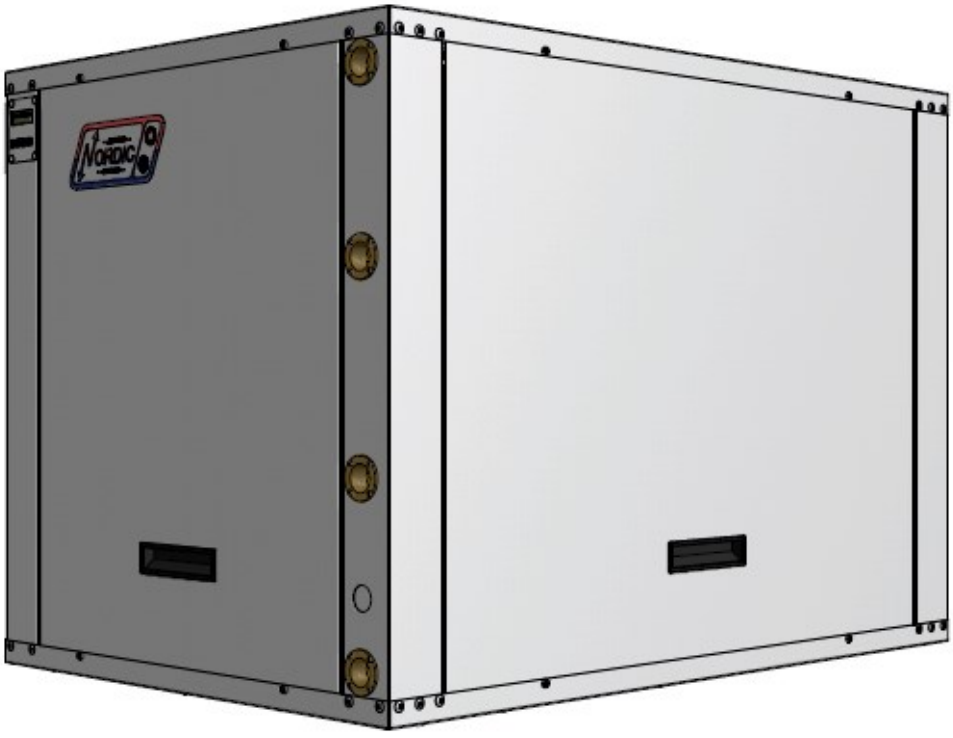
Application, Installation, & Service Manual

WC-Series

High Temperature Water-to-Water Heat Pump

Cascade R410a / R134a
Model Sizes 16-80
Space Heating or Dedicated Domestic Hot Water Options



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002138MAN-03

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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

WC - 65 - H - C - 1D - CP - xx

Series:
WC = cascade high temp. liquid to water

Nominal Size:
16 = 1.5 ton
25 = 2 ton
45 = 3 ton
55 = 4 ton
65 = 5 ton
75 = 6 ton
80 = 6.5 ton

Functions:
H = Heating

Refrigerant:
C = cascade R410a/R134a

Revision:
01, 02 etc.

Indoor Loop Exchanger:
P = brazed plate (single wall)
D = brazed plate (double wall)

Outdoor Loop Exchanger:
C = Copper coaxial
Y = CuNi coax coil & piping
Z = CuNi coax coil only

Compressor:
D = dual scroll

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

APPLICATION TABLE									
MODEL	**FUNCTION**	**REFRIGERANT**	**VOLTAGE**	**COMPRESOR**	**OUTDOOR COIL**	**INDOOR COIL**	**REVISIONS**		
WC-16	H	C	1	D	C Z	P D	04		
WC-25	H	C	1 6	D	C Y Z	P D	04		
WC-45 WC-55 WC-65	H	C	1 2 4 5 6 7	D	C Y Z	P D	04		
WC-75 WC-80	H	C	1 2 4 5 7	D	C Y Z	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+

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WC-Series Description

Maritime Geothermal Ltd. has manufactured NORDIC brand **W-series** water-to-water geothermal/geoexchange 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, or hydronic air handlers/fan coils, and have a maximum indoor water temperature capability of **120°F (49°C)**.

Introduced in 2015, the **WC-series** is an extended temperature range water to water heat pump. It's a cascade heat pump using two compressors and two refrigeration circuits: a R410a circuit does the first part of the temperature lift, then transfers its heat to a second R134a circuit which completes the temperature lift.

The **WC-series** can heat water on the indoor side up to **160°F (71°C),** for use with high temperature heating distribution systems like hot water baseboards. It can also deal with the low temperatures encountered in closed ground loops in northern climates, as low as **23°F**. (If the source loop is always warmer than 45°F and high temperature heating is required, see the high-temperature NORDIC **WH-series** instead.)

An alternate application to space heating for the WC-series is direct heating of domestic hot water up to the plumbing code temperature of **140°F (60°C)**. For this application, be sure the water to be heated is not hard (i.e. prone to calcium scaling), and order the optional double wall condenser. (Heat pumps with a single wall condenser 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 building codes.)

The **WC-series** is a unique heat pump that provides a solution for high temperature hydronic heating from a cold climate ground loop, with minimal strain on the technology. Its disadvantages are a higher equipment cost than other water to water heat pumps due to its two refrigeration circuits, and a slightly lower COP (efficiency) when heating hydronic water to a moderate temperature similar to that of lower-temperature-capability heat pumps.

1. Heating Mode

In heating mode, the heat pump heats water in a buffer tank (or DHW tank) to a user-adjustable setpoint temperature, while extracting heat from the outdoor ground 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, hot water baseboards, or other hydronic devices. 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

Because it would be mechanically complex, the WC-series does not have reversing valve(s) to switch over to chill water for hydronic cooling applications. For advanced system designers, it is still possible to use a simultaneous 2-tank setup with external controller to include cooling in a geothermal system using the WC-series. See **Piping** chapter.

The outdoor loop heat exchangers are heavy duty coaxial copper / steel models with optional CuNi inner tube. The indoor loop heat exchanger is a brazed plate, single or double walled. 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.

Sizing for Space Heating/Cooling

WC-Series Heat Pump Sizing

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

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

THE TABLE ABOVE IS FOR ESTIMATION ONLY. IT 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 (e.g.140°F or 160°F) and the minimum expected ground loop temperature (usually considered to be 30-35°F in cold climates). These capacities can be found in the performance tables in the **Model Specific Information** section. For 100% heat pump sizing, choose a heat pump with a capacity at expected fluid temperatures that matches or just slightly exceeds the calculated heat load.

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 2 - Auxiliary Heat Sizing		
Model	**Tank Element Size**	
	Recommended	**EcoUltra Tank Available**
WC-25	**7 kW**	**12 kW (50 gal)**
WC-45	**10 kW**	**12 kW (50 gal)**
WC-55	**12 kW**	**15 kW (70 gal)**
WC-65	**15 kW**	**15 kW (70 gal)**
WC-75	**20 kW**	**20 kW (70 gal)**
WC-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 but not less.

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.

Installation Basics

Unpacking the Unit

When the heat pump reaches the site 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 or DHW 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 **and left** 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 - WC Series on Ground Loop

FROM MARITIME GEOTHERMAL
- WC 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)

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 - WC Series on Open Loop

FROM MARITIME GEOTHERMAL
- WC SERIES HEAT PUMP
- BUFFER TANK W/ELEMENTS __kW (or INDIRECT TANK FOR DEDICATED DHW)
- P/T PORTS AND HOSE ADAPTERS (2)
- DOLE VALVE
- TACO, SOLENOID, OR MODULATING WATER VALVE

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

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 3 - 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 required only if connecting 220VAC 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 4 - 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 LP Limit Selection

There are two low pressure safety limits in the heat pump: 75 psi for open loop (water), and 55 psi for closed loop (antifreeze). As shipped, the closed loop low pressure limit will be active.

If an open loop is used, it is very important to remove the jumper plug located in the wiring harness behind the piping post, and replace it with the water valve connection harness that comes with the water valve from Maritime Geothermal. This will automatically select the higher low pressure limit, and ensure that the heat pump is properly protected from freezing. It will also ensure the water valve is open before starting the compressor. See wiring diagram for water valve wiring.

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** chapter for details.

TABLE 5 - 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. Since there is no reversing valve in the WC series, there are no external control connections.

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. 160°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 6 - 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** 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** terminal to call for compressor. **CA** is the common terminal for use in powering the external device.

TABLE 7 - Aquastat (Signals Control) Connections	
Signal	**Description**
CA	**24VAC common (ground)**
RA	**24VAC hot**
Y1A	**Compressors ON**
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

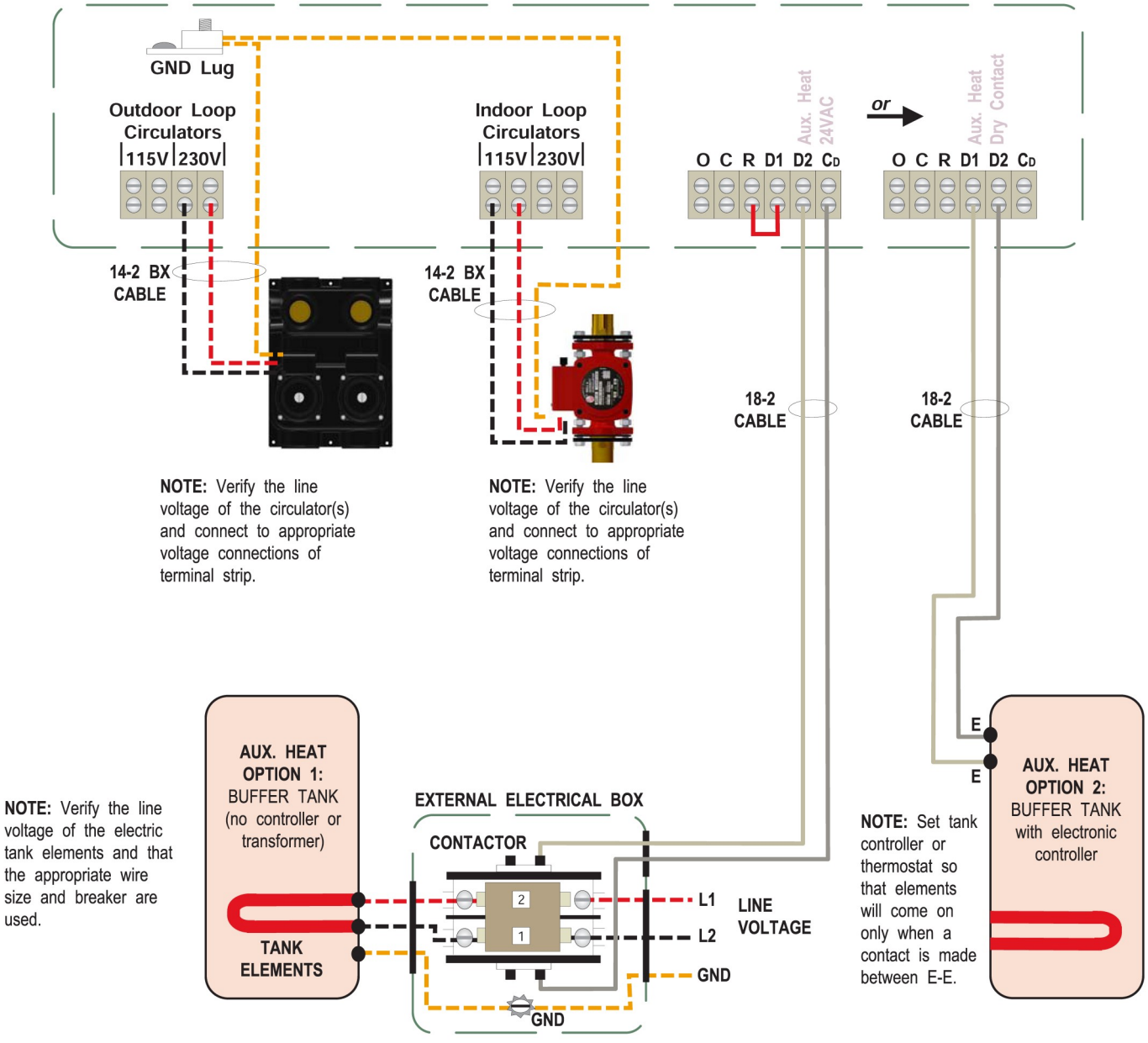
Hot tank and/or cold tank temperature sensors can be used in place of the **ICR** sampling routine with Setpoint Control. This is the **HTS/CTS** option.

Accessory current sensors 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



REV	ECO #	IMPL BY	APVD BY	DATE
02	000282	Dan Rheault	Dan Rheault	1-Feb-2021
01	Initial Release	Dan Rheault	Dan Rheault	1-Sep-2017

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

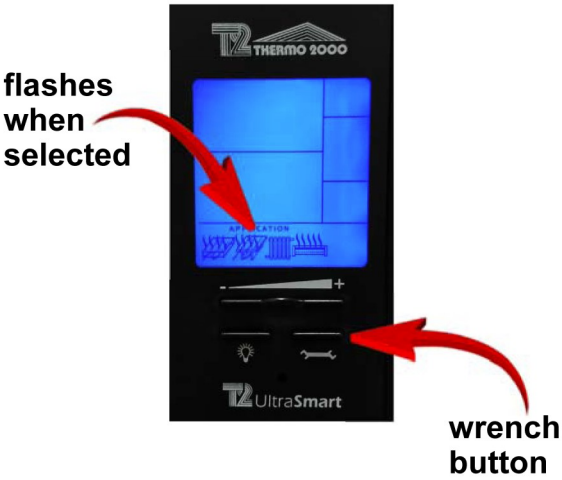
AltSource Tanks: Getting Started

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.)*

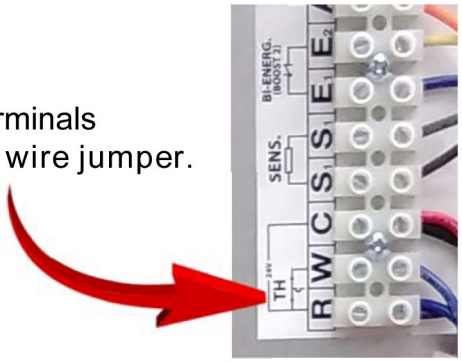
1. Put the tank in “Bi-Energy” rather than “Electric” mode, with switch on back of controller.

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.



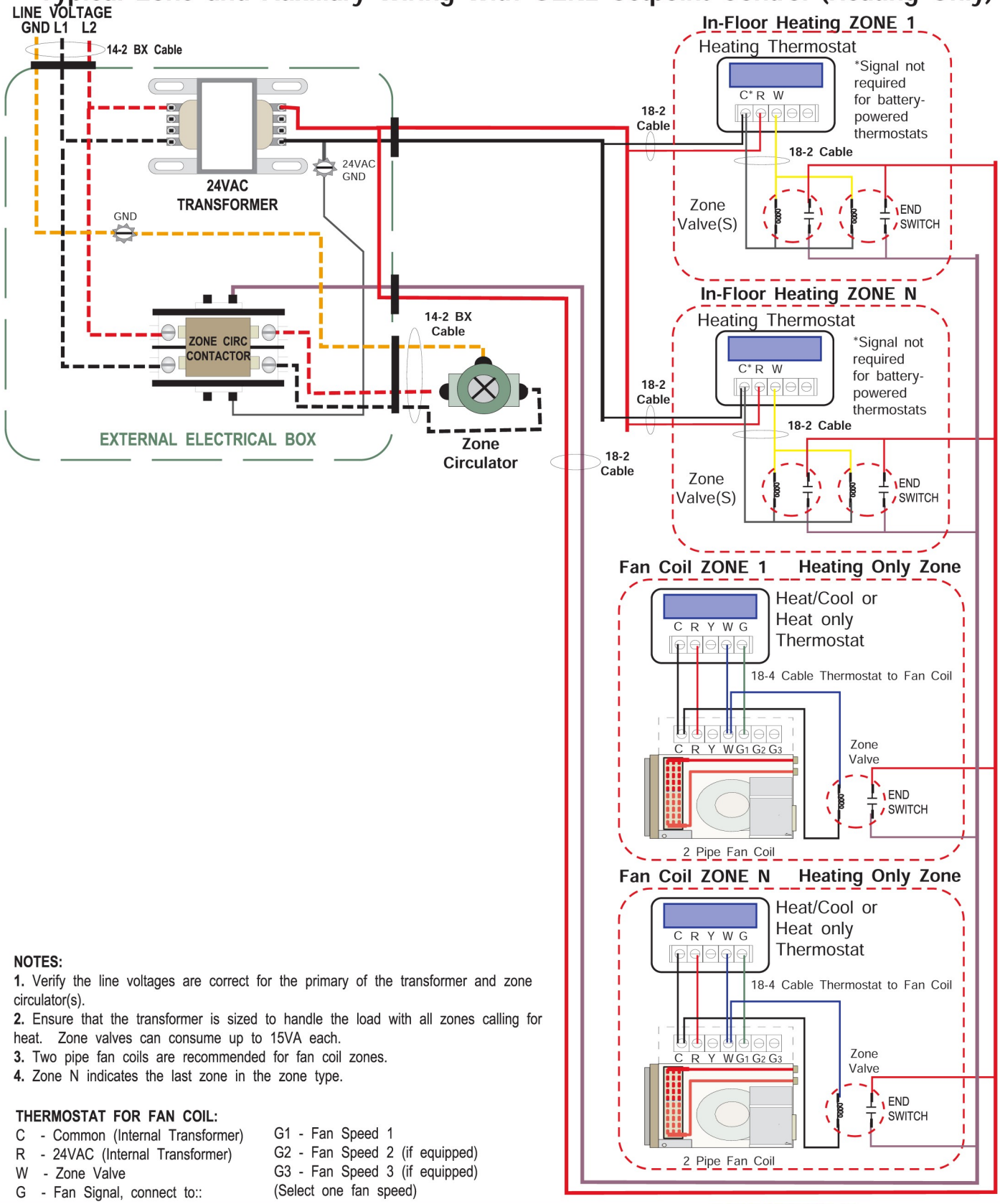
4. Now the tank elements will only be activated by a connection between the E_1-E_2 tank terminals, up to the 125°F maximum. This will be done by an 18-2 wire to the **D1-D2** terminals in the heat pump, activating the elements only when ***AUX*** heat is required.

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)

REV	ECO #	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	Initial Release	C. GEDDES	C. GEDDES	04-APR-2017

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

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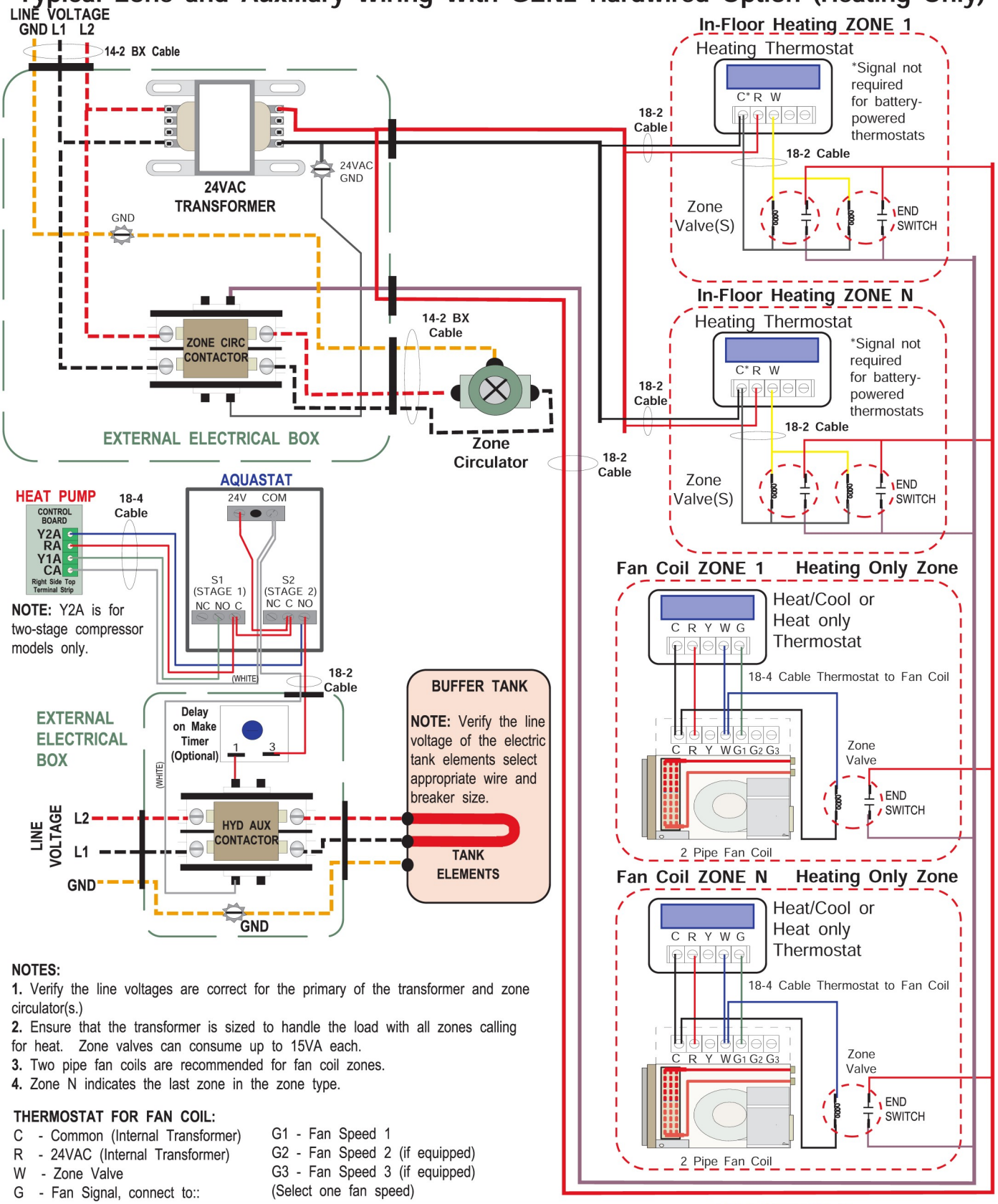
Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating Only)

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

Typical Zone and Auxiliary Wiring With GEN2 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)

REV	ECO #	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	Initial Release	C. GEDDES	C. GEDDES	04-APR-2017

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

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
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E4Z 6H4

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

Piping

WC-Series: Space Heating vs. DHW

The indoor loop piping will be different depending on whether it's a WC-series heat pump with single wall condenser being connected for space heating use, or a WC-series heat pump with optional double wall condenser being connected for direct heating of domestic hot water (DHW). See diagrams on following pages.

WC-Series: Number of Tanks

All **WC-series** systems will require at least **one buffer tank**. If there is one buffer tank, it will contain the heated water.

Note that since the WC-series does not have a reversing valve, water can only be chilled using a simultaneous 2-tank (hot tank / cold tank) setup with external controller as shown on the following diagram **002288PDG**.

The hot buffer tank may have electric elements for auxiliary heat, or an existing boiler may be used. See piping diagrams on following pages.

Indoor Loop & Buffer (or DHW) Tank

WC-series connections for the indoor loop are 1" brass female NPT. They are labelled INDOOR/DHW IN and INDOOR/DHW 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 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 8 - Buffer Tank Size

Heat Pump Size	Minimum Size gal (L)	Recommended Size gal (L)
16	16 (60)	50 (190)
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)

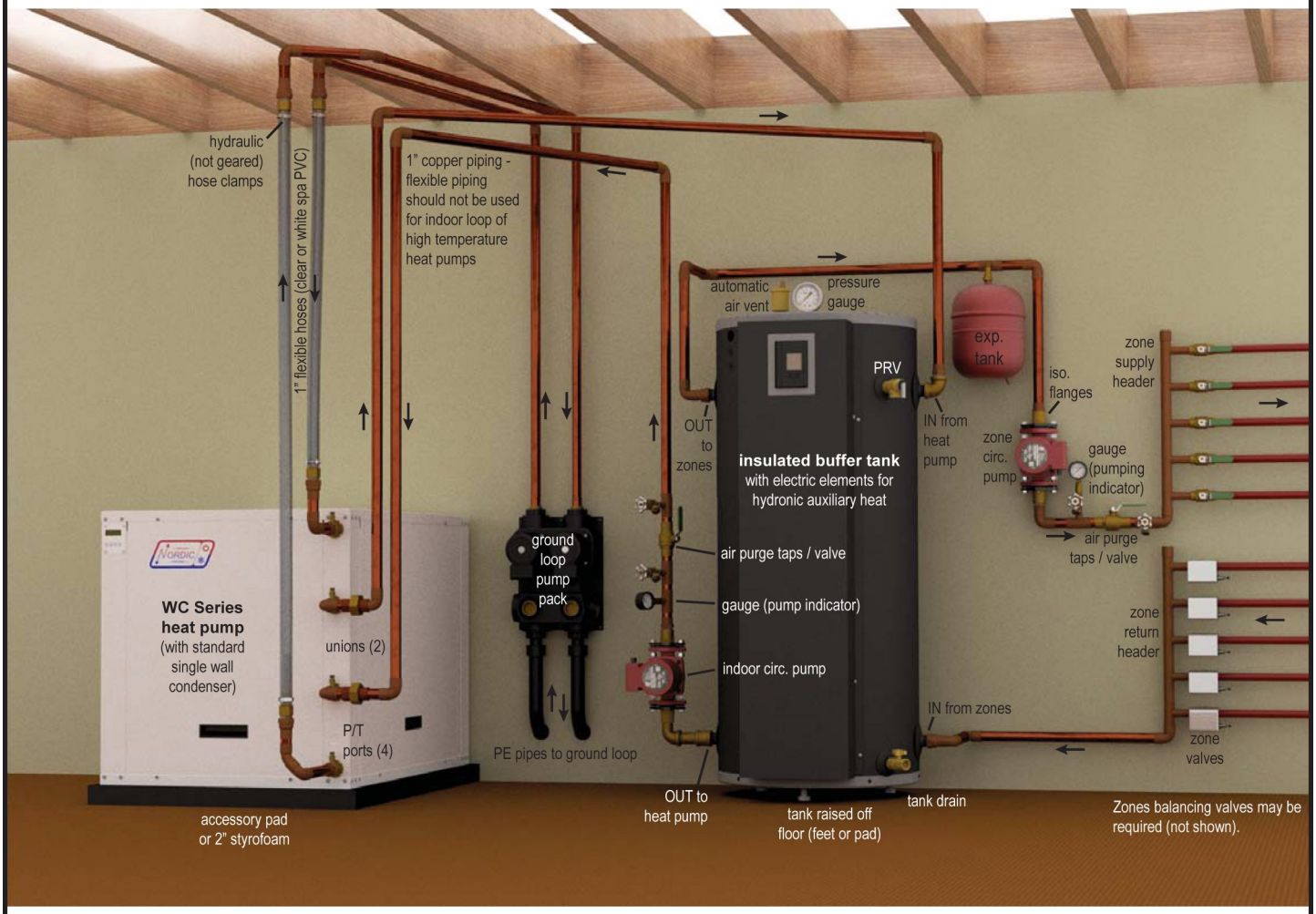
If a tank size is not available, use the next size larger tank.

Outdoor Loop

WC-series connections for the outdoor loop are 1" brass female NPT. They are labelled OUTDOOR IN and OUTDOOR OUT.

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

Typical Piping Connections - WC Series
HIGH TEMPERATURE SPACE HEATING



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
01	Initial Rel.	Dan Rheault	Dan Rheault	10-Jan-2022

Drawn By: Dan Rheault	Date: 10-Jan-2022	
Checked By: Dan Rheault	Date: 10-Jan-2022	
Eng. Approved By	Date	
Mfg. Approved By	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
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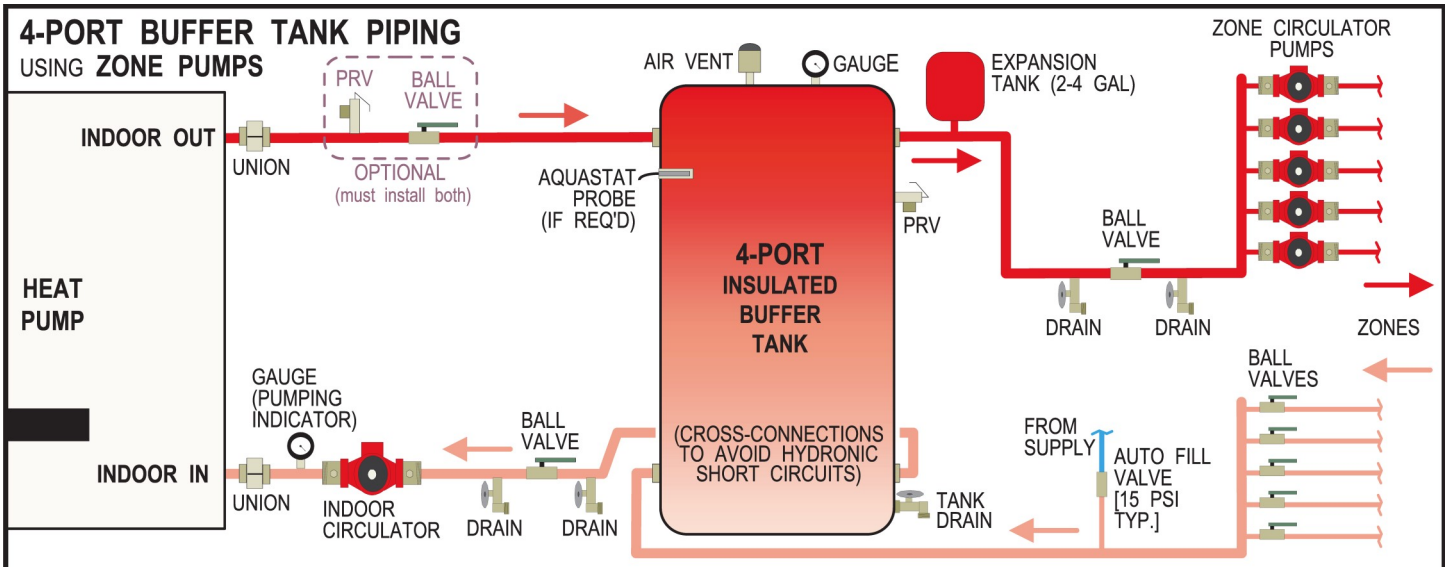
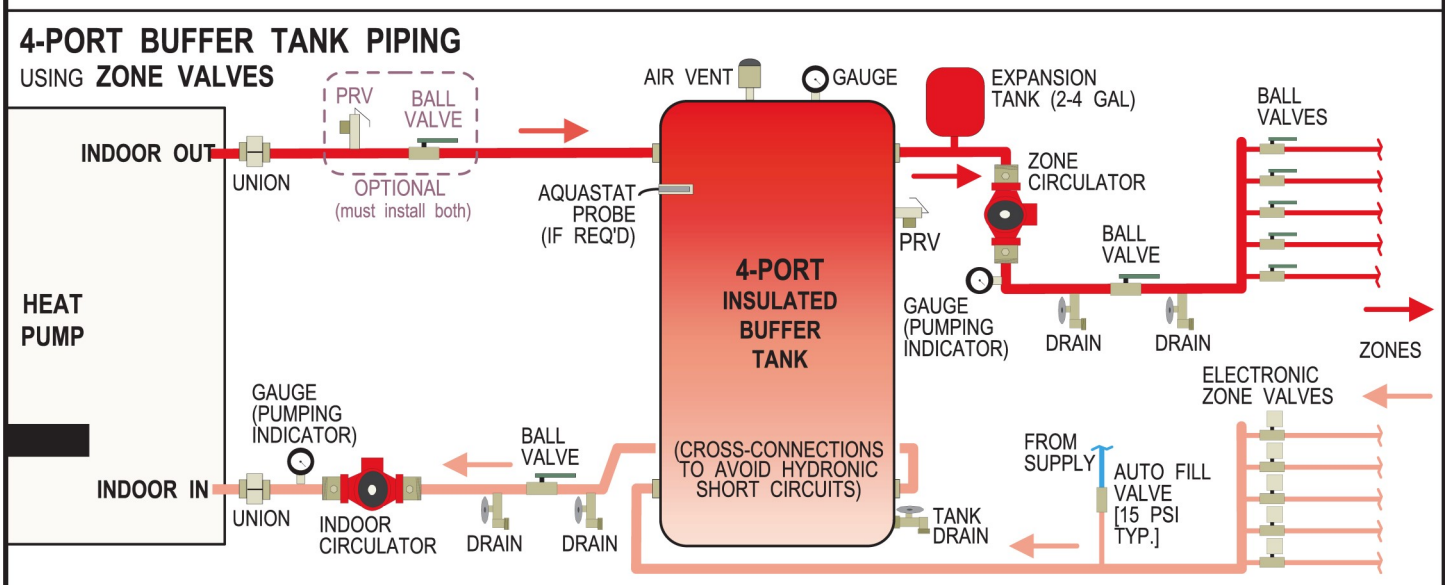
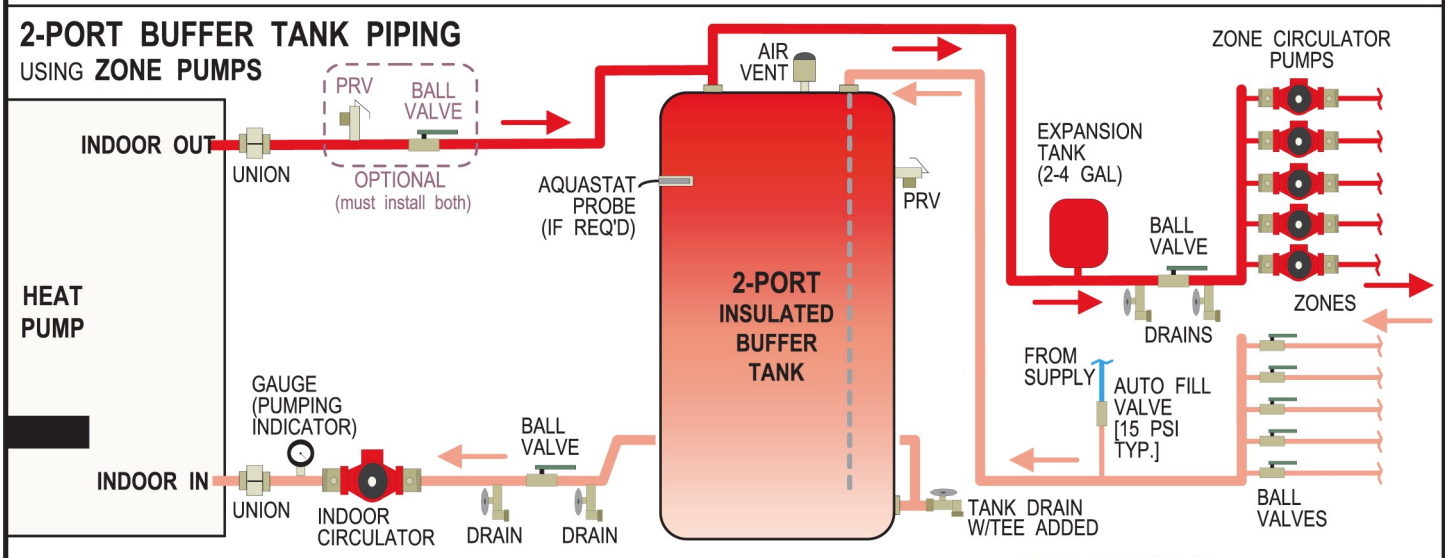
Drawing Name: **Typical Piping Connections - WC for Space Heating**

Size	Drawing Number	Revision	Sheet
LET	002575PDG	01	1 / 1





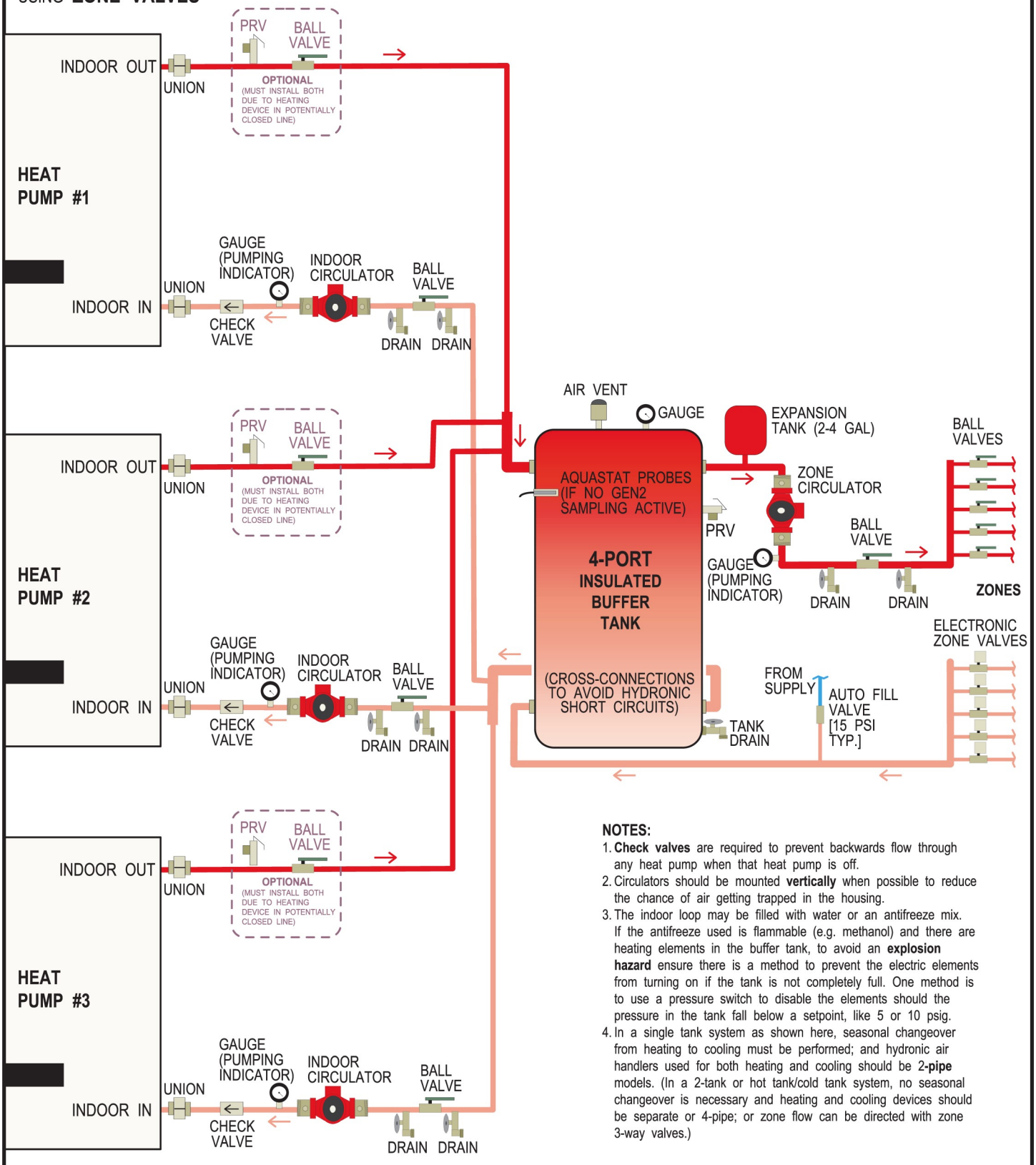


REV	ECO #	IMPL BY	APVD BY	DATE
02	(add fill valve)	D. RHEAULT	D. RHEAULT	1-Feb-2021
01	Initial Release	D. RHEAULT	D. RHEAULT	14-Dec-2018

Drawn By: Dan Rheault	Date: 14-Dec-2018	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 14-Dec-2018	Drawing Name: Recommended Hydronic Buffer Tank Piping
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	

Size	Drawing Number	REV	SHEET
A	002366PDG	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.)

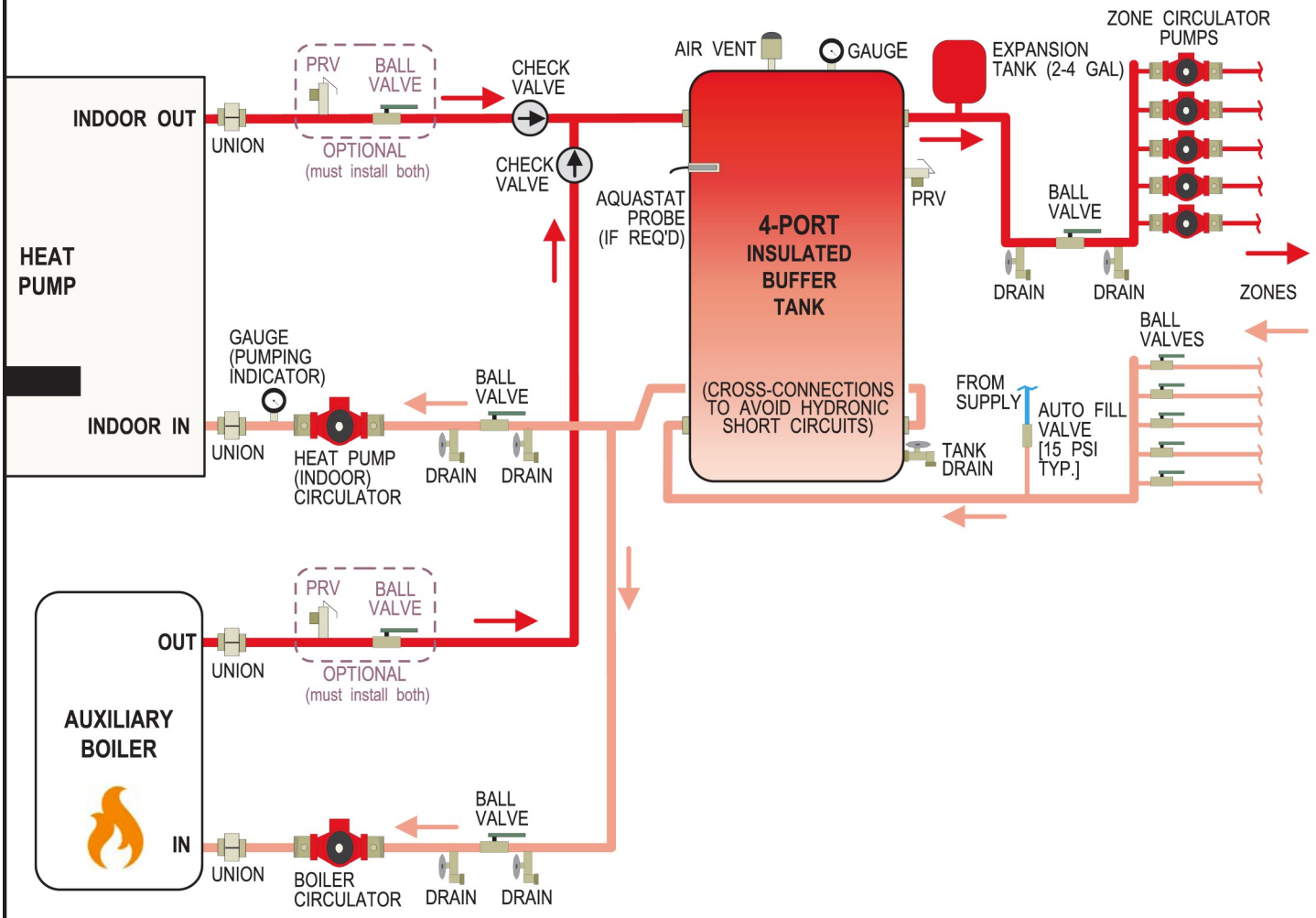
REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	9-Aug-2021

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

Auxiliary Boiler Piping

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

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

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Drawing Name: **Auxiliary Boiler Piping**

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

Two Tank Simultaneous Heating / Cooling

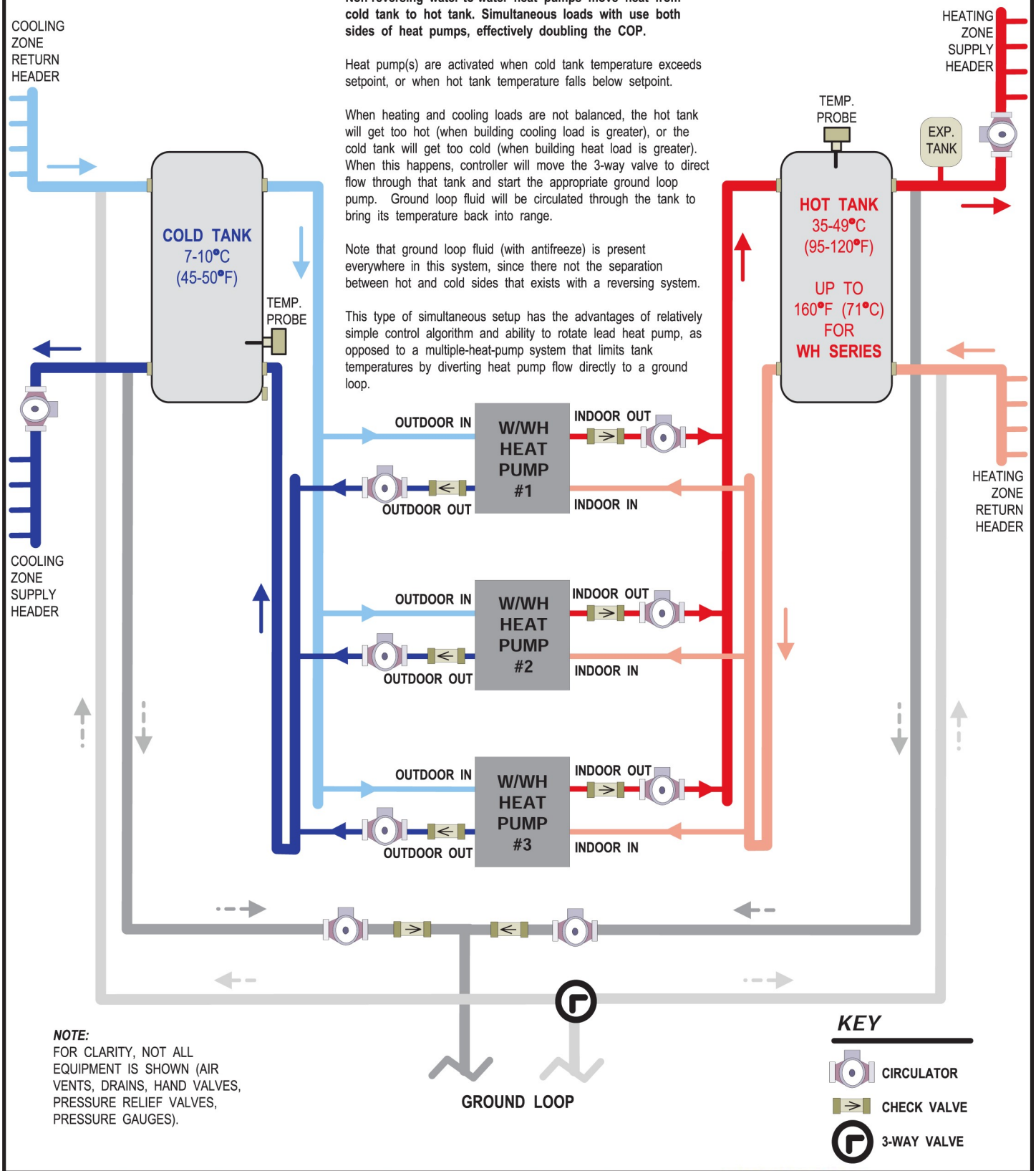
Non-reversing water-to-water heat pumps move heat from cold tank to hot tank. Simultaneous loads with use both sides of heat pumps, effectively doubling the COP.

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
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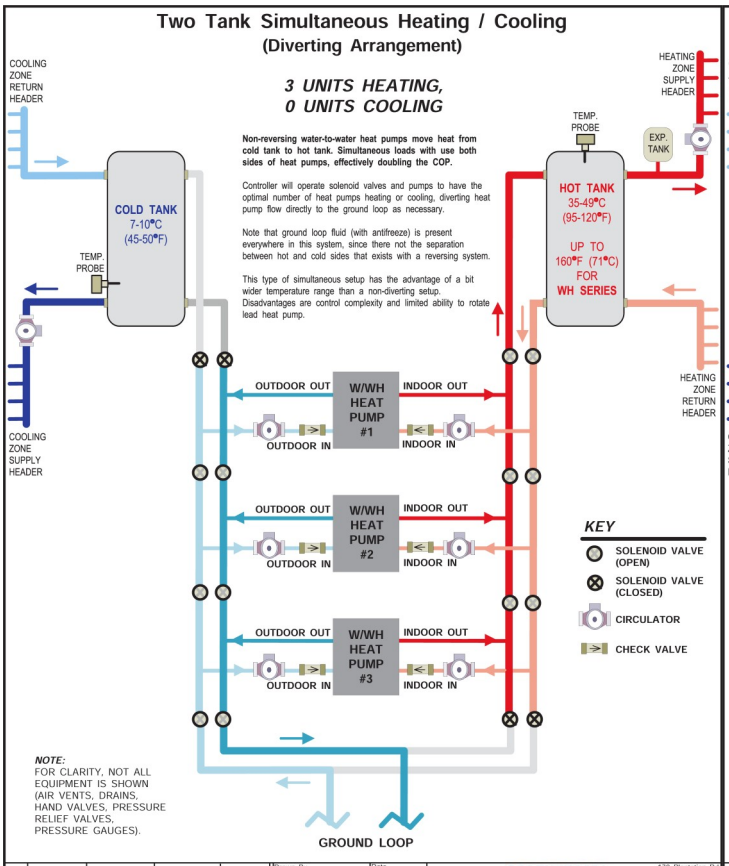
Drawing Name: Two Tank Simultaneous Heating / Cooling

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

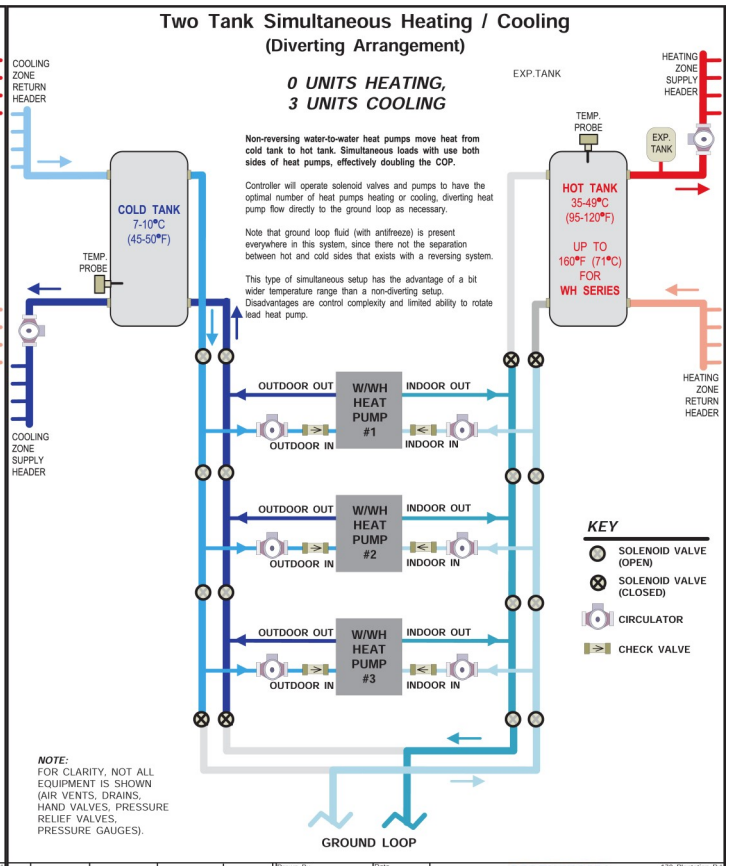


REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

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

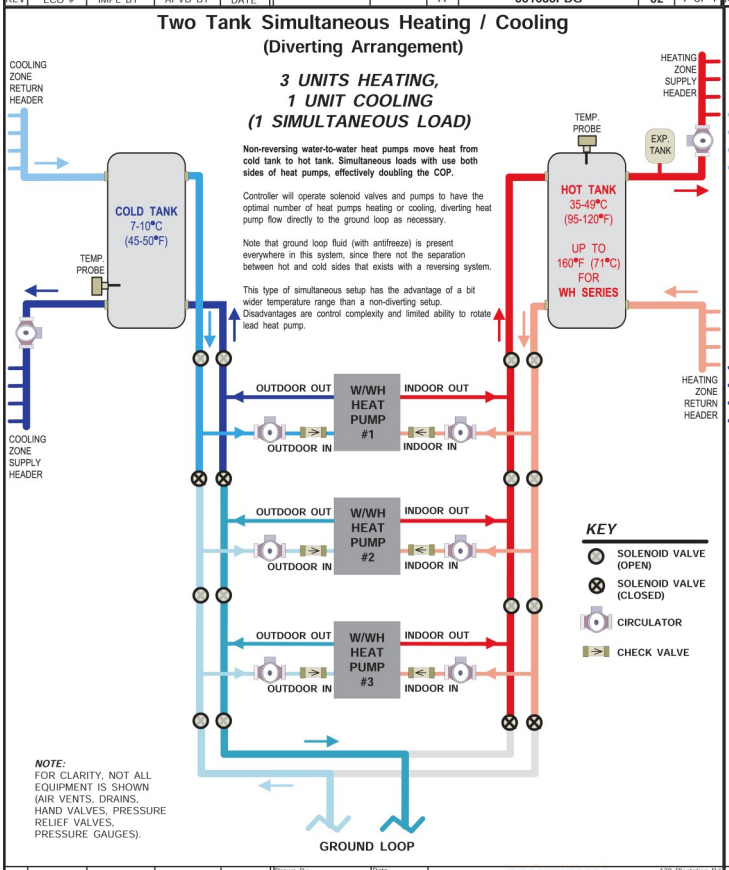


REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

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

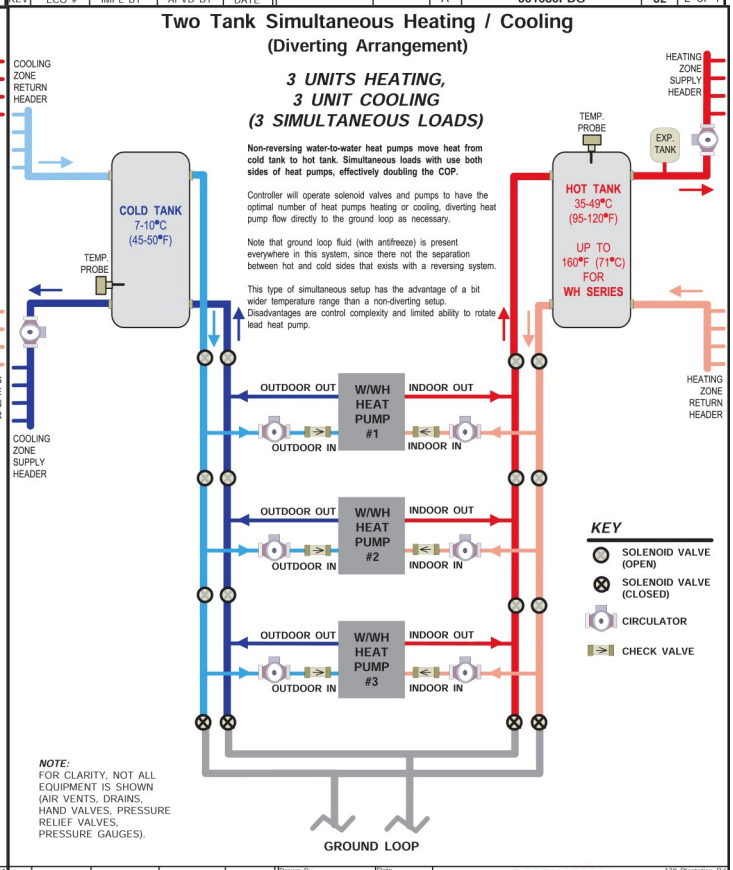


REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

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



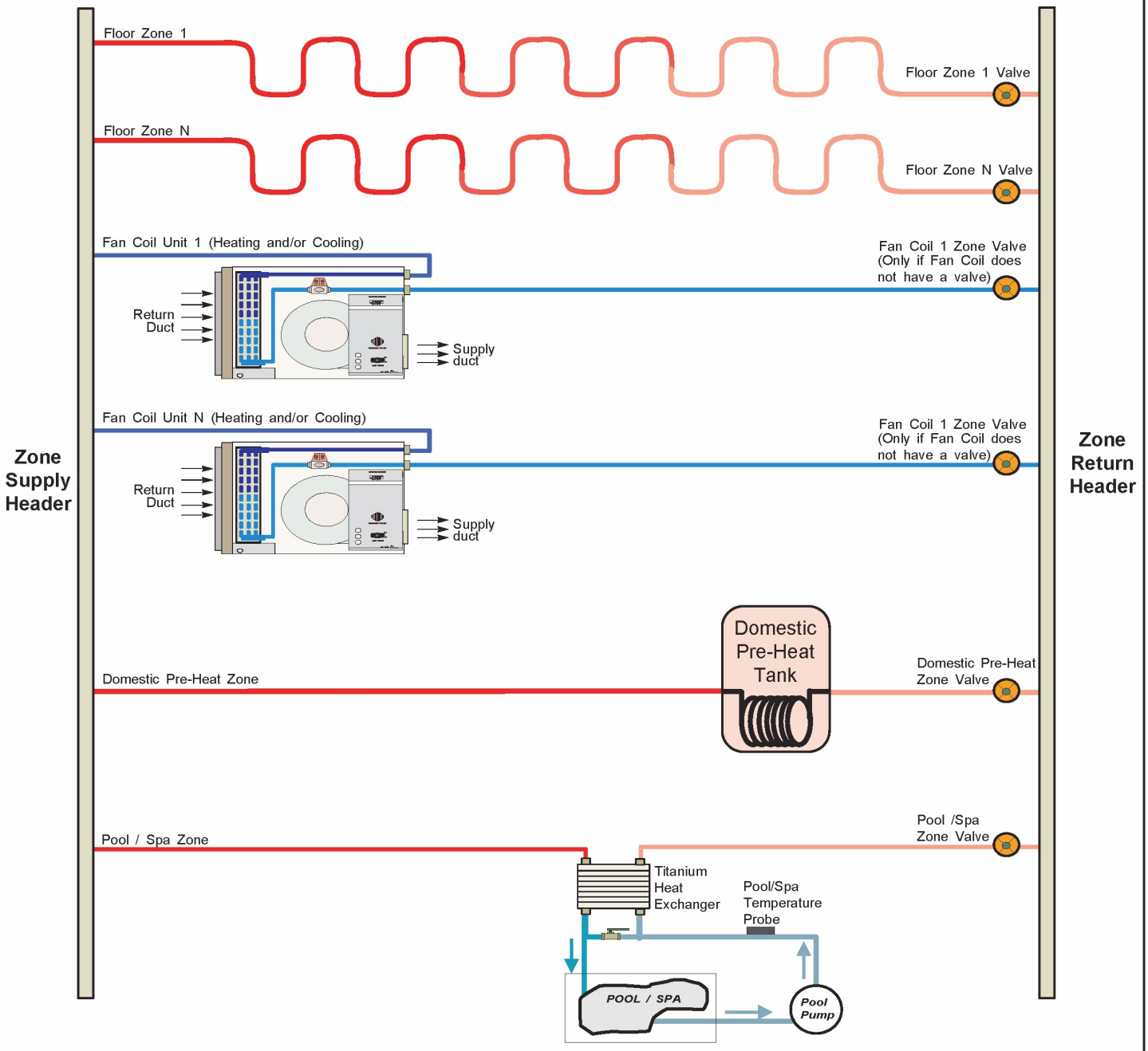
REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

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:	

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Drawing Name: Typical Zone Types for Hydronic Applications

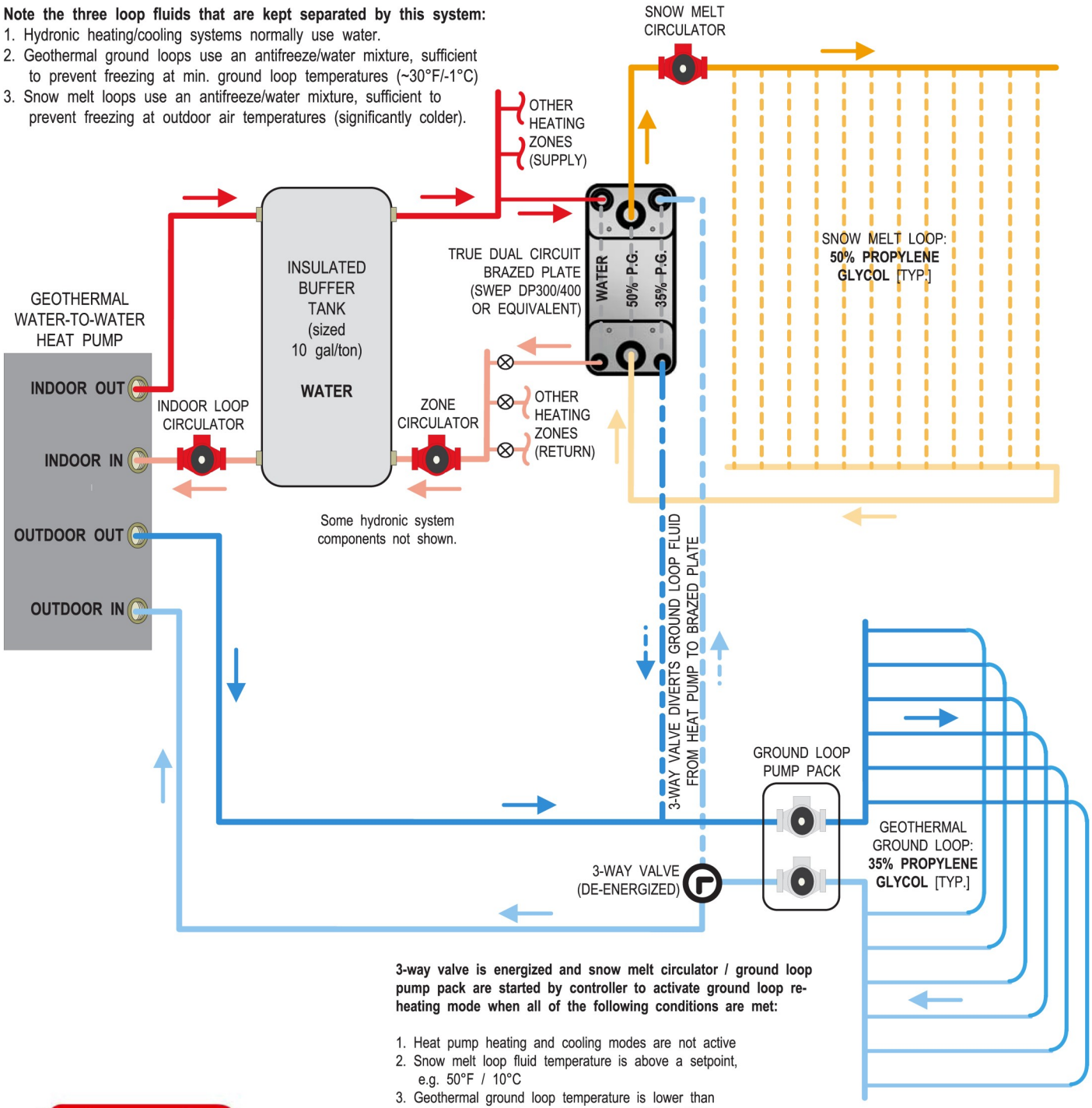
Size	Drawing Number	REV	SHEET
A	000530PDG	01	1 of 1

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

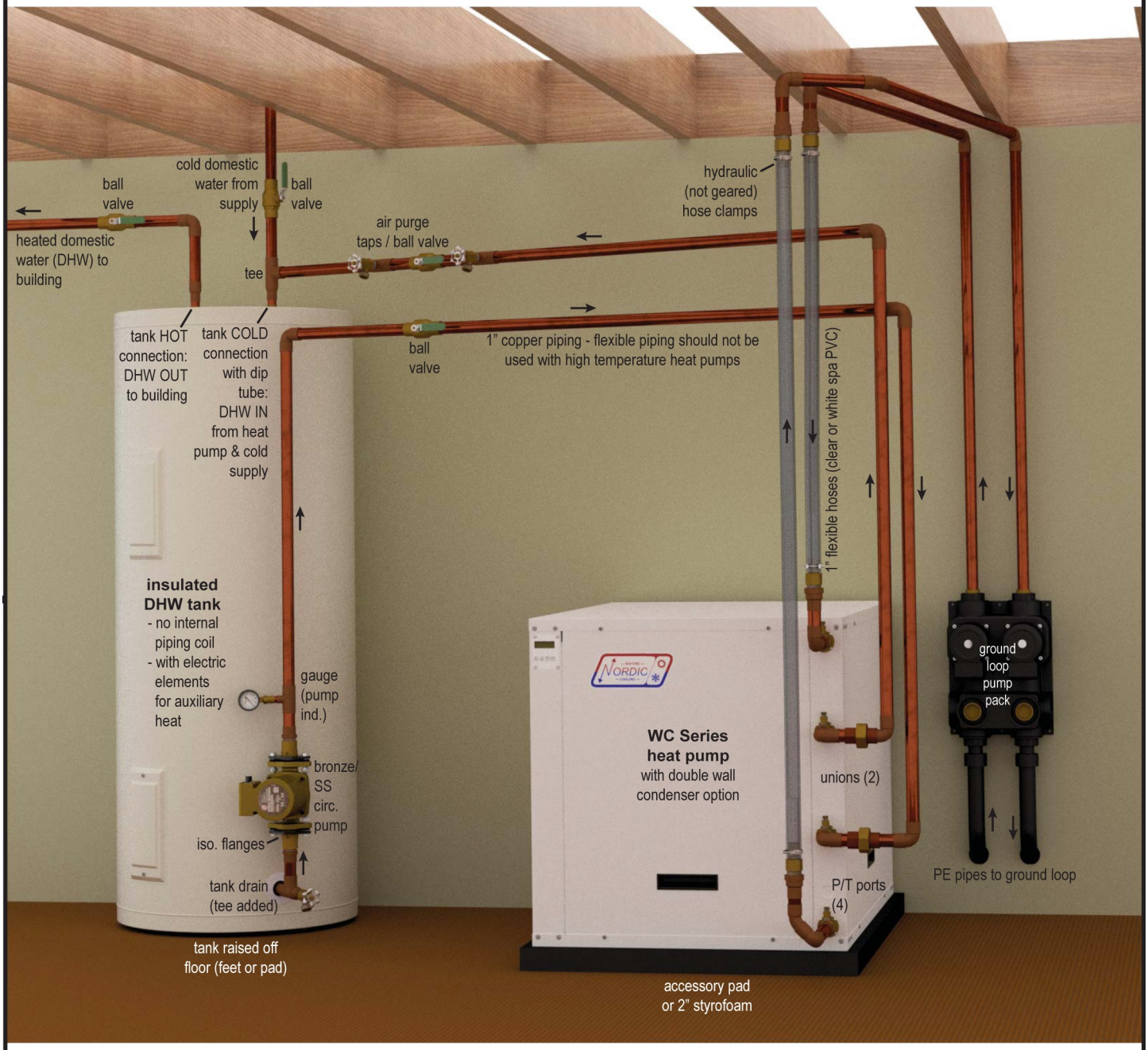
When 3-way valve is energized, snow melt hydronic heating zone is locked out.

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:	Size: A / Drawing Number: 002286PDG / REV: 01 / SHEET: 1 of 1
Approved By:	Date:	

Typical Piping Connections - WC Series

DIRECT DOMESTIC HOT WATER HEATING with
DOUBLE WALL CONDENSER OPTION



REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Rel.	Dan Rheault	Dan Rheault	10-Jan-2022

Drawn By: Dan Rheault	Date: 10-Jan-2022	
Checked By: Dan Rheault	Date: 10-Jan-2022	
Eng. Approved By	Date	
Mfg. Approved By	Date	
Approved By	Date	

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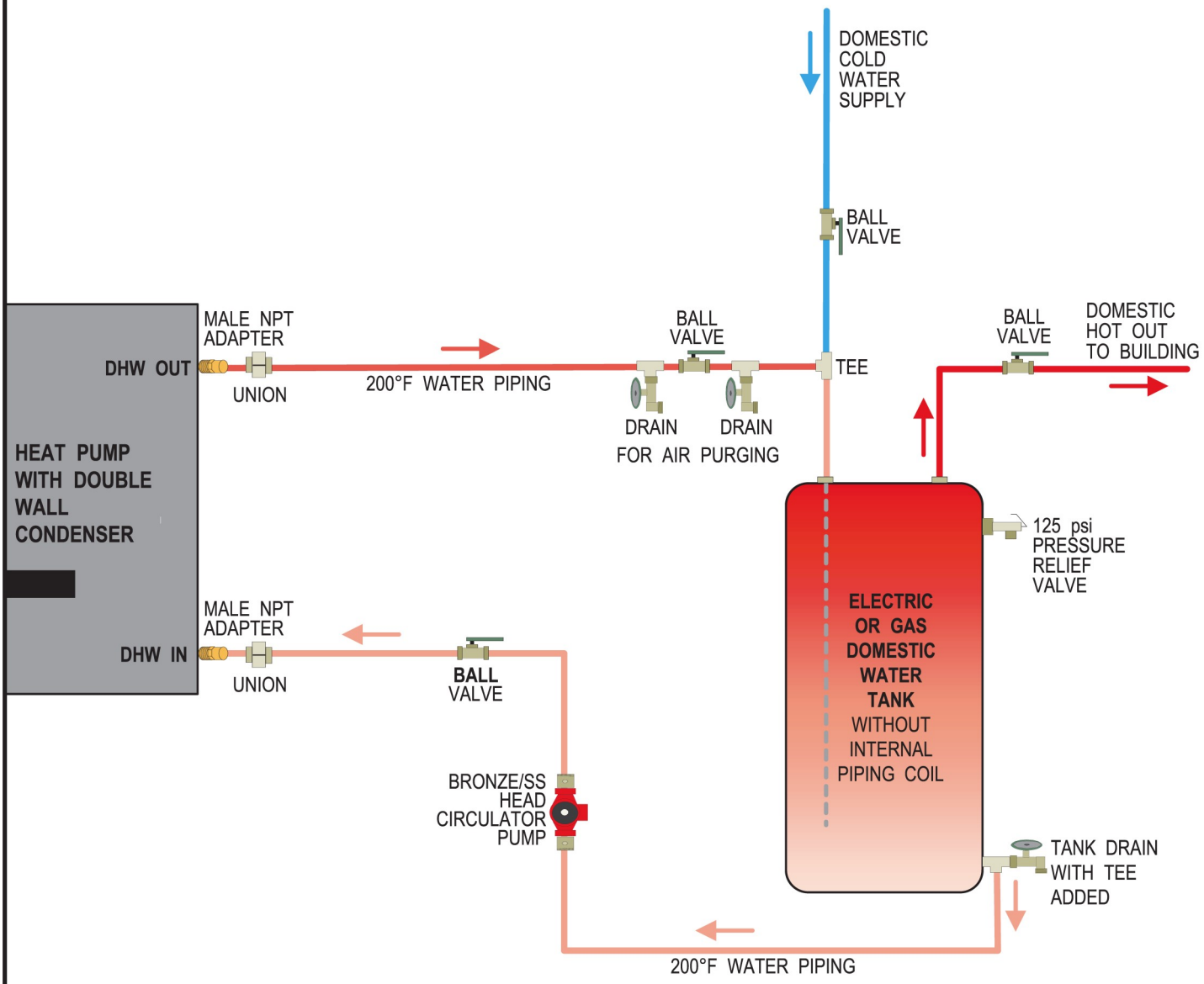
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: **Typical Piping Connections - WC Direct DHW Heating**

Size	Drawing Number	Revision	Sheet
LET	002576PDG	01	1 / 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

Ground Loop Installations

WARNING: Heating-only WC units only extract heat from (never reject heat to) the ground loop. This must be taken into account during ground loop sizing & 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.

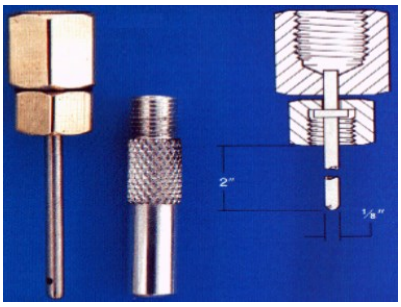
Figure 1: Ground Loop Accessories & Tools

2-pump module

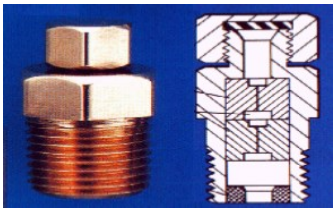
Barbed Adapters

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 9 - 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 10 - 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.

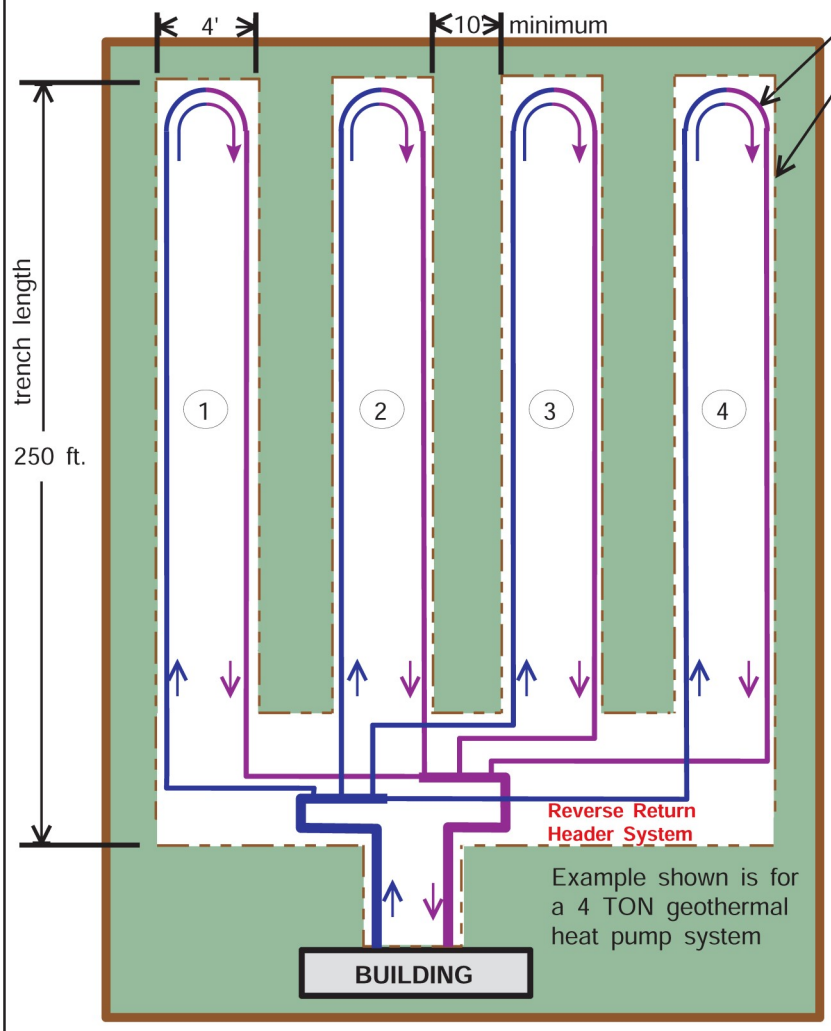
- Pressurize the loop to a static pressure of **45 psig**. when installing a system in the fall going into the heating season.
- Pressurize the loop to a static pressure of **25 psig**. when installing a system in the spring or summer going into the cooling season.

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

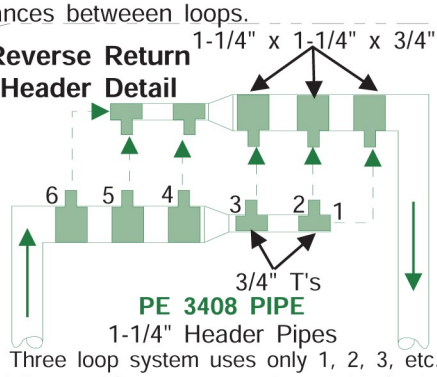
All ground loop piping inside the structure (between the structure entry point and the heat pump) should be insulated with 3/8" thick closed cell pipe insulation to prevent condensation and dripping onto floors or walls.

TYPICAL HORIZONTAL GROUND LOOP CONFIGURATION



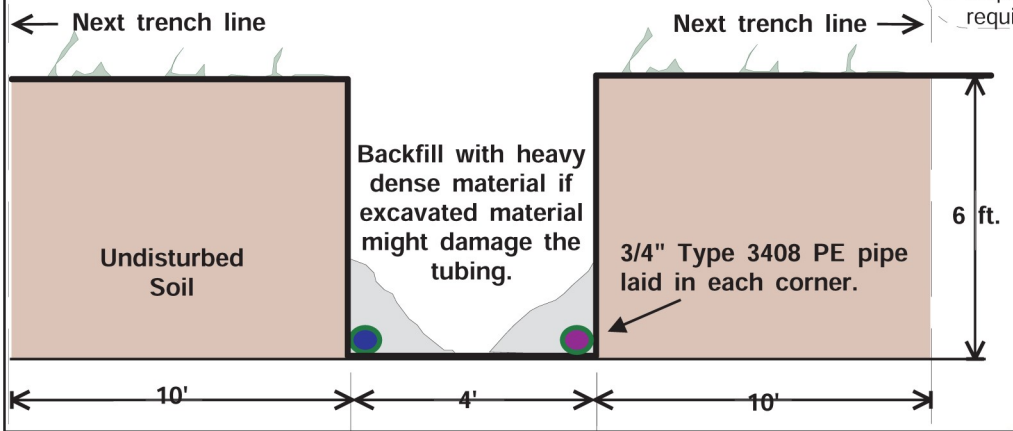
- Type PE 3408 Pipe
- Excavated trenches minimum 4' wide x 6' deep
- Trenches will be backfilled with material which will maximize the thermal conductivity of the adjacent earth.
- Each loop consists of 500ft. of 3/4" type 3408 PE 160 psig (SDR 11) geothermal heat pump polyethelene tubing.
- Each trench 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

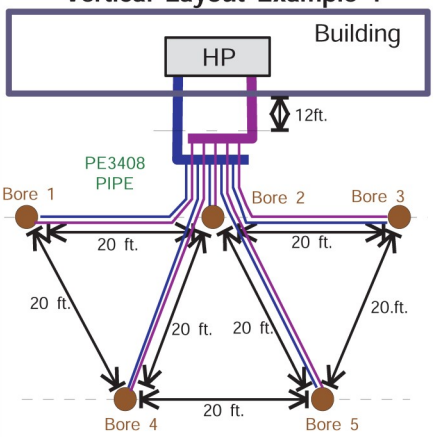
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Horizontal Ground Loop Configuration

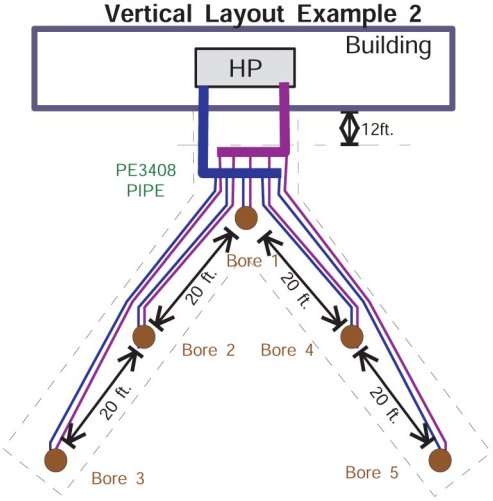
Size	Drawing Number	REV	SHEET
A	000608INF	01	1 of 1

TYPICAL VERTICAL GROUND LOOP CONFIGURATION

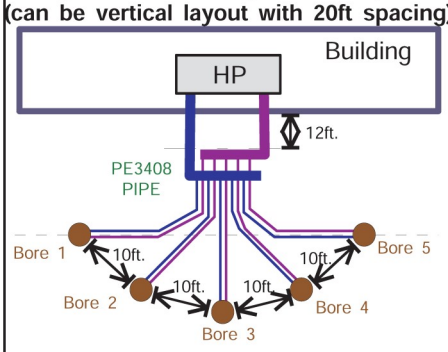
Vertical Layout Example 1



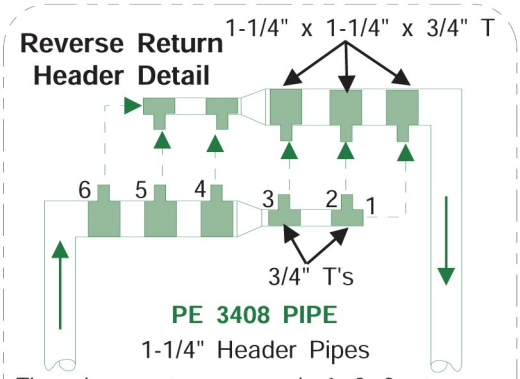
Vertical Layout Example 2



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

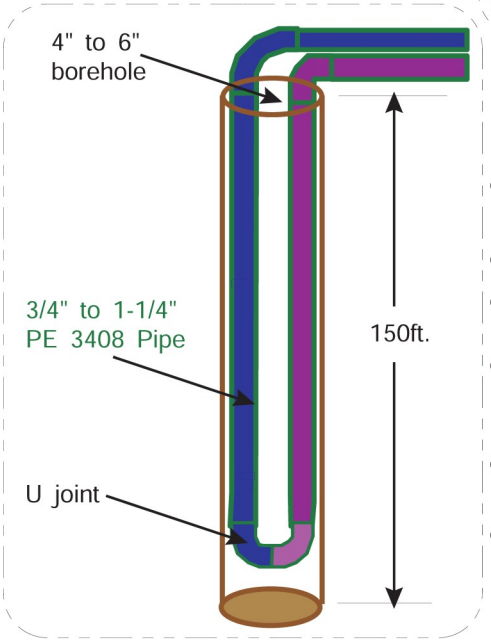


Reverse Return Header Detail



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

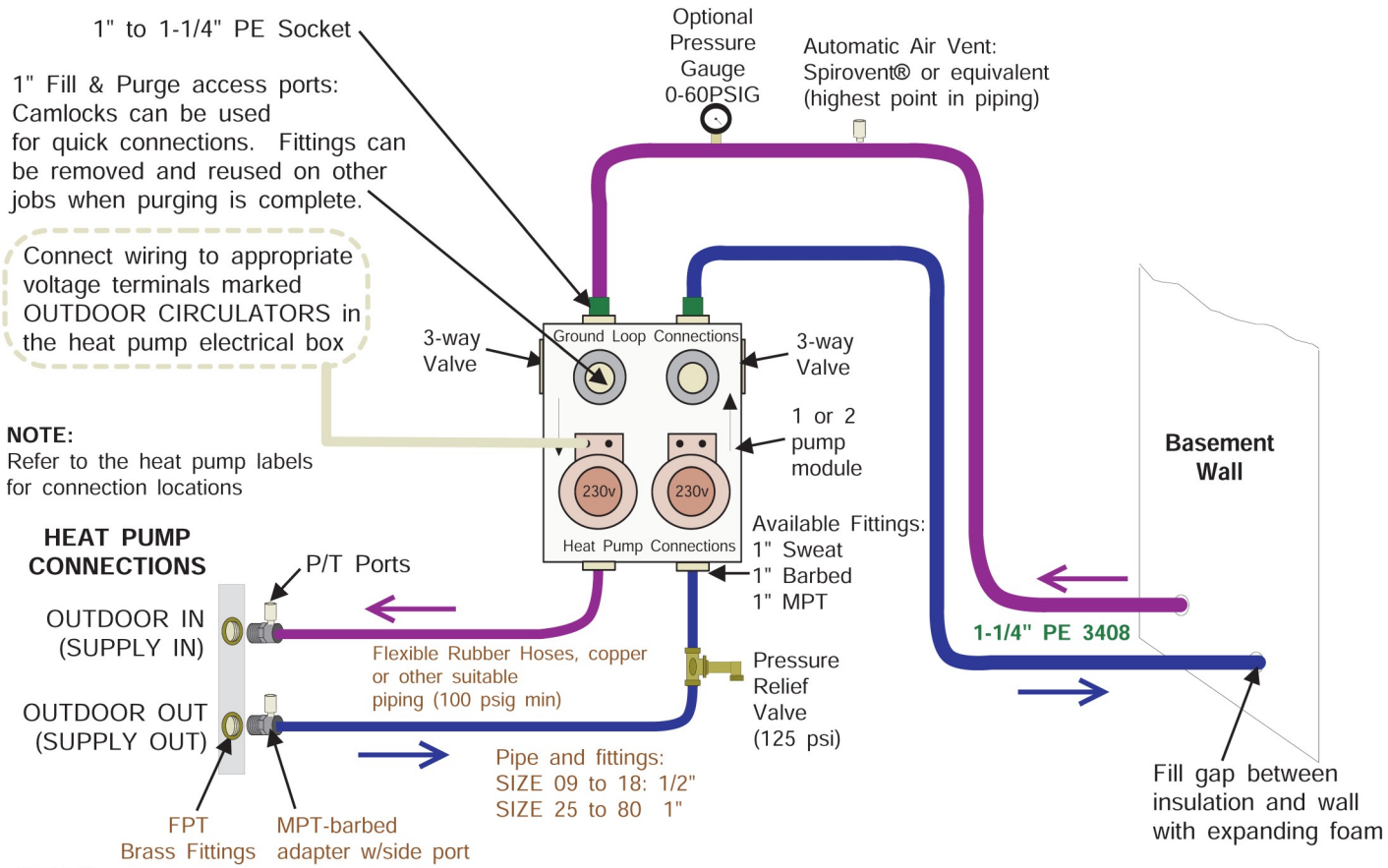
Drawn By: Chris Geddes	Date: 22 JAN 08	
Checked By: Chris Geddes	Date: 22 JAN 08	
Approved By (ENG): Chris Geddes	Date: 22 JAN 08	
Approved By (MFG):	Date:	
Approved By:	Date:	

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

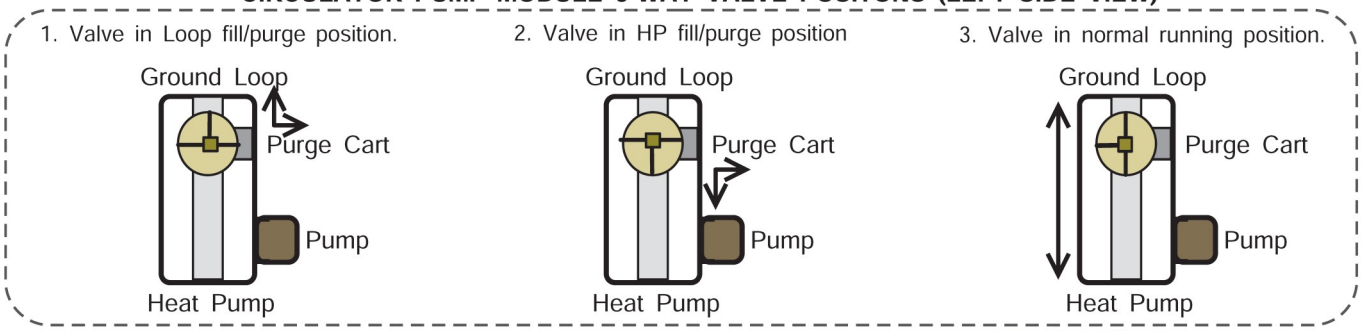
Geo-Flo Circulator Pump Module Installation
(Units with Brass FPT Fittings)



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.
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Petitcodiac, NB
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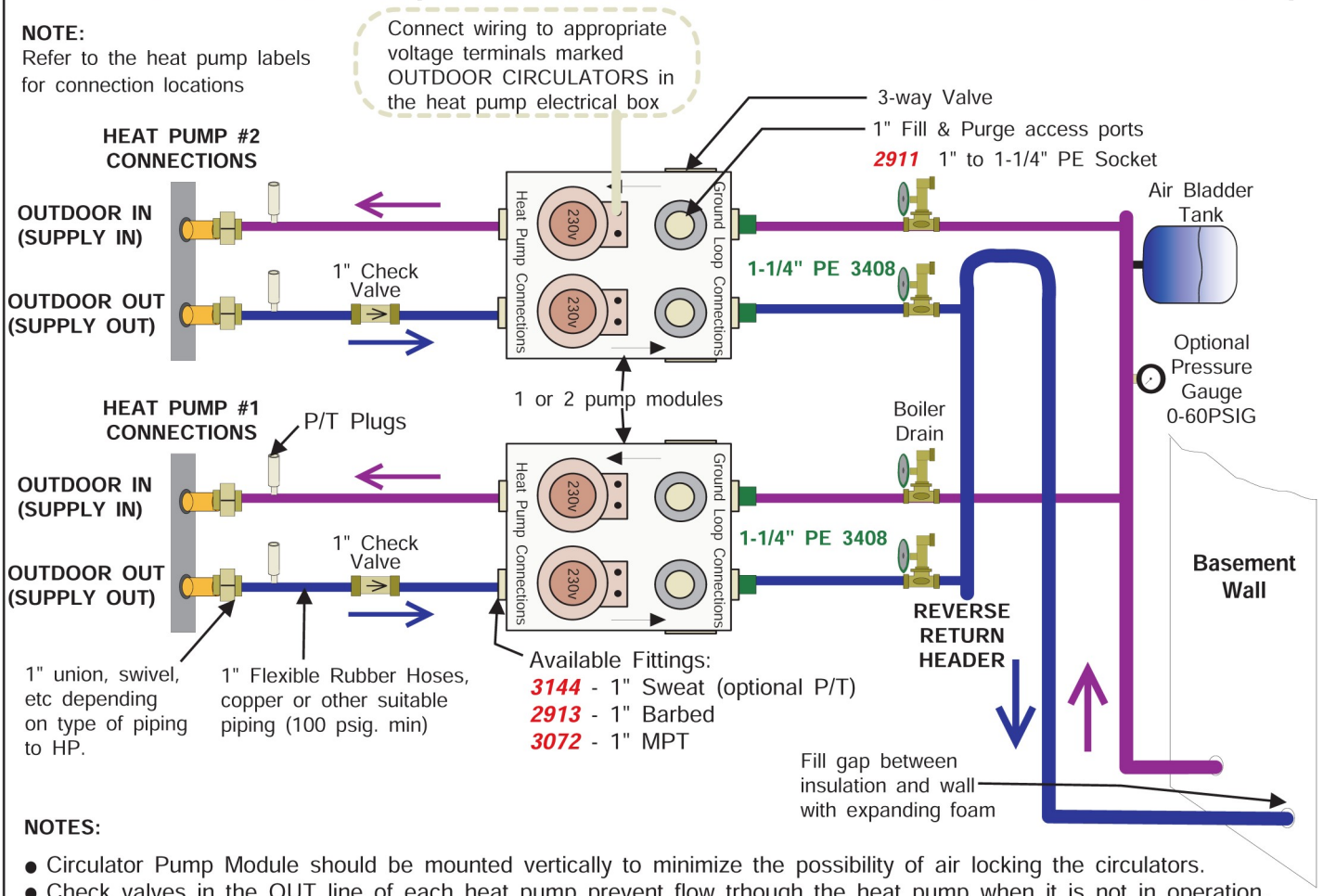
Drawing Name: Geo-Flo Circulator Pump Module Installation (Brass FPT)

Size	Drawing Number	Drawing Rev	SHEET
A	000906PDG	03	1 of 1

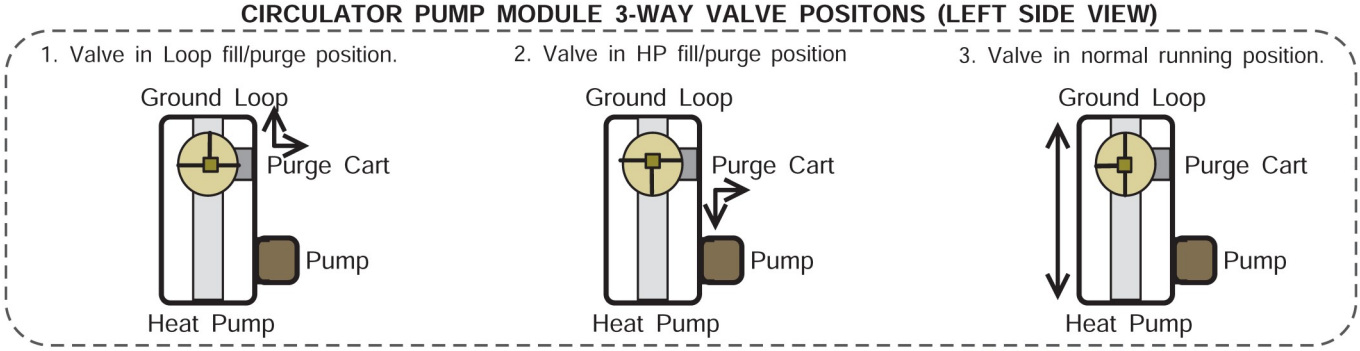
Geo-Flo Circulator Pump Module Installation - Two Units On One Ground Loop



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

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

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

Well Water Temperature

The temperature of the well water should be a minimum of **41°F (5°C)**. If the water is always above **45°F (7°C),** use a **WH-series** heat pump instead of the WC-series**.** 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. 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 11 - 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

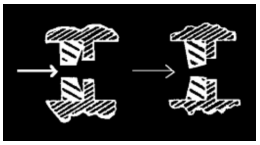
Water Level Sounder

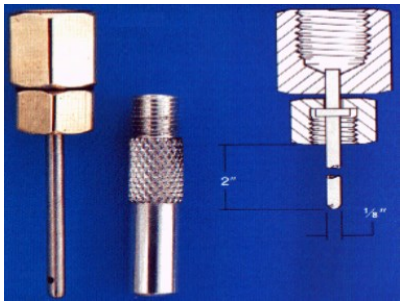
Cumulative Gallon Meter

Taco EBV

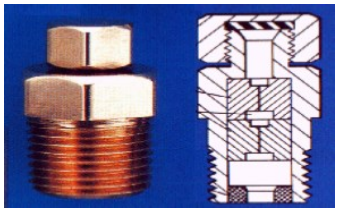
Rainbird Solenoid Valve

Dole Valve





Gauge adapter for P/T port



P/T port

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

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 control for open loop operation (since there is no antifreeze present).

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" 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.

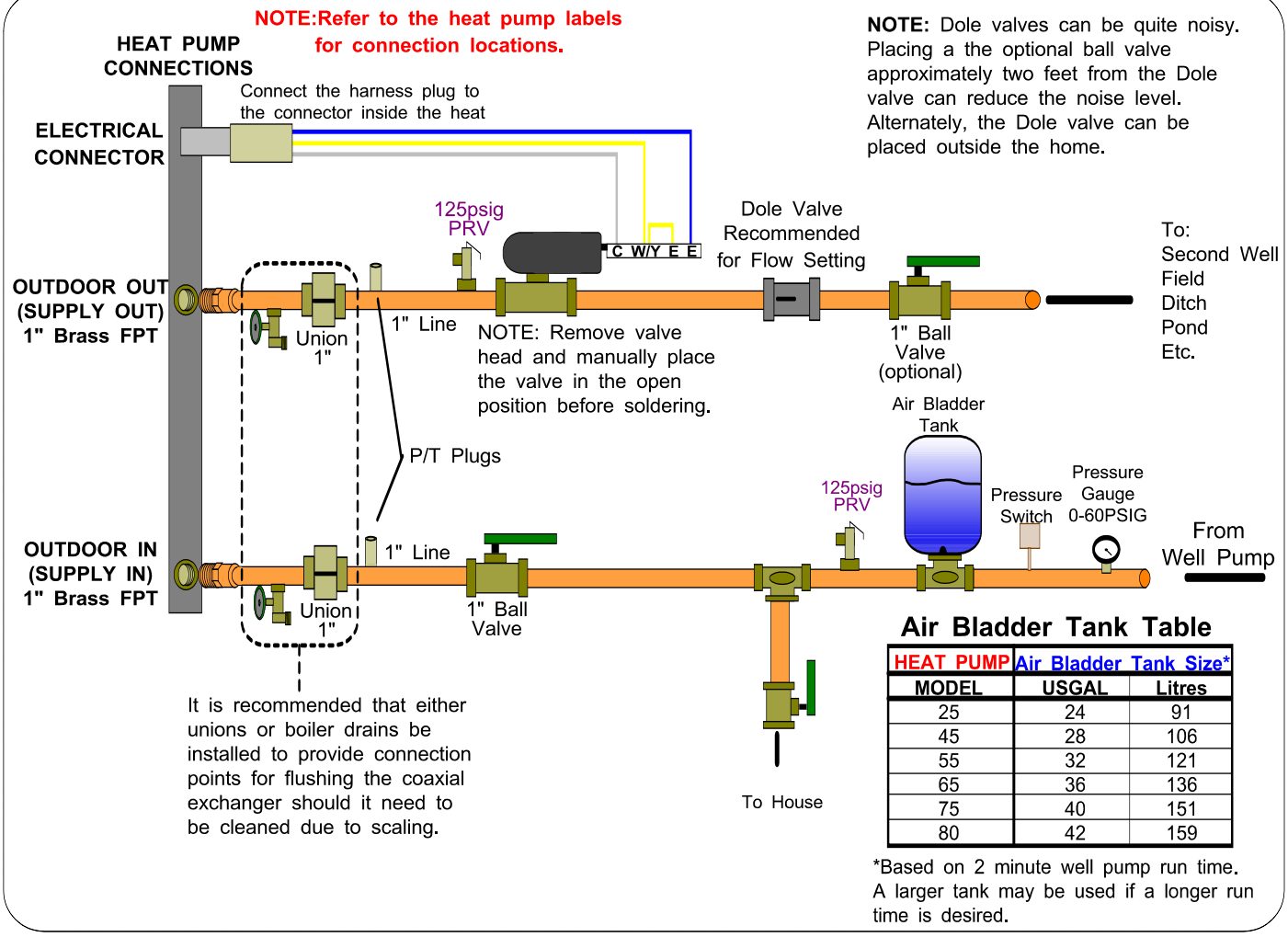
All water line valves on both the supply and discharge lines should be either BALL or GATE valves. GLOBE valves have a higher pressure drop, meaning more pumping power to maintain the required flow to the heat pump.

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)



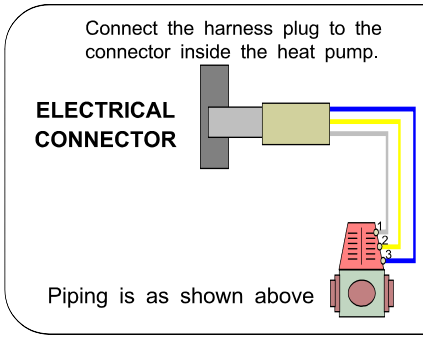
NOTE: Dole valves can be quite noisy. Placing a the optional ball valve approximately two feet from the Dole valve can reduce the noise level. Alternately, the Dole valve can be placed outside the home.

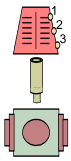
Air Bladder Tank Table

HEAT PUMP MODEL	Air Bladder Tank Size* 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

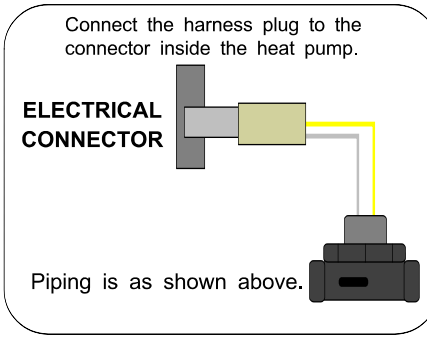




NOTE: Ensure the pin is installed in the proper orientation as shown here when re-installing the head.

NOTE: Remove the head from the valve before soldering the valve in place.

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

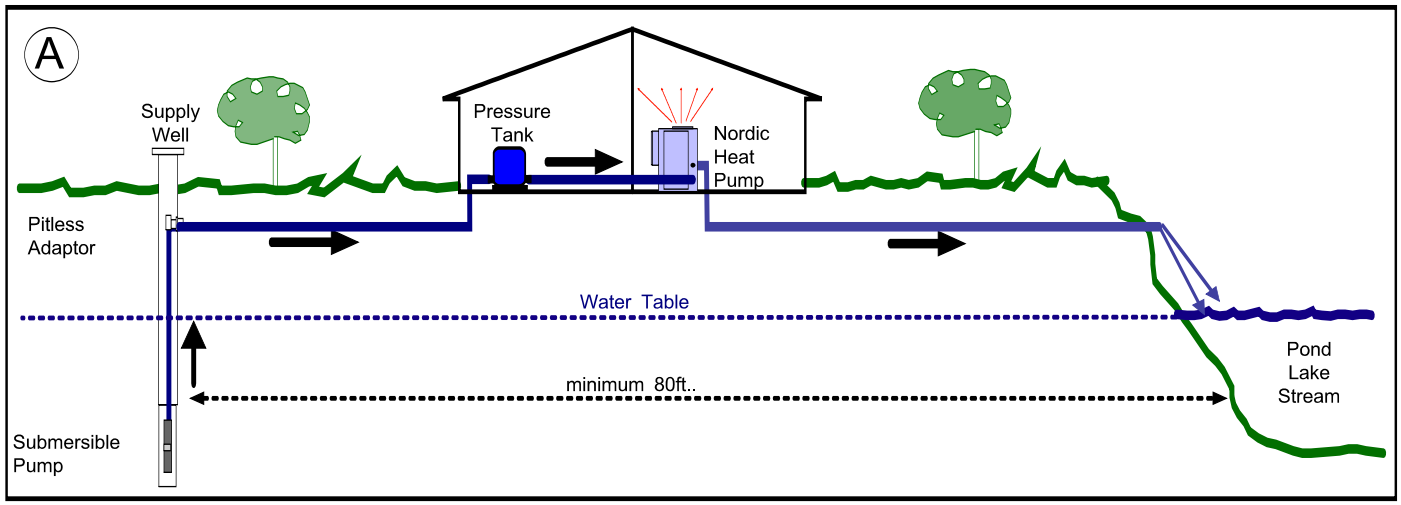
Drawn By: Chris Geddes	Date: 10 DEC 08	
Checked By: Chris Geddes	Date: 10 DEC 08	
Approved By (ENG): Chris Geddes	Date: 10 DEC 08	
Approved By (MFG)	Date	
Approved By	Date	

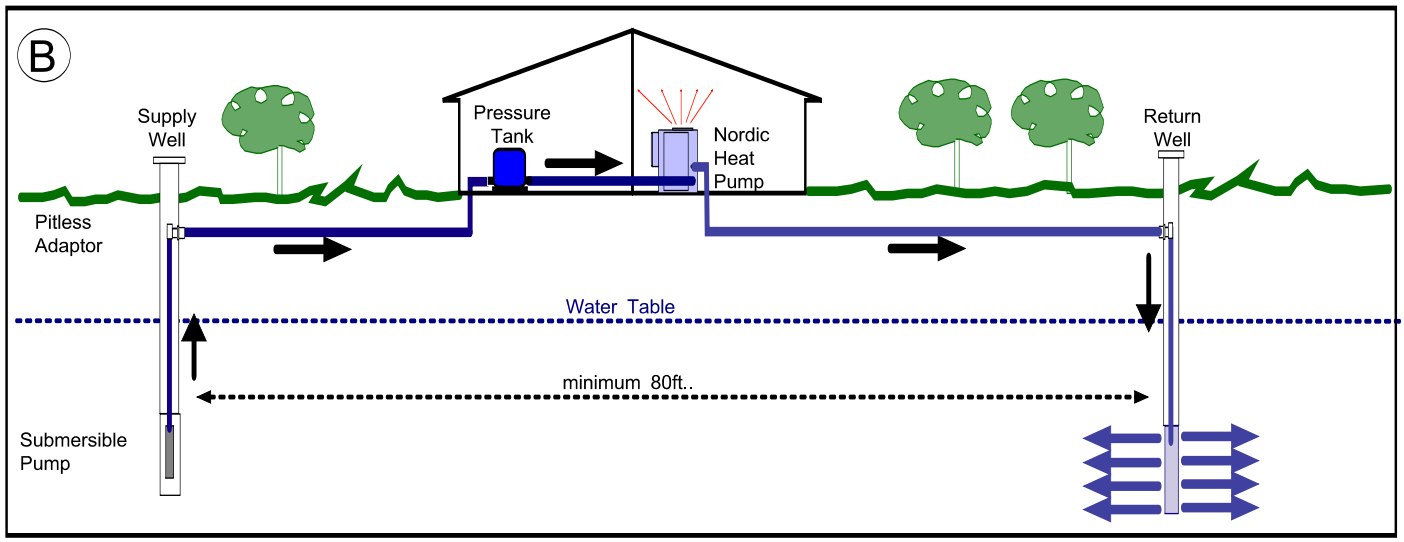
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

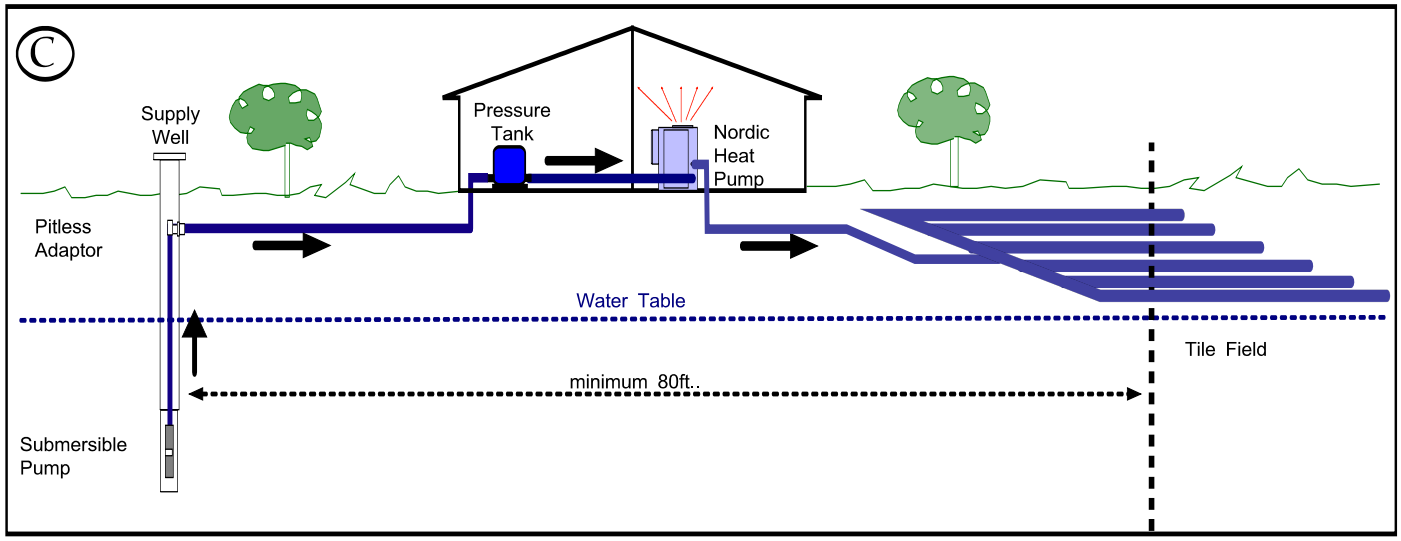
Drawing Name: Typical Ground Water Installation for Size 25-80 Heat Pumps (Brass FPT)

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

GROUND WATER DISPOSAL METHODS







01	Initial Release	C. GEDDES	C. GEDDES	04 FEB 08
REV	ECO #	IMPL BY	APVD BY	DATE

Drawn By: Chris Geddes	Date: 04 FEB 08
Checked By: Chris Geddes	Date: 04 JAN 08
Approved By (ENG): Chris Geddes	Date: 04 FEB 08
Approved By (MFG):	Date:
Approved By:	Date:

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

Drawing Name: Ground Water Disposal Methods

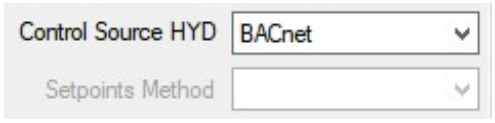
Size	Drawing Number	REV	SHEET
A	000619INF	01	1 of 1

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 an 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. 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

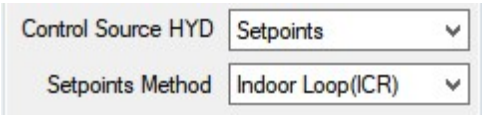
3. Setpoint Control

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).

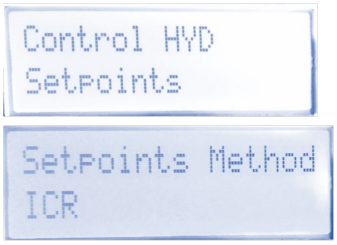
There are two options for Setpoint Control:

Setpoint Control Method 1 - Indoor Loop (ICR)

PC APP: Tools-->Configuration



LCD Interface: Configuration



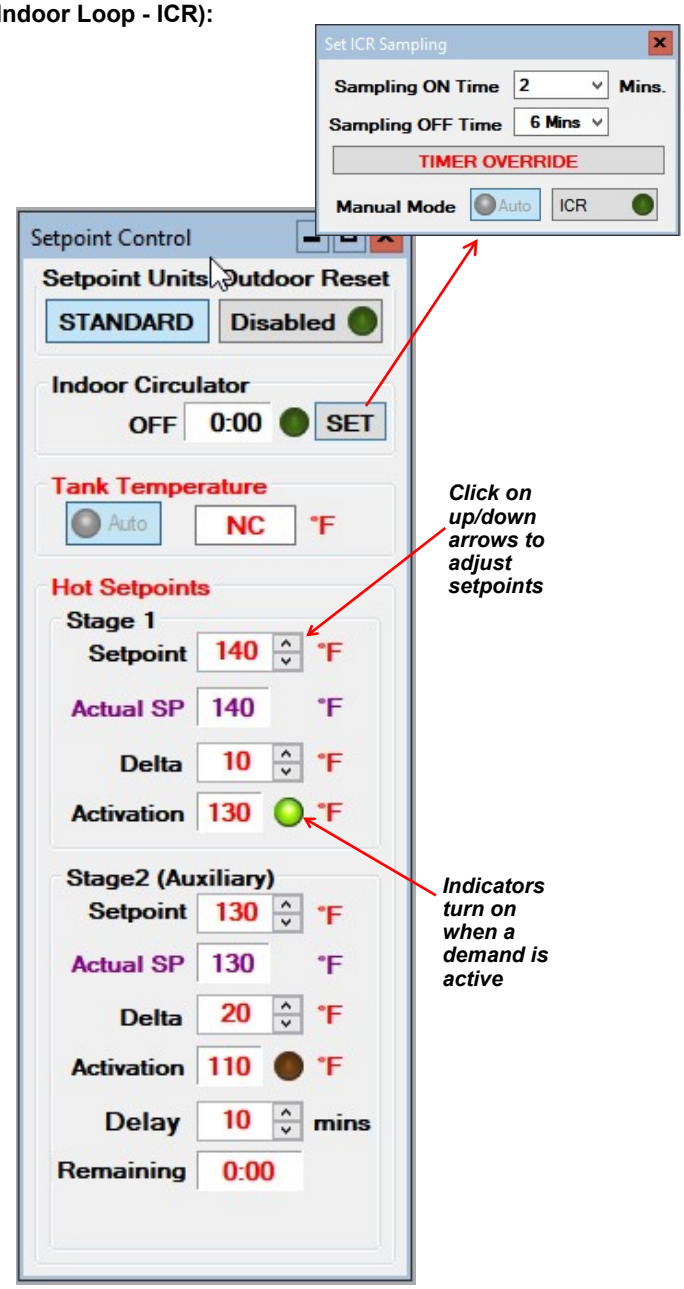
ICR (Internal Circulator Relay) is the default method and uses the **Indoor OUT** temperature probe inside the unit for temperature control. Its value is displayed in the **Tank Temperature** box on the PC App's **View-->Setpoint Control** window, shown below. If this temperature shows **NC**, then either 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.

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 12 - WC-series Typical Space Heating Temperature Setpoints

SPACE 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**	

*Activation is determined by the Setpoint and Delta values

Space heating setpoints can vary widely depending on the application, but the selection of a WC-series heat pump (with its higher cost and lower COP compared to non-cascade models) implies that high temperature water is needed to serve a high temperature heating distribution system like hot water baseboards or radiators. Therefore it is recommended to use a fairly high setpoint, and then reduce the water temperature in periods of lower heating load using the **Outdoor Reset** feature described on the next page.

The maximum water temperature setpoint for **WC-series** is **160°F / 71°C**.

Increasing the Delta value will also increase efficiency due to longer runtimes, and lead to less wear on compressor due to a reduced number of compressor starts.

Summer Setback

Since the WC is non-reversing, 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 2 (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.

TABLE 13 - WC-series Typical Temperature Setpoints for Direct DHW Heating

DHW HEATING	Stage 1		Stage 2 (Aux)	
	°F	°C	°F	°C
Setpoint	**140**	***60***	**140**	***60***
Delta	**10**	***5***	**20**	***10***
Activation *	130	*55*	120	*50*
Delay			**10 minutes**	

*Activation is determined by the Setpoint and Delta values

Since the WC-series can be ordered with an optional double wall heat exchanger, it can be used to directly heat domestic hot water. In this case, the setpoints can be reduced a bit as shown in the table to achieve the plumbing code temperature of 140°F / 60°C.

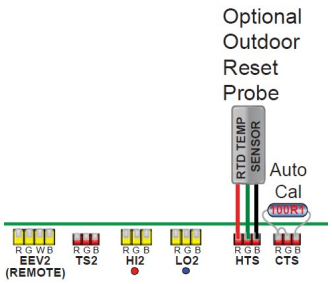
For DHW, a lower delta setpoint can generally be used since new cold water is continuously being introduced and therefore the heating task is of generally longer duration.

Outdoor Reset

Lower heating setpoints will translate directly into a higher COP (efficiency). On warm winter days, a lower hydronic water temperature will often still allow the high temperature heating distribution system to maintain the space at a comfortable temperature, since the heat load is lower during mild weather.

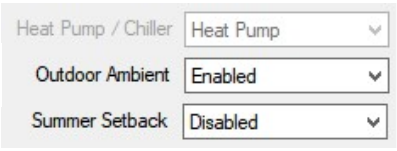
When **Control Source HYD** is set to **Setpoints**, an optional Outdoor Reset control algorithm is available for heating mode, which reduces the heating temperature setpoints at warmer outdoor temperatures as measured by an accessory outdoor temperature sensor.

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

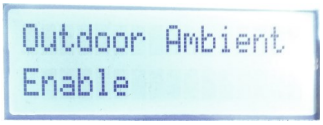


Then enable the outdoor sensor in the **Tools --> Configuration** window or LCD interface:

PC APP: Tools-->Configuration



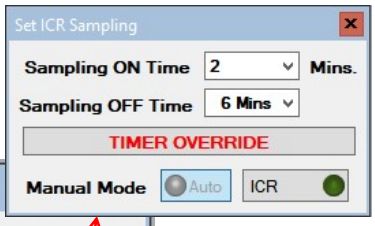
LCD Interface: Configuration



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:

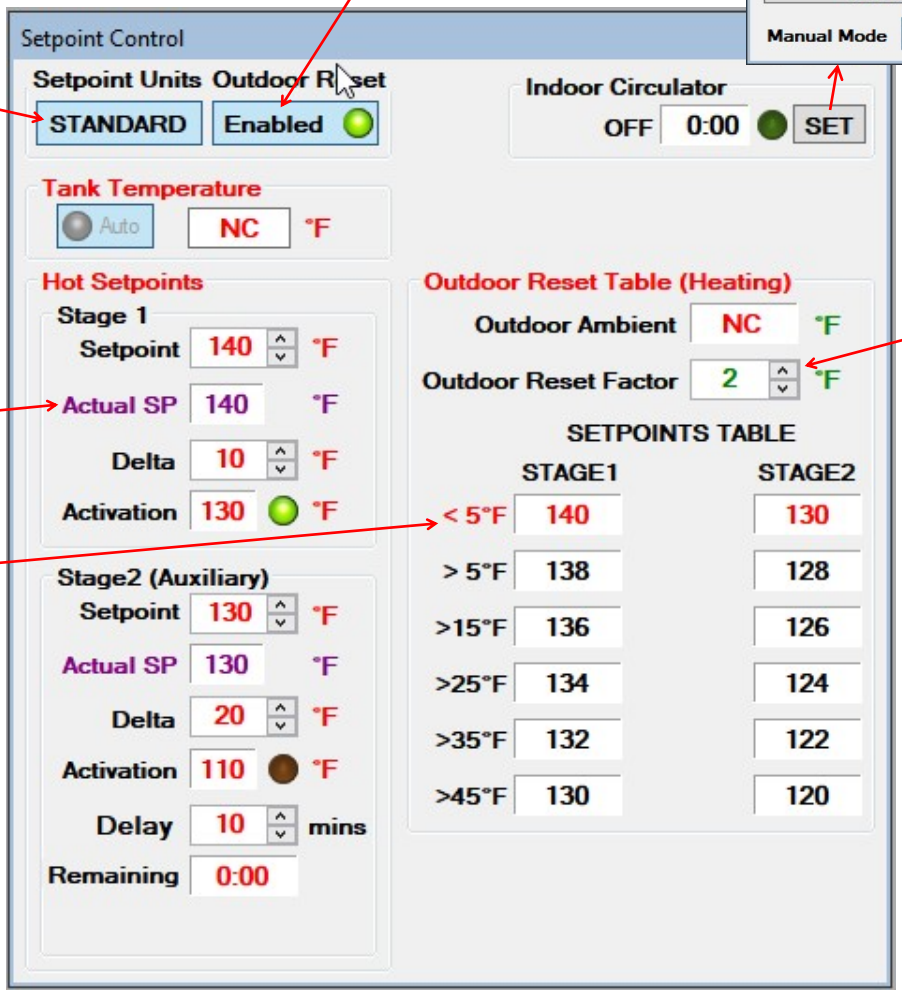


Change units of Setpoint Control only

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

Row in use will be RED

Outdoor Reset Factor adjusts the temperature difference between table rows



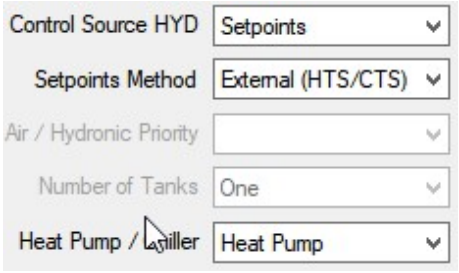
Setpoint Control Method 2 - External (HTS/CTS)

a) HTS/CTS - 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). The previously described control method works this way, as does this one. This is ***Heat Pump Mode***.

[It is also possible to control the demand on non-reversing heat pumps like the WC-series based on the temperature of the outdoor or cold loop. This is ***Chiller Mode***, described on next page.]

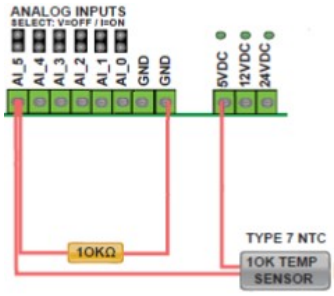
PC APP: Tools-->Configuration



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.

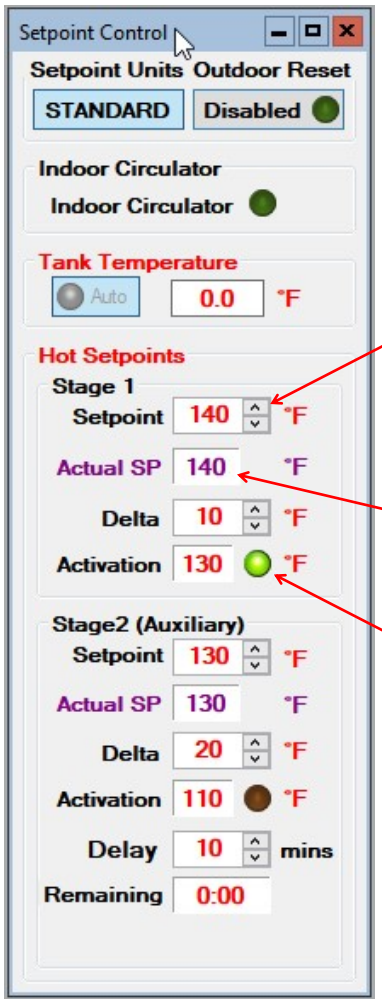
A 10K Type 7 (or Type 3) NTC thermistor along with a 10K 1% or better resistor must be connected to the control board in order to use the External HTS/CTS method. These are available as accessories. Connect the sensor to the AI_5 input as shown below and on the wiring diagram (SCH) in the **Model Specific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



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 2a (External HTS/CTS, Heat Pump Mode):**



Click on up/down arrows to adjust setpoints

Actual Setpoint is reduced by Outdoor Reset (when enabled and optional outdoor temperature probe is present)

Indicators turn on when a demand is active

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)** also apply to **Setpoint Control Method 2 - External (HTS/CTS):**

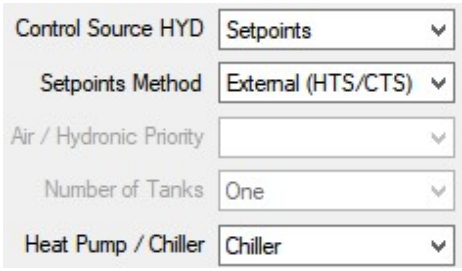
- **Typical Temperature Setpoints**
- **Summer Setback**
- **Outdoor Reset function**

b) HTS/CTS - Chiller Mode

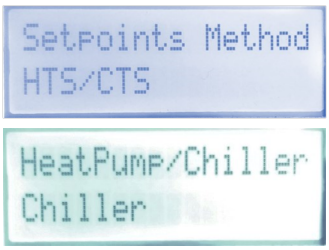
Chiller Mode allows the heat pump to be controlled from the Outdoor Loop (cold side) rather than the Indoor Loop (hot side) for applications that require controlled cooling with hot water heat rejection. The heat pump is still operating in "heating mode"; it is simply being started and stopped based 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

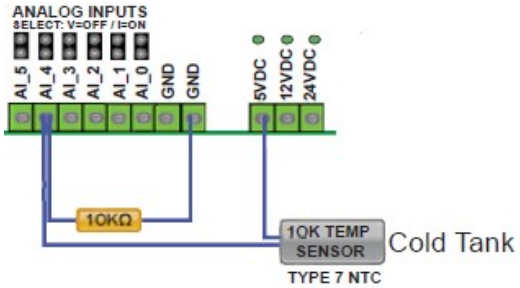


LCD Interface: Configuration



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 2b (External HTS/CTS, Chiller Mode):**

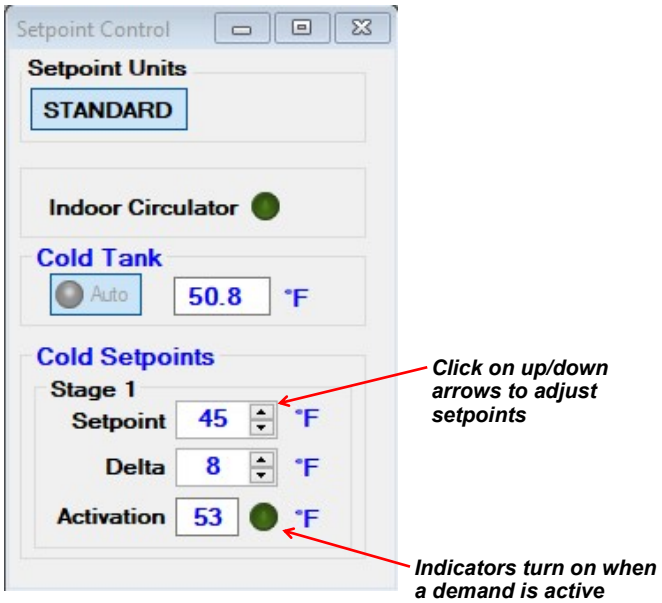
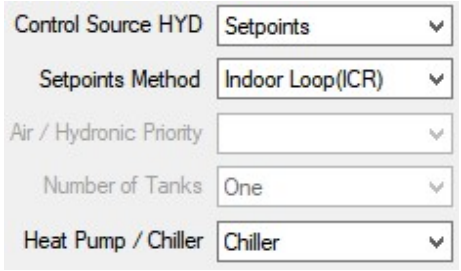


TABLE 14 - Typical Setpoints
HTS/CTS Method - Chiller Mode

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

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:



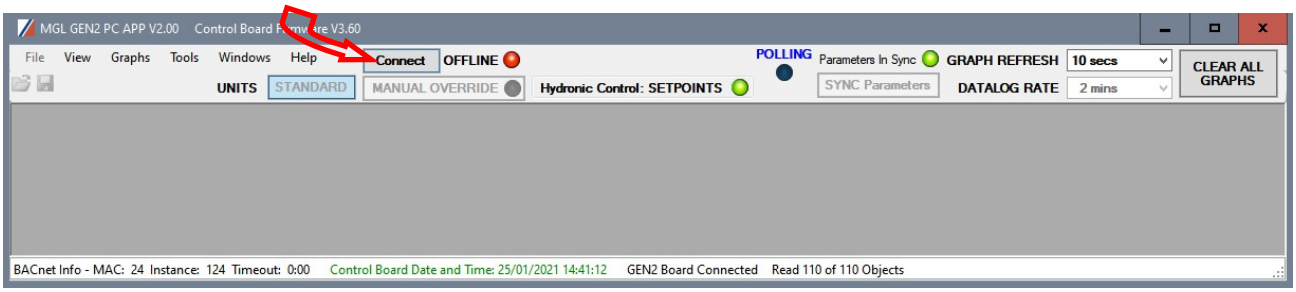
The complication is that sampling will actually be done with the *outdoor* loop circulator, and there is no built in outdoor circulator relay. So two approaches can be taken:

- 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.

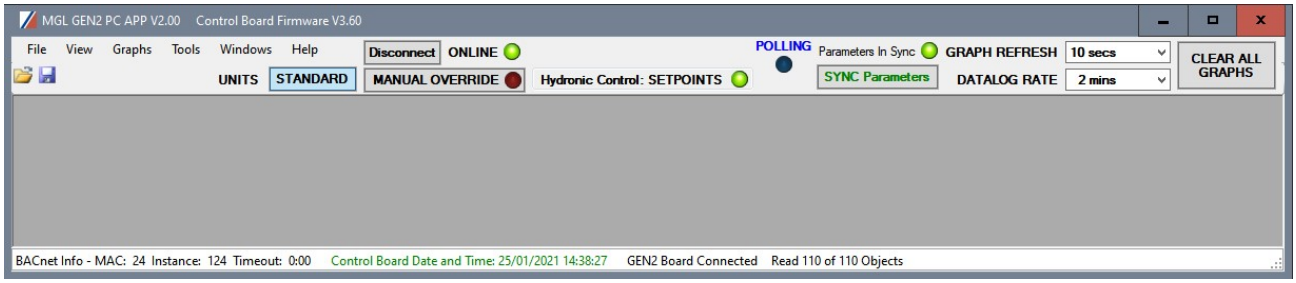
PC Application (PC App)

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.

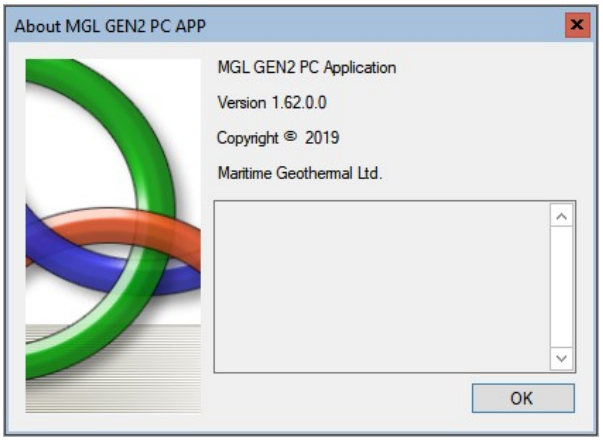
File-->Open: Opens a saved page arrangement.
File-->Save: Saves the current page arrangement.
File-->Exit: Exits the PC Application.

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.

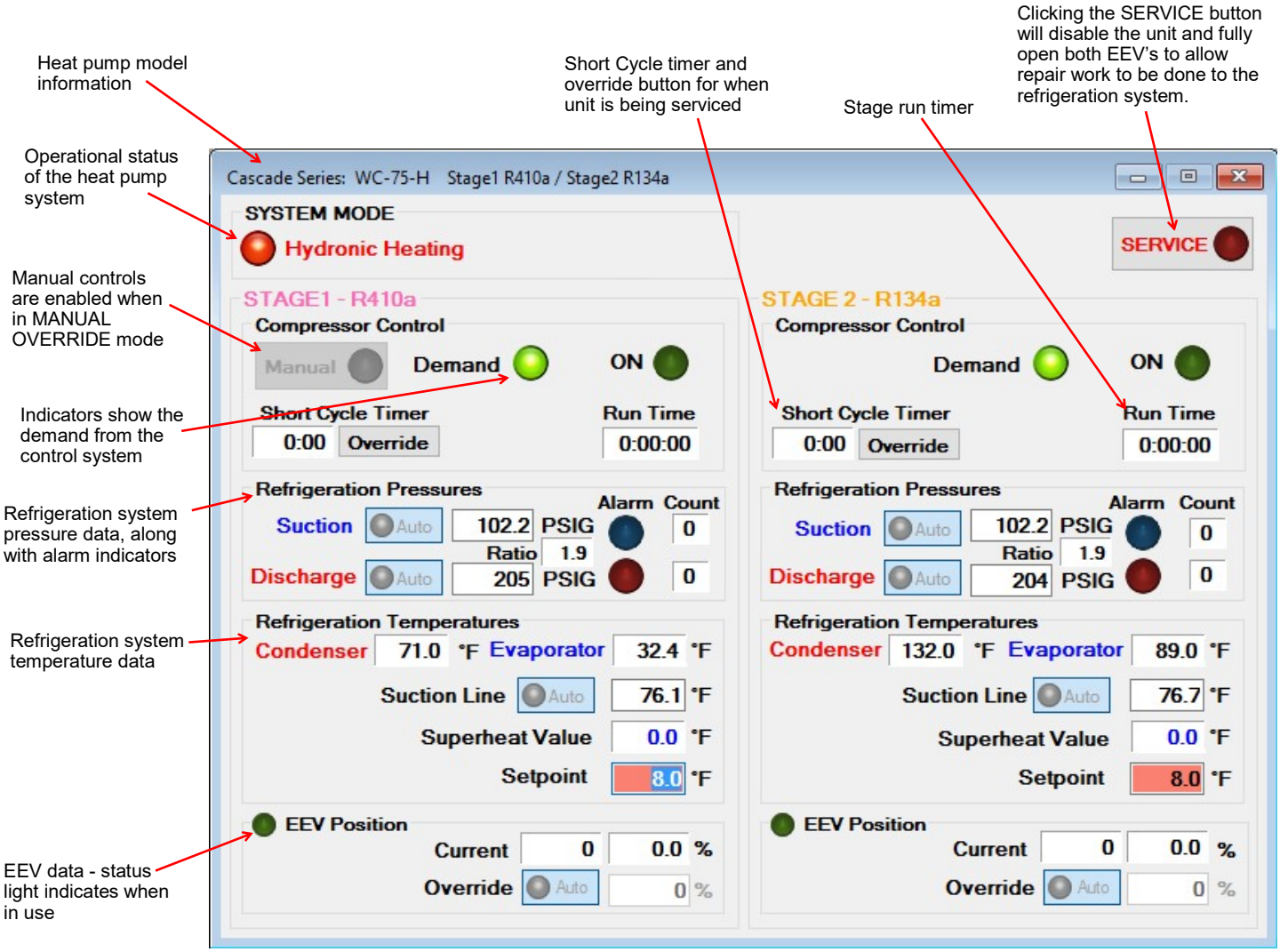
Help-->About: Displays the window shown to the right.



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.

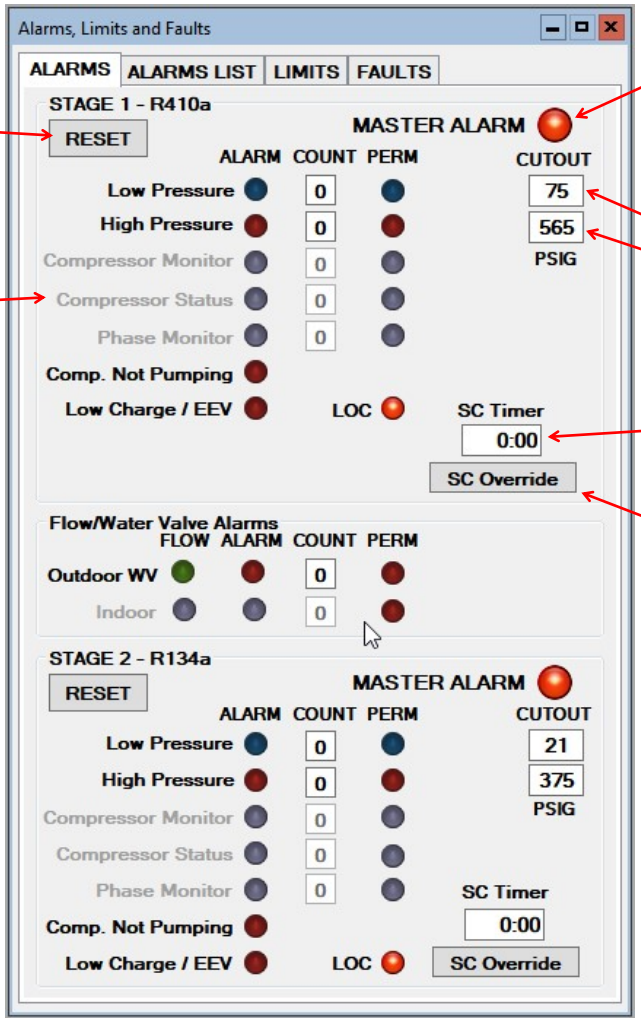
Comp. Not Pumping: Discharge pressure is less than 30 psi higher than suction pressure after 1 minute run time. It indicates leaking reversing valve, manual high pressure control trip, bad contactor, or defective compressor.

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

Greyed out alarms are not applicable to the system.

Master Alarm occurs when any alarm occurs

Low Pressure cut out
High Pressure cut out

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

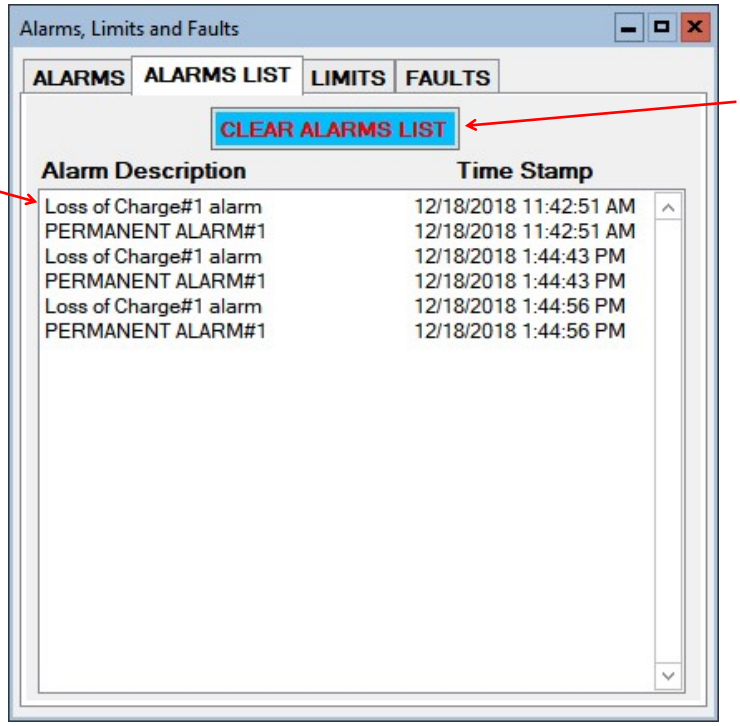
This button will reduce the short cycle timer value to 10 seconds

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.

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.

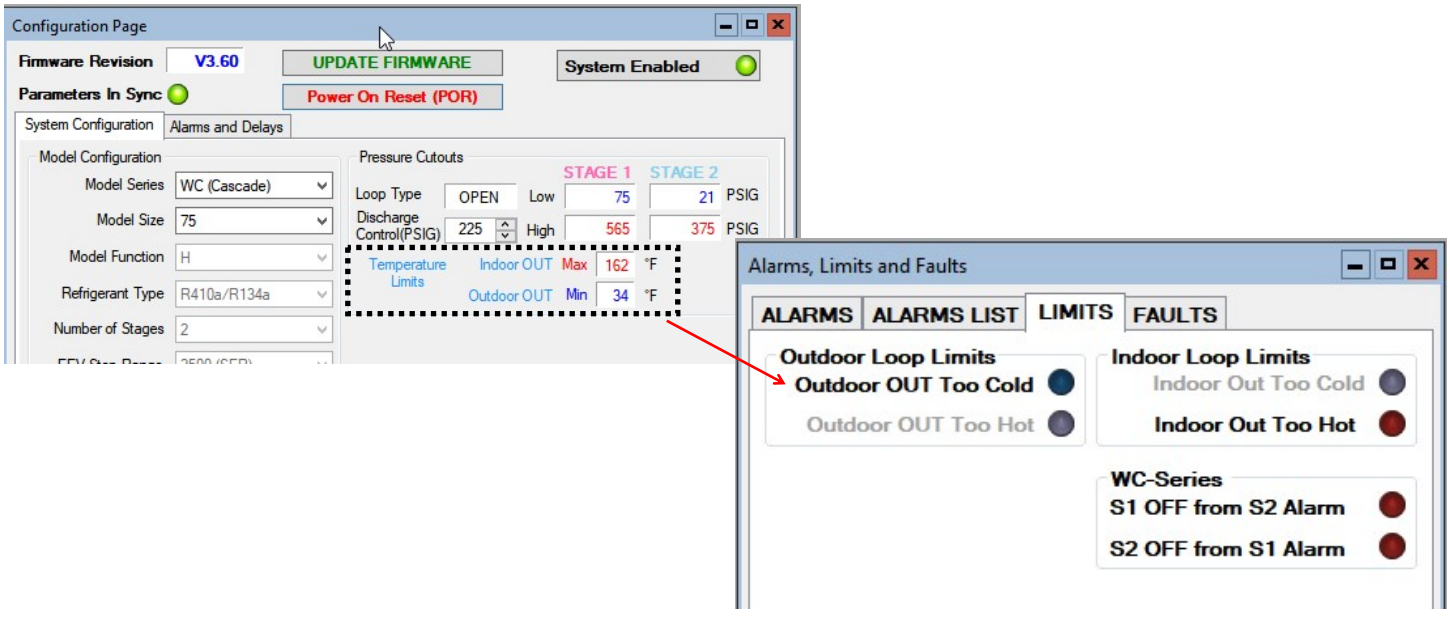
Each alarm that occurs while the PC APP is connected to the control board will appear here. The alarm type and a time stamp will be shown. The alarms list will be erased when the PC APP is disconnected from the control board.



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):

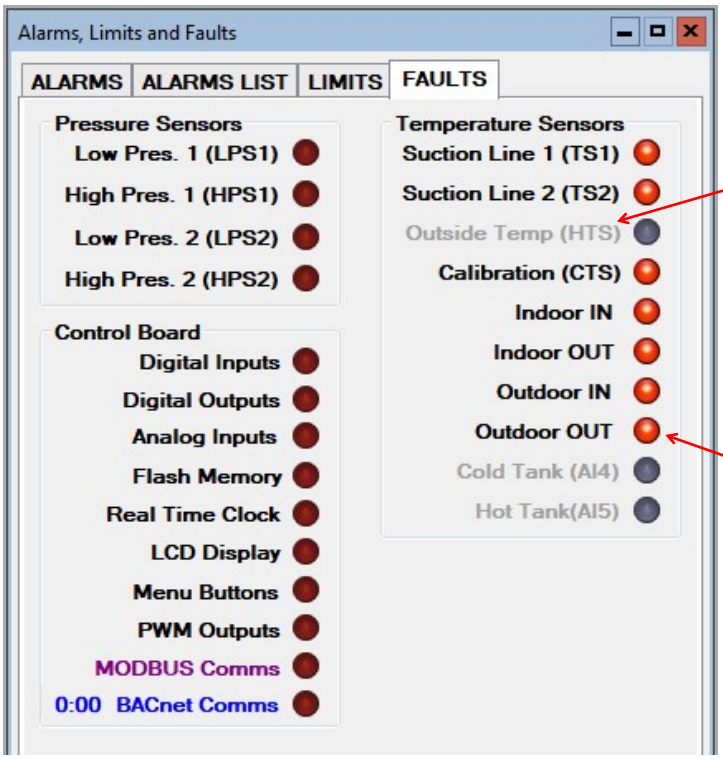
This tab shows hardware faults that could occur. If one of these faults occurs there may be a problem with the control board hardware, with LCD Display and buttons, or with a sensor.

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.

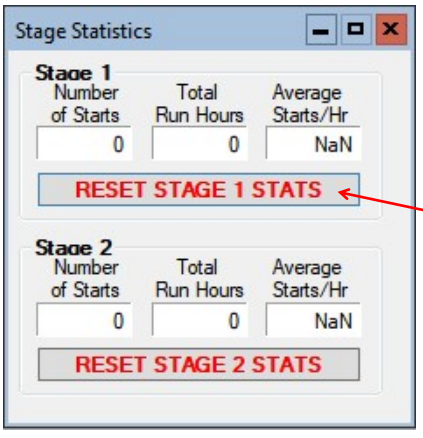
If the fault persists then there is most likely a hardware problem, and the sensor, control board, or LCD board will need to be replaced.

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.



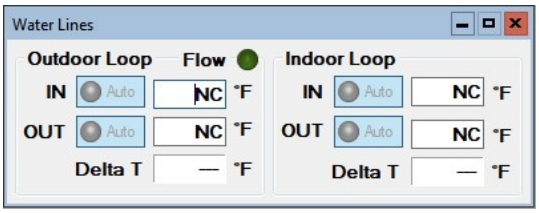
View-->Stage Stats:

The information for both compressors: number of starts, run hours and starts per hour.



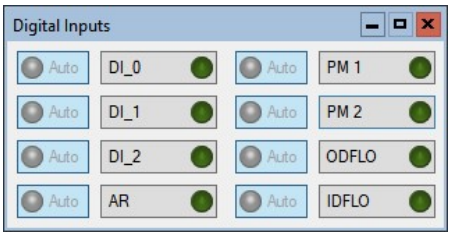
View-->Water Lines

Shows the water line temperatures.



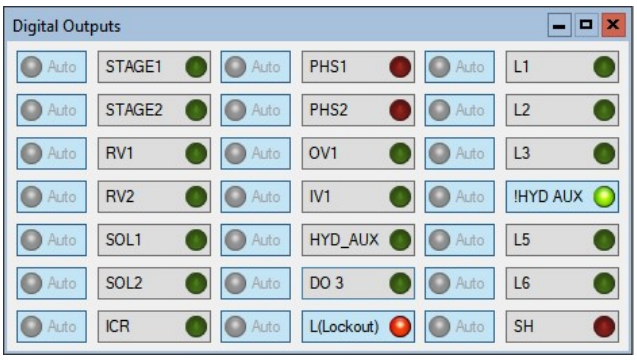
View-->Digital Inputs

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

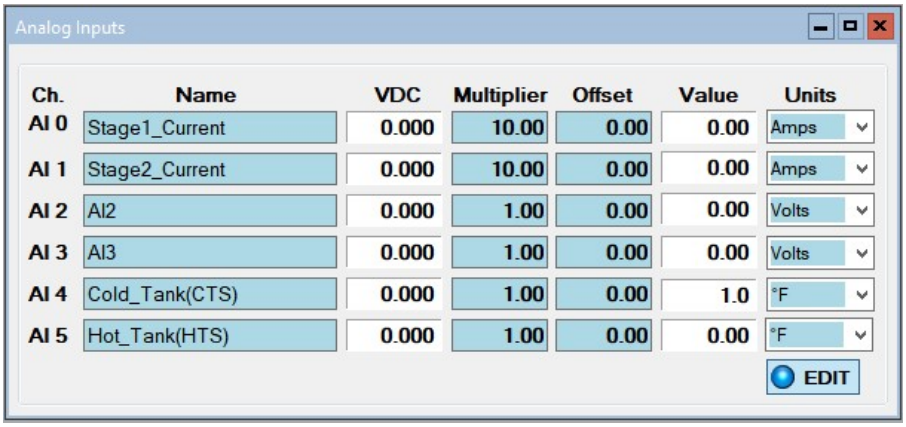
Shows the digital outputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.
.



View-->Analog Inputs

Shows the Analog inputs and their individual settings and values.

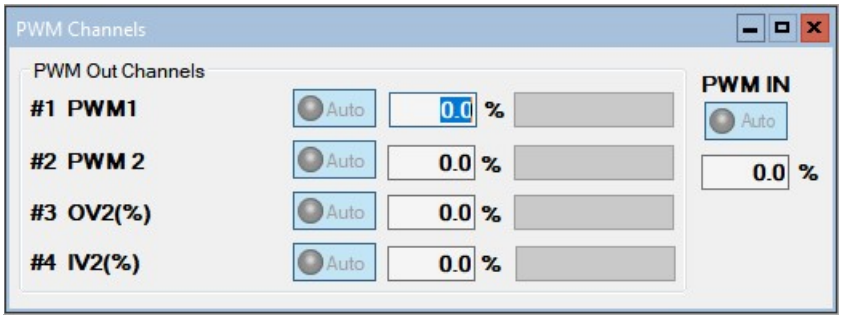
Click on the ***EDIT*** button to modify the blue boxes (button will now say ***SAVE***). For each channel a name may be selected (up to 16 characters), and the multiplier and Offset values may be set to accommodate the connected sensor scaling. Signals may be 4-20mA (channel jumper on board ON) or 0-10VDC (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

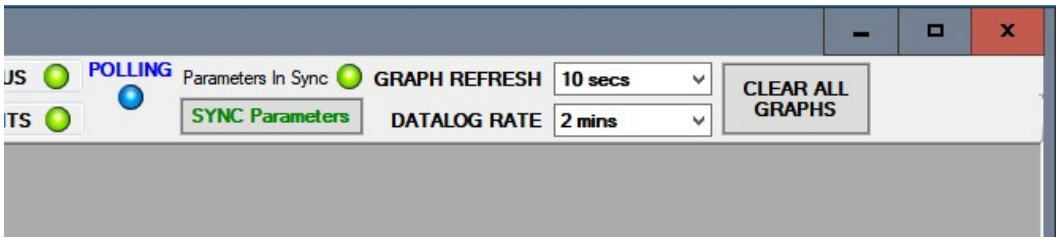
Shows the PWM channels and their individual status (0-100%). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.

EMW-series does not use any PWM channels.

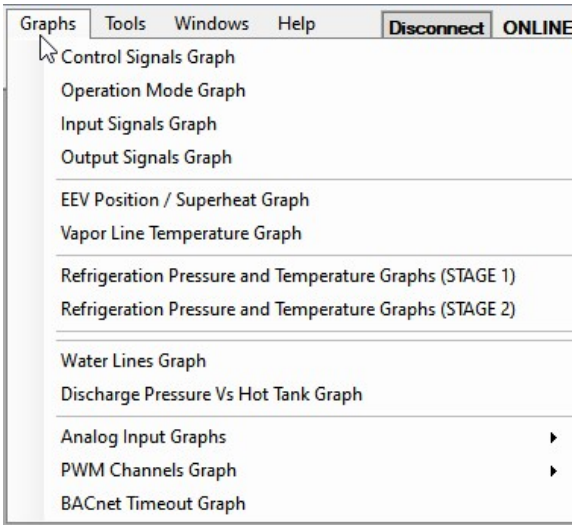


Graphs Menu:

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.

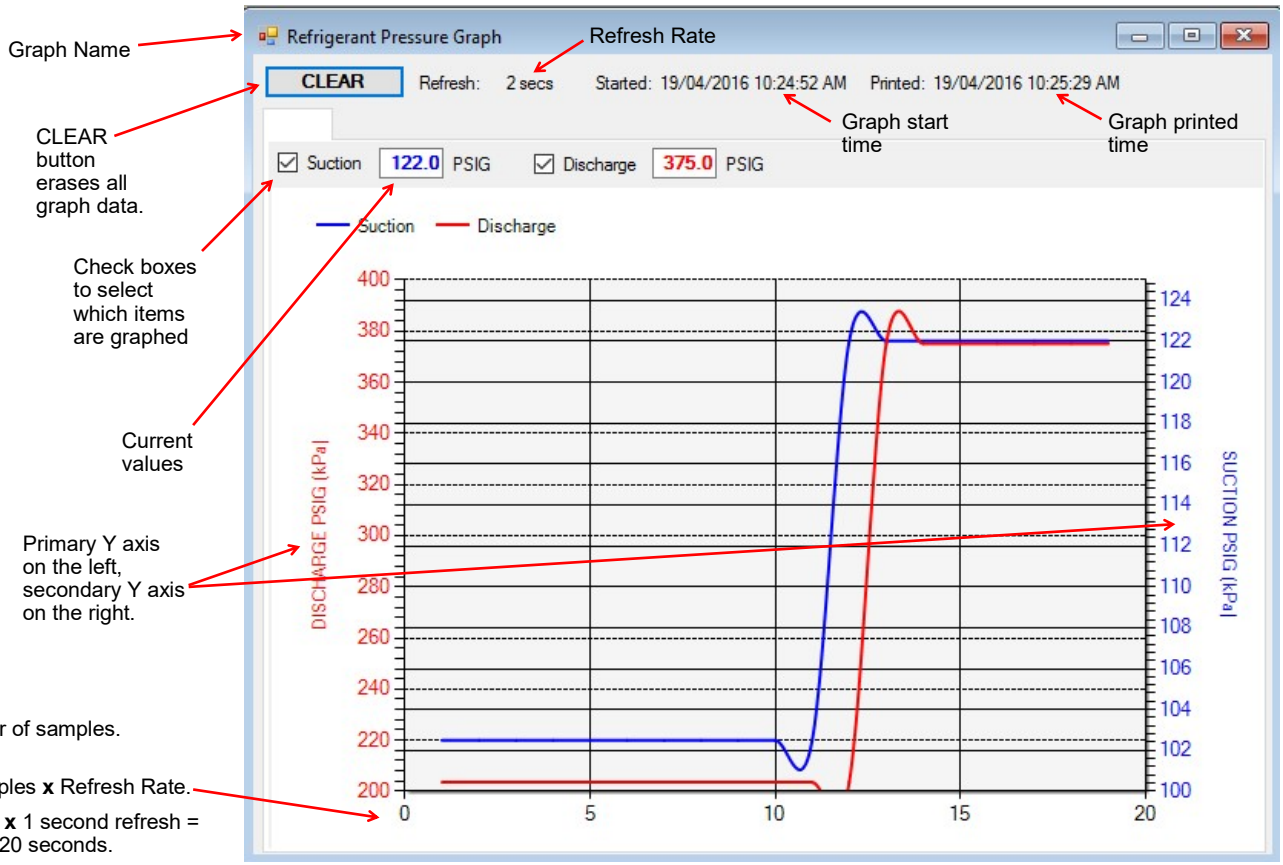


TIP: To screen print a graph and save it as a picture, press Print Screen on the keyboard and then paste into MS Paint or other graphics program. Select the desired graph with the selection tool and copy it to a new MS Paint, then save the file as the desired name.



ON/OFF status of the system control signals (demands)
ON/OFF status of heating mode
ON/OFF status of input signals
ON/OFF status of digital outputs
Position of EEVs and resulting superheats
Temperature of both suction lines
R410a suction and discharge pressures & temperatures
R134a suction and discharge pressures & temperatures
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 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.

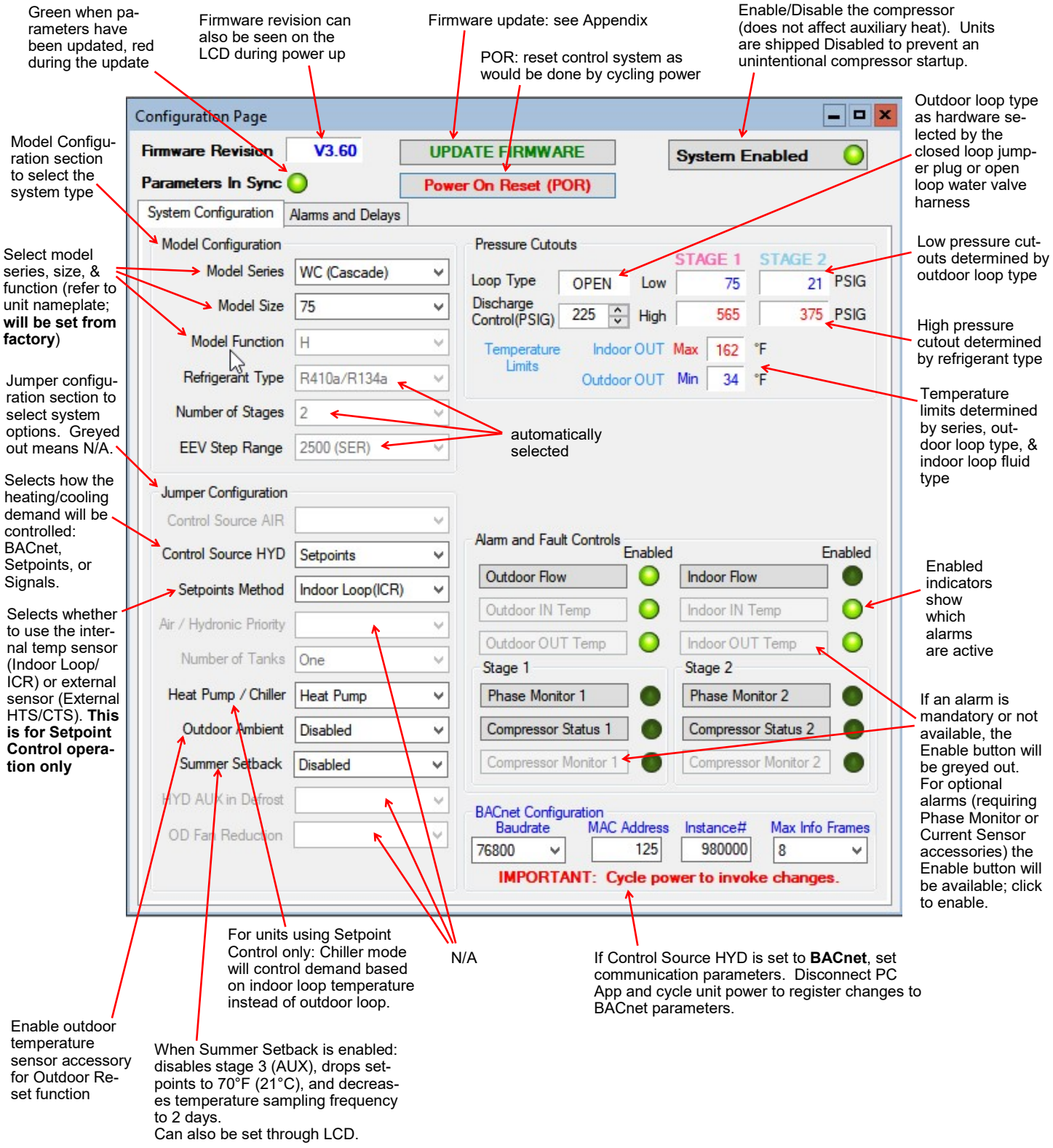


Tools Menu:

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

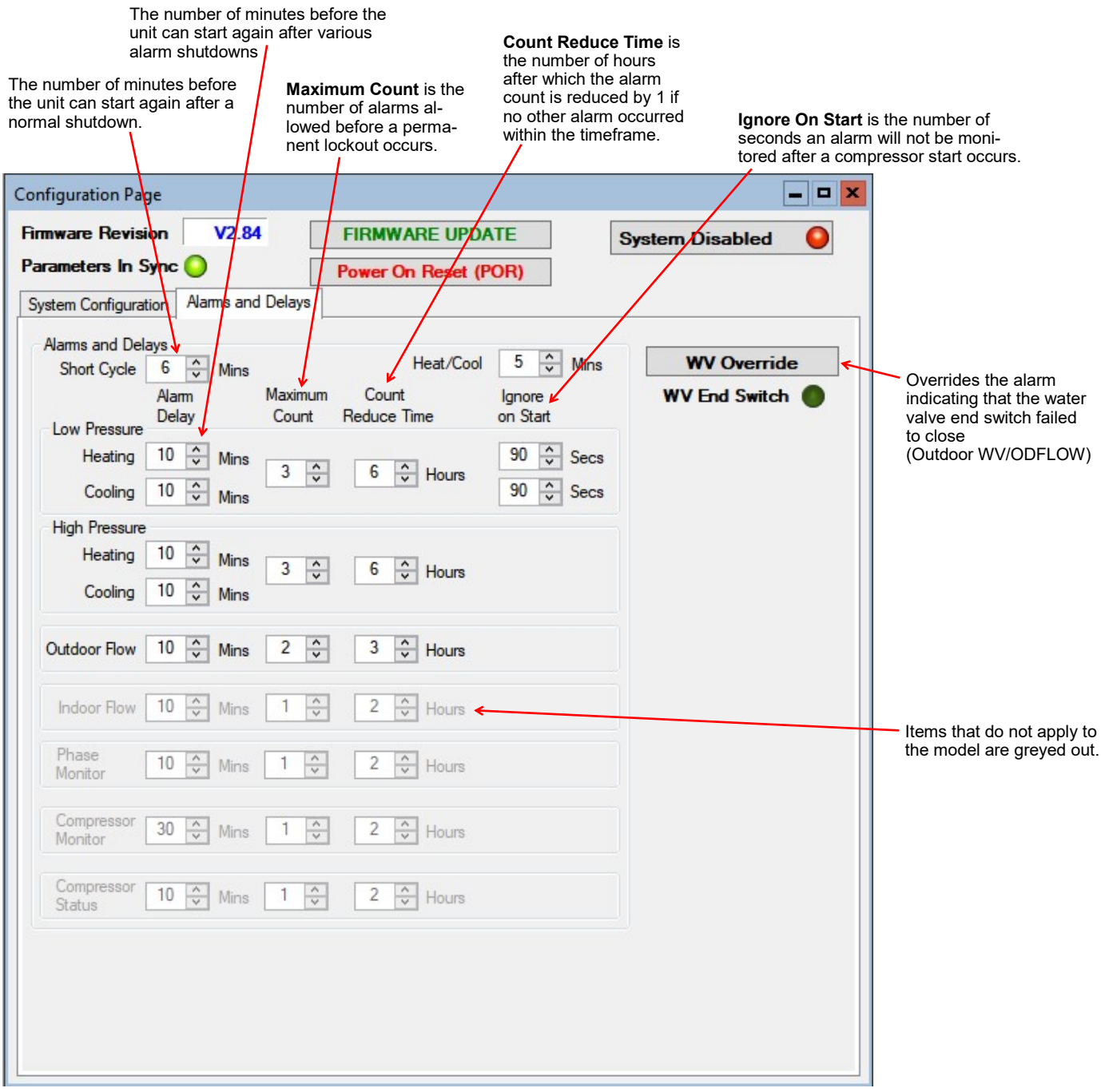
Tools-->Configuration (System Configuration tab):

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.

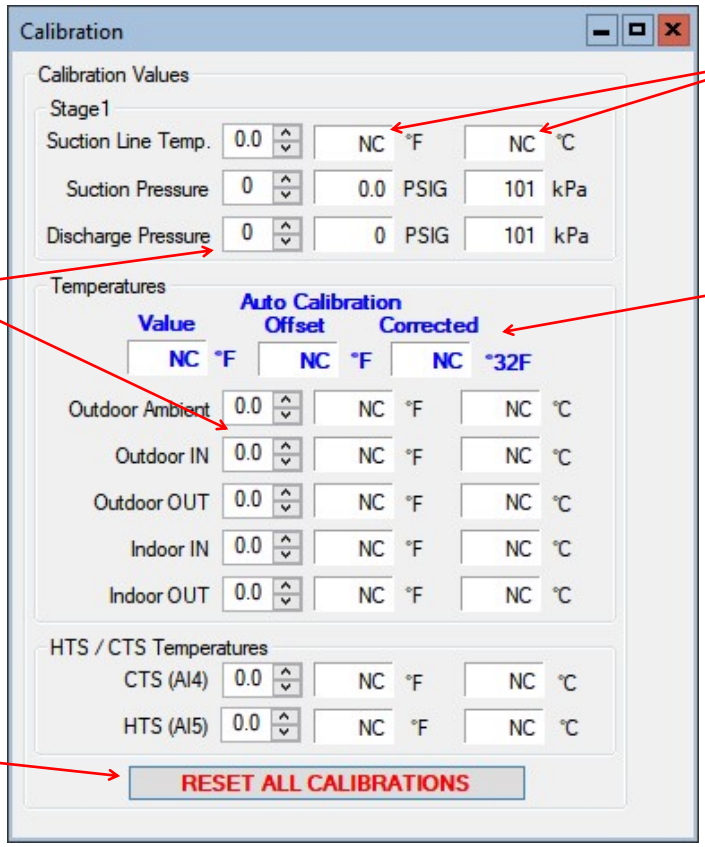


Tools-->Calibration:

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.

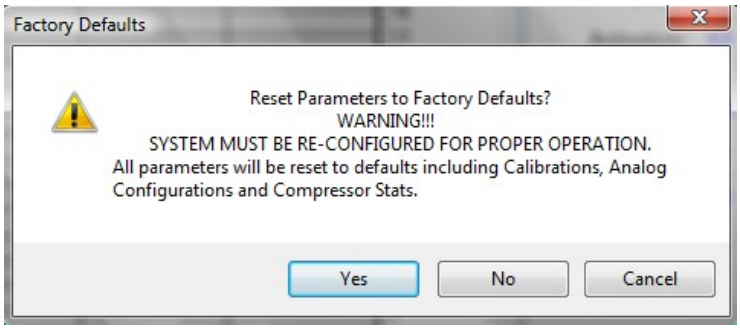
The date and time of both the computer and the control board are shown in the status bar at the bottom of the PC App.

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.

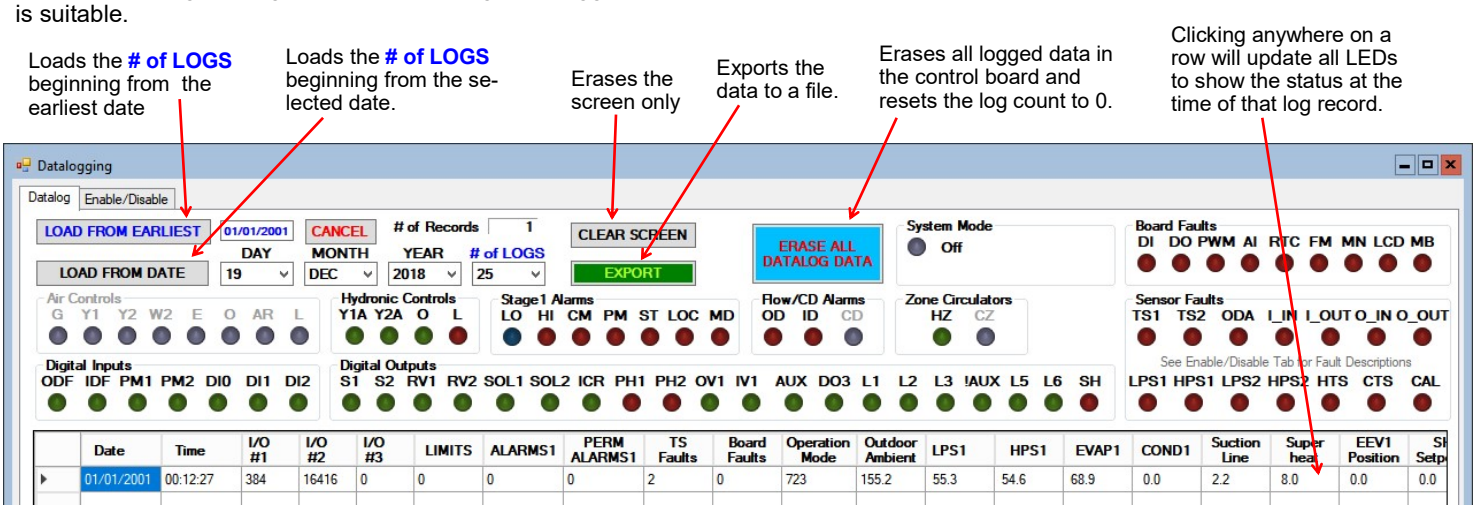
Tools-->Datalogging (Datalog tab):

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

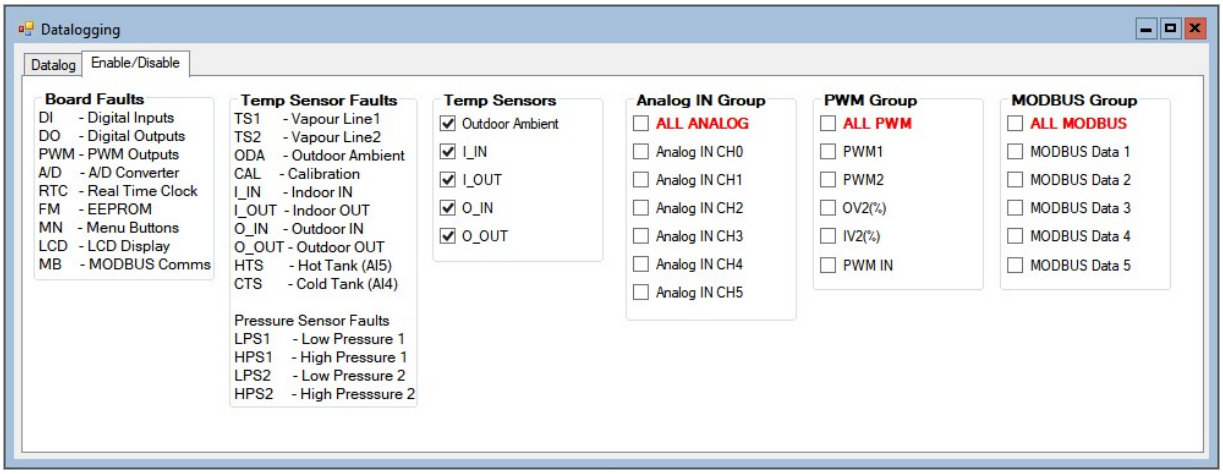
The maximum number of datalog records is 32,224, which will take 45 days to fill up at the default recording rate of 2 minutes.

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. Boxes must be checked to be included in exported data.

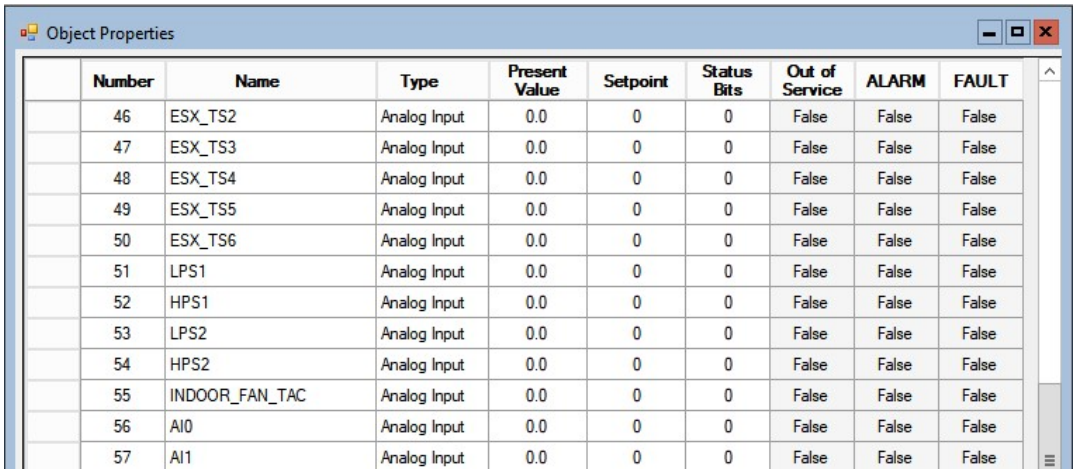


Tools-->MODBUS:

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.

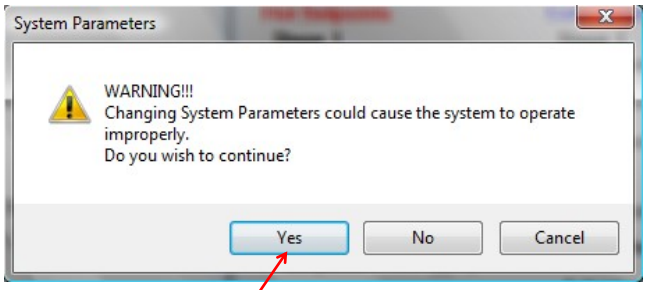


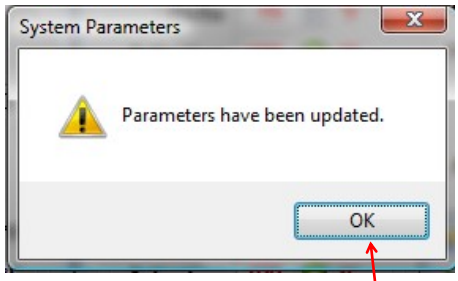
Number	Name	Type	Present Value	Setpoint	Status Bits	Out of Service	ALARM	FAULT
46	ESX_TS2	Analog Input	0.0	0	0	False	False	False
47	ESX_TS3	Analog Input	0.0	0	0	False	False	False
48	ESX_TS4	Analog Input	0.0	0	0	False	False	False
49	ESX_TS5	Analog Input	0.0	0	0	False	False	False
50	ESX_TS6	Analog Input	0.0	0	0	False	False	False
51	LPS1	Analog Input	0.0	0	0	False	False	False
52	HPS1	Analog Input	0.0	0	0	False	False	False
53	LPS2	Analog Input	0.0	0	0	False	False	False
54	HPS2	Analog Input	0.0	0	0	False	False	False
55	INDOOR_FAN_TAC	Analog Input	0.0	0	0	False	False	False
56	AI0	Analog Input	0.0	0	0	False	False	False
57	AI1	Analog Input	0.0	0	0	False	False	False

Tools-->Parameters:

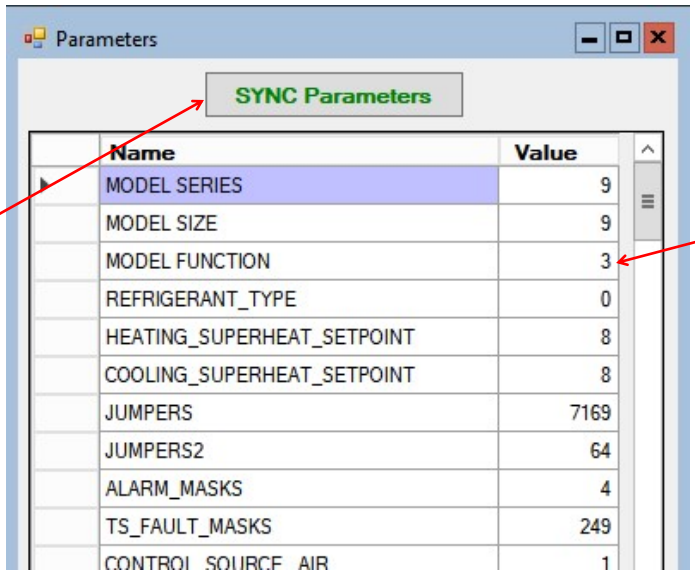
WARNING! The Parameters page is for advanced use only.
Changing parameter values can cause the system to stop functioning properly.

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.

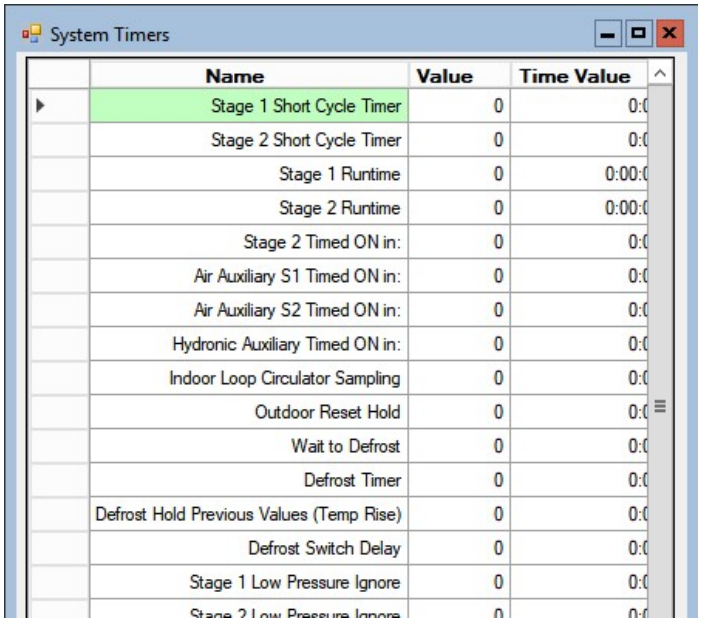


Click this button to reload the table with the values from the control board memory.

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

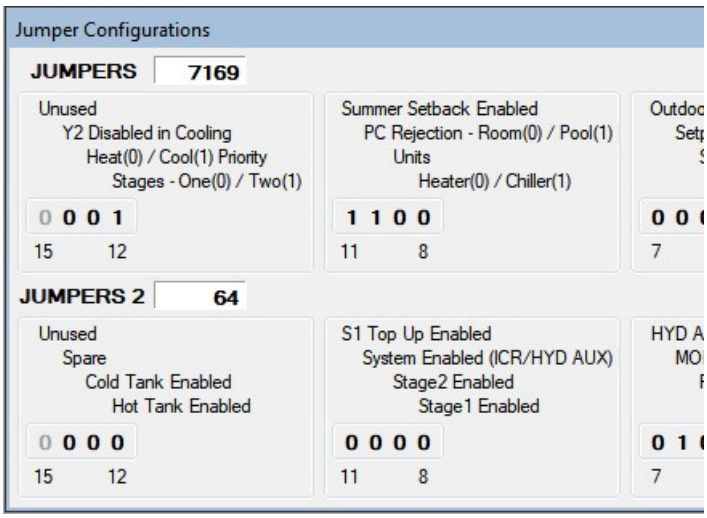
Tools-->SYSTEM TIMERS:

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



Tools-->Jumpers:

This page shows internal jumper configurations, for developers.

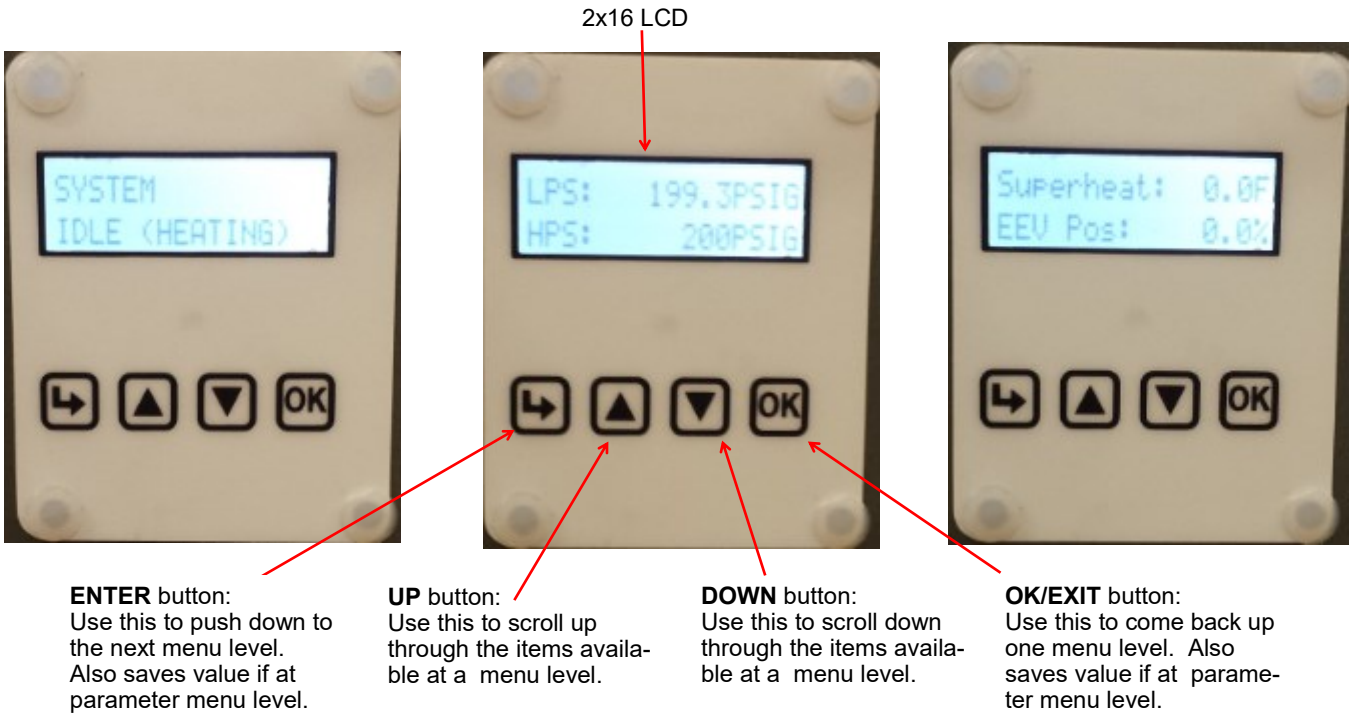


Tools-->System Enable/Disable:

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.



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.
			— AUX Setpoint	Stage 3 stops when water temperature rises to this point.
			— AUX 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 Delay	Delays Stage 3 start by timer amount.
			— Outdoor Reset *(only if enabled)*	Temperature factor to use in the outdoor reset table.
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 (R410a)***	***— Auto/Manual***	***— Auto***	Puts EEV1 in Auto mode
			— Manual	Puts EEV1 in Manual mode
		— Manual Position	***— EEV Position (%)***	Enter desired EEV1 position
	— EEV2 (R134a)	***— Auto/Manual***	***— Auto***	Puts EEV2 in Auto mode
			— Manual	Puts EEV2 in Manual mode
		— Manual Position	***— EEV Position (%)***	Enter desired EEV2 position

Main Menu Tree Continued

ENTER (From Main)	ENTER (First Press)	ENTER (Second Press)	ENTER (Third Press)	Description
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 and **Outdoor Ambient** is Enabled)*	***— 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 sensor
	— Heat Pump / Chiller *(only if using Setpoint Control)*	***— Heat Pump***		Control on indoor loop water temperature
		— Chiller		Control on outdoor loop water temperature
	— 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***		R410a suction pressure	Calibration in 1PSI intervals.
	— Discharge 1		R410a discharge pressure	Calibration in 1PSI intervals.
	— Vapour Line 1		R410a suction line temperature	Calibration in 0.1°F intervals
	— Suction 2		R134a suction pressure	Calibration in 1PSI intervals.
	— Discharge 2		R134a discharge pressure	Calibration in 1PSI intervals.
	— Vapour Line 2		R134a suction line temperature	Calibration in 0.1°F intervals
	— Outdoor Ambient		Outdoor air temp.	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.

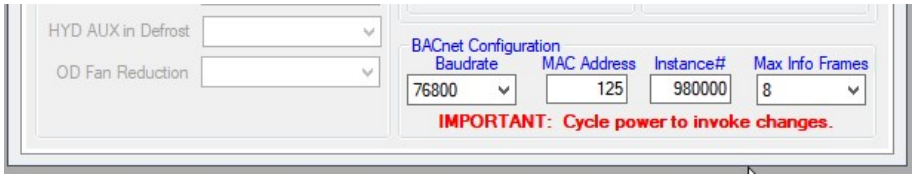
The connector on the control board is a three wire removable screw connector. The signals are as follows:
A: Communications line (+) (right pin)
B: Communications line (-) (middle pin)
C: Ground connection (left pin)

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 15 - 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)
BACnet_Units	Binary Value	BV9	Present Value	Select units for BACnet objects. OFF=US, ON=metric

TABLE 16 - BACnet OBJECTS - OPERATION MODE Description (Read Only)

Name	Data Type	ID	Present Value	Description
Operation Mode	Analog Value	**AV5**	2	Hydronic heating
			11	Hydronic heating OFF
Note: Object is type Analog Value but value will always be an integer value.				

TABLE 17 - BACnet OBJECTS - LIMITS Description (Read Only)

Name	ID	BIT #	Decimal Value*	Bit Description
Limits (Present Value)	**AV6**	1	2	High Indoor OUT temperature
		2	4	Low 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 18 - BACnet OBJECTS - DATA (Read Only)					
	Name	**ID**	**Property**	**Units**	**Description**
Type - Analog Input	AI0 (Comp1_Current)	AI0	Present Value	Amps	R410a compressor current draw (AI0) - requires accessory
	AI1 (Comp2_Current)	AI1	Present Value	User	R134a compressor current draw (AI1) - requires accessory
	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)	N/A
	AI5 (HTS)	AI5	Present Value	degF (degC)	Hot tank temperature from sensor - requires accessory
	LPS1	AI6	Present Value	PSIG (kPa)	R410a low pressure value (suction pressure)
	HPS1	AI7	Present Value	PSIG (kPa)	R410a high pressure value (discharge pressure)
	EVAP1	AI8	Present Value	degF (degC)	R410a evaporating temperature
	COND1	AI9	Present Value	degF (degC)	R410a condensing temperature
	Suction Line 1	AI10	Present Value	degF (degC)	R410a suction line temperature
	Superheat 1	AI11	**Setpoint Value**	degF (degC)	R410a superheat
	EEV1 Position	AI12	Present Value	%	R410a EEV position (% open)
	LPS2	AI13	Present Value	PSIG (kPa)	R134a low pressure value (suction pressure)
	HPS2	AI14	Present Value	PSIG (kPa)	R134a high pressure value (discharge pressure)
	EVAP2	AI15	Present Value	degF (degC)	R134a evaporating temperature
	COND2	AI16	**Setpoint Value**	degF (degC)	R134a condensing temperature
	Suction Line 2	AI17	Present Value	degF (degC)	R134a suction line temperature
	Superheat 2	AI18	**Setpoint Value**	degF (degC)	R134a superheat
	EEV2 Position	AI19	Present Value	%	R134a active EEV position (% open)
	Outside Ambient	AI20	Present Value	degF (degC)	Outdoor Ambient temperature - requires accessory
	O_IN	AI21	Present Value	degF (degC)	Outdoor loop IN temperature
	O_OUT	AI22	Present Value	degF (degC)	Outdoor loop OUT temperature
	I_IN	AI23	Present Value	degF (degC)	Indoor loop IN temperature
	I_OUT	AI24	Present Value	degF (degC)	Indoor loop 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 R410a alarms - see Alarm Descr. table
	Permanent Alarms 2	AV8	Present Value	N/A	Description of active R134a alarms - see Alarm Descr. table
	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	R410a compressor contactor
	STAGE2	BO1	Present Value	N/A	R134a compressor contactor
	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	R410a dry contact pin for locked out on alarm
	PHS2	BO8	Present Value	N/A	R134a dry contact pin for locked out on alarm
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	N/A
	Phase Monitor1	BV12	Present Value	N/A	N/A
	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 19 - BACnet OBJECTS - ALARM Descriptions (Read Only)			
Name	**Data Type**	**ID**	**Description**
AI0 (Comp1 Current)	Analog Input	AI0	R410a status alarm (start / stop failure, from accessory current sensor)
AI1 (Comp2 Current)	Analog Input	AI1	R134a status alarm (start / stop failure, from accessory current sensor)
LPS1	Analog Input	AI6	R410a low pressure alarm
HPS1	Analog Input	AI7	R410a high pressure alarm
LPS2	Analog Input	AI13	R134a low pressure alarm
HPS2	Analog Input	AI14	R134a high pressure alarm
Outdoor Flow	Binary Value	BV10	Outdoor loop water valve
Indoor Flow	Binary Value	BV11	N/A
Phase Monitor1	Binary Value	BV12	N/A
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	R410a master permanent alarm (occurs when any alarm occurs)
		1	3	R410a low pressure heating mode alarm (suction pressure)
		2	5	R410a low pressure cooling mode alarm (suction pressure)
		3	9	R410a high pressure heating mode alarm (discharge pressure)
		4	17	R410a high pressure cooling mode alarm (discharge pressure)
		5	33	R410a loss of charge alarm
		6	65	N/A
		7	129	N/A
		8	257	R410a status alarm (start / stop failure, from accessory current sensor)
		14	16,385	Outdoor loop water valve alarm
		15*	32,769	N/A
Permanent Alarms 2 (Present Value)	**AV8**	0	1	R134a master permanent alarm (occurs when any alarm occurs)
		1	3	R134a low pressure heating mode alarm (suction pressure)
		2	5	R134a low pressure cooling mode alarm (suction pressure)
		3	9	R134a high pressure heating mode alarm (discharge pressure)
		4	17	R134a high pressure cooling mode alarm (discharge pressure)
		5	33	R134a loss of charge alarm
		6	65	N/A
		7	129	N/A
		8	257	R134a status alarm (start / stop failure, from accessory current sensor)
		14	16,385	Outdoor loop water valve alarm
		15*	32,769	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 20 - BACnet OBJECTS - FAULT Descriptions (Read Only)			
Name	**Data Type**	**ID**	**Description**
AI4 (Cold Tank)	Analog Input	AI0	N/A
AI5 (Hot Tank)	Analog Input	AI1	Hot tank temperature sensor faulty or disconnected - requires accessory
LPS1	Analog Input	AI6	R410a low pressure sensor faulty or disconnected
HPS1	Analog Input	AI7	R410a high pressure sensor faulty or disconnected
LPS2	Analog Input	AI13	R134a low pressure sensor faulty or disconnected
HPS2	Analog Input	AI14	R134a high pressure sensor faulty or disconnected
Suction Line1	Analog Input	AI10	R410a suction line temperature sensor faulty or disconnected
Suction Line2	Analog Input	AI17	R134a suction line temperature sensor faulty or disconnected
Outside Ambient	Analog Input	AI20	Outdoor 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	R410a suction line temperature sensor
		1	2	R134a suction line temperature sensor
		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	N/A
		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 WC-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.

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 power block 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 **200-300 psig** for the R410a circuit and **50-100 psig** and **105-250 psig** for the R134a circuit.
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 pressures (R410a & R134a)
    2. Discharge pressures (R410a & R134a)
    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. Both compressors' L1 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. Activate AUX heat if equipped by changing the AUX setpoint. Be sure the auxiliary heat breaker at the panel is ON. Measure the auxiliary heat's L1 current draw with an clamp meter and record the value.

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 customer sign as well. Leave the Startup Record with the customer, retain a copy for filing, and send a copy to Maritime Geothermal Ltd. for warranty registration.

Startup Record - WC-Series

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										
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)	R410a Suction Pressure / Discharge Pressure							psig	kPa		
	R134a Suction Pressure / Discharge Pressure							psig	kPa		
	Indoor In, Indoor Out, and Delta T		In		Out				°F	°C	
	Outdoor In, Outdoor Out, and Delta T		In		Out				°F	°C	
	Outdoor Flow		lgpm		USgpm		L/s				
	R410a Compressor L1 (black wire) current		A								
	R134a Compressor L1 (black wire) current		A								
	AUX heat L1 (black wire) current		A								
	Heating setpoint and discharge pressure at cycle end		°F	°C				psig	kPa		
Final Setpoints	Heating S1 Setpoint, S1 Delta							°F	°C		

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

A total of three copies are required: one for the customer, 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.
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 outdoor open loop or the indoor loop of direct DHW heating systems. See instructions below.

Heat Exchanger Flushing Procedure - Outdoor Open Loop or Indoor Direct DHW 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.

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 a compressor but no call for the compressor to be on (welded contactor) or when there is a call for a compressor to be on but there is no compressor current draw (manual high pressure control is open or contactor failure). Requires current sensor accessories.	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 compressor very hot and tripped on internal overload, manual high pressure control trip, bad contactor, or defective compressor.	Check for 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 or STAGE2 when corresponding 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.

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 160°F (71°C).	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.
	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.

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.

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 heat exchangers **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.

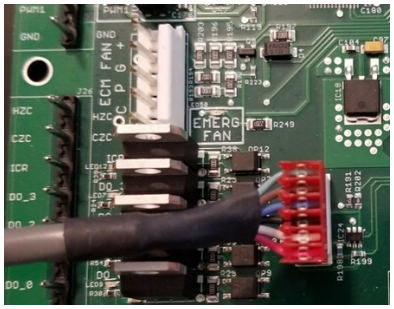
1. Release the nitrogen pressure and connect the vacuum pump to the charging manifold. Start the vacuum pump and open the charging manifold valves. Vacuum until the vacuum gauge remains at less than 500 microns for at least 1 minute with the vacuum pump valve closed.
2. Close the charging manifold valves 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.

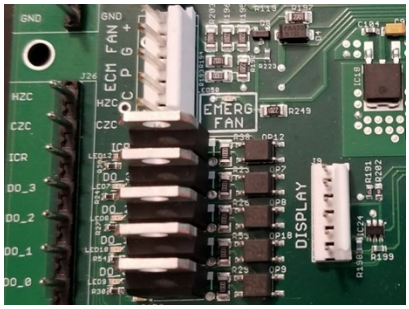
Compressor Replacement Procedure

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).





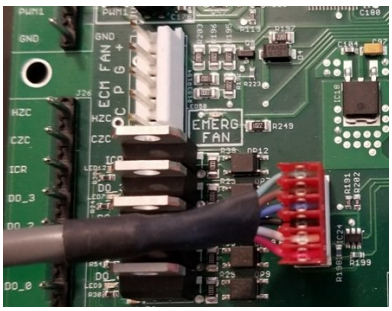
5. Remove all connectors from the top of the control board. Each connector (or wire) should be marked already from the factory, e.g. HPS1, LP1, TS1, etc.. This matches the marking on the control board.
6. The control board is held in place at its four corners. Squeeze each standoff by hand or with needle 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

Table 21 - Refrigerant Charge				
MODEL	R410a		R134a	
	lb.	kg	lb.	kg
WC-16	3.0	1.4	3.0	1.4
WC-25	3.5	1.6	3.5	1.6
WC-45	4.0	1.8	4.0	1.8
WC-55	5.0	2.3	5.0	2.3
WC-65	6.0	2.7	6.0	2.7
WC-75	7.0	3.2	7.0	3.2
WC-80	8.0	3.6	8.0	3.6

Refrigerant charge is subject to revision; actual charge is indicated on the unit nameplate.
POE oil capacity is marked on the compressor label.

Table 22 - Shipping Information				
MODEL	WEIGHT	DIMENSIONS in (cm)		
	lb. (kg)	L	W	H
WC-16	345 (157)	46 (117)	36 (91)	35 (89)
WC-25	380 (173)	46 (117)	36 (91)	35 (89)
WC-45	410 (186)	46 (117)	36 (91)	35 (89)
WC-55	490 (223)	46 (117)	36 (91)	35 (89)
WC-65	510 (232)	46 (117)	36 (91)	35 (89)
WC-75	560 (255)	46 (117)	36 (91)	35 (89)
WC-80	585 (266)	46 (117)	36 (91)	35 (89)

Table 23 - WC-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*	
Outdoor (Water)	Heating	Minimum ELT	39	*4*	
	Heating	Maximum ELT	70	*21*	Reduce flow above this temp. to limit refrigerant suction pressure.
Outdoor (Antifreeze)	Heating	Minimum ELT	23	*-5*	Adequate antifreeze protection required.
	Heating	Maximum ELT	70	*21*	Reduce flow above this temp. to limit refrigerant suction pressure.

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 24 - Required Indoor & Outdoor Loop Flow Rates		
MODEL	gpm	*L/s*
WC-16	6	*0.38*
WC-25	8	*0.50*
WC-45	10	*0.63*
WC-55	12	*0.76*
WC-65	14	*0.88*
WC-75	16	*1.0*
WC-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 25: WC Pressure Drop Data

			INDOOR *Single wall option* (water 140°F)		INDOOR *Double wall option* (water 140°F)		OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% propylene glycol 32°F)	
	gpm	***L/s***	psi	*kPa*	psi	*kPa*	psi	*kPa*	psi	*kPa*	psi	*kPa*
WC-16	4	*0.25*	0.9	*5.9*	0.8	*5.5*	1.0	*6.9*	1.1	*7.6*	1.7	*12*
	5	*0.32*	1.3	*8.9*	1.2	*8.3*	1.5	*10*	1.7	*12*	2.3	*16*
	6	***0.38***	**1.8**	***13***	**1.6**	***11***	**2.1**	***15***	**2.3**	***16***	**2.9**	***20***
	7	*0.44*	2.5	*17*	2.1	*14*	2.7	*19*	3.0	*21*	3.8	*26*
	8	*0.50*	3.2	*22*	2.8	*19*	3.4	*23*	3.8	*26*	4.8	*33*
WC-25	4	*0.25*	0.4	*2.5*	0.4	*2.8*	0.9	*6.2*	0.9	*6.2*	1.2	*8.2*
	5	*0.32*	0.6	*3.8*	0.6	*4.1*	1.4	*10*	1.4	*9.6*	1.8	*13*
	6	*0.38*	0.8	*5.3*	0.8	*5.5*	1.7	*12*	1.9	*13*	2.5	*17*
	7	*0.44*	1.0	*7.1*	1.0	*6.9*	2.3	*16*	2.4	*17*	3.2	*22*
	8	***0.50***	**1.3**	***9.1***	**1.3**	***9.0***	**3.2**	***22***	**3.0**	***21***	**4.0**	***27***
	9	*0.57*	1.7	*12*	1.6	*11*	3.4	*23*	3.9	*27*	5.1	*35*
	10	*0.63*	2.0	*14*	1.9	*13*	4.4	*30*	4.8	*33*	6.3	*43*
	11	*0.69*	2.4	*17*	2.3	*16*	5.1	*35*	5.7	*39*	7.5	*52*
WC-45	6	*0.38*	0.8	*5.3*	0.8	*5.5*	1.7	*12*	2.0	*14*	2.6	*18*
	7	*0.44*	1.0	*7.1*	1.0	*6.9*	2.1	*14*	2.5	*17*	3.3	*23*
	8	*0.50*	1.3	*9.1*	1.3	*9.0*	2.8	*19*	3.0	*21*	4.0	*27*
	9	*0.57*	1.7	*12*	1.6	*11*	3.5	*24*	3.8	*26*	5.0	*34*
	10	***0.63***	**2.0**	***14***	**1.9**	***13***	**4.0**	***28***	**4.7**	***32***	**6.2**	***43***
	11	*0.69*	2.4	*17*	2.3	*16*	4.6	*32*	5.5	*38*	7.2	*50*
	12	*0.76*	2.9	*20*	2.7	*19*	5.5	*38*	6.6	*45*	8.7	*60*
	13	*0.82*	3.3	*23*	3.1	*21*	6.2	*43*	7.4	*51*	9.7	*67*
WC-55	6	*0.38*	0.5	*3.2*	0.4	*2.8*	1.2	*8.3*	1.3	*9.0*	1.7	*12*
	7	*0.44*	0.6	*4.2*	0.5	*3.4*	1.6	*11*	1.6	*11*	2.1	*14*
	8	*0.50*	0.8	*5.3*	0.7	*4.8*	1.9	*13*	2.1	*14*	2.8	*19*
	9	*0.57*	1.0	*6.5*	0.9	*6.2*	2.4	*17*	2.4	*17*	3.2	*22*
	10	*0.63*	1.2	*8.0*	1.1	*7.6*	2.9	*20*	3.1	*21*	4.1	*28*
	11	*0.69*	1.4	*9.6*	1.2	*8.3*	3.1	*21*	3.6	*25*	4.7	*33*
	12	***0.76***	**1.6**	***11***	**1.4**	***9.7***	**3.7**	***26***	**4.4**	***30***	**5.8**	***40***
	13	*0.82*	1.9	*14*	1.6	*11*	4.3	*30*	5	*34*	6.6	*45*
	14	*0.88*	2.2	*15*	1.8	*12*	5	*34*	5.7	*39*	7.5	*52*
	15	*0.95*	2.5	*17*	2.1	*14*	5.8	*40*	6.4	*44*	8.4	*58*

Table 25: WC Pressure Drop Data (cont'd)			INDOOR *Single wall option* (water 140°F)		INDOOR *Double wall option* (water 140°F)		OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% propylene glycol 32°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*	psi	*kPa*	psi	*kPa*	psi	*kPa*
WC-65	8	*0.50*	0.8	*5.3*	0.7	*4.8*	1.9	*13*	2.2	*15*	2.9	*20*
	9	*0.57*	1.0	*6.5*	0.9	*6.2*	2.3	*16*	2.7	*19*	3.6	*24*
	10	*0.63*	1.2	*8.0*	1.1	*7.6*	2.6	*18*	3.3	*23*	4.3	*30*
	11	*0.69*	1.4	*9.6*	1.2	*8.3*	3.2	*22*	4	*28*	5.3	*36*
	12	*0.76*	1.6	*11*	1.4	*9.7*	3.9	*27*	4.6	*32*	6.0	*42*
	13	*0.82*	1.9	*14*	1.6	*11*	4.4	*30*	5.2	*36*	6.8	*47*
	14	***0.88***	**2.2**	***15***	**1.8**	***12***	**5**	***34***	**5.8**	***40***	**7.6**	***53***
	15	*0.95*	2.5	*17*	2.1	*14*	5.7	*39*	6.5	*45*	8.5	*59*
	16	*1.01*	2.8	*20*	2.3	*16*	6.5	*45*	7.3	*50*	9.6	*66*
WC-75	8	*0.50*	0.6	*4.3*	0.5	*3.4*	1.3	*9.0*	1.3	*9.0*	1.7	*12*
	9	*0.57*	0.8	*5.4*	0.7	*4.8*	1.6	*11*	1.6	*11*	2.1	*14*
	10	*0.63*	1.0	*6.5*	0.9	*6.2*	1.9	*13*	2.1	*14*	2.8	*19*
	11	*0.69*	1.1	*7.6*	1.0	*6.9*	2.3	*16*	2.4	*17*	3.2	*22*
	12	*0.76*	1.3	*8.9*	1.2	*8.3*	2.6	*18*	2.9	*20*	3.8	*26*
	13	*0.82*	1.5	*11*	1.3	*9.0*	3.0	*21*	3.3	*23*	4.3	*30*
	14	*0.88*	1.8	*12*	1.5	*10*	3.2	*22*	3.7	*26*	4.9	*33*
	15	*0.95*	2.0	*14*	1.7	*12*	3.5	*24*	4.1	*28*	5.4	*37*
	16	***1.01***	**2.3**	***16***	**2.0**	***14***	**4.0**	***28***	**4.7**	***32***	**6.2**	***43***
	17	*1.07*	2.5	*17*	2.3	*16*	4.4	*30*	5.2	*36*	6.8	*47*
WC-80	9	*0.57*	0.8	*5.4*	0.7	*4.8*	1.3	*9.0*	1.4	*10*	1.8	*13*
	10	*0.63*	1.0	*6.5*	0.9	*6.2*	1.6	*11*	1.7	*12*	2.2	*15*
	11	*0.69*	1.1	*7.6*	1.0	*6.9*	1.9	*13*	2.2	*15*	2.9	*20*
	12	*0.76*	1.3	*8.9*	1.2	*8.3*	2.4	*17*	2.6	*18*	3.4	*24*
	13	*0.82*	1.5	*11*	1.3	*9.0*	2.7	*19*	3.1	*21*	4.1	*28*
	14	*0.88*	1.8	*12*	1.5	*10*	3.1	*21*	3.5	*24*	4.6	*32*
	15	*0.95*	2.0	*14*	1.7	*12*	3.3	*23*	3.8	*26*	5.0	*34*
	16	*1.01*	2.3	*16*	2.0	*14*	3.6	*25*	4.1	*28*	5.4	*37*
	17	***1.07***	**2.5**	***17***	**2.3**	***16***	**4.1**	***28***	**4.6**	***32***	**6.0**	***42***
	18	*1.14*	2.8	*20*	2.5	*17*	4.5	*31*	4.9	*34*	6.4	*44*

Performance Tables

WC-16-H-C-*D-** *60 Hz, ZP14K5E-PFV / ZR16K5E-PFV*

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	14	6.0	22	3.1	8,600	1,840	115	123	6.0	120	4.9	**14,900**	**2.38**
	30	18	6.0	27	3.4	9,600	1,870	115	123	6.0		5.4	**16,000**	**2.50**
	35	23	6.0	31	3.7	10,200	1,930	114	125	6.0		5.6	**16,800**	**2.56**
	40	27	6.0	36	4.0	10,900	1,980	114	125	6.0		5.9	**17,700**	**2.62**
	45	32	6.0	41	3.9	11,600	2,050	114	127	6.0		6.2	**18,600**	**2.67**
	50	37	6.0	46	4.2	12,700	2,100	113	128	6.0		6.7	**19,900**	**2.77**
	25	14	6.0	22	3.2	8,800	2,110	135	143	6.0	140	5.3	**16,000**	**2.22**
	30	19	6.0	27	3.4	9,600	2,150	134	144	6.0		5.7	**17,000**	**2.31**
	35	24	6.0	31	3.6	10,000	2,200	134	145	6.0		5.9	**17,500**	**2.34**
	40	28	6.0	36	3.8	10,500	2,250	134	145	6.0		6.0	**18,200**	**2.37**
	45	32	6.0	41	3.8	11,200	2,340	134	146	6.0		6.3	**19,200**	**2.41**
	50	36	6.0	46	4.1	12,300	2,410	133	147	6.0		6.9	**20,500**	**2.49**
	25	15	6.0	22	3.1	8,600	2,470	154	165	6.0	160	5.6	**17,100**	**2.02**
	30	19	6.0	27	3.4	9,500	2,500	154	166	6.0		6.1	**18,000**	**2.11**
	35	24	6.0	32	3.5	9,900	2,560	154	167	6.0		6.2	**18,700**	**2.14**
	40	29	6.0	36	3.8	10,400	2,610	154	167	6.0		6.4	**19,300**	**2.17**
	45	33	6.0	41	3.8	11,100	2,710	153	168	6.0		6.7	**20,400**	**2.20**
	50	36	6.0	46	4.1	12,200	2,790	153	169	6.0		7.3	**21,700**	**2.28**

METRIC

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	-3.9	-10.0	0.38	-5.6	1.7	2,500	1,840	46.2	50.3	0.38	49	2.7	**4,400**	**2.38**
	-1.1	-7.6	0.38	-3.0	1.9	2,800	1,870	45.9	50.7	0.38		3.0	**4,700**	**2.50**
	1.7	-5.2	0.38	-0.4	2.0	3,000	1,930	45.8	51.4	0.38		3.1	**4,900**	**2.56**
	4.4	-2.8	0.38	2.2	2.2	3,200	1,980	45.6	51.9	0.38		3.3	**5,200**	**2.62**
	7.2	-0.2	0.38	5.0	2.2	3,400	2,050	45.5	52.6	0.38		3.4	**5,500**	**2.67**
	10.0	2.6	0.38	7.6	2.4	3,700	2,100	45.2	53.1	0.38		3.7	**5,800**	**2.77**
	-3.9	-9.8	0.38	-5.7	1.8	2,600	2,110	57.1	61.7	0.38	60	2.9	**4,700**	**2.22**
	-1.1	-7.2	0.38	-3.0	1.9	2,800	2,150	56.8	62.1	0.38		3.2	**5,000**	**2.31**
	1.7	-4.7	0.38	-0.3	2.0	2,900	2,200	56.7	62.5	0.38		3.3	**5,100**	**2.34**
	4.4	-2.1	0.38	2.3	2.1	3,100	2,250	56.6	62.8	0.38		3.4	**5,300**	**2.37**
	7.2	0.1	0.38	5.1	2.1	3,300	2,340	56.5	63.2	0.38		3.5	**5,600**	**2.41**
	10.0	2.4	0.38	7.7	2.3	3,600	2,410	56.2	64.1	0.38		3.8	**6,000**	**2.49**
	-3.9	-9.8	0.38	-5.6	1.7	2,500	2,470	68.0	73.9	0.38	71	3.1	**5,000**	**2.02**
	-1.1	-7.0	0.38	-3.0	1.9	2,800	2,500	67.7	74.2	0.38		3.4	**5,300**	**2.11**
	1.7	-4.3	0.38	-0.3	2.0	2,900	2,560	67.7	74.7	0.38		3.5	**5,500**	**2.14**
	4.4	-1.6	0.38	2.3	2.1	3,100	2,610	67.5	74.9	0.38		3.6	**5,700**	**2.17**
	7.2	0.4	0.38	5.1	2.1	3,300	2,710	67.4	75.4	0.38		3.7	**6,000**	**2.20**
	10.0	2.4	0.38	7.7	2.3	3,600	2,790	67.1	75.9	0.38		4.0	**6,400**	**2.28**

Performance Tables

WC-25-H-C-*D-** *60 Hz, ZP16K6E-PFV / ZR21K5E-PFV*

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	14	8.0	22	2.9	10,600	2,170	115	123	8.0	120	4.6	**18,000**	**2.43**
	30	18	8.0	27	3.2	11,800	2,300	115	123	8.0		5.0	**19,700**	**2.50**
	35	23	8.0	32	3.4	12,600	2,390	115	125	8.0		5.2	**20,700**	**2.54**
	40	27	8.0	36	3.7	13,700	2,490	115	125	8.0		5.5	**22,200**	**2.62**
	45	32	8.0	41	3.6	14,300	2,500	114	127	8.0		5.7	**22,900**	**2.68**
	50	37	8.0	46	4.1	16,000	2,470	114	128	8.0		6.4	**24,400**	**2.90**
	25	14	8.0	22	3.0	10,800	2,500	135	143	8.0	140	4.9	**19,400**	**2.27**
	30	19	8.0	27	3.2	11,800	2,640	135	144	8.0		5.3	**20,800**	**2.31**
	35	24	8.0	32	3.3	12,300	2,730	135	145	8.0		5.4	**21,600**	**2.32**
	40	28	8.0	37	3.5	13,200	2,830	134	145	8.0		5.7	**22,900**	**2.37**
	45	32	8.0	42	3.4	13,800	2,850	134	146	8.0		5.9	**23,500**	**2.42**
	50	36	8.0	46	3.9	15,500	2,830	133	147	8.0		6.6	**25,100**	**2.60**
	25	15	8.0	22	2.9	10,600	2,930	155	165	8.0	160	5.2	**20,600**	**2.07**
	30	19	8.0	27	3.2	11,600	3,070	154	166	8.0		5.6	**22,100**	**2.11**
	35	24	8.0	32	3.3	12,200	3,170	154	167	8.0		5.7	**23,000**	**2.12**
	40	29	8.0	37	3.5	13,100	3,280	154	167	8.0		6.1	**24,300**	**2.17**
	45	33	8.0	42	3.4	13,700	3,310	154	168	8.0		6.2	**25,000**	**2.21**
	50	36	8.0	46	3.9	15,500	3,280	153	169	8.0		7.0	**26,700**	**2.38**

METRIC

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	-3.9	-10.0	0.50	-5.5	1.6	3,100	2,170	46.4	50.3	0.50	49	2.5	**5,300**	**2.43**
	-1.1	-7.6	0.50	-2.9	1.8	3,500	2,300	46.1	50.7	0.50		2.8	**5,800**	**2.50**
	1.7	-5.2	0.50	-0.2	1.9	3,700	2,390	46.0	51.4	0.50		2.9	**6,100**	**2.54**
	4.4	-2.8	0.50	2.4	2.0	4,000	2,490	45.8	51.9	0.50		3.1	**6,500**	**2.62**
	7.2	-0.2	0.50	5.2	2.0	4,200	2,500	45.7	52.6	0.50		3.2	**6,700**	**2.68**
	10.0	2.6	0.50	7.7	2.3	4,700	2,470	45.3	53.1	0.50		3.6	**7,200**	**2.90**
	-3.9	-9.8	0.50	-5.5	1.6	3,200	2,500	57.3	61.7	0.50	60	2.7	**5,700**	**2.27**
	-1.1	-7.2	0.50	-2.9	1.8	3,500	2,640	57.1	62.1	0.50		2.9	**6,100**	**2.31**
	1.7	-4.7	0.50	-0.2	1.8	3,600	2,730	57.0	62.5	0.50		3.0	**6,300**	**2.32**
	4.4	-2.1	0.50	2.5	2.0	3,900	2,830	56.8	62.8	0.50		3.2	**6,700**	**2.37**
	7.2	0.1	0.50	5.3	1.9	4,000	2,850	56.7	63.2	0.50		3.3	**6,900**	**2.42**
	10.0	2.4	0.50	7.8	2.2	4,500	2,830	56.3	64.1	0.50		3.7	**7,400**	**2.60**
	-3.9	-9.8	0.50	-5.5	1.6	3,100	2,930	68.2	73.9	0.50	71	2.9	**6,000**	**2.07**
	-1.1	-7.0	0.50	-2.9	1.8	3,400	3,070	68.0	74.2	0.50		3.1	**6,500**	**2.11**
	1.7	-4.3	0.50	-0.2	1.8	3,600	3,170	67.9	74.7	0.50		3.2	**6,700**	**2.12**
	4.4	-1.6	0.50	2.5	1.9	3,800	3,280	67.7	74.9	0.50		3.4	**7,100**	**2.17**
	7.2	0.4	0.50	5.3	1.9	4,000	3,310	67.7	75.4	0.50		3.5	**7,300**	**2.21**
	10.0	2.4	0.50	7.8	2.2	4,500	3,280	67.2	75.9	0.50		3.9	**7,800**	**2.38**

Performance Tables

WC-45-H-C-*D-** *60 Hz, ZP25K6E-PFV / ZR32K5E-PFV*

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	14	10	21	3.6	16,500	3,380	114	122	10	120	5.6	**28,100**	**2.43**
	30	18	10	26	3.8	17,900	3,460	114	124	10		6.0	**29,700**	**2.52**
	35	23	10	31	4.2	19,300	3,650	114	124	10		6.4	**31,800**	**2.56**
	40	27	10	36	4.5	21,100	3,850	113	126	10		6.9	**34,200**	**2.60**
	45	33	10	40	4.6	22,600	3,950	113	127	10		7.2	**36,100**	**2.68**
	50	37	10	45	4.8	23,900	3,900	113	128	10		7.5	**37,200**	**2.80**
	25	14	10	21	3.7	16,900	3,900	134	143	10	140	6.0	**30,100**	**2.27**
	30	19	10	26	3.8	17,900	3,960	134	144	10		6.4	**31,400**	**2.32**
	35	24	10	31	4.1	19,000	4,160	133	144	10		6.6	**33,200**	**2.34**
	40	28	10	36	4.4	20,300	4,390	133	145	10		7.1	**35,300**	**2.36**
	45	32	10	41	4.4	21,800	4,510	133	146	10		7.4	**37,200**	**2.42**
	50	36	10	45	4.6	23,100	4,460	132	148	10		7.8	**38,300**	**2.52**
	25	15	10	21	3.6	16,600	4,550	154	165	10	160	6.4	**32,100**	**2.07**
	30	19	10	26	3.8	17,700	4,620	153	166	10		6.8	**33,400**	**2.12**
	35	24	10	31	4.1	18,700	4,840	153	166	10		7.1	**35,300**	**2.14**
	40	29	10	36	4.3	20,100	5,090	152	167	10		7.6	**37,500**	**2.16**
	45	33	10	41	4.4	21,600	5,230	152	168	10		7.8	**39,500**	**2.21**
	50	36	10	45	4.6	23,000	5,180	152	169	10		8.2	**40,700**	**2.30**

METRIC

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	-3.9	-9.9	0.63	-5.9	2.0	4,800	3,380	45.8	50.2	0.63	49	3.1	**8,200**	**2.43**
	-1.1	-7.6	0.63	-3.2	2.1	5,200	3,460	45.6	50.8	0.63		3.3	**8,700**	**2.52**
	1.7	-5.1	0.63	-0.7	2.3	5,700	3,650	45.4	51.3	0.63		3.5	**9,300**	**2.56**
	4.4	-2.8	0.63	1.9	2.5	6,200	3,850	45.0	52.0	0.63		3.8	**10,000**	**2.60**
	7.2	-0.1	0.63	4.7	2.5	6,600	3,950	44.9	52.5	0.63		4.0	**10,600**	**2.68**
	10.0	2.5	0.63	7.4	2.6	7,000	3,900	44.7	53.2	0.63		4.2	**10,900**	**2.80**
	-3.9	-9.8	0.63	-5.9	2.0	4,900	3,900	56.7	61.6	0.63	60	3.3	**8,800**	**2.27**
	-1.1	-7.3	0.63	-3.2	2.1	5,200	3,960	56.5	62.2	0.63		3.5	**9,200**	**2.32**
	1.7	-4.6	0.63	-0.6	2.3	5,600	4,160	56.3	62.4	0.63		3.7	**9,700**	**2.34**
	4.4	-2.1	0.63	2.0	2.4	5,900	4,390	56.0	62.9	0.63		4.0	**10,300**	**2.36**
	7.2	0.2	0.63	4.8	2.4	6,400	4,510	55.9	63.1	0.63		4.1	**10,900**	**2.42**
	10.0	2.3	0.63	7.4	2.6	6,800	4,460	55.7	64.2	0.63		4.3	**11,200**	**2.52**
	-3.9	-9.7	0.63	-5.9	2.0	4,900	4,550	67.6	73.8	0.63	71	3.5	**9,400**	**2.07**
	-1.1	-7.1	0.63	-3.2	2.1	5,200	4,620	67.4	74.3	0.63		3.8	**9,800**	**2.12**
	1.7	-4.3	0.63	-0.6	2.3	5,500	4,840	67.2	74.6	0.63		3.9	**10,300**	**2.14**
	4.4	-1.6	0.63	2.0	2.4	5,900	5,090	66.9	75.1	0.63		4.2	**11,000**	**2.16**
	7.2	0.4	0.63	4.8	2.4	6,300	5,230	66.8	75.3	0.63		4.3	**11,600**	**2.21**
	10.0	2.4	0.63	7.5	2.5	6,700	5,180	66.5	76.1	0.63		4.6	**11,900**	**2.30**

Performance Tables

WC-55-H-C-*D-** *60 Hz, ZP36K5E-PFV / ZR42K5E-PFV*

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	14	12	21	4.1	22,600	4,720	114	122	12	120	6.5	**38,800**	**2.41**
	30	18	12	26	4.4	24,700	4,970	113	123	12		7.1	**41,700**	**2.46**
	35	23	12	30	4.7	26,500	5,040	113	125	12		7.3	**43,700**	**2.54**
	40	27	12	35	5.2	28,600	5,070	112	126	12		7.6	**45,900**	**2.66**
	45	32	12	40	5.2	30,700	5,190	112	127	12		8.0	**48,400**	**2.74**
	50	37	12	45	5.4	32,500	5,410	112	128	12		8.5	**51,000**	**2.76**
	25	14	12	21	4.2	23,100	5,440	133	143	12	140	7.0	**41,700**	**2.25**
	30	19	12	26	4.4	24,600	5,700	133	144	12		7.5	**44,100**	**2.27**
	35	24	12	30	4.6	26,000	5,750	132	145	12		7.6	**45,600**	**2.32**
	40	28	12	35	5.0	27,600	5,770	132	145	12		7.8	**47,300**	**2.40**
	45	32	12	40	5.0	29,700	5,930	132	146	12		8.3	**49,900**	**2.47**
	50	36	12	45	5.2	31,300	6,200	131	148	12		8.8	**52,500**	**2.48**
	25	15	12	21	4.1	22,700	6,360	153	165	12	160	7.5	**44,400**	**2.05**
	30	19	12	26	4.3	24,200	6,640	152	166	12		7.9	**46,900**	**2.07**
	35	24	12	30	4.6	25,700	6,690	152	167	12		8.1	**48,500**	**2.12**
	40	29	12	35	5.0	27,400	6,690	152	167	12		8.3	**50,300**	**2.20**
	45	33	12	40	5.0	29,500	6,870	151	168	12		8.8	**53,000**	**2.26**
	50	36	12	45	5.2	31,200	7,190	151	169	12		9.3	**55,700**	**2.27**

METRIC

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	-3.9	-10.0	0.76	-6.2	2.3	6,600	4,720	45.3	50.2	0.76	49	3.6	**11,400**	**2.41**
	-1.1	-7.6	0.76	-3.6	2.4	7,200	4,970	45.0	50.7	0.76		3.9	**12,200**	**2.46**
	1.7	-5.2	0.76	-1.0	2.6	7,800	5,040	44.8	51.4	0.76		4.1	**12,800**	**2.54**
	4.4	-2.8	0.76	1.6	2.9	8,400	5,070	44.7	51.9	0.76		4.2	**13,500**	**2.66**
	7.2	-0.2	0.76	4.3	2.9	9,000	5,190	44.4	52.6	0.76		4.5	**14,200**	**2.74**
	10.0	2.6	0.76	7.0	3.0	9,500	5,410	44.2	53.2	0.76		4.7	**14,900**	**2.76**
	-3.9	-9.8	0.76	-6.2	2.3	6,800	5,440	56.1	61.6	0.76	60	3.9	**12,200**	**2.25**
	-1.1	-7.2	0.76	-3.5	2.4	7,200	5,700	55.9	62.1	0.76		4.1	**12,900**	**2.27**
	1.7	-4.7	0.76	-0.9	2.6	7,600	5,750	55.8	62.5	0.76		4.2	**13,400**	**2.32**
	4.4	-2.1	0.76	1.7	2.8	8,100	5,770	55.7	62.9	0.76		4.3	**13,900**	**2.40**
	7.2	0.1	0.76	4.4	2.8	8,700	5,930	55.4	63.2	0.76		4.6	**14,600**	**2.47**
	10.0	2.4	0.76	7.1	2.9	9,200	6,200	55.1	64.2	0.76		4.9	**15,400**	**2.48**
	-3.9	-9.8	0.76	-6.2	2.3	6,600	6,360	67.0	73.8	0.76	71	4.2	**13,000**	**2.05**
	-1.1	-7.0	0.76	-3.5	2.4	7,100	6,640	66.7	74.2	0.76		4.4	**13,700**	**2.07**
	1.7	-4.3	0.76	-0.9	2.6	7,500	6,690	66.6	74.7	0.76		4.5	**14,200**	**2.12**
	4.4	-1.6	0.76	1.7	2.8	8,000	6,690	66.5	75.0	0.76		4.6	**14,700**	**2.20**
	7.2	0.4	0.76	4.4	2.8	8,600	6,870	66.2	75.4	0.76		4.9	**15,500**	**2.26**
	10.0	2.4	0.76	7.1	2.9	9,100	7,190	66.0	76.0	0.76		5.2	**16,300**	**2.27**

Performance Tables

WC-65-H-C-*D-** *60 Hz, ZP42K5E-PFV / ZR54K5E-PFV*

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	14	14	21	4.3	27,800	5,700	113	122	14	120	6.7	**47,200**	**2.43**
	30	19	14	26	4.4	29,300	5,910	113	123	14		7.1	**49,500**	**2.46**
	35	23	14	30	5.0	32,600	6,050	113	125	14		7.5	**53,300**	**2.58**
	40	27	14	35	5.5	35,500	6,490	112	126	14		8.3	**57,700**	**2.60**
	45	32	14	39	5.6	38,700	6,580	111	127	14		8.6	**61,100**	**2.72**
	50	37	14	44	5.7	39,800	6,730	111	128	14		9.1	**62,700**	**2.73**
	25	14	14	21	4.4	28,400	6,560	133	143	14	140	7.2	**50,800**	**2.27**
	30	19	14	26	4.4	29,400	6,740	132	144	14		7.6	**52,400**	**2.28**
	35	24	14	30	4.9	32,000	6,900	132	144	14		7.9	**55,600**	**2.36**
	40	28	14	35	5.3	34,300	7,350	131	145	14		8.6	**59,400**	**2.37**
	45	32	14	40	5.4	37,300	7,510	131	146	14		8.9	**62,900**	**2.45**
	50	36	14	45	5.5	38,400	7,670	131	148	14		9.3	**64,600**	**2.47**
	25	15	14	21	4.3	27,900	7,670	152	165	14	160	7.7	**54,100**	**2.07**
	30	20	14	26	4.4	28,900	7,850	152	166	14		8.0	**55,700**	**2.08**
	35	24	14	30	4.8	31,700	8,030	152	166	14		8.4	**59,100**	**2.16**
	40	29	14	35	5.3	34,000	8,520	151	167	14		9.1	**63,100**	**2.17**
	45	33	14	40	5.4	37,100	8,710	151	168	14		9.5	**66,800**	**2.25**
	50	36	14	45	5.5	38,200	8,890	150	169	14		9.9	**68,500**	**2.26**

METRIC

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	-3.9	-10.0	0.88	-6.3	2.4	8,100	5,700	45.2	50.2	0.88	49	3.7	**13,800**	**2.43**
	-1.1	-7.5	0.88	-3.6	2.5	8,600	5,910	44.9	50.8	0.88		4.0	**14,500**	**2.46**
	1.7	-5.3	0.88	-1.1	2.8	9,600	6,050	44.7	51.4	0.88		4.2	**15,600**	**2.58**
	4.4	-2.8	0.88	1.4	3.1	10,400	6,490	44.3	52.0	0.88		4.6	**16,900**	**2.60**
	7.2	-0.2	0.88	4.1	3.1	11,300	6,580	44.1	52.6	0.88		4.8	**17,900**	**2.72**
	10.0	2.6	0.88	6.8	3.2	11,700	6,730	43.9	53.2	0.88		5.0	**18,400**	**2.73**
	-3.9	-9.8	0.88	-6.3	2.4	8,300	6,560	56.0	61.6	0.88	60	4.0	**14,900**	**2.27**
	-1.1	-7.2	0.88	-3.6	2.5	8,600	6,740	55.8	62.1	0.88		4.2	**15,300**	**2.28**
	1.7	-4.7	0.88	-1.0	2.7	9,400	6,900	55.6	62.4	0.88		4.4	**16,300**	**2.36**
	4.4	-2.1	0.88	1.5	3.0	10,100	7,350	55.2	62.9	0.88		4.8	**17,400**	**2.37**
	7.2	0.1	0.88	4.2	3.0	10,900	7,510	55.1	63.2	0.88		4.9	**18,400**	**2.45**
	10.0	2.4	0.88	6.9	3.1	11,300	7,670	54.8	64.2	0.88		5.2	**18,900**	**2.47**
	-3.9	-9.8	0.88	-6.3	2.4	8,200	7,670	66.9	73.8	0.88	71	4.3	**15,800**	**2.07**
	-1.1	-6.9	0.88	-3.5	2.4	8,500	7,850	66.6	74.3	0.88		4.5	**16,300**	**2.08**
	1.7	-4.4	0.88	-1.0	2.7	9,300	8,030	66.4	74.7	0.88		4.7	**17,300**	**2.16**
	4.4	-1.6	0.88	1.5	2.9	10,000	8,520	66.0	75.1	0.88		5.1	**18,500**	**2.17**
	7.2	0.3	0.88	4.2	3.0	10,900	8,710	65.9	75.3	0.88		5.3	**19,600**	**2.25**
	10.0	2.4	0.88	7.0	3.0	11,200	8,890	65.6	76.1	0.88		5.5	**20,100**	**2.26**

Performance Tables

WC-75-H-C-*D-** *60 Hz, ZP54K5E-PFV / ZR61KCE-PFV*

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	14	16	21	4.4	33,200	7,030	113	122	16	120	7.2	**57,200**	**2.38**
	30	18	16	25	4.9	36,000	7,010	113	123	16		7.4	**59,900**	**2.50**
	35	23	16	30	5.3	39,400	7,540	112	125	16		8.2	**65,100**	**2.53**
	40	27	16	34	5.8	42,200	7,470	112	126	16		8.4	**67,700**	**2.66**
	45	32	16	39	5.6	45,300	7,960	111	127	16		9.2	**72,500**	**2.67**
	50	36	16	44	6.0	47,700	7,820	111	128	16		9.2	**74,400**	**2.79**
	25	15	16	21	4.5	33,800	8,100	132	143	16	140	7.8	**61,400**	**2.22**
	30	19	16	25	4.9	36,000	8,030	132	144	16		7.9	**63,400**	**2.31**
	35	24	16	30	5.2	38,700	8,560	131	145	16		8.6	**67,900**	**2.32**
	40	28	16	34	5.6	40,700	8,500	131	145	16		8.6	**69,700**	**2.40**
	45	32	16	40	5.4	43,600	9,090	131	146	16		9.4	**74,600**	**2.41**
	50	36	16	44	5.8	46,000	8,960	131	148	16		9.5	**76,600**	**2.50**
	25	15	16	21	4.4	33,100	9,470	152	165	16	160	8.3	**65,400**	**2.02**
	30	19	16	25	4.8	35,500	9,360	152	166	16		8.4	**67,400**	**2.11**
	35	24	16	30	5.2	38,400	9,910	151	167	16		9.1	**72,200**	**2.14**
	40	29	16	35	5.5	40,400	9,860	151	167	16		9.2	**74,100**	**2.20**
	45	33	16	40	5.4	43,500	10,490	150	168	16		10.0	**79,300**	**2.21**
	50	36	16	44	5.8	45,800	10,390	150	169	16		10.1	**81,300**	**2.29**

METRIC

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	-3.9	-9.9	1.0	-6.3	2.5	9,700	7,030	44.9	50.2	1.0	49	4.0	**16,700**	**2.38**
	-1.1	-7.6	1.0	-3.8	2.7	10,500	7,010	44.8	50.7	1.0		4.1	**17,600**	**2.50**
	1.7	-5.1	1.0	-1.3	2.9	11,500	7,540	44.3	51.4	1.0		4.6	**19,100**	**2.53**
	4.4	-2.9	1.0	1.2	3.2	12,400	7,470	44.2	51.9	1.0		4.7	**19,800**	**2.66**
	7.2	-0.1	1.0	4.1	3.1	13,300	7,960	43.8	52.6	1.0		5.1	**21,200**	**2.67**
	10.0	2.4	1.0	6.7	3.3	14,000	7,820	43.8	53.2	1.0		5.1	**21,800**	**2.79**
	-3.9	-9.7	1.0	-6.4	2.5	9,900	8,100	55.7	61.6	1.0	60	4.3	**18,000**	**2.22**
	-1.1	-7.3	1.0	-3.8	2.7	10,500	8,030	55.6	62.1	1.0		4.4	**18,600**	**2.31**
	1.7	-4.6	1.0	-1.2	2.9	11,300	8,560	55.2	62.5	1.0		4.8	**19,900**	**2.32**
	4.4	-2.2	1.0	1.4	3.1	11,900	8,500	55.2	62.9	1.0		4.8	**20,400**	**2.40**
	7.2	0.2	1.0	4.2	3.0	12,800	9,090	54.8	63.2	1.0		5.2	**21,900**	**2.41**
	10.0	2.3	1.0	6.8	3.2	13,500	8,960	54.7	64.2	1.0		5.3	**22,400**	**2.50**
	-3.9	-9.6	1.0	-6.3	2.5	9,700	9,470	66.5	73.8	1.0	71	4.6	**19,200**	**2.02**
	-1.1	-7.1	1.0	-3.8	2.7	10,400	9,360	66.5	74.2	1.0		4.6	**19,800**	**2.11**
	1.7	-4.3	1.0	-1.2	2.9	11,200	9,910	66.0	74.7	1.0		5.1	**21,200**	**2.14**
	4.4	-1.7	1.0	1.4	3.1	11,800	9,860	66.0	75.0	1.0		5.1	**21,700**	**2.20**
	7.2	0.4	1.0	4.2	3.0	12,700	10,490	65.5	75.4	1.0		5.6	**23,200**	**2.21**
	10.0	2.3	1.0	6.8	3.2	13,400	10,390	65.5	76.0	1.0		5.6	**23,800**	**2.29**

Performance Tables

WC-80-H-C-*D-** *60 Hz, ZP61K5E-PFV / ZR68KCE-PFV*

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	14	17	20	4.7	37,100	7,730	113	122	17	120	7.5	**63,500**	**2.41**
	30	18	17	25	5.1	40,500	8,020	112	123	17		8.0	**67,900**	**2.48**
	35	23	17	29	5.6	44,000	8,290	112	125	17		8.5	**72,300**	**2.56**
	40	27	17	34	6.0	47,500	8,550	111	126	17		9.0	**76,700**	**2.63**
	45	32	17	39	6.0	50,600	8,750	111	127	17		9.5	**80,500**	**2.70**
	50	37	17	44	6.3	53,700	8,950	110	128	17		9.9	**84,300**	**2.76**
	25	14	17	20	4.8	37,800	8,900	132	143	17	140	8.0	**68,200**	**2.25**
	30	19	17	25	5.1	40,500	9,190	132	144	17		8.5	**71,800**	**2.29**
	35	24	17	30	5.5	43,100	9,460	131	144	17		8.9	**75,400**	**2.34**
	40	2	17	34	5.8	45,800	9,730	131	145	17		9.3	**79,000**	**2.38**
	45	32	17	39	5.7	48,800	10,000	130	146	17		9.8	**82,900**	**2.43**
	50	36	17	44	6.1	51,800	10,250	130	148	17		10.2	**86,800**	**2.48**
	25	15	17	20	4.7	37,100	10,410	151	165	17	160	8.6	**72,600**	**2.05**
	30	19	17	25	5.1	39,800	10,710	151	166	17		9.0	**76,400**	**2.09**
	35	24	17	30	5.4	42,600	11,000	151	166	17		9.4	**80,200**	**2.14**
	40	29	17	34	5.8	45,400	11,280	150	167	17		9.9	**84,000**	**2.18**
	45	33	17	39	5.7	48,500	11,590	150	168	17		10.4	**88,000**	**2.23**
	50	36	17	44	6.1	51,500	11,890	149	169	17		10.8	**92,100**	**2.27**

METRIC

	OUTDOOR LOOP *(35% Propylene Glycol)*						ELECTRICAL	INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	-3.9	-9.9	1.1	-6.5	2.6	10,900	7,730	44.7	50.2	1.1	49	4.2	**18,600**	**2.41**
	-1.1	-7.6	1.1	-4.0	2.9	11,900	8,020	44.4	50.8	1.1		4.4	**19,900**	**2.48**
	1.7	-5.2	1.1	-1.4	3.1	12,900	8,290	44.2	51.4	1.1		4.7	**21,200**	**2.56**
	4.4	-2.8	1.1	1.1	3.4	13,900	8,550	43.9	51.9	1.1		5.0	**22,500**	**2.63**
	7.2	-0.2	1.1	3.9	3.3	14,800	8,750	43.6	52.6	1.1		5.3	**23,600**	**2.70**
	10.0	2.5	1.1	6.5	3.5	15,700	8,950	43.4	53.2	1.1		5.5	**24,700**	**2.76**
	-3.9	-9.8	1.1	-6.6	2.7	11,100	8,900	55.5	61.6	1.1	60	4.5	**20,000**	**2.25**
	-1.1	-7.2	1.1	-4.0	2.9	11,900	9,190	55.3	62.1	1.1		4.7	**21,000**	**2.29**
	1.7	-4.7	1.1	-1.4	3.0	12,600	9,460	55.1	62.4	1.1		4.9	**22,100**	**2.34**
	4.4	-2.1	1.1	1.2	3.2	13,400	9,730	54.8	62.9	1.1		5.2	**23,200**	**2.38**
	7.2	0.1	1.1	4.0	3.2	14,300	10,000	54.6	63.2	1.1		5.4	**24,300**	**2.43**
	10.0	2.3	1.1	6.6	3.4	15,200	10,250	54.3	64.2	1.1		5.7	**25,400**	**2.48**
	-3.9	-9.7	1.1	-6.5	2.6	10,900	10,410	66.4	73.8	1.1	71	4.8	**21,300**	**2.05**
	-1.1	-7.0	1.1	-3.9	2.8	11,700	10,710	66.1	74.3	1.1		5.0	**22,400**	**2.09**
	1.7	-4.3	1.1	-1.3	3.0	12,500	11,000	65.9	74.7	1.1		5.2	**23,500**	**2.14**
	4.4	-1.6	1.1	1.2	3.2	13,300	11,280	65.6	75.0	1.1		5.5	**24,600**	**2.18**
	7.2	0.4	1.1	4.1	3.2	14,200	11,590	65.4	75.3	1.1		5.8	**25,800**	**2.23**
	10.0	2.4	1.1	6.6	3.4	15,100	11,890	65.1	76.0	1.1		6.0	**27,000**	**2.27**

Electrical Specifications

TABLE 26 - WC-Series Electrical Specifications

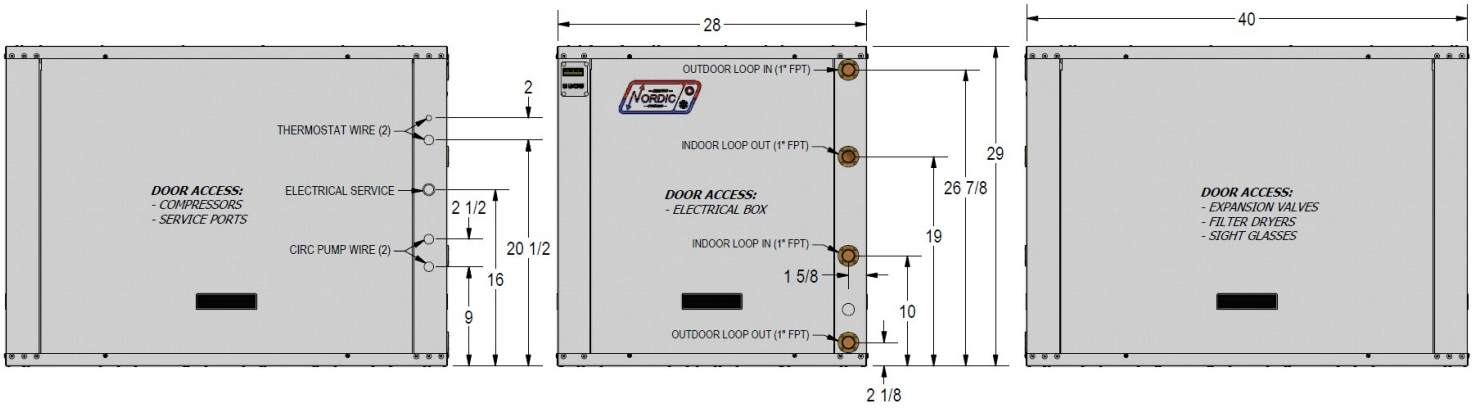
Model	Code	Power Supply			Compressor (R410a)		Compressor (R134a)		Circulators	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	RLA	LRA	Max A	Amps	Amps	Amps	ga
WC-16	**1**	208/230-1-60	187	253	**9.0**	**46**	**8.3**	**13**	**5.0**	**17.5**	**24.8**	**30**	**#10-2***
WC-25	**1**	208/230-1-60	187	253	**9.0**	**48**	**10.8**	**56**	**5.0**	**20.0**	**27.7**	**40**	**#8-2***
	6	220-1-50	187	253	**7.1**	**44**	**9.3**	**54**	**5.0**	**16.6**	**23.9**	**30**	**#10-2**
WC-45	**1**	208/230-1-60	187	253	**13.5**	**72**	**15.4**	**87**	**5.0**	**29.1**	**38.0**	**50**	**#8-2***
	2	208-3-60	187	229	**8.9**	**58**	**10.8**	**73**	**5.0**	**19.9**	**27.6**	**40**	**#8-3***
	4	460-3-60	414	506	**4.2**	**38**	**5.8**	**38**	**-**	**10.2**	**11.7**	**15**	**#14-3**
	5	575-3-60	518	632	**3.5**	**24**	**4.2**	**28**	**-**	**7.9**	**9.0**	**15**	**#14-3**
	6	220-1-50	187	253	**11.2**	**60**	**12.8**	**79**	**5.0**	**24.2**	**32.4**	**40**	**#8-2**
	7	380-3-50	342	418	**4.0**	**38**	**5.8**	**38**	**5.0**	**10.0**	**16.5**	**20**	**#12-3****
WC-55	**1**	208/230-1-60	187	253	**17.9**	**112**	**19.9**	**104**	**7.0**	**38.0**	**50.0**	**60**	**#6-2***
	2	208-3-60	187	229	**13.5**	**88**	**12.8**	**93**	**7.0**	**26.5**	**36.9**	**50**	**#8-3***
	4	460-3-60	414	506	**6.0**	**44**	**5.8**	**48**	**-**	**12.0**	**13.5**	**20**	**#12-3**
	5	575-3-60	518	632	**4.9**	**34**	**4.7**	**38**	**-**	**9.8**	**11.0**	**15**	**#14-3**
	6	220-1-50	187	253	**16.0**	**87**	**17.3**	**122**	**7.0**	**33.5**	**44.8**	**60**	**#6-2**
	7	380-3-50	342	418	**6.0**	**44**	**5.8**	**48**	**7.0**	**12.0**	**20.5**	**25**	**#10-3****
WC-65	**1**	208/230-1-60	187	253	**21.8**	**117**	**25.3**	**146**	**7.0**	**47.3**	**60.6**	**80**	**#6-2***
	2	208-3-60	187	229	**13.7**	**83**	**15.4**	**114**	**7.0**	**29.3**	**40.2**	**50**	**#8-3***
	4	460-3-60	414	506	**6.2**	**41**	**7.1**	**52**	**-**	**13.5**	**15.3**	**20**	**#12-3**
	5	575-3-60	518	632	**4.8**	**33**	**5.3**	**40**	**-**	**10.3**	**11.6**	**15**	**#14-3**
	6	220-1-50	187	253	**15.9**	**98**	**19.2**	**133**	**7.0**	**35.3**	**47.1**	**60**	**#6-2**
	7	380-3-50	342	418	**6.2**	**41**	**7.1**	**52**	**7.0**	**13.5**	**22.3**	**30**	**#10-3****
WC-75	**1**	208/230-1-60	187	253	**26.3**	**134**	**23.7**	**144**	**7.0**	**50.2**	**63.8**	**80**	**#6-2***
	2	208-3-60	187	229	**15.6**	**110**	**18.6**	**128**	**7.0**	**34.4**	**46.1**	**60**	**#6-3***
	4	460-3-60	414	506	**7.8**	**52**	**9.0**	**63**	**-**	**17.0**	**19.3**	**30**	**#10-3**
	5	575-3-60	518	632	**5.8**	**39**	**6.6**	**49**	**-**	**12.6**	**14.3**	**20**	**#12-3**
	7	380-3-50	342	418	**7.8**	**52**	**9.0**	**63**	**7.0**	**17.0**	**26.3**	**30**	**#10-3****
WC-80	**1**	208/230-1-60	187	253	**30.8**	**178**	**28.8**	**176**	**7.0**	**59.8**	**74.5**	**100**	**#4-2***
	2	208-3-60	187	229	**19.6**	**136**	**20.7**	**156**	**7.0**	**40.5**	**52.7**	**60**	**#6-3***
	4	460-3-60	414	506	**8.2**	**66**	**9.0**	**75**	**-**	**17.4**	**19.7**	**30**	**#10-3**
	5	575-3-60	518	632	**6.6**	**55**	**7.4**	**54**	**-**	**14.2**	**16.1**	**20**	**#12-3**
	7	380-3-50	342	418	**8.2**	**66**	**9.0**	**75**	**7.0**	**17.4**	**26.7**	**30**	**#10-3****

* If connecting 115V circulators, additional conductor required for NEUTRAL connection

** If connecting 220V circulators, additional conductor required for NEUTRAL connection

Dimensions

All dimensions in inches.

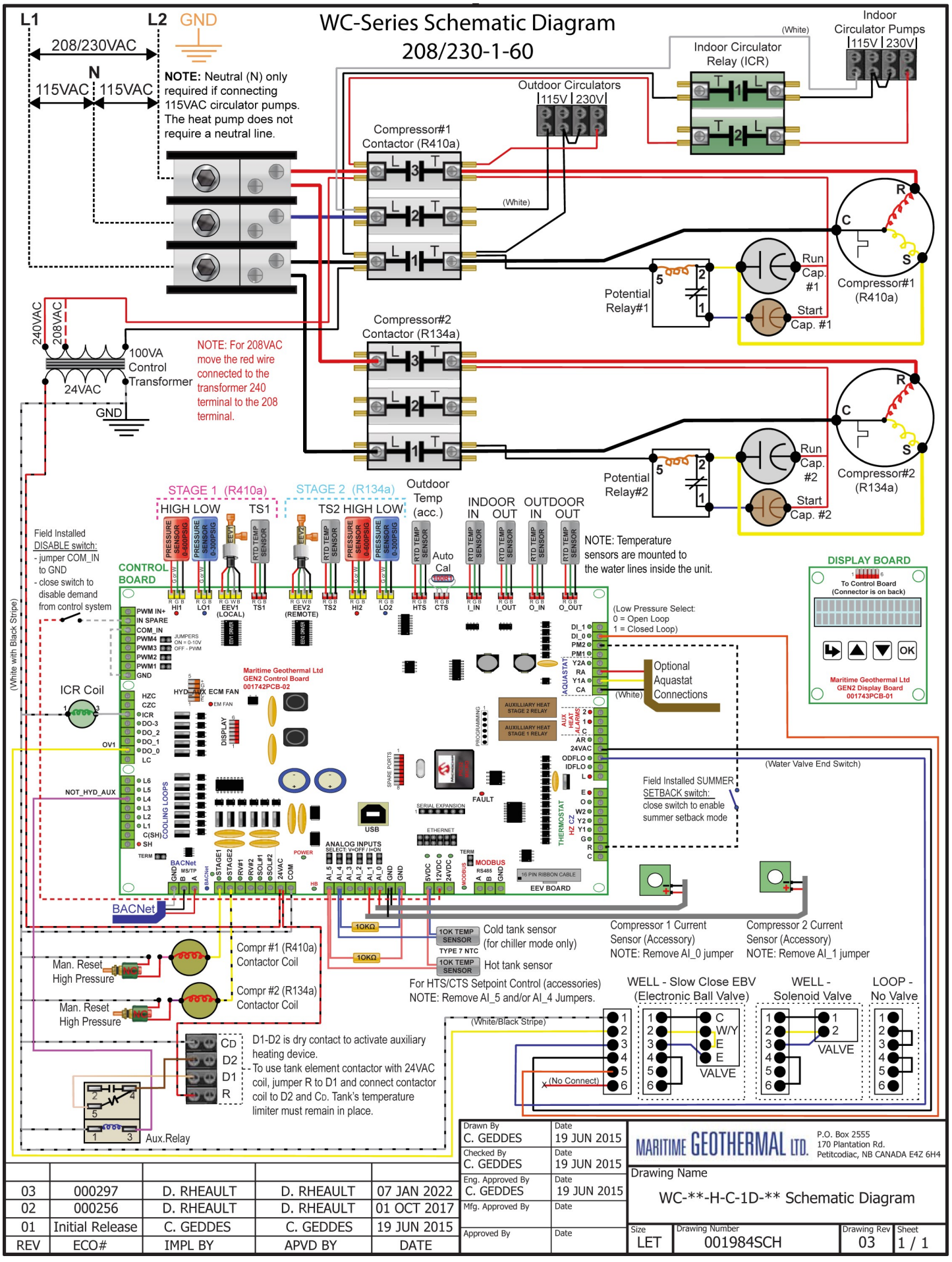


LEFT SIDE:
> 24” service access clearance required

FRONT:
> 24” service access clearance required

RIGHT SIDE:
> 24” service access clearance required

BACK:
no clearance required



REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	19 JUN 2015

Drawn By	C. GEDDES	Date	19 JUN 2015
Checked By	C. GEDDES	Date	19 JUN 2015
Eng. Approved By	C. GEDDES	Date	19 JUN 2015
Mfg. Approved By		Date	
Approved By		Date	

MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: WC-**-H-C-1D-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001984SCH	03	1 / 1

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

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)

If using an external aquastat ("Signals" control method), use an 18-3 cable for these right side board connections to control compressor demand:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor

A dry contact connection between R/RA and an external control connection (Y1A) will activate the external control signal input to the control board.

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 Gnd.Lug		

CIRCULATOR CONNECTIONS (230/115VAC)

REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 115VAC circulators to 115V
Connect 230VAC circulators to 230V

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

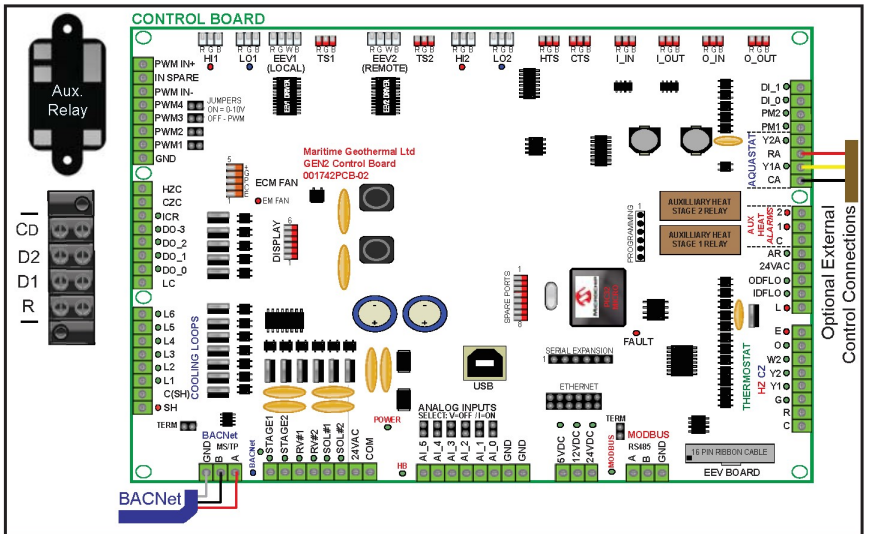
D2 / D1 — Dry contacts, closed during call for auxiliary heat

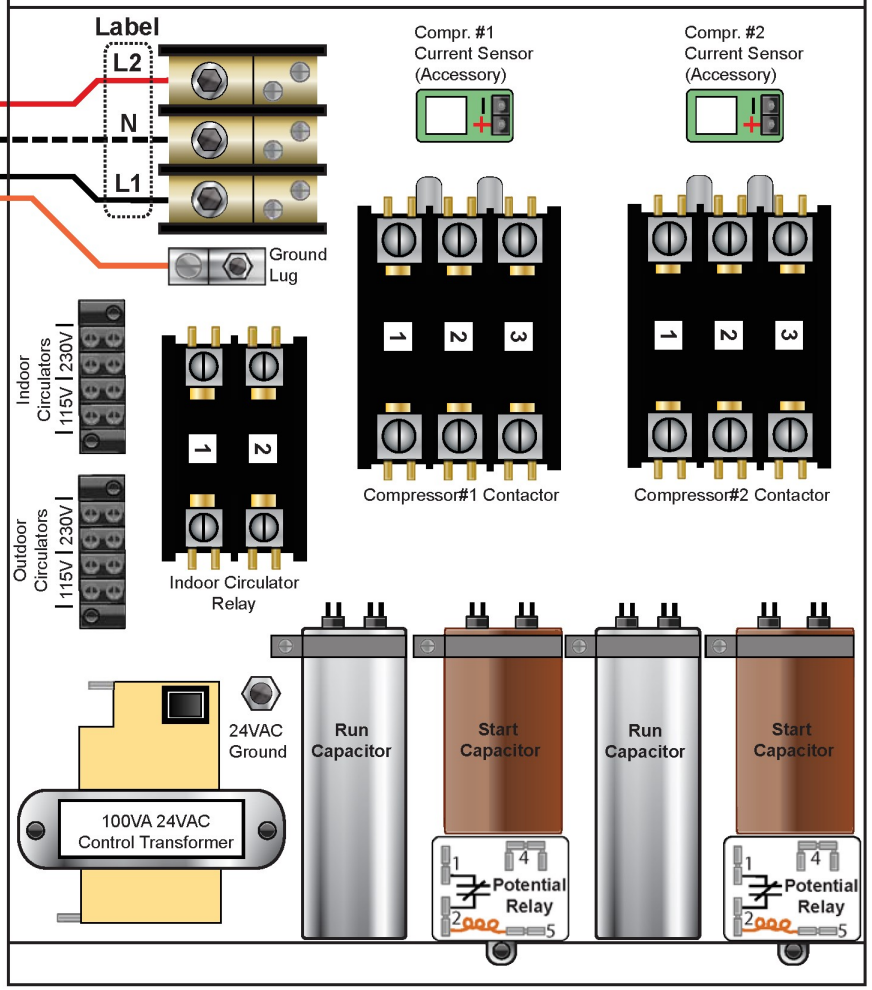
CD / D2 / D1 / R — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

NOTE: In case of a control system short or overload, rectify the problem and press the black button on the transforrmer to reset the built-in breaker.

NOTE: For 208VAC move the red wire connected to the 240 terminal of the transformer to the 208 terminal.

WC-Series Electrical Box Diagram 208/230-1-60





REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	19 JUN 2015

Drawn By: C. GEDDES	Date: 19 JUN 2015	
Checked By: C. GEDDES	Date: 19 JUN 2015	
Eng. Approved By: C. GEDDES	Date: 19 JUN 2015	
Mfg. Approved By	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
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Drawing Name: WC-**-H-C-1D-** Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
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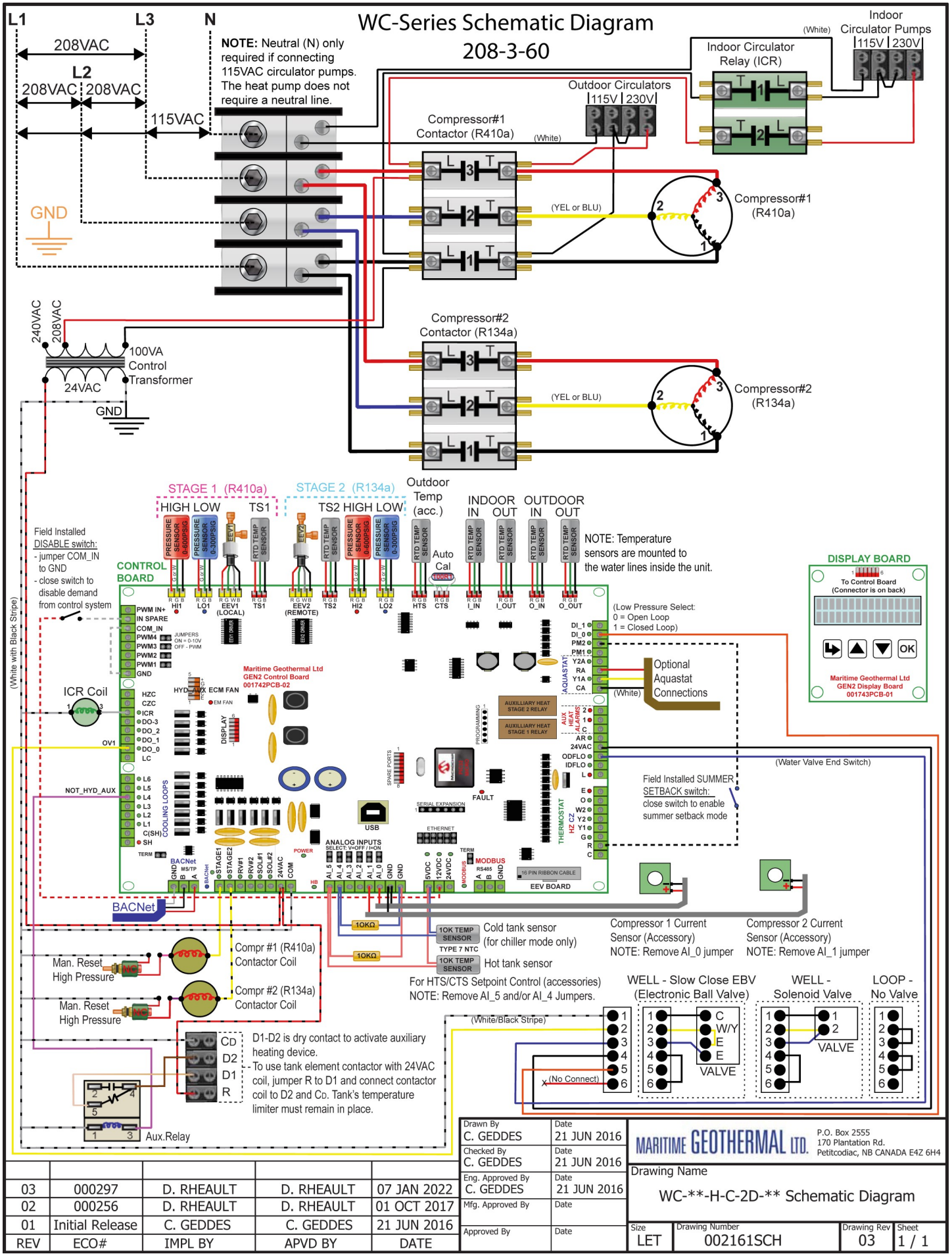

03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	21 JUN 2016
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By C. GEDDES	Date 21 JUN 2016
Checked By C. GEDDES	Date 21 JUN 2016
Eng. Approved By C. GEDDES	Date 21 JUN 2016
Mfg. Approved By	Date
Approved By	Date

MARITIME GEOTHERMAL LTD.
P.O. Box 2555
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Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: WC-**-H-C-2D-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002161SCH	03	1 / 1

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

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)

If using an external aquastat ("Signals" control method), use an 18-3 cable for these right side board connections to control compressor demand:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor

A dry contact connection between R/RA and an external control connection (Y1A) will activate the external control signal input to the control board.

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 Gnd.Lug		

CIRCULATOR CONNECTIONS (230/115VAC)

REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 115VAC circulators to 115V
Connect 230VAC circulators to 230V

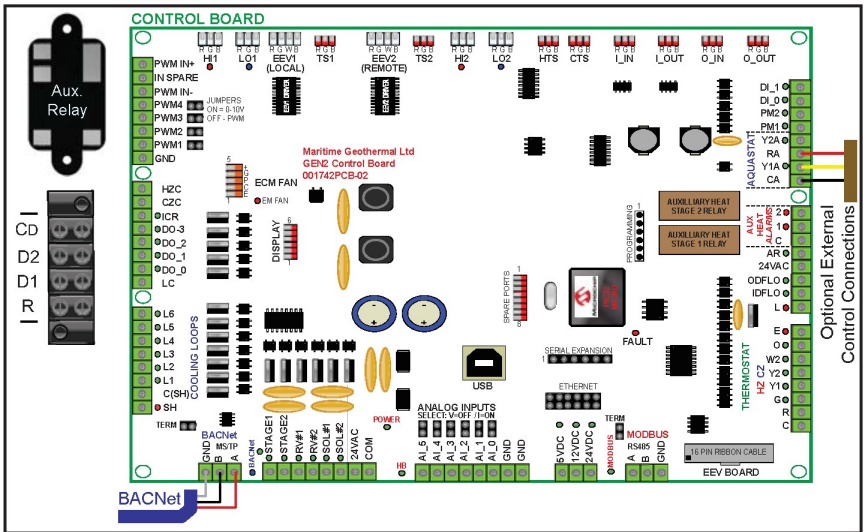
AUXILIARY HEAT CONTROL CONNECTIONS

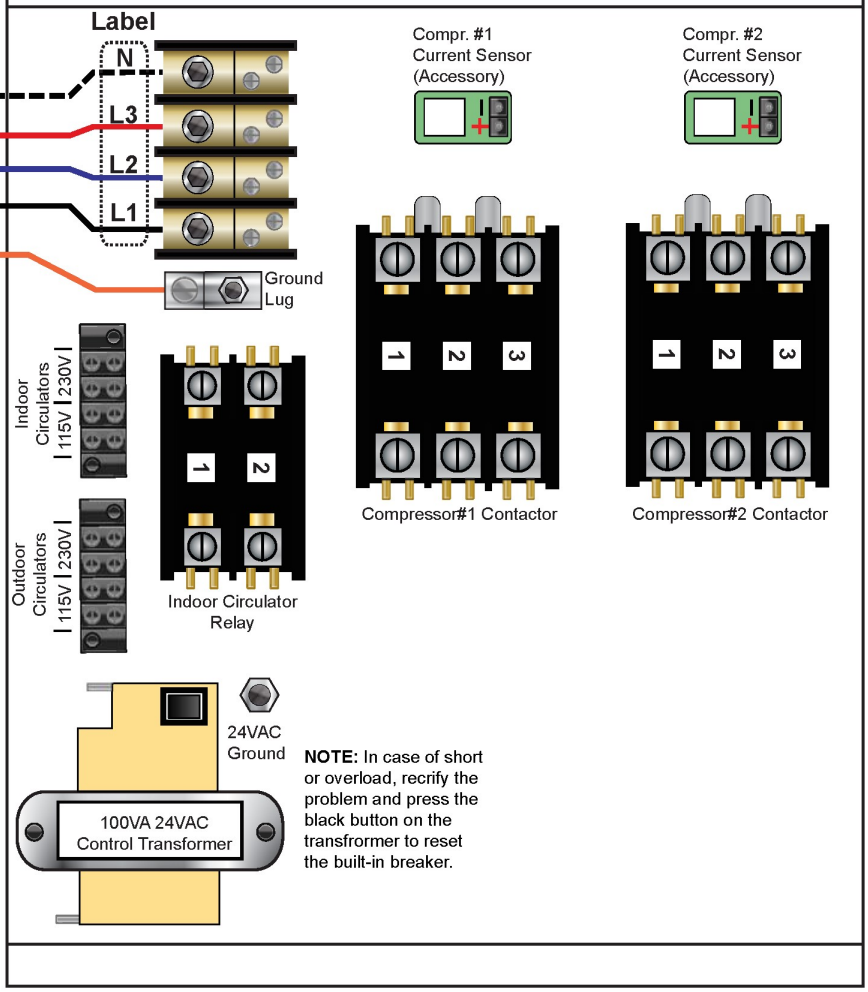
Use an 18-2 cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

D2 / D1 — Dry contacts, closed during call for auxiliary heat

CD / D2 / D1 / R — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

WC-Series Electrical Box Diagram
208-3-60





NOTE: In case of short or overload, recrify the problem and press the black button on the transfrormer to reset the built-in breaker.

REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	29 JUN 2016

Drawn By	C. GEDDES	Date	29 JUN 2016
Checked By	C. GEDDES	Date	29 JUN 2016
Eng. Approved By	C. GEDDES	Date	29 JUN 2016
Mfg. Approved By		Date	
Approved By		Date	

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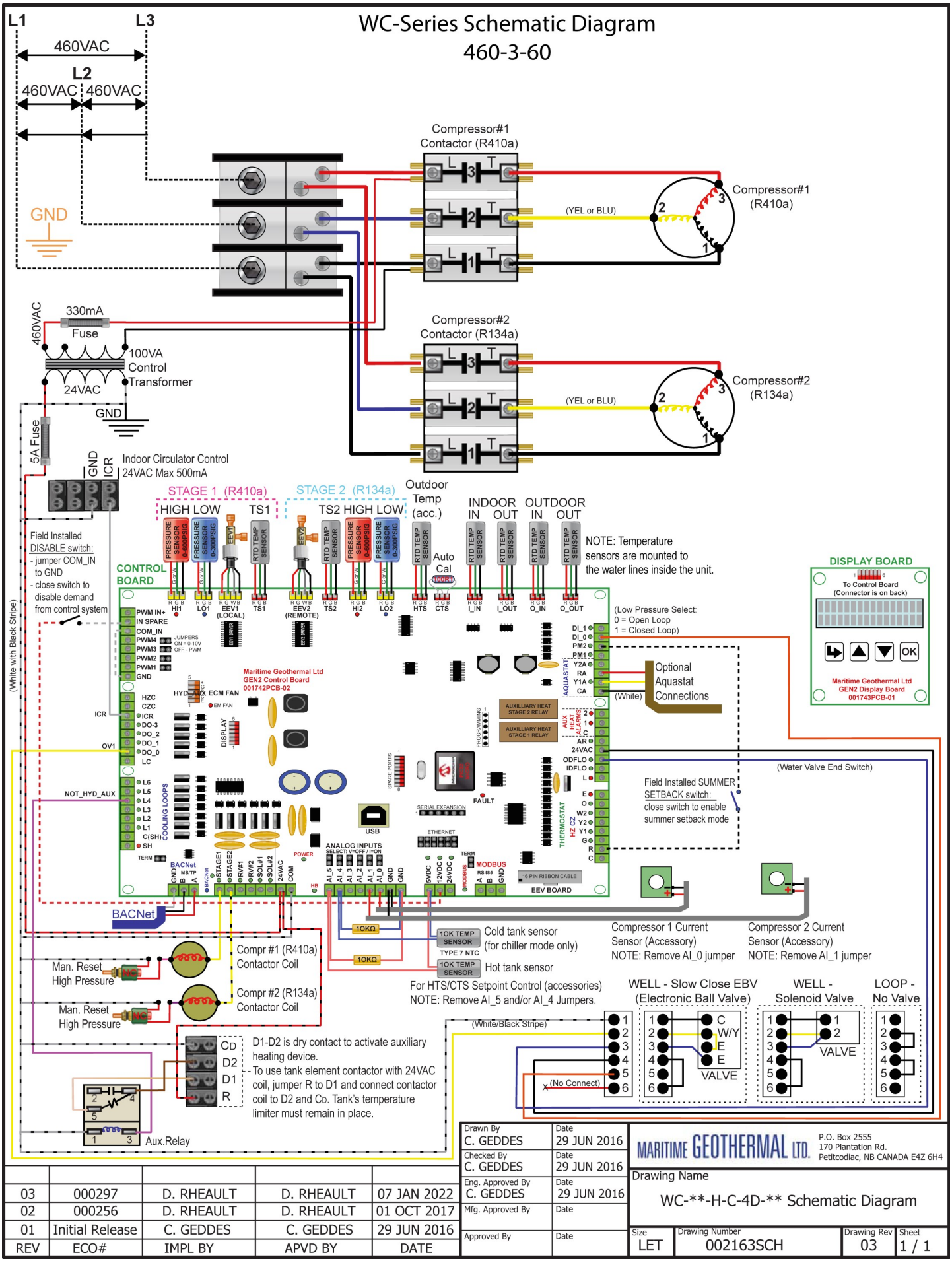
Drawing Name: WC-**-H-C-2D-** Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002162ELB	03	1 / 1



REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
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Drawing Name: WC-**-H-C-4D-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002163SCH	03	1 / 1

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

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)

If using an external aquastat ("Signals" control method), use an 18-3 cable for these right side board connections to control compressor demand:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor

A dry contact connection between R/RA and an external control connection (Y1A) will activate the external control signal input to the control board.

POWER SUPPLY CONNECTIONS

L3
L2
L1
GND

460VAC CONNECTIONS		
Wire	Colour	Contactor (Label)
Line 3	Red	L3
Line 2	Blue	L2
Line 1	Black	L1
Connect "GND" to Ground Lug		

INDOOR CIRCULATOR CONTROL (24VAC)

Use an 18-2 conductor cable. Connect the output signals as per the descriptions below:
GND - 24VAC Common
ICR - 24VAC Indoor Circulator Control (Hot)
ICR is used for sampling when system is operating under the Setpoint Control method. May be used to power a contactor or relay. **Max load 500mA**.

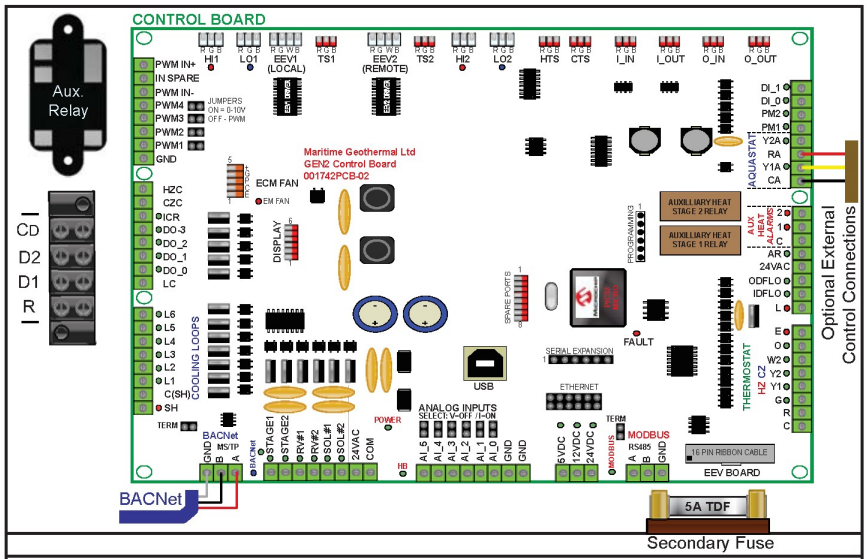
AUXILIARY HEAT CONTROL CONNECTIONS

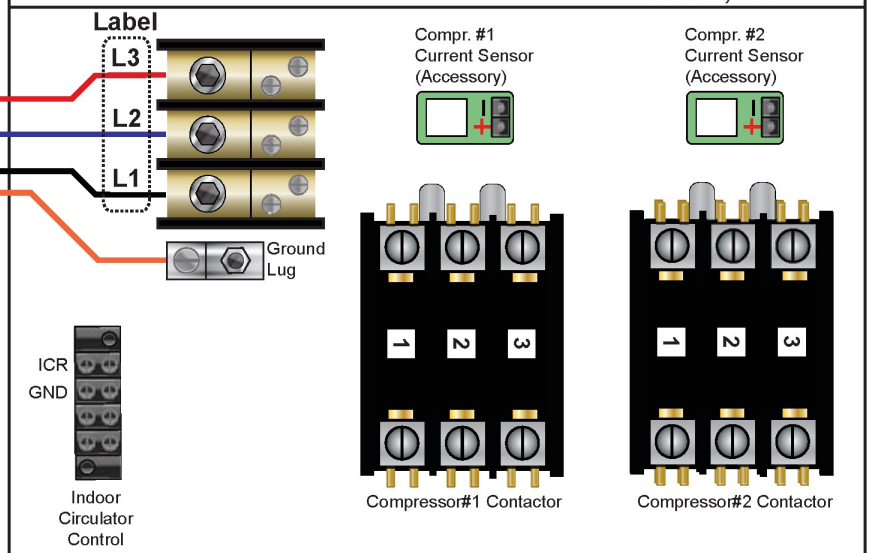
Use an 18-2 cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

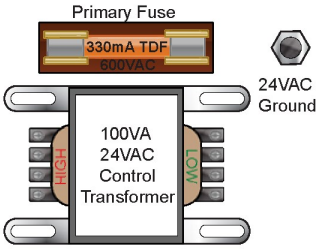
D2, D1 — Dry contacts, closed during call for auxiliary heat

CD, D2, D1, R — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

WC-Series Electrical Box Diagram 460-3-60







REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	29 JUN 2016

Drawn By: C. GEDDES	Date: 29 JUN 2016	
Checked By: C. GEDDES	Date: 29 JUN 2016	
Eng. Approved By: C. GEDDES	Date: 29 JUN 2016	
Mfg. Approved By	Date	
Approved By	Date	

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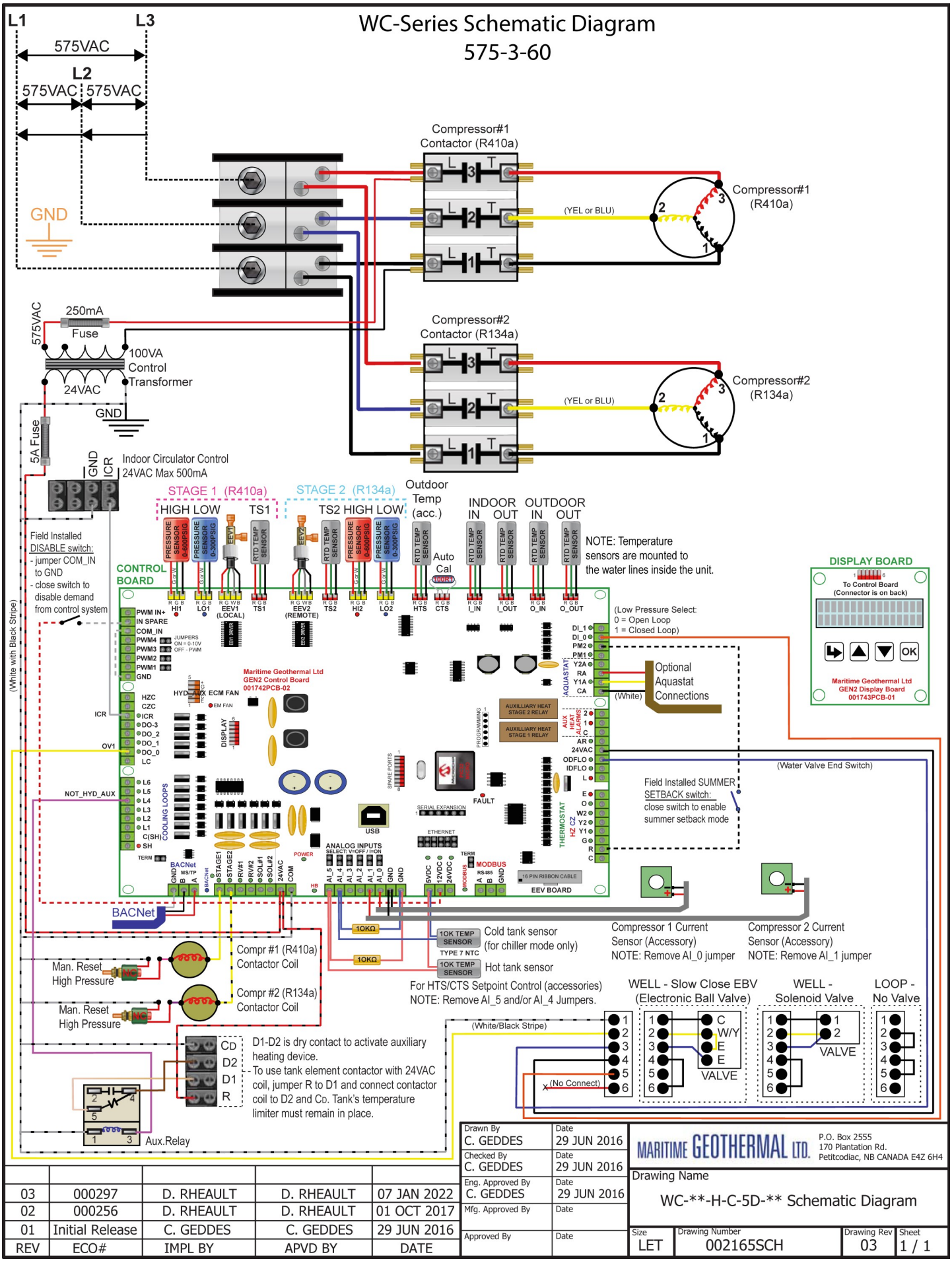
Drawing Name: WC-**-H-C-4D-** Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002164ELB	03	1 / 1



REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	29 JUN 2016

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Mfg. Approved By		Date	
Approved By		Date	

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Drawing Name: WC-**-H-C-5D-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002165SCH	03	1 / 1

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

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)

If using an external aquastat ("Signals" control method), use an 18-3 cable for these right side board connections to control compressor demand:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor

A dry contact connection between R/RA and an external control connection (Y1A) will activate the external control signal input to the control board.

POWER SUPPLY CONNECTIONS

575VAC CONNECTIONS		
Wire	Colour	Contactor (Label)
Line 3	Red	L3
Line 2	Blue	L2
Line 1	Black	L1
Connect "GND" to Ground Lug		

INDOOR CIRCULATOR CONTROL (24VAC)

Use an 18-2 conductor cable. Connect the output signals as per the descriptions below:
GND - 24VAC Common
ICR - 24VAC Indoor Circulator Control (Hot)
ICR is used for sampling when system is operating under the Setpoint Control method. May be used to power a contactor or relay. **Max load 500mA**.

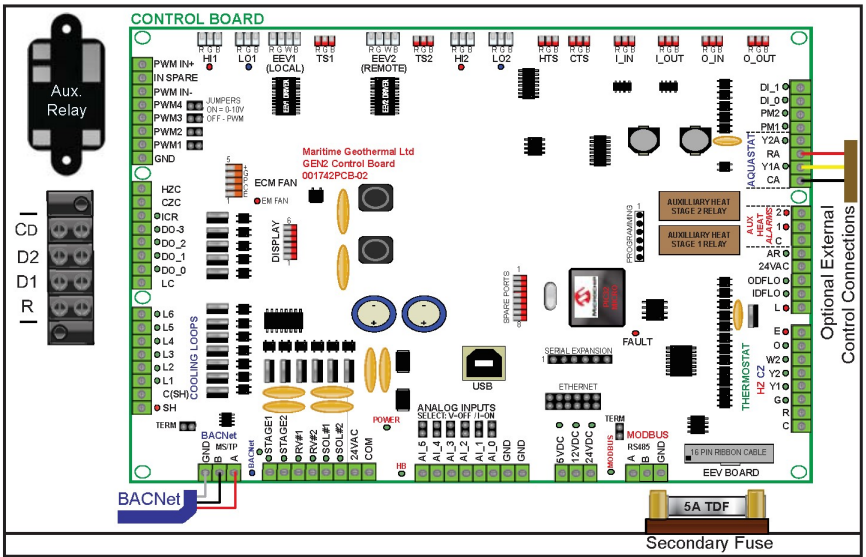
AUXILIARY HEAT CONTROL CONNECTIONS

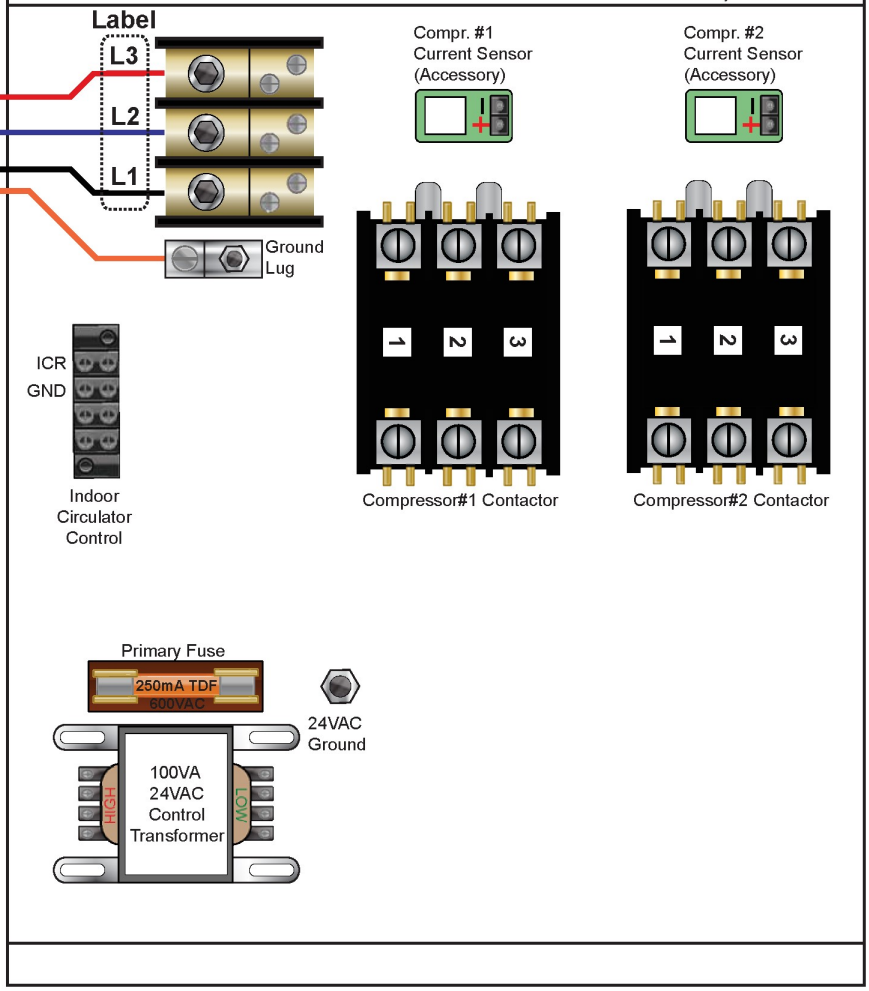
Use an 18-2 cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

D2 / D1 — Dry contacts, closed during call for auxiliary heat

CD / D2 / D1 / R — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

WC-Series Electrical Box Diagram
575-3-60





REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	29 JUN 2016

Drawn By: C. GEDDES	Date: 29 JUN 2016	
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Eng. Approved By: C. GEDDES	Date: 29 JUN 2016	
Mfg. Approved By	Date	
Approved By	Date	

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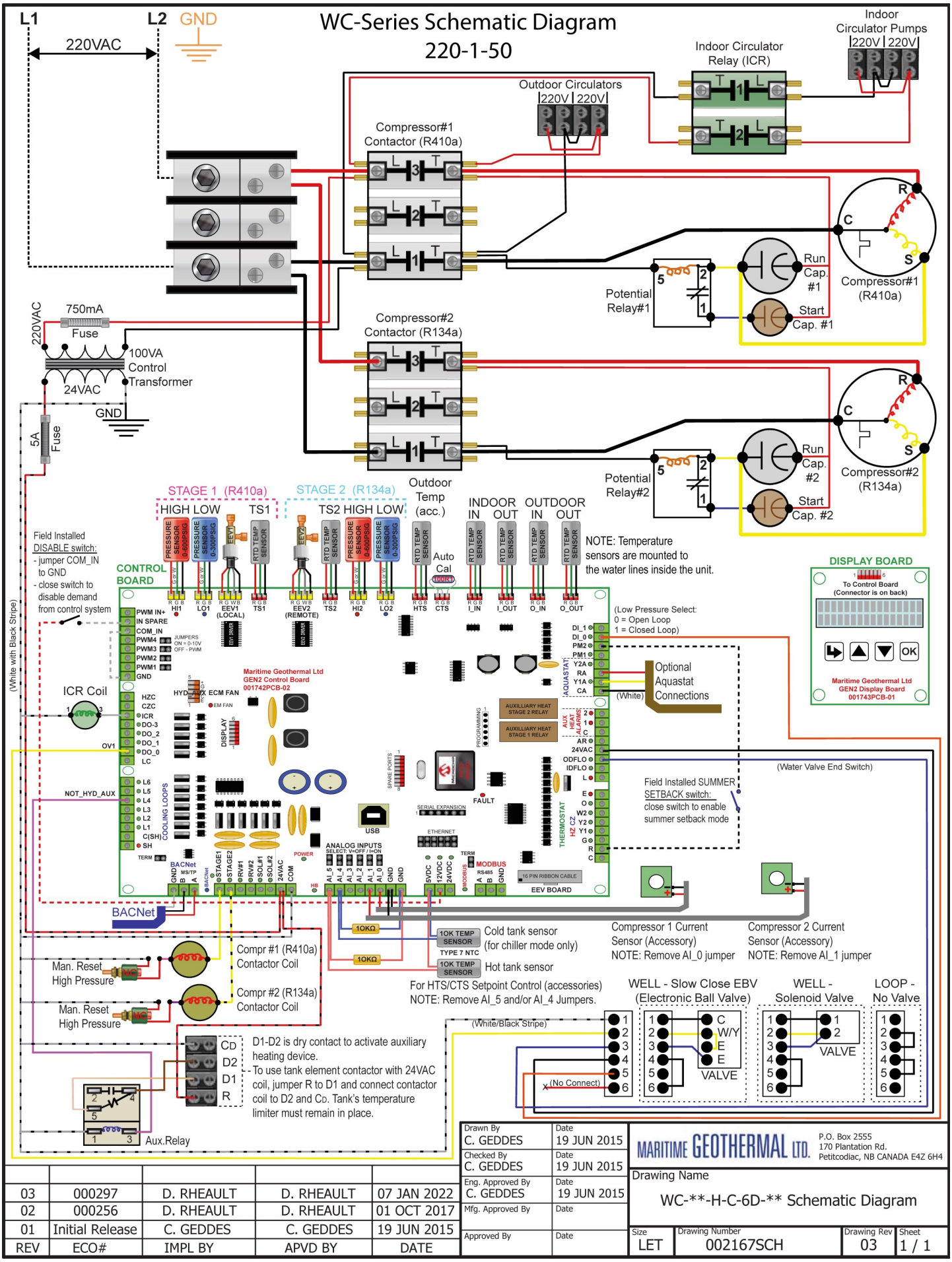
Drawing Name: WC-**-H-C-5D-** Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002166ELB	03	1 / 1



REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	19 JUN 2015

Drawn By	C. GEDDES	Date	19 JUN 2015
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Eng. Approved By	C. GEDDES	Date	19 JUN 2015
Mfg. Approved By		Date	
Approved By		Date	

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Drawing Name: WC-**-H-C-6D-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002167SCH	03	1 / 1

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

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)

If using an external aquastat ("Signals" control method), use an 18-3 cable for these right side board connections to control compressor demand:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor

A dry contact connection between R/RA and an external control connection (Y1A) will activate the external control signal input to the control board.

POWER SUPPLY CONNECTIONS

L2
L1
GND

220VAC CONNECTIONS		
Wire	Colour	Contactor (Label)
Line 2	Red	L2
Line 1	Black	L1
Connect "GND" to Ground Lug		

CIRCULATOR CONNECTIONS (220VAC)

REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 220VAC circulators to 220V

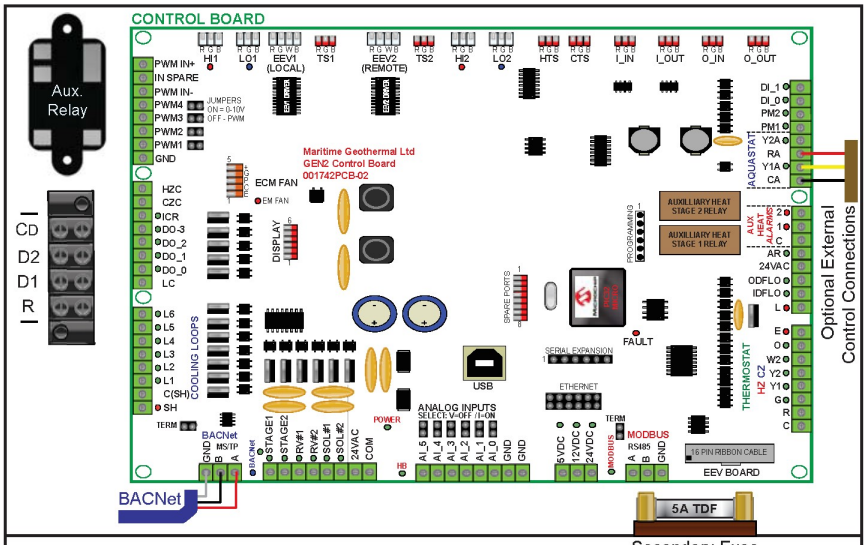
AUXILIARY HEAT CONTROL CONNECTIONS

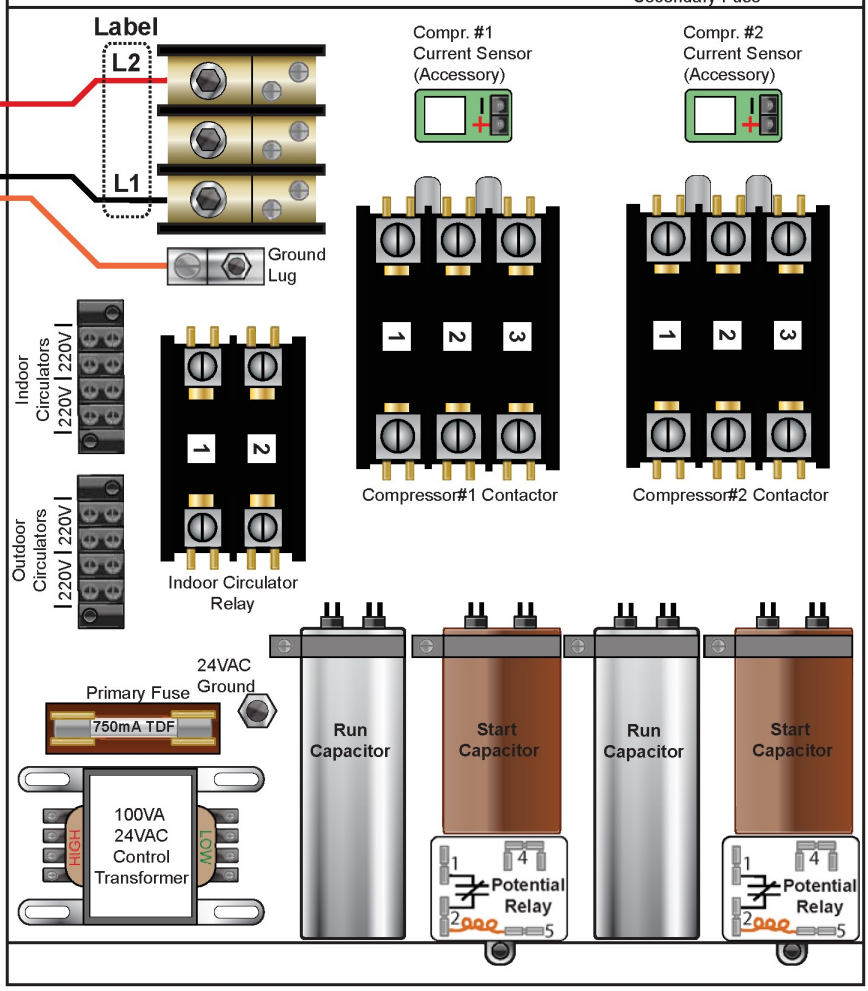
Use an 18-2 cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

D2 / D1 — Dry contacts, closed during call for auxiliary heat

CD / D2 / D1 / R — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

WC-Series Electrical Box Diagram 220-1-50





REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	19 JUN 2015

Drawn By: C. GEDDES	Date: 19 JUN 2015	
Checked By: C. GEDDES	Date: 19 JUN 2015	
Eng. Approved By: C. GEDDES	Date: 19 JUN 2015	
Mfg. Approved By	Date	
Approved By	Date	

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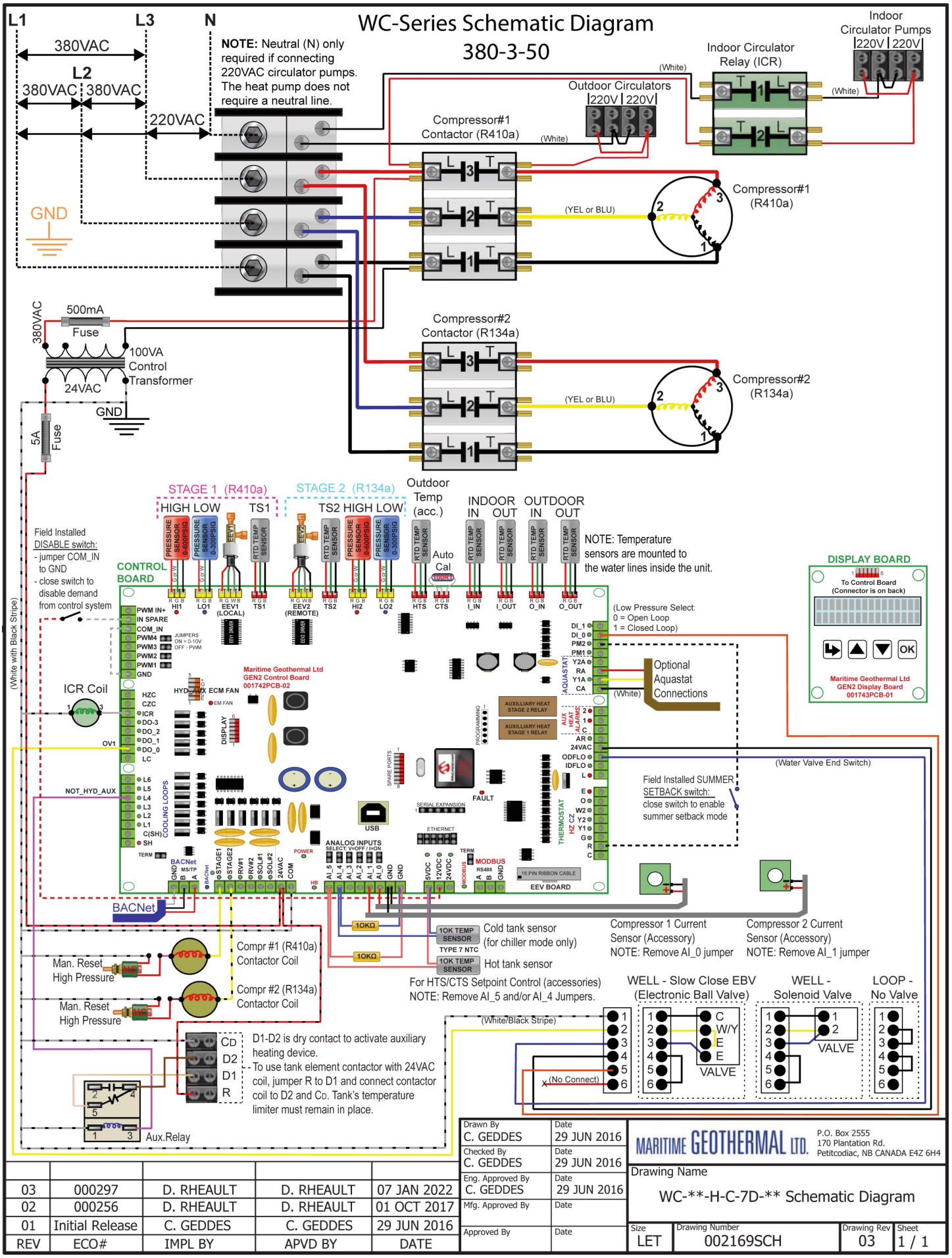
Drawing Name: WC-**-H-C-6D-** Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002168ELB	03	1 / 1



REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	29 JUN 2016

Drawn By	C. GEDDES	Date	29 JUN 2016
Checked By	C. GEDDES	Date	29 JUN 2016
Eng. Approved By	C. GEDDES	Date	29 JUN 2016
Mfg. Approved By		Date	
Approved By		Date	

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Drawing Name: WC-**-H-C-7D-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002169SCH	03	1 / 1

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

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)

If using an external aquastat ("Signals" control method), use an 18-3 cable for these right side board connections to control compressor demand:
RA - 24VAC Hot
CA - Common (for use with RA to power aquastat)
Y1A - Compressor

A dry contact connection between R/RA and an external control connection (Y1A) will activate the external control signal input to the control board.

POWER SUPPLY CONNECTIONS

*NOTE: Neutral (N) is only required if connecting 220VAC circulators. 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		

CIRCULATOR CONNECTIONS (220VAC)

REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 220VAC circulators to 220V

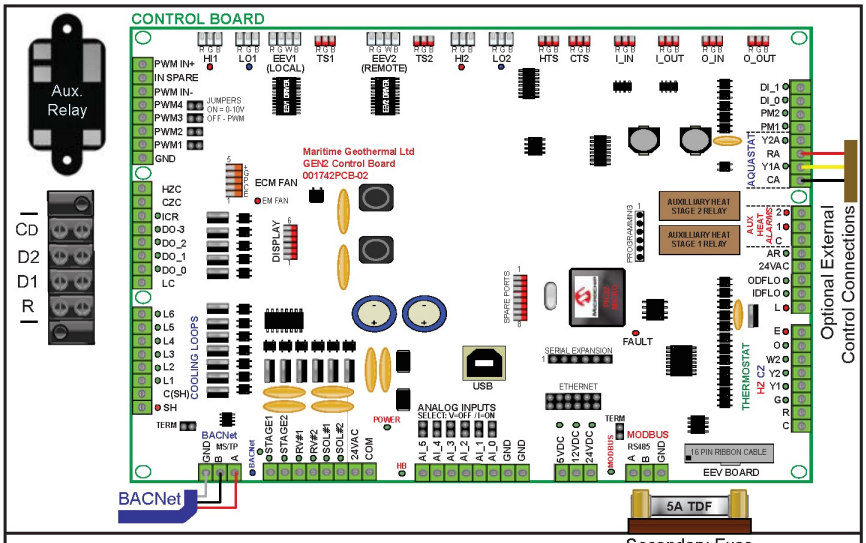
AUXILIARY HEAT CONTROL CONNECTIONS

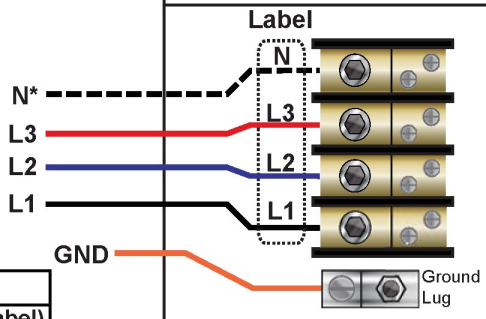
Use an 18-2 cable.
Choose one of two types of auxiliary heat connections.
In either case, default is "ON".
Tank's temperature limiter must remain in place.

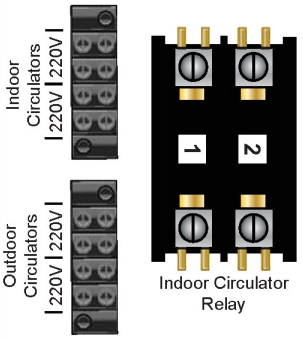
D2 / D1 — Dry contacts, closed during call for auxiliary heat

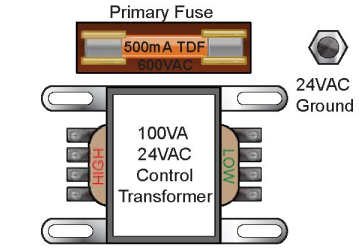
CD / D2 / D1 / R — To use tank element contactor that has a 24VAC coil, jumper R to D1 and connect contactor coil between D2 and CD.

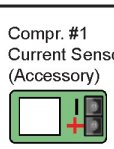
WC-Series Electrical Box Diagram 380-3-50

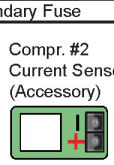


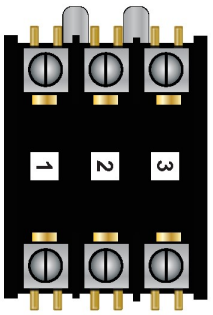


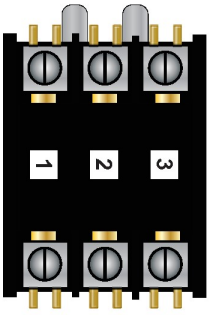












REV	ECO#	IMPL BY	APVD BY	DATE
03	000297	D. RHEAULT	D. RHEAULT	07 JAN 2022
02	000256	D. RHEAULT	D. RHEAULT	01 OCT 2017
01	Initial Release	C. GEDDES	C. GEDDES	29 JUN 2016

Drawn By: C. GEDDES	Date: 29 JUN 2016	
Checked By: C. GEDDES	Date: 29 JUN 2016	
Eng. Approved By: C. GEDDES	Date: 29 JUN 2016	
Mfg. Approved By	Date	
Approved By	Date	

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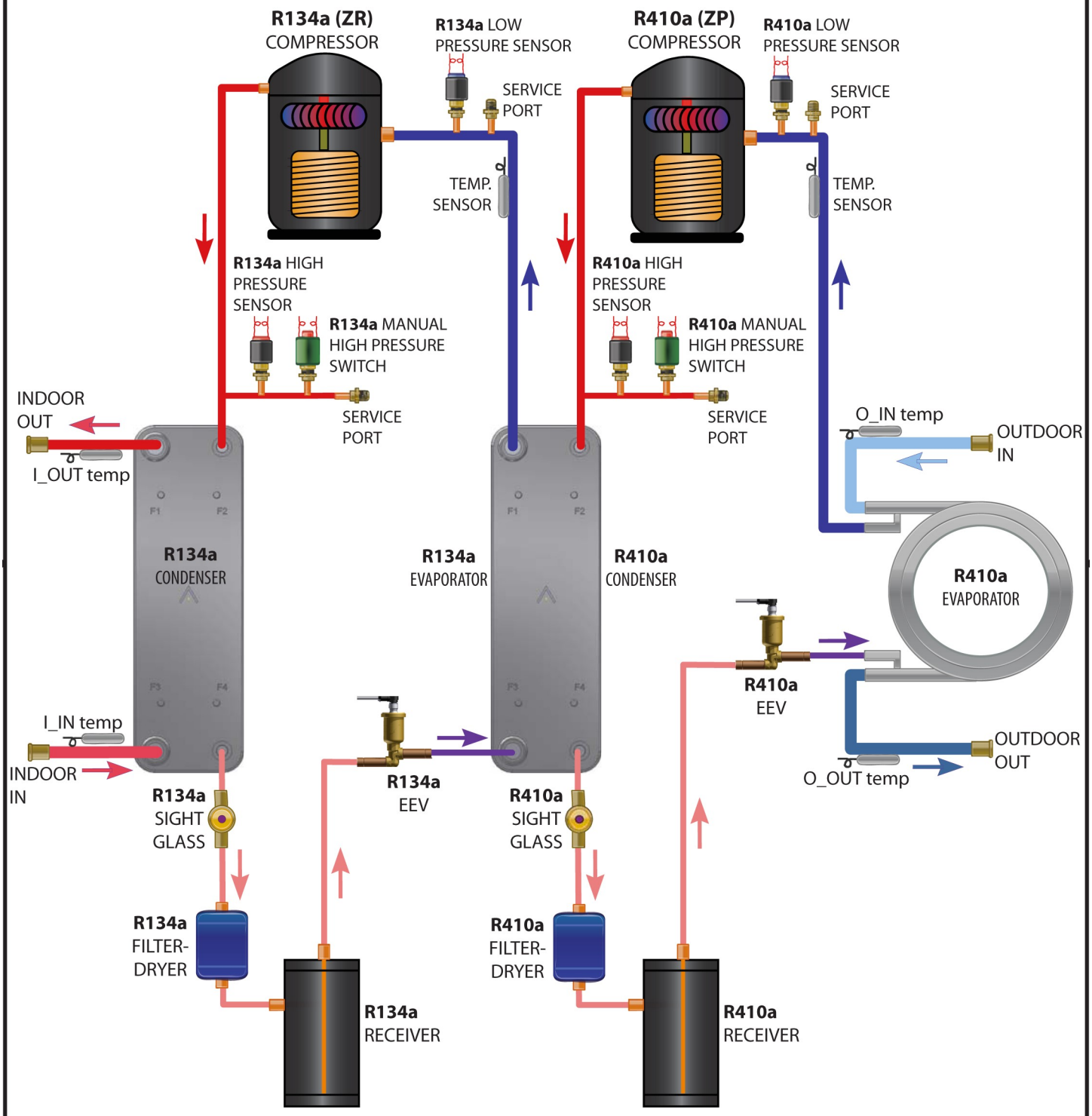
Drawing Name: WC-**-H-C-7D-** Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002170ELB	03	1 / 1

WC-Series Refrigeration Circuit



01	Initial Release	D. RHEAULT	D. RHEAULT	22-JUN-2015
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By: DAN RHEAULT	Date: 22-JUN-2015
Checked By: DAN RHEAULT	Date: 22-JUN-2015
Eng. Approved By	Date
Mfg. Approved By	Date
Approved By	Date

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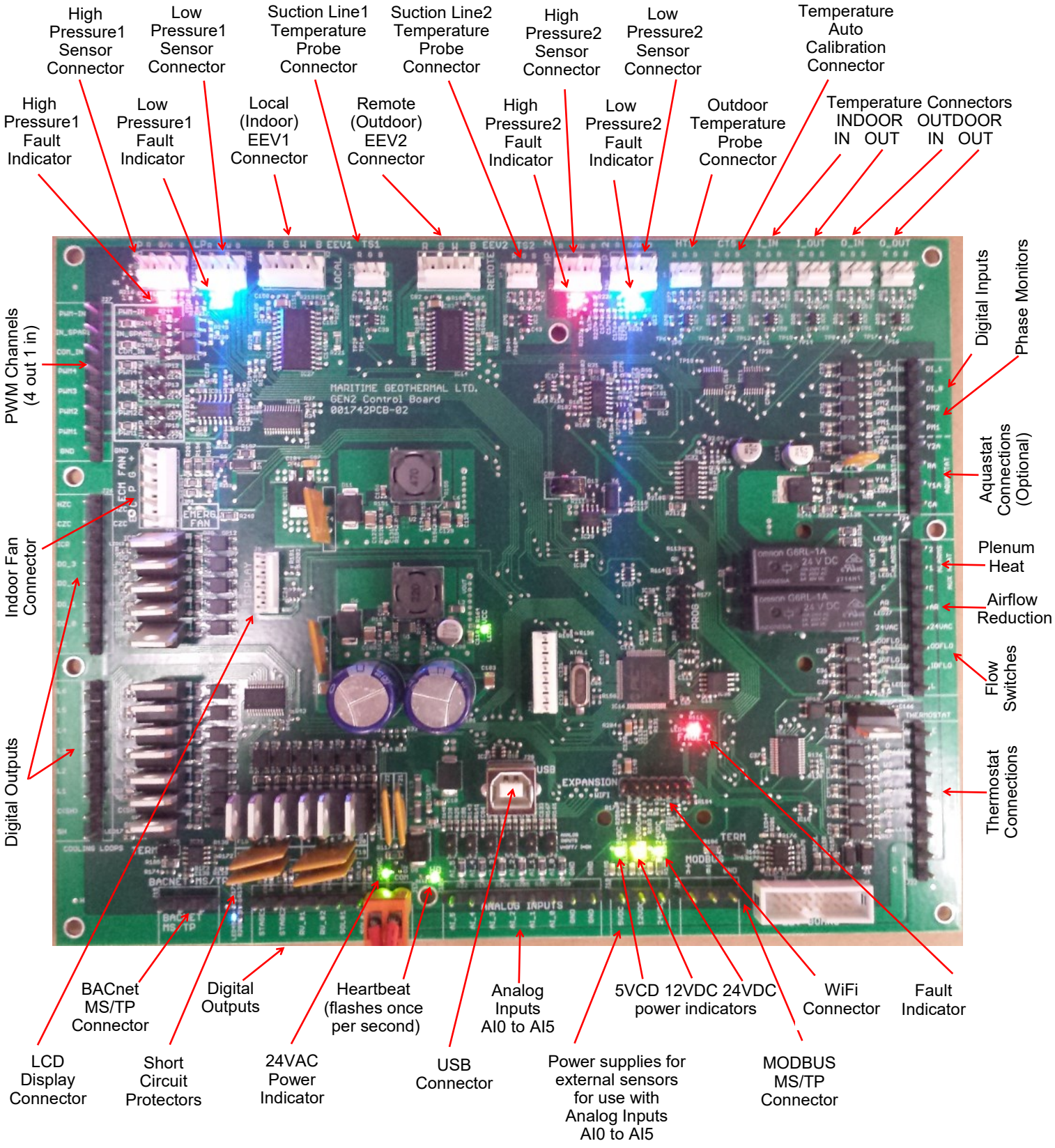
Drawing Name: WC-Series Refrigeration Circuit

Size	Drawing Number	Drawing Revision	Sheet
LET	001996RCD	01	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	R410a discharge pressure.
LPS1/LO1	Low Pressure Sensor 1	R410a suction pressure.
EEV1	Local EEV	R410a expansion valve control.
TS1	Suction Line Temperature 1	R410a suction line inside unit.
EEV2	Remote EEV	R134a expansion valve control.
TS2	Suction Line Temperature 2	R134a suction line inside unit.
HPS2/HI2	High Pressure Sensor 2	R134a discharge pressure.
LPS2/LO2	Low Pressure Sensor 2	R134a suction pressure.
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	Unused.
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 R410a compressor.
STAGE2	Compressor Stage 2	Starts / stops the R134a compressor.
RV#1	Reversing Valve#1	Unused.
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	Unused.
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	Optional compressor 1 current sensor.
AI_0	Analog In Channel 0	Optional compressor 2 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	Unused.
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	Unused.
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.

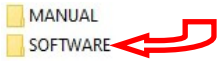
*NOTE: There is no need for an external aquastat for most systems, since the Setpoint Control Method provides built in aquastat functionality.

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:

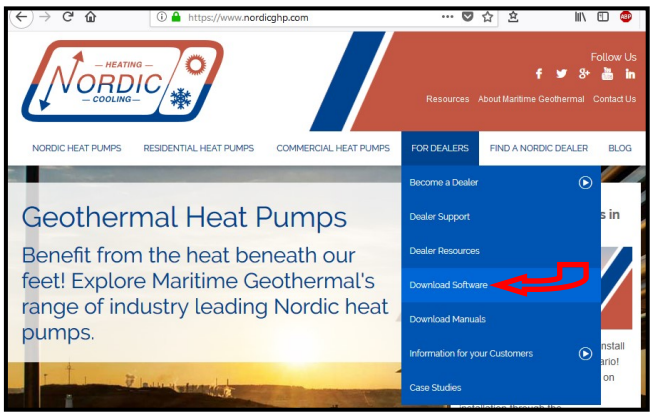


Double click on the SOFTWARE folder to show its contents:

To install the USB driver, double click on **Step 1** and follow the prompts, clicking "allow" or "yes" as required.

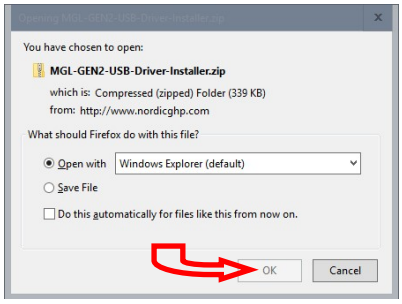
If the USB drive is not available, the same files can be **down-loaded from the web page**.

1. Go to www.nordicghp.com, Download Software page:

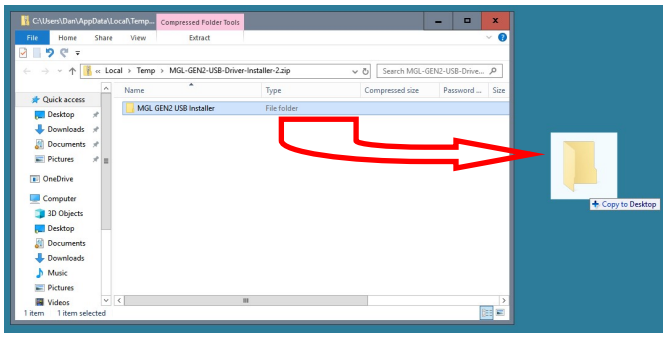


2. Click on **MGL GEN2 USB Driver Installer** to download it:

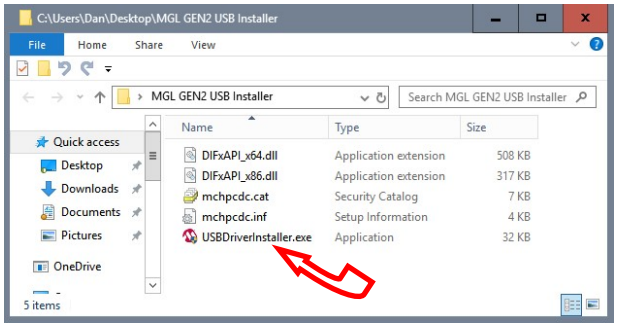
3. Choose "Open with Windows Explorer", and hit "OK". *(If the choice window doesn't pop up, find the downloaded file in your browser downloads and double click on it.)*



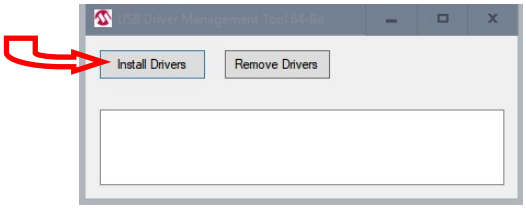
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



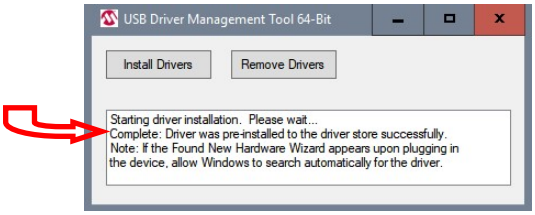
5. Double click on the folder you just dragged onto the desktop, then double click on the "USBDriverInstaller" file:



6. In the next window, click on "Install Drivers":



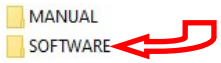
7. You will see a message indicating the driver was installed successfully. You are now ready to install the PC App.



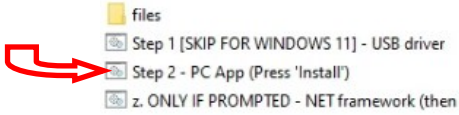
Appendix C - PC App Installation (Windows 11)

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:



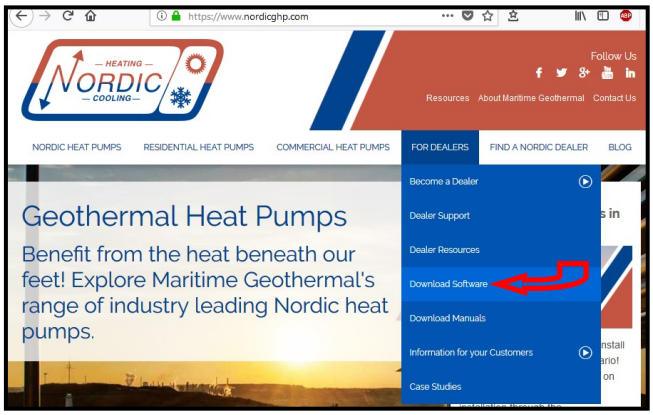
Double click on the SOFTWARE folder to show its contents:



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**.

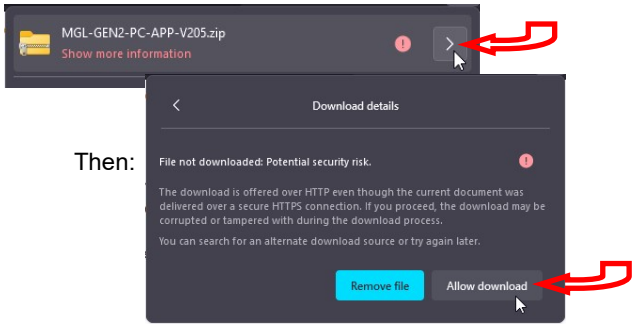
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

1. Go to www.nordicghp.com, Download Software page:

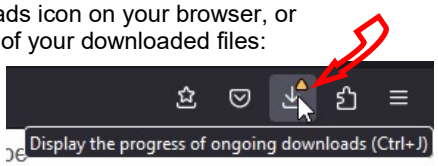


2. Click on **MGL GEN2 PC APP V2__** to download it:

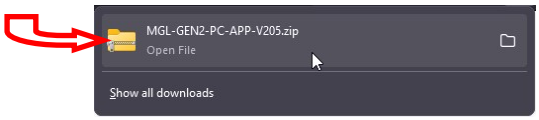
3. You may see a warning like this one. Click as shown:



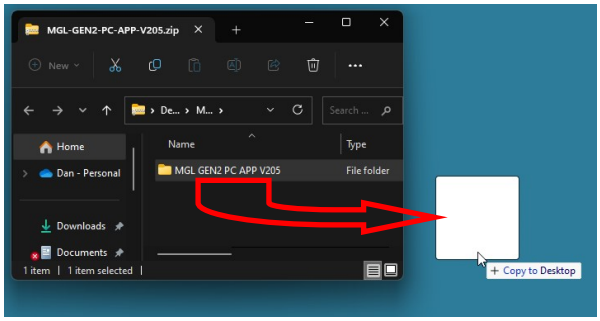
4. Click on the downloads icon on your browser, or otherwise view a list of your downloaded files:



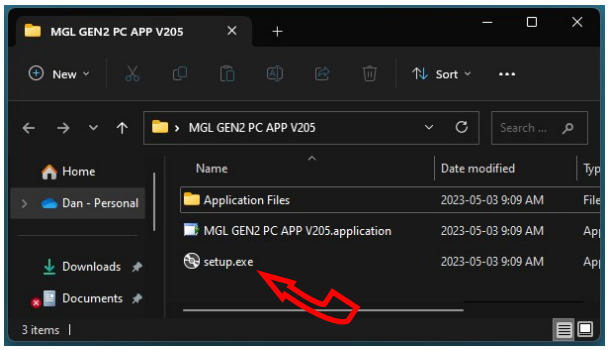
5. Then click on the .zip file to open it in a File Explorer window:



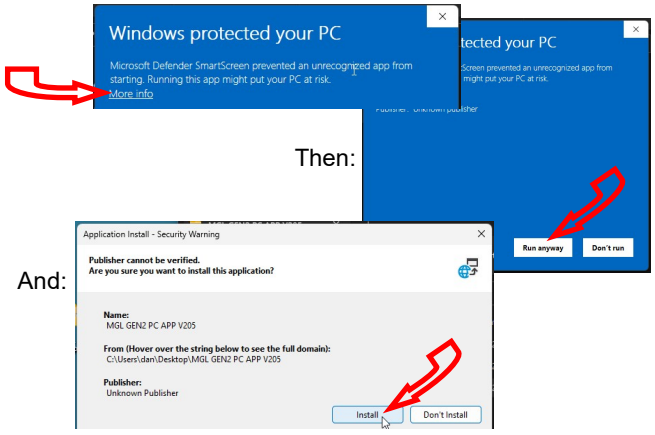
6. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



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.

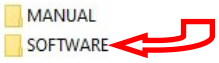


9. The PC App will open when it is finished installing. (In the future, it should be started from the start menu.) You are now ready to connect a USB cord between the laptop computer and GEN2 control board, and connect.

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:

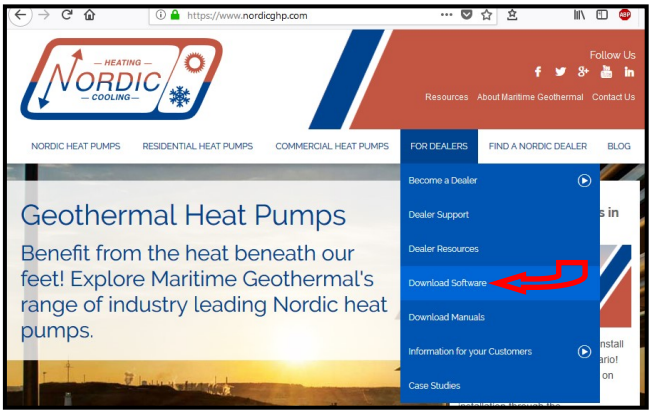


Double click on the SOFTWARE folder to show its contents:

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.

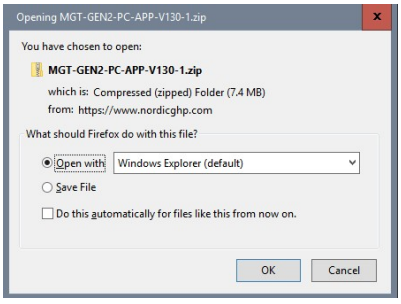
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

1. Go to www.nordicghp.com, Download Software page:

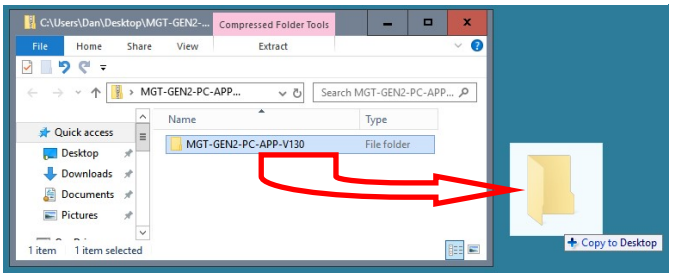


2. Click on **MGL GEN2 PC APP V2__** to download it:

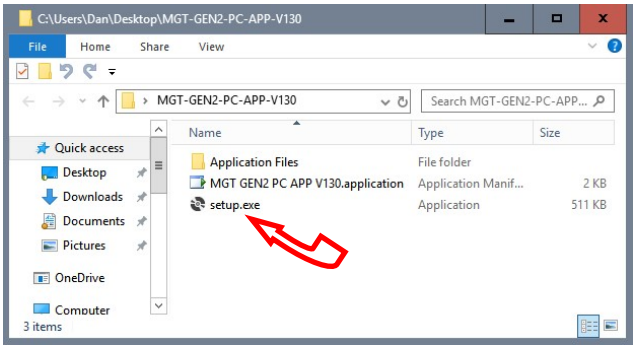
3. Choose "Open with Windows Explorer", and hit "OK":



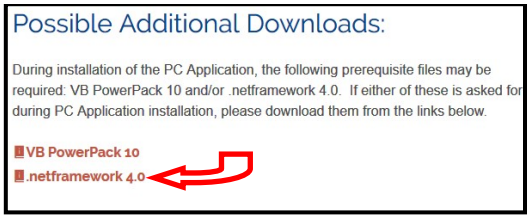
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



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:

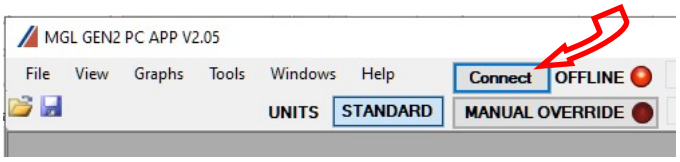
MGL_GEN2_V376.production.hex	(firmware file)
PIC32UBL.exe	(the programmer)
USB Bootloader Instructions.pdf	(these instructions)

   Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

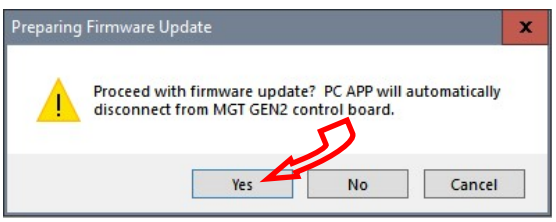
3. Connect a USB (printer) cable between computer and control board.

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.

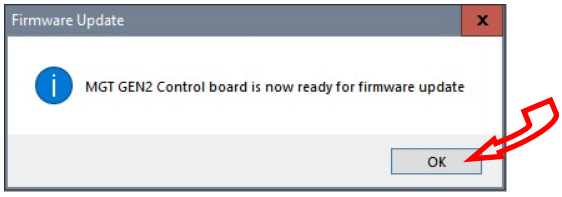


6. Go to menu **Tools --> Update Firmware**. The following message box will appear:



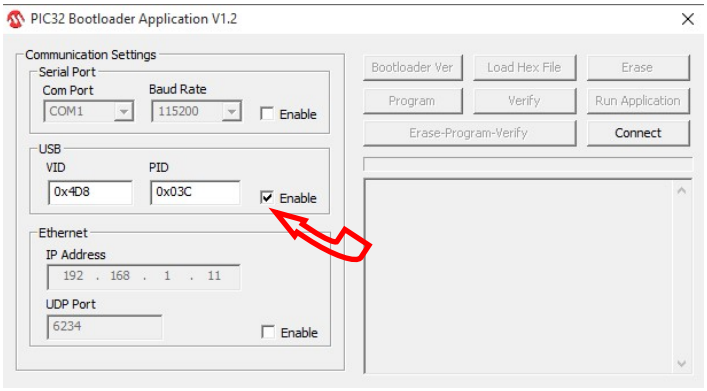
7. Click on **YES**. The following message box will appear:

8. Click on **OK**. After a minute, the following message box will appear:

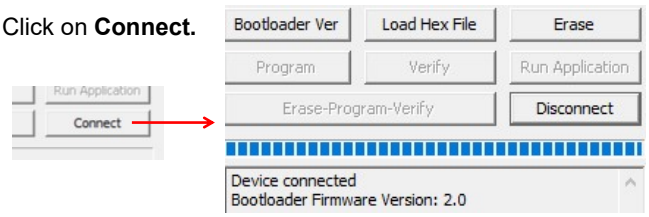


9. Click on **OK**. The control board is now in bootloader mode and is ready to be programmed.

10. Double click on the downloaded file PIC32UBL.exe to run it. In the window that opens, click on the USB **Enable** check box.

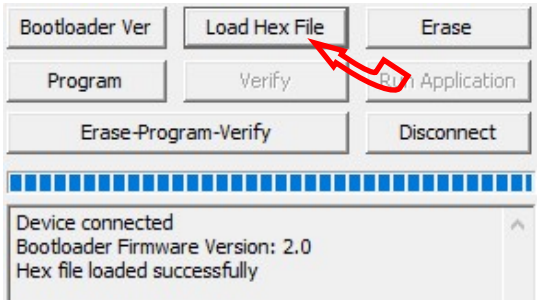


11. Click on **Connect.**

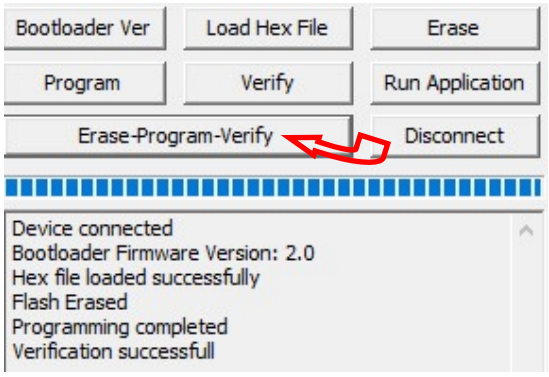


*If device fails to connect and an error message is displayed, the board's bootloader may be older than v2.0. It will be necessary to instead update the firmware via jumper pins (**METHOD 2**), as per the next section.*

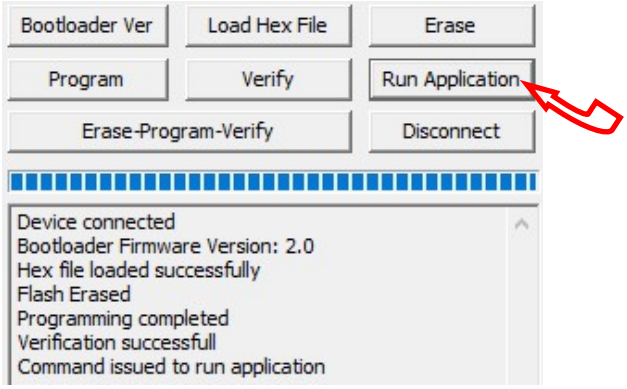
12. Click on **Load Hex File**. Select the M*GL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.



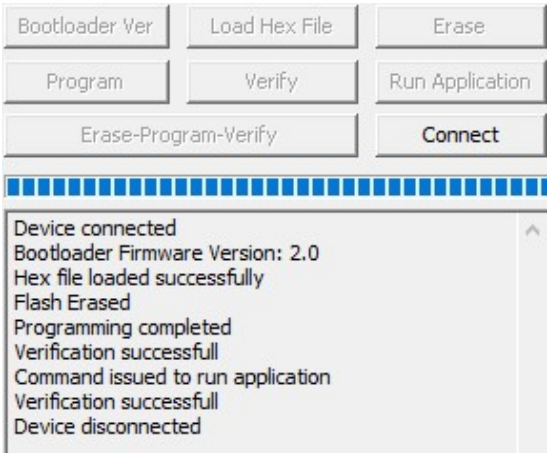
13. Click on **Erase—Program—Verify.** Programming…. Wait while status bar shows progress. The messages should read as below when finished:



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.



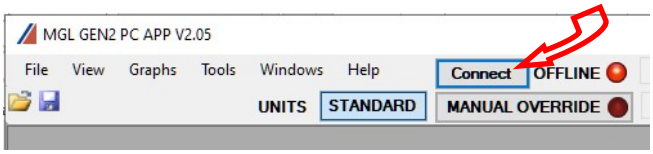
15. **Wait until the programmer disconnects itself.** The messages should read as follows:



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.



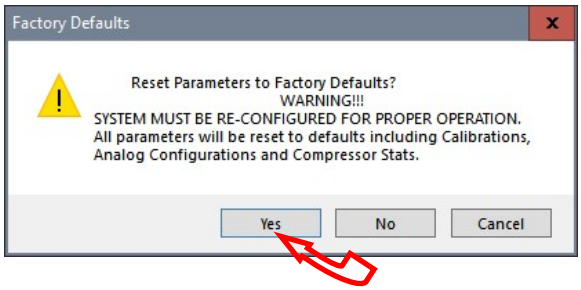
NOTE: Updating the firmware does not affect the configuration settings.

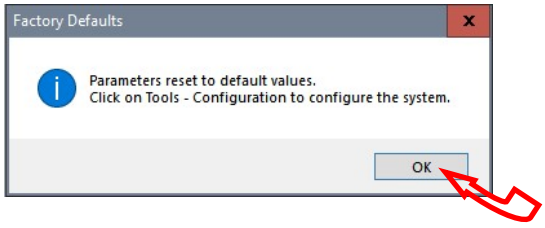
Reset to Defaults?

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)

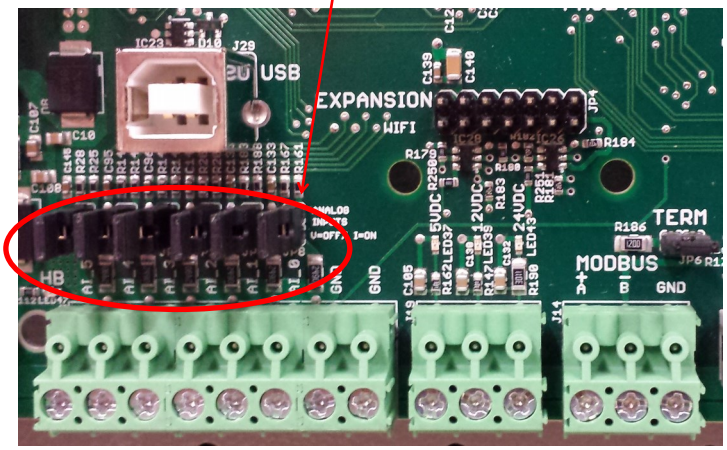
   Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

3. Connect a USB (printer) cable between computer and control board.

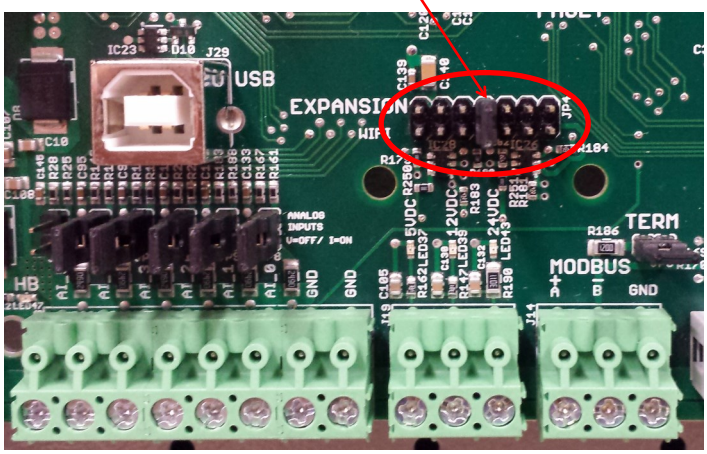
4. Turn power off to the heat pump.

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)

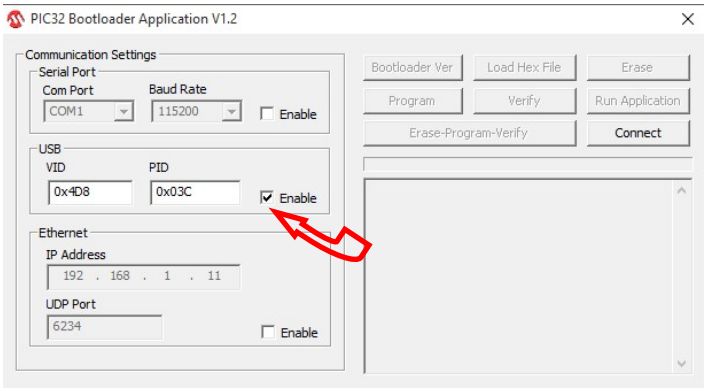


Place jumper here

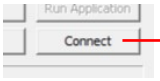


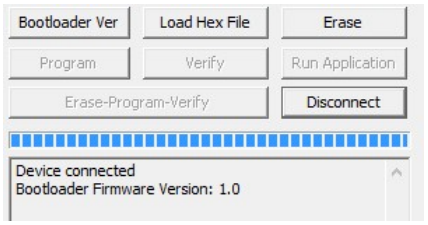
6. Turn the power back on. The control board is now in boot loader mode and is ready to be programmed.

7. Double click on the downloaded PIC32UBL.exe to run it. In the window that opens, click on the USB **Enable** check box.

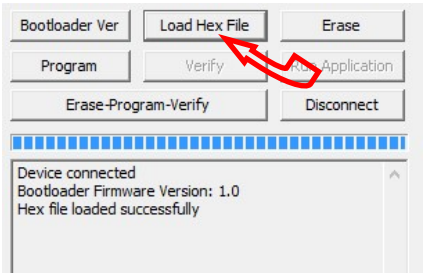


8. Click on **Connect.**



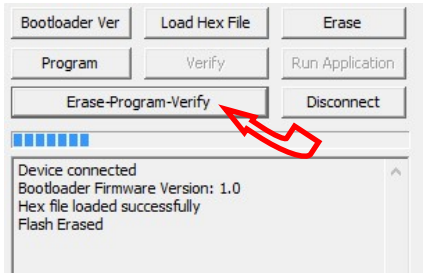


9. Click on **Load Hex File**. Select the *MGL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.

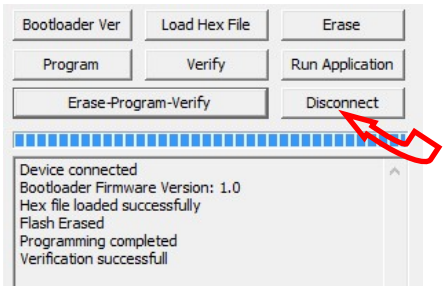


10. Click on **Erase—Program—Verify**

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.

LIMITED WARRANTY

MARITIME GEOTHERMAL LTD. warrants that its commercial geothermal heat pumps shall be free from defects in materials and workmanship for a period of ONE (1) YEAR after the date of installation or for a period of ONE (1) YEAR AND SIXTY (60) DAYS after the date of shipment, whichever occurs first. This warranty covers all internal components of the heat pump.

MARITIME GEOTHERMAL LTD. shall, at its option, repair or replace any part covered by this warranty. Defective parts shall be returned to MARITIME GEOTHERMAL LTD., transportation charges prepaid. Replacement or repaired parts and components are warranted only for the remaining portion of the original warranty period.

This warranty is subject to the following conditions:

1. The geothermal heat pump must be properly installed and maintained in accordance with MARITIME GEOTHERMAL LTD. guidelines.

2. The installer must complete the **Startup Record** and return it to MARITIME GEOTHERMAL LTD. within 21 days of unit installation.

3. For new construction, it is the responsibility of the building or general contractor to supply temporary heat to the structure prior to occupancy. Geothermal heat pumps are designed to provide heat only to the completely finished and insulated structure. Startup of the unit shall not be scheduled prior to completion of construction and final duct installation for validation of this warranty.

4. It is the customer's responsibility to supply the proper quantity and quality of water or properly sized ground loop with adequate freeze protection.

If a geothermal heat pump manufactured by MARITIME GEOTHERMAL LTD. fails to conform to this warranty, MARITIME GEOTHERMAL LTD.'s sole and exclusive liability shall be, at its option, to repair or replace any part or component which is returned by the customer during the applicable warranty period set forth above, provided that (1) MARITIME GEOTHERMAL LTD. is promptly notified in writing upon discovery by the customer that such part or component fails to conform to this warranty; (2) the customer returns such part or component to MARITIME GEOTHERMAL LTD., transportation charges prepaid, within (30) thirty days of failure, and (3) MARITIME GEOTHERMAL LTD.'s examination of such component discloses to its satisfaction that such part or component fails to conform to this warranty and the alleged defects were not caused by accident, misuse, neglect, alteration, improper installation, repair or improper testing. MARITIME GEOTHERMAL LTD. will not be responsible for any consequential damages or labour costs incurred. In additional, MARITIME GEOTHERMAL LTD. will not be responsible for the cost of replacement parts purchased from a third party.