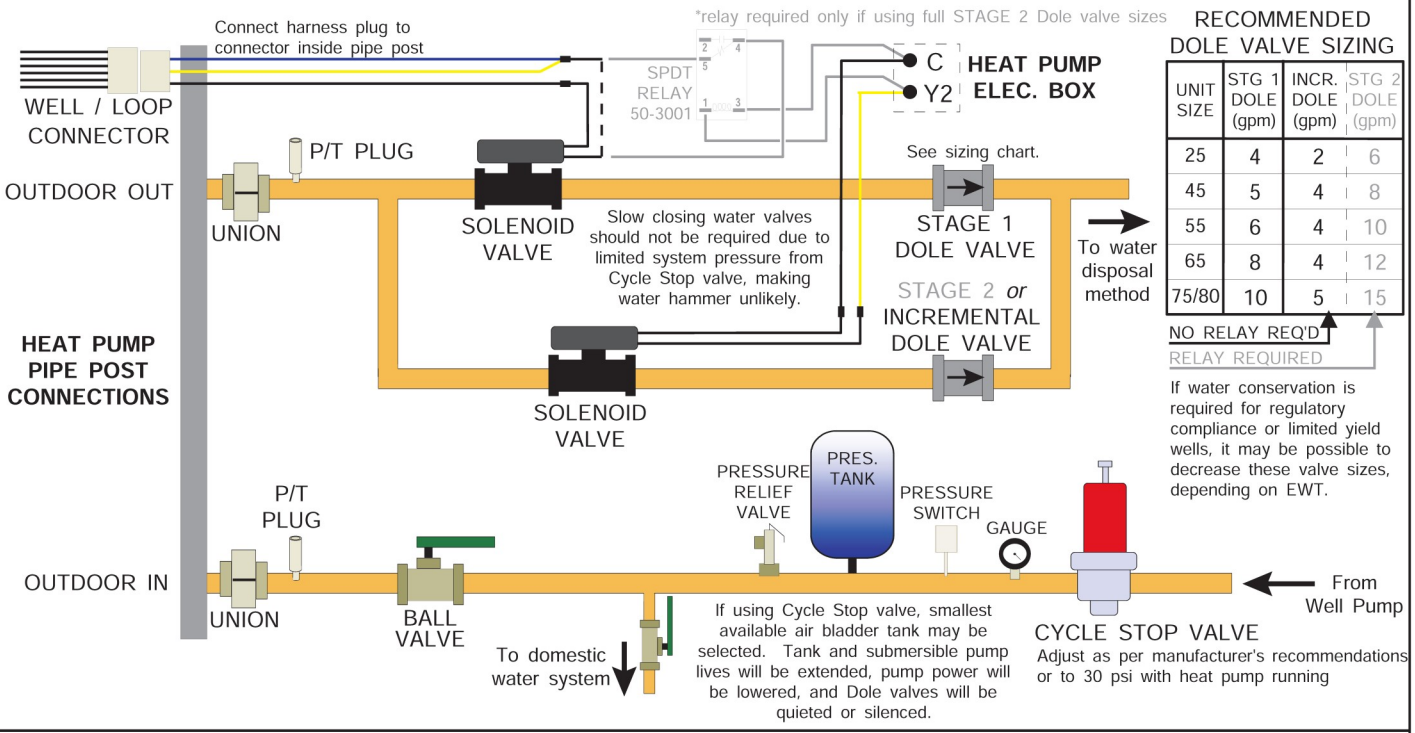
Drawn By: Chris Geddes	Date: 10 DEC 08	
Checked By: Chris Geddes	Date: 10 DEC 08	
Approved By (ENG): Chris Geddes	Date: 10 DEC 08	
Approved By (MFG)	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Ground Water Installation for Size 25-80 Heat Pumps (Brass FPT)

Size	Drawing Number	Drawing Rev	SHEET
A	000907CDG	02	1 of 1

1. Dual-Flow Groundwater (Well) Installation



RECOMMENDED DOLE VALVE SIZING

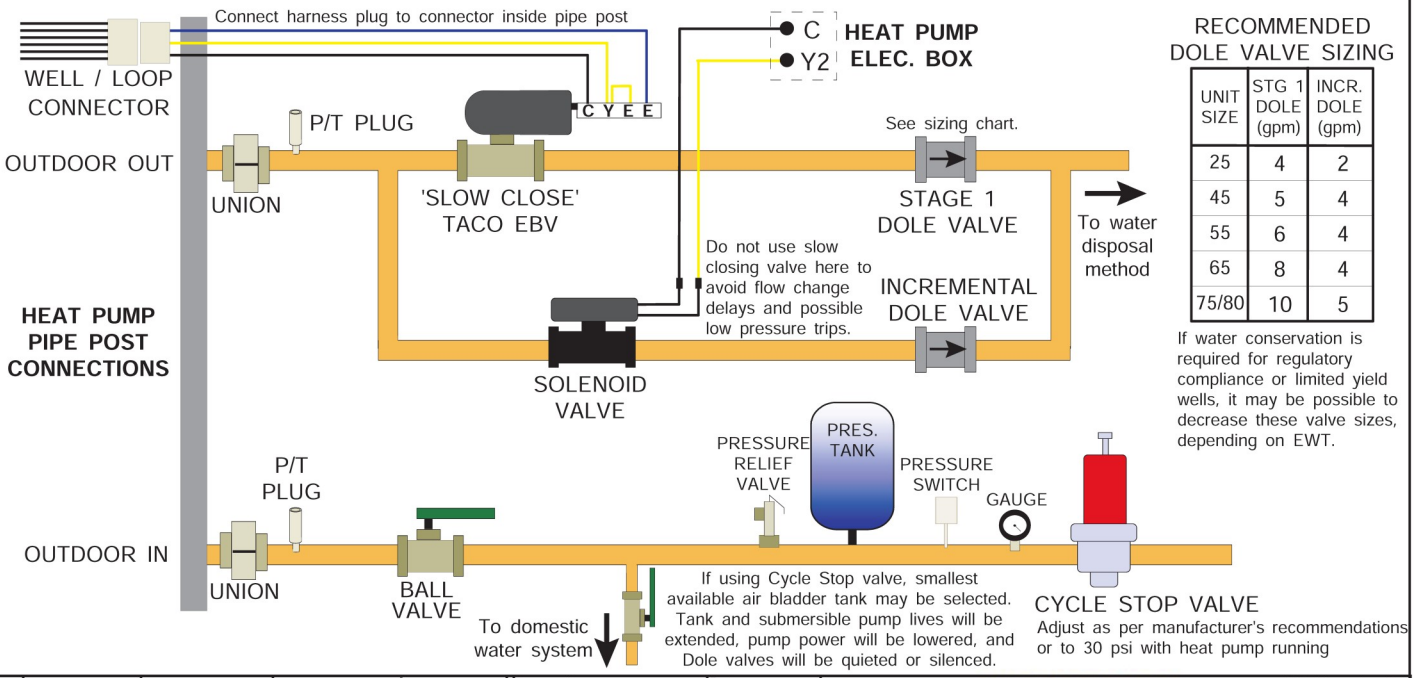
UNIT SIZE	STG 1 DOLE (gpm)	INCR. DOLE (gpm)	STG 2 DOLE (gpm)
25	4	2	6
45	5	4	8
55	6	4	10
65	8	4	12
75/80	10	5	15

NO RELAY REQ'D
RELAY REQUIRED

If water conservation is required for regulatory compliance or limited yield wells, it may be possible to decrease these valve sizes, depending on EWT.

2. Dual-Flow Groundwater (Well) Installation with Slow Closing Water Valve

For Installations Subject to Water Hammer Even at Low System Pressures, or Without Cycle Stop Valve



RECOMMENDED DOLE VALVE SIZING

UNIT SIZE	STG 1 DOLE (gpm)	INCR. DOLE (gpm)
25	4	2
45	5	4
55	6	4
65	8	4
75/80	10	5

If water conservation is required for regulatory compliance or limited yield wells, it may be possible to decrease these valve sizes, depending on EWT.

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	22-Nov-2013

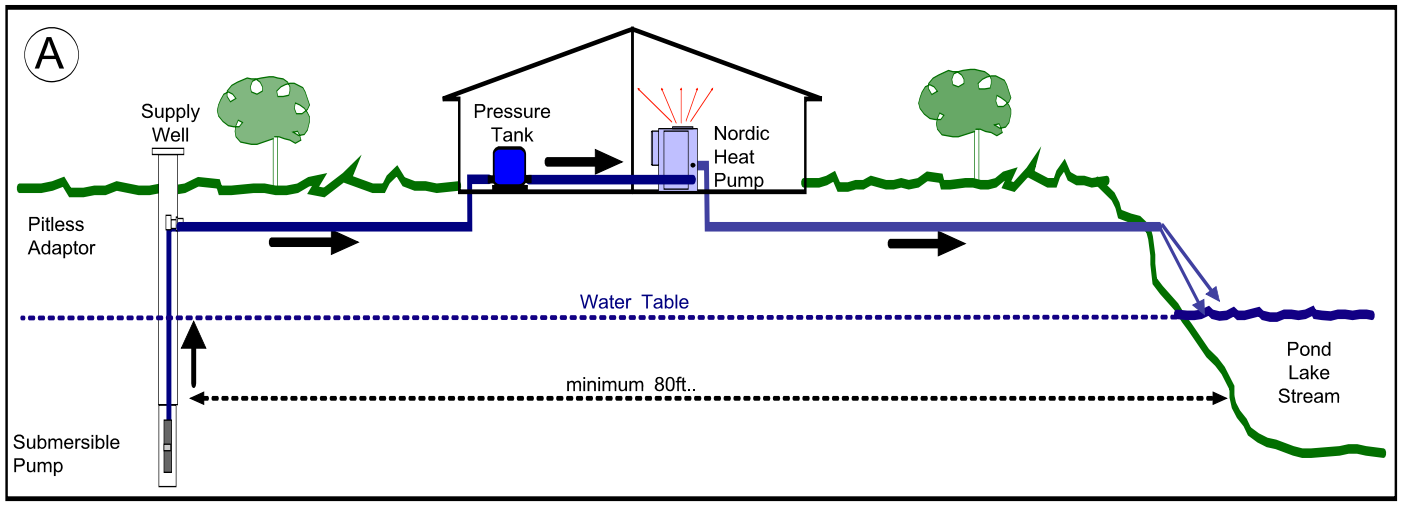
Drawn By	Dan Rheault	Date	22-Nov-2013
Checked By	Dan Rheault	Date	22-Nov-2013
Approved By	(ENG)	Date	
Approved By	(MFG)	Date	
Approved By		Date	

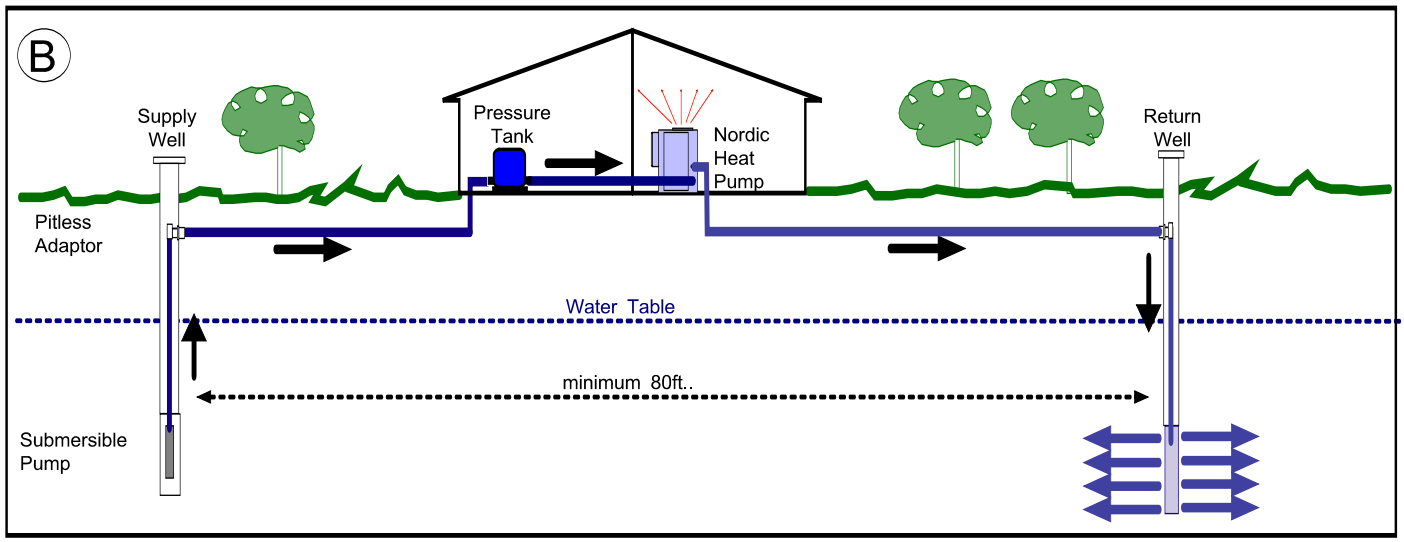
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

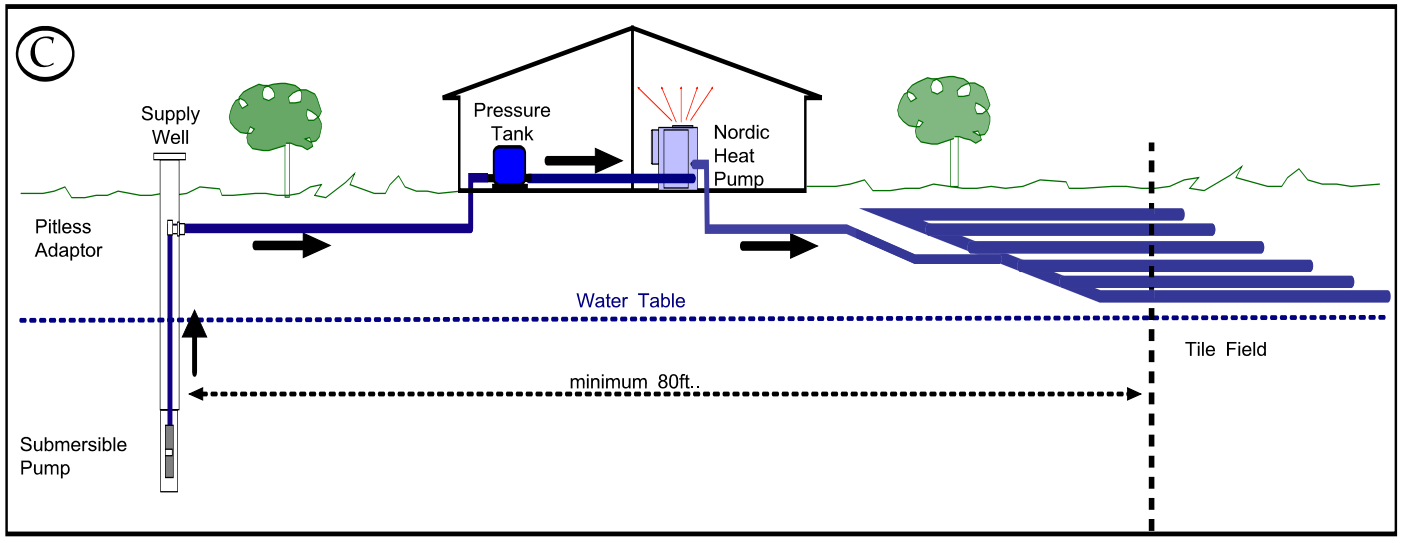
Drawing Name: Dual-Flow Groundwater (Well) Installation for Size 25-75 Heat Pumps

Size	Drawing Number	REV	SHEET
A	001822CDG	01	1 of 1

GROUND WATER DISPOSAL METHODS







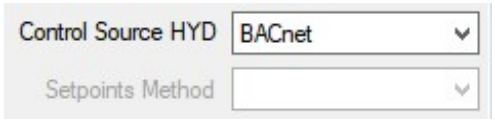
					Drawn By: Chris Geddes	Date: 04 FEB 08	MARITIME GEOTHERMAL LTD.	170 Plantation Rd. Petitcodiac, NB E4Z 6H4
					Checked By: Chris Geddes	Date: 04 JAN 08	Drawing Name: Ground Water Disposal Methods	
					Approved By (ENG): Chris Geddes	Date: 04 FEB 08		
01	Initial Release	C. GEDDES	C. GEDDES	04 FEB 08	Approved By (MFG):	Date:	Size: A	Drawing Number: 000619INF
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By:	Date:	REV: 01	SHEET: 1 of 1

Operation

1. BACnet Control

If using **BACnet Control**, the heat pump will turn the compressor on and off and activate cooling mode when it is told to by the building control system. The heat pump's internal control logic will not be used, except to limit loop temperatures and report operating data and alarms. See the **BACnet Interface** section later in this manual for network specification and BACnet object names.

PC APP: Tools-->Configuration



LCD Interface: Configuration

2. Signals / Hardwired Control

Similar to BACnet control, with **Signals Control** the heat pump will turn the compressor stage on and off and activate cooling mode when it is told to by 24VAC signals. These are provided via external dry contacts, most often from a 2-stage aquastat (available as an accessory) or a lead/lag controller for multiple heat pumps. See **Wiring** section. The heat pump's internal control logic will not be used, except to limit loop temperatures and activate alarm outputs.

Most installations will instead use **Setpoint Control**; however, **Signals Control** provides control flexibility for certain situations, for example if two water loops with different setpoints are being heated, or if a lead/lag controller will be used to give equal run time to multiple units. Temperature settings similar to those outlined in the following **Setpoint Control** section should be used.

When using Signals Control, the backup tank element thermostat can be set to maximum, allowing the electric elements to be controlled by an external contactor placed in the power supply connections (see diagrams in **Wiring** section). The contactor can be connected to stage 2 of the heating aquastat via an optional 0-2 hour timer. Alternatively, tanks with their own programmable controller can be set to run independently with a lower temperature setpoint than the aquastat(s).

PC APP: Tools-->Configuration

LCD Interface: Configuration

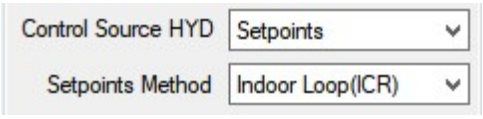
3. Setpoint Control

One of the features of the heat pump's GEN2 Control Board is built in temperature control functionality called "**Setpoint Control**". It is recommended that this method be used to control the system's hydronic heating and cooling demand since it eliminates the need for an external aquastat or temperature sensor (although external sensors may be used, as described below).

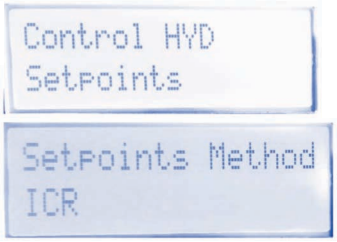
There are four options for Setpoint Control:

Setpoint Control Method 1 - Indoor Loop (ICR) One Tank

PC APP: Tools-->Configuration



LCD Interface: Configuration



ICR (Internal Circulator Relay) is the default method and uses the **Indoor OUT** temperature probe inside the unit for temperature control. Its value is displayed in the **Tank Temperature** box on the PC App's **View-->Setpoint Control** window, shown below. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

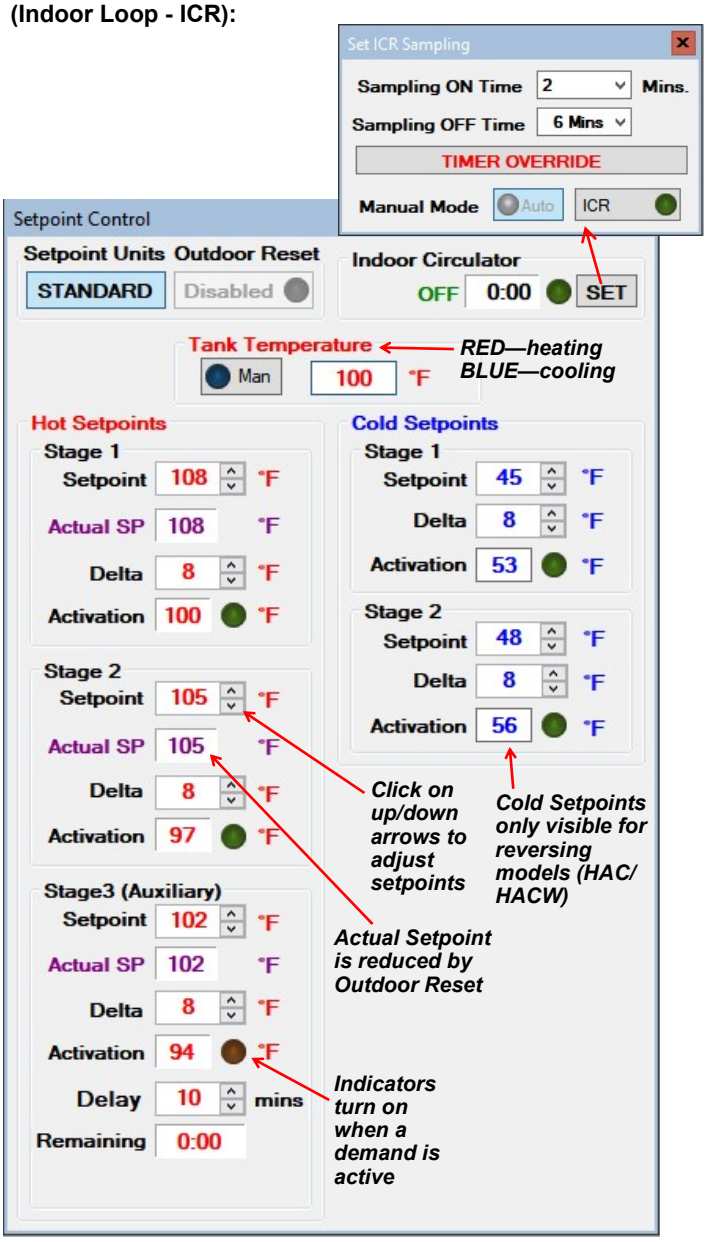
The heat pump will cycle the indoor circulator on and off when the unit is idle to sample the water temperature. When heating mode ends, the indoor circulator will continue to run for 30 seconds. It will then cycle with an OFF time and ON time as set by the **Set ICR Sampling** popup which appears when ***SET*** is clicked on the **View-->Setpoint Control** window. The timer counts down the time remaining before the next switch between ON/OFF. The indoor circulator indicator will indicate when the circulator is ON, OFF or SAMPLING. The default sampling times are 2 minutes ON and 6 minutes OFF. The LCD display will also indicate when the ICR is sampling (ON). The ***Timer Override*** button will reduce the countdown timer to 10 seconds. The compressor will only start when sampling is completed.

For reversing models only (HAC/HACW), cooling mode is selected by making a dry contact connection between **R** and **O** on the terminal strip. This is the one external control requirement. To prevent the tank from being repeatedly cycled between hot and cold, which would be undesirable, the **O** signal must be continuous through the cooling season.

To prevent the compressor from starting when the power is first turned on, the system is **DISABLED** from factory. The LCD screen will show "**SYSTEM DISABLED**". To enable the system, use either the ***System Enable/Disable*** button at the top right corner of the PC App's ***Tools-->Configuration*** window or use the LCD interface and select ***SYSTEM EN/DIS***.

See below, and also the **PC Application (PC App)** section for full screenshots of the various windows.

The **Setpoint Control** window looks like this for **Method 1 (Indoor Loop - ICR):**



WARNING: When in Manual Override mode, Activation no longer responds to Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached). Go to the PC App's Control Panel to turn demand ON/OFF with the Stage buttons.

TABLE 14 - W-series Typical Temp. Setpoints

HEATING	Stage 1		Stage 2		Stage 3 (Aux)	
	°F	°C	°F	°C	°F	°C
Setpoint	**108**	***42***	**105**	***41***	**102**	***39***
Delta	**8**	***4***	**8**	***4***	**8**	***4***
Activation *	100	*38*	97	*37*	94	*35*
Delay					**10 minutes**	
COOLING	**Stage 1**		**Stage 2**		*Activation is determined by the Setpoint and Delta values	
	°F	°C	°F	°C		
Setpoint	**45**	***7***	**48**	***9***		
Delta	**8**	***4***	**8**	***4***		
Activation *	53	*11*	56	*13*		

TABLE 15 - WP-series Typical Temp. Setpoints

HEATING		Stage 1		Stage 2 (Aux)	
		°F	°C	°F	°C
POOL	**Setpoint**	**80**	***27***	**78**	***25***
	Delta	**2**	***1***	**2**	***1***
	Activation *	78	*26*	76	*24*
	Delay			**10 minutes**	
HOT TUB	**Setpoint**	**104**	***40***	**101**	***38***
	Delta	**2**	***1***	**2**	***1***
	Activation *	102	*39*	99	*37*
	Delay			**10 minutes**	

*Activation is determined by the Setpoint and Delta values

TABLE 16 - WH-series Typical Temp. Setpoints

HEATING	Stage 1		Stage 2 (Aux)	
	°F	°C	°F	°C
Setpoint	**150**	***65***	**150**	***65***
Delta	**10**	***5***	**20**	***10***
Activation *	140	*60*	130	*55*
Delay			**10 minutes**	
COOLING	**Stage 1**		*Activation is determined by the Setpoint and Delta values	
	°F	°C		
Setpoint	**45**	***7***		
Delta	**8**	***4***		
Activation *	53	*11*		

Heating setpoints will vary widely with the W and WH-series, depending on the application. Lower values may be able to be used, for example if using well-designed in-concrete-floor heating, the heating setpoints may be as low as the 90°F range. Lower heating setpoints will translate directly into a higher COP (efficiency). Heating setpoints should be set to the lowest values that still maintain an acceptable temperature in the building on the coldest day of the year; this may take some trial and error. Increasing Delta values will also increase efficiency due to longer runtimes, and lead to less wear on compressor due to a reduced number of compressor starts.

The maximum water temperature setpoint for **W-series** is **120°F / 49°C**, for **WP-series** is **105°F / 41°C**, and for **WH-series** is **160°F / 71°C**. The minimum setpoint for cooling is **45°F (7°C)**, lower if indoor loop fluid is set to an antifreeze mixture.

Summer Setback

In locations where hydronic cooling is not required, or with non-reversing models, the heating system may be idle for several months in the summer. In this case, the heat pump may be put in **Summer Setback** mode via the PC App's **Tools--> Configuration** window or the LCD Interface.

Summer Setback disables stage 3 (AUX), drops setpoints to 70°F (21°C), and decreases temperature sampling frequency to 2 days. This minimizes electric power usage while keeping cast iron head circulation pumps operational.

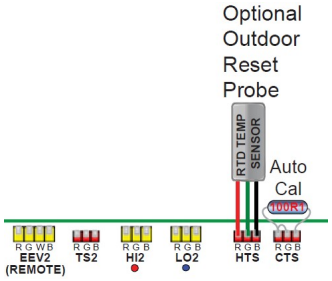
For homeowner convenience, **Summer Setback** mode may also be enabled by an external switch from control board R to PM2 as shown on the wiring diagram in the **Model Specific Information** section.

Outdoor Reset

As mentioned earlier, lower heating setpoints will translate directly into a higher COP (efficiency).

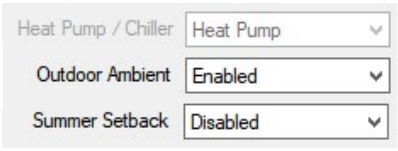
When **Control Source HYD** is set to **Setpoints**, an optional Outdoor Reset control algorithm is available for heating mode, which reduces the heating temperature setpoints at warmer outdoor temperatures as measured by an accessory outdoor temperature sensor.

To enable outdoor reset, first connect the outdoor temperature sensor accessory as shown on the wiring diagram (SCH) in the **Model Specific Information** section:

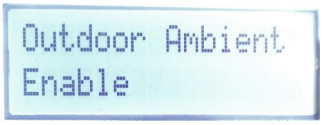


Then enable the outdoor sensor in the **Tools --> Configuration** window or LCD interface:

PC APP: Tools-->Configuration



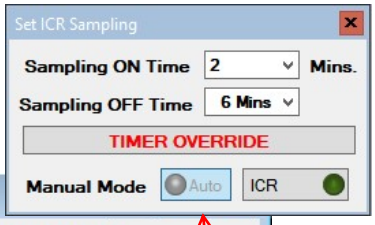
LCD Interface: Configuration



Next, click on the **Outdoor Reset** button at the top of the **Setpoint Control** window. The button will change to say Enabled, the indicator will come on and the Outdoor Reset Table will appear. The table is created by subtracting the value of the Outdoor Reset Factor from the original setpoints once for each table row . The user-selected Hot Setpoints are located in the top row(<5°F), and the next row down equals the row above minus the Outdoor Reset Factor. The table row in use based on current outdoor temperature is shown in red.

It can be seen that as outdoor temperature rises and heating load falls, the heating mode buffer tank temperature will be decreased and a higher seasonal efficiency will result.

Click to enable Outdoor Reset, or use LCD:



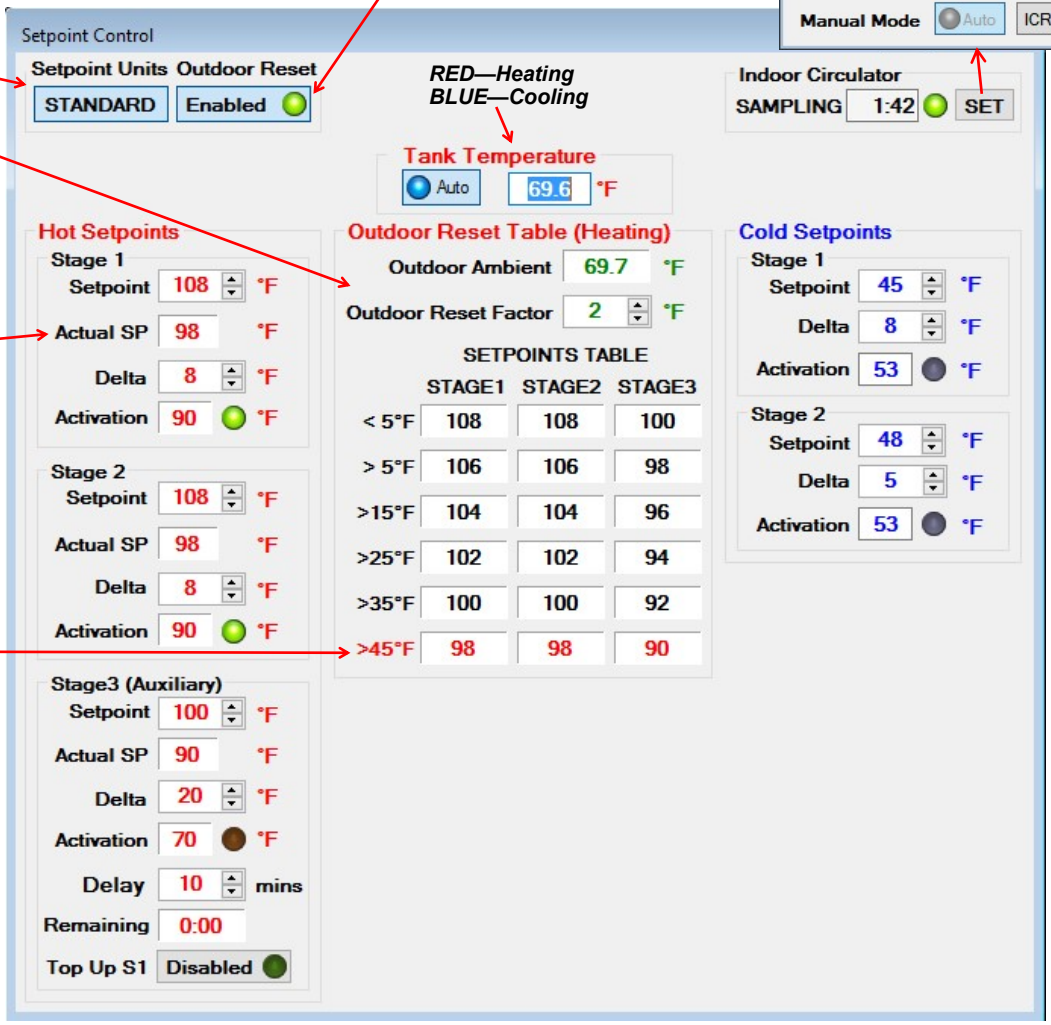
Change units of Setpoint Control only

Outdoor Reset Factor adjusts the temperature difference between table rows

Actual Setpoint is reduced by outdoor temperature de-rating and Outdoor Reset

Row in use will be RED

RED—Heating
BLUE—Cooling



Setpoint Control Method 2 - Indoor Loop (ICR) Two Tanks

It is possible to use all of the **Setpoint Control Method 1** settings, and operate two buffer tanks: one for heated water and one for chilled water. The heat pump will switch over to cooling tank in response to a dry contact between the **R** and **O** terminals on the terminal strip. The **O** signal (along with **C/GND**) will also energize a 3-way valve to divert flow to the cold tank (see **Piping** section).

However, it is suggested to use **Method 4** (External HTS/CTS with two tanks) for this purpose. This will require two external tank temperature sensors, but has the benefit of both tank temperatures being constantly monitored and also has the added **Auto Maintain** option (maintaining both hot and cold tank setpoints without the requirement for an external dry contact to provide the "**O**" signal).

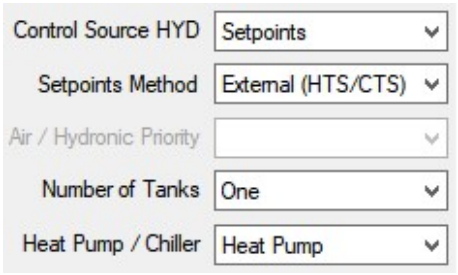
Setpoint Control Method 3 - External (HTS/CTS) One Tank

a) HTS/CTS w/ One Tank - Heat Pump Mode

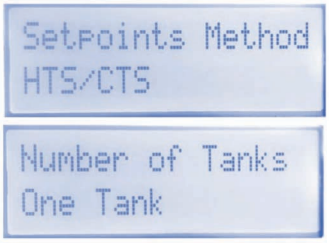
Most of the time, water heating/cooling heat pumps turn on and off in response to the temperature of the indoor loop (indoor buffer tank). All previous described control methods (1, 2) work this way, as does this one. This is ***Heat Pump Mode***, and is the only control option for reversing models (HAC/HACW).

[For non-reversing models (H/HW), it is also possible to control demand based on the temperature of the outdoor or cold loop. This is ***Chiller Mode***, described on next page.]

PC APP: Tools-->Configuration

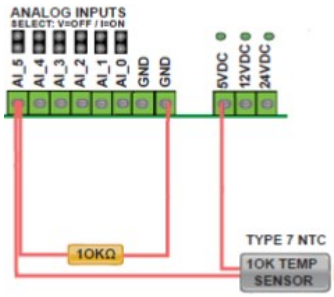


LCD Interface: Configuration



When this method is used, no indoor circulator control for temperature sampling will occur. It requires an external temperature sensor placed in a dry well near the top of the buffer tank. Its value is displayed in the **Tank Temperature** box on the PC App's **View-->Setpoint Control** screen. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

A 10K Type 7 (or Type 3) NTC thermistor along with a 10K 1% or better resistor must be connected to the control board in order to use the External HTS/CTS method. These are available as accessories. Connect the sensor to the AI_5 input as shown below and on the wiring diagram (SCH) in the **Model Specific Information** section. This sensor will be used for both heating and cooling. ***Remove the AI_5 jumper on the control board.***

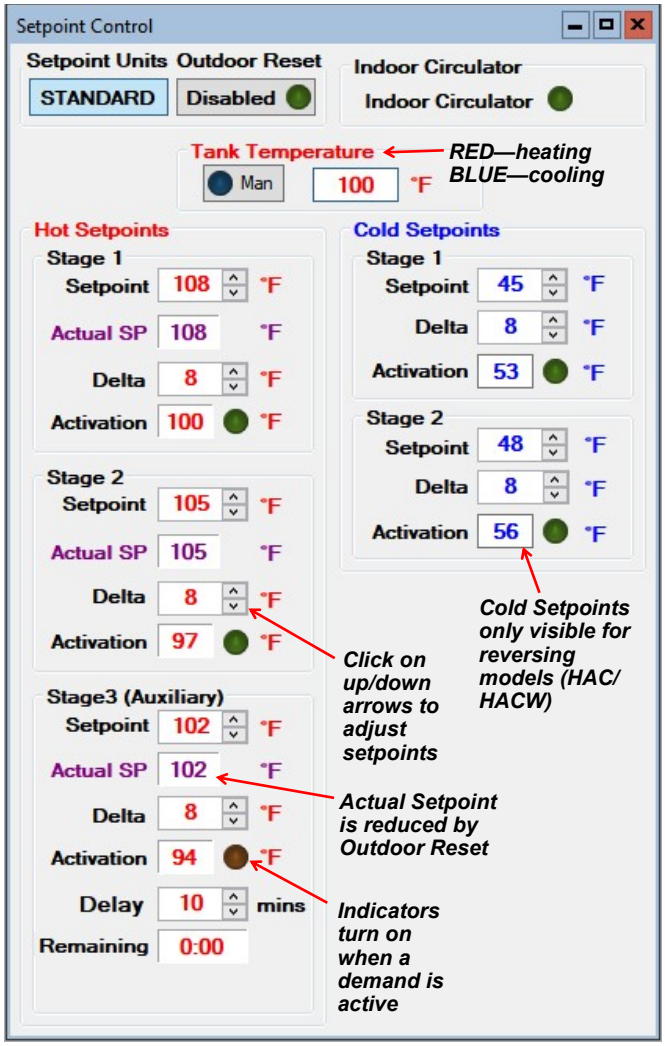


For reversing models only (HAC/HACW), cooling mode is selected by making a dry contact connection between the **R** and **O** terminals on the terminal strip in the electrical box. This is the one external control requirement.

To prevent the compressor from starting when the power is first turned on, the system is **DISABLED** from factory. The LCD display will show "**SYSTEM DISABLED**". To enable the system, use either the ***System Enable/Disable*** button at the top right corner of the PC App's ***Tools-->Configuration*** window or use the LCD interface and select ***SYSTEM ENABLE***.

See below, and also the **PC Application (PC App)** section for full screenshots of the various windows.

The **Setpoint Control** window looks like this for **Method 3a (External HTS/CTS with One Tank, Heat Pump Mode):**



WARNING: When in Manual Override mode, Activation no longer responds to Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached). Go to the PC App's Control Panel to turn demand ON/OFF with the Stage buttons.

The features explained in **Setpoint Control Method 1 - Indoor Loop ICR with One Tank** also apply to **Setpoint Control Method 3 - External HTS/CTS with One Tank:**

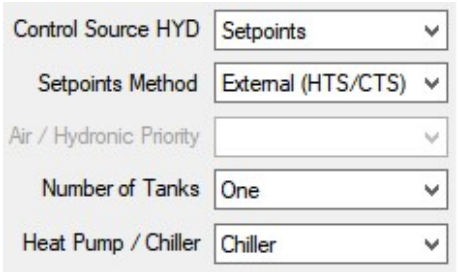
- **Typical Temperature Settings**
- **Summer Setback**
- **Outdoor Reset function**

b) HTS/CTS w/ One Tank - Chiller Mode

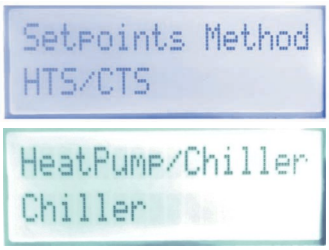
For ***non-reversing models only*** (H/HW), **Chiller Mode** allows the heat pump to be controlled from the Outdoor Loop (cold side) rather than the Indoor Loop (hot side) for applications that require controlled cooling with hot water heat rejection. The heat pump is still operating in "heating mode"; it is simply being started and stopped based on the cold side temperature.

Just as with Heat Pump Mode, a buffer tank should normally be used. With **Chiller Mode**, it will be on the cold side loop.

PC APP: Tools-->Configuration

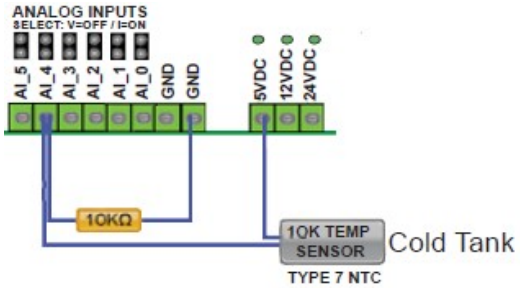


LCD Interface: Configuration



When this method is used, no circulator control for temperature sampling will occur. It requires an external temperature sensor placed in a dry well near the ***bottom*** of the cold buffer tank. Its value is displayed in the **Cold Tank** box on the PC App's **View-->Setpoint Control** screen. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

A 10K Type 7 (or Type 3) NTC thermistor along with a 10K 1% (or better) resistor must be used. These are available as accessories. Connect the sensor to the AI_4 input as shown below and on the wiring diagram (SCH) in the **Model Specific Information** section. This sensor will be used for both heating and cooling. ***Remove the AI_4 jumper on the control board.***



To prevent the compressor from starting when the power is first turned on, the system is **DISABLED** from factory. The LCD display will show "**SYSTEM DISABLED**". To enable the system, use either the ***System Enable/Disable*** button at the top right corner of the PC App's ***Tools-->Configuration*** window or use the LCD interface and select ***SYSTEM ENABLE***.

See below, and also the **PC Application (PC App)** section for full screenshots of the various windows.

The **Setpoint Control** window looks like this for **Method 3b (External HTS/CTS with One Tank, Chiller Mode):**

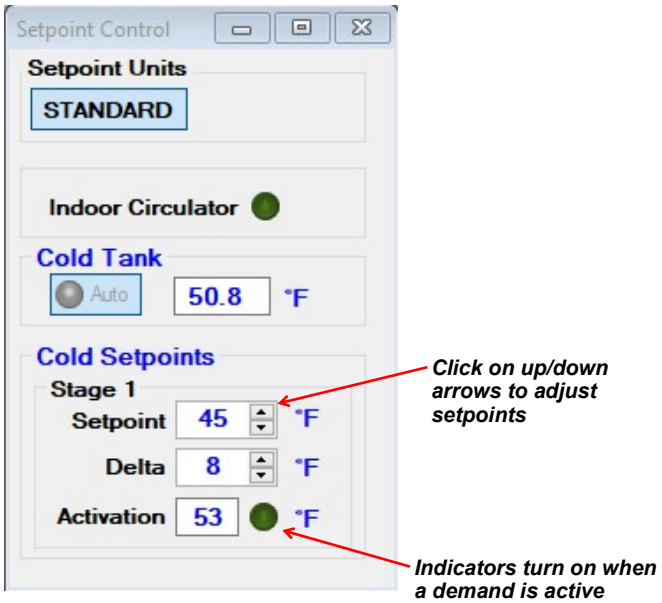
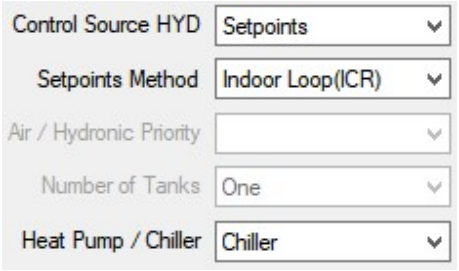


TABLE 17 - Typical Setpoints
HTS/CTS Method-Chiller Mode

	Stage 1		Stage 2		
	°F	°C	°F	°C	
Setpoint	**45**	**7**	**48**	**9**	*Activation is determined by the Setpoint and Delta values
Delta	**8**	**4**	**8**	**4**	
Activation *	53	11	56	13	

WARNING: When in Manual Override mode the Activation no longer responds to the Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached). Go to the Control Panel to turn demand ON/OFF with the Stage buttons when in Manual Override Mode.

Above is outlined the recommended method to use Chiller Mode. However, it is also possible to use the ICR setpoint control method (circulator sampling) for chiller mode:



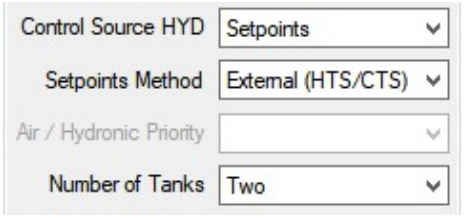
The complication is that sampling will actually be done with the *outdoor* loop circulator, and there is no built in outdoor circulator relay. So two approaches can be taken:

- Connect outdoor circulator to the indoor circulator terminal strip, and vice versa (indoor circulator to outdoor terminal strip) ***OR***
- Install an OCR relay, with coil connected between OV1 (control board DO_0) and C (24vac ground); and outdoor circulator powered from the normally open relay contacts.

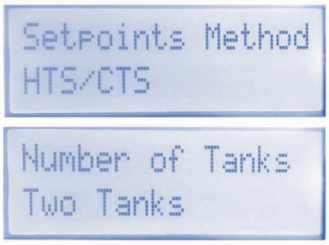
Setpoint Control Method 4 - External (HTS/CTS) Two Tanks

REVERSING MODELS ONLY (HAC/HACW)

PC APP: Tools-->Configuration

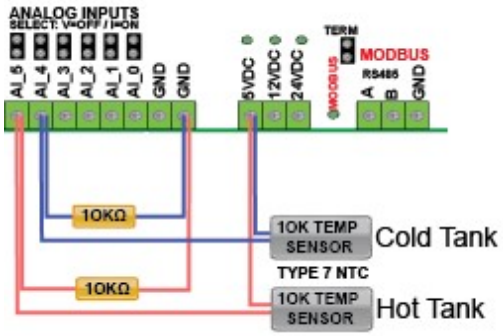


LCD Interface: Configuration



Like with Method 3, when this method is used no indoor circulator control for temperature sampling will occur. It requires an external temperature sensor placed in a dry well in the hot buffer tank as well as one in the cold buffer tank. The values are displayed in the **Hot Tank** and **Cold Tank** boxes in the PC App's **View-->Setpoint Control** window. If either temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

10K Type 7 (or Type 3) NTC thermistors along with 10K 1% or better resistors must be connected to the control board. Connect the Hot Tank sensor to the AI_5 input and the Cold Tank sensor to the AI_4 input as shown below and on the wiring diagram (SCH) in the **Model Specific Information** section. ***Remove the AI_5 and AI_4 jumpers on the control board.***



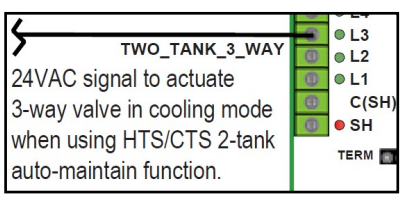
a) O Signal Control

Cooling mode may selected by making a dry contact connection between the **R** and **O** terminals on the terminal strip in the electrical box. This results in one external control requirement. **O** and **C** can be used to energize a 3-way valve to divert flow to the cold tank (see **Piping** section).

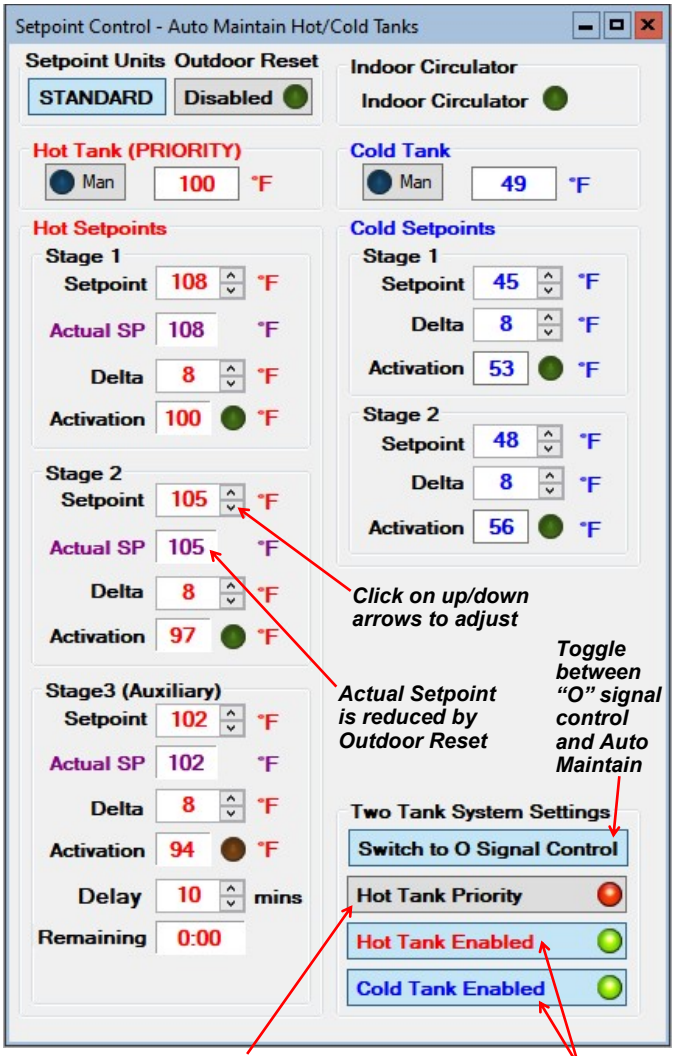
b) Auto Maintain

Alternatively, the heat pump can automatically switch between heating the hot tank and chilling the cold tank, without the need for any external control signals. Click the "**Switch to Auto Maintain**" button in following screenshot (PC App only). If using this function, hot tank or cold tank can be set as priority, and either tank can be disabled to turn it off.

For Auto Maintain, the **L3** signal from the left side of control board in conjunction with **C/GND** should be used to energize the 3-way valve in cooling, since there is no **O** signal.



The **Setpoint Control** window looks like this for **Method 4 (External HTS/CTS with Two Tanks):**



WARNING: When in Manual Override mode, Activation no longer responds to Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached). Go to the PC App's Control Panel to turn demand ON/OFF with the Stage buttons.

To prevent the compressor from starting when the power is first turned on, the system is **DISABLED** from factory. The LCD display will show "**SYSTEM DISABLED**". To enable the system, use either the ***System Enable/Disable*** button at the top right corner of the PC App's ***Tools-->Configuration*** window or use the LCD interface and select ***SYSTEM ENABLE***.

See above & below, and also the **PC Application (PC App)** section for full screenshots of the various windows.

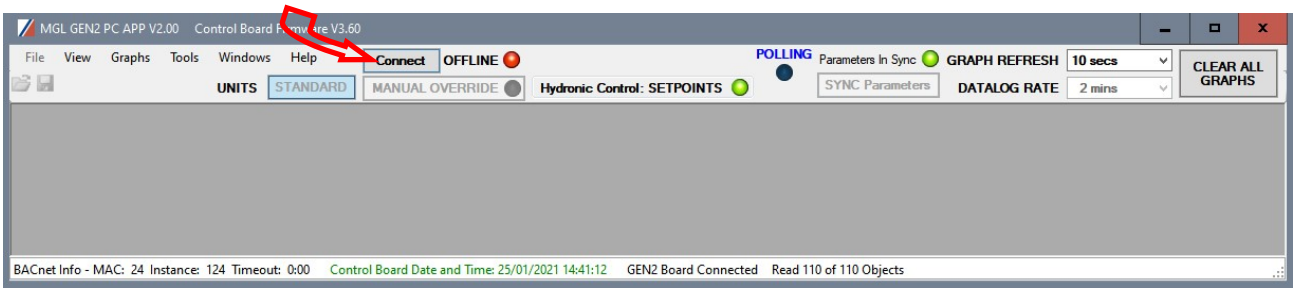
The features explained in **Setpoint Control Method 1 - Indoor Loop ICR with One Tank** also apply to **Setpoint Control Method 4 - External HTS/CTS with Two Tanks:**

- **Typical Temperature Settings**
- **Summer Setback**
- **Outdoor Reset function**

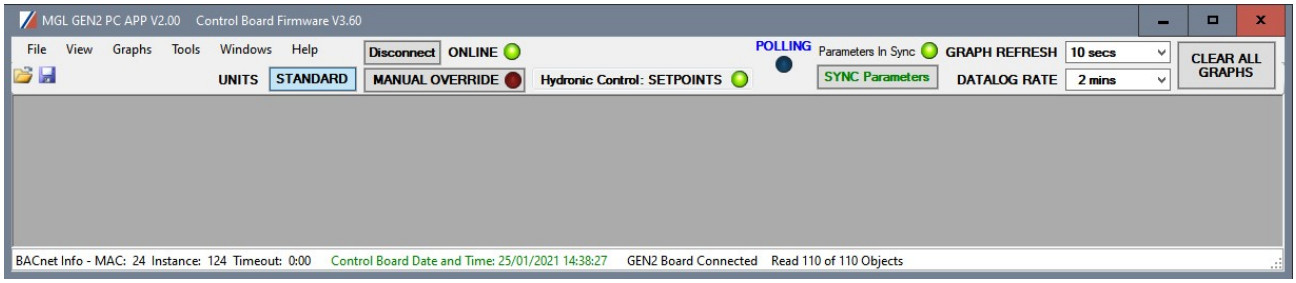
PC Application (PC App)

NOTE: Before using the PC Application, refer to **Appendices** for installation instructions for the PC Application and USB driver for the COM port. Both must be installed in order to run the PC App and communicate with the control board.

Connect a USB cable between the PC and the control board USB connector located at the bottom center of the board. Use the Windows Start menu to launch the PC App. You should see a screen similar to the one below. The revision of the PC APP is shown in the top left corner of the screen. Click the ***Connect*** button to begin communications with the control board.



Once connected, the menus and buttons will become accessible, the number of Objects available and Read should appear (they should be the same) and the Polling LED will begin to flash. The PC time and date will appear at the bottom left corner of the screen. Clicking on "Control Board Date and Time" will display the current control board date and time. If the date and time need to be adjusted, click on menu ***Tools—>Set Date and Time***. The control board date and time will be set to that of the PC.



PC Application Menus

The following pages describe the PC APP's menus in detail. There are six menus: ***File, View, Graphs, Tools, Windows, Help***.

File Menu: This menu handles page arrangements. If one or multiple pages are open and arranged as desired for viewing, this page arrangement may be saved and re-used the next time the PC APP is used.

File-->Open: Opens a saved page arrangement.
File-->Save: Saves the current page arrangement.
File-->Exit: Exits the PC Application.

Windows Menu: This menu is used to arrange windows (pages), or to bring a particular window to the front.

Windows-->Cascade: Arranges windows one in front of the other each with a small right and down offset from the last.
Windows-->Tile Vertical: Arranges windows side by side, stretching them fully from top to bottom.
Windows-->Tile Horizontal: Arranges windows up and down, stretching them fully from left to right
Windows-->Close All: Closes all open windows.

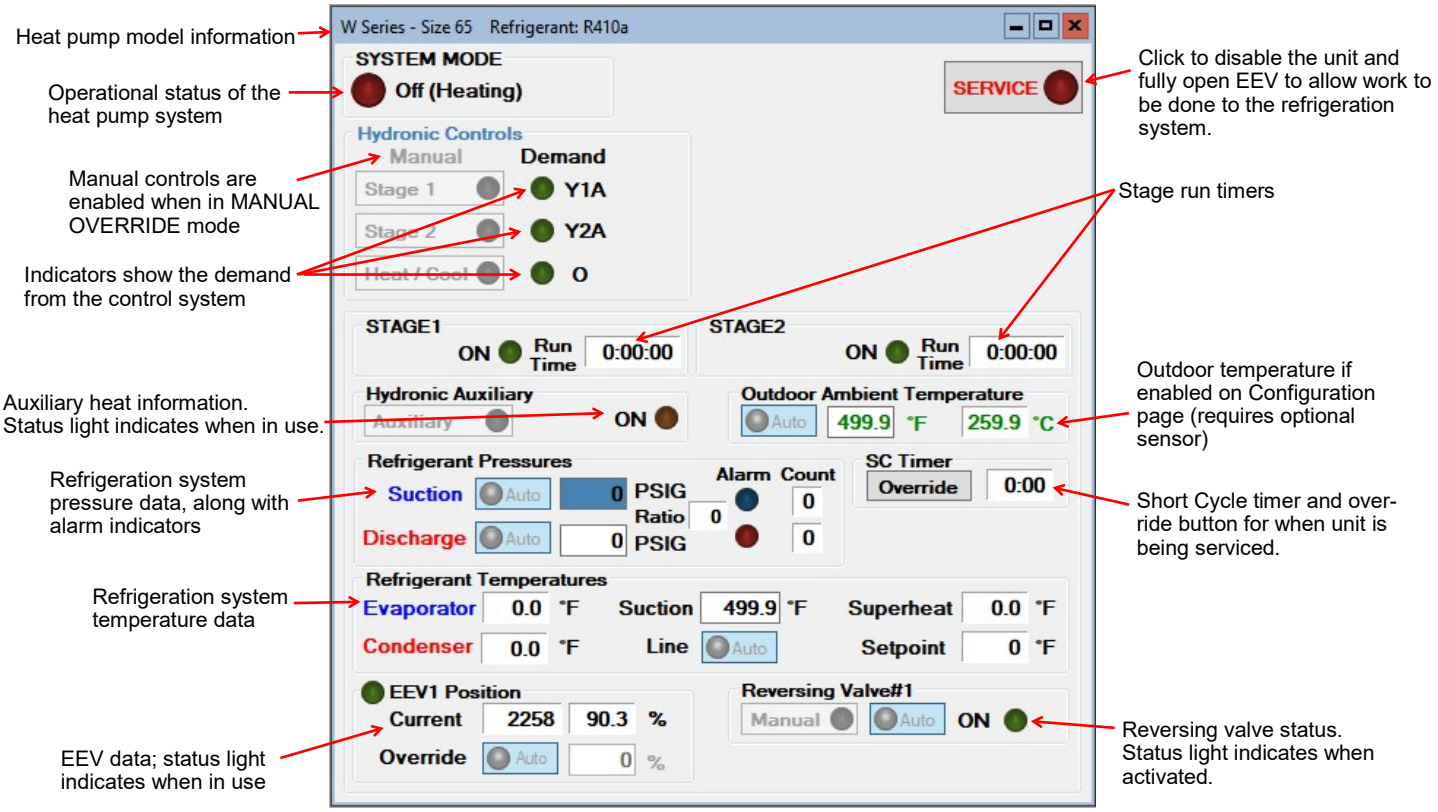
Help Menu: This shows information about the PC Application.

Help-->About: Displays the window shown to the right.

View Menu:

This menu handles all of the operational viewing screens. Clicking on the View submenus will open the page in the PC APP's frame. The next few pages of the manual show screenshots of each of the pages along with some descriptions of what is on each page.

View-->Control Panel: The main control panel window will open, shown below.



View-->Setpoint Control:

Shows the on-board temperature control screen. This screen is only available when **Control Source HYD** on the Configuration Page is set to **Setpoints** (not **BACnet** or **Signals**).

Refer to the **Operation** chapter earlier in this manual for details.

View-->Alarms, Limits and Faults

The alarms page has four tabs:

1. **ALARMS** - Current alarm status, alarm count, high and low refrigeration alarm cutout values, and short cycle timer.
2. **ALARMS LIST** - List of alarms that have occurred since the PC APP has been operating (this will be lost when the PC is disconnected from the control board.)
3. **LIMITS** - Limits in effect which prevent compressor operation but that do not cause an alarm.
4. **FAULTS** - List of board hardware faults.

View-->Alarms, Limits and Faults (ALARMS Tab):

NOTE: Greyed out Alarms in the PC APP are not applicable to the system setup and are not monitored by the control board.
NOTE: Refer to Alarms and Faults screenshot below to see which alarms have a count.

Alarms without a count: These alarms only occur one time at which point they immediately create a **Permanent Alarm**.

Alarms with a count: When an alarm occurs the compressor will stop, the alarm count will increase and the ***Short Cycle Timer*** will start. When the ***SC Timer*** expires the compressor will re-start. If no further alarms occur within ***Count Reduce Time***, the alarm count will be reduced by 1. If another alarm occurs within ***Count Reduce Time*** (see **Configuration Page**) the count will increase by 1. If alarms continue to occur, when the alarm count reaches the ***Maximum Count*** value a ***Permanent Alarm*** will occur.

Master Alarm: This alarm occurs when any permanent alarm occurs. It is used to simply indicate that there is an alarm.

Permanent Alarm: The compressor will be locked out until the ***Permanent Alarm*** is manually reset either by cycling the power or clicking on the ***RESET*** button

Low Pressure: A low pressure alarm occurs when the suction pressure drops to or below the ***Low Pressure Cutout*** value. The low pressure is checked just before a compressor start, if it is OK the compressor will start, otherwise an alarm will occur. When the compressor starts, the low pressure alarm will be ignored for the number of seconds that ***Low Pressure Ignore*** is set to, after which the low pressure alarm will be re-enabled. This allows a dip in suction pressure below the cutout point during startup without causing a nuisance alarm.

High Pressure: A high pressure alarm occurs when the discharge pressure rises to or above the ***High Pressure Cutout*** Value.

Compressor Monitor: This alarm occurs when the compressor protection module sends a fault signal to the control board, generally due to the compressor windings overheating. (Most residential models do not have compressor protection modules.)

Compressor Status: This alarm occurs when there is current draw on the compressor but no call for the compressor to be on (i.e. welded contactor) or when there is call for the compressor to be on but there is no compressor current draw (i.e. manual high pressure control is open or contactor failure). Requires current sensor accessory.

Phase Monitor: This alarm occurs when the 3-Phase Monitor detects a fault condition and sends a fault signal to the control board. For three phase units only and requires Phase Monitor accessory.

Comp. Not Pumping: Discharge pressure is less than 30 psi higher than suction pressure after 1 minute run time. It indicates leaking reversing valve, manual high pressure control trip, bad contactor, or defective compressor.

Low Charge / EEV: This alarm occurs if the EEV has been at >99% for 20 minutes within first hour of a cycle.

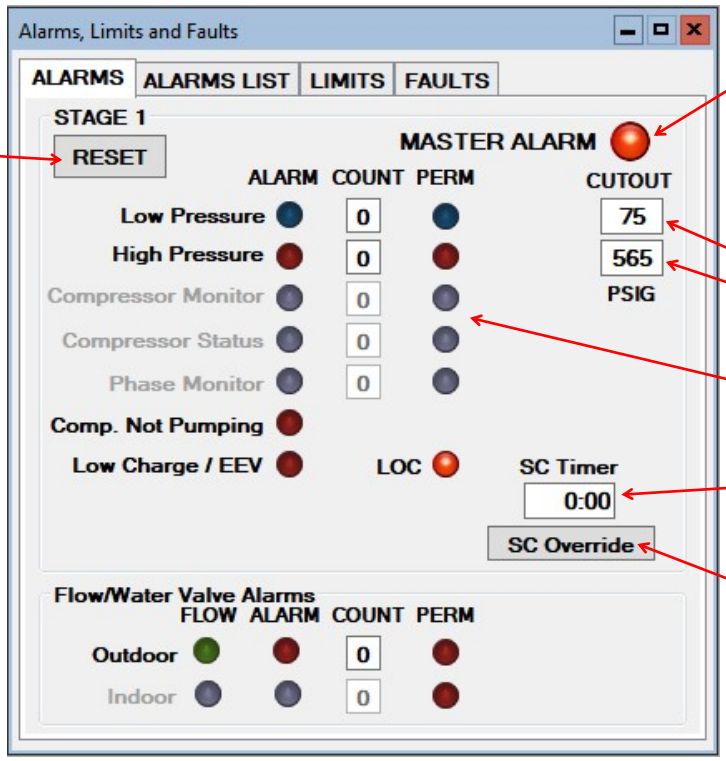
LOC (Loss of Charge): This alarm occurs if both the low pressure and high pressure sensors are below 30 psig (207kPa).

Outdoor Water Valve: Outdoor loop water valve end switch did not close in 90 seconds (open loop only).

Go the Alarms Troubleshooting section of the Troubleshooting chapter of the manual to address alarm issues.

This button will erase all alarms and alarm counters, including a permanent alarm.

WARNING: Repeated resets can freeze and rupture heat exchangers, ruining the heat pump and voiding the warranty. The source of the alarm should be determined before resetting the unit if possible or during operation after a reset.



Master Alarm occurs when any alarm occurs.

Low Pressure cut out.
High Pressure cut out.

Greyed out alarms are not applicable to the system.

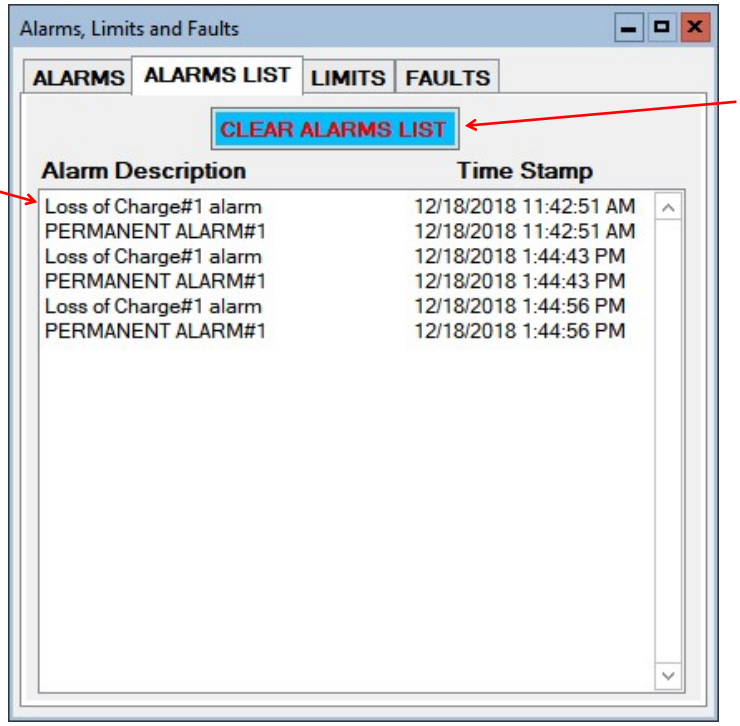
Short Cycle Timer counts down time until the next compressor start is allowed.

This button will reduce the short cycle timer value to 10 seconds.

View-->Alarms, Limits and Faults (ALARMS LIST Tab):

This tab show a history of alarms that have occurred since the PC APP was connected to the control board. This list will be lost when the PC APP is disconnected.

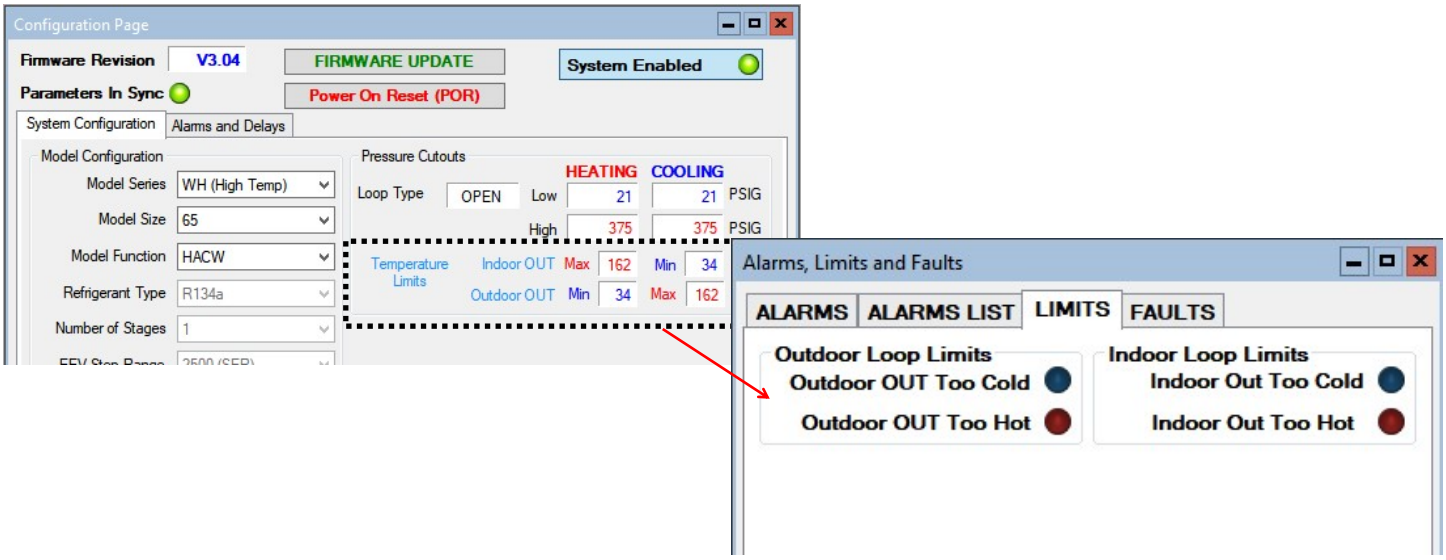
Each alarm that occurs while the PC APP is connected to the control board will appear here. The alarm type and a time stamp will be shown. The alarms list will be erased when the PC APP is disconnected from the control board.



This button will erase the alarm events in the Alarm List.

View-->Alarms, Limits and Faults (LIMITS Tab):

This tab shows temperatures that are out of limits but have not caused an alarm. These limits are shown on the **Tools-->Configuration** page.



View-->Alarms, Limits and Faults (FAULTS tab):

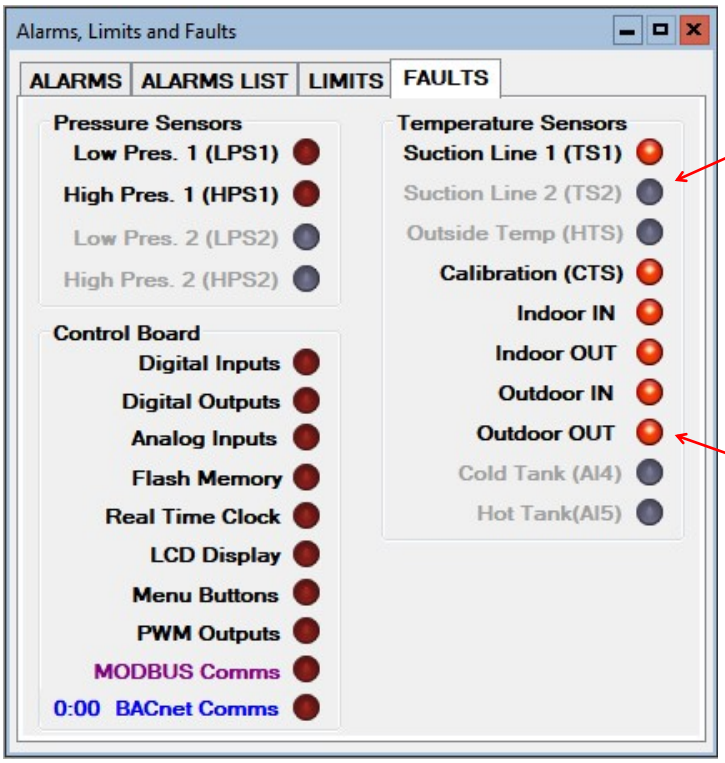
This tab shows hardware faults that could occur. If one of these faults occurs there may be a problem with the control board hardware, with LCD Display and buttons, or with a sensor.

If a fault occurs, some things to try:

- Turn the power to the heat pump off for 20 seconds and then back on again.
- Use the menu item ***Tools-->Reset to Factory Defaults***. If this clears the fault then the system configuration will have to be set up again.
- For LCD Display or Menu Button faults, turn off the power, disconnect and reconnect the cable between the LCD display board and the control board, then turn the power back on again.

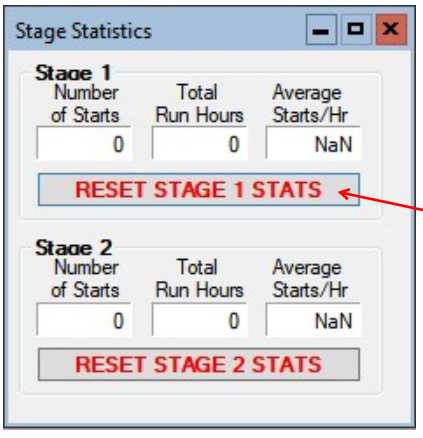
If the fault persists then there is most likely a hardware problem, and the sensor, control board, or LCD board will need to be replaced.

IMPORTANT NOTE: If the Indoor OUT (I_OUT) probe is faulty or disconnected, neither the heat pump nor the auxiliary will operate if using Setpoint Control. They will continue to operate under BACnet control.



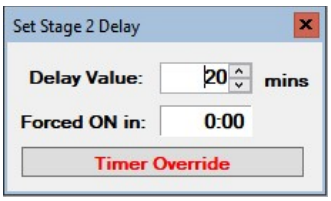
View-->Stage Stats:

The compressor information: number of starts, run hours and starts per hour.



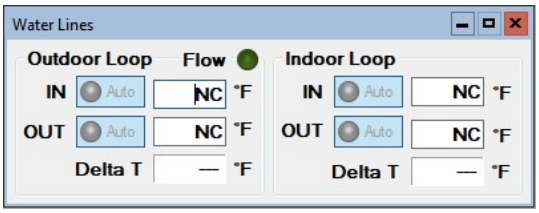
View-->Set Stage 2 Delay

Sets the Stage 1 run time after which stage 2 will be forced ON. *Set to 0:00 to disable.* (Applicable to R410a heat pumps with 2-stage compressors only.)



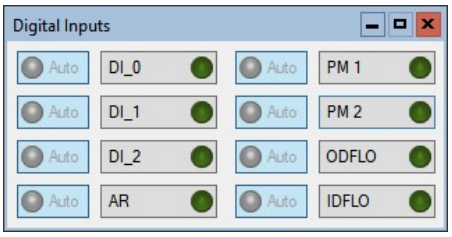
View-->Water Lines

Shows the water line temperatures.



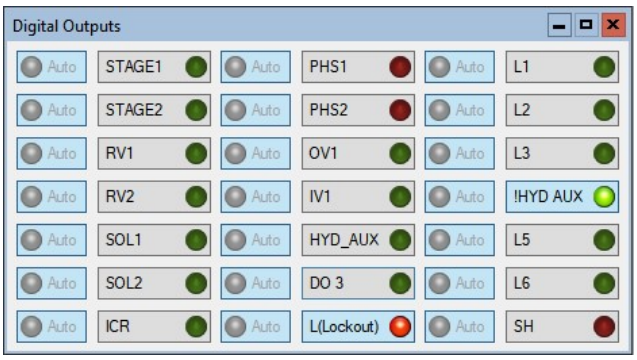
View-->Digital Inputs

Shows the digital inputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.



View-->Digital Outputs

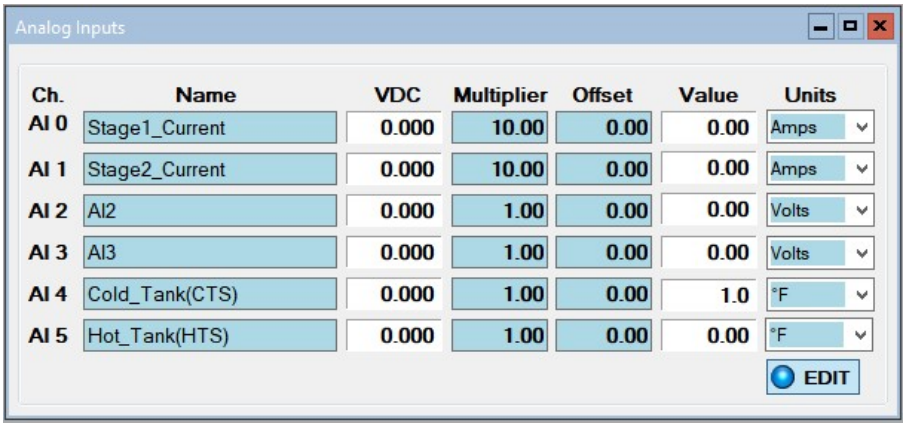
Shows the digital outputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.
.



View-->Analog Inputs

Shows the Analog inputs and their individual settings and values.

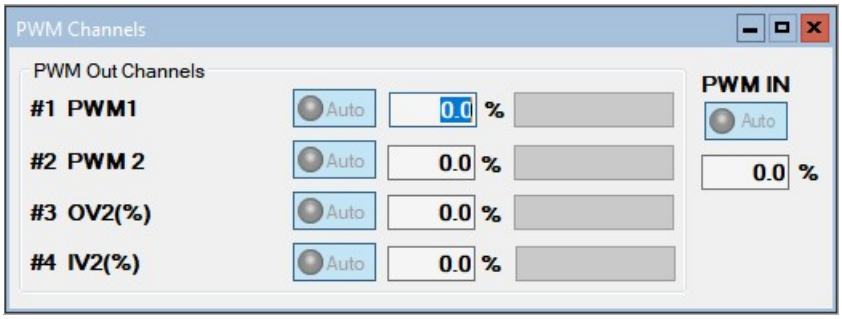
Click on the ***EDIT*** button to modify the blue boxes (button will now say ***SAVE***). For each channel a name may be selected (up to 16 characters), and the multiplier and Offset values may be set to accommodate the connected sensor scaling. Signals may be 4-20mA (channel jumper on board ON) or 0-10VDC (channel jumper on board OFF). A variety of units are also available for selection of common measurement types. Click on ***SAVE*** to save the changes. Values are kept even when power is removed from the unit.



View-->PWM Channels

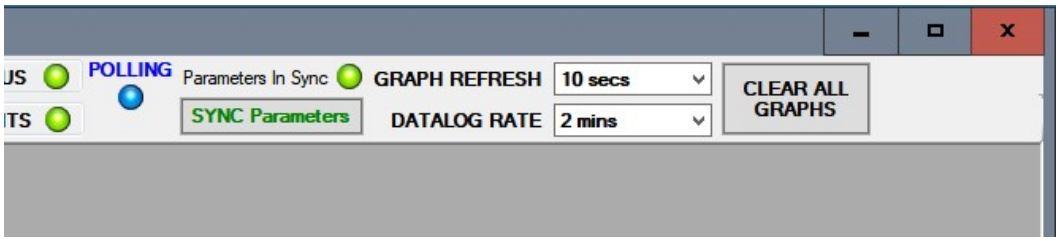
Shows the PWM channels and their individual status (0-100%). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.

EMW-series does not use any PWM channels.

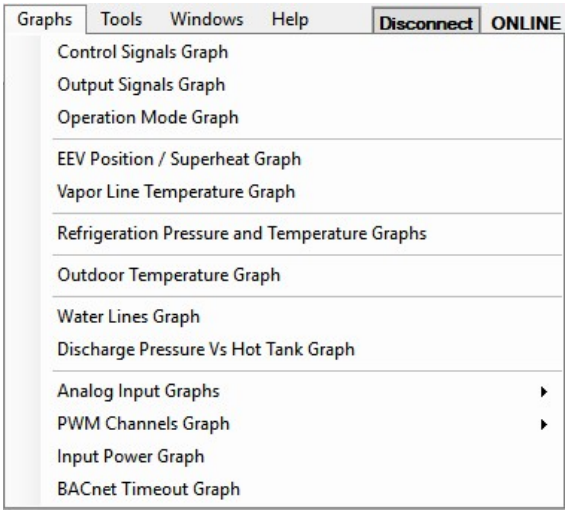


Graphs Menu:

This menu is a list of the available graphs. Graphs are real-time and show a time stamp of when the recording started as well as a current time which will show up if the graph is screen captured. Each graph has a CLEAR button which will erase the stored data and restart the graph. There is also a master CLEAR ALL GRAPHS button at the top right of the PC APP; this will clear all open graphs and re-start them all simultaneously to keep them in sync with each other. The refresh rate for the graphs is also located at the top right of the PC APP.

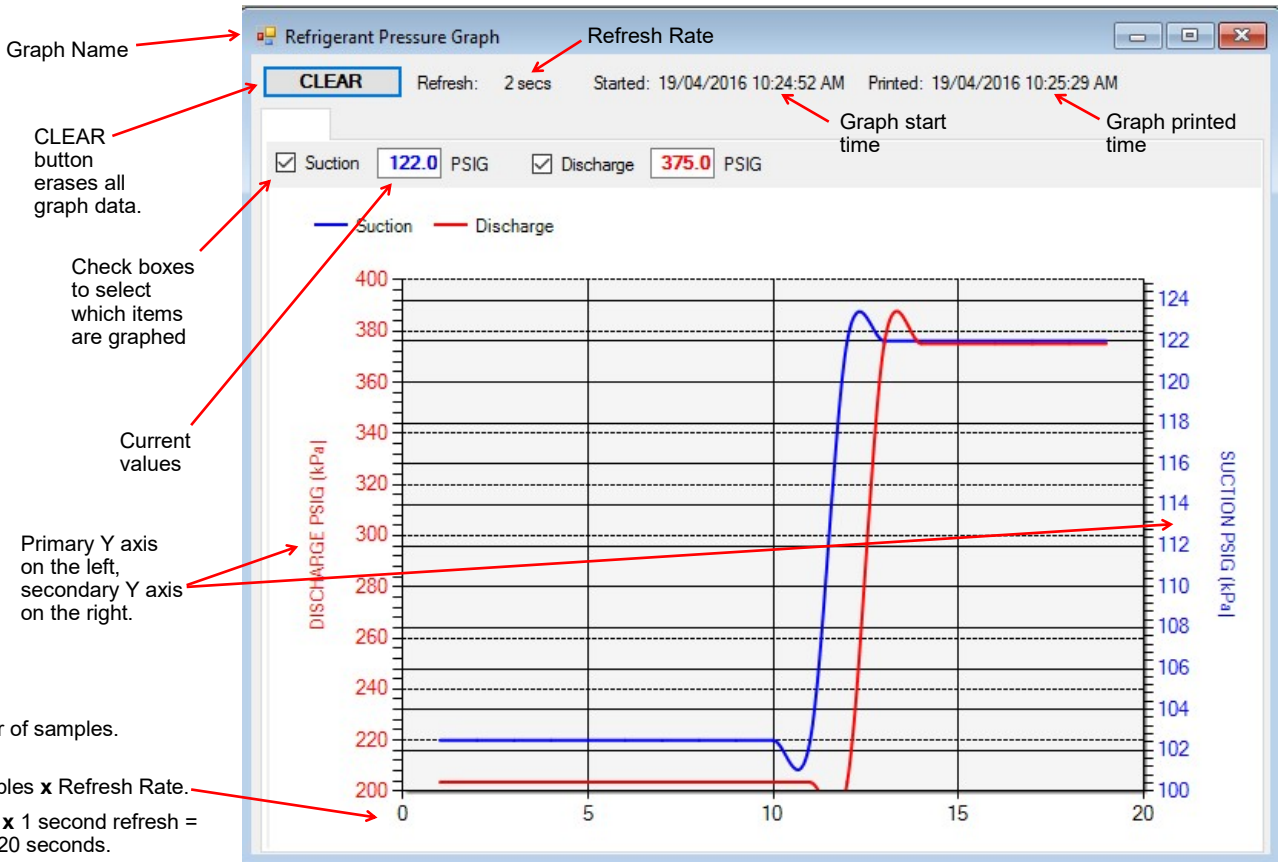


TIP: To screen print a graph and save it as a picture, press Print Screen on the keyboard and then paste into MS Paint or other graphics program. Select the desired graph with the selection tool and copy it to a new MS Paint, then save the file as the desired name.



ON/OFF status of the system control signals (demands).
ON/OFF status of digital outputs.
ON/OFF status of heating and cooling modes.
EEV position and resulting superheat.
Suction temperature.
Suction and discharge pressures & temperatures.
Outdoor temperature (accessory) vs. suction pressure.
2 tabs: one for indoor IN/OUT/Delta T, and one for outdoor IN/OUT/Delta T.
Discharge pressure vs. hot tank temperature.
All analog input channels (0-10VDC or 4-20mA).
All PWM / 0-10VDC output channels and one PWM / 0-10VDC input channel.
For future use.
For troubleshooting synchronization with 3rd party BACnet controllers.

Below is an example of a typical graph screen. Items that are checked will be plotted, unchecked items will not. The graph screens show the time the graph started as well as the current time to time stamp the graph when screen printed.

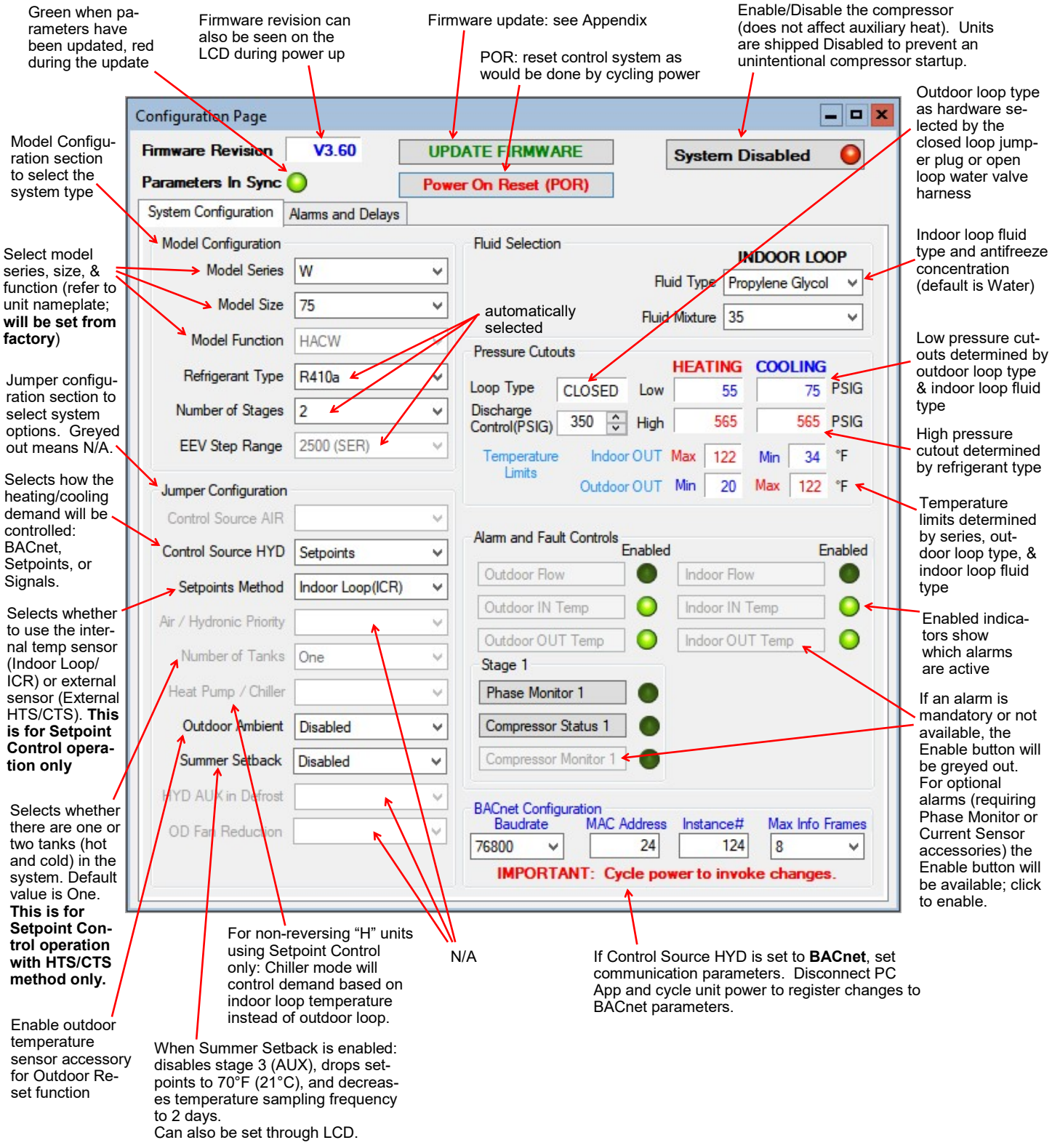


Tools Menu:

This is where various tools for system setup and monitoring are located.

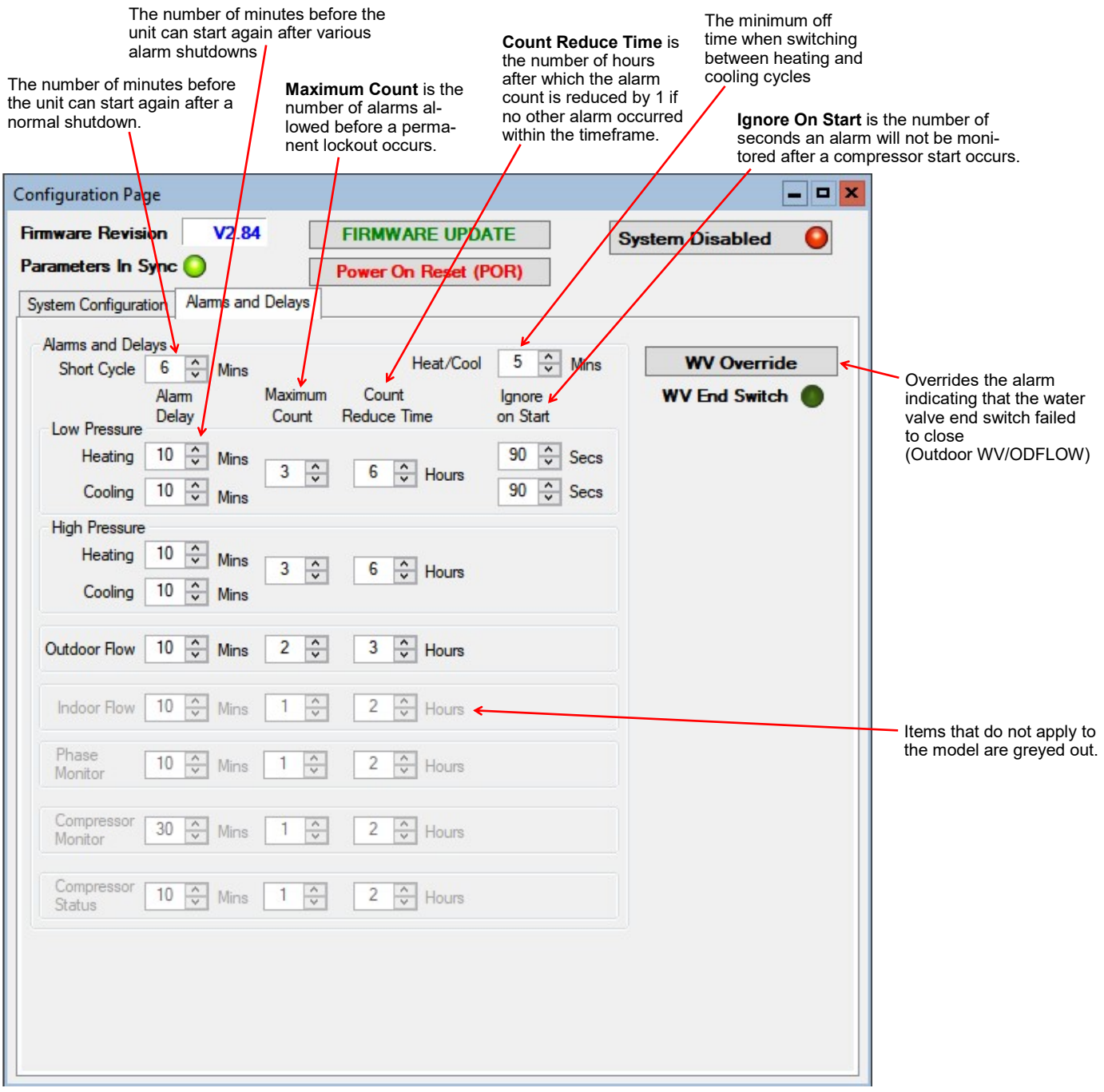
Tools-->Configuration (System Configuration tab):

This is where the system setup is done. ***Settings should only be changed by a person who has a good understanding of system operation***. Improper settings could cause the system to operate poorly or not at all.



Tools-->Configuration (Alarms and Delays tab):

Click on the UP/DOWN arrows to change the value, noting that values have both a low and high limit.

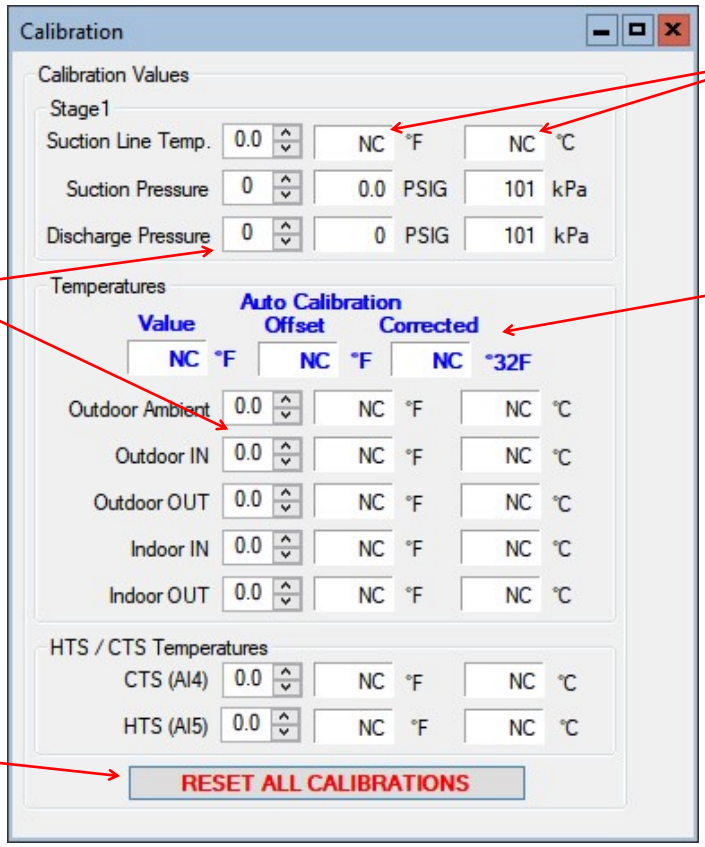


Tools-->Calibration:

Generally there is no need for calibration.

The suction and discharge pressures may be calibrated in increments of 1 psi if there is a discrepancy in the readings when compared to a known good reference.

Temperature sensors may be adjusted in increments of 0.1°F. There is an **AUTO CALIBRATION** routine in the program that continually calibrates the temperatures sensors against an on board reference resistor by applying an offset to the temperature sensors. Calibration adjustments made here are in addition to the Auto Calibration routine.



Current values in standard and metric.

Calibration adjustments

Temperature Auto Calibration information. The offset is applied to all temperature sensors. Calibration adjustments made to each sensor are in addition to the Auto Calibration values.

Click on the RESET ALL CALIBRATIONS button to clear all calibration data. A popup window will appear for confirmation.

Tools-->Set Date and Time:

This will synchronize the date and time of the control board with the computer's date and time, and will be necessary for new units or units that have been powered off for several days or more.

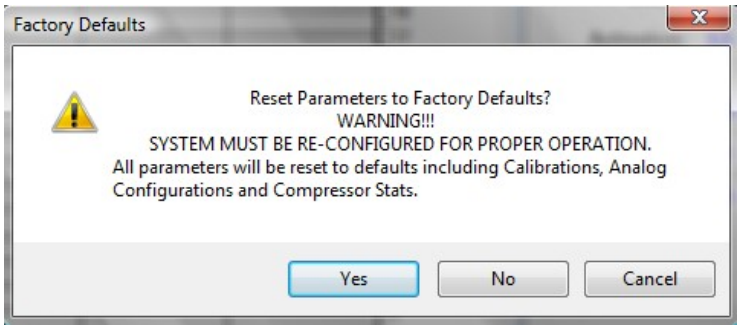
The date and time of both the computer and the control board are shown in the status bar at the bottom of the PC App.

Tools-->Reset to Factory Defaults:

This will reset all parameters to default values.

THE SYSTEM MUST BE RECONFIGURED AFTER A RESET IS PERFORMED.

A reset will default the system to a two stage ATW Series Size 65 with Signals as the control source. Calibrations, alarm delays, analog configurations, compressor statistics, and Setpoint Control values will be returned to defaults as well.



Tools-->Update Firmware:

This will put the control board in bootloader mode in preparation for a firmware update using the PIC32.EXE program. See Appendix for firmware update procedure.

Tools-->Power On Reset (POR):

This will reset the control system as would be done by cycling power.

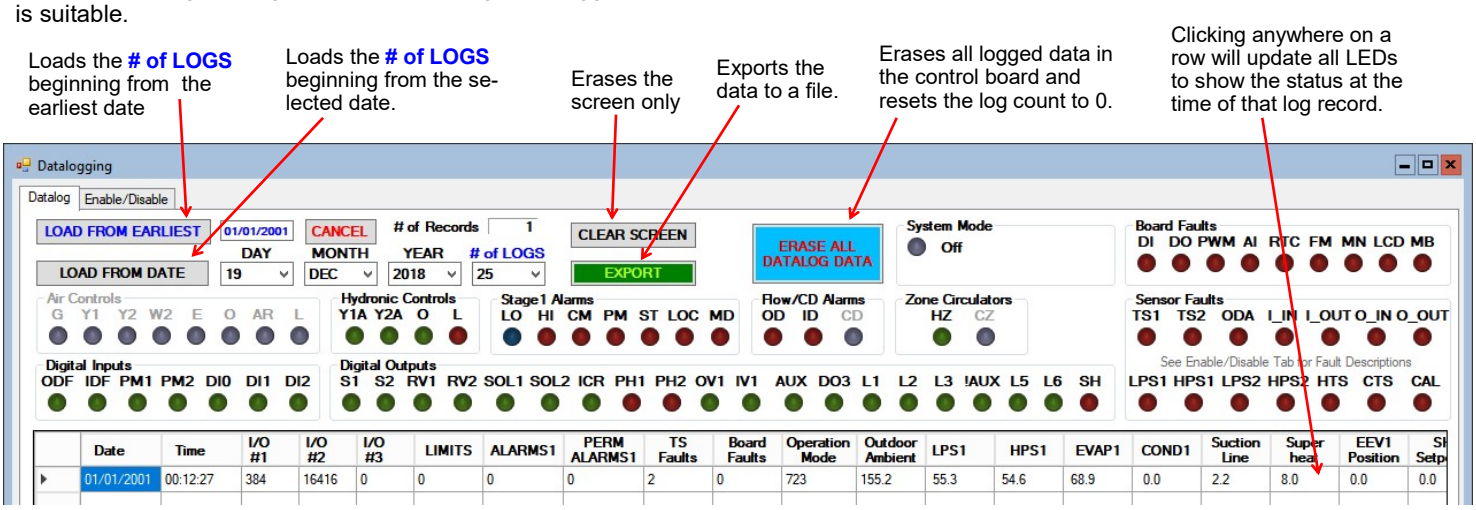
Tools-->Datalogging (Datalog tab):

A log will be automatically recorded at the following rates:

- SYSTEM DISABLED: every 10 minutes
- SYSTEM ENABLED: logging frequency set via the dropdown box at the top right of the PC App main window
- ALARM: logging frequency automatically set to 10 seconds, for 2 hours
- PERMANENT ALARM: every 10 minutes

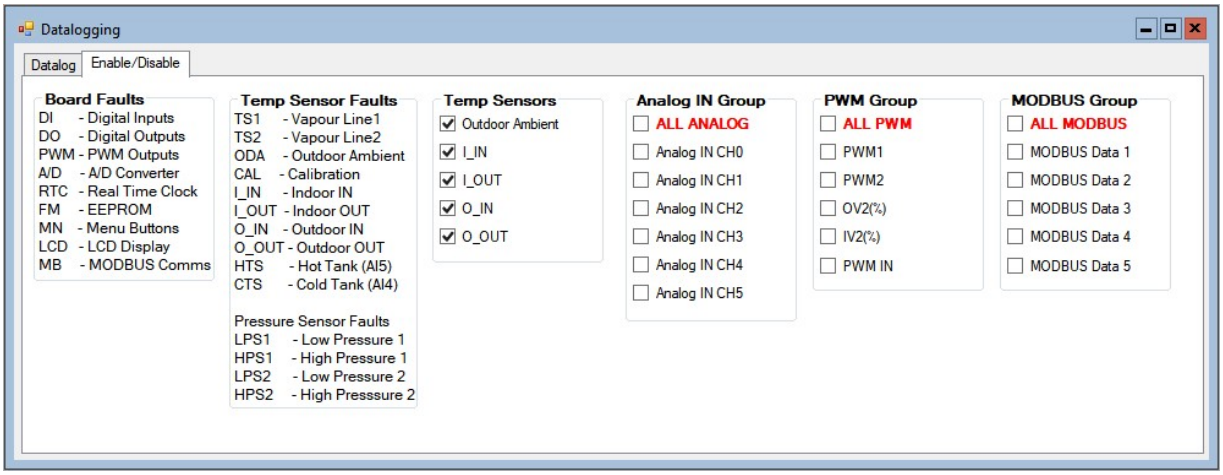
The maximum number of datalog records is 32,224, which will take 45 days to fill up at the default recording rate of 2 minutes.

Note that loading datalogs is time-consuming. It is suggested to leave the ***# of LOGS*** at **25** until it is shown that the start date selected is suitable.



Tools-->Datalogging (Enable/Disable tab):

Click on the checkboxes to customize which columns are shown/hidden in the datalog table.

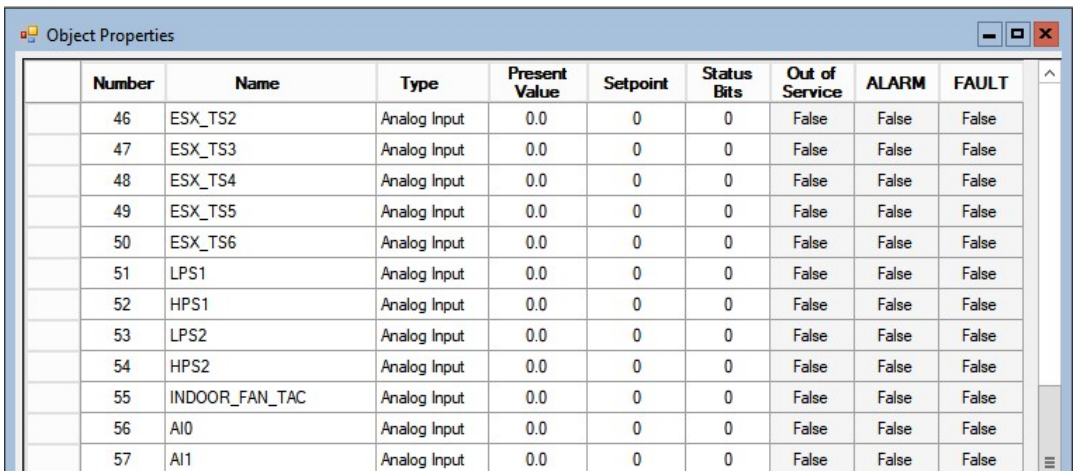


Tools-->MODBUS:

For future use.

Tools-->Objects:

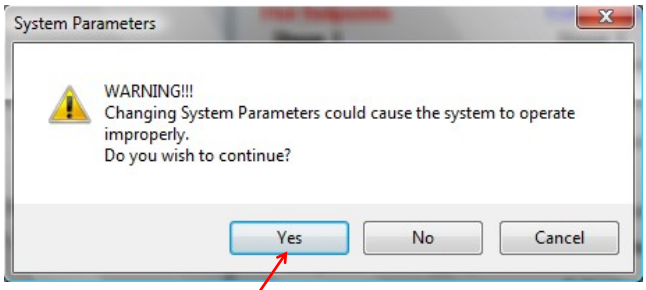
This is a window to display the runtime data, which is not stored when the power is turned off. No changes are possible.

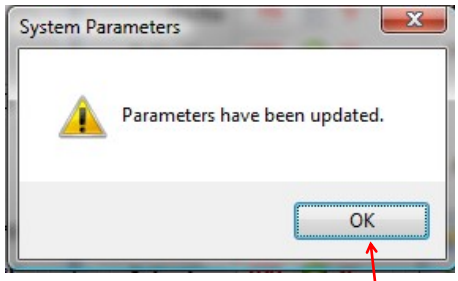


Tools-->Parameters:

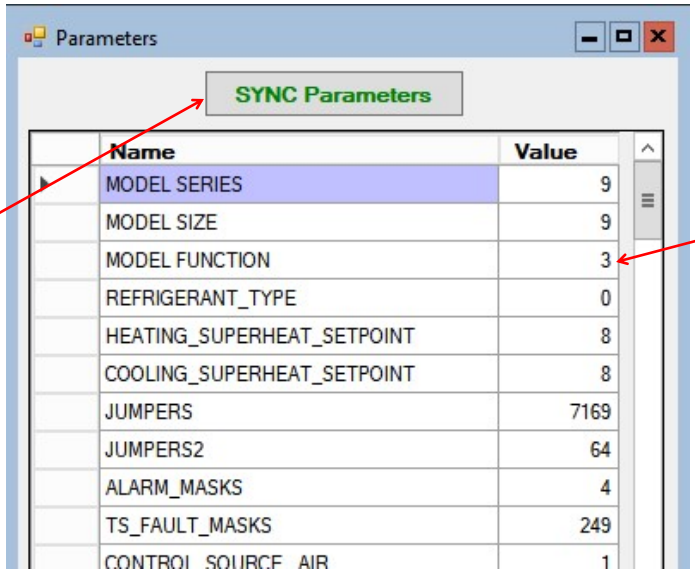
WARNING! The Parameters page is for advanced use only.
Changing parameter values can cause the system to stop functioning properly.

The parameters page shows all configurable memory spaces with their name and current value and allows them to be edited directly. To change a parameter value type in the new value and press ENTER.





Clicking on menu item ***Tools-->Parameters*** will display this warning. Click on **YES** to open the parameters page.

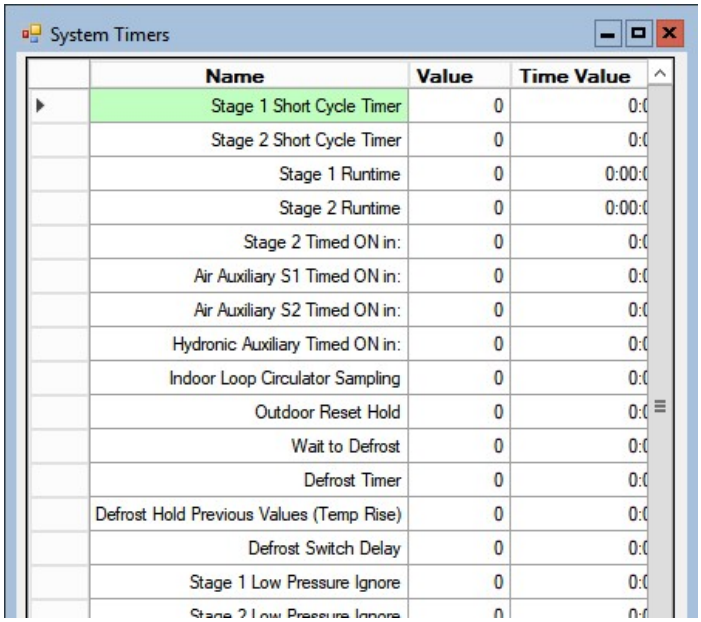


Click this button to reload the table with the values from the control board memory.

Type in the new value and press **ENTER**, the confirmation popup will appear, click on **OK**.

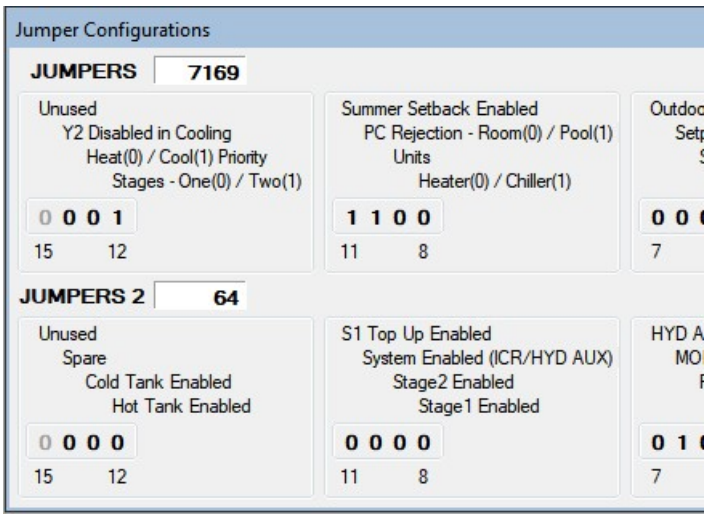
Tools-->SYSTEM TIMERS:

This page shows all internal timers by name along with their current values.



Tools-->Jumpers:

This page shows internal jumper configurations, for developers.

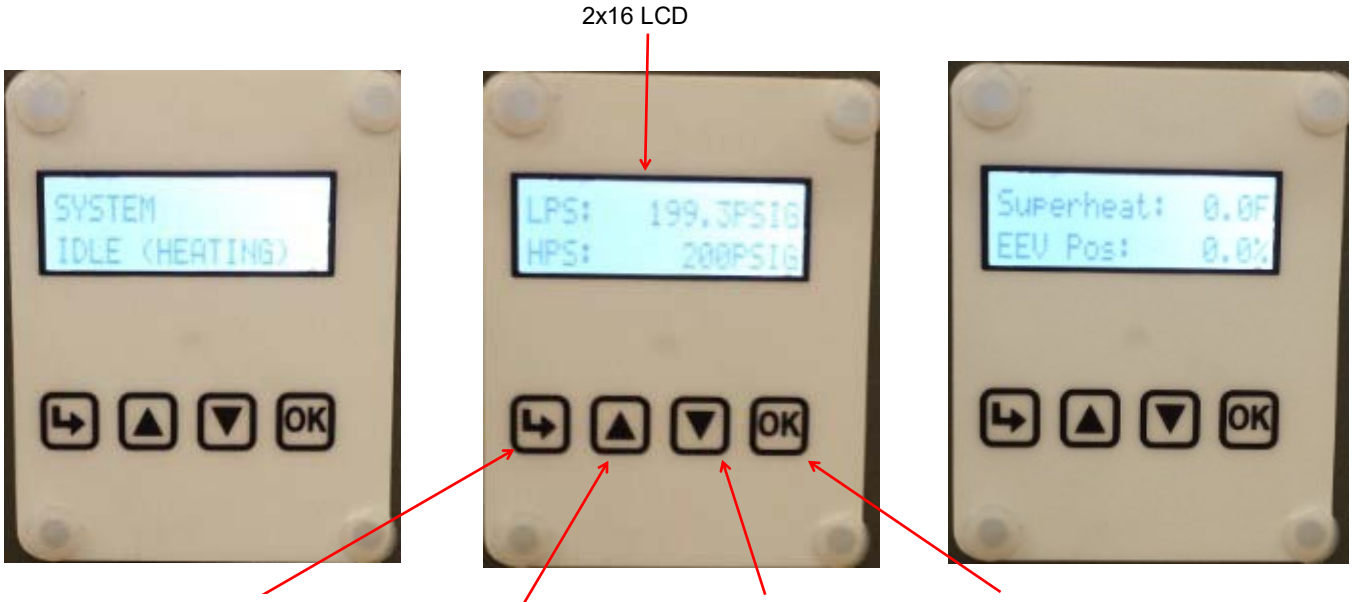


Tools-->System Enable/Disable:

Enable/Disable the compressor (does not affect auxiliary heat). Units are shipped Disabled to prevent an unintentional compressor startup. Also available as a button at the top right of ***Tools-->Configuration*** window.

LCD Interface & Menus

These are examples of the unit status and operating data displayed when at the message display level (top level). Pressing ENTER will enter into the menu levels beginning with the Main Menu.



ENTER button:
Use this to push down to the next menu level. Also saves value if at parameter menu level.

UP button:
Use this to scroll up through the items available at a menu level.

DOWN button:
Use this to scroll down through the items available at a menu level.

OK/EXIT button:
Use this to come back up one menu level. Also saves value if at parameter menu level.

Menu Tree: This is a list of the various tools are used for system setup and monitoring.
The table shows what is displayed based on each press of the ENTER button starting at the Main Menu level.

ENTER (From Main)	ENTER (First Press)	ENTER (Second Press)	ENTER (Third Press)	Description
Setpoint Control *(only if using Setpoint Control)*	***— Setpoints***	***— Heating***	***— Stage 1 Setpoint***	Stage 1 stops when water temperature rises to this point.
			— Stage 1 Delta	Stage 1 starts when water temperature drops below setpoint by this amount.
			— Stage 2 Setpoint	Stage 2 stops when water temperature rises to this point.
			— Stage 2 Delta	Stage 2 starts when water temperature drops below setpoint by this amount.
			— AUX (S3) Setpoint	Stage 3 stops when water temperature rises to this point.
			— AUX (S3) Delta	Stage 3 time delay starts when water temperature drops below setpoint by this amount. (Stage 3 starts immediately if time delay is set to 0).
			— AUX (S3) Delay	Delays Stage 3 start by timer amount.
			— Outdoor Reset *(only if enabled)*	Temperature factor to use in the outdoor reset table.
		— Cooling	***— Stage 1 Setpoint***	Stage 1 stops when water temperature drops to this point.
			— Stage 1 Delta	Stage 1 starts when water temperature rises above setpoint by this amount.
			— Stage 2 Setpoint	Stage 2 stops when water temperature drops to this point.
			— Stage 2 Delta	Stage 2 starts when water temperature rises above setpoint by this amount.

Main Menu Tree Continued				
ENTER (From Main)	**ENTER (First Press)**	**ENTER (Second Press)**	**ENTER (Third Press)**	**Description**
Summer Setback *(only if using Setpoint Control)*	***— Enable Setback?***	***— Enable***		Enable summer setback.
		— Disable		Disable summer setback.
System EN/DIS	***— Enable System?***	***— Enable***		Enable compressor, auxiliary, and ICR.
		— Disable		Disable compressor, auxiliary, and ICR.
Service Mode	***— Service Mode?***	***— No***		Do not enter Service Mode.
		— Yes		Enter into Service Mode.
EEV Control	***— EEV1***	***— Auto/Manual***	***— Auto***	Puts EEV in Auto mode
			— Manual	Puts EEV in Manual mode
		— Manual Position	***— EEV Position (%)***	Enter desired EEV position
Configuration	***— Control HYD***	***— Setpoints***		On-board water temp. control—see **Setpoint Control** section
		— Signals		Hardwired Signal control
		— BACnet		BACnet control—see **BACnet** section
	— Outdoor Reset *(only if using Setpoint Control)*	***— Enable***		Enables Outdoor Reset functionality
		— Disable		Disables Outdoor Reset functionality
	— Outdoor Ambient	***— Enable***		Enables accessory outdoor temp. sensor
		— Disable		Disables accessory outdoor temp. sensor
	— Setpoints Method *(only if using Setpoint Control)*	***— ICR***		Use Indoor Circulator Relay sampling
		— HTS/CTS		Use external temperature sensors
	— Heat Pump / Chiller *(only if using Setpoint Control, H/HW models)*	***— Heat Pump***		Control on indoor loop water temperature
		— Chiller		Control on outdoor loop water temperature
	— Number of Tanks *(only if using Setpoint control with HTS/CTS)*	***— One Tank***		One tank for heating/cooling functions
		— Two Tanks		Separate hot and cold tanks
	— Time Delays	***— Short Cycle***	***— Short Cycle (min)***	Enter short-cycle timer value
		— Heat/Cool	***— Heat/Cool (min)***	Enter minimum off time between modes
	— Units	***— Standard***		Standard units
		— Metric		Metric units (does not affect calibration units)
	— Set Time	***— Hours***		Set the system hours.
		— Minutes		Set the system minutes.
	— Set Date	***— Day***		Set the system day.
		— Month		Set the system month.
		— Year		Set the system year.
Calibration	***— Suction 1***		Suction Pressure.	Calibration in 1PSI intervals.
	— Discharge 1		Discharge Pressure	Calibration in 1PSI intervals.
	— Vapour Line 1		Suction line temperature	Calibration in 0.1°F intervals
	— Outdoor Ambient		Outside air temperature	Calibration in 0.1°F intervals
	— Outdoor IN Temp			Calibration in 0.1°F intervals
	— Outdoor OUT Temp			Calibration in 0.1°F intervals
	— Indoor IN Temp			Calibration in 0.1°F intervals
	— Indoor OUT Temp			Calibration in 0.1°F intervals

NOTE: Calibration is generally not required. Pressure sensors may be calibrated against a known source if needed. All temperature sensors have an Auto Calibration feature.

BACnet Interface

The BACnet interface is an **MS/TP** connection via RS-485 twisted pair. BACnet **IP** is not available.
Recommended wire: 22-24 AWG single twisted pair, 100-120 Ohms impedance, 17pF/ft or lower capacitance, with braided or aluminum foil shield, such as Belden 9841 or 89841.

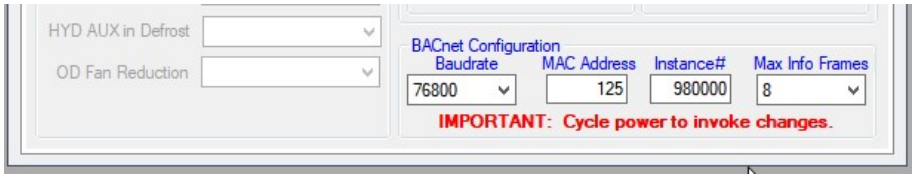
The connector on the control board is a three wire removable screw connector. The signals are as follows:
A: Communications line (+) (right pin)
B: Communications line (-) (middle pin)
C: Ground connection (left pin)

If connecting multiple units to one RS-485 connection point, connect the signal cable from the master building controller to the first unit. Connect the second unit to the first unit (in same connector), connect the third unit to the second unit, and so on until all units are connected (daisy-chain). Remove the TERM jumper (located just above the BACnet connector on control board) from all units except the last one. The shield ground should be connected only to the GND pin of the unit for single unit installations. For multiple units, the shield ground should only be connected to the GND pin of the last unit. The shield grounds for intermediate units should be connected together. The shield ground should be left unconnected at the building controller end for all cases.

Vendor: Maritime Geothermal Ltd.
Vendor ID: 260
Model Name: MGT GEN2 Control Board

The following parameters can be set via the PC App's *Configuration* Window:

1) **Baud rate**
   9600, 19200, 38400, or 76800
2) **MAC address**
   Maximum value is 125.
3) **Instance number**
   Maximum value is 4194303.



The BACnet parameter **Max_Master** has a fixed value of **127** in this device.

BACnet data is available regardless of the selected control method. In order to control the unit via the BACnet interface, set **Control Source** to ***BACnet*** either by using the PC App's configuration window or the LCD menus.

TABLE 18 - BACnet OBJECTS - CONTROL SIGNALS (READ/WRITE)

Name	Data Type	ID	Property	Description
SYSTEM_Y1A	Binary Value	BV0	Present Value	Demand for water heating or cooling (active is on)
SYSTEM_Y2A	Binary Value	BV1	Present Value	Demand for compressor stage 2 if present (active is on)
SYSTEM_O	Binary Value	BV2	Present Value	Reversing valve, if present. Inactive=HEATING, Active=COOLING
BACnet_Units	Binary Value	BV9	Present Value	Select units for BACnet objects. OFF=US, ON=metric

TABLE 19 - BACnet OBJECTS - OPERATION MODE Description (Read Only)

Name	Data Type	ID	Present Value	Description
Operation Mode	Analog Value	**AV5**	2	Hydronic heating
			3	Hydronic cooling (HAC/HACW units only)
			11	Hydronic heating OFF
			12	Hydronic cooling OFF (HAC/HACW units only)
Note: Object is type Analog Value but value will always be an integer value.				

TABLE 20 - BACnet OBJECTS - LIMITS Description (Read Only)

Name	ID	BIT #	Decimal Value*	Bit Description
Limits (Present Value)	**AV6**	0	1	Low Indoor OUT temperature
		1	2	High Indoor OUT temperature
		2	4	Low Outdoor OUT temperature
		3	8	High Outdoor OUT temperature
Note: Limits object is type Analog Value but value is bit coded and may be decoded as such (integer value). Note * : Value is for a single alarm and reference only.				

Note: object names are subject to change without prior notice.

TABLE 21 - BACnet OBJECTS - DATA (Read Only)					
	Name	**ID**	**Property**	**Units**	**Description**
Type - Analog Input	AI0 (Comp1_Current)	AI0	Present Value	Amps	Compressor current draw (AI0) - requires accessory
	AI1 (Comp2_Current)	AI1	Present Value	User	User defined (0-5VDC or 4-20mA)
	AI2	AI2	Present Value	User	User defined (0-5VDC or 4-20mA)
	AI3	AI3	Present Value	User	User defined (0-5VDC or 4-20mA)
	AI4 (CTS)	AI4	Present Value	degF (degC)	Cold tank temperature from sensor - requires accessory
	AI5 (HTS)	AI5	Present Value	degF (degC)	Hot tank temperature from sensor - requires accessory
	LPS1	AI6	Present Value	PSIG (kPa)	Low pressure value (suction pressure)
	HPS1	AI7	Present Value	PSIG (kPa)	High pressure value (discharge pressure)
	EVAP1	AI8	Present Value	degF (degC)	Evaporating Temperature
	COND1	AI9	Present Value	degF (degC)	Condensing Temperature
	Suction Line 1	AI10	Present Value	degF (degC)	Suction line temperature
	Superheat 1	AI11	**Setpoint Value**	degF (degC)	Superheat
	EEV1 Position	AI12	Present Value	%	EEV position (% open)
	LPS2	AI13	Present Value	PSIG (kPa)	N/A
	HPS2	AI14	Present Value	PSIG (kPa)	N/A
	EVAP2	AI15	Present Value	degF (degC)	N/A
	COND2	AI16	**Setpoint Value**	degF (degC)	N/A
	Suction Line 2	AI17	Present Value	degF (degC)	N/A
	Superheat 2	AI18	**Setpoint Value**	degF (degC)	N/A
	EEV2 Position	AI19	Present Value	%	N/A
	Outside Ambient	AI20	Present Value	degF (degC)	Outdoor Ambient temperature - requires accessory
	O_IN	AI21	Present Value	degF (degC)	Outdoor IN temperature
	O_OUT	AI22	Present Value	degF (degC)	Outdoor OUT temperature
	I_IN	AI23	Present Value	degF (degC)	Indoor IN temperature
	I_OUT	AI24	Present Value	degF (degC)	Indoor OUT temperature
Type - Analog Value	PWM_IN	AV0	Present Value	%	PWM input (from external source)
	PWM1 (OD Fan)	AV1	Present Value	%	PWM output value (spare)
	PWM2	AV2	Present Value	%	PWM output value (spare)
	PWM3 (OV2)	AV3	Present Value	%	OV2 - PWM or 0-10VDC for outdoor loop water valve
	PWM4 (IV2)	AV4	Present Value	%	IV2 - PWM or 0-10VDC for indoor loop water valve
	Operation Mode	AV5	Present Value	N/A	Description of mode - see Operation Mode Description table
	Limits description	AV6	Present Value	N/A	Description of active limits - see Limits Description table
	Permanent Alarms 1	AV7	Present Value	N/A	Description of active alarms - see Alarm Descriptions table
	Permanent Alarms 2	AV8	Present Value	N/A	N/A
	Board Faults	AV9	Present Value	N/A	Description of active faults - see Fault Descriptions table
	Sensor Faults	AV10	Present Value	N/A	Description of active faults - see Fault Descriptions table
Type - Binary Output	STAGE1	BO0	Present Value	N/A	Compressor contactor
	STAGE2	BO1	Present Value	N/A	Compressor stage 2 solenoid (2-stage units only)
	ICR (Indoor Circ)	BO2	Present Value	N/A	Indoor circulator control
	DO0 (OV1)	BO3	Present Value	N/A	OV1 (to 24VAC Outdoor Loop water valve)
	DO1 (IV1)	BO4	Present Value	N/A	IV1 (to 24VAC Indoor Loop water valve)
	DO2 (HYD_AUX)	BO5	Present Value	N/A	Hydronic Auxiliary ON
	DO3 (AUX_ONLY)	BO6	Present Value	N/A	N/A
	PHS1	BO7	Present Value	N/A	Stage 1 dry contact pin for locked out on alarm
	PHS2	BO8	Present Value	N/A	N/A
Type - Binary Value	CONTROLS	BV9	Present Value	N/A	Control indicator: 0=local (man.override), 1=remote (BACnet)
	Outdoor Flow	BV10	Present Value	N/A	Outdoor loop water valve ON
	Indoor Flow	BV11	Present Value	N/A	Indoor Loop flow switch - requires accessory
	Phase Monitor1	BV12	Present Value	N/A	3 Phase Monitor - requires accessory
	Phase Monitor2	BV13	Present Value	N/A	N/A
	Comp Monitor1	BV14	Present Value	N/A	N/A
	Comp Monitor2	BV15	Present Value	N/A	N/A

TABLE 22 - BACnet OBJECTS - ALARM Descriptions (Read Only)			
Name	**Data Type**	**ID**	**Description**
AI0 (Comp1 Current)	Analog Input	AI0	Status alarm (Start / Stop Failure) - requires current sensor accessory
AI1 (Comp2 Current)	Analog Input	AI1	N/A
LPS1	Analog Input	AI6	Low pressure alarm
HPS1	Analog Input	AI7	High pressure alarm
LPS2	Analog Input	AI13	N/A
HPS2	Analog Input	AI14	N/A
Outdoor Flow	Binary Value	BV10	Outdoor loop water valve
Indoor Flow	Binary Value	BV11	Indoor loop flow alarm - requires accessory
Phase Monitor1	Binary Value	BV12	3-Phase Monitor alarm - requires accessory
Phase Monitor2	Binary Value	BV13	N/A
Comp Monitor1	Binary Value	BV14	N/A
Comp Monitor2	Binary Value	BV15	N/A

Name	**ID**	**BIT #**	**Decimal Value***	**Bit Description**
Permanent Alarms 1 (Present Value)	**AV7**	0	1	Master permanent alarm (occurs when any alarm occurs)
		1	3	Low pressure heating mode alarm (suction pressure)
		2	5	Low pressure cooling mode alarm (suction pressure)
		3	9	High pressure heating mode alarm (discharge pressure)
		4	17	High pressure cooling mode alarm (discharge pressure)
		5	33	Loss of charge alarm
		6	65	Phase monitor alarm - requires accessory
		7	129	Compressor monitor alarm - N/A
		8	257	Status alarm - requires accessory
		14	16,385	Outdoor loop water valve
		15*	32,769	Indoor loop flow alarm - requires accessory
Permanent Alarms 2 (Present Value)	**AV8**	-	-	N/A

Note: Permanent Alarm objects are type Analog Value but values are bit coded and may be decoded as such (integer value).
Note * : Value is for a single alarm and reference only. Value includes + 1 for Master Alarm

Note: object names are subject to change without prior notice.

TABLE 23 - BACnet OBJECTS - FAULT Descriptions (Read Only)			
Name	**Data Type**	**ID**	**Description**
AI4 (Cold Tank)	Analog Input	AI0	Cold tank temperature sensor faulty or disconnected - requires accessory
AI5 (Hot Tank)	Analog Input	AI1	Hot tank temperature sensor faulty or disconnected - requires accessory
LPS1	Analog Input	AI6	Low pressure sensor faulty or disconnected
HPS1	Analog Input	AI7	High pressure sensor faulty or disconnected
LPS2	Analog Input	AI13	N/A
HPS2	Analog Input	AI14	N/A
Suction Line1	Analog Input	AI10	Suction line 1 temperature sensor faulty or disconnected.
Suction Line2	Analog Input	AI17	N/A
Outside Ambient	Analog Input	AI20	Outside temperature sensor faulty or disconnected - requires accessory
O_IN	Analog Input	AI21	Outdoor IN temperature sensor faulty or disconnected
O_OUT	Analog Input	AI22	Outdoor OUT temperature sensor faulty or disconnected
I_IN	Analog Input	AI23	Indoor IN temperature sensor faulty or disconnected
I_OUT	Analog Input	AI24	Indoor OUT temperature sensor faulty or disconnected

Name	**ID**	**BIT #**	**Decimal Value***	**Bit Description**
Board Faults (Present Value)	**AV9**	0	1	Digital inputs
		1	2	Digital outputs
		2	4	PWM outputs
		3	8	Analog to digital conversion
		4	16	Real time clock
		5	32	EEPROM memory
		6	64	Menu buttons
		7	128	LCD interface
Sensor Faults (Present Value)	**AV10**	0	1	Suction line temperature sensor
		1	2	N/A
		2	4	Outdoor Ambient temperature sensor - accessory
		3	8	Calibration temperature resistor plug
		4	16	Indoor IN temperature sensor
		5	32	Indoor OUT temperature sensor
		6	64	Outdoor IN temperature sensor
		7	128	Outdoor OUT temperature sensor
		8	256	Cold tank temperature sensor on AI4 - accessory
		9	512	Hot tank temperature sensor on AI5 - accessory

Note: Board and Sensor Fault objects are type Analog Value but values are bit coded and may be decoded as such (integer value).
Note * : Value is for a single fault and reference only.

Note: object names are subject to change without prior notice.

Startup Procedure

The W/WH-Series Startup Record located in this manual is used in conjunction with this startup procedure to provide a detailed record of the installation. A completed copy should be left on site, a copy kept on file by the installer, and a copy should be sent to Maritime Geothermal Ltd.

Check the boxes or fill in the data as each step is completed. For data boxes, circle the appropriate units.

Pre-Start Inspection

Indoor Loop (Hydronic Loop):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the indoor loop, and that full flow is available to the heat pump.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the loop contains the proper mix of antifreeze (if used) for the intended application. If applicable, record the type of antifreeze and the mixture value on the startup sheet, circle % Vol. or % Weight.
4. Record the static loop pressure on the startup sheet.

Outdoor Loop (Ground Loop):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the ground loop, and that full flow is available to the heat pump.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the loop contains the proper mix of antifreeze for the intended application. Record the type of antifreeze and the mixture value on the startup sheet; circle % Vol. or % Weight.
4. Record the static loop pressure on the startup sheet.

Outdoor Loop (Ground Water):

1. Verify there are no leaks in the connections to the unit. Verify the water valve is installed and properly oriented in the OUT line.
2. Verify that there is flow control in the OUT line.

Domestic Hot Water (Desuperheater): *HACW/HW only*

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the domestic hot water tank.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the brown wire with the insulated terminal is disconnected in the electrical box. Refer to the schematic diagram for more information.

Electrical:

1. **Ensure the power to the unit is off.**
2. Verify all high voltage connections. Ensure that there are no stray wire strands, all connections are tight, and the ground wire is connected tightly to the ground connector.
3. Record the circuit breaker size and wire gauge for the heat pump.
4. Verify that the control connections to the unit are properly connected and all control signals are off, so that the unit will not start up when the power is turned on.
5. Verify that the circulator pumps are connected to the proper voltage terminals in the heat pump. Record the voltages of the circulator pumps.
6. Ensure all access panels except the one that provides access to the electrical box are in place.

Unit Startup

The unit is now ready to be started. The steps below outline the procedure for starting the unit and verifying proper operation of the unit. **It is recommended that safety glasses be worn during the following procedures.**

IMPORTANT NOTE: The unit is shipped with the SYSTEM DISABLED in order to prevent the unit from starting when the power is first turned on. Follow the instructions below in the Preparation section to enable the compressor.

The LCD will automatically scroll through various data including low (suction) pressure, high (discharge) pressure, superheat, EEV position and water in/out temperatures.

Preparation:

1. Set all controls (including zone thermostats) to OFF. Turn power on to the heat pump. All LED's on the control board should turn on, the LCD should say "**MGT GEN2 VERx.xx**" on line 1 and "**Zeroing EEV's**" on line 2. You should be able to hear the EEV moving (a clicking sound).
2. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.
3. Connect a USB cable between the USB connector on the board and a laptop with the PC App installed (recommended but optional).
4. Select the desired Control Source HYD via the PC APP Configuration Page or via the LCD Configuration Menu.
5. Enable the system either with the PC App's Configuration Page **System Enable/Disable** button or via the LCD display.

Heating Mode:

1. Adjust the Setpoint Control settings via the PC App or LCD to activate stage 1 (or activate via BACnet or 24V signal if used). The EEV will begin to open and the compressor will start, as will the circulator pumps.
2. Check the PC App or LCD. The suction and discharge pressures will vary based on the outdoor loop temperature and the indoor loop temperature, but for a typical startup they should be **90-110 psig** and **260-360 psig** for W/WP-series or **25-35 psig** and **105-200 psig** for WH-series.
3. Monitor the unit via the PC APP or LCD while the unit runs, and record the following after 10 minutes of run time:
    1. Suction pressure
    2. Discharge pressure
    3. Four water line temperatures: Indoor IN, Indoor OUT, Outdoor IN, Outdoor OUT
    4. Outdoor Delta T (should be **5-8°F, 3-4°C**)
    5. Indoor Delta T (should be **8-12°F, 4-6°C**)
    6. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
4. Adjust the control setpoints to the desired buffer tank temperature and let the unit run through a cycle.
5. For units with desuperheater (HACW/HW), turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown on the electrical box diagram. Turn the DHW switch in the unit post on. Turn the power to the unit on.
6. Open a zone (or zones) and let the tank cool down until stage 1 is activated. Close the zone(s) again.
7. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand **(caution: pipes can get hot).** If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.
8. Activate AUX heat if equipped by changing the AUX setpoints. Be sure the auxiliary heat breaker at the panel is ON. Measure the L1 current draw with an clamp meter and record the value.

Cooling Mode: *HACW/HAC only*

1. Set a zone thermostat to cooling mode or otherwise activate cooling mode by sending an "O" signal to the heat pump. Adjust the setpoints via the PC App or LCD to activate stage 1.
2. Monitor the unit via the PC APP or LCD Display while the unit runs, and record the following after 10 minutes of run time:
    1. Suction pressure
    2. Discharge pressure
    3. Four water line temperatures: Indoor IN, Indoor OUT, Outdoor IN, Outdoor OUT
    4. Outdoor Delta T (should be **8-12°F, 4-6°C**)
    5. Indoor Delta T (should be **5-8°F, 3-4°C**)
3. Adjust the setpoints and let the unit run through a cycle.

Final Inspection:

1. Turn the power off to the unit and remove all test equipment.
2. Install the electrical box cover and the access panel on the heat pump. Install the service port caps securely to prevent refrigerant loss.
3. Do a final check for leaks/spills and ensure the area is clean.
4. Turn the power on to the unit. Set the heat pump setpoints and zone thermostats to their final settings.

Startup Record:

1. Sign and date the Startup Record and have the homeowner sign as well. Leave the Startup Record with the homeowner, retain a copy for filing and send a copy to Maritime Geothermal Ltd. for warranty registration.

Startup Record

Installation Site		**Startup Date**	**Installer**		
City			**Company**		
Province		**Check boxes unless asked to record data. Circle data units.**	**Model**		
Country			**Serial #**		
Customer Name		**Customer Phone #**			

PRE-START INSPECTION

Indoor Loop (Hydronic)	All shut-off valve are open (full flow available)							
	Loop is full and purged of air							
	Antifreeze type, if any							
	Antifreeze concentration, if any		% Volume		% Weight			
	Loop static pressure		PSI	kPa				
Ground Loop System	All shut-off valve are open (full flow available)							
	Loop is full and purged of air							
	Antifreeze type							
	Antifreeze concentration		% Volume		% Weight			
	Loop static pressure		PSI	kPa				
Ground Water System	Water valve installed in return line							
	Flow control installed in return line							
Domestic Hot Water *HACW/HW only*	All shut-off valves are open							
	Lines are full and purged							
	Desuperheater pump wire is disconnected							
Electrical	High voltage connections are correct and securely fastened							
	Circuit breaker (or fuse) size and wire gauge for Heat Pump		A		Ga.			
	Circulator pump voltages (Outdoor 1, Outdoor 2, Indoor 1)		V		V		V	
	Low voltage connections are correct and securely fastened							

STARTUP DATA

Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3							VAC
Heating Mode (10 minutes)	Suction Pressure / Discharge Pressure					psig	kPa	
	Outdoor In, Outdoor Out, and Delta T		In		Out		°F	°C
	Outdoor Flow		Igpm	USgpm		L/s		
	Compressor L1 (black wire) current		A					
	Heating setpoint and discharge pressure at cycle end		°F	°C		psig	kPa	
	Domestic Hot Water functioning (if equipped)?							
Cooling Mode (10 minutes) *HACW/HAC only*	Suction Pressure / Discharge Pressure					psig	kPa	
	Outdoor In, Outdoor Out, and Delta T		In		Out		°F	°C
	Cooling setpoint and suction pressure at cycle end		°F	°C		psig	kPa	
Final Setpoints	Heating S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C	
	Cooling S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C	

Date:		**Installer Signature:**		**Customer Signature:**	

A total of three copies are required: one for the homeowner, one for the installer, and one to be sent to Maritime Geothermal Ltd.

Routine Maintenance

MAINTENANCE SCHEDULE			
Item		**Interval**	**Procedure**
Compressor Contactor		1 year	Inspect for pitted or burned points. Replace if necessary.
LCD Interface or PC App		When heat pump problem is suspected	Check for alarms and faults (only necessary if alarms not reported through a BACnet system). Rectify problem if alarms found. See **Troubleshooting** chapter.
Coaxial Heat Exchangers		When experiencing performance degradation that is not explained by a refrigeration circuit problem or low loop flow rate	Disconnect the loop and flush heat exchanger with a calcium removing solution. Generally not required for closed loop or cold water open loop systems or indoor loops; whenever system performance is reduced for warm water open loop systems. See instructions below.

Coaxial Heat Exchanger Flushing Procedure - Open Loop

1. Isolate the heat exchanger by closing the valves in the IN and OUT ports to the heat exchanger.
2. Blow out the heat exchanger into a clean 5 gallon bucket using compressed air.
3. If a purge cart is not available, use a 5 gallon plastic bucket, a circulator and some plastic piping to create a make-shift pump system. Connect a the inlet and outlet to the heat exchanger ports.
4. Place 2 gallons of RYDLYME or similar in the purge cart (or bucket). Circulate the fluid through the heat exchanger for at least 2 hours (3 hours recommended).
5. Disconnect the purge system and dispose of the solution. RYDLYME is non-toxic and biodegradable and as such can be poured down a drain.
6. Connect fresh water and a drain to the heat exchanger ports and flush the exchanger for several minutes.
7. Return the plumbing to its original configuration and open the IN and OUT valves. Operate the system and check for improved performance.

Coaxial Heat Exchanger Flushing Procedure - Closed Ground Loop

1. Isolate the heat exchanger by placing the pump module valves in the exchanger flushing position.
2. Connect a compressed air and a drain pipe to the pump module purge ports and blow the anti-freeze solution into a clean 5 gallon bucket.
3. Connect a purge cart to the pump module purge ports.
4. Place 2 gallons of RYDLYME or similar in the purge cart. Circulate the fluid through the heat exchanger for at least 2 hours (3 hours recommended).
5. Disconnect the purge cart and dispose of the solution. RYDLYME is non-toxic and biodegradable and as such can be poured down a drain. Clean the purge cart thoroughly.
6. Connect fresh water and a drain to the pump module purge ports and flush the exchanger for several minutes.
7. Blow the heat exchanger out with compressed air as per STEP 2 and dump the water down a drain.
8. Connect the purge cart to the pump module purge ports. Re-fill and purge the heat exchanger with as per standard procedures (the antifreeze from STEP 2 can be re-used).
9. Disconnect the purge cart and set the pump module valves back to the original positions. Operate the system and check for improved performance.

Troubleshooting Guide

The following steps are for troubleshooting the heat pump. Repair procedures and reference refrigeration circuit diagrams can be found later in this manual.

STEP 1: Verify that the LCD screen is functioning . If it is not, proceed to POWER SUPPLY TROUBLE SHOOTING, otherwise proceed to STEP 2.

STEP 2: Record the alarm shown on the LCD screen or use the PC APP Alarms page to determine the alarm type. Proceed to the ALARMS and/or FAULTS TROUBLESHOOTING section.

STEP 3: If there are no alarms and STAGE1 is showing ON (LCD screen, PC APP or LED on control board) but the compressor is not operating, does not attempt to start, attempts to start but cannot, starts hard, or starts but does not sound normal, proceed to the COMPRESSOR TROUBLESHOOTING section.

STEP 4: If the compressor starts and sounds normal, this means the compressor is most likely OK. Proceed to the OPERATION TROUBLESHOOTING section.

NOTE: To speed up the troubleshooting process, if using the PC Application, click on SC Override to reduce the short cycle timer to 10 seconds.

POWER SUPPLY TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No power to the heat pump	Disconnect switch open (if installed).	Verify disconnect switch is in the ON position.	Determine why the disconnect switch was opened; if all is OK close the switch.
	Fuse blown / breaker tripped.	At heat pump disconnect box, voltmeter shows 230VAC on the line side but not on the load side.	Reset breaker or replace fuse with proper size and type. (Time-delay type “D”)
No heartbeat on control board	Transformer breaker tripped (or fuse blown for those without breaker).	Breaker on transformer is sticking out (or fuse looks burnt).	Push breaker back in. If it trips again locate cause of short circuit and correct (or replace fuse) .
	Faulty transformer.	Transformer breaker is not tripped (or fuse not blown), 230VAC is present across L1 and L3 of the compressor contactor but 24VAC is not present across 24VAC and COM of the control board.	Replace transformer.
	Faulty Control Board.	24VAC is present across 24VAC and COM of the control board.	Replace the control board.
No display on aquastat (if used)	No power from transformer.	See **No heartbeat on control board**.	
	Faulty wiring between heat pump and aquastat.	24VAC is not present across 24V and COM of the aquastat.	Correct the wiring.
	Faulty aquastat.	24VAC is present across COM and 24V of the aquastat but aquastat has no display.	Replace aquastat.

ALARM TROUBLESHOOTING		
Alarm/Fault	**Description**	**Recommended Action**
The data logging function of the GEN2 Control Board is a very useful tool for troubleshooting alarms. It provides a history of the unit operation up to and including the time at which the alarm(s) occurred. Note that some alarms require accessory components.		
Low Pressure	A low pressure alarm occurs when the suction pressure drops to or below the ***Low Pressure Cutout*** value. The low pressure is checked just before a compressor start; if it is OK the compressor will start, otherwise an alarm will occur. When the compressor starts, the low pressure alarm will be ignored for the number of seconds that ***Low Pressure Ignore*** is set to, after which the low pressure alarm will be re-enabled. This allows a dip in suction pressure below the cutout point during startup without causing a nuisance alarm.	Go to the Low Pressure section of the mode the unit was operating in at the time of the alarm.
High Pressure	A high pressure alarm occurs when the discharge pressure rises to or above the ***High Pressure Cutout*** value.	Go to the High Pressure section of the mode the unit was operating in at the time of the alarm.
Compressor Status (accessory)	This alarm occurs when there is a current draw on the compressor but no call for the compressor to be on (welded contactor) or when there is a call for the compressor to be on but there is no compressor current draw (manual high pressure control is open or contactor failure). Requires current sensor accessory.	Check contactor if compressor is staying on when it should be off. Go to Compressor section if compressor is not on when it should be. Also check for tripped manual high pressure control.
Comp. Not Pumping	Discharge pressure is less than 30 psi higher than suction pressure after 2 minutes run time. It indicates leaking reversing valve, compressor very hot and tripped on internal overload, manual high pressure control trip, bad contactor, or defective compressor.	Check for reversing valve not seated properly, tripped manual high pressure control, or a contactor or compressor problem.
Low Charge	EEV position has been above 99% for 20 minutes within the first hour of cycle.	Check system for refrigerant leak. Also check EEV for proper operation (see **EEV Troubleshooting** section)
LOC (Loss of Charge)	This alarm occurs if the low pressure and/or high pressure sensors are below 30 psig (207 kPa).	Check system for refrigerant leak. Check for incorrect pressure sensor reading.
Outdoor Flow (ODFLOW)	For open loop, 24vac signal from water valve end switch indicating water valve open was not received in the time limit (90 seconds).	Verify water valve operation and that it is wired properly using the factory wiring harness (see wiring diagram in the **Model Specific Information** section later in this manual).

FAULT TROUBLESHOOTING		
Alarm/Fault	**Description**	**Recommended Action**
Digital Inputs **Digital Outputs** **Analog Inputs** **MODBUS Comms** **PWM Outputs** **Real Time Clock**	A failure has occurred and the indicated section of the control board may no longer work properly.	Cycle the power a few times; if the fault persists replace the control board.
Flash Memory	A failure has occurred and stored data may be corrupt.	It may be possible to correct this by using the menu item ***Tools—Reset to Factory Defaults***. If this clears the fault then the system configuration will have to be set up again.
Menu Buttons	A failure has occurred and the control board may no longer respond to menu button key presses.	Try turning off the power, disconnecting and reconnecting the cable between the LCD Interface board and the Control Board, and then turning the power back on again. If this does not work then either the LDC Display board, the cable, or the driver section of the Control Board may be faulty.
LCD Interface	A failure has occurred and display may show erratic data, no data or may not turn on at all.	
BACnet Comms	BACnet communications experienced a timeout.	See below.
Pressure Sensors	The sensor is reading outside of the acceptable range. Check to ensure connector is on securely.	Replace the pressure sensor. If this does not rectify the problem, replace the control board.
Temperature Sensors	The sensor is reading outside of the acceptable range. Check to ensure connector is on securely.	Replace the temperature sensor. If this does not rectify the problem, replace the control board.

BACnet TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
BACnet communications not working properly **Or** **BACnet FAULT indication**	Selected baud rate does not match building control system.	Check baud rate of system.	Adjust BACnet parameters in the PC App's **Tools-->Configuration** window. **Cycle power to invoke any changes.**
	Selected MAC address and/or Instance # conflict with other devices on the network.	Check MAC address and Instance # in relation to other system devices.	
	BACnet wiring or termination problem.	Verify correct twisted pair wire and termination in the **BACnet Interface** chapter (earlier).	Correct wiring.
	Hardware problem on heat pump control board.	Remove BACnet connector from board as well as jumper from TERM (located just above the BACnet connector). Using a multimeter set to DC volts with negative probe on **B** and positive probe on **A**, confirm there is **+2.5VDC**.	Replace board if voltage not correct.

COMPRESSOR TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Compressor will not start	Faulty control board	No 24vac output on STAGE1 when compressor should be operating.	Replace control board.
	Faulty run capacitor (Single phase only)	Check value with capacitance meter. Should match label on capacitor. Compressor will hum while trying to start and then trip its overload.	Replace if faulty.
	Loose or faulty wiring.	Check all compressor wiring, including inside compressor electrical box.	Fix any loose connections. Replace any damaged wires.
	Faulty compressor contactor	Voltage on line side with contactor held closed, but no voltage on one or both terminals on the load side. Points pitted or burned. Or, 24VAC across coil but contactor will not engage.	Replace contactor.
	Thermal overload on compressor tripped	Ohmmeter shows reading when placed across R and S terminals and infinity between C & R or C & S. A valid resistance reading is present again after the compressor has cooled down.	Proceed to Operation Troubleshooting (particularly *high suction pressure* and *high discharge pressure*) to determine the cause of the thermal overload trip.
	Burned out motor (open winding)	Remove wires from compressor. Ohmmeter shows infinite resistance between any two terminals. Note: Be sure compressor overload has had a chance to reset. If compressor is hot this may take several hours.	Replace the compressor.
	Burned out motor (shorted windings)	Remove wires from compressor. Resistance between any two terminals is below the specified value.	Replace the compressor.
	Motor shorted to ground	Remove wires from compressor. Check for infinite resistance between each terminal and ground.	If any terminal to ground is not infinite replace the compressor.
	Seized compressor due to locked or damaged mechanism	Compressor attempts to start but trips its internal overload after a few seconds. (Run capacitor already verified)	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.
Compressor starts hard	Start capacitor faulty. (Single phase only)	Check with capacitance meter. Check for black residue around blowout hole on top of capacitor.	Replace if faulty. Remove black residue in electrical box if any.
	Potential relay faulty. (Single phase only)	Replace with new one and verify compressor starts properly.	Replace if faulty.
	Compressor is “tight” due to damaged mechanism	Compressor attempts to start but trips its internal overload after a few seconds. Run capacitor has been verified already.	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.
Compressor stage 2 will not activate	Faulty stage 2 plug (solenoid coil is in plug).	Verify if 24VAC is present across Y2 and C of the terminal strip.	Replace module if signal is present. Check wiring if signal is not present.

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High or low suction or discharge pressure	Faulty sensor	Compare pressure sensor reading against a known reference such as a new refrigeration manifold set.	Check wiring, replace sensor. If problem persists, replace control board.
High discharge pressure	Low or no indoor loop flow	Verify that indoor delta T is 8-12°F (4-7°C)	Verify pump is working and sized correctly. Check for restrictions in the circuit, e.g. valve partially closed.
	Temperature setpoint(s) too high (if using BACnet or Signals control)	Use PC APP to verify that Indoor OUT does not exceed 120°F (49°C) for W/WP-series or 160°F (71°C) for WH-series.	Reduce setpoint(s).
	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and low suction pressure.	Go to EEV troubleshooting section.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Unit is overcharged (after servicing)	High subcooling, low Indoor Loop delta T.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces. Or remove charge and weigh back in the amount listed on nameplate.
Low suction pressure	Low or no outdoor loop flow	Verify that indoor delta T is 5-7°F (3-4°C).	Determine the cause of the flow restriction and correct it. Verify pumps are working and sized correctly for ground loop systems, and not air locked. Verify well pump and water valve is working for ground water systems.
	Outdoor loop ELT too cold	Measure the entering liquid temperature. Most likely caused by undersized ground loop or cold well water.	Increase the size of the ground loop.
	Dirty or fouled outdoor loop coaxial heat exchanger (typically for open loop, unlikely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Backflush the coaxial exchanger with a lime/calcium removing solution according to instructions in **General Maintenance** section.
	Indoor OUT temperature too cold (on startup or if unit has been off for extended period)	Ensure Indoor OUT temperature is above the low limit indicated in the **Model Specific Information** section.	Reduce flow temporarily until Indoor OUT temperature has risen sufficiently.
	TS1 temperature sensor not reading properly.	If the sensor is reading low it will cause the superheat to appear high, which causes the EEV to continually close.	Verify EEV position is low compared to normal. Check temperature sensor, replace if necessary.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Low suction pressure (continued)	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and discharge pressure.	Go to EEV troubleshooting section.
	Low refrigerant charge	Superheat is high, EEV position is high.	Locate the leak and repair it. Spray Nine, a sniffer, and/or dye are common methods of locating a leak.
High suction pressure (may appear to not be pumping)	EEV stuck open	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and low discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve if present (can cause compressor to overheat and trip internal overload)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	Switch back and forth into cooling mode to try to free up valve. If it can't be freed, replace reversing valve.
	Faulty compressor, not pumping (unusual)	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Compressor frosting up	See Low Suction Pressure in this section.		
EEV frosting up	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and discharge pressure.	Go to EEV troubleshooting section.
Random high pressure trip (may not occur while on site)	Faulty indoor circulator relay (ICR)	Using the PC APP, manually turn the ICR on/off several times and ensure the circulator(s) start and stop.	Replace relay.
Random manual high pressure trip (may not occur while on site)	Faulty compressor contactor	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it should be off.	Replace contactor.

OPERATION TROUBLESHOOTING - COOLING MODE (HACW / HAC models only)			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Heating instead of cooling	Zone thermostat interconnection or zone controller not set up properly.	Verify that there is 24VAC across O and C of the terminal strip when buffer tank should be cooled.	Correct setup.
	Faulty reversing valve solenoid coil.	Verify solenoid by removing it from the shaft while the unit is running. There should be a loud “whoosh” sound when it is removed.	Replace solenoid if faulty.
	Faulty reversing valve.	A click can be heard when the coil is energized but the unit continues to heat instead of cool.	Replace reversing valve.
High discharge pressure	Low or no outdoor loop flow	Verify that indoor delta T is 5-7°F (3-4°C).	Determine the cause of the flow restriction and correct it. Verify pumps are working and sized correctly for ground loop systems, and not air locked. Verify well pump and water valve is working for ground water systems.
	Outdoor loop ELT too hot	Measure the entering liquid temperature. Most likely caused by undersized ground loop.	Increase the size of the ground loop.
	Dirty or fouled outdoor loop coaxial heat exchanger (typically for open loop, unlikely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Backflush the coaxial exchanger with a lime/calcium removing solution according to instructions in General Maintenance section.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Unit is overcharged (after servicing)	High subcooling, low Indoor Loop delta T.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces. Or remove charge and weigh back in the amount listed on nameplate.

OPERATION TROUBLESHOOTING - COOLING MODE (HACW / HAC models only)			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High suction pressure (may appear to not be pumping)	EEV stuck open	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and low discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve (can cause compressor to overheat and trip internal overload)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	Switch back and forth into cooling mode to try to free up valve. If it can't be freed, replace reversing valve.
	Faulty compressor, not pumping (unusual)	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Low suction pressure	Low or no indoor loop flow	Verify that indoor delta T is 8-12°F (4-7°C).	Verify pump is working and sized correctly. Check for restrictions in the circuit, e.g. valve partially closed.
	Temperature setpoint(s) too low (if using BACnet or Signals control)	Use PC APP to verify that Indoor OUT is not less than the minimums listed in the **Model Specific Information** section.	Reduce setpoint(s).
	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and high discharge pressure.	Go to EEV troubleshooting section.
	TS1 temperature sensor not reading properly	If the sensor is reading low it will cause the superheat to appear high, which causes the EEV to continually close.	Verify EEV position is low compared to normal. Check temperature sensor, replace if necessary.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes high discharge pressure.	Replace filter-dryer.
	Low refrigerant charge	Indoor loop EWT and flow are good but suction is low. Check static refrigeration pressure of unit for a low value. Weigh out charge to verify amount.	Locate the leak and repair it. Spray Nine, a sniffer, and dye are common methods of locating a leak.
Compressor frosting up	See Low Suction Pressure in this section.		
EEV frosting up	EEV stuck almost closed or partially blocked by foreign object.	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and discharge pressure.	Go to EEV troubleshooting section.
Random manual high pressure trip (may not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it should be off.	Replace contactor.

EEV (Electronic Expansion Valve) TROUBLESHOOTING

Electronic expansion valves are a great advancement over TVX's, allowing more precise refrigerant control, but they do have a couple of limitations.

a) EEV's receive commands to open or close from the control board, but they don't send any feedback to the control board to confirm that command has been received and acted upon. If they aren't reliably acted upon (due to pulses missed due to a wiring issue or EEV being mechanically stuck), the actual valve opening position won't match what the control board thinks it is. In extreme cases, the resulting repeated commands can cause the *apparent* valve position to go to **15%** (minimum) or **100%**, when the valve is actually in between.

b) A restriction in the refrigeration circuit (particularly the liquid line, e.g. plugged filter-dryer) or shortage of refrigerant due to a leak can cause a similar issue. If the EEV opens to allow more refrigerant flow to lower the superheat but liquid refrigerant is not available at its inlet, the EEV will continue to open to attempt to let more refrigerant through and will work its way towards **100%** (full open). **High superheat** is also a symptom.

If there is low suction pressure and the EEV position is also low then the problem is generally not in the refrigeration system; check the water or airflow of the indoor or outdoor loop, whichever is currently the cold side (evaporator).

Tests to determine if an EEV is working

- Sound test: turn the power to the heat pump off and back on again. Or manually set the EEV to 25% and wait for it to stop, then set the EEV to "–1%". Both actions will cause the EEV to overdrive closed. You should hear the valve clicking and then the clicking should change and get louder when the valve reaches 0%. If there is no sound, then it is likely that the EEV is faulty or stuck.
- Using the PC APP, put the system in manual override mode. Manually adjust the EEV position by at least 25% either up or down and check to see that the suction pressure, discharge pressure and superheat react to the change. If there is no reaction, then it is likely that the EEV is faulty or stuck.
- Set the EEV back to AUTO and then turn the heating or cooling demand off (but leave power on). Once the demand is off, if the EEV is working then the discharge pressure should remain significantly higher than the suction pressure, i.e. the system will not equalize (since EEV's are closed when there is no demand). If the system does equalize it is likely that the EEV is not working and is partially open.

There are 3 possible causes for EEV problems: the control board is not working properly, the wire/cable is faulty, or the EEV is faulty.

The EEV can be checked electrically:

- RED to GREEN 75ohms
- WHITE to BLACK 75ohms

If this test fails, EEV is bad and should be replaced, but if it passes it still may be mechanically defective.

Check with a new EEV:

A further check that can be performed is to connect a new EEV and cable to the control board and visually check the EEV so see if it opens and closes by setting the position to 0 and 100% If the new EEV works then the EEV in the unit or the cable needs to be replaced.

1) Connect a test EEV and test cable to the control board.
2) Set the EEV position to 0%.
3) Set the EEV position to 100% and then listen for clicking and watch to see if the pintle in the EEV moves open.
4) Set the EEV position to 0% and then listen for clicking and watch to see if the pintle in the EEV moves closed.
5) If the EEV does not move in one or both directions then the control board must be replaced.
6) If the test EEV moves in both directions then then either the cable or the EEV in the unit is faulty.
7) Disconnect the test EEV from the test cable and connect it to the cable in the unit.
8) Repeat steps 2 to 4.
9) If the test EEV moves in both directions then the EEV in the unit is faulty and must be replaced.
10) If the test EEV does not move in one or both directions then the cable must be replaced.

DOMESTIC HOT WATER (DESUPERHEATER) TROUBLESHOOTING (HACW / HW models only)			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Insufficient hot water (tank problem)	Thermostat on hot water tank set too low. Should be set at 120°F to 140°F.	Visually inspect the setting.	Adjust the setting.
	Breaker tripped, or fuse blown in electrical supply to hot water tank	Check both line and load sides of fuses. If switch is open determine why (possible shorted element).	Correct problem, and replace blown fuse or reset breaker.
	Reset button tripped on hot water tank.	Check voltage at elements with multimeter.	Push reset button.
Insufficient hot water (heat pump problem)	DHW switch is turned off	Inspect switch, located on heat pump cabinet post.	Turn switch on.
	Wire is not connected at contactor (shipped disconnected to prevent unintentional startup)	Check that brown wire with blue insulated terminal is connected to contactor as shown on electrical box diagram.	Connect wire.
	Circulator pump seized or motor failed	Use an amprobe to measure current draw.	Replace if faulty.
	Blockage or restriction in the water line or hot water heat exchanger	Check water flow and power to pump. Check water lines for obstructions.	Remove obstruction in water lines. Acid treat the domestic hot water coil.
	Faulty DHW cutout (failed open)	Check contact operation. Should close at 120°F and open at 140°F.	Replace DHW cutout if faulty.
	Heat pump not running enough hours to make sufficient hot water	Note the amount of time the heat pump runs in any given hour.	Temporarily turn up the tank thermostats until colder weather creates longer run cycles.
Water is too hot.	Faulty DHW cutout (failed closed)	Check contact operation. Should close at 120°F and open at 140°F.	Replace DHW cutout if faulty.
	Thermostat on hot water tank set too high. Should be set at 120°F to 140°F.	Visually inspect the setting.	Adjust the setting.

Repair Procedures

Pumpdown Procedure

1. Place the unit in SERVICE mode via the PC App or LCD interface; this will open the EEVs and start the indoor circulator (as long that circulator is powered and controlled by the heat pump). **DO NOT** turn off electrical power at the breaker panel, since the coaxial coils **must have full water flow** during refrigerant recovery.
2. Connect the refrigerant recovery unit to the heat pump's internal service ports via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. Plan to dispose of refrigerant if there was a compressor burnout.
3. All refrigerant to water heat exchangers (coaxial coils, brazed plates) **must either have full flow or be completely drained** of fluid before recovery begins. Failure to do so can freeze and rupture the heat exchanger, voiding its warranty. (Note that this does not apply to desuperheater coils.)
4. Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual.
5. Allow the recovery unit suction pressure to reach a vacuum. Once achieved, close the charging manifold valves. Shut down, purge and disconnect the recovery unit as per the instructions in its manual. Ensure the recovery tank valve is closed before disconnecting the hose to it.
6. Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive gauge pressure of 5-10 psig is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected.

Turn off power to heat pump. The heat pump is now ready for repairs.

General Repair Procedure

1. Perform repairs to system.

    - Always ensure nitrogen is flowing through the system at the lowest flow rate that can be felt at the discharge during any brazing procedures to prevent soot buildup inside the pipes.
    - It is recommended to replace the liquid line filter-dryer any time the refrigeration system has been exposed to the atmosphere.
    - Place a wet rag around any valves being installed, as almost all valve types have non-metallic seats or seals that will be damaged by excessive heat, and aim the torch flame away from the valve body. Solder only one joint at a time and cool joints down in between.

2. Pressure test the system with nitrogen. It is recommended to check for leaks using leak detection spray, Spray Nine, or soapy water. Check at 10, 25, 50 and 100 psig. Allow the system to sit at 100 psig for at least an hour, then re-check. With a laptop connected, the **PC App** may be used to graph the nitrogen pressure (**Graphs** menu--> **Refrigeration Pressure and Temperature Graphs**) to make any downward trend due to a leak apparent. Be aware that changing room temperature can also cause upward or downward trends in nitrogen pressure.

Vacuuming & Charging Procedure

After completion of repairs and nitrogen pressure testing, the refrigeration circuit is ready for vacuuming.

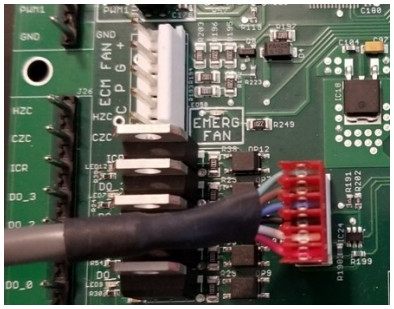
1. Release the nitrogen pressure and connect the vacuum pump to the charging manifold. Start the vacuum pump and open the charging manifold valves. Vacuum until the vacuum gauge remains at less than 500 microns for at least 1 minute with the vacuum pump valve closed.
2. Close the charging manifold valves then shut off and disconnect the vacuum pump. Place a refrigerant tank with the proper refrigerant on a scale and connect it to the charging manifold. Purge the hose to the tank.
3. Weigh in the appropriate amount **and type** of refrigerant through the low pressure (suction) service port. Refer to the nameplate label on the unit for the proper refrigerant type and charge amount.
4. If the unit will not accept the entire charge, the remainder can be added through the low pressure service port after the unit has been restarted.

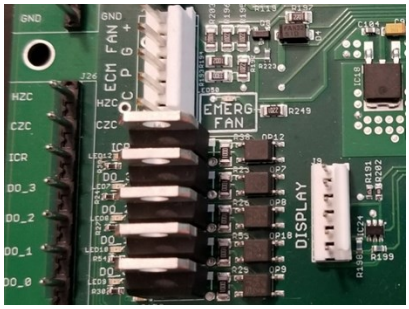
Compressor Replacement Procedure

1. Pump down the unit as per the Pumpdown Procedure above. **If there was a compressor burn out (motor failure), the refrigerant cannot be reused and must be disposed of according to local codes**.
2. Disconnect piping.
3. Replace the compressor. Replace the liquid line filter-dryer. Always ensure nitrogen is flowing through the system at the lowest flow rate that can be felt at the discharge during any brazing procedures to prevent soot buildup inside the pipes.
4. Vacuum the unit as per above procedure.
5. If there was a compressor burnout:
   a) Charge the unit with **new** refrigerant and operate it for continuously for 2 hours. Pump down the unit and replace the filter-dryer. Vacuum the unit as per above procedure.
   b) Charge the unit (refrigerant can be re-used) and operate it for 2-3 days. Perform an acid test. If it fails, pump down the unit and replace the filter-dryer.
   c) Charge the unit (refrigerant can be re-used) and operate it for 2 weeks. Perform and acid test. If it fails, pump down the unit and replace the filter-dryer.
6. Charge the unit a final time. Unit should now be clean and repeated future burn-outs can be avoided.

Control Board Replacement Procedure

1. Turn the power off to the unit.
2. Take a picture of the control board and connectors for reference. The picture in **Appendix A** may also be helpful.
3. Carefully remove all green terminal strips on the left side, the right side and the bottom of the control board. They pull straight off the board, with no need to disconnect wires from their screw terminals. You may need to wiggle them from both ends for the 8 pin ones.
4. Remove the red six pin display board connector from the left side of the control board (marked DISPLAY on the board).





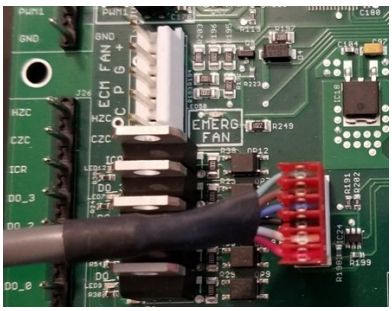
5. Remove all connectors from the top of the control board. Each connector (or wire) should be marked already from the factory, e.g. HPS1, LP1, TS1, etc.. This matches the marking on the control board.
6. The control board is held in place at its four corners. Squeeze each standoff by hand or with needle nose pliers if necessary and carefully pull the corner of the board off of the standoff.
7. Once the control board has been removed, if there are any other standoffs left (they have the bottom snap cut off) remove them as well.
8. Carefully remove the new control board from the static bag it was shipped in. Place any cut off standoffs from the old board into the same locations on the new board.
9. Align the control board with the four corner standoffs in the electrical box then push on each corner until they snap in place.
10. Connect the top connectors to the control board. Refer to the **Step 2** picture if necessary for proper locations.

    Note that the connector with the resistor (no cable) goes on **CTS**.
    Note that the connector to the left of **CTS** is marked **HTS** on older boards, and **ODTS** on newer boards.

11. Check each of the connectors from Step 10 to ensure they are properly aligned and that no pins are showing.
12. Connect the green terminal strips to the left side, right side and bottom of the control board. Refer to the **Step 2** picture if necessary for locations.
13. Turn the power on to the heat pump. Ensure the LCD display comes on. Note the firmware version. After EEV zeroing and Random Start countdown the display should begin alternating data.
14. If the replacement control board was pre-configured for this unit at the factory then the system is ready for operation. If it was not then use the PC App corresponding to the unit's firmware version to configure the unit. Refer to the **Tools -> Configuration** menu in the **PC APP** section.

LCD Interface (Display) Board Replacement Procedure

1. Turn the power off to the unit.
2. Remove the display board cable connector from the control board.



3. Using a sharp utility knife with a long blade, slice each of the display board standoff heads off, taking care to not damage the lexan cover.

4. Pull the display board from the unit.
5. Remove the display board cable connector from the back of the display board.
6. Place a new display board standoff into each of the four holes in the cabinet.
7. Remove the new display board from the static bag it was shipped in.
8. Connect one end of the display board cable to the back of the display board. Ensure the connector is properly aligned and that no pins are showing.
9. Place the display board in position and align the four standoffs into the four holes of the board.
10. Push on each corner of the board until each standoff snaps in place, while pushing on the front of the standoff to keep it from popping out of the cabinet hole.
11. Connect the other end of the display board cable to the control board, ensuring the connector is aligned properly and that no pins are showing.
12. Turn the power on to the unit and verify the display works.
13. Once the display begins to scroll data, test each of the buttons to ensure they work. Push the Arrow button to enter the Main Menu, then use the Up and Down to move through the list, then push the OK button to exit again. If any of the buttons seem hard to press, repeat Step 10 and then test the buttons again.

Model Specific Information: W-Series

Table 24 - W-Series Refrigerant Charge				
MODEL	**lb**	***kg***	**Refrigerant**	**Oil Type**
W-25	4.0	*1.8*	R410a	POE
W-45	5.5	*2.5*	R410a	POE
W-55	7.0	*3.2*	R410a	POE
W-65	8.5	*3.9*	R410a	POE
W-75	9.0	*4.1*	R410a	POE
W-80	10.0	*4.5*	R410a	POE

- Oil capacity is marked on the compressor label.
- **Refrigerant charge is subject to revision;** actual charge is indicated on the unit nameplate.

Table 25 - W-Series Shipping Information				
MODEL	**WEIGHT**	**DIMENSIONS in (cm)**		
	lb. (kg)	**L**	**W**	**H**
W-25	305 (138)	34 (86)	34 (86)	35 (89)
W-45	330 (150)	34 (86)	34 (86)	35 (89)
W-55	390 (177)	34 (86)	34 (86)	35 (89)
W-65	490 (222)	45 (114)	37 (94)	37 (94)
W-75	540 (245)	45 (114)	37 (94)	37 (94)
W-80	590 (268)	45 (114)	37 (94)	37 (94)

Table 26 - W-Series Operating Temperature Limits					
Loop	**Mode**	**Parameter**	**(°F)**	***(°C)***	**Note**
Indoor	Heating	Minimum EWT	50	*10*	Reduce flow if necessary during startup.
	Heating	Maximum LWT	120	*49*	
	Cooling	Minimum LWT	41	*5*	Water system (no antifreeze).
	Cooling	Minimum LLT	32	*0*	Antifreeze system. Adequate freeze protection required.
	Cooling	Maximum EWT	80	*27*	
Outdoor	Heating	Minimum ELT	39	*4*	Ground water (open loop) system.
	Heating	Minimum ELT	23	*-5*	Ground loop system. Adequate freeze protection required.
	Cooling	Minimum ELT	39	*4*	Ground water (open loop) system.
	Cooling	Minimum ELT	32	*0*	Ground loop system. Adequate freeze protection required.
	Cooling	Maximum LLT	120	*49*	

* Values in this table are for rated liquid flow values.

Table 27 - W-Series Required Indoor & Outdoor Loop Flow Rates		
MODEL	**gpm**	***L/s***
W-25	8	*0.50*
W-45	10	*0.63*
W-55	12	*0.76*
W-65	14	*0.88*
W-75	16	*1.0*
W-80	17	*1.1*

Note for circ pump sizing: these flow rates may be greater than those required for boilers of a similar heating capacity.

Table 28 - W-Series Sound Levels (dBA)*		
MODEL	**1 ft distance**	**3 ft distance**
W-25	57.1	55.8
W-45	57.2	56.0
W-55	56.4	54.9
W-65	55.7	53.0
W-75	55.7	53.0
W-80	55.7	53.0

* With all doors installed.

Table 29: W-Series Pressure Drop Data

			INDOOR (water 104°F)		OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% prop. glycol 32°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*	psi	*kPa*	psi	*kPa*
W-25	4	*0.25*	0.8	*5.5*	0.9	*6.2*	0.9	*6.2*	1.2	*8.2*
	5	*0.32*	1.3	*9.0*	1.4	*10*	1.4	*9.6*	1.8	*13*
	6	*0.38*	1.6	*11*	1.7	*12*	1.9	*13*	2.5	*17*
	7	*0.44*	2.1	*14*	2.3	*16*	2.4	*17*	3.2	*22*
	8	***0.50***	**3.0**	***21***	**3.2**	***22***	**3.0**	***21***	**4.0**	***27***
	9	*0.57*	3.1	*21*	3.4	*23*	3.9	*27*	5.1	*35*
	10	*0.63*	4.1	*28*	4.4	*30*	4.8	*33*	6.3	*43*
	11	*0.69*	4.8	*33*	5.1	*35*	5.7	*39*	7.5	*52*
	12	*0.76*	5.7	*39*	6.0	*41*	6.6	*45*	8.7	*60*
	13	*0.82*	6.7	*46*	6.9	*48*	7.7	*53*	10.1	*70*
W-45	6	*0.38*	1.6	*11*	1.7	*12*	2.0	*14*	2.6	*18*
	7	*0.44*	1.9	*13*	2.1	*14*	2.5	*17*	3.3	*23*
	8	*0.50*	2.6	*18*	2.8	*19*	3.0	*21*	4.0	*27*
	9	*0.57*	3.2	*22*	3.5	*24*	3.8	*26*	5.0	*34*
	10	***0.63***	**3.8**	***26***	**4.0**	***28***	**4.7**	***32***	**6.2**	***43***
	11	*0.69*	4.3	*30*	4.6	*32*	5.5	*38*	7.2	*50*
	12	*0.76*	5.2	*36*	5.5	*38*	6.6	*45*	8.7	*60*
	13	*0.82*	5.9	*41*	6.2	*43*	7.4	*51*	9.7	*67*
	14	*0.88*	6.7	*46*	7.0	*48*	8.6	*59*	11.3	*78*
	15	*0.95*	8.0	*55*	8.2	*57*	9.5	*65*	12.5	*86*
W-55	6	*0.38*	1.1	*7.6*	1.2	*8.3*	1.3	*9.0*	1.7	*12*
	7	*0.44*	1.5	*10*	1.6	*11*	1.6	*11*	2.1	*14*
	8	*0.50*	1.8	*12*	1.9	*13*	2.1	*14*	2.8	*19*
	9	*0.57*	2.2	*15*	2.4	*17*	2.4	*17*	3.2	*22*
	10	*0.63*	2.7	*19*	2.9	*20*	3.1	*21*	4.1	*28*
	11	*0.69*	2.8	*19*	3.1	*21*	3.6	*25*	4.7	*33*
	12	***0.76***	**3.4**	***23***	**3.7**	***26***	**4.4**	***30***	**5.8**	***40***
	13	*0.82*	4	*28*	4.3	*30*	5	*34*	6.6	*45*
	14	*0.88*	4.7	*32*	5	*34*	5.7	*39*	7.5	*52*
	15	*0.95*	5.6	*39*	5.8	*40*	6.4	*44*	8.4	*58*
	16	*1.01*	6.1	*42*	6.3	*43*	7.1	*49*	9.3	*64*

Table 29: W-Series Pressure Drop Data (cont'd)			INDOOR (water 104°F)		OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% prop. glycol 32°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*	psi	*kPa*	psi	*kPa*
W-65	8	*0.50*	1.8	*12*	1.9	*13*	2.2	*15*	2.9	*20*
	9	*0.57*	2.1	*14*	2.3	*16*	2.7	*19*	3.6	*24*
	10	*0.63*	2.4	*17*	2.6	*18*	3.3	*23*	4.3	*30*
	11	*0.69*	2.9	*20*	3.2	*22*	4	*28*	5.3	*36*
	12	*0.76*	3.6	*25*	3.9	*27*	4.6	*32*	6.0	*42*
	13	*0.82*	4.1	*28*	4.4	*30*	5.2	*36*	6.8	*47*
	14	***0.88***	**4.7**	***32***	**5**	***34***	**5.8**	***40***	**7.6**	***53***
	15	*0.95*	5.5	*38*	5.7	*39*	6.5	*45*	8.5	*59*
	16	*1.01*	6.3	*43*	6.5	*45*	7.3	*50*	9.6	*66*
W-75	8	*0.50*	1.2	*8.3*	1.3	*9.0*	1.3	*9.0*	1.7	*12*
	9	*0.57*	1.5	*10*	1.6	*11*	1.6	*11*	2.1	*14*
	10	*0.63*	1.8	*12*	1.9	*13*	2.1	*14*	2.8	*19*
	11	*0.69*	2.1	*14*	2.3	*16*	2.4	*17*	3.2	*22*
	12	*0.76*	2.4	*17*	2.6	*18*	2.9	*20*	3.8	*26*
	13	*0.82*	2.8	*19*	3.0	*21*	3.3	*23*	4.3	*30*
	14	*0.88*	2.9	*20*	3.2	*22*	3.7	*26*	4.9	*33*
	15	*0.95*	3.2	*22*	3.5	*24*	4.1	*28*	5.4	*37*
	16	***1.01***	**3.8**	***26***	**4.0**	***28***	**4.7**	***32***	**6.2**	***43***
	17	*1.07*	4.2	*29*	4.4	*30*	5.2	*36*	6.8	*47*
W-80	9	*0.57*	1.2	*8.3*	1.3	*9.0*	1.4	*10*	1.8	*13*
	10	*0.63*	1.5	*10*	1.6	*11*	1.7	*12*	2.2	*15*
	11	*0.69*	1.8	*12*	1.9	*13*	2.2	*15*	2.9	*20*
	12	*0.76*	2.2	*15*	2.4	*17*	2.6	*18*	3.4	*24*
	13	*0.82*	2.5	*17*	2.7	*19*	3.1	*21*	4.1	*28*
	14	*0.88*	2.9	*20*	3.1	*21*	3.5	*24*	4.6	*32*
	15	*0.95*	3.1	*21*	3.3	*23*	3.8	*26*	5.0	*34*
	16	*1.01*	3.3	*23*	3.6	*25*	4.1	*28*	5.4	*37*
	17	***1.07***	**3.7**	***26***	**4.1**	***28***	**4.6**	***32***	**6.0**	***42***
	18	*1.14*	4.2	*29*	4.5	*31*	4.9	*34*	6.4	*44*

W-series: Standard Capacity Ratings - Closed Loop

Standards ARI/ISO/CSA 13256-2

Table 30 - Standard Capacity Ratings - Ground Loop Heating*							60Hz
EWT 104°F (40°C)		*15% Methanol by Weight Ground Loop Fluid				STAGE 1 - ELT 41°F (5°C) STAGE 2 - ELT 32°F (0°C)	
Model	Liquid Flow (Outdoor & Indoor)		Mode	Input Energy	Capacity		COP_H
	gpm	*L/s*		Watts	Btu/hr	*kW*	W/W
W-25	8.0	*0.50*	Stage 1	1,290	14,100	*4.1*	3.2
			Stage 2	1,635	17,300	*5.1*	3.1
W-45	10.0	*0.63*	Stage 1	1,760	19,000	*5.6*	3.1
			Stage 2	2,309	24,400	*7.2*	3.1
W-55	12.0	*0.76*	Stage 1	2,740	27,500	*8.0*	3.1
			Stage 2	3,270	34,600	*10.1*	3.1
W-65	14.0	*0.88*	Stage 1	3,120	34,100	*10.0*	3.1
			Stage 2	4,025	42,600	*12.5*	3.1
W-75	16.0	*1.0*	Stage 1	3,765	41,100	*12.0*	3.2
			Stage 2	4,630	49,000	*14.4*	3.1
W-80	17.0	*1.1*	(Stage 2)	5,860	57,500	*16.9*	3.0

Table 31 - Standard Capacity Ratings - Ground Loop Cooling*								60Hz
EWT 53.6°F (12°C)		*15% Methanol by Weight Ground Loop Fluid				STAGE 1 - ELT 68°F (20°C) STAGE 2 - ELT 77°F (25°C)		
Model	Liquid Flow (Outdoor & Indoor)		Mode	Input Energy	Capacity		COP_C	EER
	gpm	*L/s*		Watts	Btu/hr	*kW*	W/W	Btu/hr/W
W-25	8.0	*0.50*	Stage 1	800	17,100	*5.0*	5.3	18.5
			Stage 2	1,305	21,000	*6.2*	4.0	14.5
W-45	10.0	*0.63*	Stage 1	1,205	23,000	*6.7*	5.6	19.1
			Stage 2	2,125	30,500	*8.9*	4.3	14.6
W-55	12.0	*0.76*	Stage 1	1,615	31,500	*9.2*	5.7	19.5
			Stage 2	2,685	40,300	*11.8*	4.4	15.0
W-65	14.0	*0.88*	Stage 1	1,975	39,100	*11.5*	5.8	19.8
			Stage 2	3,305	49,600	*14.5*	4.4	15.0
W-75	16.0	*1.0*	Stage 1	2,535	45,600	*13.4*	5.3	18.0
			Stage 2	3,750	55,900	*16.4*	4.4	14.9
W-80	17.0	*1.1*	(Stage 2)	4,460	64,800	*19.0*	4.3	14.5

Table 32 - Standard Capacity Ratings - Ground Water Heating							60Hz
EWT 104°F (40°C)							ELT 50°F (10°C)
Model	Liquid Flow (Outdoor & Indoor)		Mode	Input Energy	Capacity		COP_H
	gpm	*L/s*		Watts	Btu/hr	*kW*	W/W
W-25	8.0	*0.50*	Stage 1	1,300	16,400	*4.8*	3.7
			Stage 2	1,740	22,600	*6.6*	3.8
W-45	10.0	*0.63*	Stage 1	1,855	22,800	*6.7*	3.6
			Stage 2	2,455	32,700	*9.6*	3.9
W-55	12.0	*0.76*	Stage 1	2,475	32,100	*9.4*	3.8
			Stage 2	3,565	45,000	*13.2*	3.7
W-65	14.0	*0.88*	Stage 1	3,200	39,300	*11.5*	3.6
			Stage 2	4,345	54,900	*16.1*	3.7
W-75	16.0	*1.0*	Stage 1	3,785	47,800	*14.0*	3.7
			Stage 2	4,845	64,500	*18.9*	3.9
W-80	17.0	*1.1*	(Stage 2)	6,095	75,000	*22.0*	3.6

Table 33 - Standard Capacity Ratings - Ground Water Cooling									60Hz
EWT 53.6°F (12°C)									ELT 59°F (15°C)
Model	Liquid Flow (Outdoor & Indoor)		Mode	Input Energy	Capacity		COP_C	EER	
	gpm	*L/s*		Watts	Btu/hr	*kW*	W/W	Btu/hr/W	
W-25	8.0	*0.50*	Stage 1	695	17,700	*5.2*	7.5	25.5	
			Stage 2	1,105	23,200	*6.8*	6.2	21.0	
W-45	10.0	*0.63*	Stage 1	985	24,500	*7.2*	7.3	24.8	
			Stage 2	1,665	34,000	*10.0*	6.0	20.4	
W-55	12.0	*0.76*	Stage 1	1,370	33,900	*9.9*	7.2	24.7	
			Stage 2	2,180	44,700	*13.1*	6.0	20.5	
W-65	14.0	*0.88*	Stage 1	1,755	41,300	*12.1*	6.9	23.5	
			Stage 2	2,710	54,800	*16.1*	5.9	20.2	
W-75	16.0	*1.0*	Stage 1	2,120	49,800	*14.6*	6.9	23.5	
			Stage 2	3,105	62,400	*18.3*	5.9	20.1	
W-80	17.0	*1.1*	(Stage 2)	3,725	71,000	*21.1*	5.5	18.6	

Performance Tables

W-25-HACW-P-1T *R410a, 60 Hz, ZPS20K6E-PFV*

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	18	8	22	3	10,300	6.5	1,592	104	112	8	108	4	**15,500**	**2.85**
	30	23	8	27	3	11,400	6.7	1,625		112	8	108	4	**16,700**	**3.01**
	35	28	8	32	3	12,600	6.8	1,656		113	8	109	5	**18,100**	**3.20**
	40	33	8	36	4	14,000	7.0	1,685		113	8	109	5	**19,600**	**3.41**
	45	37	8	41	4	15,300	7.1	1,715		114	8	109	5	**21,000**	**3.59**
	50	42	8	46	4	16,800	7.2	1,741		114	8	110	6	**22,600**	**3.80**
	55	47	8	50	5	18,400	7.4	1,766		115	8	110	6	**24,300**	**4.03**
	60	51	8	55	5	20,000	7.5	1,790		116	8	111	7	**26,000**	**4.26**
	25	19	8	23	2	9,500	7.4	1,801	116	124	8	120	4	**15,400**	**2.51**
	30	24	8	27	3	10,500	7.5	1,819	116	124	8		4	**16,500**	**2.66**
	35	29	8	32	3	11,700	7.6	1,837	116	124	8		5	**17,800**	**2.84**
	40	33	8	37	3	12,900	7.7	1,851	115	124	8		5	**19,000**	**3.01**
	45	38	8	41	4	14,200	7.8	1,865	115	124	8		5	**20,400**	**3.21**
	50	43	8	46	4	15,700	7.8	1,875	115	124	8		6	**21,900**	**3.42**
	55	47	8	51	4	17,200	7.9	1,882	114	124	8		6	**23,500**	**3.66**
	60	52	8	55	5	18,800	7.9	1,890	114	125	8		6	**25,100**	**3.89**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING	60	77	8	67	7	26,600	4.4	1,122	54	42	8	48	6	**23,100**	**20.6**
	65	82	8	72	7	26,300	4.7	1,212		43	8	48	6	**22,500**	**18.6**
	70	87	8	77	7	26,000	5.0	1,306		43	8	48	6	**21,900**	**16.8**
	75	92	8	82	7	25,800	5.3	1,406		44	8	48	5	**21,300**	**15.1**
	80	97	8	87	7	25,400	5.7	1,513		44	8	48	5	**20,600**	**13.6**
	85	102	8	91	6	25,200	6.1	1,628		45	8	49	5	**20,000**	**12.3**
	90	107	8	96	6	24,900	6.4	1,752		45	8	49	5	**19,300**	**11.0**
	95	112	8	101	6	24,800	6.9	1,886		46	8	49	5	**18,700**	**9.9**

METRIC

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
HEATING (METRIC)	-3.9	-7.6	0.51	-5.3	1.4	3.0	6.5	1,592	40.0	44.3	0.51	42.2	2.2	**4.5**	**2.85**
	-1.1	-4.9	0.51	-2.7	1.6	3.3	6.7	1,625		44.6	0.51	42.3	2.3	**4.9**	**3.01**
	1.7	-2.3	0.51	-0.1	1.8	3.7	6.8	1,656		44.9	0.51	42.5	2.5	**5.3**	**3.20**
	4.4	0.3	0.51	2.4	2.0	4.1	7.0	1,685		45.2	0.51	42.7	2.7	**5.7**	**3.41**
	7.2	2.9	0.51	5.0	2.2	4.5	7.1	1,715		45.5	0.51	42.9	2.9	**6.2**	**3.59**
	10.0	5.6	0.51	7.6	2.4	4.9	7.2	1,741		45.8	0.51	43.2	3.2	**6.6**	**3.80**
	12.8	8.2	0.51	10.2	2.6	5.4	7.4	1,766		46.1	0.51	43.4	3.4	**7.1**	**4.03**
	15.6	10.8	0.51	12.8	2.8	5.9	7.5	1,790		46.4	0.51	43.6	3.6	**7.6**	**4.26**
	-3.9	-7.1	0.51	-5.2	1.3	3	7.4	1,801	46.7	50.8	0.51	48.9	2.2	**5**	**2.51**
	-1.1	-4.5	0.51	-2.6	1.5	3	7.5	1,819	46.6	50.9	0.51		2.3	**5**	**2.66**
	1.7	-1.9	0.51	0.0	1.7	3	7.6	1,837	46.4	51.0	0.51		2.5	**5**	**2.84**
	4.4	0.7	0.51	2.6	1.8	4	7.7	1,851	46.2	51.1	0.51		2.7	**6**	**3.01**
	7.2	3.3	0.51	5.2	2.0	4	7.8	1,865	46.1	51.2	0.51		2.8	**6**	**3.21**
	10.0	5.9	0.51	7.8	2.2	5	7.8	1,875	45.8	51.2	0.51		3.1	**6**	**3.42**
	12.8	8.5	0.51	10.4	2.4	5	7.9	1,882	45.6	51.3	0.51		3.3	**7**	**3.66**
	15.6	11.1	0.51	12.9	2.7	6	7.9	1,890	45.4	51.4	0.51		3.5	**7**	**3.89**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (kW)	**COP_C**
COOLING (METRIC)	15.6	25.0	0.51	19.4	3.8	7.8	4.4	1,122	12.0	5.6	0.51	8.8	3.2	**6.8**	**6.04**
	18.3	27.8	0.51	22.0	3.7	7.7	4.7	1,212		5.9	0.51	8.9	3.1	**6.6**	**5.45**
	21.1	30.6	0.51	24.8	3.7	7.6	5.0	1,306		6.2	0.51	8.9	3.1	**6.4**	**4.92**
	23.9	33.3	0.51	27.6	3.7	7.6	5.3	1,406		6.6	0.51	9.1	2.9	**6.2**	**4.43**
	26.7	36.1	0.51	30.3	3.6	7.4	5.7	1,513		6.8	0.51	9.1	2.9	**6.0**	**3.99**
	29.4	38.9	0.51	33.0	3.6	7.4	6.1	1,628		7.2	0.51	9.2	2.8	**5.9**	**3.60**
	32.2	41.7	0.51	35.8	3.6	7.3	6.4	1,752		7.4	0.51	9.3	2.7	**5.7**	**3.22**
	35.0	44.4	0.51	38.5	3.5	7.3	6.9	1,886		7.8	0.51	9.4	2.6	**5.5**	**2.90**

Performance Tables

W-45-HACW-P-1T *R410a, 60 Hz, ZPS30K6E-PFV*

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	14	10	22	3	14,300	9.4	2,240	104	112	10	108	4	**21,700**	**2.84**
	30	19	10	27	3	16,000	9.6	2,288		113	10	109	5	**23,600**	**3.02**
	35	24	10	31	4	17,900	9.8	2,332		113	10	109	5	**25,600**	**3.22**
	40	29	10	36	4	19,900	10.0	2,377		114	10	110	6	**27,800**	**3.43**
	45	33	10	41	5	22,100	10.2	2,417		114	10	110	6	**30,100**	**3.65**
	50	38	10	45	5	24,500	10.4	2,458		115	10	111	7	**32,700**	**3.90**
	55	43	10	50	6	27,100	10.6	2,497		116	10	111	7	**35,400**	**4.15**
	60	47	10	54	6	29,800	10.8	2,531		116	10	112	8	**38,300**	**4.43**
	25	15	10	22	3	13,100	10.6	2,511	116	123	10	120	4	**21,400**	**2.50**
	30	20	10	27	3	14,700	10.8	2,542	115	123	10		5	**23,100**	**2.66**
	35	25	10	32	3	16,500	10.9	2,574	115	123	10		5	**25,100**	**2.86**
	40	29	10	36	4	18,500	11.0	2,600	115	123	10		5	**27,200**	**3.07**
	45	34	10	41	4	20,500	11.2	2,627	114	124	10		6	**29,300**	**3.27**
	50	39	10	45	5	22,900	11.3	2,648	114	124	10		6	**31,700**	**3.51**
	55	43	10	50	5	25,400	11.4	2,666	113	124	10		7	**34,300**	**3.77**
	60	48	10	54	6	28,000	11.5	2,684	113	124	10		7	**37,000**	**4.04**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING	60	80	10	68	8	39,200	6.9	1,689	54	39	10	47	7	**33,800**	**20.0**
	65	85	10	73	8	38,600	7.4	1,801		39	10	47	7	**32,900**	**18.3**
	70	90	10	78	8	38,000	7.8	1,915		40	10	47	6	**31,900**	**16.7**
	75	95	10	83	8	37,400	8.3	2,038		40	10	47	6	**30,900**	**15.2**
	80	100	10	88	8	36,900	8.9	2,166		41	10	48	6	**29,900**	**13.8**
	85	105	10	92	7	36,400	9.4	2,307		41	10	48	6	**28,900**	**12.5**
	90	110	10	97	7	35,900	10.0	2,456		42	10	48	6	**27,900**	**11.4**
	95	115	10	102	7	35,400	10.7	2,622		43	10	48	5	**26,900**	**10.3**

METRIC

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
HEATING (METRIC)	-3.9	-9.8	0.63	-5.5	1.6	4.2	9.4	2,240	40	44.6	0.63	42.4	2.4	**6.4**	**2.84**
	-1.1	-7.2	0.63	-2.9	1.8	4.7	9.6	2,288		44.9	0.63	42.6	2.6	**6.9**	**3.02**
	1.7	-4.6	0.63	-0.4	2.1	5.3	9.8	2,332		45.2	0.63	42.8	2.8	**7.5**	**3.22**
	4.4	-1.9	0.63	2.1	2.3	5.8	10.0	2,377		45.5	0.63	43.1	3.1	**8.2**	**3.43**
	7.2	0.7	0.63	4.7	2.5	6.5	10.2	2,417		45.8	0.63	43.3	3.3	**8.8**	**3.65**
	10.0	3.3	0.63	7.2	2.8	7.2	10.4	2,458		46.1	0.63	43.6	3.6	**9.6**	**3.90**
	12.8	5.9	0.63	9.7	3.1	7.9	10.6	2,497		46.4	0.63	43.9	3.9	**10.4**	**4.15**
	15.6	8.6	0.63	12.2	3.4	8.7	10.8	2,531		46.7	0.63	44.3	4.3	**11.2**	**4.43**
	-3.9	-9.3	0.63	-5.4	1.5	3.8	10.6	2,511	46.5	50.5	0.63	49	2.4	**6.3**	**2.50**
	-1.1	-6.7	0.63	-2.8	1.7	4.3	10.8	2,542	46.3	50.6	0.63		2.6	**6.8**	**2.66**
	1.7	-4.1	0.63	-0.2	1.9	4.8	10.9	2,574	46.1	50.7	0.63		2.8	**7.4**	**2.86**
	4.4	-1.5	0.63	2.3	2.1	5.4	11.0	2,600	45.9	50.7	0.63		3.0	**8.0**	**3.07**
	7.2	1.1	0.63	4.9	2.3	6.0	11.2	2,627	45.6	50.8	0.63		3.3	**8.6**	**3.27**
	10.0	3.7	0.63	7.4	2.6	6.7	11.3	2,648	45.4	50.9	0.63		3.5	**9.3**	**3.51**
	12.8	6.3	0.63	9.9	2.9	7.4	11.4	2,666	45.1	50.9	0.63		3.8	**10.1**	**3.77**
	15.6	8.8	0.63	12.4	3.2	8.2	11.5	2,684	44.8	51.1	0.63		4.1	**10.8**	**4.04**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (kW)	**COP_C**
COOLING (METRIC)	15.6	26.6	0.63	20.0	4.4	11.5	6.9	1,689	12	3.7	0.63	8.2	3.8	**9.9**	**5.86**
	18.3	29.4	0.63	22.7	4.4	11.3	7.4	1,801		4.0	0.63	8.3	3.7	**9.6**	**5.36**
	21.1	32.2	0.63	25.4	4.3	11.1	7.8	1,915		4.3	0.63	8.4	3.6	**9.4**	**4.89**
	23.9	35.0	0.63	28.1	4.2	11.0	8.3	2,038		4.6	0.63	8.6	3.4	**9.1**	**4.45**
	26.7	37.8	0.63	30.9	4.2	10.8	8.9	2,166		4.9	0.63	8.7	3.3	**8.8**	**4.04**
	29.4	40.6	0.63	33.5	4.1	10.7	9.4	2,307		5.2	0.63	8.8	3.2	**8.5**	**3.66**
	32.2	43.4	0.63	36.3	4.1	10.5	10.0	2,456		5.5	0.63	8.9	3.1	**8.2**	**3.34**
	35.0	46.2	0.63	39.0	4.0	10.4	10.7	2,622		5.8	0.63	9.0	3.0	**7.9**	**3.02**

Performance Tables

W-55-HACW-P-1T *R410a, 60 Hz, ZPS40K6E-PFV*

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	14	12	22	4	20,600	14.0	3,145	104	115	12	109	5	**31,100**	**2.90**
	30	19	12	26	4	22,800	14.4	3,234		116	12	110	6	**33,600**	**3.04**
	35	24	12	31	4	25,100	14.8	3,317		116	12	110	6	**36,200**	**3.20**
	40	29	12	35	5	27,600	15.2	3,405		117	12	111	7	**39,000**	**3.36**
	45	33	12	40	5	30,300	15.5	3,485		117	12	111	7	**42,000**	**3.53**
	50	38	12	44	6	33,100	15.9	3,568		118	12	112	8	**45,100**	**3.70**
	55	43	12	49	6	36,000	16.3	3,649		119	12	112	8	**48,200**	**3.87**
	60	47	12	53	7	39,200	16.7	3,723		119	12	113	9	**51,700**	**4.07**
	25	15	12	22	3	18,800	15.8	3,548	115	125	12	120	5	**30,600**	**2.53**
	30	20	12	27	4	20,800	16.1	3,609	115	125	12		6	**32,900**	**2.67**
	35	25	12	31	4	23,100	16.4	3,673	114	125	12		6	**35,400**	**2.82**
	40	29	12	36	4	25,500	16.6	3,730	114	125	12		6	**38,000**	**2.99**
	45	34	12	40	5	28,000	16.9	3,787	113	126	12		7	**40,700**	**3.15**
	50	39	12	45	5	30,800	17.1	3,838	113	126	12		7	**43,700**	**3.34**
	55	43	12	49	6	33,800	17.4	3,885	112	126	12		8	**46,900**	**3.54**
	60	48	12	54	6	36,900	17.6	3,934	112	126	12		8	**50,100**	**3.73**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING	60	82	12	69	9	51,500	9.8	2,207	54	39	12	46	7	**44,400**	**20.1**
	65	87	12	74	9	50,700	10.3	2,337		39	12	46	7	**43,200**	**18.5**
	70	91	12	79	9	50,000	11.0	2,477		40	12	47	7	**42,000**	**17.0**
	75	96	12	83	8	49,300	11.6	2,626		40	12	47	7	**40,800**	**15.5**
	80	101	12	88	8	48,500	12.3	2,784		41	12	47	7	**39,500**	**14.2**
	85	106	12	93	8	47,900	13.0	2,948		41	12	47	6	**38,300**	**13.0**
	90	110	12	98	8	47,300	13.8	3,127		42	12	47	6	**37,100**	**11.9**
	95	115	12	103	8	46,700	14.7	3,319		42	12	48	6	**35,800**	**10.8**

METRIC

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
HEATING (METRIC)	-3.9	-9.8	0.76	-5.8	1.9	6.0	14.0	3,145	40	46.2	0.76	42.9	2.9	**9.1**	**2.90**
	-1.1	-7.2	0.76	-3.3	2.2	6.7	14.4	3,234		46.6	0.76	43.1	3.1	**9.9**	**3.04**
	1.7	-4.6	0.76	-0.7	2.4	7.4	14.8	3,317		46.8	0.76	43.3	3.3	**10.6**	**3.20**
	4.4	-1.9	0.76	1.8	2.6	8.1	15.2	3,405		47.2	0.76	43.6	3.6	**11.4**	**3.36**
	7.2	0.7	0.76	4.3	2.9	8.9	15.5	3,485		47.4	0.76	43.9	3.9	**12.3**	**3.53**
	10.0	3.3	0.76	6.9	3.1	9.7	15.9	3,568		47.8	0.76	44.2	4.2	**13.2**	**3.70**
	12.8	5.9	0.76	9.4	3.4	10.6	16.3	3,649		48.1	0.76	44.4	4.4	**14.1**	**3.87**
	15.6	8.6	0.76	11.9	3.7	11.5	16.7	3,723		48.4	0.76	44.8	4.8	**15.2**	**4.07**
	-3.9	-9.3	0.76	-5.7	1.8	5.5	15.8	3,548	46.1	51.7	0.76	49	2.8	**9.0**	**2.53**
	-1.1	-6.7	0.76	-3.0	1.9	6.1	16.1	3,609	45.8	51.7	0.76		3.1	**9.6**	**2.67**
	1.7	-4.1	0.76	-0.5	2.2	6.8	16.4	3,673	45.6	51.8	0.76		3.3	**10.4**	**2.82**
	4.4	-1.5	0.76	2.0	2.4	7.5	16.6	3,730	45.4	51.9	0.76		3.5	**11.1**	**2.99**
	7.2	1.1	0.76	4.5	2.7	8.2	16.9	3,787	45.1	52.0	0.76		3.8	**11.9**	**3.15**
	10.0	3.7	0.76	7.1	2.9	9.0	17.1	3,838	44.8	52.1	0.76		4.1	**12.8**	**3.34**
	12.8	6.3	0.76	9.6	3.2	9.9	17.4	3,885	44.6	52.1	0.76		4.3	**13.7**	**3.54**
	15.6	8.8	0.76	12.1	3.5	10.8	17.6	3,934	44.2	52.2	0.76		4.7	**14.7**	**3.73**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (kW)	**COP_C**
COOLING (METRIC)	15.6	27.7	0.76	20.5	4.9	15.1	9.8	2,207	12	3.6	0.76	7.9	4.1	**13.0**	**5.89**
	18.3	30.3	0.76	23.1	4.8	14.9	10.3	2,337		3.9	0.76	8.0	4.0	**12.7**	**5.42**
	21.1	32.9	0.76	25.8	4.7	14.7	11.0	2,477		4.2	0.76	8.1	3.9	**12.3**	**4.98**
	23.9	35.6	0.76	28.6	4.7	14.4	11.6	2,626		4.5	0.76	8.2	3.8	**12.0**	**4.54**
	26.7	38.3	0.76	31.3	4.6	14.2	12.3	2,784		4.8	0.76	8.3	3.7	**11.6**	**4.16**
	29.4	40.9	0.76	33.9	4.5	14.0	13.0	2,948		5.1	0.76	8.4	3.6	**11.2**	**3.81**
	32.2	43.6	0.76	36.6	4.4	13.9	13.8	3,127		5.4	0.76	8.6	3.4	**10.9**	**3.49**
	35.0	46.2	0.76	39.4	4.4	13.7	14.7	3,319		5.7	0.76	8.7	3.3	**10.5**	**3.2**

Performance Tables

W-65-HACW-P-1T *R410a, 60 Hz, ZPS51K6E-PFV*

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	15	14	21	4	25,600	16.9	3,893	104	116	14	110	6	**38,400**	**2.89**
	30	20	14	26	4	28,200	17.4	3,992		117	14	110	6	**41,400**	**3.04**
	35	25	14	31	5	31,000	17.9	4,084		117	14	110	6	**44,500**	**3.19**
	40	29	14	35	5	34,000	18.3	4,176		118	14	111	7	**47,800**	**3.35**
	45	34	14	40	5	37,100	18.8	4,261		118	14	111	7	**51,300**	**3.53**
	50	39	14	44	6	40,400	19.2	4,346		119	14	112	8	**54,900**	**3.70**
	55	43	14	49	6	43,900	19.6	4,429		120	14	112	8	**58,700**	**3.88**
	60	48	14	53	7	47,700	20.0	4,506		120	14	113	9	**62,800**	**4.08**
	25	16	14	22	3	23,200	19.2	4,376	115	126	14	120	5	**37,600**	**2.52**
	30	21	14	26	4	25,800	19.6	4,449	114	126	14		6	**40,500**	**2.67**
	35	25	14	31	4	28,500	19.9	4,520	114	126	14		6	**43,500**	**2.82**
	40	30	14	35	5	31,400	20.2	4,580	113	126	14		7	**46,600**	**2.98**
	45	35	14	40	5	34,400	20.6	4,639	113	126	14		7	**49,800**	**3.15**
	50	39	14	45	6	37,700	20.8	4,689	112	126	14		8	**53,300**	**3.33**
	55	44	14	49	6	41,100	21.1	4,734	112	127	14		8	**56,900**	**3.52**
	60	48	14	54	7	44,600	21.3	4,780	111	127	14		9	**60,600**	**3.72**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING	60	81	14	69	9	63,100	12.5	2,740	54	39	14	46	8	**54,500**	**19.9**
	65	86	14	74	9	62,200	13.2	2,889		39	14	46	8	**53,100**	**18.4**
	70	91	14	79	9	61,300	13.9	3,055		40	14	46	7	**51,600**	**16.9**
	75	96	14	84	9	60,500	14.7	3,232		40	14	46	7	**50,200**	**15.5**
	80	101	14	89	9	59,700	15.6	3,427		41	14	47	7	**48,700**	**14.2**
	85	106	14	94	9	58,900	16.5	3,634		41	14	47	7	**47,200**	**13.0**
	90	111	14	99	9	58,100	17.5	3,861		41	14	47	7	**45,600**	**11.8**
	95	116	14	103	8	57,300	18.6	4,099		42	14	47	6	**44,000**	**10.7**

METRIC

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
HEATING (METRIC)	-3.9	-9.3	0.88	-6.0	2.1	7.5	16.9	3,893	40	46.8	0.88	43.1	3.1	**11.3**	**2.89**
	-1.1	-6.7	0.88	-3.4	2.3	8.3	17.4	3,992		47.1	0.88	43.3	3.3	**12.1**	**3.04**
	1.7	-4.1	0.88	-0.8	2.5	9.1	17.9	4,084		47.4	0.88	43.6	3.6	**13.0**	**3.19**
	4.4	-1.6	0.88	1.6	2.8	10.0	18.3	4,176		47.7	0.88	43.8	3.8	**14.0**	**3.35**
	7.2	1.1	0.88	4.2	3.0	10.9	18.8	4,261		48.0	0.88	44.1	4.1	**15.0**	**3.53**
	10.0	3.6	0.88	6.7	3.3	11.8	19.2	4,346		48.3	0.88	44.3	4.3	**16.1**	**3.70**
	12.8	6.2	0.88	9.2	3.6	12.9	19.6	4,429		48.7	0.88	44.7	4.7	**17.2**	**3.88**
	15.6	8.8	0.88	11.7	3.9	14.0	20.0	4,506		48.9	0.88	45.0	5.0	**18.4**	**4.08**
	-3.9	-8.9	0.88	-5.8	1.9	6.8	19.2	4,376	45.9	52.1	0.88	49	3.0	**11.0**	**2.52**
	-1.1	-6.3	0.88	-3.2	2.1	7.6	19.6	4,449	45.7	52.1	0.88		3.2	**11.9**	**2.67**
	1.7	-3.7	0.88	-0.6	2.3	8.4	19.9	4,520	45.4	52.2	0.88		3.4	**12.7**	**2.82**
	4.4	-1.2	0.88	1.8	2.6	9.2	20.2	4,580	45.2	52.3	0.88		3.7	**13.7**	**2.98**
	7.2	1.4	0.88	4.4	2.8	10.1	20.6	4,639	44.9	52.4	0.88		3.9	**14.6**	**3.15**
	10.0	3.9	0.88	6.9	3.1	11.0	20.8	4,689	44.7	52.4	0.88		4.2	**15.6**	**3.33**
	12.8	6.5	0.88	9.5	3.3	12.0	21.1	4,734	44.4	52.5	0.88		4.5	**16.7**	**3.52**
	15.6	9.1	0.88	12.0	3.6	13.1	21.3	4,780	44.1	52.6	0.88		4.8	**17.8**	**3.72**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (kW)	**COP_C**
COOLING (METRIC)	15.6	27.3	0.88	20.7	5.1	18.5	12.5	2,740	12	3.7	0.88	7.7	4.3	**16.0**	**5.83**
	18.3	30.0	0.88	23.4	5.1	18.2	13.2	2,889		3.9	0.88	7.8	4.2	**15.6**	**5.39**
	21.1	32.8	0.88	26.0	4.9	18.0	13.9	3,055		4.2	0.88	7.9	4.1	**15.1**	**4.95**
	23.9	35.5	0.88	28.8	4.9	17.7	14.7	3,232		4.4	0.88	8.0	4.0	**14.7**	**4.54**
	26.7	38.3	0.88	31.5	4.8	17.5	15.6	3,427		4.7	0.88	8.1	3.9	**14.3**	**4.16**
	29.4	41.0	0.88	34.2	4.8	17.3	16.5	3,634		5.0	0.88	8.3	3.7	**13.8**	**3.81**
	32.2	43.8	0.88	36.9	4.7	17.0	17.5	3,861		5.2	0.88	8.4	3.6	**13.4**	**3.46**
	35.0	46.5	0.88	39.7	4.7	16.8	18.6	4,099		5.5	0.88	8.5	3.5	**12.9**	**3.14**

Performance Tables

W-75-HACW-P-1T *R410a, 60 Hz, ZPS60K6E-PFV*

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	16	16	21	4	28,800	21.3	4,530	104	113	16	110	6	**43,900**	**2.84**
	30	20	16	26	4	32,200	21.6	4,596		114	16	110	6	**47,500**	**3.03**
	35	25	16	30	5	35,700	21.9	4,665		115	16	110	6	**51,300**	**3.22**
	40	29	16	35	5	39,600	22.1	4,728		115	16	111	7	**55,400**	**3.43**
	45	33	16	39	6	43,800	22.4	4,795		116	16	112	8	**59,800**	**3.65**
	50	37	16	44	6	48,300	22.7	4,854		117	16	112	8	**64,500**	**3.89**
	55	42	16	48	7	53,200	23.0	4,914		117	16	113	9	**69,600**	**4.15**
	60	46	16	53	7	58,300	23.3	4,978		118	16	113	9	**74,900**	**4.41**
	25	17	16	22	3	26,300	23.5	5,077	115	123	16	120	5	**43,300**	**2.50**
	30	21	16	26	4	29,500	23.6	5,110	114	123	16		6	**46,600**	**2.67**
	35	25	16	31	4	32,900	23.8	5,147	114	123	16		6	**50,100**	**2.85**
	40	30	16	35	5	36,700	24.0	5,181	113	123	16		7	**54,000**	**3.05**
	45	34	16	40	5	40,800	24.1	5,205	113	124	16		7	**58,200**	**3.28**
	50	38	16	44	6	45,100	24.2	5,234	112	124	16		8	**62,600**	**3.51**
	55	42	16	49	6	49,800	24.3	5,261	112	124	16		8	**67,400**	**3.75**
	60	47	16	53	7	54,900	24.4	5,281	111	124	16		9	**72,500**	**4.02**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING	60	81	16	69	9	72,000	16.3	3,138	54	38	16	46	8	**62,000**	**19.8**
	65	85	16	74	9	70,800	17.0	3,308		39	16	46	8	**60,300**	**18.2**
	70	90	16	79	9	69,700	17.8	3,486		39	16	46	7	**58,500**	**16.8**
	75	95	16	84	9	68,400	18.6	3,676		40	16	47	7	**56,600**	**15.4**
	80	99	16	89	9	67,300	19.5	3,872		40	16	47	7	**54,800**	**14.2**
	85	104	16	93	8	66,200	20.4	4,080		41	16	47	7	**53,000**	**13.0**
	90	108	16	98	8	65,100	21.4	4,301		41	16	47	6	**51,100**	**11.9**
	95	113	16	103	8	64,100	22.4	4,537		42	16	47	6	**49,300**	**10.9**

METRIC

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
HEATING (METRIC)	-3.9	-8.9	1.0	-6.0	2.1	8.4	21.3	4,530	40	45.2	1.0	43.1	3.1	**12.9**	**2.84**
	-1.1	-6.6	1.0	-3.4	2.3	9.4	21.6	4,596		45.5	1.0	43.3	3.3	**13.9**	**3.03**
	1.7	-4.2	1.0	-0.9	2.6	10.5	21.9	4,665		45.9	1.0	43.6	3.6	**15.0**	**3.22**
	4.4	-1.8	1.0	1.6	2.8	11.6	22.1	4,728		46.2	1.0	43.8	3.8	**16.2**	**3.43**
	7.2	0.6	1.0	4.1	3.1	12.8	22.4	4,795		46.6	1.0	44.2	4.2	**17.5**	**3.65**
	10.0	3.0	1.0	6.6	3.4	14.2	22.7	4,854		46.9	1.0	44.5	4.5	**18.9**	**3.89**
	12.8	5.4	1.0	9.0	3.8	15.6	23.0	4,914		47.3	1.0	44.8	4.8	**20.4**	**4.15**
	15.6	7.8	1.0	11.5	4.1	17.1	23.3	4,978		47.7	1.0	45.2	5.2	**22.0**	**4.41**
	-3.9	-8.6	1.0	-5.8	1.9	7.7	23.5	5,077	45.9	50.5	1.0	49	3.0	**12.7**	**2.50**
	-1.1	-6.2	1.0	-3.2	2.1	8.6	23.6	5,110	45.7	50.6	1.0		3.2	**13.7**	**2.67**
	1.7	-3.8	1.0	-0.6	2.3	9.6	23.8	5,147	45.4	50.7	1.0		3.5	**14.7**	**2.85**
	4.4	-1.4	1.0	1.8	2.6	10.8	24.0	5,181	45.1	50.8	1.0		3.8	**15.8**	**3.05**
	7.2	1.0	1.0	4.3	2.9	12.0	24.1	5,205	44.8	50.8	1.0		4.1	**17.1**	**3.28**
	10.0	3.4	1.0	6.8	3.2	13.2	24.2	5,234	44.6	50.9	1.0		4.3	**18.3**	**3.51**
	12.8	5.8	1.0	9.2	3.6	14.6	24.3	5,261	44.2	51.1	1.0		4.7	**19.8**	**3.75**
	15.6	8.2	1.0	11.7	3.9	16.1	24.4	5,281	43.8	51.1	1.0		5.1	**21.2**	**4.02**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (kW)	**COP_C**
COOLING (METRIC)	15.6	27.1	1.0	20.7	5.1	21.1	16.3	3,138	12	3.6	1.0	7.7	4.3	**18.2**	**5.80**
	18.3	29.6	1.0	23.3	5.0	20.7	17.0	3,308		3.8	1.0	7.8	4.2	**17.7**	**5.33**
	21.1	32.2	1.0	26.0	4.9	20.4	17.8	3,486		4.1	1.0	7.9	4.1	**17.1**	**4.92**
	23.9	34.8	1.0	28.7	4.8	20.0	18.6	3,676		4.4	1.0	8.1	3.9	**16.6**	**4.51**
	26.7	37.3	1.0	31.5	4.8	19.7	19.5	3,872		4.7	1.0	8.2	3.8	**16.1**	**4.16**
	29.4	39.9	1.0	34.1	4.7	19.4	20.4	4,080		4.9	1.0	8.3	3.7	**15.5**	**3.81**
	32.2	42.4	1.0	36.8	4.6	19.1	21.4	4,301		5.2	1.0	8.4	3.6	**15.0**	**3.49**
	35.0	45.0	1.0	39.6	4.6	18.8	22.4	4,537		5.5	1.0	8.6	3.4	**14.4**	**3.19**

Performance Tables

W-80-HACW-P-1T *R410a, 60 Hz, ZP72KCE-PFV*

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	16	17	21	4	33,300	24.1	5,488	104	117	17	110	6	**51,700**	**2.76**
	30	20	17	26	5	37,100	24.5	5,578		117	17	111	7	**55,800**	**2.93**
	35	24	17	30	5	41,100	24.9	5,672		118	17	111	7	**60,100**	**3.11**
	40	28	17	35	6	45,400	25.3	5,759		119	17	112	8	**64,700**	**3.29**
	45	32	17	39	6	50,000	25.7	5,852		119	17	112	8	**69,700**	**3.49**
	50	37	17	43	7	55,000	26.2	5,941		120	17	113	9	**75,000**	**3.70**
	55	41	17	48	7	60,400	26.6	6,032		121	17	114	10	**80,700**	**3.92**
	60	45	17	52	8	66,000	27.0	6,135		121	17	114	10	**86,600**	**4.14**
	25	16	17	21	4	30,300	27.1	6,186	114	126	17	120	6	**51,100**	**2.42**
	30	20	17	26	4	33,800	27.3	6,237	114	126	17		7	**54,800**	**2.58**
	35	25	17	31	5	37,700	27.6	6,292	113	126	17		7	**58,800**	**2.74**
	40	29	17	35	5	41,900	27.8	6,336	113	126	17		7	**63,200**	**2.92**
	45	33	17	39	6	46,300	28.1	6,384	112	126	17		8	**67,800**	**3.11**
	50	37	17	44	6	51,200	28.3	6,426	111	126	17		9	**72,800**	**3.32**
	55	41	17	48	7	56,400	28.5	6,470	111	127	17		9	**78,200**	**3.54**
	60	45	17	53	7	61,900	28.7	6,523	110	127	17		10	**83,900**	**3.77**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING	60	85	17	70	10	83,500	18.6	3,717	54	39	17	45	8	**71,600**	**19.3**
	65	89	17	75	10	82,200	19.6	3,927		39	17	45	8	**69,500**	**17.7**
	70	94	17	80	10	81,000	20.7	4,149		40	17	46	8	**67,600**	**16.3**
	75	98	17	85	10	79,800	21.7	4,374		41	17	46	8	**65,600**	**15.0**
	80	103	17	89	9	78,600	22.8	4,614		41	17	46	8	**63,600**	**13.8**
	85	107	17	94	9	77,500	23.9	4,863		42	17	46	7	**61,600**	**12.7**
	90	112	17	99	9	76,600	25.1	5,133		42	17	47	7	**59,800**	**11.7**
	95	116	17	104	9	75,600	26.4	5,415		43	17	47	7	**57,800**	**10.7**

METRIC

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
HEATING (METRIC)	-3.9	-9.2	1.1	-6.1	2.2	9.8	24.1	5,488	40	47.1	1.1	43.4	3.4	**15.2**	**2.76**
	-1.1	-6.8	1.1	-3.6	2.5	10.9	24.5	5,578		47.4	1.1	43.7	3.7	**16.4**	**2.93**
	1.7	-4.5	1.1	-1.0	2.7	12.0	24.9	5,672		47.8	1.1	43.9	3.9	**17.6**	**3.11**
	4.4	-2.2	1.1	1.3	3.1	13.3	25.3	5,759		48.2	1.1	44.2	4.2	**19.0**	**3.29**
	7.2	0.2	1.1	3.9	3.3	14.7	25.7	5,852		48.6	1.1	44.6	4.6	**20.4**	**3.49**
	10.0	2.5	1.1	6.3	3.7	16.1	26.2	5,941		48.9	1.1	44.9	4.9	**22.0**	**3.70**
	12.8	4.8	1.1	8.7	4.1	17.7	26.6	6,032		49.2	1.1	45.3	5.3	**23.7**	**3.92**
	15.6	7.2	1.1	11.2	4.4	19.3	27.0	6,135		49.6	1.1	45.7	5.7	**25.4**	**4.14**
	-3.9	-8.7	1.1	-5.9	2.0	8.9	27.1	6,186	45.6	52.1	1.1	49	3.3	**15.0**	**2.42**
	-1.1	-6.4	1.1	-3.4	2.3	9.9	27.3	6,237	45.3	52.1	1.1		3.6	**16.1**	**2.58**
	1.7	-4.1	1.1	-0.8	2.5	11.0	27.6	6,292	45.1	52.2	1.1		3.8	**17.2**	**2.74**
	4.4	-1.8	1.1	1.6	2.8	12.3	27.8	6,336	44.8	52.3	1.1		4.1	**18.5**	**2.92**
	7.2	0.5	1.1	4.1	3.1	13.6	28.1	6,384	44.4	52.4	1.1		4.4	**19.9**	**3.11**
	10.0	2.8	1.1	6.6	3.4	15.0	28.3	6,426	44.1	52.4	1.1		4.8	**21.3**	**3.32**
	12.8	5.2	1.1	9.0	3.8	16.5	28.5	6,470	43.8	52.5	1.1		5.1	**22.9**	**3.54**
	15.6	7.4	1.1	11.5	4.1	18.1	28.7	6,523	43.4	52.6	1.1		5.5	**24.6**	**3.77**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (kW)	**COP_C**
COOLING (METRIC)	15.6	29.4	1.1	21.2	5.6	24.5	18.6	3,717	12	3.8	1.1	7.3	4.7	**21.0**	**5.66**
	18.3	31.9	1.1	23.8	5.5	24.1	19.6	3,927		4.1	1.1	7.4	4.6	**20.4**	**5.19**
	21.1	34.4	1.1	26.5	5.4	23.7	20.7	4,149		4.4	1.1	7.6	4.4	**19.8**	**4.78**
	23.9	36.8	1.1	29.2	5.3	23.4	21.7	4,374		4.7	1.1	7.7	4.3	**19.2**	**4.40**
	26.7	39.3	1.1	31.9	5.2	23.0	22.8	4,614		5.0	1.1	7.8	4.2	**18.6**	**4.04**
	29.4	41.8	1.1	34.6	5.2	22.7	23.9	4,863		5.3	1.1	7.9	4.1	**18.1**	**3.72**
	32.2	44.3	1.1	37.3	5.1	22.4	25.1	5,133		5.6	1.1	8.1	3.9	**17.5**	**3.43**
	35.0	46.7	1.1	40.1	5.1	22.2	26.4	5,415		5.9	1.1	8.2	3.8	**16.9**	**3.14**

W-Series Electrical Specifications

** equipped with K6E compressors where available*

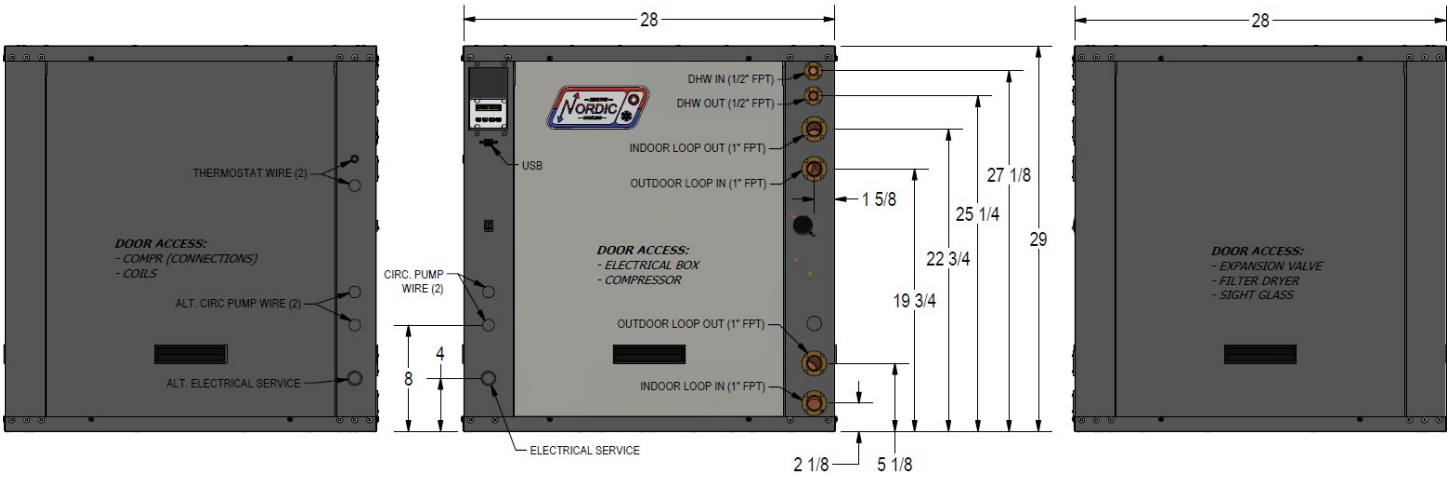
TABLE 34	Code	Power Supply			Compressor		Circulators	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	Max. A	Amps	Amps	Amps	ga
W-25	1	208/230-1-60	187	253	10.9	63	5.0	16.7	19.4	30	#10-2*
	2	208-3-60	187	229	6.5	55	5.0	12.3	13.9	20	#12-3*
	4	460-3-60	414	506	3.5	28	-	4.3	5.2	15	#14-3
	5	-	-	-	-	-	-	-	-	-	-
	6	220-1-50	187	253	9.2	52	5.0	15.0	17.3	30	#10-2
	7	380-3-50	342	418	3.2	27	5.0	9.0	9.8	15	#14-4**
W-45	1	208/230-1-60	187	253	14.1	84	5.0	19.9	23.4	40	#8-2*
	2	208-3-60	187	229	9.6	74	5.0	15.4	17.8	30	#10-3*
	4	460-3-60	414	506	5.1	37	-	5.9	7.2	15	#14-3
	5	575-3-60	518	632	3.2	26	-	4.0	4.8	15	#14-3
	6	220-1-50	187	253	12.4	67	5.0	18.2	21.3	30	#10-2
	7	380-3-50	342	418	4.9	37	5.0	10.7	11.9	15	#14-4**
W-55	1	208/230-1-60	187	253	20.4	122	7.0	28.2	33.3	50	#8-2*
	2	208-3-60	187	229	14.0	83	7.0	21.8	25.3	40	#8-3*
	4	460-3-60	414	506	6.4	41	-	7.2	8.8	15	#14-3
	5	575-3-60	518	632	4.6	33	-	5.4	6.6	15	#14-3
	6	220-1-50	187	253	15.5	100	7.0	23.3	27.2	40	#8-2
	7	380-3-50	342	418	6.1	43	7.0	13.9	15.4	20	#12-4**
W-65	1	208/230-1-60	187	253	22.8	147	7.0	30.6	36.3	60	#6-2*
	2	208-3-60	187	229	16.5	110	7.0	24.3	28.4	40	#8-3*
	4	460-3-60	414	506	7.2	52	-	8.0	9.8	15	#14-3
	5	575-3-60	518	632	5.7	44	-	6.5	7.9	15	#14-3
	6	220-1-50	187	253	21.5	126	7.0	29.3	34.7	50	#8-2
	7	380-3-50	342	418	6.9	52	7.0	14.7	16.4	20	#12-4**
W-75	1	208/230-1-60	187	253	27.6	190	7.0	35.4	42.3	60	#6-2*
	2	208-3-60	187	229	18.6	149	7.0	26.4	31.1	50	#8-3*
	4	460-3-60	414	506	9.0	61	-	9.8	12.1	20	#12-3
	5	575-3-60	518	632	7.1	56	-	7.9	9.7	15	#14-3
	6	220-1-50	187	253	28.2	155	7.0	36.0	43.1	60	#6-2
	7	380-3-50	342	418	7.7	59	7.0	15.5	17.4	25	#10-4**
W-80	1	208/230-1-60	187	253	36.9	185	7.0	44.7	53.9	80	#4-2*
	2	208-3-60	187	229	23.2	164	7.0	31.0	36.8	60	#6-3*
	4	460-3-60	414	506	11.2	75	-	12.0	14.8	20	#12-3
	5	575-3-60	518	632	7.9	54	-	8.7	10.7	20	#12-3
	6	-	-	-	-	-	7.0	-	-	-	-
	7	380-3-50	342	418	11.2	75	7.0	19.0	21.8	30	#10-4**

* For 208/230-1-60 and 208-3-60, 1 additional conductor (neutral) is required if connecting 115VAC circulators to the unit.

** For 380-3-50, only 3 conductors are required (no neutral) if not using desuperheater and not connecting 220V circulators to the unit.

Dimensions: W-25/45/55

All dimensions in inches.



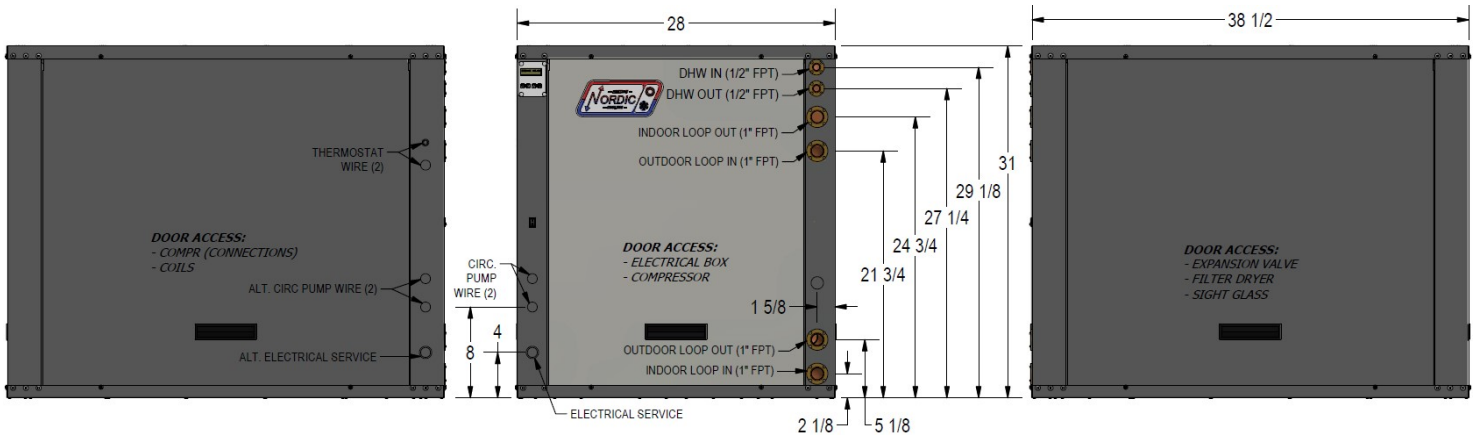
LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE:
2 FT

RECOMMENDED RIGHT SIDE CLEARANCE:
2 FT

NO BACK CLEARANCE REQUIRED

Dimensions: W-65/75/80



LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE:
2 FT

RECOMMENDED RIGHT SIDE CLEARANCE:
2 FT

NO BACK CLEARANCE REQUIRED

Model Specific Information: WH-Series

Table 35 - WH-Series Refrigerant Charge				
MODEL	**lb**	***kg***	**Refrigerant**	**Oil Type**
WH-25	4.0	*1.8*	R134a	POE
WH-45	5.5	*2.5*	R134a	POE
WH-55	6.5	*3.0*	R134a	POE
WH-65	8.5	*3.9*	R134a	POE
WH-75	9.0	*4.1*	R134a	POE
WH-80	10.5	*4.8*	R134a	POE
WH-85	12.0	*6.4*	R134a	POE

- Oil capacity is marked on the compressor label.
- **Refrigerant charge is subject to revision;** actual charge is indicated on the unit nameplate.

Table 36 - WH-Series Shipping Information				
MODEL	**WEIGHT lb. (kg)**	**DIMENSIONS in (cm)**		
		L	**W**	**H**
WH-25	285 (129)	34 (86)	34 (86)	35 (89)
WH-45	310 (141)	34 (86)	34 (86)	35 (89)
WH-55	370 (168)	34 (86)	34 (86)	35 (89)
WH-65	460 (208)	45 (114)	37 (94)	37 (94)
WH-75	510 (231)	45 (114)	37 (94)	37 (94)
WH-80	560 (254)	45 (114)	37 (94)	37 (94)
WH-85	466 (211)	45 (114)	37 (94)	37 (94)

Table 37 - WH-Series Operating Temperature Limits					
Loop	**Mode**	**Parameter**	**(°F)**	***(°C)***	**Note**
Indoor	Heating	Minimum EWT	70 - 110	*21 - 43*	Use formula (Outdoor ELT + 20°F) or (Outdoor ELT + 11°C).
	Heating	Maximum LWT	160	*71*	
	Cooling	Minimum LWT	45	*7*	
	Cooling	Maximum EWT	90	*32*	Reduce flow above this temp. to limit refrigerant suction pressure.
Outdoor	Heating	Minimum ELT	45	*7*	
	Heating	Maximum ELT	90	*32*	Reduce flow above this temp. to limit refrigerant suction pressure.
	Cooling	Minimum ELT	70 - 110	*21 - 43*	Use formula (Indoor EWT + 20°F) or (Indoor EWT + 11°C).
	Cooling	Maximum LLT	160	*71*	

Values in this table are for rated liquid flow values.
EWT - Entering Water Temp., LWT - Leaving Water Temp., ELT - Entering Liquid Temp., LLT - Leaving Liquid Temp.

Table 38 - WH-Series Required Indoor & Outdoor Loop Flow Rates		
SIZE	**gpm**	***L/s***
WH-25	8	*0.50*
WH-45	10	*0.63*
WH-55	12	*0.76*
WH-65	14	*0.88*
WH-75	16	*1.0*
WH-80	17	*1.1*
WH-85	24	*1.5*

Note for circ pump sizing: these flow rates may be greater than those required for boilers of a similar heating capacity.

Table 39 - WH-Series Sound Levels (dBA)*		
MODEL	**1 ft distance**	**3 ft distance**
WH-25	57.1	55.8
WH-45	57.2	56.0
WH-55	56.4	54.9
WH-65	55.7	53.0
WH-75	55.7	53.0
WH-80	55.7	53.0

* With all doors installed.

Table 40: WH-Series Pressure Drop Data

			INDOOR (water 104°F)		OUTDOOR (water 50°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*
WH-25	4	*0.25*	0.8	*5.5*	0.9	*6.2*
	5	*0.32*	1.3	*9.0*	1.4	*10*
	6	*0.38*	1.6	*11*	1.7	*12*
	7	*0.44*	2.1	*14*	2.3	*16*
	8	***0.50***	**3.0**	***21***	**3.2**	***22***
	9	*0.57*	3.1	*21*	3.4	*23*
	10	*0.63*	4.1	*28*	4.4	*30*
	11	*0.69*	4.8	*33*	5.1	*35*
	12	*0.76*	5.7	*39*	6.0	*41*
	13	*0.82*	6.7	*46*	6.9	*48*
WH-45	6	*0.38*	1.6	*11*	1.7	*12*
	7	*0.44*	1.9	*13*	2.1	*14*
	8	*0.50*	2.6	*18*	2.8	*19*
	9	*0.57*	3.2	*22*	3.5	*24*
	10	***0.63***	**3.8**	***26***	**4.0**	***28***
	11	*0.69*	4.3	*30*	4.6	*32*
	12	*0.76*	5.2	*36*	5.5	*38*
	13	*0.82*	5.9	*41*	6.2	*43*
	14	*0.88*	6.7	*46*	7.0	*48*
	15	*0.95*	8.0	*55*	8.2	*57*
WH-55	6	*0.38*	1.1	*7.6*	1.2	*8.3*
	7	*0.44*	1.5	*10*	1.6	*11*
	8	*0.50*	1.8	*12*	1.9	*13*
	9	*0.57*	2.2	*15*	2.4	*17*
	10	*0.63*	2.7	*19*	2.9	*20*
	11	*0.69*	2.8	*19*	3.1	*21*
	12	***0.76***	**3.4**	***23***	**3.7**	***26***
	13	*0.82*	4	*28*	4.3	*30*
	14	*0.88*	4.7	*32*	5	*34*
	15	*0.95*	5.6	*39*	5.8	*40*
	16	*1.01*	6.1	*42*	6.3	*43*

Table 40: (cont'd) WH-Series Pressure Drop Data

			INDOOR (water 104°F)		OUTDOOR (water 50°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*
WH-65	8	*0.50*	1.8	*12*	1.9	*13*
	9	*0.57*	2.1	*14*	2.3	*16*
	10	*0.63*	2.4	*17*	2.6	*18*
	11	*0.69*	2.9	*20*	3.2	*22*
	12	*0.76*	3.6	*25*	3.9	*27*
	13	*0.82*	4.1	*28*	4.4	*30*
	14	***0.88***	**4.7**	***32***	**5**	***34***
	15	*0.95*	5.5	*38*	5.7	*39*
	16	*1.01*	6.3	*43*	6.5	*45*
WH-75	8	*0.50*	1.2	*8.3*	1.3	*9.0*
	9	*0.57*	1.5	*10*	1.6	*11*
	10	*0.63*	1.8	*12*	1.9	*13*
	11	*0.69*	2.1	*14*	2.3	*16*
	12	*0.76*	2.4	*17*	2.6	*18*
	13	*0.82*	2.8	*19*	3.0	*21*
	14	*0.88*	2.9	*20*	3.2	*22*
	15	*0.95*	3.2	*22*	3.5	*24*
	16	***1.01***	**3.8**	***26***	**4.0**	***28***
	17	*1.07*	4.2	*29*	4.4	*30*
WH-80	9	*0.57*	1.2	*8.3*	1.3	*9.0*
	10	*0.63*	1.5	*10*	1.6	*11*
	11	*0.69*	1.8	*12*	1.9	*13*
	12	*0.76*	2.2	*15*	2.4	*17*
	13	*0.82*	2.5	*17*	2.7	*19*
	14	*0.88*	2.9	*20*	3.1	*21*
	15	*0.95*	3.1	*21*	3.3	*23*
	16	*1.01*	3.3	*23*	3.6	*25*
	17	***1.07***	**3.7**	***26***	**4.1**	***28***
	18	*1.14*	4.2	*29*	4.5	*31*
WH-85	22	*1.39*	9.8	*68*	5.2	*36*
	24	***1.51***	**10.9**	***75***	**5.7**	***39***
	26	*1.64*	12.8	*88*	6.8	*47*

Performance Tables

WH-25-H***-B-1S *R134a, 60 Hz, ZR21K5E-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	50	40	8	48	2	8,661	8.2	1,261	117	126	8	120	3	**12,814**	**2.98**
	60	49	8	57	3	12,095	8.1	1,230	116	126	8		4	**16,143**	**3.85**
	70	58	8	66	4	15,494	8.2	1,201	115	125	8		5	**19,442**	**4.74**
	80	67	8	75	5	18,865	8.5	1,176	114	125	8		6	**22,727**	**5.66**
	90	75	8	85	6	22,057	9.1	1,197	114	126	8		7	**25,987**	**6.36**
	50	40	8	48	2	6,575	10.9	1,533	137	144	8	140	3	**11,658**	**2.23**
	60	49	8	58	2	9,703	10.6	1,554	136	144	8		4	**14,858**	**2.80**
	70	58	8	67	3	12,857	10.6	1,545	136	145	8		5	**17,980**	**3.41**
	80	67	8	76	4	16,034	10.7	1,520	135	145	8		5	**21,072**	**4.06**
	90	76	8	85	5	19,295	11.3	1,454	134	145	8		6	**24,104**	**4.86**
	50	41	8	49	1	5,636	14.7	1,452	157	163	8	160	3	**10,442**	**2.11**
	60	50	8	58	2	8,085	14.1	1,632	157	164	8		3	**13,505**	**2.42**
	70	59	8	67	3	10,675	13.8	1,736	156	164	8		4	**16,451**	**2.78**
	80	68	8	77	3	13,399	13.7	1,788	155	164	8		5	**19,351**	**3.17**
	90	77	8	86	4	16,058	14.0	1,824	154	164	8		6	**22,129**	**3.56**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	60**		8						54		8				
	65**		8								8				
	70**		8								8				
	75**		8								8				
	80		8								8				
	85		8								8				
	90		8								8				
	95		8								8				

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	10.0	4.6	0.51	8.8	1.2	2,538	8.2	1,261	47.1	52.0	0.51	49	1.8	**3,754**	**2.98**
	15.6	9.5	0.51	13.9	1.7	3,544	8.1	1,230	46.7	51.9	0.51		2.2	**4,730**	**3.85**
	21.1	14.3	0.51	19.0	2.2	4,540	8.2	1,201	46.2	51.8	0.51		2.7	**5,696**	**4.74**
	26.7	19.2	0.51	24.0	2.6	5,527	8.5	1,176	45.7	51.8	0.51		3.2	**6,659**	**5.66**
	32.2	23.9	0.51	29.2	3.1	6,463	9.1	1,197	45.3	51.9	0.51		3.6	**7,614**	**6.36**
	10.0	4.4	0.51	9.1	0.9	1,926	10.9	1,533	58.4	62.3	0.51	60	1.6	**3,416**	**2.23**
	15.6	9.4	0.51	14.2	1.3	2,843	10.6	1,554	57.9	62.4	0.51		2.1	**4,353**	**2.80**
	21.1	14.2	0.51	19.3	1.8	3,767	10.6	1,545	57.5	62.5	0.51		2.5	**5,268**	**3.41**
	26.7	19.3	0.51	24.4	2.2	4,698	10.7	1,520	57.1	62.6	0.51		2.9	**6,174**	**4.06**
	32.2	24.5	0.51	29.5	2.7	5,653	11.3	1,454	56.7	62.8	0.51		3.4	**7,062**	**4.86**
	10.0	5.1	0.51	9.2	0.8	1,651	14.7	1,452	69.7	73.0	0.51	71	1.5	**3,059**	**2.11**
	15.6	10.0	0.51	14.4	1.1	2,369	14.1	1,632	69.2	73.1	0.51		1.9	**3,957**	**2.42**
	21.1	14.9	0.51	19.6	1.5	3,128	13.8	1,736	68.8	73.2	0.51		2.3	**4,820**	**2.78**
	26.7	19.8	0.51	24.8	1.9	3,926	13.7	1,788	68.4	73.4	0.51		2.7	**5,670**	**3.17**
	32.2	25.1	0.51	30.0	2.2	4,705	14.0	1,824	67.9	73.5	0.51		3.1	**6,484**	**3.56**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (W)	**COP_C**
COOLING* (METRIC)	15.6**		0.51						12		0.51				
	18.3**		0.51								0.51				
	21.1**		0.51								0.51				
	23.9**		0.51								0.51				
	26.7		0.51								0.51				
	29.4		0.51								0.51				
	32.2		0.51								0.51				
	35.0		0.51								0.51				

** Cooling mode is only available on reversing models (HAC/HACW)*

*** Lower cooling mode ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop*

Performance Tables

WH-45-H***-B-1S *R134a, 60 Hz, ZR32K5E-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	50	41	10	47	3	13,423	12.7	1,733	116	128	10	120	4	**19,118**	**3.23**
	60	49	10	57	4	17,402	12.7	1,690	115	128	10		5	**22,952**	**3.98**
	70	57	10	66	4	21,287	12.7	1,661	114	129	10		5	**26,737**	**4.72**
	80	66	10	75	5	25,851	12.7	1,684	113	131	10		6	**31,381**	**5.46**
	90	74	10	84	6	30,477	12.6	1,779	112	133	10		7	**36,328**	**5.98**
	50	41	10	48	2	11,212	16.9	2,153	136	147	10	140	4	**18,340**	**2.50**
	60	49	10	57	3	15,019	17.0	2,102	135	148	10		4	**21,976**	**3.06**
	70	58	10	66	4	18,591	17.0	2,070	135	150	10		5	**25,438**	**3.60**
	80	67	10	76	5	22,668	17.0	2,146	133	151	10		6	**29,774**	**4.07**
	90	76	10	85	5	26,991	16.9	2,197	132	153	10		7	**34,271**	**4.57**
	50	42	10	48	2	9,730	22.2	2,342	156	165	10	160	4	**17,506**	**2.19**
	60	51	10	57	3	12,786	22.0	2,454	155	165	10		4	**20,944**	**2.50**
	70	59	10	67	3	15,744	21.8	2,500	154	166	10		5	**24,059**	**2.82**
	80	68	10	76	4	19,602	21.4	2,544	153	166	10		6	**28,067**	**3.23**
	90	77	10	85	5	23,662	21.1	2,544	152	167	10		6	**32,125**	**3.70**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	60**		10						54		10				
	65**		10								10				
	70**		10								10				
	75**		10								10				
	80		10								10				
	85		10								10				
	90		10								10				
	95		10								10				

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	10.0	5.0	0.63	8.5	1.5	3,933	12.7	1,733	46.7	53.1	0.63	49	2.1	**5,601**	**3.23**
	15.6	9.4	0.63	13.6	1.9	5,099	12.7	1,690	46.2	53.4	0.63		2.6	**6,725**	**3.98**
	21.1	13.9	0.63	18.7	2.4	6,237	12.7	1,661	45.7	54.0	0.63		3.0	**7,834**	**4.72**
	26.7	18.6	0.63	23.8	2.9	7,574	12.7	1,684	45.1	54.9	0.63		3.5	**9,195**	**5.46**
	32.2	23.3	0.63	28.8	3.4	8,930	12.6	1,779	44.4	55.9	0.63		4.0	**10,644**	**5.98**
	10.0	5.0	0.63	8.8	1.2	3,285	16.9	2,153	57.8	64.0	0.63	60	2.0	**5,374**	**2.50**
	15.6	9.6	0.63	13.9	1.7	4,400	17.0	2,102	57.4	64.7	0.63		2.4	**6,439**	**3.06**
	21.1	14.2	0.63	19.0	2.1	5,447	17.0	2,070	57.1	65.3	0.63		2.8	**7,453**	**3.60**
	26.7	19.3	0.63	24.1	2.5	6,642	17.0	2,146	56.3	66.2	0.63		3.3	**8,724**	**4.07**
	32.2	24.4	0.63	29.2	3.0	7,908	16.9	2,197	55.6	67.1	0.63		3.8	**10,041**	**4.57**
	10.0	5.6	0.63	8.9	1.1	2,851	22.2	2,342	69.0	73.9	0.63	71	1.9	**5,129**	**2.19**
	15.6	10.3	0.63	14.1	1.4	3,746	22.0	2,454	68.4	74.1	0.63		2.3	**6,137**	**2.50**
	21.1	15.0	0.63	19.4	1.8	4,613	21.8	2,500	67.9	74.3	0.63		2.7	**7,049**	**2.82**
	26.7	19.8	0.63	24.5	2.2	5,743	21.4	2,544	67.3	74.5	0.63		3.1	**8,224**	**3.23**
	32.2	24.7	0.63	29.6	2.6	6,933	21.1	2,544	66.7	74.9	0.63		3.6	**9,413**	**3.70**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (W)	**COP_C**
COOLING* (METRIC)	15.6**		0.63						12		0.63				
	18.3**		0.63								0.63				
	21.1**		0.63								0.63				
	23.9**		0.63								0.63				
	26.7		0.63								0.63				
	29.4		0.63								0.63				
	32.2		0.63								0.63				
	35.0		0.63								0.63				

* *Cooling mode is only available on reversing models (HAC/HACW)*

** *Lower cooling mode ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop*

Performance Tables

WH-55-H***-B-1S *R134a, 60 Hz, ZR42K5E-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
HEATING	50	41	12	47	3	17,134	16.3	2,229	116	128	12	120	4	**24,523**	**3.22**
	60	49	12	56	4	22,189	16.2	2,172	115	128	12		5	**29,383**	**3.96**
	70	57	12	66	5	27,256	16.2	2,133	114	129	12		6	**34,317**	**4.71**
	80	66	12	75	6	33,165	16.2	2,174	113	131	12		7	**40,367**	**5.44**
	90	74	12	83	7	40,591	16.1	2,381	112	133	12		8	**48,498**	**5.97**
	50	41	12	48	2	14,515	22.4	2,725	136	147	12	140	4	**23,599**	**2.54**
	60	49	12	57	3	19,363	22.5	2,641	135	148	12		5	**28,159**	**3.12**
	70	58	12	66	4	23,871	22.5	2,671	135	150	12		6	**32,770**	**3.59**
	80	67	12	75	5	29,310	22.5	2,797	133	151	12		6	**38,639**	**4.05**
	90	76	12	84	6	36,600	22.4	2,993	132	153	12		8	**46,597**	**4.56**
	50	42	12	48	2	12,446	30.2	3,044	156	165	12	160	4	**22,617**	**2.18**
	60	51	12	57	3	16,188	29.9	3,142	155	165	12		5	**26,692**	**2.49**
	70	59	12	67	3	20,261	29.5	3,247	154	166	12		5	**31,124**	**2.81**
	80	68	12	76	4	25,590	29.0	3,342	153	166	12		6	**36,778**	**3.22**
	90	77	12	85	5	32,497	28.6	3,532	152	167	12		7	**44,335**	**3.68**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	**EER**
COOLING*	60**		12						54		12				
	65**		12								12				
	70**		12								12				
	75**		12								12				
	80		12								12				
	85		12								12				
	90		12								12				
	95		12								12				

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (W)**	**COP_H**
HEATING (METRIC)	10.0	5.0	0.76	8.4	1.6	5,020	16.3	2,229	46.7	53.1	0.76	49	2.3	**7,185**	**3.22**
	15.6	9.4	0.76	13.5	2.1	6,501	16.2	2,172	46.2	53.4	0.76		2.7	**8,609**	**3.96**
	21.1	13.9	0.76	18.6	2.5	7,986	16.2	2,133	45.7	54.0	0.76		3.2	**10,055**	**4.71**
	26.7	18.6	0.76	23.6	3.1	9,717	16.2	2,174	45.1	54.9	0.76		3.7	**11,827**	**5.44**
	32.2	23.3	0.76	28.5	3.8	11,893	16.1	2,381	44.4	55.9	0.76		4.5	**14,210**	**5.97**
	10.0	5.0	0.76	8.7	1.3	4,253	22.4	2,725	57.8	64.0	0.76	60	2.2	**6,914**	**2.54**
	15.6	9.6	0.76	13.8	1.8	5,673	22.5	2,641	57.4	64.7	0.76		2.6	**8,251**	**3.12**
	21.1	14.2	0.76	18.9	2.2	6,994	22.5	2,671	57.1	65.3	0.76		3.0	**9,602**	**3.59**
	26.7	19.3	0.76	24.0	2.7	8,588	22.5	2,797	56.3	66.2	0.76		3.6	**11,321**	**4.05**
	32.2	24.4	0.76	28.8	3.4	10,724	22.4	2,993	55.6	67.1	0.76		4.3	**13,653**	**4.56**
	10.0	5.6	0.76	8.8	1.2	3,647	30.2	3,044	69.0	73.9	0.76	71	2.1	**6,627**	**2.18**
	15.6	10.3	0.76	14.1	1.5	4,743	29.9	3,142	68.4	74.1	0.76		2.5	**7,821**	**2.49**
	21.1	15.0	0.76	19.2	1.9	5,936	29.5	3,247	67.9	74.3	0.76		2.9	**9,119**	**2.81**
	26.7	19.8	0.76	24.3	2.4	7,498	29.0	3,342	67.3	74.5	0.76		3.4	**10,776**	**3.22**
	32.2	24.7	0.76	29.2	3.0	9,522	28.6	3,532	66.7	74.9	0.76		4.1	**12,990**	**3.68**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (W)**	**COP_C**
COOLING* (METRIC)	15.6**		0.76						12		0.76				
	18.3**		0.76								0.76				
	21.1**		0.76								0.76				
	23.9**		0.76								0.76				
	26.7		0.76								0.76				
	29.4		0.76								0.76				
	32.2		0.76								0.76				
	35.0		0.76								0.76				

* *Cooling mode is only available on reversing models (HAC/HACW)*

** *Lower cooling mode ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop*

Performance Tables

WH-65-H***-B-1S *R134a, 60 Hz, ZR54K5E-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
HEATING	50	39	14	47	3	23,044	21.2	2,995	115	127	14	120	5	**32,952**	**3.22**
	60	47	14	56	4	30,152	20.9	3,043	114	127	14		6	**40,223**	**3.87**
	70	56	14	65	5	37,359	20.6	3,064	113	128	14		7	**47,501**	**4.54**
	80	64	14	74	6	44,939	20.3	3,075	112	128	14		8	**55,122**	**5.25**
	90	73	14	83	8	52,528	20	3,092	111	129	14		9	**62,784**	**5.95**
	50	40	14	47	3	19,169	28.6	3,783	135	147	14	140	5	**31,766**	**2.46**
	60	49	14	56	4	26,017	28.1	3,776	135	147	14		6	**38,590**	**2.99**
	70	58	14	65	5	32,742	27.5	3,794	134	147	14		7	**45,378**	**3.50**
	80	66	14	74	6	39,787	26.8	3,815	133	147	14		8	**52,494**	**4.03**
	90	75	14	83	7	46,715	26.2	3,860	132	148	14		9	**59,593**	**4.52**
	50	42	14	48	2	15,380	38	4,493	155	164	14	160	4	**30,401**	**1.98**
	60	51	14	57	3	21,021	37.9	4,706	155	165	14		5	**36,769**	**2.29**
	70	60	14	66	4	27,000	37.7	4,792	154	166	14		6	**43,041**	**2.63**
	80	69	14	75	5	33,238	37.2	4,890	153	167	14		7	**49,613**	**2.97**
	90	78	14	84	6	39,624	36.7	4,932	152	169	14		8	**56,160**	**3.34**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	**EER**
COOLING*	60**		14						54		14				
	65**		14								14				
	70**		14								14				
	75**		14								14				
	80		14								14				
	85		14								14				
	90		14								14				
	95		14								14				

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (W)**	**COP_H**
HEATING (METRIC)	10.0	3.6	0.88	8.2	1.8	6,752	21.2	2,995	46.3	52.8	0.88	49	2.6	**9,655**	**3.22**
	15.6	8.4	0.88	13.2	2.4	8,834	20.9	3,043	45.7	52.9	0.88		3.2	**11,785**	**3.87**
	21.1	13.2	0.88	18.1	3.0	10,946	20.6	3,064	45.1	53.2	0.88		3.8	**13,918**	**4.54**
	26.7	18.0	0.88	23.1	3.6	13,167	20.3	3,075	44.5	53.4	0.88		4.4	**16,150**	**5.25**
	32.2	22.8	0.88	28.1	4.2	15,391	20	3,092	43.9	53.6	0.88		5.0	**18,396**	**5.95**
	10.0	4.4	0.88	8.5	1.5	5,616	28.6	3,783	57.4	63.6	0.88	60	2.5	**9,307**	**2.46**
	15.6	9.3	0.88	13.5	2.1	7,623	28.1	3,776	56.9	63.7	0.88		3.1	**11,307**	**2.99**
	21.1	14.2	0.88	18.5	2.6	9,593	27.5	3,794	56.4	63.9	0.88		3.6	**13,296**	**3.50**
	26.7	18.9	0.88	23.5	3.2	11,657	26.8	3,815	55.8	64.0	0.88		4.2	**15,381**	**4.03**
	32.2	23.6	0.88	28.5	3.7	13,687	26.2	3,860	55.3	64.2	0.88		4.7	**17,461**	**4.52**
	10.0	5.6	0.88	8.8	1.2	4,506	38	4,493	68.6	73.1	0.88	71	2.4	**8,907**	**1.98**
	15.6	10.6	0.88	13.9	1.7	6,159	37.9	4,706	68.1	73.7	0.88		2.9	**10,773**	**2.29**
	21.1	15.6	0.88	19.0	2.1	7,911	37.7	4,792	67.7	74.4	0.88		3.4	**12,611**	**2.63**
	26.7	20.6	0.88	24.0	2.6	9,739	37.2	4,890	67.2	75.1	0.88		3.9	**14,536**	**2.97**
	32.2	25.6	0.88	29.1	3.1	11,610	36.7	4,932	66.7	75.8	0.88		4.5	**16,455**	**3.34**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (W)**	**COP_C**
COOLING* (METRIC)	15.6**		0.88						12		0.88				
	18.3**		0.88								0.88				
	21.1**		0.88								0.88				
	23.9**		0.88								0.88				
	26.7		0.88								0.88				
	29.4		0.88								0.88				
	32.2		0.88								0.88				
	35.0		0.88								0.88				

* *Cooling mode is only available on reversing models (HAC/HACW)*

** *Lower cooling mode ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop*

Performance Tables

WH-75-H***-B-1S *R134a, 60 Hz, ZR61K5E-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	50	40	16	46	4	30,730	19.9	4,000	115	127	16	120	6	**44,124**	**3.23**
	60	49	16	55	5	38,548	20.1	4,026	114	128	16		7	**52,028**	**3.79**
	70	57	16	64	6	46,826	20.3	4,101	113	128	16		8	**60,562**	**4.33**
	80	66	16	73	7	56,291	20.5	4,068	111	128	16		9	**69,915**	**5.04**
	90	75	16	82	8	66,866	20.8	4,027	110	127	16		10	**80,349**	**5.85**
	50	41	16	47	3	26,454	23.5	4,882	135	147	16	140	5	**42,858**	**2.57**
	60	50	16	56	4	34,160	23.6	4,798	134	147	16		6	**50,278**	**3.07**
	70	59	16	65	5	42,259	23.9	4,779	133	147	16		7	**58,311**	**3.57**
	80	67	16	74	6	50,822	24.1	4,862	132	147	16		8	**67,156**	**4.05**
	90	76	16	83	8	60,180	24.4	5,015	131	147	16		10	**77,035**	**4.50**
	50	42	16	47	3	22,619	28.7	5,581	155	167	16	160	5	**41,409**	**2.17**
	60	51	16	56	4	29,011	28.8	5,735	154	167	16		6	**48,324**	**2.47**
	70	61	16	66	5	35,882	29.1	5,923	153	167	16		7	**55,839**	**2.76**
	80	69	16	75	6	43,828	29.3	6,030	152	167	16		8	**64,150**	**3.12**
	90	78	16	83	7	53,059	29.6	6,058	150	167	16		9	**73,478**	**3.55**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	60**		16						54		16				
	65**		16								16				
	70**		16								16				
	75**		16								16				
	80		16								16				
	85		16								16				
	90		16								16				
	95		16								16				

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	10.0	4.4	1.0	7.9	2.1	9,004	19.9	4,000	45.8	53.0	1.0	49	3.1	**12,928**	**3.23**
	15.6	9.2	1.0	12.9	2.7	11,295	20.1	4,026	45.3	53.1	1.0		3.6	**15,244**	**3.79**
	21.1	13.9	1.0	17.9	3.3	13,720	20.3	4,101	44.7	53.1	1.0		4.2	**17,744**	**4.33**
	26.7	18.9	1.0	22.8	3.9	16,493	20.5	4,068	44.1	53.1	1.0		4.9	**20,485**	**5.04**
	32.2	23.9	1.0	27.6	4.6	19,591	20.8	4,027	43.3	53.0	1.0		5.6	**23,542**	**5.85**
	10.0	5.0	1.0	8.2	1.8	7,751	23.5	4,882	57.0	63.8	1.0	60	3.0	**12,557**	**2.57**
	15.6	9.9	1.0	13.2	2.4	10,009	23.6	4,798	56.6	63.9	1.0		3.5	**14,731**	**3.07**
	21.1	14.7	1.0	18.2	2.9	12,382	23.9	4,779	55.9	64.0	1.0		4.1	**17,085**	**3.57**
	26.7	19.4	1.0	23.1	3.5	14,891	24.1	4,862	55.3	64.0	1.0		4.7	**19,677**	**4.05**
	32.2	24.2	1.0	28.0	4.2	17,633	24.4	5,015	54.7	63.8	1.0		5.4	**22,571**	**4.50**
	10.0	5.6	1.0	8.4	1.6	6,627	28.7	5,581	68.1	74.7	1.0	71	2.9	**12,133**	**2.17**
	15.6	10.7	1.0	13.5	2.0	8,500	28.8	5,735	67.6	74.9	1.0		3.4	**14,159**	**2.47**
	21.1	15.8	1.0	18.6	2.5	10,513	29.1	5,923	67.0	75.1	1.0		3.9	**16,361**	**2.76**
	26.7	20.6	1.0	23.6	3.0	12,842	29.3	6,030	66.4	75.1	1.0		4.5	**18,796**	**3.12**
	32.2	25.3	1.0	28.5	3.7	15,546	29.6	6,058	65.7	75.2	1.0		5.1	**21,529**	**3.55**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (W)	**COP_C**
COOLING* (METRIC)	15.6**		1.0						12		1.0				
	18.3**		1.0								1.0				
	21.1**		1.0								1.0				
	23.9**		1.0								1.0				
	26.7		1.0								1.0				
	29.4		1.0								1.0				
	32.2		1.0								1.0				
	35.0		1.0								1.0				

** Cooling mode is only available on reversing models (HAC/HACW)*

*** Lower cooling mode ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop*

Performance Tables

WH-80-H***-B-1S *R134a, 60 Hz, ZR68KCE-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	50	40	17	46	4	34,898	21.6	4,610	114	127	17	120	6	**50,350**	**3.20**
	60	49	17	55	5	43,447	21.9	4,564	113	128	17		7	**58,745**	**3.77**
	70	57	17	64	6	52,420	22.2	4,606	112	128	17		8	**67,860**	**4.32**
	80	66	17	73	7	62,865	22.6	4,586	111	128	17		9	**78,237**	**5.00**
	90	75	17	81	9	74,746	23.1	4,537	109	127	17		11	**89,949**	**5.81**
	50	41	17	47	4	29,891	25.3	5,602	134	147	17	140	6	**48,731**	**2.55**
	60	50	17	56	5	38,263	25.6	5,464	133	147	17		7	**56,631**	**3.04**
	70	59	17	65	6	46,925	26.0	5,450	132	147	17		8	**65,245**	**3.51**
	80	67	17	73	7	56,613	26.5	5,499	131	147	17		9	**75,102**	**4.00**
	90	76	17	82	8	67,310	27.0	5,644	130	147	17		10	**86,295**	**4.48**
	50	42	17	47	3	25,539	30.4	6,392	155	167	17	160	6	**47,076**	**2.16**
	60	51	17	56	4	32,521	30.6	6,507	154	167	17		6	**54,448**	**2.45**
	70	61	17	65	5	39,950	31.0	6,692	153	167	17		7	**62,510**	**2.74**
	80	69	17	74	6	49,035	31.5	6,757	152	167	17		9	**71,816**	**3.11**
	90	78	17	83	7	59,307	32.2	6,845	150	167	17		10	**82,390**	**3.53**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	60**		17						54		17				
	65**		17								17				
	70**		17								17				
	75**		17								17				
	80		17								17				
	85		17								17				
	90		17								17				
	95		17								17				

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	10.0	4.4	1.1	7.7	2.3	10,225	21.6	4,610	45.6	53.0	1.1	49	3.3	**14,752**	**3.20**
	15.6	9.2	1.1	12.7	2.8	12,730	21.9	4,564	45.1	53.1	1.1		3.8	**17,212**	**3.77**
	21.1	13.9	1.1	17.7	3.4	15,359	22.2	4,606	44.4	53.1	1.1		4.4	**19,883**	**4.32**
	26.7	18.9	1.1	22.6	4.1	18,419	22.6	4,586	43.8	53.1	1.1		5.1	**22,923**	**5.00**
	32.2	23.9	1.1	27.3	4.9	21,900	23.1	4,537	43.0	53.0	1.1		5.9	**26,355**	**5.81**
	10.0	5	1.1	8.0	2.0	8,758	25.3	5,602	56.8	63.8	1.1	60	3.2	**14,278**	**2.55**
	15.6	9.9	1.1	13.1	2.5	11,211	25.6	5,464	56.3	63.9	1.1		3.7	**16,593**	**3.04**
	21.1	14.7	1.1	18.0	3.1	13,749	26.0	5,450	55.7	64.0	1.1		4.3	**19,117**	**3.51**
	26.7	19.4	1.1	23.0	3.7	16,587	26.5	5,499	55.1	64.0	1.1		4.9	**22,005**	**4.00**
	32.2	24.2	1.1	27.8	4.4	19,722	27.0	5,644	54.4	63.8	1.1		5.6	**25,284**	**4.48**
	10.0	5.6	1.1	8.3	1.7	7,483	30.4	6,392	68.1	74.7	1.1	71	3.1	**13,793**	**2.16**
	15.6	10.7	1.1	13.4	2.1	9,529	30.6	6,507	67.6	74.9	1.1		3.6	**15,953**	**2.45**
	21.1	15.8	1.1	18.5	2.6	11,705	31.0	6,692	67.0	75.1	1.1		4.1	**18,315**	**2.74**
	26.7	20.6	1.1	23.5	3.2	14,367	31.5	6,757	66.4	75.1	1.1		4.7	**21,042**	**3.11**
	32.2	25.3	1.1	28.3	3.9	17,377	32.2	6,845	65.7	75.2	1.1		5.4	**24,140**	**3.53**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (W)	**COP_C**
COOLING* (METRIC)	15.6**		1.1						12		1.1				
	18.3**		1.1								1.1				
	21.1**		1.1								1.1				
	23.9**		1.1								1.1				
	26.7		1.1								1.1				
	29.4		1.1								1.1				
	32.2		1.1								1.1				
	35.0		1.1								1.1				

* *Cooling mode is only available on reversing models (HAC/HACW)*

** *Lower cooling mode ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop*

Performance Tables

WH-85-H-B-2S *R134a, 60 Hz, ZR94KCE-TF5*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	50	44	24	46	4	45,950	21.4	5,160	115	121	24	120	5	**63,143**	**3.59**
	60	53	24	55	5	56,089	21.7	5,281	114	122	24		6	**73,696**	**4.09**
	70	62	24	64	6	68,094	21.8	5,395	113	122	24		7	**86,090**	**4.68**
	80	70	24	73	7	81,997	21.8	5,488	112	124	24		8	**100,309**	**5.36**
	90	79	24	82	8	97,806	21.6	5,561	110	125	24		10	**116,358**	**6.13**
	50	44	24	47	3	40,019	24.8	6,251	135	142	24	140	5	**60,934**	**2.86**
	60	53	24	56	4	47,938	25.0	6,371	134	142	24		6	**69,265**	**3.19**
	70	62	24	65	5	57,225	25.0	6,439	133	142	24		7	**78,785**	**3.58**
	80	71	24	74	6	67,680	24.8	6,514	133	143	24		8	**89,494**	**4.03**
	90	80	24	83	7	79,473	24.2	6,540	132	143	24		9	**101,368**	**4.54**
	50	45	24	47	3	32,878	29.0	7,533	155	161	24	160	5	**58,169**	**2.26**
	60	54	24	57	3	39,512	29.2	7,717	155	162	24		6	**65,433**	**2.48**
	70	63	24	66	4	46,879	29.3	7,809	154	162	24		6	**73,113**	**2.74**
	80	73	24	75	5	54,940	28.9	7,818	153	163	24		7	**81,204**	**3.04**
	90	82	24	85	5	63,567	28.3	7,789	153	163	24		8	**89,725**	**3.38**

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	10.0	6.4	1.5	7.9	2.1	13,463	21.4	5,160	45.9	49.4	1.5	49	2.9	**18,501**	**3.59**
	15.6	11.4	1.5	13.0	2.6	16,434	21.7	5,281	45.5	49.7	1.5		3.4	**21,593**	**4.09**
	21.1	16.4	1.5	18.0	3.2	19,951	21.8	5,395	44.9	50.0	1.5		4.0	**25,224**	**4.68**
	26.7	21.2	1.5	22.9	3.8	24,025	21.8	5,488	44.2	50.8	1.5		4.6	**29,390**	**5.36**
	32.2	26.1	1.5	27.7	4.5	28,657	21.6	5,561	43.5	51.7	1.5		5.4	**34,093**	**6.13**
	10.0	6.4	1.5	8.1	1.9	11,726	24.8	6,251	57.2	60.8	1.5	60	2.8	**17,854**	**2.86**
	15.6	11.4	1.5	13.3	2.2	14,046	25.0	6,371	56.8	60.9	1.5		3.2	**20,295**	**3.19**
	21.1	16.4	1.5	18.5	2.7	16,767	25.0	6,439	56.3	61.1	1.5		3.7	**23,084**	**3.58**
	26.7	21.4	1.5	23.5	3.1	19,830	24.8	6,514	55.8	61.4	1.5		4.1	**26,222**	**4.03**
	32.2	26.4	1.5	28.5	3.7	23,285	24.2	6,540	55.3	61.7	1.5		4.7	**29,700**	**4.54**
	10.0	7.2	1.5	8.5	1.5	9,633	29.0	7,533	68.4	71.7	1.5	71	2.7	**17,043**	**2.26**
	15.6	12.2	1.5	13.7	1.8	11,577	29.2	7,717	68.1	71.9	1.5		3.0	**19,172**	**2.48**
	21.1	17.2	1.5	18.9	2.2	13,735	29.3	7,809	67.7	72.2	1.5		3.4	**21,422**	**2.74**
	26.7	22.5	1.5	24.1	2.5	16,097	28.9	7,818	67.3	72.5	1.5		3.8	**23,793**	**3.04**
	32.2	27.5	1.5	29.3	2.9	18,625	28.3	7,789	66.9	72.8	1.5		4.2	**26,289**	**3.38**

** Divide by 2.2 for 460VAC, by 2.8 for 575VAC*

WH-Series Electrical Specifications

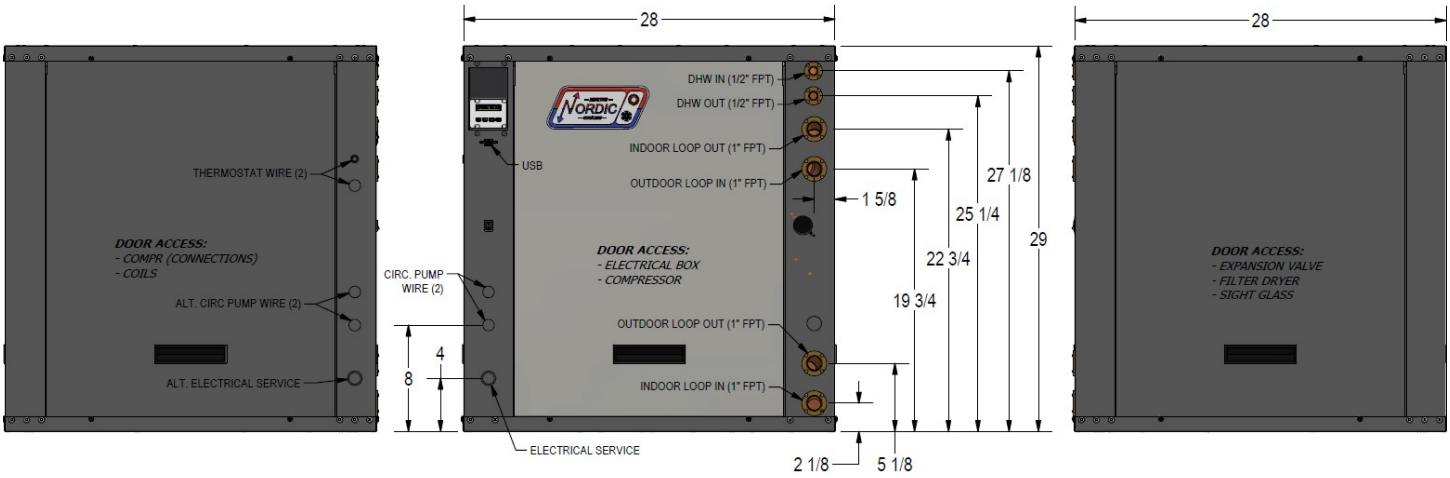
TABLE 41	Code	Power Supply			Compressor		Circulators	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	Max. A	Amps	Amps	Amps	ga
WH-25	1	208/230-1-60	187	253	10.8	56	5.0	16.0	18.7	30	#10-2*
	2	208-3-60	187	229	7.7	58	5.0	12.9	14.8	20	#12-3*
	4	460-3-60	414	506	3.8	29	N/A	4.0	5.0	15	#14-3
	5	-	-	-	-	-	-	-	-	-	-
	6	220-1-50	187	253	9.3	54	5.0	14.5	16.8	30	#10-2
	7	380-3-50	342	418	3.8	29	5.0	9.0	10.0	15	#14-4**
WH-45	1	230-1-60	187	253	15.4	87	5.0	20.6	24.5	40	#8-2*
	2	208-3-60	187	229	10.8	73	5.0	16.0	18.7	30	#10-3*
	4	460-3-60	414	506	5.8	38	N/A	6.0	7.5	15	#14-3
	5	575-3-60	518	632	4.2	28	N/A	4.4	5.5	15	#14-3
	6	220-1-50	187	253	12.8	79	5.0	18.0	21.2	30	#10-2
	7	380-3-50	342	418	5.8	38	5.0	11.0	12.5	20	#12-4**
WH-55	1	230-1-60	187	253	19.9	104	7.0	27.1	32.1	50	#8-2*
	2	208-3-60	187	229	12.8	93	7.0	20.0	23.2	30	#10-3*
	4	460-3-60	414	506	5.8	48	N/A	6.0	7.5	15	#14-3
	5	575-3-60	518	632	4.7	38	N/A	4.9	6.1	15	#14-3
	6	220-1-50	187	253	17.3	129	7.0	24.5	28.8	50	#8-2
	7	380-3-50	342	418	5.8	48	7.0	13.0	14.5	20	#12-4**
WH-65	1	230-1-60	187	253	25.3	137	7.0	32.5	38.8	60	#6-2*
	2	208-3-60	187	229	15.4	114	7.0	22.6	26.5	40	#8-3*
	4	460-3-60	414	506	7.1	52	N/A	7.3	9.1	15	#14-3
	5	575-3-60	518	632	5.3	40	N/A	5.5	6.8	15	#14-3
	6	220-1-50	187	253	19.2	133	7.0	26.4	31.2	50	#8-2
	7	380-3-50	342	418	7.1	52	7.0	14.3	16.1	20	#12-4**
WH-75	1	230-1-60	187	253	23.7	144	7.0	30.9	36.8	60	#6-2*
	2	208-3-60	187	229	18.6	128	7.0	25.8	30.5	50	#8-3*
	4	460-3-60	414	506	9.0	63	N/A	9.2	11.5	20	#12-3
	5	575-3-60	518	632	6.6	49	N/A	6.8	8.5	15	#14-3
	6	-	-	-	-	-	-	-	-	-	-
	7	380-3-50	342	418	9.0	66	7.0	16.2	18.5	30	#10-4**
WH-80	1	230-1-60	187	253	28.8	176	7.0	36.0	43.2	60	#6-2*
	2	208-3-60	187	229	18.6	156	7.0	25.8	30.5	50	#8-3*
	4	460-3-60	414	506	9.0	75	N/A	9.2	11.5	20	#12-3
	5	575-3-60	518	632	7.4	54	N/A	7.6	9.5	15	#14-3
	6	220-1-50	187	253	27.6	150	7.0	34.8	41.7	60	#6-2
	7	380-3-50	342	418	9.0	74	7.0	16.2	18.5	30	#10-4**
WH-85	1	-	-	-	-	-	-	-	-	-	-
	2	208-3-60	187	229	25.3	195	7.0	32.5	38.8	60	#6-3*
	4	460-3-60	414	506	11.5	95	N/A	11.7	14.6	20	#12-3
	5	575-3-60	518	632	10.3	80	N/A	10.5	13.1	20	#12-3
	6	-	-	-	-	-	-	-	-	-	-
	7	380-3-50	342	418	11.5	95	7.0	18.7	21.6	30	#10-4**

* For 208/230-1-60 and 208-3-60, 1 additional conductor (neutral) is required if connecting 115VAC circulators to the unit.

** For 380-3-50, only 3 conductors are required (no neutral) if not using desuperheater and not connecting 220V circulators to the unit.

Dimensions: WH-25/45/55

All dimensions in inches.



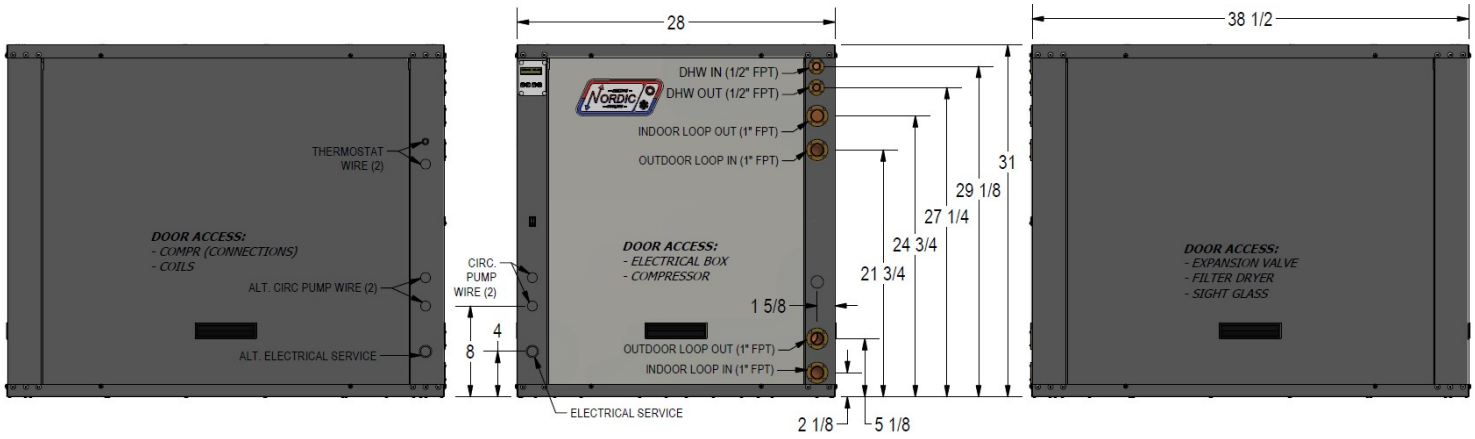
LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE: **2 FT**

RECOMMENDED RIGHT SIDE CLEARANCE: **2 FT**

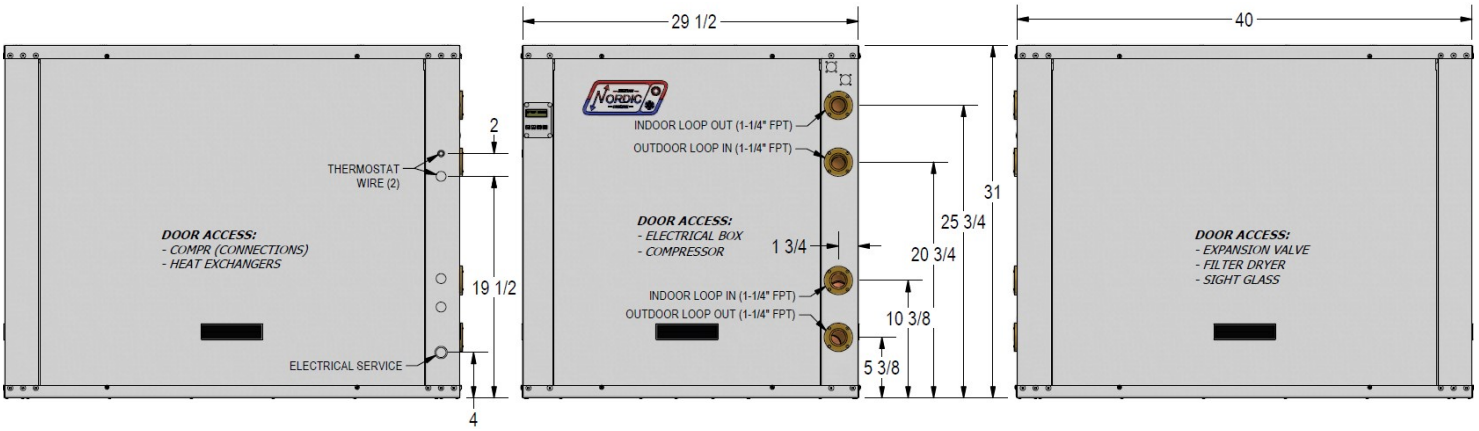
NO BACK CLEARANCE REQUIRED

Dimensions: WH-65/75/80



CLEARANCES: AS ABOVE

Dimensions: WH-85



CLEARANCES: AS ABOVE

Model Specific Information: WP-Series

Table 42 - WP-Series Refrigerant Charge

MODEL	lb	*kg*	Refrigerant	Oil Type
WP-45	5.5	*2.5*	R410a	POE
WP-55	7.0	*3.2*	R410a	POE
WP-65	8.5	*3.9*	R410a	POE
WP-75	9.0	*4.1*	R410a	POE
WP-80	10.0	*4.5*	R410a	POE

- Oil capacity is marked on the compressor label.
- **Refrigerant charge is subject to revision;** actual charge is indicated on the unit nameplate.

Table 43 - WP-Series Shipping Information

MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm) L	W	H
WP-45	320 (145)	48 (122)	37 (94)	37 (94)
WP-55	380 (173)	48 (122)	37 (94)	37 (94)
WP-65	480 (218)	48 (122)	37 (94)	37 (94)
WP-75	520 (236)	48 (122)	37 (94)	37 (94)
WP-80	570 (259)	48 (122)	37 (94)	37 (94)

Table 44 - WP-Series Operating Temperature Limits

Loop	Mode	Parameter	(°F)	*(°C)*	Note
Pool	Heating	Minimum EWT	50	*10*	Reduce flow if necessary during startup.
	Heating	Maximum LWT	**105**	***38***	
Outdoor	Heating	Minimum ELT	39	*4*	Ground water (open loop) system.
	Heating	Minimum ELT	23	*-5*	Ground loop system. Adequate freeze protection required.

* Values in this table are for rated liquid flow values.

Table 45 - WP-Series Required Loop Flow Rates

	OUTDOOR LOOP		POOL WATER LOOP	
MODEL	**gpm**	***L/s***	**gpm**	***L/s***
WP-45	10	*0.63*	21	*1.3*
WP-55	12	*0.76*	28	*1.8*
WP-65	14	*0.88*	35	*2.2*
WP-75	16	*1.0*	40	*2.5*
WP-80	17	*1.1*	45	*2.8*

Note for pool pump sizing: These flow rates are greater than those required for space heating heat pumps of a similar heating capacity.

Table 46 - Sound Levels (dBA)*

MODEL	1 ft distance	3 ft distance
WP-45	57.2	56.0
WP-55	56.4	54.9
WP-65	55.7	53.0
WP-75	55.7	53.0
WP-80	55.7	53.0

* With all doors installed.

Table 47 - WP-Series Pool Water Pressure Drop (all model sizes)

Flow (gpm)	psi	***kPa***	Comments
20	1.5	*10*	
21	1.6	*11*	This is flow required for WP-45.
25	2.2	*15*	
28	2.6	*18*	This is flow required for WP-55.
30	2.9	*20*	
35	3.8	*26*	This is flow required for WP-65.
40	4.7	*32*	This is flow required for WP-75.
45	5.8	*40*	This is flow required for WP-80.
50	6.9	*48*	
60	9.5	*66*	

Table 48: WP Outdoor Loop Pressure Drop			OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% prop. glycol 32°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*	psi	*kPa*
WP-45	6	*0.38*	1.7	*12*	2.0	*14*	2.6	*18*
	7	*0.44*	2.1	*14*	2.5	*17*	3.3	*23*
	8	*0.50*	2.8	*19*	3.0	*21*	4.0	*27*
	9	*0.57*	3.5	*24*	3.8	*26*	5.0	*34*
	10	***0.63***	**4.0**	***28***	**4.7**	***32***	**6.2**	***43***
	11	*0.69*	4.6	*32*	5.5	*38*	7.2	*50*
	12	*0.76*	5.5	*38*	6.6	*45*	8.7	*60*
	13	*0.82*	6.2	*43*	7.4	*51*	9.7	*67*
	14	*0.88*	7.0	*48*	8.6	*59*	11.3	*78*
	15	*0.95*	8.2	*57*	9.5	*65*	12.5	*86*
WP-55	6	*0.38*	1.2	*8.3*	1.3	*9.0*	1.7	*12*
	7	*0.44*	1.6	*11*	1.6	*11*	2.1	*14*
	8	*0.50*	1.9	*13*	2.1	*14*	2.8	*19*
	9	*0.57*	2.4	*17*	2.4	*17*	3.2	*22*
	10	*0.63*	2.9	*20*	3.1	*21*	4.1	*28*
	11	*0.69*	3.1	*21*	3.6	*25*	4.7	*33*
	12	***0.76***	**3.7**	***26***	**4.4**	***30***	**5.8**	***40***
	13	*0.82*	4.3	*30*	5	*34*	6.6	*45*
	14	*0.88*	5	*34*	5.7	*39*	7.5	*52*
	15	*0.95*	5.8	*40*	6.4	*44*	8.4	*58*
	16	*1.01*	6.3	*43*	7.1	*49*	9.3	*64*
WP-65	8	*0.50*	1.9	*13*	2.2	*15*	2.9	*20*
	9	*0.57*	2.3	*16*	2.7	*19*	3.6	*24*
	10	*0.63*	2.6	*18*	3.3	*23*	4.3	*30*
	11	*0.69*	3.2	*22*	4	*28*	5.3	*36*
	12	*0.76*	3.9	*27*	4.6	*32*	6.0	*42*
	13	*0.82*	4.4	*30*	5.2	*36*	6.8	*47*
	14	***0.88***	**5**	***34***	**5.8**	***40***	**7.6**	***53***
	15	*0.95*	5.7	*39*	6.5	*45*	8.5	*59*
	16	*1.01*	6.5	*45*	7.3	*50*	9.6	*66*
WP-75 **WP-80**	8	*0.50*	1.3	*9.0*	1.3	*9.0*	1.7	*12*
	9	*0.57*	1.6	*11*	1.6	*11*	2.1	*14*
	10	*0.63*	1.9	*13*	2.1	*14*	2.8	*19*
	11	*0.69*	2.3	*16*	2.4	*17*	3.2	*22*
	12	*0.76*	2.6	*18*	2.9	*20*	3.8	*26*
	13	*0.82*	3.0	*21*	3.3	*23*	4.3	*30*
	14	*0.88*	3.2	*22*	3.7	*26*	4.9	*33*
	15	*0.95*	3.5	*24*	4.1	*28*	5.4	*37*
	16	***1.01***	**4.0**	***28***	**4.7**	***32***	**6.2**	***43***
	17	*1.07*	4.4	*30*	5.2	*36*	6.8	*47*

WP-Series Capacity Ratings

The tables show the heat pump performance when heating a pool to 80°F (27°C), or a hot tub to 104°F (40°C).
All data is for ***60 Hz operation*** with ***water*** as the pool loop fluid.

Table 49 - Standard Capacity Ratings: HEATING							
Model	Out-door Loop Flow	Pool Water Flow	Pool Water LWT	Ground Loop ELT	Input Energy (W)	Capacity (Btu/hr)	COP_H
WP-45	8.0 gpm	21 gpm	80°F	50°F	1790	37,900	6.2
				32°F	1700	28,300	4.9
			104°F	50°F	2455	32,700	3.9
				32°F	2309	24,400	3.1
WP-55	10.0 gpm	28 gpm	80°F	50°F	2600	52,200	5.8
				32°F	2410	40,100	4.9
			104°F	50°F	3565	45,000	3.7
				32°F	3270	34,600	3.1
WP-65	12.0 gpm	35 gpm	80°F	50°F	3170	63,700	5.8
				32°F	6990	49,400	4.9
			104°F	50°F	4345	54,900	3.7
				32°F	4025	42,600	3.1
WP-75	14.0 gpm	40 gpm	80°F	50°F	3540	74,800	6.2
				32°F	3410	56,800	4.9
			104°F	50°F	4845	64,500	3.9
				32°F	4630	49,000	3.1
WP-80	16.0 gpm	45 gpm	80°F	50°F	4450	87,000	5.8
				32°F	4320	66,700	4.8
			104°F	50°F	6095	75,000	3.7
				32°F	5860	57,500	3.0

METRIC

Table 49a - Standard Capacity Ratings: HEATING (METRIC)							
Model	Out-door Loop Flow	Pool Water Flow	Pool Water LWT	Ground Loop ELT	Input Energy (W)	Capacity (kW)	COP_H
WP-45	0.50 L/s	1.3 L/s	27°C	10°C	1790	11.1	6.2
				0°C	1700	8.3	4.9
			40°C	10°C	2455	9.6	3.9
				0°C	2309	7.2	3.1
WP-55	0.63 L/s	1.8 L/s	27°C	10°C	2600	15.3	5.8
				0°C	2410	11.8	4.9
			40°C	10°C	3565	13.2	3.7
				0°C	3270	10.1	3.1
WP-65	0.76 L/s	2.2 L/s	27°C	10°C	3170	18.7	5.8
				0°C	6990	14.5	4.9
			40°C	10°C	4345	16.1	3.7
				0°C	4025	12.5	3.1
WP-75	0.88 L/s	2.5 L/s	27°C	10°C	3540	21.9	6.2
				0°C	3410	16.6	4.9
			40°C	10°C	4845	18.9	3.9
				0°C	4630	14.4	3.1
WP-80	1.0 L/s	2.8 L/s	27°C	10°C	4450	25.5	5.8
				0°C	4320	19.5	4.8
			40°C	10°C	6095	22.0	3.7
				0°C	5860	16.9	3.0

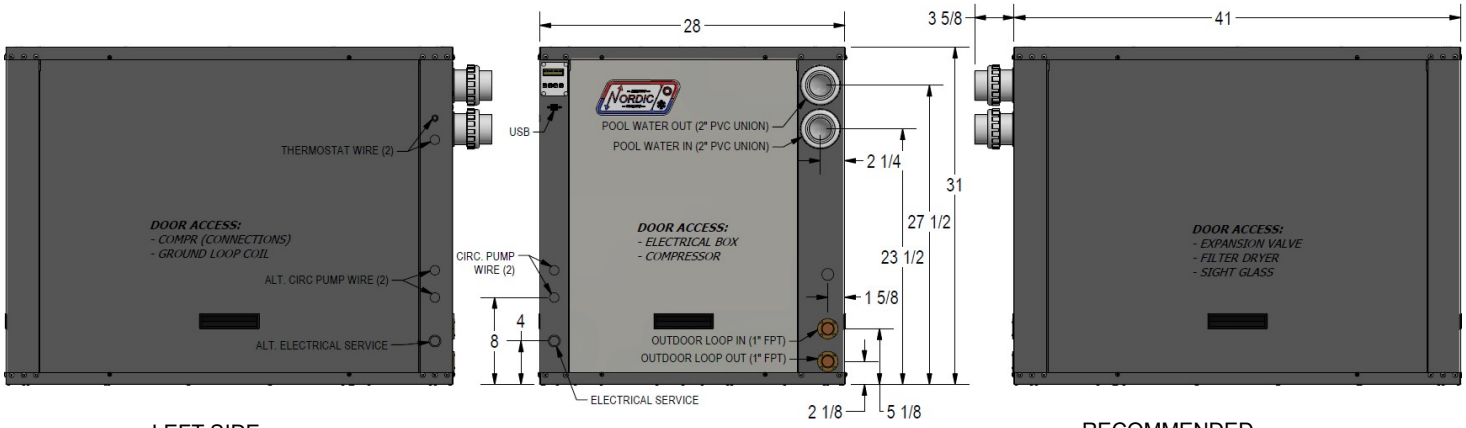
WP-Series Electrical Specifications

TABLE 50	Code	Power Supply			Compressor		Circulators	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	Max. A	Amps	Amps	Amps	ga
WP-45	1	208/230-1-60	187	253	15.4	84	5.0	20.6	24.5	40	#8-2*
	2	208-3-60	187	229	10.4	73	5.0	15.6	18.2	30	#10-3*
	4	460-3-60	414	506	5.8	38	-	6.0	7.5	15	#14-3
	5	575-3-60	518	632	3.8	37	-	4.0	5.0	15	#14-3
	6	220-1-50	187	253	13.5	67	5.0	18.7	22.1	30	#10-2
	7	380-3-50	342	418	5.4	38	5.0	10.6	12.0	15	#14-3*
WP-55	1	208/230-1-60	187	253	19.6	130	7.0	26.8	31.7	50	#8-2*
	2	208-3-60	187	229	13.7	83	7.0	20.9	24.3	40	#8-3*
	4	460-3-60	414	506	6.2	41	-	6.4	8.0	15	#14-3
	5	575-3-60	518	632	4.8	33	-	5.0	6.2	15	#14-3
	6	220-1-50	187	253	15.9	98	7.0	21.1	25.1	40	#8-2
	7	380-3-50	342	418	6.1	43	7.0	13.3	14.8	15	#14-3*
WP-65	1	208/230-1-60	187	253	24.7	166	7.0	31.9	38.1	60	#6-2*
	2	208-3-60	187	229	15.6	110	7.0	22.8	26.7	40	#8-3*
	4	460-3-60	414	506	7.8	52	-	8.0	10.0	15	#14-3
	5	575-3-60	518	632	5.8	39	-	6.0	7.5	15	#14-3
	6	220-1-50	187	253	20.2	128	7.0	27.4	32.5	50	#8-2
	7	380-3-50	342	418	7.8	52	7.0	15.0	17.0	20	#12-3*
WP-75	1	208/230-1-60	187	253	30.8	178	7.0	38.0	45.7	60	#6-2*
	2	208-3-60	187	229	19.6	136	7.0	26.8	31.7	50	#8-3*
	4	460-3-60	414	506	8.2	66	-	8.4	10.5	20	#12-3
	5	575-3-60	518	632	6.6	55	-	6.8	8.5	15	#14-3
	6	-	-	-	-	-	-	-	-	-	-
	7	380-3-50	342	418	8.0	67	7.0	15.2	17.2	25	#10-3*
WP-80	1	208/230-1-60	187	253	32.1	148	7.0	39.3	47.3	60	#6-2*
	2	208-3-60	187	229	22.4	149	7.0	29.6	35.2	50	#8-3*
	4	460-3-60	414	506	10.6	75	-	10.8	13.5	20	#12-3
	5	575-3-60	518	632	7.7	54	-	7.9	9.8	20	#12-3
	6	220-1-50	187	253	29.5	176	7.0	36.7	44.1	60	#6-2
	7	380-3-50	342	418	10.6	74	7.0	17.8	20.5	30	#10-3*

* For 208/230-1-60, 208-3-60, & 380-3-50: 1 additional conductor (neutral) is required if connecting 115VAC circulators to the unit.

Dimensions: WP-45/55/65/75/80

All dimensions in inches.

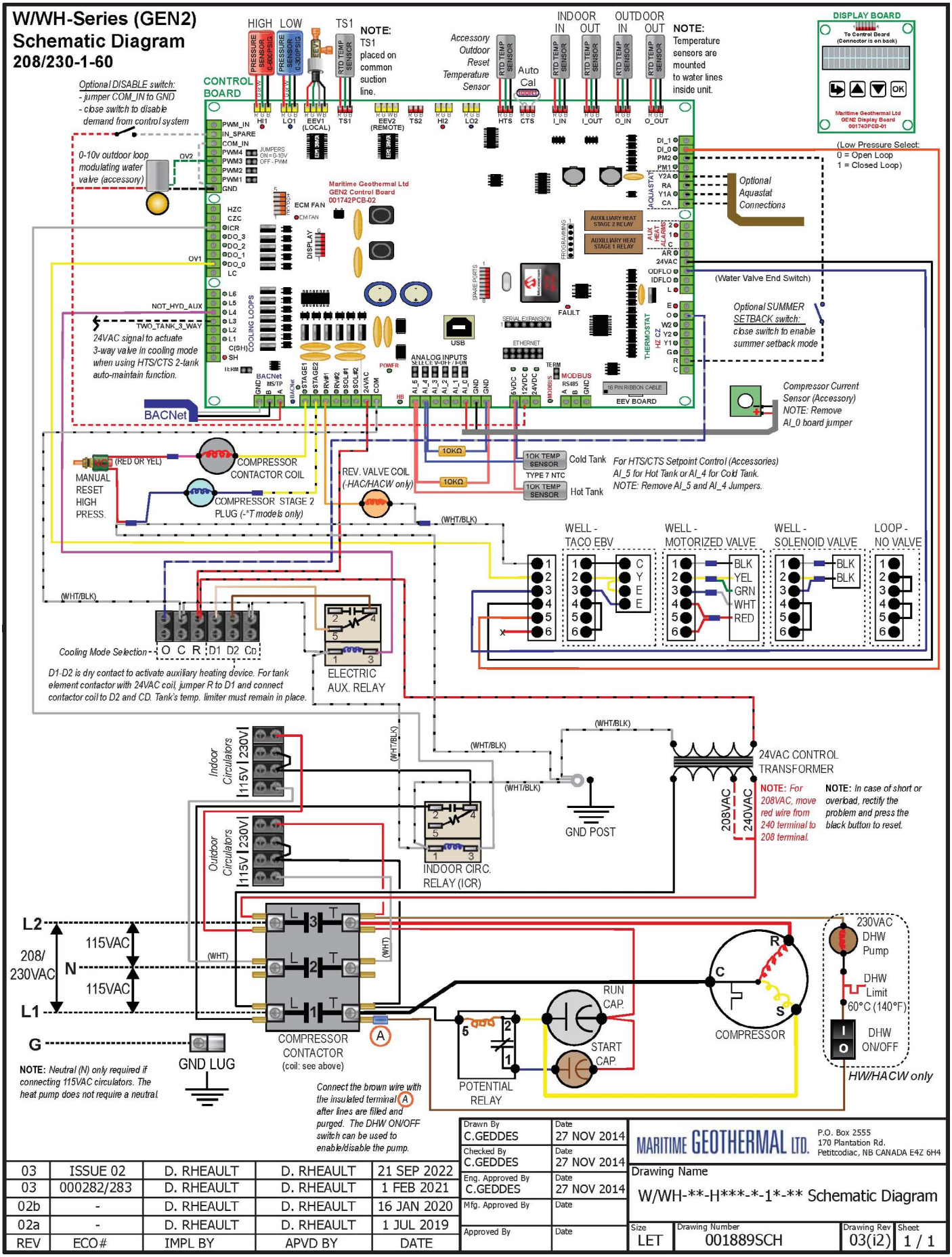


LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE: **3 FT** (NO BACK CLEARANCE REQUIRED)

RECOMMENDED RIGHT SIDE CLEARANCE: **2 FT**

W/WH/WP-Series Wiring Diagram (208/230-1-60)



03	ISSUE 02	D. RHEAULT	D. RHEAULT	21 SEP 2022
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020
02a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
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Drawn By	C.GEDDES	Date	27 NOV 2014
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Eng. Approved By	C.GEDDES	Date	27 NOV 2014
Mfg. Approved By		Date	
Approved By		Date	

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Drawing Name: W/WH-**-H***-*-1*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001889SCH	03(i2)	1 / 1

W/WH/WP-Series Electrical Box Layout (208/230-1-60)

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	**External**	**Activation**
SYSTEM_Y1A	Y1A	Compressor Stage 1
SYSTEM_Y2A	Y2A	Compressor Stage 2 (-*T models only)
SYSTEM_O	O	OFF=heating, ON=cooling (-HAC/HACW models only)

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

Use twisted pair shielded, conductor cable to connect the BACNet connections to the control board connector.
A - Communication (+)
B - Communication (-)
GND - Ground

EXTERNAL CONTROL CONNECTIONS (24VAC)

For cooling mode activation (reversing -HAC/HACW models only), use 18-2 cable to connect terminals at terminal strip through a dry contact:
O - Cooling Mode (Active) / Heating Mode (Inactive)
C - Common (for use with R to power external device)
R - 24VAC Hot

If using an external aquastat ("Signals" control method), use these right side board connections for compressor control:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor Stage 1
Y2A - Compressor Stage 2 (-*T models only)

A dry contact connection between R/RA and an external control connection (Y1A, Y2A, O) will activate the external control signal input to the control board.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

D1 D2	Dry contacts, closed during call for auxiliary heat
R D1 D2 CD	To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

CIRCULATOR CONNECTIONS (230/115VAC)

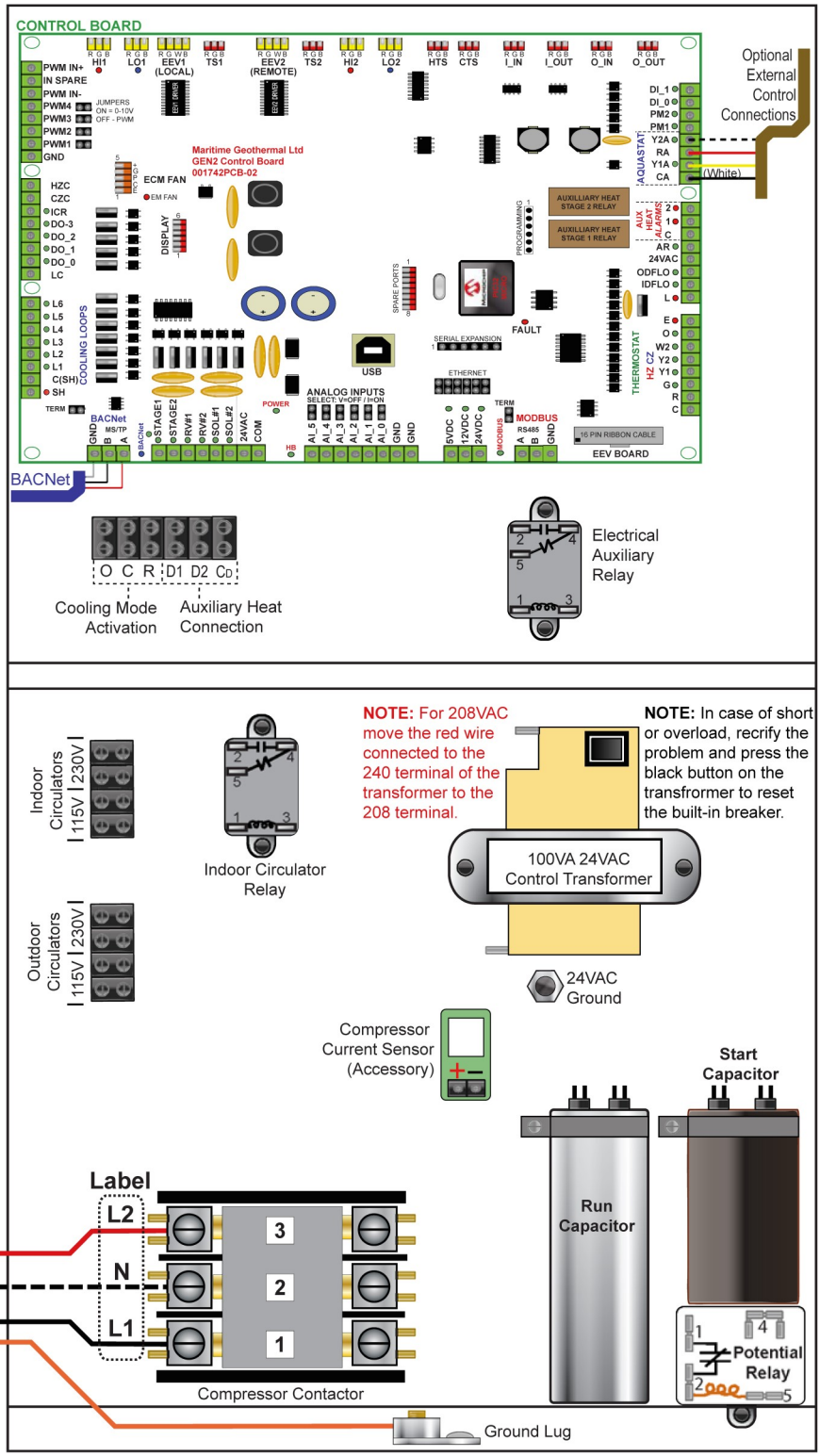
REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 115VAC circulators to 115V
Connect 230VAC circulators to 230V

POWER SUPPLY CONNECTIONS

*NOTE: Neutral (N) is only required if connecting 115VAC circulators. The heat pump itself does not require a neutral.

208/230/115VAC CONNECTIONS		
Wire	**Colour**	**Contactor (Label)**
Line 2	Red	L2
Neutral*	White	N*
Line 1	Black	L1
Connect "GND" to ground lug.		

W/WH-Series Electrical Box Diagram 208/230-1-60



Drawn By	Date
C.GEDDES	27 NOV 2014
Checked By	Date
C.GEDDES	27 NOV 2014
Eng. Approved By	Date
C.GEDDES	27 NOV 2014
Mfg. Approved By	Date
Approved By	Date

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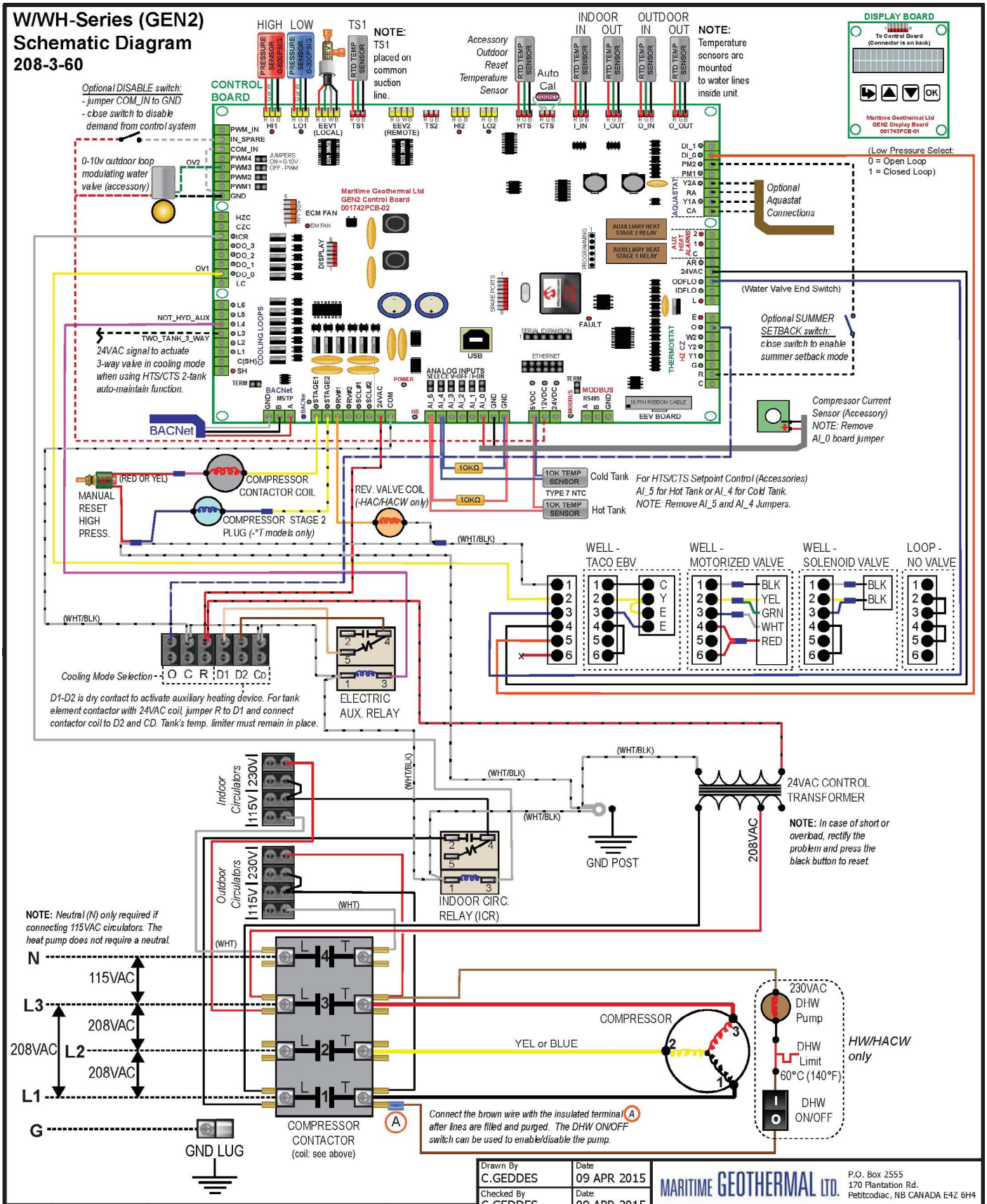
Drawing Name: W/WH-**-H***-*-1*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001890ELB	03	1 / 1

REV	ECO#	IMPL BY	APVD BY	DATE
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020
02a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
02	000254	D. RHEAULT	D. RHEAULT	15 AUG 2017

W/WH/WP-Series Wiring Diagram (208-3-60)



04	ISSUE 02	D. RHEAULT	D. RHEAULT	21 SEP 2022
04	000296	D. RHEAULT	D. RHEAULT	10 DEC 2021
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
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Drawn By	C.GEDDES	Date	09 APR 2015
Checked By	C.GEDDES	Date	09 APR 2015
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Mfg. Approved By		Date	
Approved By		Date	

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Drawing Name: W/WH-**-H***-*-2*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001934SCH	04(i2)	1 / 1

W/WH/WP-Series Electrical Box Layout (208-3-60)

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	External	Activation
SYSTEM_Y1A	Y1A	Compressor Stage 1
SYSTEM_Y2A	Y2A	Compressor Stage 2 (-*T models only)
SYSTEM_O	O	OFF=heating, ON=cooling (-HAC/HACW models only)

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

Use twisted pair shielded, conductor cable to connect the BACNet connections to the control board connector.
A - Communication (+)
B - Communication (-)
GND - Ground

EXTERNAL CONTROL CONNECTIONS (24VAC)

For cooling mode activation (reversing -HAC/HACW models only), use 18-2 cable to connect terminals at terminal strip through a dry contact:
O - Cooling Mode (Active) / Heating Mode (Inactive)
C - Common (for use with R to power external device)
R - 24VAC Hot

If using an external aquastat ("Signals" control method), use these right side board connections for compressor control:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor Stage 1
Y2A - Compressor Stage 2 (-*T models only)

A dry contact connection between R/RA and an external control connection (Y1A, Y2A, O) will activate the external control signal input to the control board.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

D1, D2 — Dry contacts, closed during call for auxiliary heat

R, D1, D2, CD — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

CIRCULATOR CONNECTIONS (230/115VAC)

REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 115VAC circulators to 115V
Connect 230VAC circulators to 230V

*** IMPORTANT NOTE FOR 3 PHASE POWER ***

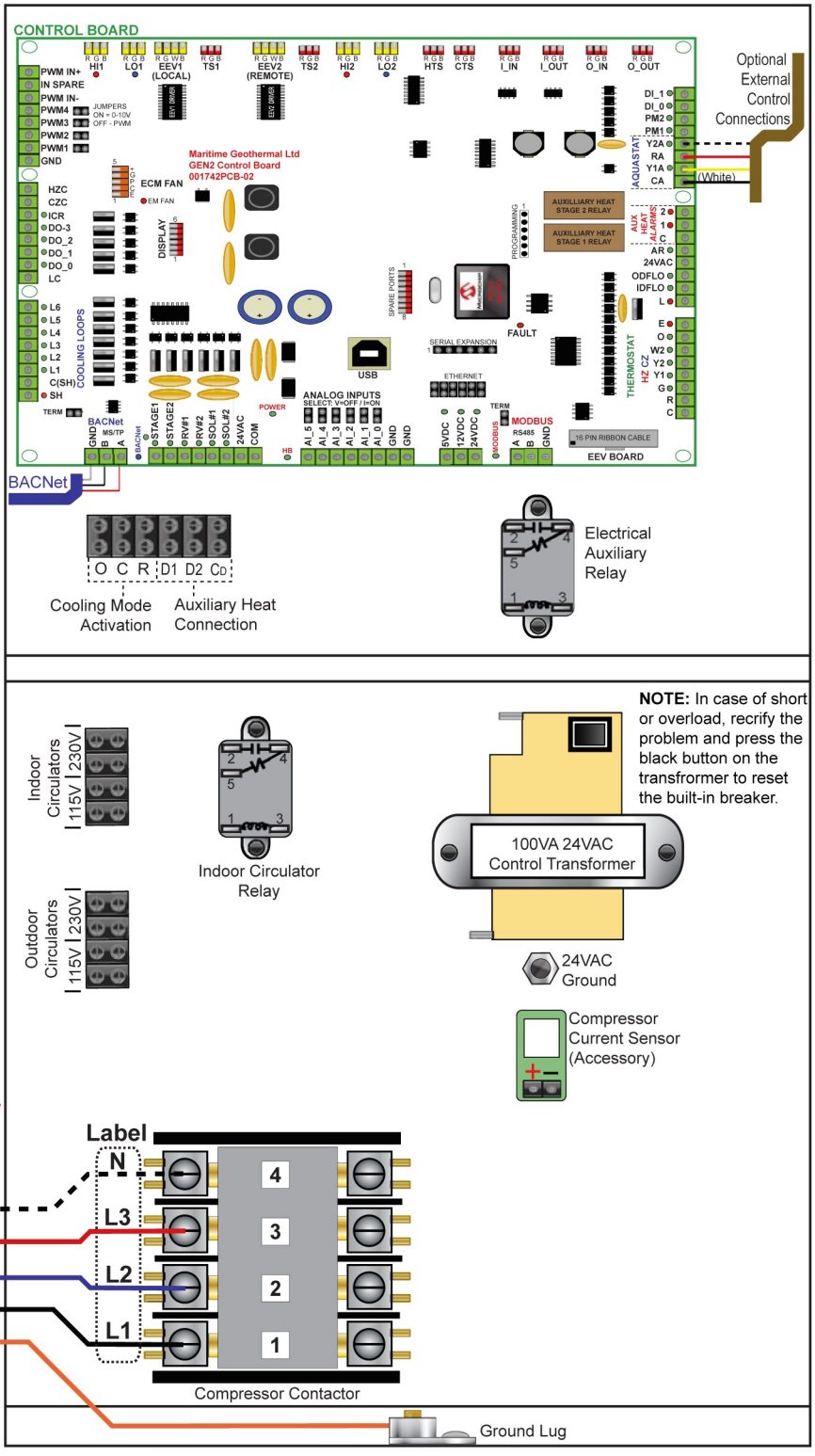
The unit is eqipped with a scroll compressor. If on initial startup the compressor is noisy and not pumping, reverse the L1 and L2 supply wires.

POWER SUPPLY CONNECTIONS

*NOTE: Neutral (N) is only required if connecting 115VAC circulators. The heat pump itself does not require a neutral.

208/115VAC CONNECTIONS		
Wire	Colour	Contactor (Label)
Neutral*	White	N*
Line 3	Red	L3
Line 2	Blue	L2
Line 1	Black	L1
Connect "GND" to ground lug.		

W/WH-Series Electrical Box Diagram
208-3-60



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03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020
02a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
02	000254	D. RHEAULT	D. RHEAULT	15 AUG 2017

Drawn By: C.GEDDES	Date: 09 APR 2015	
Checked By: C.GEDDES	Date: 09 APR 2015	
Eng. Approved By: C.GEDDES	Date: 09 APR 2015	
Mfg. Approved By	Date	
Approved By	Date	

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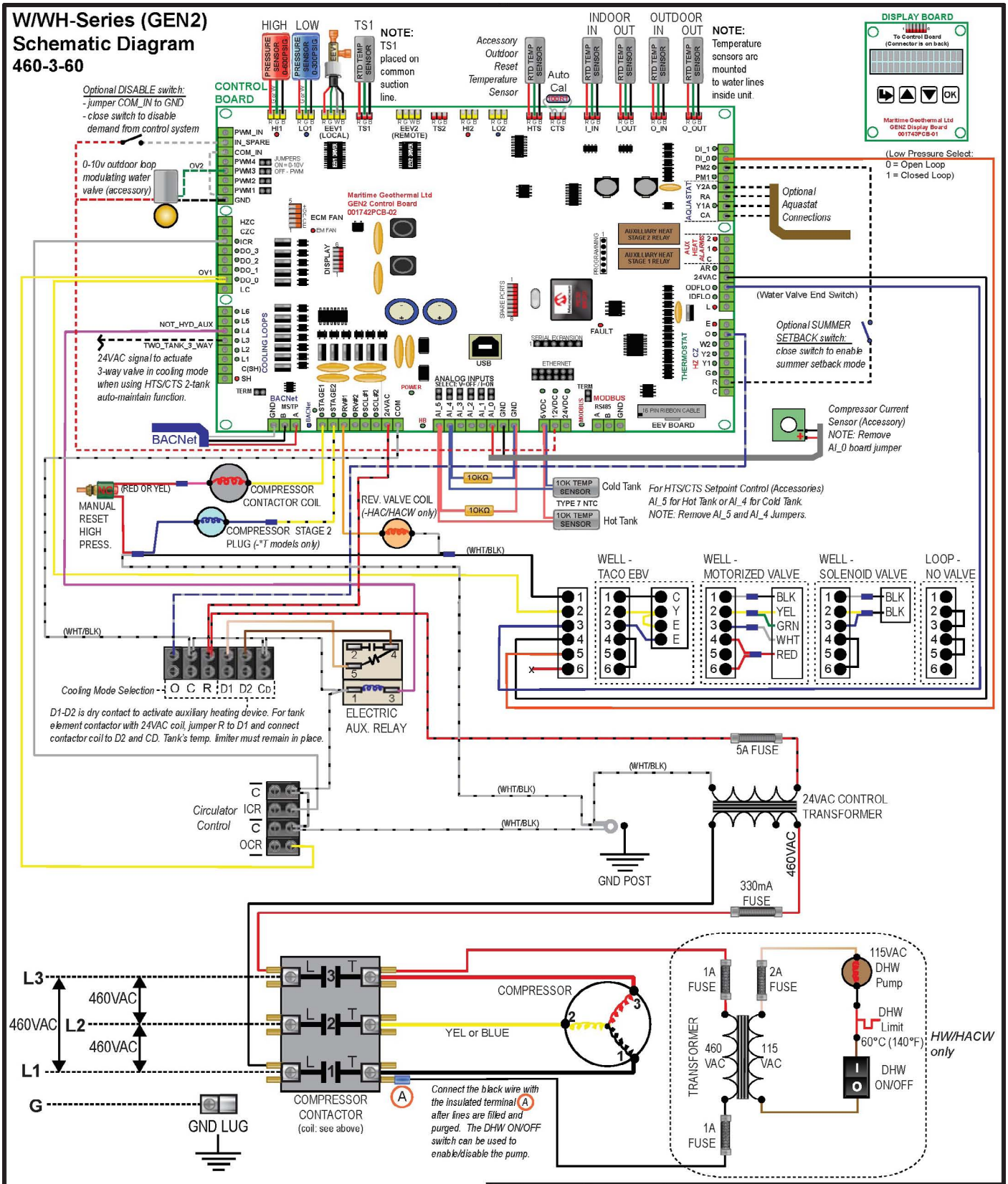
Drawing Name: W/WH-**-H***-*-2*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001935ELB	03	1 / 1

W/WH/WP-Series Wiring Diagram (460-3-60)



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04	ISSUE 02	D. RHEAULT	D. RHEAULT	21 SEP 2022
04	000296	D. RHEAULT	D. RHEAULT	10 DEC 2021
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020

Drawn By	C.GEDDES	Date	09 APR 2015
Checked By	C.GEDDES	Date	09 APR 2015
Eng. Approved By	C.GEDDES	Date	09 APR 2015
Mfg. Approved By		Date	
Approved By		Date	

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Drawing Name: W/WH-**-H***-*-4*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001936SCH	04(i2)	1 / 1

W/WH/WP-Series Electrical Box Layout (460-3-60)

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	External	Activation
SYSTEM_Y1A	Y1A	Compressor Stage 1
SYSTEM_Y2A	Y2A	Compressor Stage 2 (-*T models only)
SYSTEM_O	O	OFF=heating, ON=cooling (-HAC/HACW models only)

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

Use twisted pair shielded, conductor cable to connect the BACNet connections to the control board connector.
A - Communication (+)
B - Communication (-)
GND - Ground

EXTERNAL CONTROL CONNECTIONS (24VAC)

For cooling mode activation (reversing -HAC/HACW models only), use 18-2 cable to connect terminals at terminal strip through a dry contact:
O - Cooling Mode (Active) / Heating Mode (Inactive)
C - Common (for use with R to power external device)
R - 24VAC Hot

If using an external aquastat ("Signals" control method), use these right side board connections for compressor control:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor Stage 1
Y2A - Compressor Stage 2 (-*T models only)

A dry contact connection between R/RA and an external control connection (Y1A, Y2A, O) will activate the external control signal input to the control board.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

D1, D2 — Dry contacts, closed during call for auxiliary heat

R, D1, D2, CD — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

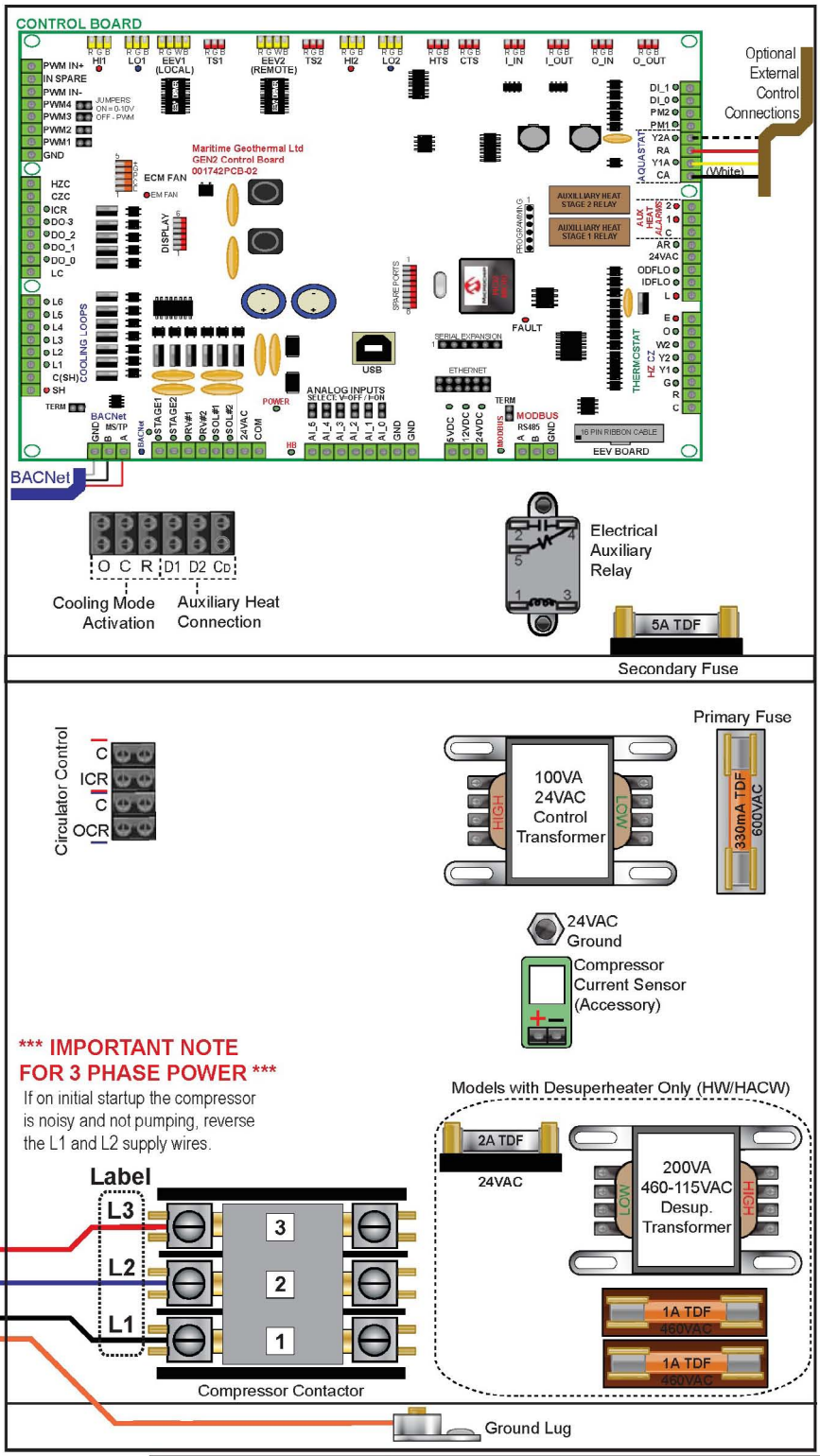
CIRCULATOR CONTROL CONNECTIONS (24VAC)

Use an 18-2 conductor cable for each pair. Connect output signals as per the descriptions below:
C - 24VAC Common
ICR - 24VAC Indoor Circulator Control (Hot)
C - 24VAC Common
OCR - 24VAC Outdoor Circulator Control (Hot)
The ICR and OCR pins will start / stop the circulators.
Max load 500mA each OCR and ICR.

POWER SUPPLY CONNECTIONS

460-3-60VAC CONNECTIONS		
Wire	Colour	Contactor (Label)
Line 3	Red	L3
Line 2	Blue	L2
Line 1	Black	L1
Connect "GND" to ground lug.		

W/WH-Series Electrical Box Diagram 460-3-60



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02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020
02a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
02	000254	D. RHEAULT	D. RHEAULT	15 AUG 2017

Drawn By: C.GEDDES	Date: 09 APR 2015	
Checked By: C.GEDDES	Date: 09 APR 2015	
Eng. Approved By: C.GEDDES	Date: 09 APR 2015	
Mfg. Approved By	Date	
Approved By	Date	

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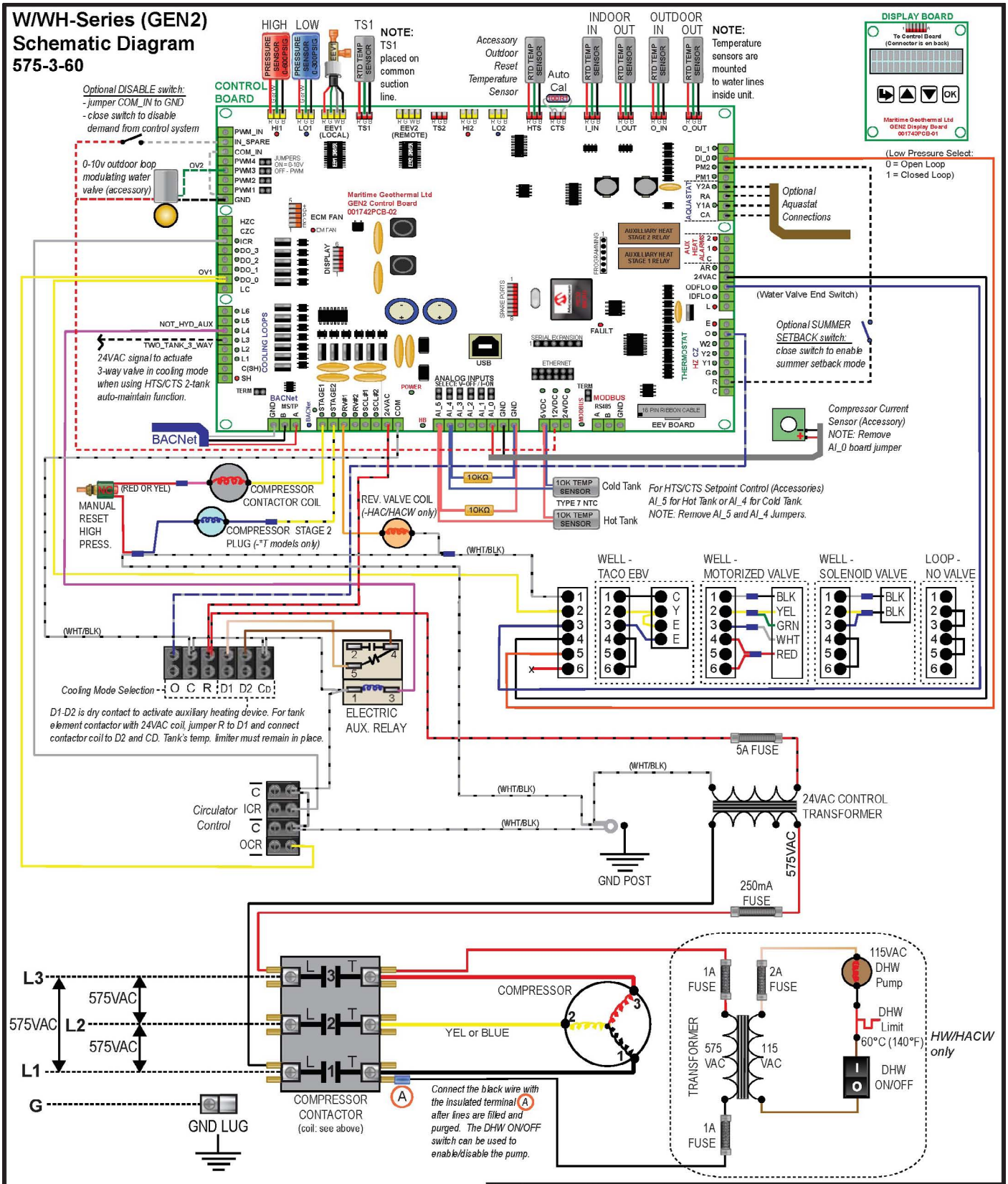
Drawing Name: W/WH-**-H***-*-4*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001937ELB	03	1 / 1

W/WH/WP-Series Wiring Diagram (575-3-60)



04	ISSUE 02	D. RHEAULT	D. RHEAULT	21 SEP 2022
04	000296	D. RHEAULT	D. RHEAULT	10 DEC 2021
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By	C.GEDDES	Date	09 APR 2015
Checked By	C.GEDDES	Date	09 APR 2015
Eng. Approved By	C.GEDDES	Date	09 APR 2015
Mfg. Approved By		Date	
Approved By		Date	

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Drawing Name: W/WH-**-H***-*-5*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001938SCH	04(i2)	1 / 1

W/WH/WP-Series Electrical Box Layout (575-3-60)

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	External	Activation
SYSTEM_Y1A	Y1A	Compressor Stage 1
SYSTEM_Y2A	Y2A	Compressor Stage 2 (-*T models only)
SYSTEM_O	O	OFF=heating, ON=cooling (-HAC/HACW models only)

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

Use twisted pair shielded, conductor cable to connect the BACNet connections to the control board connector.
A - Communication (+)
B - Communication (-)
GND - Ground

EXTERNAL CONTROL CONNECTIONS (24VAC)

For cooling mode activation (reversing -HAC/HACW models only), use 18-2 cable to connect terminals at terminal strip through a dry contact:
O - Cooling Mode (Active) / Heating Mode (Inactive)
C - Common (for use with R to power external device)
R - 24VAC Hot

If using an external aquastat ("Signals" control method), use these right side board connections for compressor control:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor Stage 1
Y2A - Compressor Stage 2 (-*T models only)

A dry contact connection between R/RA and an external control connection (Y1A, Y2A, O) will activate the external control signal input to the control board.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

D1, D2 — Dry contacts, closed during call for auxiliary heat

R, D1, D2, CD — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

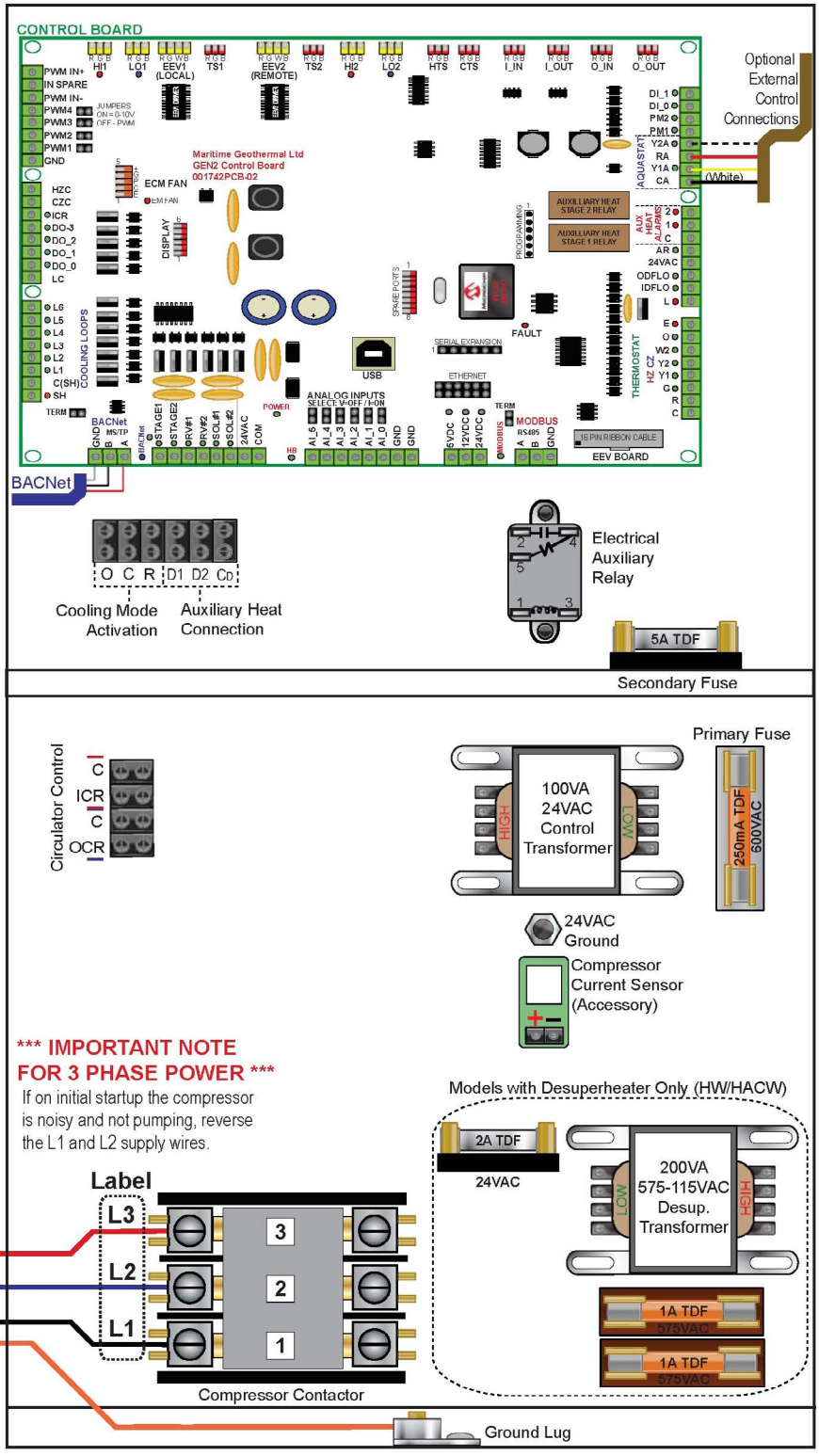
CIRCULATOR CONTROL CONNECTIONS (24VAC)

Use an 18-2 conductor cable for each pair. Connect output signals as per the descriptions below:
C - 24VAC Common
ICR - 24VAC Indoor Circulator Control (Hot)
C - 24VAC Common
OCR - 24VAC Outdoor Circulator Control (Hot)
The ICR and OCR pins will start / stop the circulators.
Max load 500mA each OCR and ICR.

POWER SUPPLY CONNECTIONS

575-3-60VAC CONNECTIONS		
Wire	Colour	Contactor (Label)
Line 3	Red	L3
Line 2	Blue	L2
Line 1	Black	L1
Connect "GND" to ground lug.		

W/WH-Series Electrical Box Diagram 575-3-60



Drawn By	Date
C.GEDDES	09 APR 2015
Checked By	Date
C.GEDDES	09 APR 2015
Eng. Approved By	Date
C.GEDDES	09 APR 2015
Mfg. Approved By	Date
Approved By	Date

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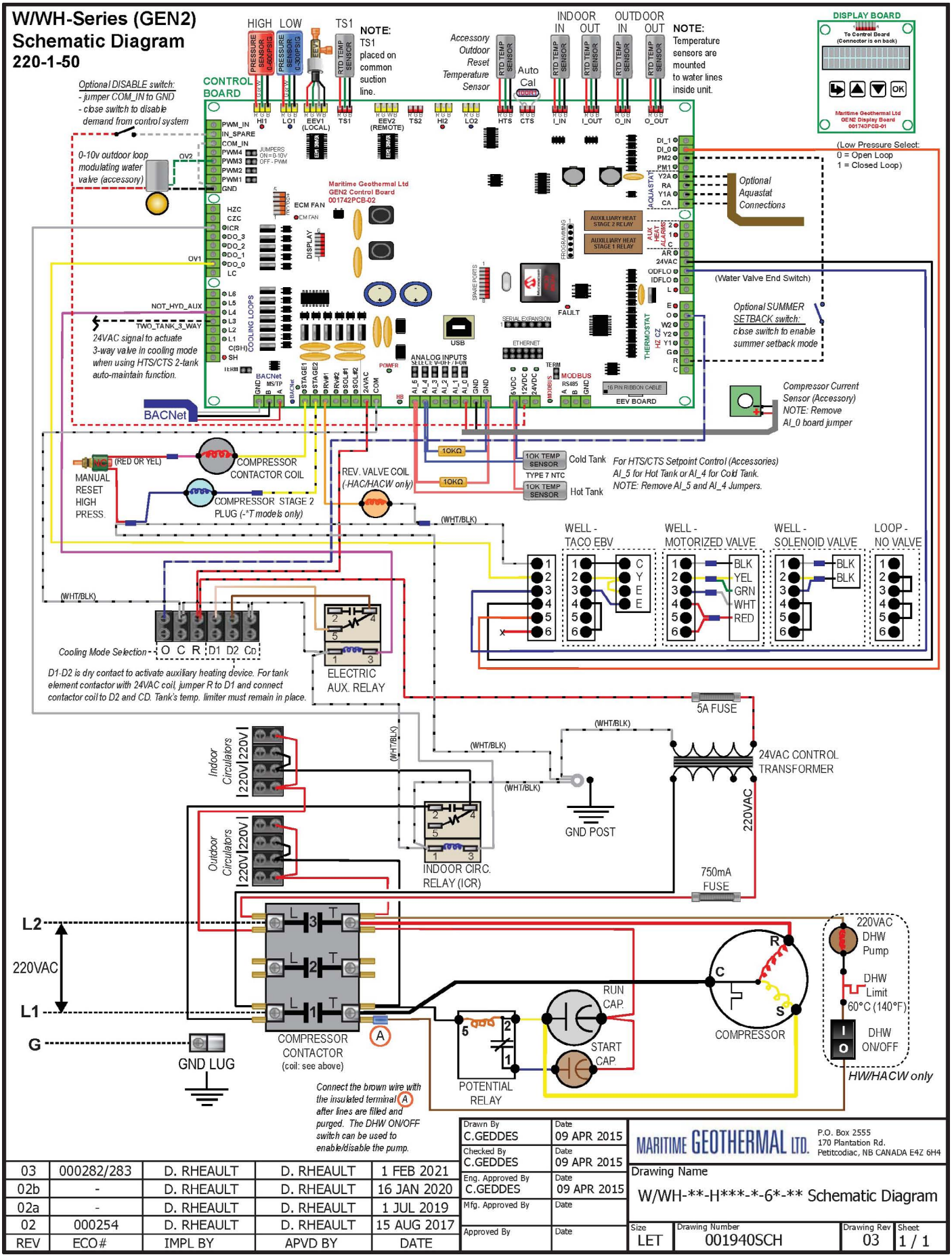
Drawing Name: W/WH-**-H***-*-5*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001939ELB	03	1 / 1

REV	ECO#	IMPL BY	APVD BY	DATE
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020
02a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
02	000254	D. RHEAULT	D. RHEAULT	15 AUG 2017

W/WH/WP-Series Wiring Diagram (220-1-50)



REV	ECO#	IMPL BY	APVD BY	DATE
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020
02a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
02	000254	D. RHEAULT	D. RHEAULT	15 AUG 2017

Drawn By: C.GEDDES	Date: 09 APR 2015	MARITIME GEOTHERMAL LTD.	P.O. Box 2555, 170 Plantation Rd., Petitcodiac, NB CANADA E4Z 6H4
Checked By: C.GEDDES	Date: 09 APR 2015	Drawing Name: W/WH-**-H***-*-6*-** Schematic Diagram	
Eng. Approved By: C.GEDDES	Date: 09 APR 2015		
Mfg. Approved By:	Date:		
Approved By:	Date:	Size: LET	Drawing Number: 001940SCH
		Drawing Rev: 03	Sheet: 1 / 1

W/WH/WP-Series Electrical Box Layout (220-1-50)

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	**External**	**Activation**
SYSTEM_Y1A	Y1A	Compressor Stage 1
SYSTEM_Y2A	Y2A	Compressor Stage 2 (-*T models only)
SYSTEM_O	O	OFF=heating, ON=cooling (-HAC/HACW models only)

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

Use twisted pair shielded, conductor cable to connect the BACNet connections to the control board connector.
A - Communication (+)
B - Communication (-)
GND - Ground

EXTERNAL CONTROL CONNECTIONS (24VAC)

For cooling mode activation (reversing -HAC/HACW models only), use 18-2 cable to connect terminals at terminal strip through a dry contact:
O - Cooling Mode (Active) / Heating Mode (Inactive)
C - Common (for use with R to power external device)
R - 24VAC Hot

If using an external aquastat ("Signals" control method), use these right side board connections for compressor control:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor Stage 1
Y2A - Compressor Stage 2 (-*T models only)

A dry contact connection between R/RA and an external control connection (Y1A, Y2A, O) will activate the external control signal input to the control board.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

D1, D2 — Dry contacts, closed during call for auxiliary heat

R, D1, D2, CD — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

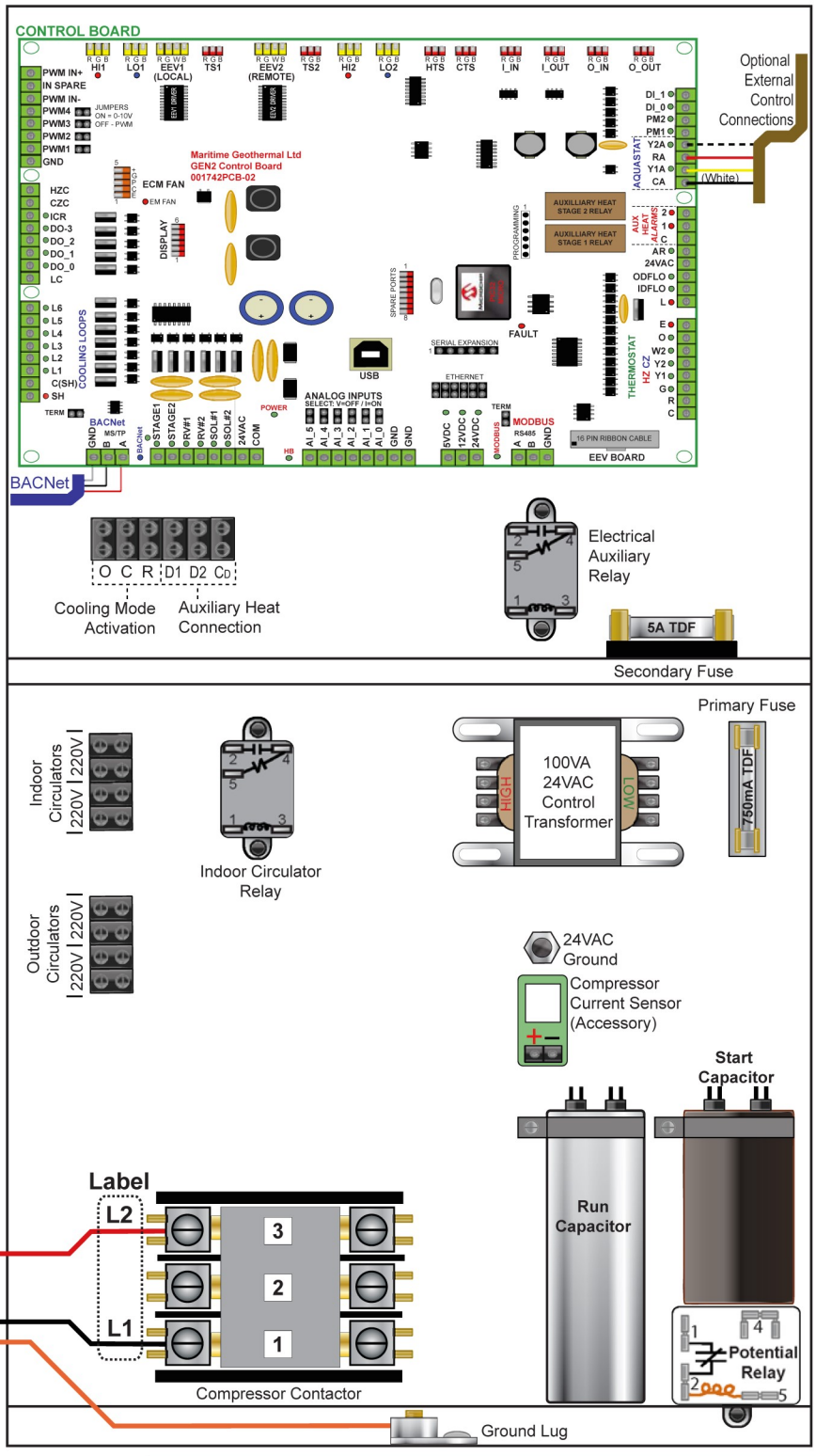
CIRCULATOR CONNECTIONS (220VAC)

REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 220VAC circulators to 220V

POWER SUPPLY CONNECTIONS

220VAC CONNECTIONS		
Wire	**Colour**	**Contactor (Label)**
Line 2	Red	L2
Line 1	Black	L1
Connect "GND" to ground lug.		

W/WH-Series Electrical Box Diagram 220-1-50



Drawn By	Date
C.GEDDES	09 APR 2015
Checked By	Date
C.GEDDES	09 APR 2015
Eng. Approved By	Date
C.GEDDES	09 APR 2015
Mfg. Approved By	Date
Approved By	Date

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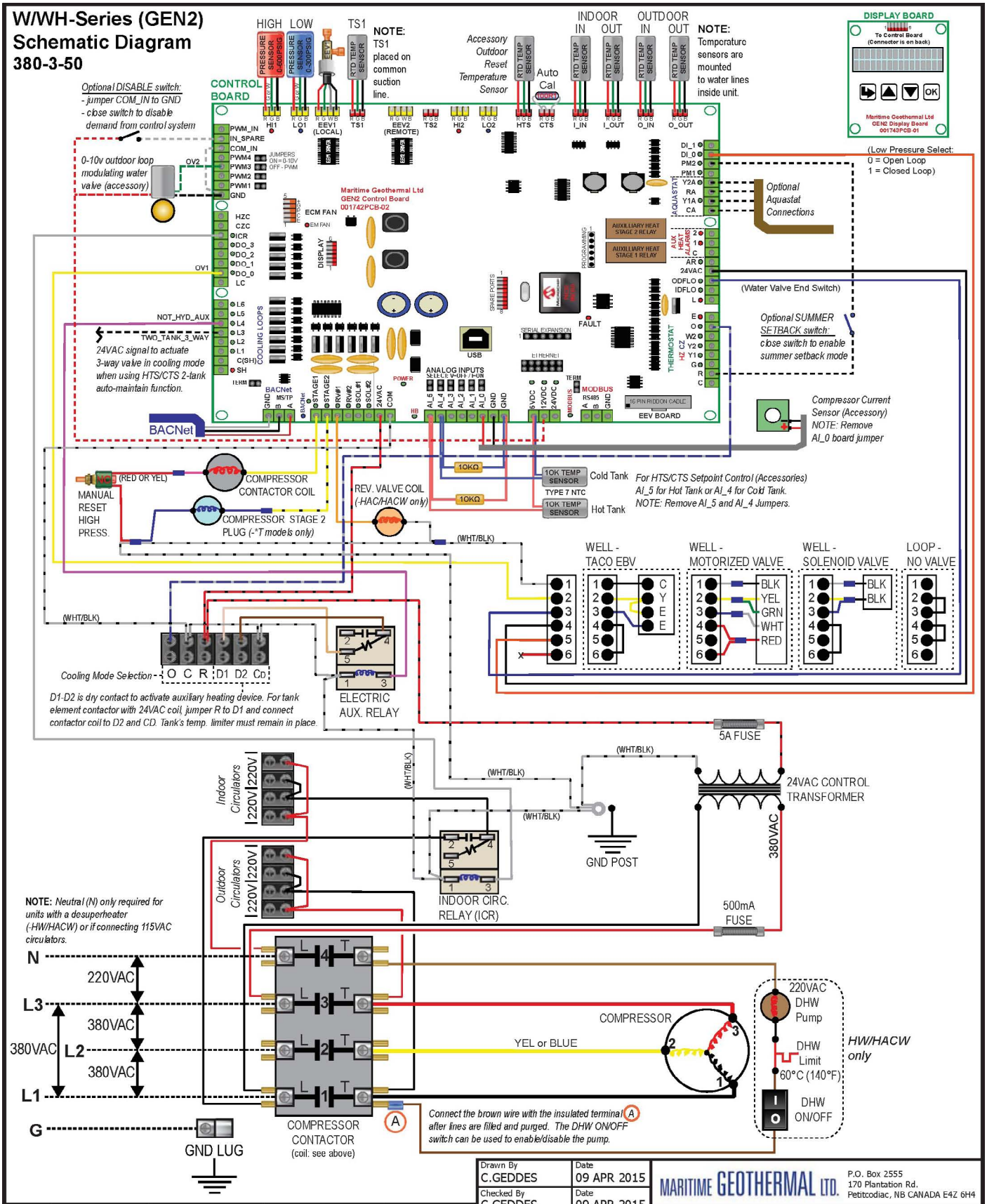
Drawing Name: W/WH-**-H***-*-6*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001941ELB	03	1 / 1

REV	ECO#	IMPL BY	APVD BY	DATE
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020
02a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
02	000254	D. RHEAULT	D. RHEAULT	15 AUG 2017

W/WH/WP-Series Wiring Diagram (380-3-50)



REV	ECO#	IMPL BY	APVD BY	DATE
04	ISSUE 02	D. RHEAULT	D. RHEAULT	21 SEP 2022
04	000296	D. RHEAULT	D. RHEAULT	10 DEC 2021
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020

Drawn By	C.GEDDES	Date	09 APR 2015
Checked By	C.GEDDES	Date	09 APR 2015
Eng. Approved By	C.GEDDES	Date	09 APR 2015
Mfg. Approved By		Date	
Approved By		Date	

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Drawing Name: W/WH-**-H***-*-7*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001942SCH	04(i2)	1 / 1

W/WH/WP-Series Electrical Box Layout (380-3-50)

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	External	Activation
SYSTEM_Y1A	Y1A	Compressor Stage 1
SYSTEM_Y2A	Y2A	Compressor Stage 2 (-*T models only)
SYSTEM_O	O	OFF=heating, ON=cooling (-HAC/HACW models only)

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

Use twisted pair shielded, conductor cable to connect the BACNet connections to the control board connector.
A - Communication (+)
B - Communication (-)
GND - Ground

EXTERNAL CONTROL CONNECTIONS (24VAC)

For cooling mode activation (reversing -HAC/HACW models only), use 18-2 cable to connect terminals at terminal strip through a dry contact:
O - Cooling Mode (Active) / Heating Mode (Inactive)
C - Common (for use with R to power external device)
R - 24VAC Hot

If using an external aquastat ("Signals" control method), use these right side board connections for compressor control:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor Stage 1
Y2A - Compressor Stage 2 (-*T models only)

A dry contact connection between R/RA and an external control connection (Y1A, Y2A, O) will activate the external control signal input to the control board.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

D1, D2 : Dry contacts, closed during call for auxiliary heat

R, D1, D2, CD : To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

CIRCULATOR CONNECTIONS (220VAC)

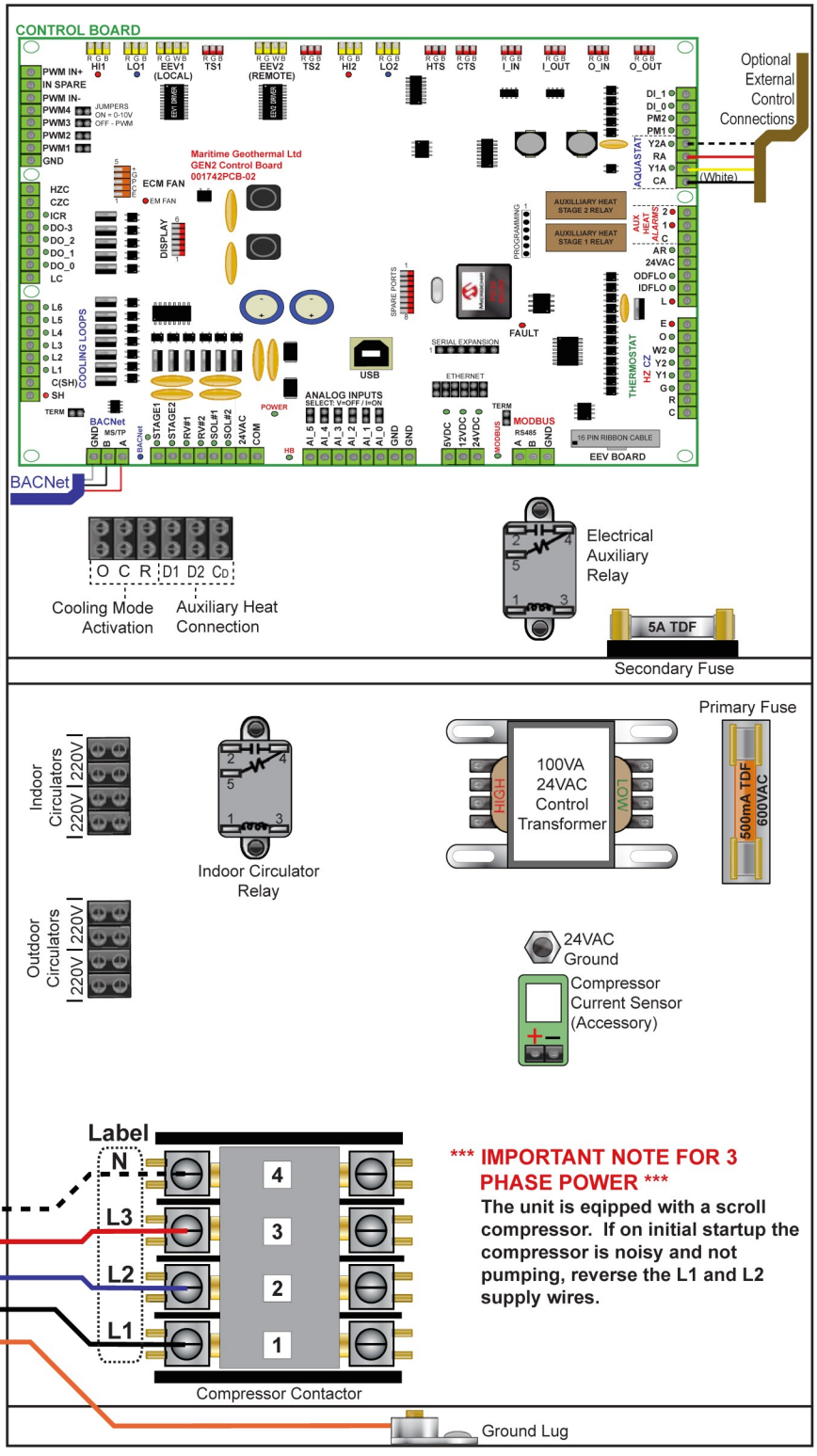
REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 220VAC circulators to 220V

POWER SUPPLY CONNECTIONS

*NOTE: Neutral (N) is only required if connecting 220VAC circulators or if unit is equipped with a desuperheater (HW/HACW). The heat pump itself does not require a neutral.

380/220VAC CONNECTIONS		
Wire	Colour	Contactor (Label)
Neutral*	White	N*
Line 3	Red	L3
Line 2	Blue	L2
Line 1	Black	L1
Connect "GND" to ground lug.		

W/WH-Series Electrical Box Diagram 380-3-50



***** IMPORTANT NOTE FOR 3 PHASE POWER *****
The unit is eqipped with a scroll compressor. If on initial startup the compressor is noisy and not pumping, reverse the L1 and L2 supply wires.

REV	ECO#	IMPL BY	APVD BY	DATE
03	000282/283	D. RHEAULT	D. RHEAULT	1 FEB 2021
02b	-	D. RHEAULT	D. RHEAULT	16 JAN 2020
02a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
02	000254	D. RHEAULT	D. RHEAULT	15 AUG 2017

Drawn By	C.GEDDES	Date	09 APR 2015
Checked By	C.GEDDES	Date	09 APR 2015
Eng. Approved By	C.GEDDES	Date	09 APR 2015
Mfg. Approved By		Date	
Approved By		Date	

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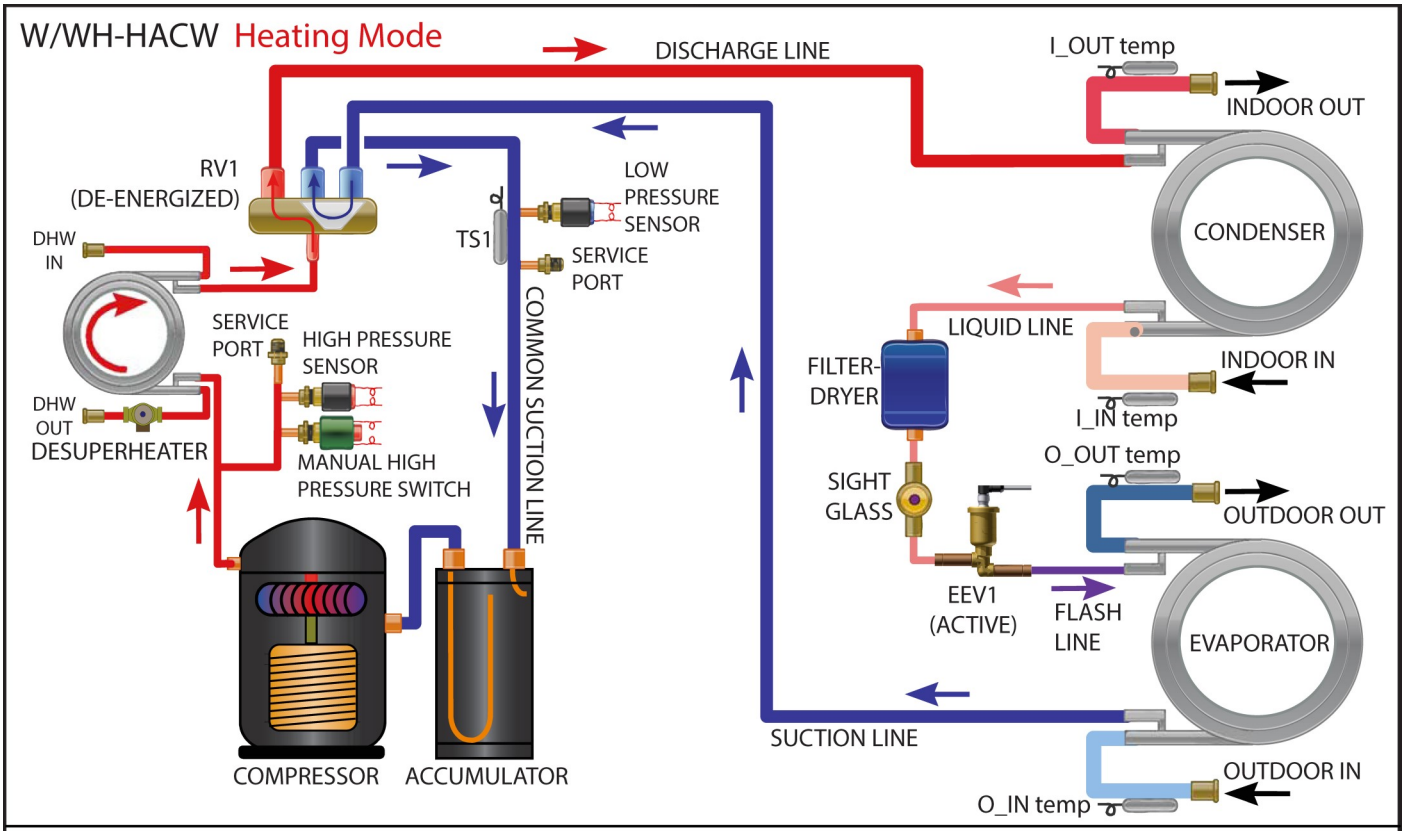
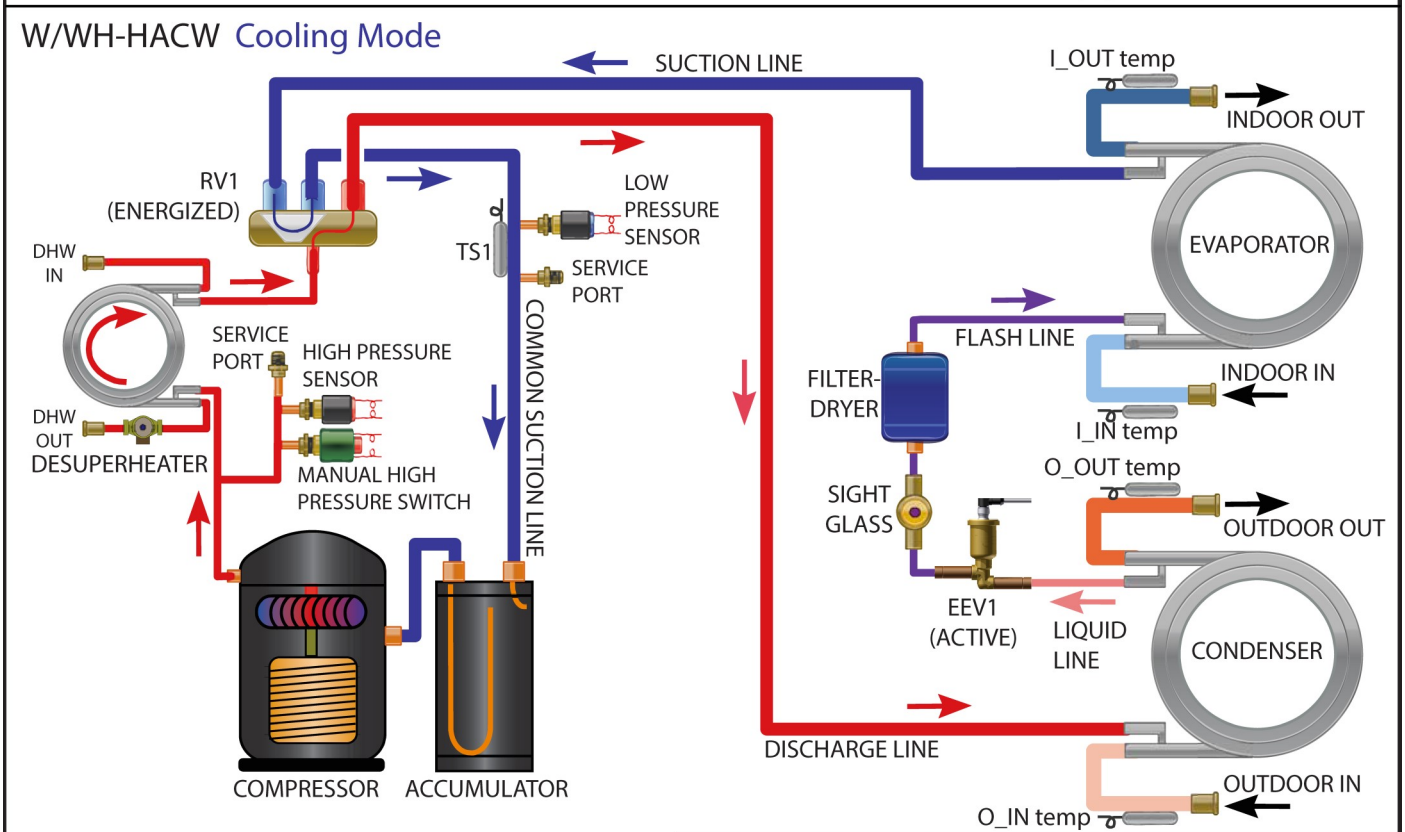
Drawing Name: W/WH-**-H***-*-7*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001943ELB	03	1 / 1

Refrigeration Circuit Diagram: Sizes 25 to 80, Reversing





01	Initial Release	D. RHEAULT	D. RHEAULT	17-JUN-2019
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By: Dan Rheault	Date: 17-JUN-2019
Checked By: Dan Rheault	Date: 17-JUN-2019
Eng. Approved By: Dan Rheault	Date: 17-JUN-2019
Mfg. Approved By	Date
Approved By	Date

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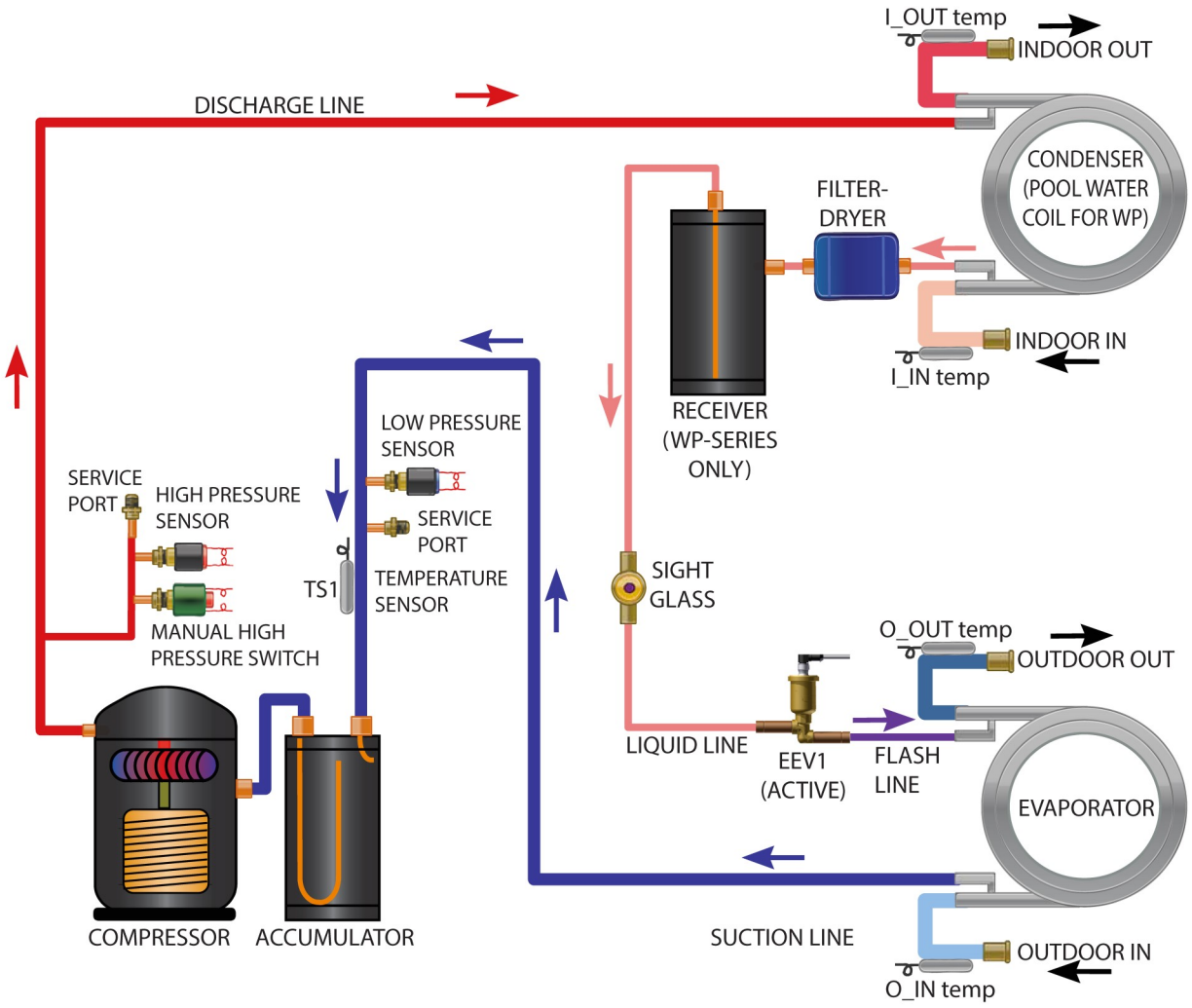
Drawing Name: W/WH-HACW Series Refrigeration Circuit (GEN2, Reversing, with Desuperheater)

Size	Drawing Number	Drawing Revision	Sheet
LET	002398RCD	01	1 / 1

Refrigeration Circuit Diagram: Sizes 25 to 80, Non-Reversing

W/WH/WP-H Heating Mode
(Non-Reversing)



REV	ECO#	IMPL BY	APVD BY	DATE
02	-	D. RHEAULT	D. RHEAULT	1 FEB 2021
01a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
01	Initial Release	C. GEDDES	C. GEDDES	29 OCT 2014

Drawn By	C.GEDDES	Date	29 OCT 2014
Checked By	C.GEDDES	Date	29 OCT 2014
Eng. Approved By	C.GEDDES	Date	29 OCT 2014
Mfg. Approved By		Date	
Approved By		Date	

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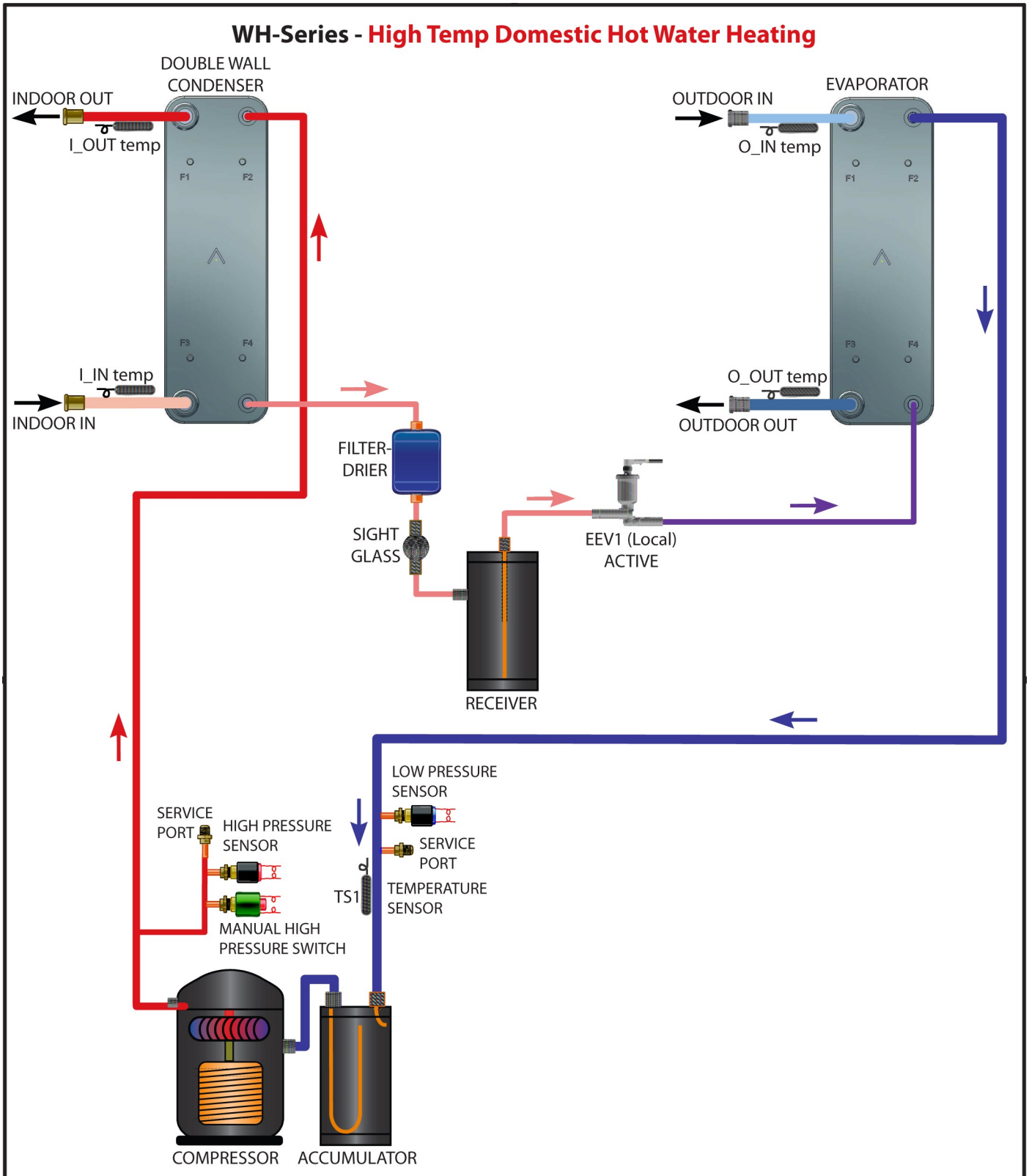
Drawing Name: W/WH/WP-H Refrigeration Circuit (Non-Reversing)

Size	Drawing Number	Drawing Revision	Sheet
LET	001877RCD	02	1 / 1

Refrigeration Circuit Diagram: WH-85 (DHW)



REV	ECO#	IMPL BY	APVD BY	DATE
02	000222	C. GEDDES	C. GEDDES	01 NOV 2014
01	Initial Release	C. GEDDES	C. GEDDES	31 JUL 2012

Drawn By C.GEDDES	Date 31 JUL 2012	
Checked By C.GEDDES	Date 31 JUL 2012	
Eng. Approved By C.GEDDES	Date 31 JUL 2012	
Mfg. Approved By	Date	
Approved By	Date	

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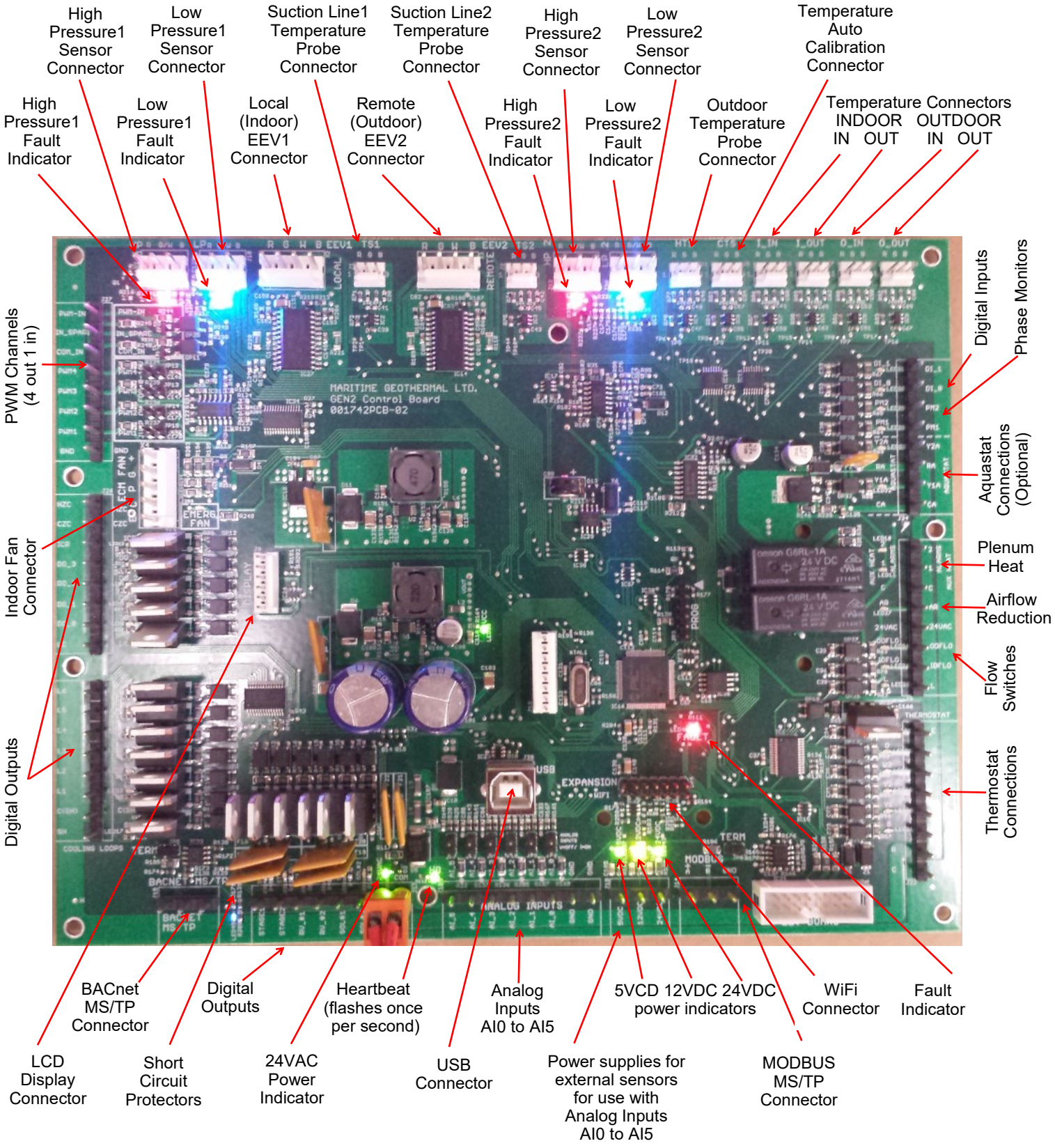
Drawing Name: WH-Series High Temp Domestic Hot Water Heating

Size	Drawing Number	Drawing Revision	Sheet
LET	001674RCD	02	1 / 1

Appendix A: Gen2 Control Board Description

The picture below shows the locations of the connectors and LED indicators of the control board. The control board offers many features such as short circuit protection on all digital outputs, Real Time Clock with super capacitor for backup power, WiFi capability, relay outputs for plenum heater control (if equipped), USB port, PIC32 microcontroller, etc.



The tables describe the connections starting with the top of the board and working around the board counter clock-wise.

TABLE A1 - Control Board Connector Descriptions (Top)		
Name	**Description**	
HPS1/HI1	High Pressure Sensor 1	Measures discharge pressure.
LPS1/LO1	Low Pressure Sensor 1	Measures suction pressure.
EEV1	Local EEV	Control of Electronic Expansion Valve.
TS1	Suction Line Temperature 1	Mounted to common suction line inside unit.
EEV2	Remote EEV	Unused.
TS2	Suction Line Temperature 2	Unused.
HPS2/HI2	High Pressure Sensor 2	Unused.
LPS2/LO2	Low Pressure Sensor 2	Unused.
HTS/ODTS	Outdoor Temperature	Optional outdoor temperature sensor for outdoor reset feature.
CTS	Auto Calibration	Resistor in connector for auto-calibration reference (32°F—0°C).
I_IN	Indoor Loop IN	Mounted to pipe inside unit.
I_OUT	Indoor Loop OUT	Mounted to pipe inside unit.
O_IN	Outdoor Loop IN	Mounted to pipe inside unit.
O_OUT	Outdoor Loop OUT	Mounted to pipe inside unit.

TABLE A2 - Control Board Connector Descriptions (Left Side)		
Name	**Description**	
PWM_IN	Signal for PWM IN	Unused.
IN_SPARE	Spare digital input	Switch or dry contact from 12VDC to disable unit (also COM_IN to GND)
COM_IN	Common for PWM IN	Jumper to GND for disable functionality.
PWM4	PWM / 0-10VDC output	Unused.
PWM3	PWM / 0-10VDC output	Unused.
PWM2	PWM / 0-10VDC output	Unused.
PWM1	PWM / 0-10VDC output	Unused.
GND	Ground	Jumper to COM_IN for disable functionality.
HZC	Hot Zone Circulator	Unused.
CZC	Cold Zone Circulator	Unused.
ICR	Internal Circulator Relay	Operates the indoor circulator.
DO_3	Auxiliary Only	Unused.
DO_2	HYD_AUX	Operates the hydronic auxiliary, terminal 1A (Setpoint control only).
DO_1	Digital output	Unused.
DO_0	OV1	To open loop water valve end switch or closed loop jumper plug (back to ODFLO).
LC	Loop common (ground)	Unused.
L6	Loop6	Unused.
L5	Loop5	Unused.
L4	NOT_HYD_AUX	Output OFF when auxiliary heat required; operates D1-D2 dry contacts.
L3	TWO_TANK_3_WAY	Energizes 3-way valve to direct flow to cold tank when using HTS/CTS with 2 tanks.
L2	Loop2	Unused.
L1	Loop1	Unused.
C(SH)	Soaker Hose common	Unused.
SH	Soaker Hose	Unused.

TABLE A3 - Control Board Connector Descriptions (Bottom)		
Name	**Description**	
GND	BACnet MS/TP	Ground for shield if required.
B	BACnet MS/TP	RS-485.
A	BACnet MS/TP	RS-485.
STAGE1	Compressor Stage 1	Starts / stops the compressor.
STAGE2	Compressor Stage 2	Unused.
RV#1	Reversing Valve#1	Off in heating mode, on in cooling mode (reversing models only).
RV#2	Reversing Valve#2	Unused.
SOL#1	Solenoid#1	Unused.
SOL#2	Solenoid#2	Unused.
24VAC	Power supply for board	24VAC power for control board.
COM	Power supply for board	GND for control board.
AI_5	Analog In Channel 5	Optional type 3/7 10k hot tank temperature sensor for HTS/CTS Setpoint Control.
AI_4	Analog In Channel 4	Optional type 3/7 10k cold tank temperature sensor for HTS/CTS Setpoint Control.
AI_3	Analog In Channel 3	0 to 5VDC or 4-20mA user settable with board jumper.
AI_2	Analog In Channel 2	0 to 5VDC or 4-20mA user settable with board jumper.
AI_1	Analog In Channel 1	0 to 5VDC or 4-20mA user settable with board jumper.
AI_0	Analog In Channel 0	Optional compressor current sensor.
GND	Ground pin	Ground for analog sensors.
GND	Ground pin	Ground for analog sensors.
5VDC	Power for analog sensors	Provides 5VDC power supply for sensors.
12VDC	Power for analog sensors	Provides 12VDC power supply for sensors.
24VDC	Power for analog sensors	Provides 24VDC power supply for sensors.
A	MODBUS	RS-485.
B	MODBUS	RS-485.
GND	MODBUS	Ground for shield if required.

TABLE A4 - Control Board Connector Descriptions (Right Side)		
Signal	**Description**	
DI_1	Digital Input1	Unused.
DI_0	Digital Input0	Low pressure select from open/closed loop harness (0=open loop, 1=closed loop)
PM2	Phase Monitor2	Switch or dry contact from R to activate Summer Setback mode.
PM1	Phase Monitor1	Accessory for 3 phase models.
Y2A	Aquastat Stage2	Unused.
RA*	Aquastat Power (24VAC)	Used only for external aquastat (Signals) control.
Y1A*	Aquastat Stage1	Used only for external aquastat (Signals) control.
CA*	Aquastat Power (Ground)	Used only for external aquastat (Signals) control.
2	Plenum Heat Stage2	Unused.
1	Plenum Heat Stage1	Unused.
C	Plenum Heat Common	Unused.
AR	Airflow Reductions	Unused.
24VAC	Power	Power back to low pressure select (DI_0).
ODFLO	Outdoor Flow Switch	Return signal from open loop water valve end switch, or closed loop jumper plug.
IDFLO	Indoor Flow Switch	Unused.
L	Thermostat Lockout Indicator	24VAC output for trouble LED.
E	Thermostat Emergency Heat	Unused.
O	Thermostat Heat/Cool	24VAC input from external dry contact to activate cooling mode.
W2	Thermostat Auxiliary Heat	Unused.
Y2	Thermostat Stage2	Unused.
Y1	Thermostat Stage1	Unused.
G	Thermostat Fan	Unused.
R	Thermostat Power (24VAC)	Unused.
C	Thermostat Power (Ground)	Unused.

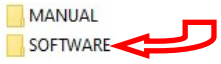
*NOTE: There is no need for an external aquastat for most systems, the Setpoint Control Method provides built in aquastat functionality.

Appendix B - USB Driver Installation (Windows 10 & earlier)

NOTE: This step is ***not necessary*** for **Windows 11**.

The first step in connecting a **Windows 10 or earlier** laptop computer to the control board is to install the USB driver.

The easiest way to install the USB driver is from the **USB drive included with the unit**. Insert the USB stick into a Windows computer, and open a File Explorer window to view its contents:

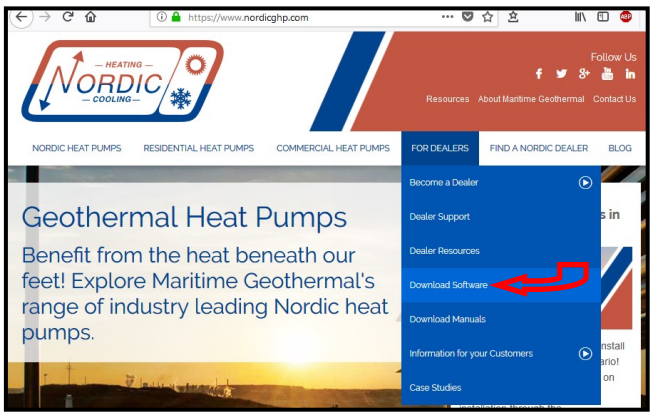


Double click on the SOFTWARE folder to show its contents:

To install the USB driver, double click on **Step 1** and follow the prompts, clicking “allow” or “yes” as required.

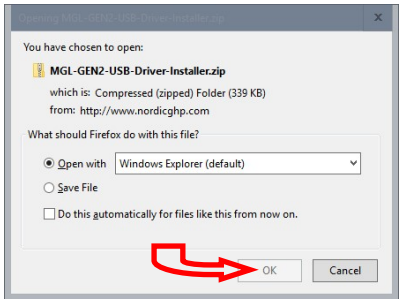
If the USB drive is not available, the same files can be **down-loaded from the web page**.

1. Go to www.nordicghp.com, Download Software page:

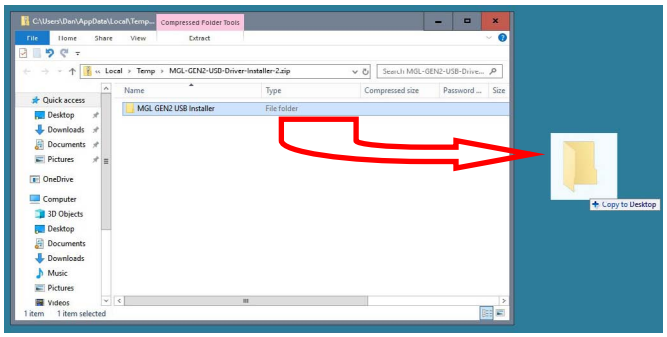


2. Click on **MGL GEN2 USB Driver Installer** to download it:

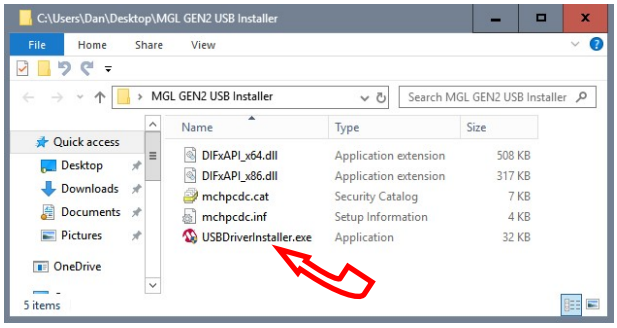
3. Choose “Open with Windows Explorer”, and hit “OK”. *(If the choice window doesn’t pop up, find the downloaded file in your browser downloads and double click on it.)*



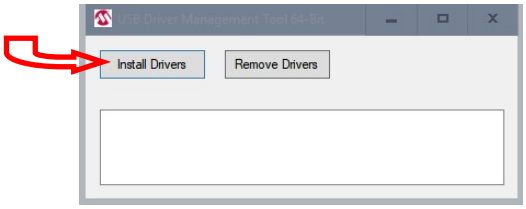
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



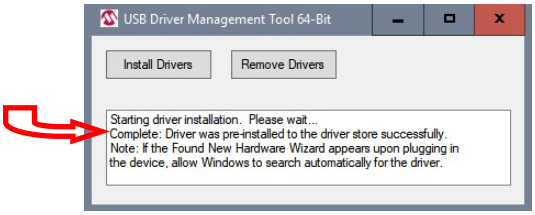
5. Double click on the folder you just dragged onto the desktop, then double click on the “USBDriverInstaller” file:



6. In the next window, click on “Install Drivers”:



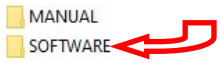
7. You will see a message indicating the driver was installed successfully. You are now ready to install the PC App.



Appendix C - PC App Installation (Windows 11)

The PC App allows detailed interfacing with the control board using a Windows laptop computer. These instructions are for ***Windows 11***.

The easiest way to install the PC App is from the **USB drive included with the unit**. Insert the USB stick into a Windows computer, and open a File Explorer window to view its contents:

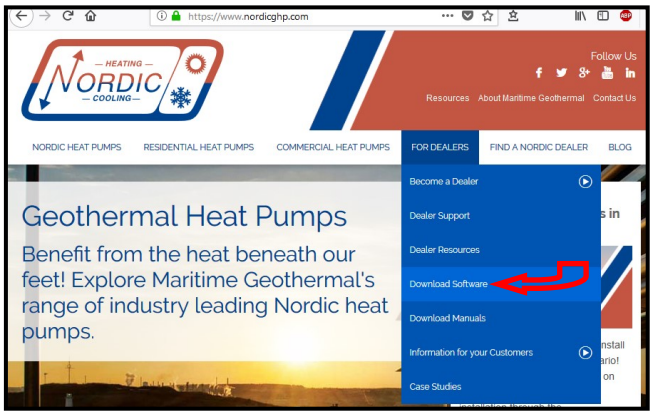


Double click on the SOFTWARE folder to show its contents:

Double click on **Step 2** and follow the prompts, clicking "More info", "Run anyway", "Install", or similar on any warning windows which pop up, perhaps more than once. Pictures of warning windows you might encounter are shown below in step **8**.

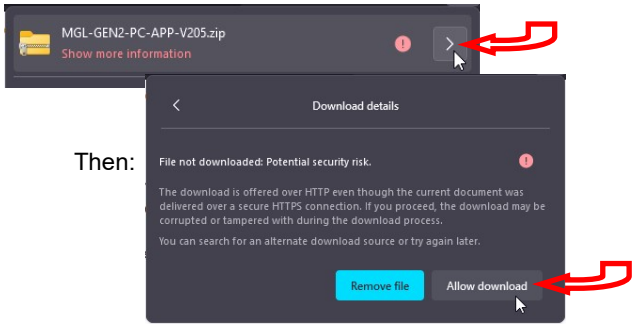
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

1. Go to www.nordicghp.com, Download Software page:

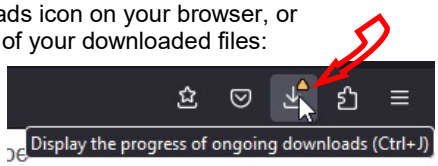


2. Click on **MGL GEN2 PC APP V2__** to download it:

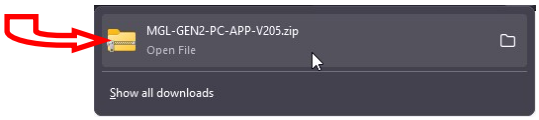
3. You may see a warning like this one. Click as shown:



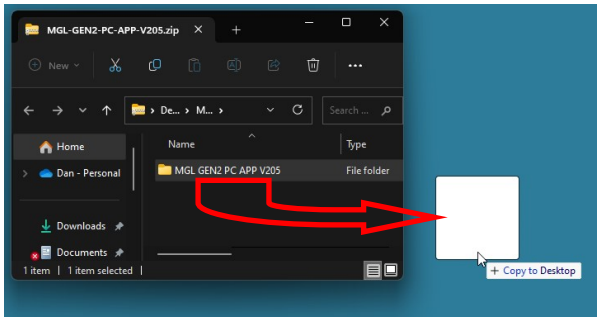
4. Click on the downloads icon on your browser, or otherwise view a list of your downloaded files:



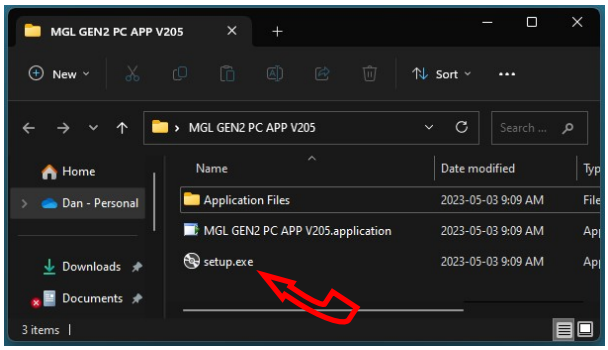
5. Then click on the .zip file to open it in a File Explorer window:



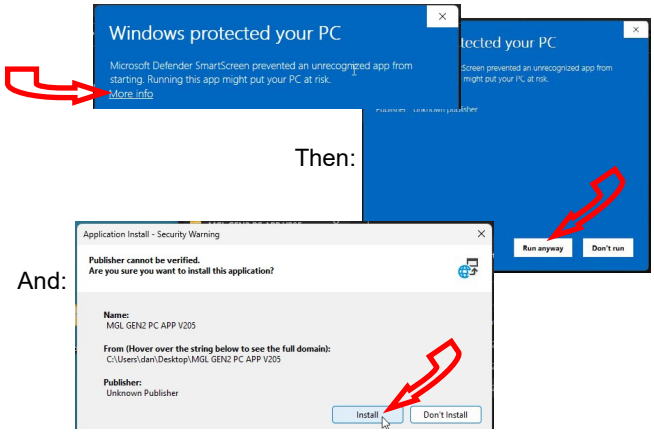
6. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



7. Double click on the folder you just dragged onto the desktop, then double click on the "setup" file:



8. Click "More info", "Run anyway", "Install", or similar on any warning windows which pop up, perhaps more than once.

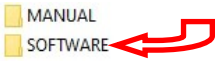


9. The PC App will open when it is finished installing. (In the future, it should be started from the start menu.) You are now ready to connect a USB cord between the laptop computer and GEN2 control board, and connect.

Appendix D - PC App Installation (Windows 10 & earlier)

The PC App allows detailed interfacing with the control board using a Windows laptop computer. These instructions are for ***Windows 10 or earlier***. First, install the USB driver as per the previous appendix.

The easiest way to install the PC App is from the **USB drive included with the unit**. Insert the USB stick into a Windows computer, and open a File Explorer window to view its contents:

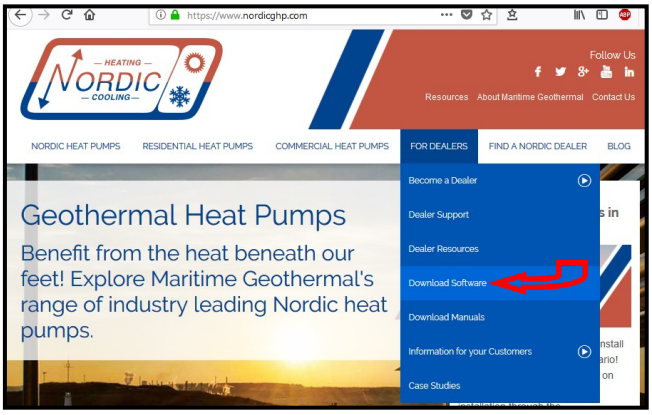


Double click on the SOFTWARE folder to show its contents:

Double click on **Step 2** and follow the prompts, clicking "allow" or "yes" as required. If you get a warning that .NET framework is required, go back and double click on step **z**, then try **Step 2** again.

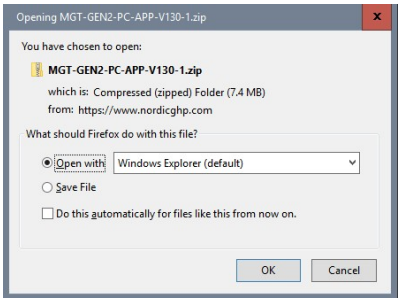
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

1. Go to www.nordicghp.com, Download Software page:

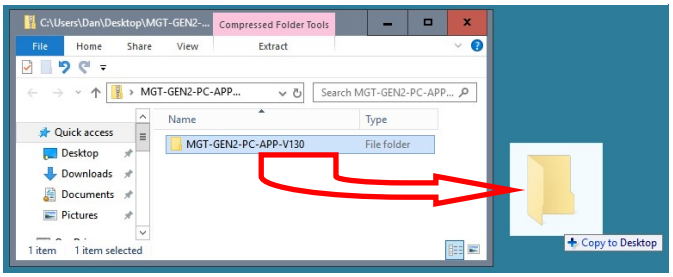


2. Click on **MGL GEN2 PC APP V2__** to download it:

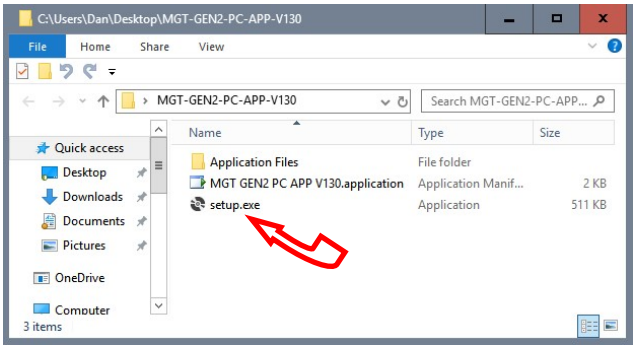
3. Choose "Open with Windows Explorer", and hit "OK":



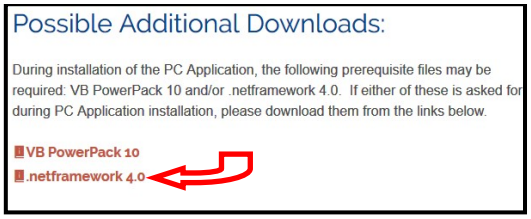
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



5. Double click on the folder you just dragged onto the desktop, then double click on the "setup" file:



6. Click "Yes", "Run", "Install", or similar on any warning windows which pop up. If an error message is encountered regarding .NET framework, exit the installation and use the link on the Download Software page to install the missing item:



Then go back to step 5.

7. The PC App will open when it is finished installing. You are now ready to connect a USB cord between the laptop computer and GEN2 control board, and connect.

Appendix E: Updating Firmware

METHOD 1: Updating Firmware Using PC App

This method can be used when updating newer control boards with bootloader version 2.0. This method will not work for older control boards with bootloader version 1.0 (approx. unit serial numbers -17 and lower); for those, see **METHOD 2**. Note that **METHOD 2** will work for all control boards.

The firmware comes as a .ZIP file named:
MGL GEN2 Bootload Firmware Vxxx.zip
where xxx is the version reference, e.g. 376 (version 3.76).
This file can be downloaded from **www.nordicghp.com**, menu *For Dealers --> Download Software*.

1. Download the file to your PC. When prompted, "Open" the zip file. If the zip file is *Saved* instead of *Opened*, find it in the web browser's Downloads list or at the bottom of browser window and click on it to open. In the window that comes up, drag the folder containing the required files onto your desktop so that it can be found easily, e.g.:

   \Desktop\MGL GEN2 Bootload Firmware V376

   Also be sure the latest PC App version (e.g. v2.05) is installed, which is listed alongside the firmware on the web page. If needed, install a new version as per those instructions, and uninstall older PC App versions to avoid their accidental use (which can corrupt control board parameters).

2. In that folder on the Desktop, there will be three files:

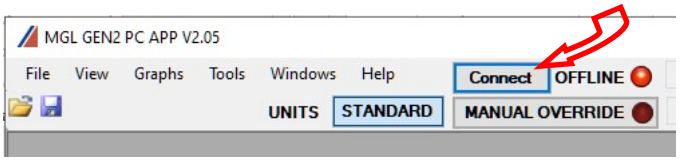
MGL_GEN2_V376.production.hex	(firmware file)
PIC32UBL.exe	(the programmer)
USB Bootloader Instructions.pdf	(these instructions)

   Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

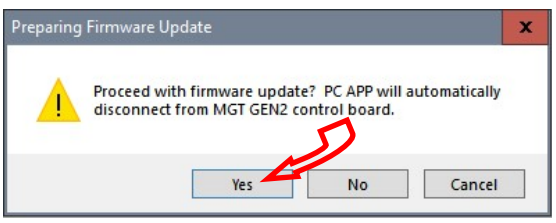
3. Connect a USB (printer) cable between computer and control board.

4. Launch the PC App version that matches the firmware (e.g. PC App 2.05 for firmware V3.76). After it is installed, the PC App can be started using the entry found under the "M" section in the Windows **START** menu, which is accessed using the 4-rectangles icon normally found at the bottom left corner of the computer screen.

5. In the PC App, click on the **Connect** button to connect to the control board.

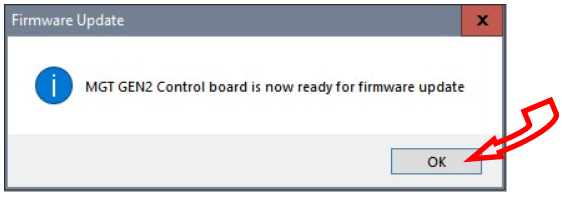


6. Go to menu **Tools --> Update Firmware**. The following message box will appear:



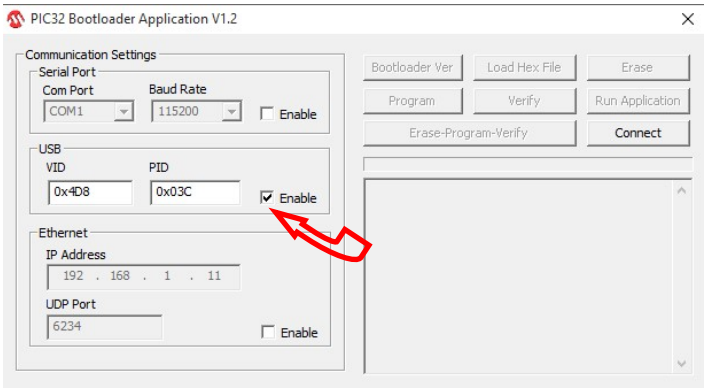
7. Click on **YES**. The following message box will appear:

8. Click on **OK**. After a minute, the following message box will appear:

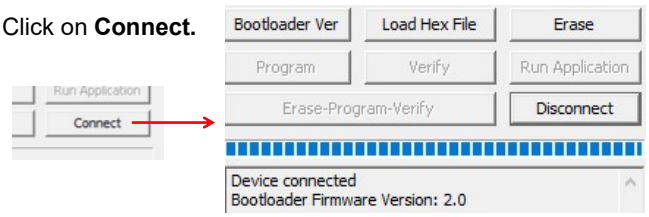


9. Click on **OK**. The control board is now in bootloader mode and is ready to be programmed.

10. Double click on the downloaded file PIC32UBL.exe to run it. In the window that opens, click on the USB **Enable** check box.

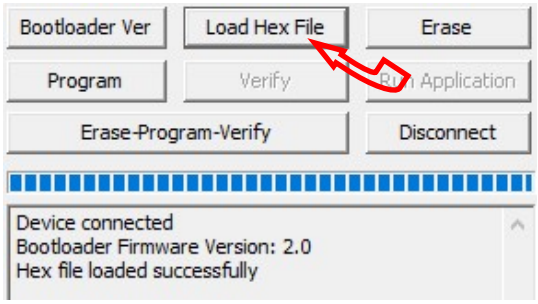


11. Click on **Connect.**

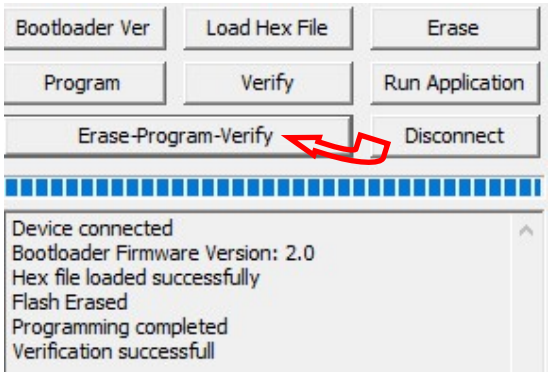


*If device fails to connect and an error message is displayed, the board's bootloader may be older than v2.0. It will be necessary to instead update the firmware via jumper pins (**METHOD 2**), as per the next section.*

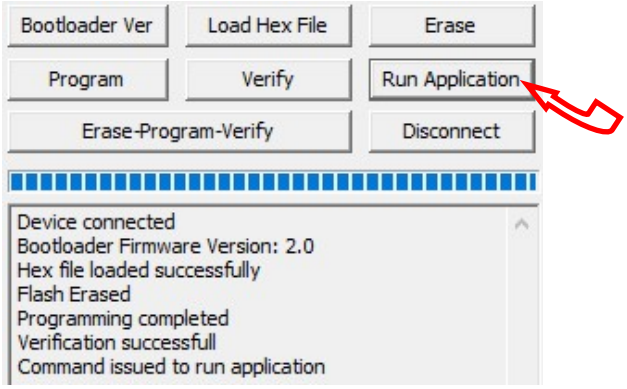
12. Click on **Load Hex File**. Select the M*GL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.



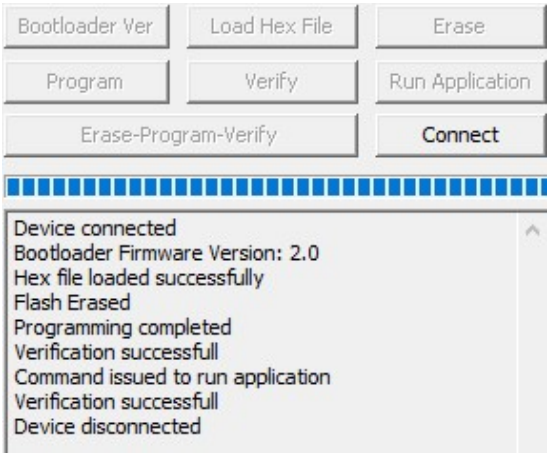
13. Click on **Erase—Program—Verify.** Programming…. Wait while status bar shows progress. The messages should read as below when finished:



11. "Programming completed. Verification successful." Click on **Run Application.** This will take the control board out of bootloader mode and back into normal operational mode, so that the PC App can connect again.



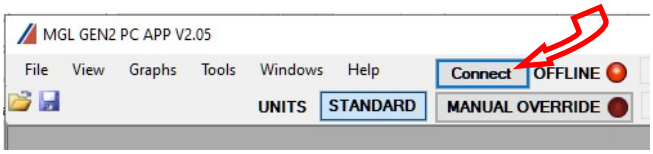
15. **Wait until the programmer disconnects itself.** The messages should read as follows:



16. Close the PIC32 program.

17. **WAIT APPROXIMATELY 10 SECONDS.** This gives the control board time to reset, initialize and re-connect to the PC USB port.

18. Go back to the PC APP and click on the **Connect** button. Verify that the firmware version, shown in the title bar after connection, has been updated. Perform any configuration needed.



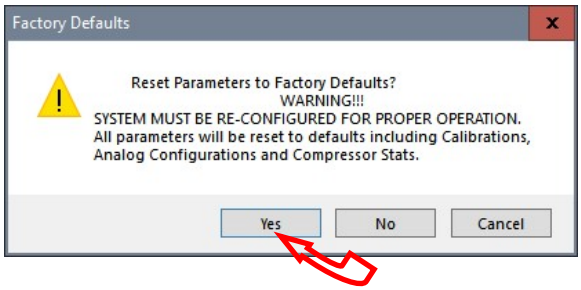
NOTE: Updating the firmware does not affect the configuration settings.

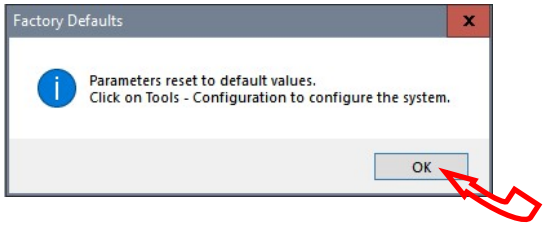
Reset to Defaults?

When updating from **firmware V3.75 or earlier**, the following steps must be taken after the update as there are significant differences in the internal parameters used to operate the system. These steps may also be performed for troubleshooting, when the control system is not acting as it should.

Note that if the firmware on a heat pumps is 2.45 or earlier, chances are that it will have an older bootloader version that requires the use of **METHOD 2** to update the firmware (see following page).

1. With PC App connected, go to menu **Tools --> Configuration** and note all settings. They will need to be re-set later.
2. Go to menu **Tools --> Reset To Factory Defaults.** Click **YES** in the pop up window, and OK in the next window.





3. Go back to menu **Tools --> Configuration**. Re-select the Model Series <u>even if it already indicates the proper series,</u> as clicking on it will load the parameters for that series.
4. Select the Model Size and make any other changes that apply to the particular system setup such as number of stages, control method, etc.

METHOD 2: Updating Firmware Using Jumper Pins

This method should be used when updating older control boards that have bootloader version 1.0, or where the PC App has trouble connecting to older firmware. This method will work for all control boards and can be used on all units.

The firmware comes as a .ZIP file named:
MGL GEN2 Bootload Firmware Vxxx.zip
where xxx is the version reference, e.g. 376 (version 3.76). This file can be downloaded from **www.nordicghp.com**, menu *For Dealers --> Download Software.*

1. Download the file to your PC. When prompted, "Open" the zip file. If the zip file is *Saved* instead of *Opened*, find it in the web browser's Downloads list or at the bottom of browser window and click on it to open. In the window that comes up, drag the folder containing the required files onto your desktop so that it can be found easily, e.g.:

   \Desktop\MGL GEN2 Bootload Firmware V376

2. In that folder on the Desktop, there will be three files:

MGL_GEN2_V376.production.hex	(firmware file)
PIC32UBL.exe	(the programmer)
USB Bootloader Instructions.pdf	(these instructions)

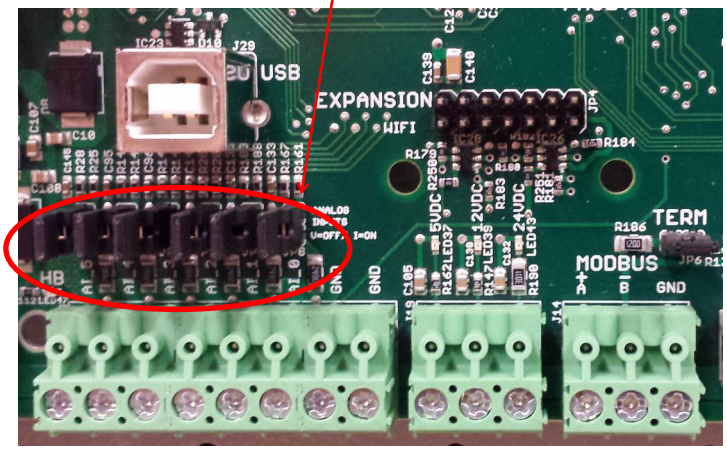
   Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

3. Connect a USB (printer) cable between computer and control board.

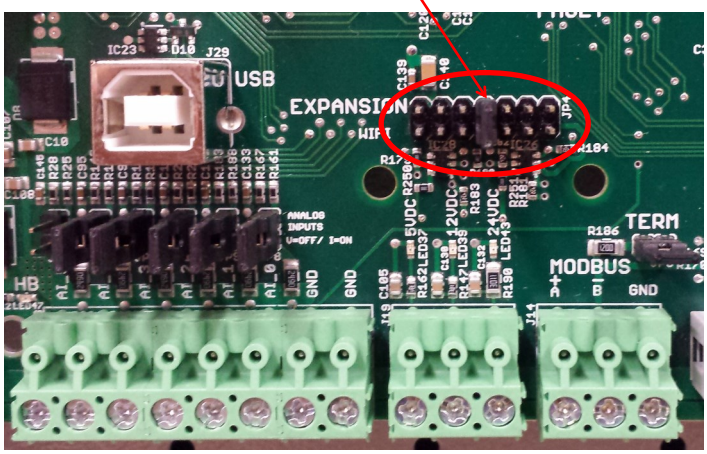
4. Turn power off to the heat pump.

5. Remove one of the black pin jumpers from just below the USB connector on the board and place in on the center pin pair of the EXPANSION header as shown below.

Borrow any one of these jumpers (however many are present)

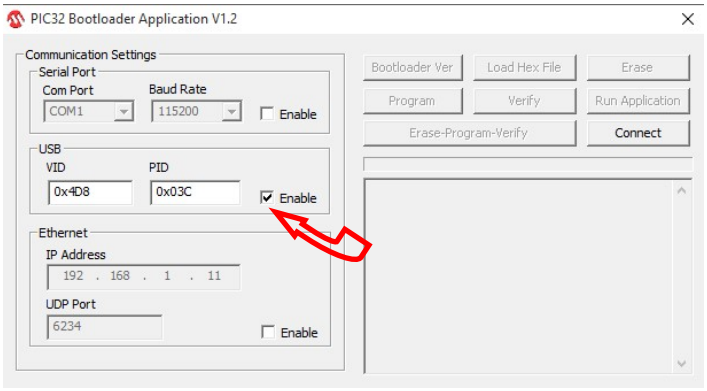


Place jumper here

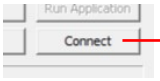


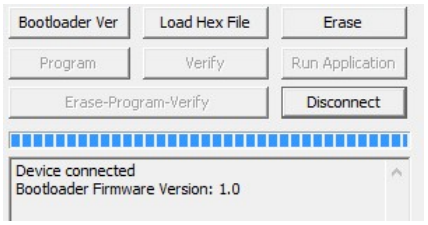
6. Turn the power back on. The control board is now in boot loader mode and is ready to be programmed.

7. Double click on the downloaded PIC32UBL.exe to run it. In the window that opens, click on the USB **Enable** check box.

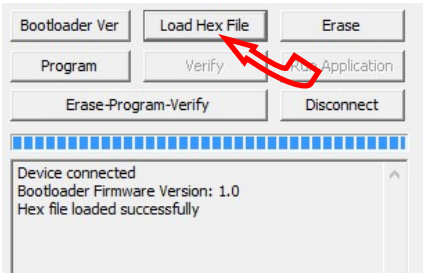


8. Click on **Connect.**



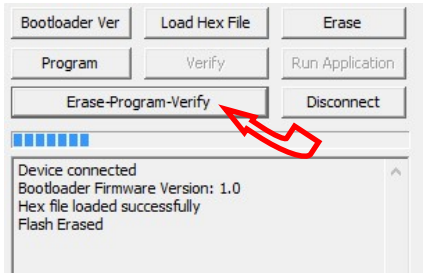


9. Click on **Load Hex File**. Select the *MGL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.

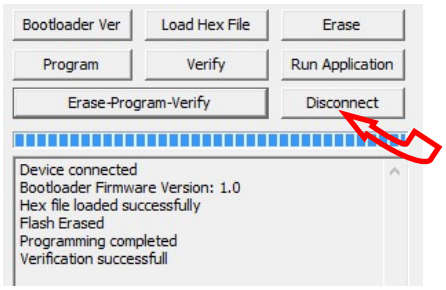


10. Click on **Erase—Program—Verify**

Programming…



11. "Programming completed. Verification successful." Click on **Disconnect** and close the program.



12. Turn power off to the heat pump again.

13. Move the jumper back to where it was taken from.

14. Turn the power back on. Check that the LCD Display shows e.g. **MGL GEN2 V3.76** on the top line during power up.

Warranty: W-Series

RESIDENTIAL LIMITED EXPRESS WARRANTY

Unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd. ("MG") or its representatives relating to MG's products, whether oral, written or contained in any sales literature, catalogue or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely MG's opinion or commendation of MG's products.
SET FORTH HERE IS THE ONLY EXPRESS WARRANTY THAT APPLIES TO MG'S PRODUCTS. MG MAKES NO WARRANTY AGAINST LATENT DEFECTS. MG MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.

LIMITED EXPRESS RESIDENTIAL WARRANTY - PARTS
MG warrants its Residential Class products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows:
(1) Air conditioning, heating and/or heat pump units built or sold by MG ("MG Units") for five (5) years from the Warranty Inception Date (as defined below).
(2) Thermostats, auxiliary electric heaters and geothermal pumping modules built or sold by MG, when installed with MG Units, for five (5) years from the Warranty Inception Date (as defined below).
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for ten (10) years from the Warranty Inception Date (as defined below).
(4) Other accessories and parts built or sold by MG, when installed and purchased with MG Units, for five (5) years from the date of shipment from MG.
(5) Other accessories, when purchased separately, for (1) year from the date of shipment from MG.

The "Warranty Inception Date" shall be the date of original unit installation, as per the date on the installation Startup Record; or six (6) months from date of unit shipment from MG, whichever comes first.

To make a claim under this warranty, parts must be returned to MG in Petitcodiac, New Brunswick, freight prepaid, no later than ninety (90) days after the date of the failure of the part. If MG determines the part to be defective and within MG's Limited Express Residential Warranty, MG shall, when such part has been either replaced or repaired, return such to a factory recognized distributor, dealer or service organization, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

LIMITED EXPRESS RESIDENTIAL WARRANTY - LABOUR
This Limited Express Residential Labour Warranty shall cover the **labour** incurred by MG authorized service personnel in connection with the installation of a new or repaired warranty part that is covered by this Limited Express Residential Warranty only to the extent specifically set forth in the current **labour** allowance schedule "A" provided by MG's Warranty Department and only as follows:
(1) MG Units for two (2) years from the Warranty Inception Date.
(2) Thermostats, auxiliary electric heaters and geothermal pump modules built or sold by MG, when installed with MG Units, for two (2) years from the Warranty Inception Date.
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for five (5) years from the Warranty Inception Date.

Labour costs are not covered by this Limited Express Residential Warranty to the extent they **exceed** the amount allowed under said allowance schedule, they are not specifically provided for in said allowance schedule, they are not the result of work performed by MG authorized service personnel, they are incurred in connection with a part not covered by this Limited Express Residential Warranty, or they are incurred more than the time periods set forth in this paragraph after the Warranty Inception Date.

This warranty does not cover and does not apply to:
(1) Air filters, fuses, refrigerant, fluids, oil.
(2) Products relocated after initial installation.
(3) Any portion or component of any system that is not supplied by MG, regardless of the cause of the failure of such portion or component.
(4) Products on which the unit identification tags or labels have been removed or defaced.
(5) Products on which payment to MG, or to the owner's seller or installing contractor, is in default.
(6) Products subjected to improper or inadequate installation, maintenance, repair, wiring or voltage conditions.
(7) Products subjected to accident, misuse, negligence, abuse, fire, flood, lightning, unauthorized alteration, misapplication, contaminated or corrosive liquid or air supply, operation at abnormal air or liquid temperatures or flow rates, or opening of the refrigerant circuit by unqualified personnel.
(8) Mold, fungus or bacteria damage
(9) Corrosion or abrasion of the product.
(10) Products supplied by others.
(11) Products which have been operated in a manner contrary to MG's printed instructions.
(12) Products which have insufficient performance as a result of improper system design or improper application, installation, or use of MG's products.
(13) Electricity or fuel, or any increases or unrealized savings in same, for any reason whatsoever.

Except for the limited **labour** allowance coverage set forth above, MG is not responsible for:
(1) The costs of fluids, refrigerant or system components **supplied by others**, or associated **labour** to repair or replace the same, which is incurred as a result of a defective part covered by MG's Limited Residential Warranty.
(2) The costs of **labour**, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part.
(3) Transportation costs of the defective part from the installation site to MG, or of the return of that part if not covered by MG's Limited Express Residential Warranty.
(4) The costs of normal maintenance.

This Limited Express Residential Warranty applies to MG Residential Class products manufactured on or after February 15, 2010. MG'S LIABILITY UNDER THE TERMS OF THIS LIMITED WARRANTY SHALL APPLY ONLY TO THE MG UNITS REGISTERED WITH MG THAT BEAR THE MODEL AND SERIAL NUMBERS STATED ON THE INSTALLATION START UP RECORD, AND MG SHALL NOT, IN ANY EVENT, BE LIABLE UNDER THE TERMS OF THIS LIMITED WARRANTY UNLESS THIS INSTALLATION START UP RECORD HAS BEEN ENDORSED BY OWNER & DEALER/INSTALLER AND RECIEVED BY MG LIMITED WITHIN 90 DAYS OF START UP.

Limitation: This Limited Express Residential Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without imitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Residential Warranty.

LIMITATION OF REMEDIES
In the event of a breach of the Limited Express Residential Warranty, MG will only be obligated at MG's option to repair the failed part or unit, or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to MG's factory in Petitcodiac, New Brunswick of each defect, malfunction or other failure, and a reasonable number of attempts by MG to correct the defect, malfunction or other failure, and the remedy fails of its essential purpose, MG shall refund the purchase price paid to MG in exchange for the return of the sold good(s). Said refund shall be the maximum liability of MG. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR PURCHASER AGAINST MG FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR MG'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY
MG shall have no liability for any damages if MG's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, shortages of transportation, fuel, material, or labour, acts of God or any other reason beyond the sole control of MG. **MG EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR MG's NEGLIGENCE OR AS STRICT LIABILITY.**

OBTAINING WARRANTY PERFORMANCE
Normally, the dealer or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any MG recognized distributor, dealer or service organization. If assistance is required in obtaining warranty performance, write or call Maritime Geothermal Ltd.

NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province.

Warranty: WH/WP-Series

COMMERCIAL LIMITED EXPRESS WARRANTY

Unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd. ("MG") or its representatives relating to MG's products, whether oral, written or contained in any sales literature, catalogue or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely MG's opinion or commendation of MG's products.
SET FORTH HERE IS THE ONLY EXPRESS WARRANTY THAT APPLIES TO MG'S PRODUCTS. MG MAKES NO WARRANTY AGAINST LATENT DEFECTS. MG MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.

LIMITED EXPRESS COMMERCIAL WARRANTY - PARTS
MG warrants its Commercial Class products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows:
(1) Air conditioning, heating and/or heat pump units built or sold by MG ("MG Units") for one (1) year from the Warranty Inception Date (as defined below).
(2) Thermostats, auxiliary electric heaters and geothermal pumping modules built or sold by MG, when installed with MG Units, for five (5) years from the Warranty Inception Date (as defined below).
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for one (1) year from the Warranty Inception Date (as defined below).
(4) Other accessories, when purchased separately, for (1) year from the date of shipment from MG.

The "Warranty Inception Date" shall be the date of original unit installation, as per the date on the installation Startup Record; or sixty (60) days from date of unit shipment from MG, whichever comes first.

To make a claim under this warranty, parts must be returned to MG in Petitcodiac, New Brunswick, freight prepaid, no later than ninety (90) days after the date of the failure of the part. If MG determines the part to be defective and within MG's Limited Express Commercial Warranty, MG shall, when such part has been either replaced or repaired, return such to a factory recognized distributor, dealer or service organization, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

LIMITED EXPRESS COMMERCIAL WARRANTY - LABOUR
MARITIME GEOTHERMAL LTD. will not be responsible for any consequential damages or labour costs incurred.

This warranty does not cover and does not apply to:
(1) Air filters, fuses, refrigerant, fluids, oil.
(2) Products relocated after initial installation.
(3) Any portion or component of any system that is not supplied by MG, regardless of the cause of the failure of such portion or component.
(4) Products on which the unit identification tags or labels have been removed or defaced.
(5) Products on which payment to MG, or to the owner's seller or installing contractor, is in default.
(6) Products subjected to improper or inadequate installation, including but not limited to:
- Indoor or outdoor loop flow lower than listed in engineering specification or as expressly approved by MARITIME GEOTHERMAL LTD.
- Operating the heat pump either manually or with automated controls so that the unit is forced to function outside its normal operating range
- Disabling of safety controls
- Insufficient loop antifreeze concentration for loop temperature, or antifreeze concentration incorrectly set in control board
- Fouled heat exchangers due to poor water quality
- Failure to use strainers or clean them regularly
- Impact or physical damage sustained by the heat pump
- Poor refrigeration maintenance practices, including brazing without nitrogen flow, or using wrong braze/flux
- Incorrect voltage or missing phase supplied to unit
- Unit modified electrically or mechanically from factory supplied condition
- Water quality outside of recommended limits (e.g. salinity or pH)
- Unit not mounted with supplied anti-vibration grommets when specified for use
- Corrosion damage due to corrosive ambient environment
- Failure due to excessive cycling caused by improper mechanical setup or improperly programmed external controller
- Physical loads or pressures placed on unit from external equipment

(7) Mold, fungus or bacteria damage
(8) Corrosion or abrasion of the product.
(9) Products supplied by others.
(10) Electricity or fuel, or any increases or unrealized savings in same, for any reason whatsoever.

MG is not responsible for:
(1) The costs of fluids, refrigerant or system components **supplied by others**, or associated **labour** to repair or replace the same, which is incurred as a result of a defective part covered by MG's Limited Commercial Warranty.
(2) The costs of **labour**, refrigerant, materials, or service incurred in diagnosis and removal of defective part, or in obtaining and replacing the new or repaired part.
(3) Transportation costs of the defective part from the installation site to MG, or of the return of that part if warranty coverage declined.
(4) The costs of normal maintenance.

MG'S LIABILITY UNDER THE TERMS OF THIS LIMITED WARRANTY SHALL APPLY ONLY TO THE MG UNITS REGISTERED WITH MG THAT BEAR THE MODEL AND SERIAL NUMBERS STATED ON THE INSTALLATION START UP RECORD, AND MG SHALL NOT, IN ANY EVENT, BE LIABLE UNDER THE TERMS OF THIS LIMITED WARRANTY UNLESS THIS INSTALLATION START UP RECORD HAS BEEN ENDORSED BY OWNER & DEALER/INSTALLER AND RECIEVED BY MG LIMITED WITHIN 90 DAYS OF START UP.

Limitation: This Limited Express Commercial Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without imitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Commercial Warranty.

LIMITATION OF REMEDIES
In the event of a breach of the Limited Express Commercial Warranty, MG will only be obligated at MG's option to repair the failed part or unit, or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to MG's factory in Petitcodiac, New Brunswick of each defect, malfunction or other failure, and a reasonable number of attempts by MG to correct the defect, malfunction or other failure, and the remedy fails of its essential purpose, MG shall refund the purchase price paid to MG in exchange for the return of the sold good(s). Said refund shall be the maximum liability of MG. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR PURCHASER AGAINST MG FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR MG'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY
MG shall have no liability for any damages if MG's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, shortages of transportation, fuel, material, or labour, acts of God or any other reason beyond the sole control of MG. **MG EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR MG's NEGLIGENCE OR AS STRICT LIABILITY.**

OBTAINING WARRANTY PERFORMANCE
Normally, the dealer or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any MG recognized distributor, dealer or service organization. If assistance is required in obtaining warranty performance, write or call Maritime Geothermal Ltd.

NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province.