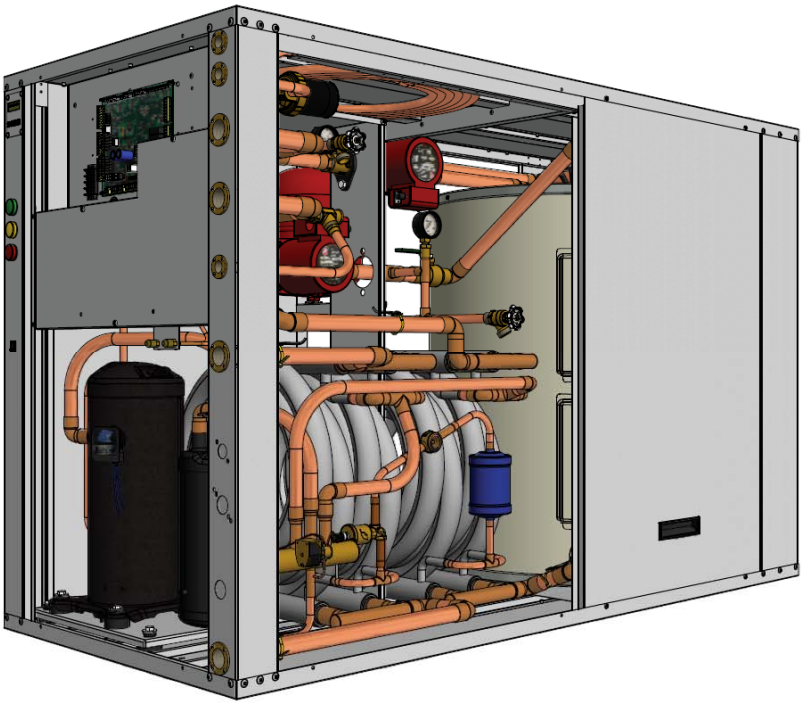
MARITIME GEOTHERMAL LTD.

Installation and Service Manual

EMW-Series
Energy Module Hydronic Geothermal Heat Pump

Two-stage R410a 60Hz
Model Sizes 45-80



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SAFETY PRECAUTIONS

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

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

WARNING: **Refrigeration 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 the system 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 equipment.**

Model Nomenclature

EMW—65—HACW—P—1T—CC—12K—xx

Series:
EMW = Energy Module
Liquid to Water (Hydronic)

Nominal Size:
45 = 030 compressor
55 = 040 compressor
65 = 051 compressor
75 = 060 compressor
80 = 067/70 compressor

Functions:
H = Heating
AC = Active Cooling
W = Domestic Hot Water

Refrigerant:
P = R410a

Voltage Code:
1 = 230-1-60 VAC
2 = 208-3-60 VAC
6 = 220-1-50 VAC
7 = 380-3-50 VAC

Revision:
01, 02 etc.

Electric Backup:
12K = 12 kW

Indoor Loop Coil:
C = Copper

Outdoor Loop Coil:
C = Copper
Y = CuNi coil & piping
Z = CuNi coil only

Compressor:
S = 1 Stage Scroll
T = 2 Stage Scroll

APPLICATION TABLE

MODEL	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESSOR	OUTDOOR LOOP COIL	INDOOR LOOP COIL	ELECTRIC BACKUP	REVISIONS			
EMW-45	H A C W	P	1 2 6 7	T	C Y Z	C	12K	07			
EMW-55	H A C W	P	1 2 6 7	T	C Y Z	C	12K	07			
EMW-65	H A C W	P	1 2 6 7	T	C Y Z	C	12K	07			
EMW-75	H A C W	P	1	T	C Y Z	C	12K	07			
			2	T							
			6	S							
			7	T							
EMW-80	H A C W	P	1 2 7	S	C Y Z	C	12K	07			

This manual applies only to the models and revisions listed in this table.

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

Table of Contents

Tables, Figures, & Documents

Tables

Figures

Documents

EMW System Description

General Overview

The Nordic EMW-series, a unique product with a more than 20-year history of reliable operation, is a water source heat pump that can heat or cool water for hydronic heating and cooling systems.

Unlike a regular water to water heat pump, it comes with most required hydronic accessories built into the cabinet:

- 50 gallon (189L) buffer tank
- 12 kW of electric elements for auxiliary/backup heat, with zero-pressure safety switch
- indoor & zone circulators with isolation valves
- expansion tank, pre-charged with air
- hydronic pressure gauges
- 125 psi pressure relief valve with external drain connection
- all ball valves and drains required for air purging
- electronic control board with full hydronic temperature control, laptop connectivity via USB with free PC App, LCD display, electronic readout of all pressures and temperatures, data logging & graphing, and BACnet interface

Being a water source, 'geoexchange', or 'geothermal' heat pump, it does require either a closed ground loop or open loop water well for a heat source/sink.

In additional to the main hydronic water heating function, there is a double-wall desuperheater for pre-heating domestic hot water with ~5% of the heat pump's capacity. This function is only active when the heat pump is running for space heating or cooling purposes.

The coaxial hydronic heat exchangers are copper / steel with optional CuNi inner tube available for the outdoor coil. Most model sizes have modulation capability through the use of 2-stage compressors, for closer load matching and to reduce cycling. An Electronic Expansion Valve (EEV) is standard, for more precise superheat and system optimization than is possible with a TXV. The cabinet is powder coated galvanized sheet metal.

There are two operational modes: hydronic heating and hydronic cooling.

1. Heating Mode

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

Building zones may be in-floor heating, hydronic air handlers, or other hydronic devices suitable for water temperatures less than 120°F (49°C). When a zone requires heat, it calls for the zone circulator pump inside the EMW to activate, and opens a zone valve located outside the EMW. There is no control connection between the zone thermostat and the heat pump, other than the call to activate the zone pump.

2. Cooling Mode

In cooling mode the heat pump chills water in its built-in buffer tank to a user-defined setpoint temperature, while rejecting heat to the outdoor loop.

In-floor zones are generally disabled for cooling mode, although in-floor cooling is possible with the addition of special dew point controllers.

Auxiliary Heat

The EMW comes with 12 kW of electric heating elements installed in the built-in buffer tank. These elements are part of the heat pump, controlled as the third stage of heating, and do not require a separate electric service (unlike elements in tanks purchased separately from the heat pump).

The electric elements will provide auxiliary heat in the event the heat pump is sized to provide less than 100% of the heat load on the coldest day of the year, and also backup heat should a problem occur that causes the heat pump to be locked out on a safety control.

Heat Pump Sizing

TABLE 1 shows a rough guideline as to the size of home each heat pump size can handle for **ground loop (closed loop)** installations.

TABLE 1 - Heat Pump Size vs. Heated Area for a Ground Loop System

Model	ft^2	m^2
45	1400	130
55	2000	185
65	2600	240
75	3100	290
80	3500	325

TABLE 2 shows a rough guideline as to the size of home each heat pump size can handle for **ground water (open loop)** installations.

TABLE 2 - Heat Pump Size vs. Heated Area for an Open Loop System

Model	ft^2	m^2
45	1800	165
55	2500	230
65	3200	295
75	3800	355
80	4200	390

THE TABLES ABOVE ARE FOR INFORMATION ONLY. THEY SHOULD NOT BE USED TO SELECT A UNIT SIZE. They simply show on average what size unit is required for a typical two-level home (main level and below grade basement) with R20 walls, R40 ceiling and average size and number of windows. The Heated Area is the area of the 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 INSTALLER WITH APPROVED CSA F-280 SOFTWARE BEFORE SELECTING THE SIZE OF UNIT REQUIRED FOR THE APPLICATION. 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 be selected by comparing the calculated heat load to the **Standard Capacity Ratings**, which are listed in the Model Specific Information section of this manual. For 100% heat pump sizing, choose a heat pump with a standard capacity rating that matches or just slightly exceeds the calculated heat load.

Closed ground loops are normally designed to reach a minimum temperature of just below freezing at the end of the heating season, in order to take advantage of the latent heat of groundwater (at least in northern climates). Hence, the Standard Capacity Ratings for Ground Loop Heating should apply in all northern climates.

The Standard Capacity Ratings for Ground Water (open loop) heat pumps assume a well water temperature of 50F (10C). If the groundwater is not close to this temperature, it will be necessary to consult the more detailed performance tables later in the section for heat pump output at a different ELT.

In cooling dominant climates, the heat pump should be similarly sized using the Ground Loop Cooling or Ground Water Cooling Standard Capacity Ratings.

Auxiliary Hydronic Heat Sizing

The EMW comes with 12kW of electric heating elements installed in the built-in buffer tank. This should be sufficient for auxiliary heat for all model sizes, since geothermal heat pump installations should be designed by code to cover 75-100% of the heat load using the compressor.

Also, in case of a heat pump problem, the elements will cover most or all of the heat load until the heat pump is serviced.

If larger elements are required for a particular installation, a standard NORDIC W-series heat pump with separate buffer tank and elements should be used instead of the EMW series.

Installation Basics

Unpacking the Unit

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

Unit Placement

The placement of a hydronic heat pump has negligible effects on the operation of the system. For ground water 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 front (narrow end) of the heat pump where the pipes come out, the right side access panels should remain clear of obstruction for a distance of at least **three feet** to facilitate air purging and servicing. The left side should be left at least **12"** away from any wall in case the small expansion tank ever needs to be replaced. No access is required for the narrow back side.

Raising the heat pump off the floor a few inches is generally a good practice since this will prevent rusting of the bottom panel of the unit. It is recommended that the heat pump be placed on a piece of 2" blue or pink styrofoam. This process will also deaden the compressor noise emitted from the bottom of the cabinet.

Sample Bill of Materials - Ground Loop Installations

Although not exhaustive, following is a list of materials needed for a typical ground loop installation:

FROM MARITIME GEOTHERMAL
- EMW SERIES HEAT PUMP
- P/T PORTS AND HOSE ADAPTERS (2)
- 1 OR 2 PUMP PACK
- PIPE ADAPTERS FOR PUMP PACK

OPTIONAL FROM MARITIME GEOTHERMAL
- COMPRESSOR SOUND JACKET
- SECURE START
- AHW-65 HYDRONIC AIR HANDLER(S)

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

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

ZONES
- ZONES VALVES
- IN-FLOOR PIPING
- 3RD PARTY AIR HANDLERS W/ DUCTING
- ZONE THERMOSTATS
- RELAYS OR ZONE CONTR. (REVERSING SYSTEMS)
- ZONE SUPPLY & RETURN HEADERS
- PIPE & FITTINGS TO ZONES

ELECTRICAL
- SERVICE WIRE: #1-3 OR #3-3
- BREAKER: 100A OR 125A
- THERMOSTAT WIRE 18-4
- THERMOSTAT WIRE 18-2
- FORK TERMINALS FOR TSTAT WIRE

- 2" STYROFOAM INSUL. FOR UNDER UNIT

Sample Bill of Materials - Open Loop Installations

Although not exhaustive, following is a list of materials needed for a typical open loop (groundwater) installation:

FROM MARITIME GEOTHERMAL
- EMW SERIES HEAT PUMP
- P/T PORTS AND HOSE ADAPTERS (2)
- DOLE VALVE
- TACO OR SOLENOID VALVE

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

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

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

ZONES
- ZONES VALVES
- IN-FLOOR PIPING
- 3RD PARTY AIR HANDLERS W/ DUCTING
- ZONE THERMOSTATS
- RELAYS OR ZONE CONTR. (REVERSING SYSTEMS)
- ZONE SUPPLY & RETURN HEADERS
- PIPE & FITTINGS TO ZONES

ELECTRICAL
- SERVICE WIRE: #1-3 OR #3-3
- BREAKER: 100A OR 125A
- THERMOSTAT WIRE 18-4
- THERMOSTAT WIRE 18-2
- FORK TERMINALS FOR TSTAT WIRE

- 2" STYROFOAM INSUL. FOR UNDER UNIT

Wiring

Power Supply Connections

There is only one power supply connection to the heat pump, which supplies both the compressor section and the backup tank elements.

The unit has a concentric 1.093" / 0.875" knockout for main power supply connection. There are also two 7/8" knockouts and a 1/2" opening with plastic grommet (grommet hole is 3/8") for control and outdoor loop circulator connections.

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 size.

IMPORTANT NOTE: A properly qualified electrician should be retained for all connections to the heat pump and associated controls. The connections to the unit MUST CONFORM TO LOCAL CODES.

TABLE 3 - Power Supply Connections

Line	Description	Voltages
L1	Line 1	All
L2	Line 2	All
L3	Line 3	3-phase only
N	Neutral	All except 220-1-50
GND	Ground	All (connect to ground lug)

Control Transformer

The low voltage controls, including the control board, are powered by a 100VA class II transformer. 208/230-1-60 models have a 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 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.

Indoor & Zone Circulator Pump Wiring

The EMW series has built-in indoor loop (heat pump to buffer tank) and zone loop (buffer tank to zones) circulator pumps, so no wiring is necessary.

The indoor loop circulator is controlled automatically by the heat pump's control board.

The zone circulator is turned on by making a dry contact between **R** and **Z** on the heat pump's terminal strip. See wiring diagrams later in this section, and in the **Model Specific Information** section.

Thermostat Connections

There are no thermostats or aquastats to directly connected to the EMW-series heat pump itself. The heat pump will run to maintain the buffer tank water temperature to the setpoints selected by the user through the LCD display or PC App software, using the ***Setpoint Control*** routine described later in this manual.

Zone thermostats are required, to request heated or chilled water for a particular zone. These may be interconnected using a 3rd party zone controller, or through external relays as illustrated in the following wiring diagrams. Systems that will provide both heating and cooling require extra relays to provide an isolated cooling signal to the heat pump and to disable radiant infloor heating zones while in cooling mode. The diagrams on the following pages show a typical wiring diagram for a heating only setup, and also a heating / cooling system. These drawings represent a basic system, in which heating is the default mode and cooling has priority. In place of relays, a third party zone controller may be used, for more flexible and detailed zone control.

Note that for heating / cooling installations, a dry contact will be needed between the **R** and **O** terminals to put the heat pump in cooling mode.

IMPORTANT NOTE: For cooling mode activation, it is important to use a setup that provides a dry contact between R and O *all cooling season* to prevent repeated heating and re-cooling of the buffer tank on every operational cycle.

TABLE 4 - Control Connections

Terminal	Description
C	24VAC common (ground)
R	24VAC hot
Z	Zone circulator activation
O	Cooling mode activation

Circulator Pump Module Wiring (Ground Loop Only)

The heat pump has provisions for connecting the ground loop 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. Ensure that the total current draw of all circulators connected to the terminal strip does not exceed the value indicated on the label in the heat pump electrical box. Refer to the electrical box drawing on the electrical box cover for more information.

Open/Closed Loop Wiring

The heat pump is provided configured for closed loop operation. For open loop operation, it is ***necessary*** to remove the jumper plug from the wiring harness found behind the pipe post and plug in the water valve harness. This will select the proper low pressure control. See the "Water Valve" section in the Open Loop Installations chapter and **000907CDG** for details.

WARNING: Connecting an open loop water valve without a harness provided by Maritime Geothermal could lead to frozen and ruptured heat exchanger, voiding the warranty.

Domestic Hot Water (Desuperheater)

The desuperheater function for domestic hot water heating is pre-wired and no field connections are necessary.

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

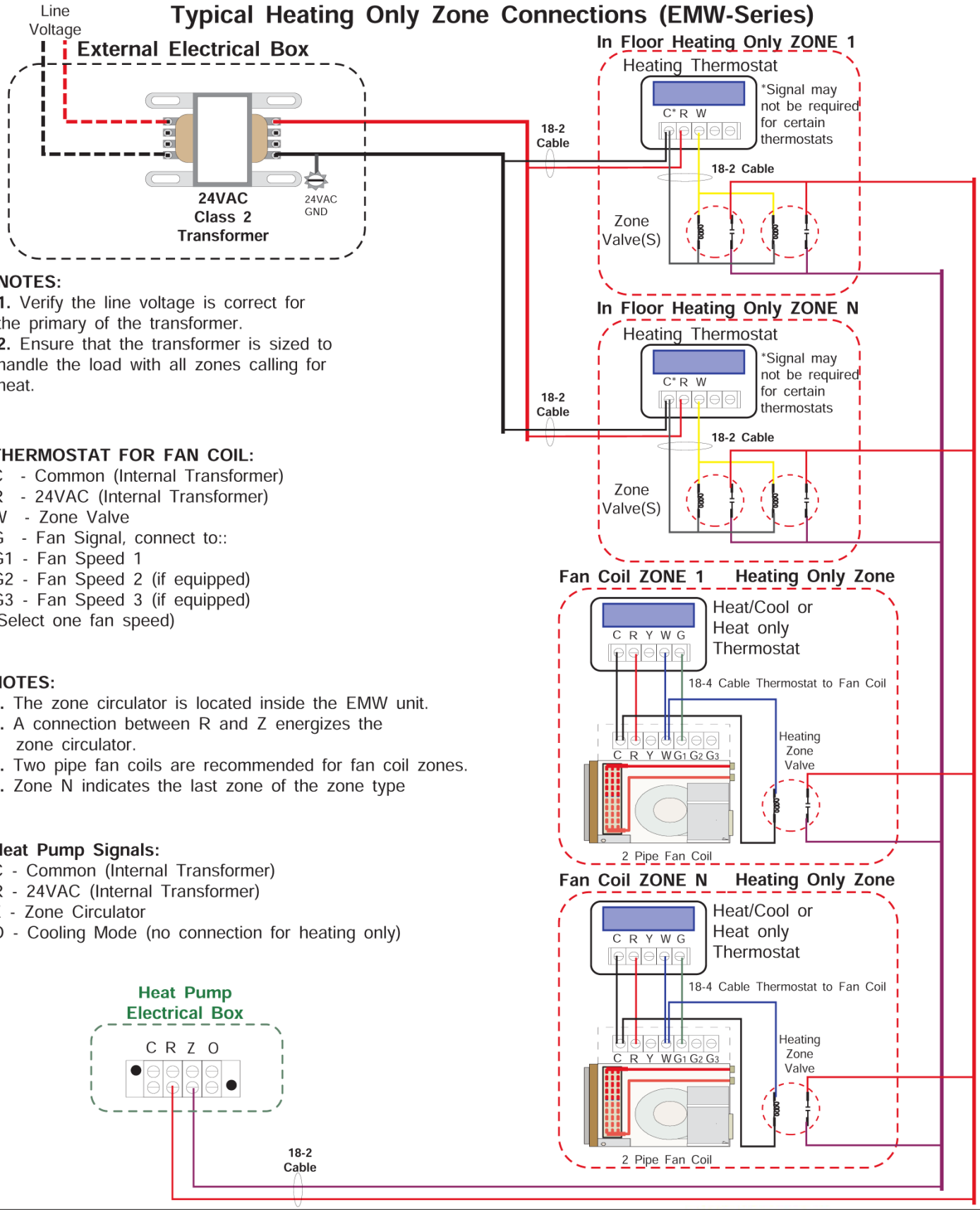
Other Connections

In most installations, accessories that are not already described will not be required. Other available accessories or external connections include:

- Compressor current sensor.
- BACnet, for external control of heating/cooling demand by the building control system.

See the wiring (SCH) diagrams in the **Model Specific Information** section or on the electrical box cover for these connections.

Typical Heating Only Zone Connections (EMW-Series)



NOTES:

1. Verify the line voltage is correct for the primary of the transformer.

2. Ensure that the transformer is sized to handle the load with all zones calling for heat.

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)

NOTES:

1. The zone circulator is located inside the EMW unit.

2. A connection between R and Z energizes the zone circulator.

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

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

Heat Pump Signals:

C - Common (Internal Transformer)
R - 24VAC (Internal Transformer)
Z - Zone Circulator
O - Cooling Mode (no connection for heating only)

REV	ECO #	IMPL BY	APVD BY	DATE
02	000232	D. RHEAULT	D. RHEAULT	17-Dec-2018
01	Initial Release	C. GEDDES	C. GEDDES	7-Sep-2007

Drawn By Chris Geddes	Date	7-Sep-2007
Checked By Chris Geddes	Date	7-Sep-2007
Approved By (ENG) Chris Geddes	Date	7-Sep-2007
Approved By (MFG)	Date	
Approved By	Date	

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Drawing Name: Typical Heating Only Zone Wiring Diagram (EMW-Series)

Size	Drawing Number	REV	SHEET
A	000531CDG	02	1 of 1

Typical Heating & Cooling Zone Connections (EMW-Series)

Heat Pump Connections:
C - Common
R - 24VAC
Z - Zone Circulator
O - Reversing Valve

Connecting R to Z starts the zone circulator.
Connecting R to O switches the unit to cooling mode.

Heat Pump Electrical Box

C R Z O

18-3 cable

Heat Pump to External Electrical Box

NOTES:
1. All transformers are isolated and dry contacts are provided for the heat pump.
3. Cooling mode has priority, & heating mode is the default mode.
4. Zone N indicates the last zone of the zone type.
5. There must be an H/C Relay for each heating/cooling and cooling only fan coil zone.
6. Two pipe fan coils are recommended for all fan coil zones.

External Electrical Box

Line Voltage

External Electrical Box

NOTES:
1. Verify the line voltage is correct for the primary of the transformer
2. Ensure that the transformer is sized to handle the load with all zones connected to it energized.

24VAC Class 2 Transformer

24VAC GND

Heating Circulator Relay

(White)

H/C Relay 1

H/C Relay 2

H/C Relay N

18-2 Cable

18-2 Cable

18-2 Cable

THERMOSTAT WITHOUT O SIGNAL:
C - Common (Internal Transformer)
R - 24VAC (Internal Transformer)
Y - Cooling Mode Signal
G - Zone Valve and Fan Signal:
G1 - Fan Speed 1
G2 - Fan Speed 2 (if equipped)
G3 - Fan Speed 3 (if equipped)
(Select one fan speed)

THERMOSTAT WITH O SIGNAL:
C - Common (Internal Transformer)
R - 24VAC (Internal Transformer)
O - Cooling mode signal
Y - Zone Valve Signal
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)

In Floor Heating Only ZONE 1

C* R W

Heating Thermostat

18-2 Cable

Zone Valve(S)

*Signal may not be required for certain thermostats

In Floor Heating Only ZONE N

C* R W

Heating Thermostat

18-2 Cable

Zone Valve(S)

(White)

(White)

(White)

Fan Coil ZONE 1 Heating/Cooling Zone

C R Y W G

Heat/Cool Thermostat without O signal

18-3 Cable Thermostat to Fan Coil

C R Y W G1 G2 G3

Zone Valve

2 Pipe Fan Coil

Fan Coil ZONE 2 Heating/Cooling Zone or Cooling Only Zone

C R Y O G

Heat/Cool Thermostat with O signal

18-4 Cable Thermostat to Fan Coil

C R Y W G1 G2 G3

Zone Valve

2 Pipe Fan Coil

Fan Coil ZONE 3 Heating Only Zone

C R Y W G

Heat/Cool or Heat only Thermostat

18-4 Cable Thermostat to Fan Coil

C R Y W G1 G2 G3

Zone Valve

2 Pipe Fan Coil

Fan Coil ZONE N Cooling Only Zone

C R Y W G

Heat/Cool Thermostat

18-4 Cable Thermostat to Fan Coil

C R Y W G1 G2 G3

Zone Valve

2 Pipe Fan Coil

REV	ECO #	IMPL BY	APVD BY	DATE
02	000232	D. RHEAULT	D. RHEAULT	17-Dec-2018
01	Initial Release	C. GEDDES	C. GEDDES	11-Dec-2007

Drawn By	Chris Geddes	Date 11-Dec-2007
Checked By	Chris Geddes	Date 11-Dec-2007
Approved By (ENG)	Chris Geddes	Date 11-Dec-2007
Approved By (MFG)		Date
Approved By		Date

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Drawing Name: Typical Heating & Cooling Zone Wiring (EM-Series)

Size: B | Drawing Number: 000583CDG | REV: 02 | SHEET: 1 of 1

Piping

NOTE: Care should be taken when routing all water lines to ensure that adequate access to the heat pump is maintained so as to not compromise ease of serviceability. All loop connections are located together on the front of the unit. Unions are recommended on all connections to allow easy access to heat exchangers for service if required.

Loop Terminology

- **Zone loop**: supplies heated or chilled water to the building. The built-in zone circulator provides flow for this loop.
- **Indoor loop**: the internal loop between the heat pump's indoor heat exchanger and built-in buffer tank. No field connection.
- **Outdoor loop**: the heat source or sink, either a closed ground loop or open loop (water well).
- **DHW (domestic hot water) loop**: the desuperheater, which heats potable water in a preheat tank while the compressor is running for space heating or cooling purposes.

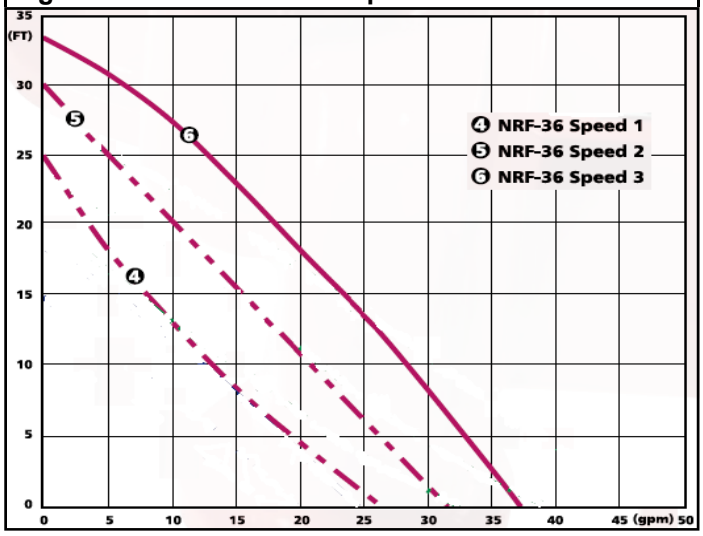
Zone Loop

The connections for the zone loop circuit are 1" brass female NPT. They are labelled as ZONE IN and ZONE OUT.

The zone loop connections will be plumbed directly to the zone supply and return headers, as illustrated in the diagram on the following page. Zone valves should be located on the return header. All hydronic accessories as well as zone loop air bleed taps and valves are located inside the heat pump cabinet.

The zone circulator has 3 speed settings and will provide flow according to the following curve:

Figure 1 - B&G NRF-36 Pump Curve



Indoor Loop

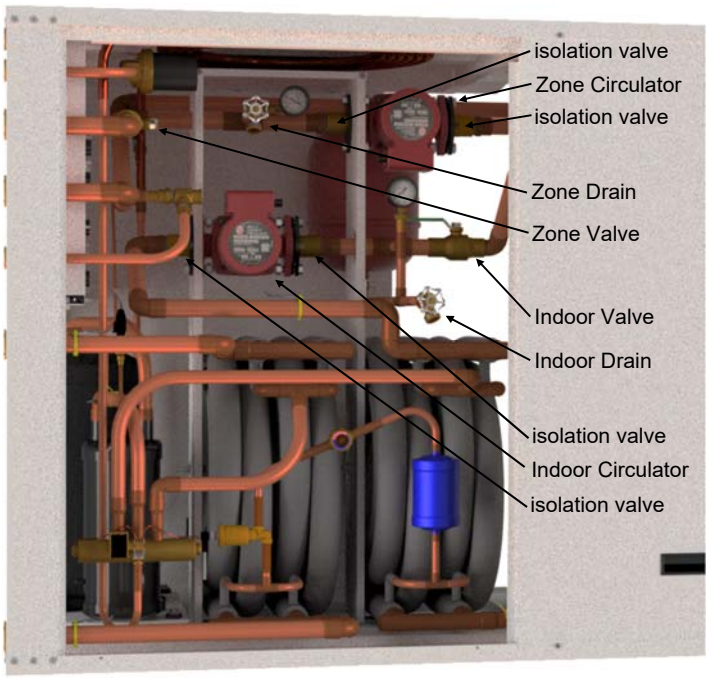
The indoor loop is internal to the heat pump and no field connections are required (or possible).

Purging the Zone & Indoor Loops

There are ball valves and drains inside the unit to facilitate filling and purging. Once the system has been filled with the desired fluid, air purging may be done in the following manner:

1. Connect a fill hose to the Zone Drain.
2. Connect a drain hose to the Indoor Drain.
3. With a T-handle hex key, close the right isolation valve of the Zone Circulator.
4. Close the right isolation valve of the Indoor Circulator.
5. Open the Zone and Indoor Drains.
6. Turn on the fill hose.
7. Purge until no air can be heard leaving the drain hose.
8. Close the Indoor Valve and open the right isolation valve of the Indoor Circulator.
9. Purge until no air can be heard leaving the drain hose.
10. Close the Zone Valve and open the right isolation valve of the Zone Circulator.
11. Purge until no air can be heard leaving the drain hose.
12. Close the Indoor Valve and open the right isolation valve of the Indoor Circulator.
13. Purge until no air can be heard leaving the drain hose.
14. Open the right isolation valve of the Indoor Circulator.
15. Open the Zone Valve.
16. Close the Indoor Drain and then close the Zone Drain when the desired system pressure is obtained.

Repeat the above procedure as necessary to ensure that all of the air has been removed, then remove the purging equipment.



Outdoor Loop

The connections for the Outdoor Loop circuit are 1" brass female NPT. They are labelled as OUTDOOR IN and OUTDOOR OUT.

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

Pressure Relief Connection

There is an external connection for the internal pressure relief valve, which is 1/2" female NPT. This may optionally be connected to a floor drain.

Domestic Hot Water (Desuperheater)

The connections for the DHW circuit are 1/2" brass female NPT fittings. They are marked as DHW IN and DHW OUT.

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

WARNING: USE ONLY COPPER LINES TO CONNECT THE DESUPERHEATER. TEMPERATURES COULD REACH 200F SHOULD THE DHW CUTOUT SWITCH FAIL, POTENTIALLY MELTING & RUPTURING PLASTIC PIPING.

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

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

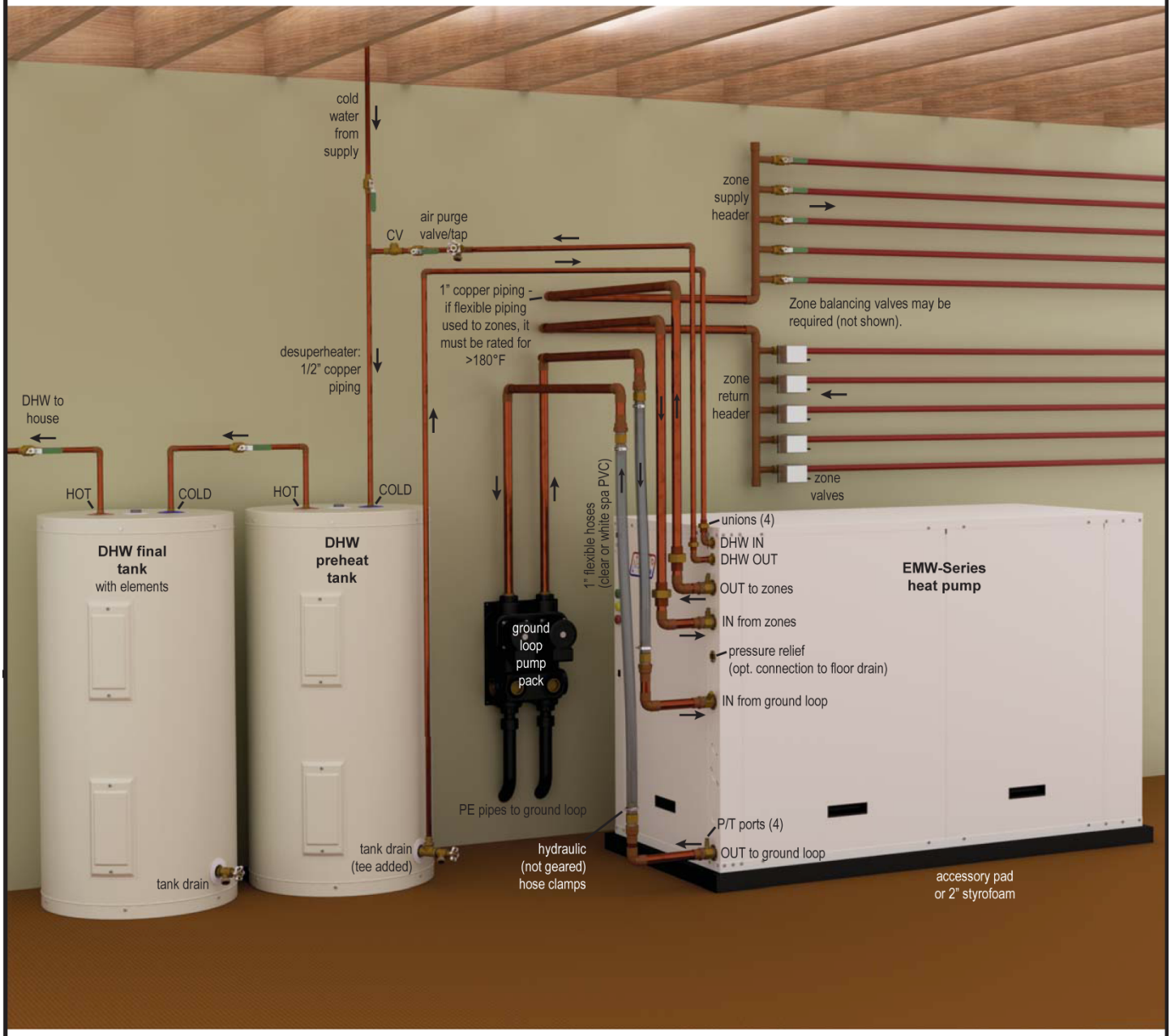
Activate the built-in DHW circulator by connecting the brown wire with the blue insulated terminal to L1 of the compressor contactor. **Ensure the power is off when connecting the wire.** Once connected the DHW switch on the front of the unit may be used to enable/disable the domestic hot water circulator.

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

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

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

Typical Piping Connections - EMW



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

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.

- Piping routed differently from that shown, or different piping & component types.

Components included inside EMW heat pump:

- hydronic buffer tank with 12 kW auxiliary electric heat
- circulator: heat pump to buffer tank
- circulator: buffer tank to zones
- circulator: domestic hot water (desuperheater)
- hydronic expansion tank
- all air bleed taps and valves
- hydronic pressure gauges
- hydronic pressure relief valve
- element safety pressure switch (in case flammable antifreeze used)

REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Rel.	Dan Rheault	Dan Rheault	1-Dec-2018

Drawn By: Dan Rheault	Date: 1-Dec-2018	
Checked By: Dan Rheault	Date: 1-Dec-2018	
Eng. Approved By	Date	
Mfg. Approved By	Date	
Approved By	Date	

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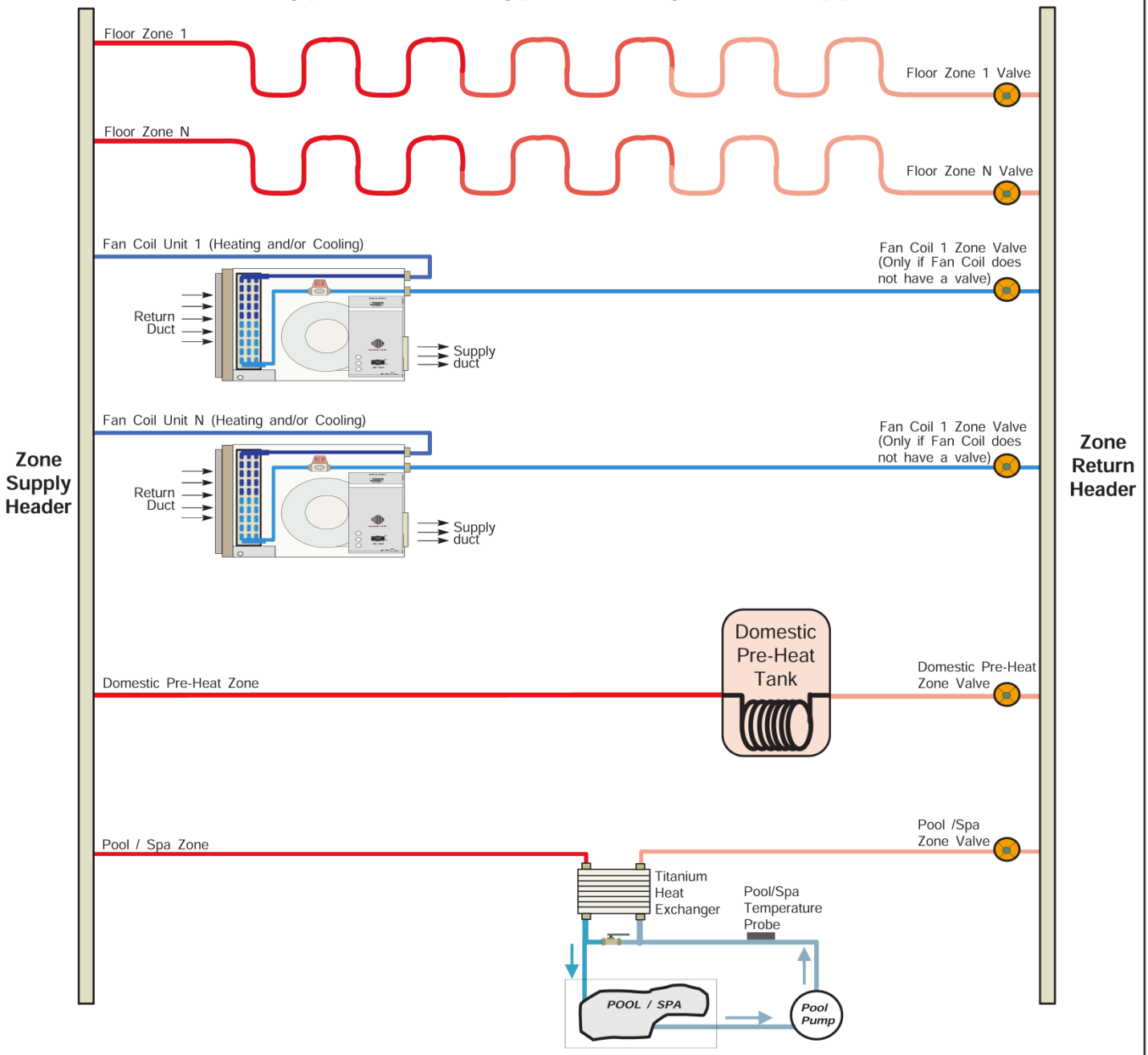
Drawing Name: **Typical Piping Connections - EMW**

Size	Drawing Number	Revision	Sheet
LET	002363PDG	01	1 / 2

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

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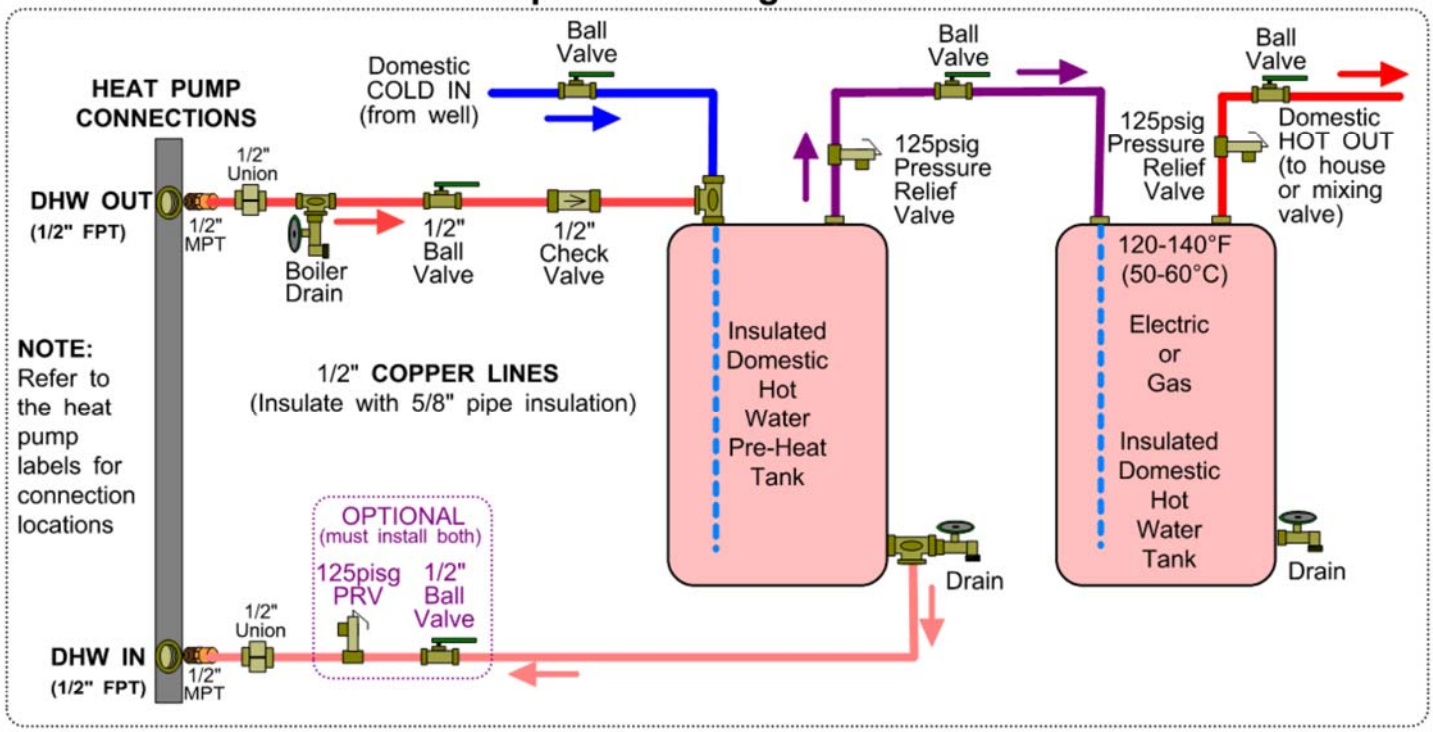
Drawing Name: Typical Zone Types for Hydronic Applications

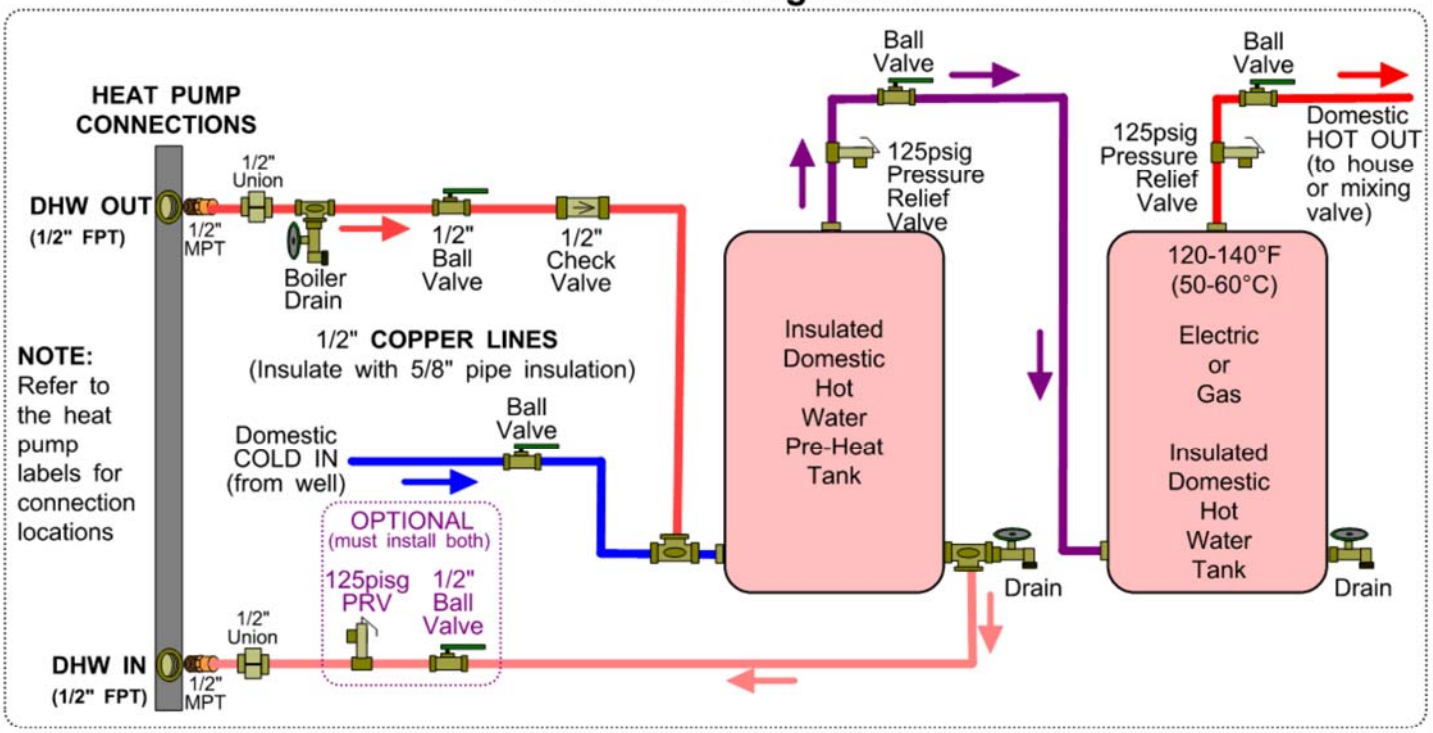
Size	Drawing Number	REV	SHEET
A	000530PDG	01	1 of 1

Single Unit Connection to Domestic Hot Water Pre-Heat Tank (Brass FPT)

Top Port Configuration



Side Port Configuration



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01	Initial Release	C. GEDDES	C. GEDDES	10 MAR 09

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

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

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

Ground Loop Installations

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 1" 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.

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.

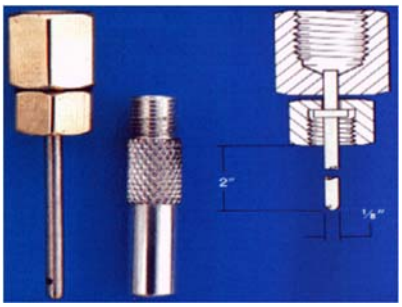
Figure 2: Ground Loop Accessories & Tools

2-pump module

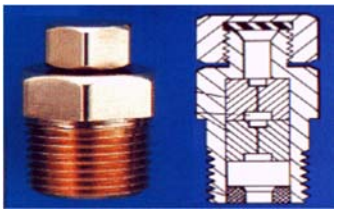
Barbed Adapters

PE Adapters

Purge Cart



Gauge adapter for P/T port



P/T port

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

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 normally 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 8** for details of freeze protection provided by different concentrations.

TABLE 5 - 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 your loop system holds can be closely estimated by totaling the number of ft. of each size pipe in the system and referencing **TABLE 9** the for approximate volume per 100 ft.

When the volume of the loop has been calculated and the appropriate amount of antifreeze is ready for addition by referencing **TABLE 9**; drain the equivalent amount of water from the flush cart or mixing barrel and replace it with the antifreeze.

TABLE 6 - 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 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.

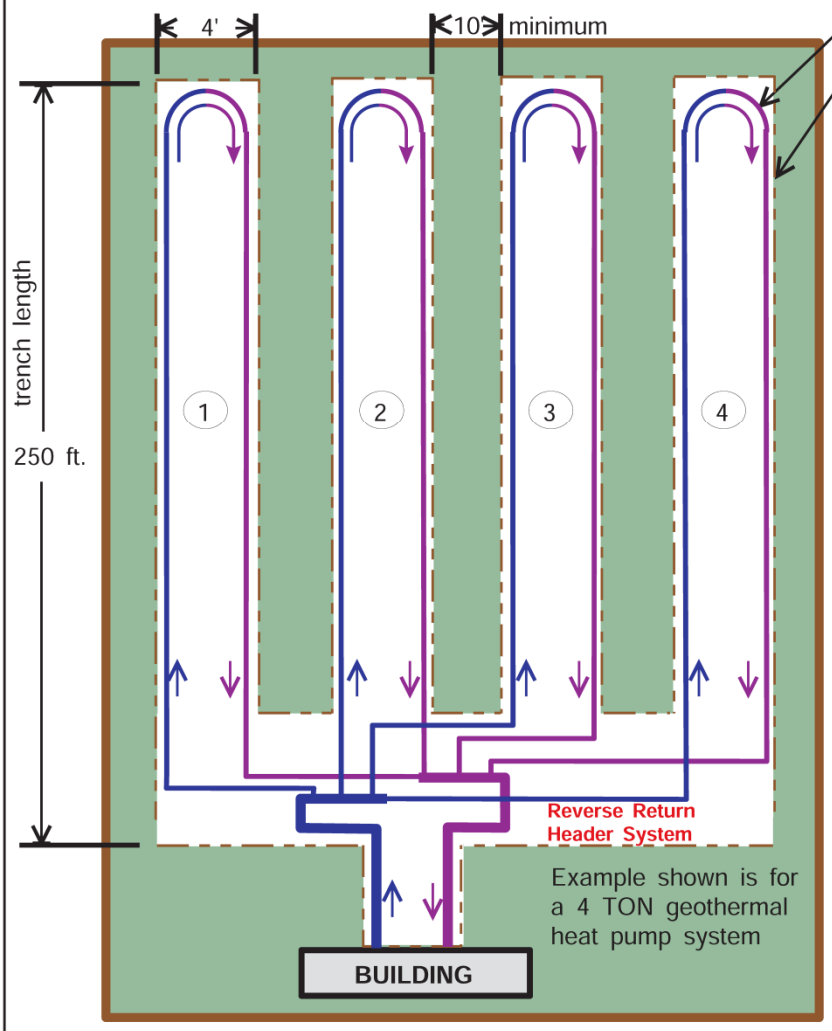
- Pressurize the loop to a static pressure of **45 psig**. when installing a system in the fall going into the heating season.
- Pressurize the loop to a static pressure of **25 psig**. when installing a system in the spring or summer going into the cooling season.

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

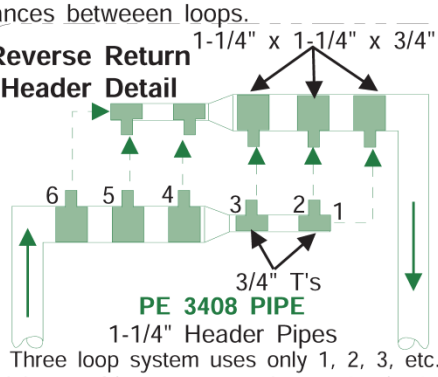
All ground loop piping inside the structure (between the structure entry point and the heat pump) should be insulated with 3/8" thick closed cell pipe insulation to prevent condensation and dripping onto floors or walls.

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.

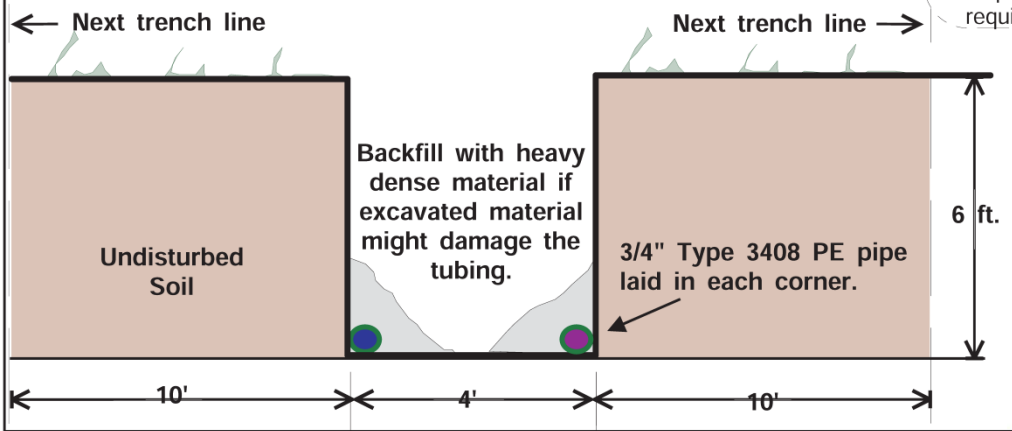
Reverse Return Header Detail



PE 3408 PIPE
1-1/4" Header Pipes

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

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01	Initial Release	C. GEDDES	C. GEDDES	17 JAN 08

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

MARITIME GEOTHERMAL LTD.
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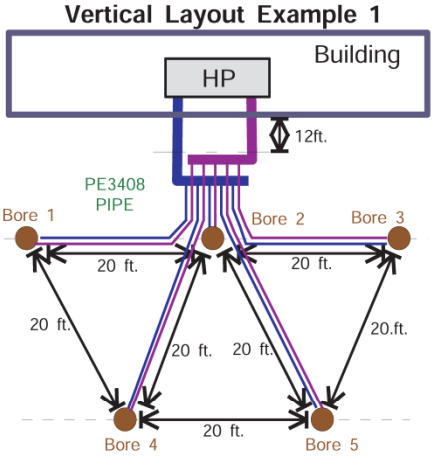
Drawing Name: Typical Horizontal Ground Loop Configuration

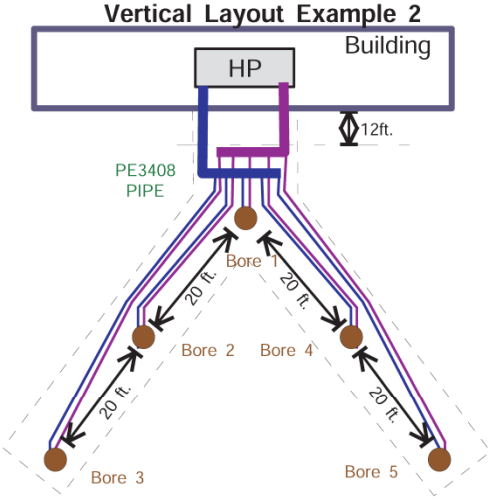
Size	Drawing Number	REV	SHEET
A	000608INF	01	1 of 1

TYPICAL VERTICAL GROUND LOOP CONFIGURATION

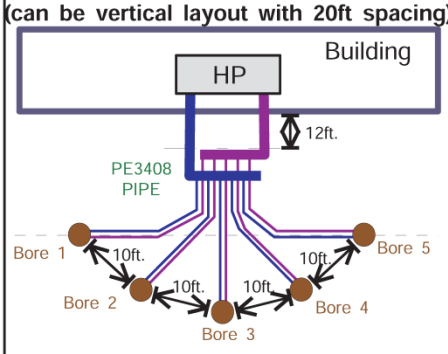
Vertical Layout Example 1



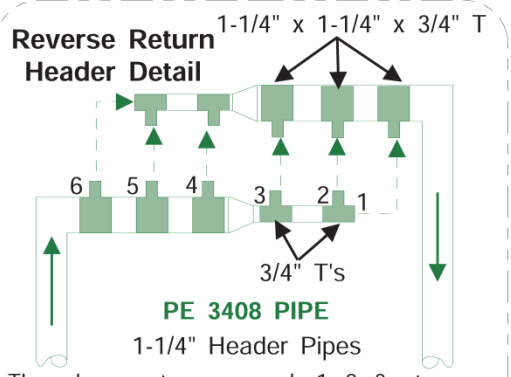
Vertical Layout Example 2



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

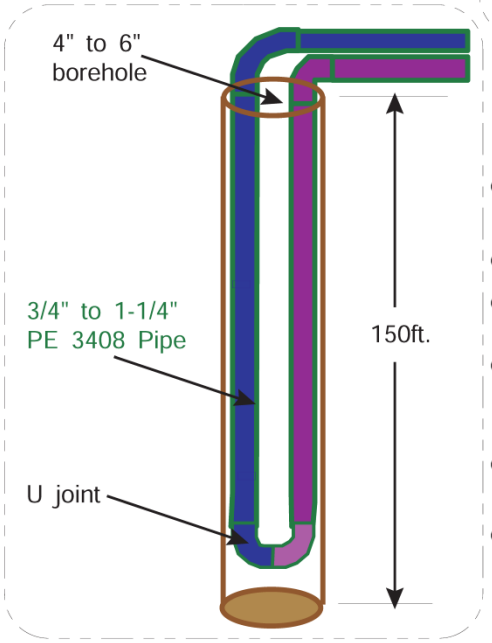


Reverse Return Header Detail



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

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Approved By (MFG):	Date:	
Approved By:	Date:	

MARITIME GEOTHERMAL LTD.
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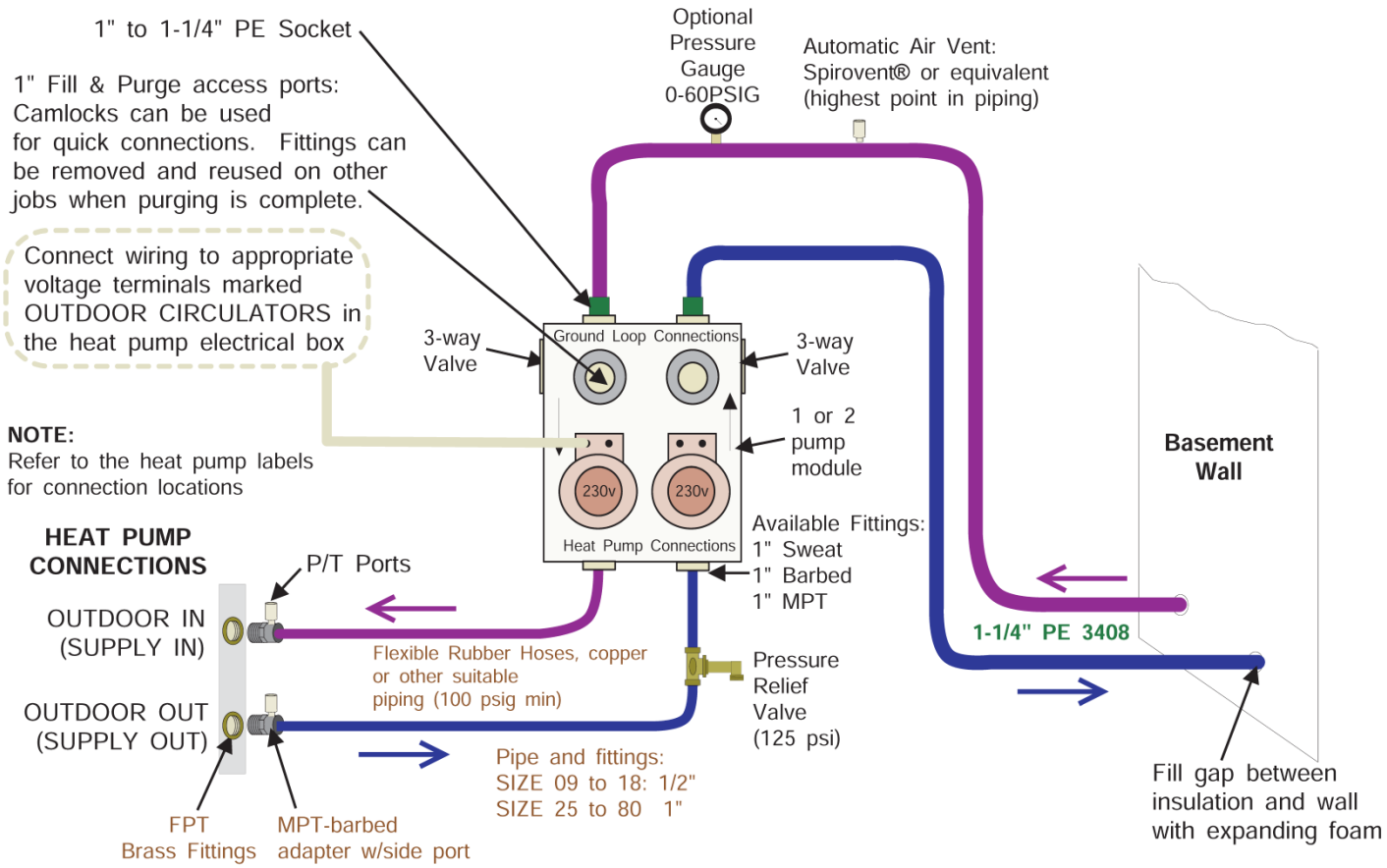
Petitcodiac, NB
E4Z 6H4

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)

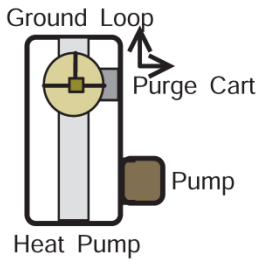


NOTES:

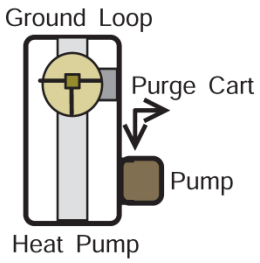
- Circulator Pump Module should be mounted vertically to minimize the possibility of air locking the circulators.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Holes through the foundation / structure should be filled 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)

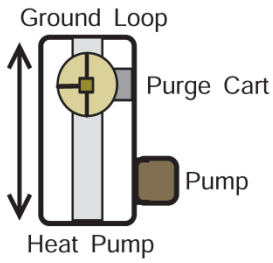
1. Valve in Loop fill/purge position.



2. Valve in HP fill/purge position



3. Valve in normal running position.



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

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

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
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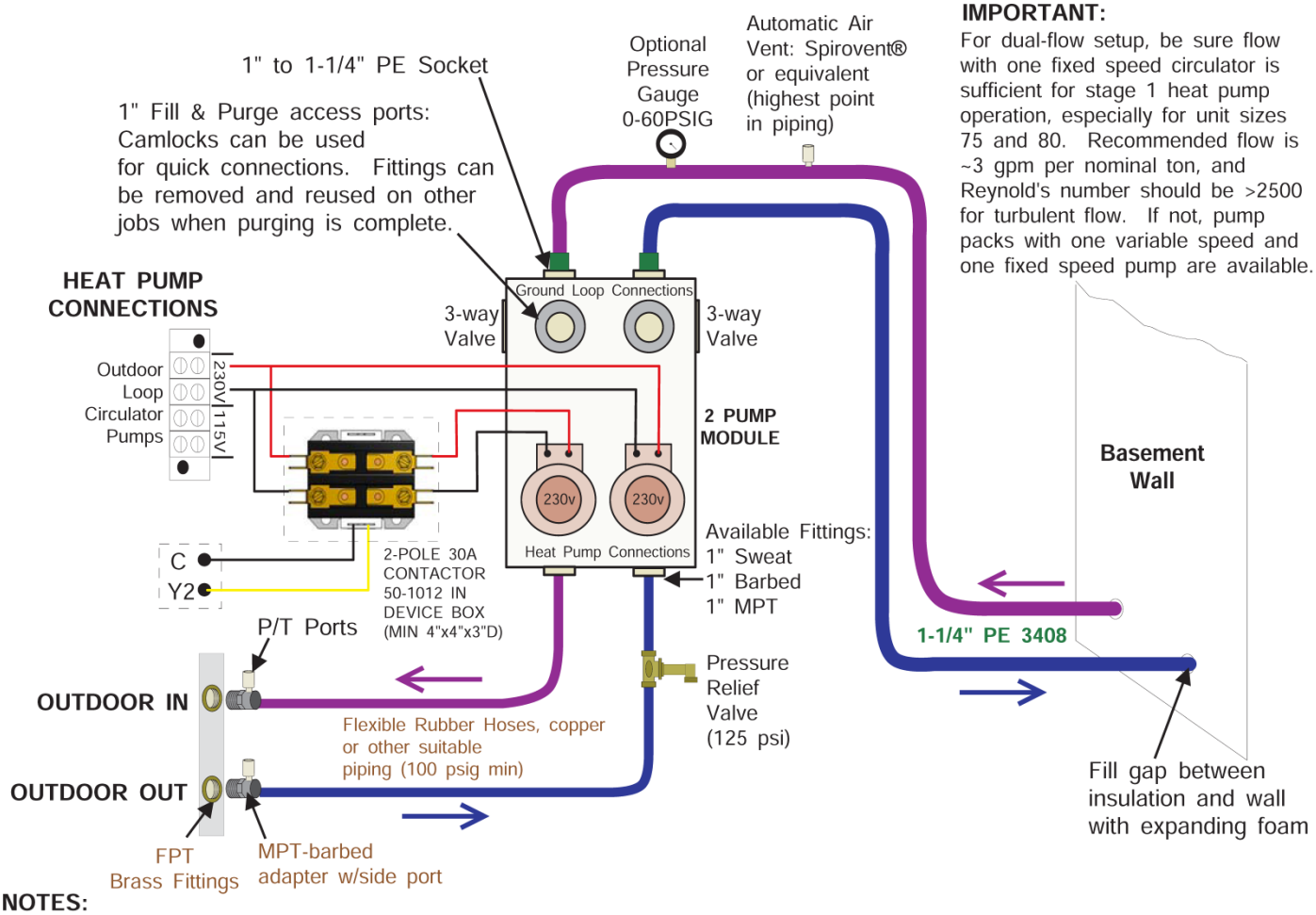
Drawing Name: Geo-Flo Circulator Pump Module Installation (Brass FPT)

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

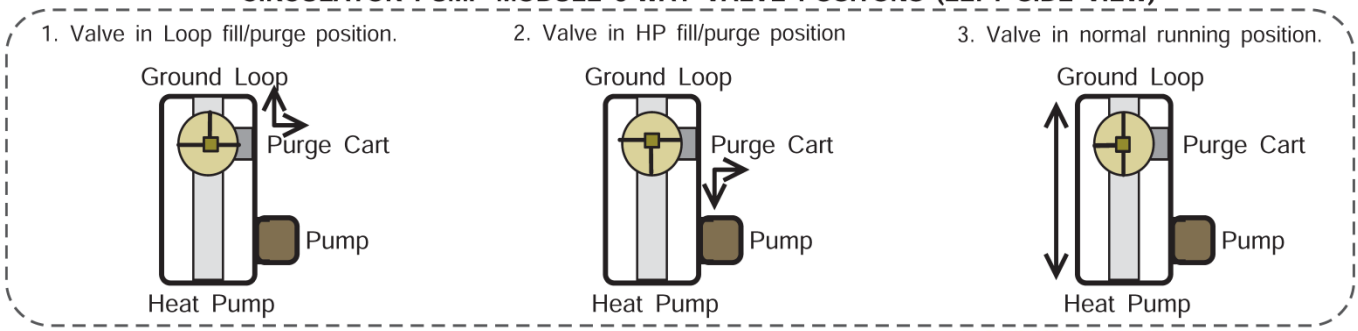
Dual Flow Circulator Pump Module Installation for 2-Stage Heat Pumps



NOTES:

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

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



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

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

Open Loop Installations

Well Water Temperature

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

The groundwater 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 **TABLE 10**.

TABLE 7 - Required Flow

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, this should be verified 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.

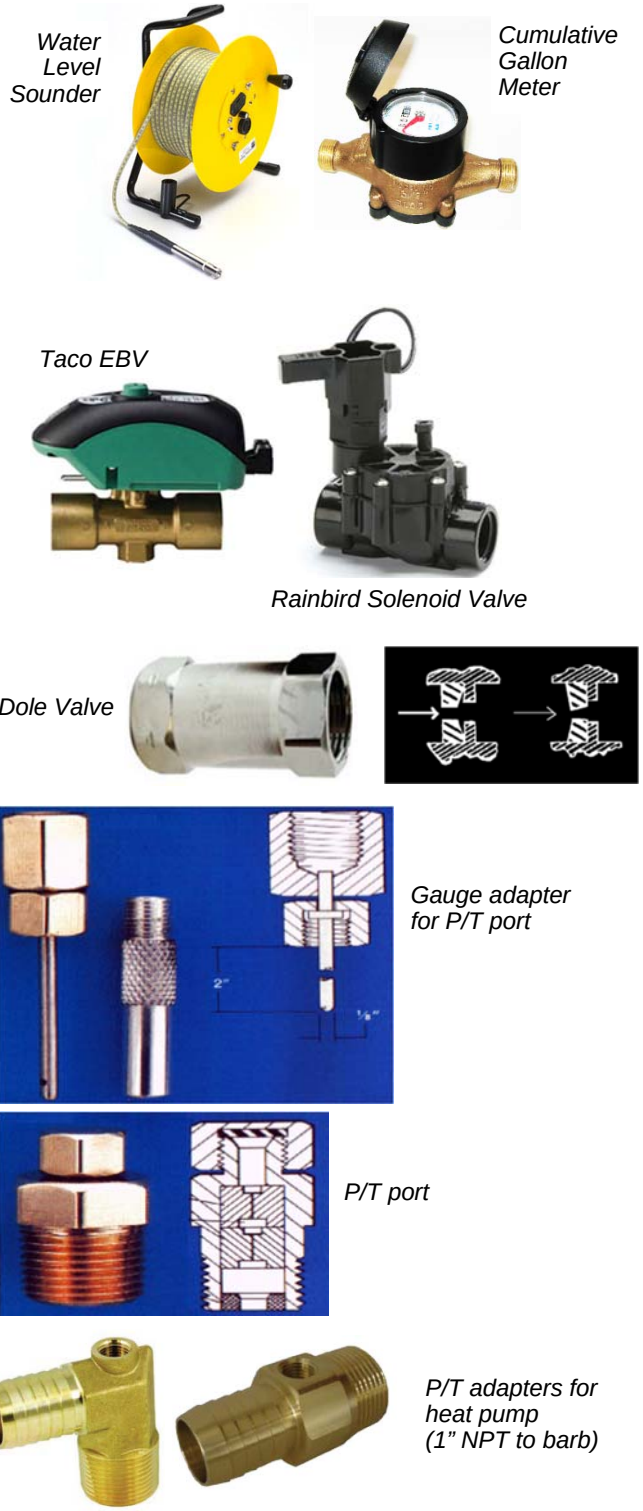
Acceptable methods for disposing of the waste water are listed below. The waste water is clean; the heat pump has no effect other than reducing the temperature of the water. **Refer to drawing 000907INF** for typical disposal method diagrams.

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

ENSURE SELECTED METHOD CONFORMS TO LOCAL REGULATIONS.

A return well should be a minimum of **80 ft.** from the supply well for residential applications. The water returned to the well

Figure 3: Open Loop Accessories & Tools



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 two types of water valves available from Maritime Geothermal.

Most installations use a 'Taco' slow closing motorized ball valve (EBV). This takes ~5 seconds to close, and avoids the water hammer which can occur with faster acting valves. There is also a more economical fasting acting 'Rainbird' solenoid valve available, for applications where water hammer is not expected. **Both come with a wiring harness, which plugs into a connector behind the pipe post of the heat pump. 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 (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.

Stage 1 vs. 2 on Open Loop

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 normal usage, the efficiency of such a pump is not particularly important, due to short run times in a domestic water system. 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.

The significant power draw of 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 as OUTDOOR IN and OUTDOOR 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" copper or plastic line should be run to the Outdoor IN (Supply IN) pipe of the heat pump. Similarly, a 1"' 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 **Figure 1** in the Ground Loop section 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.

As mentioned earlier, 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.

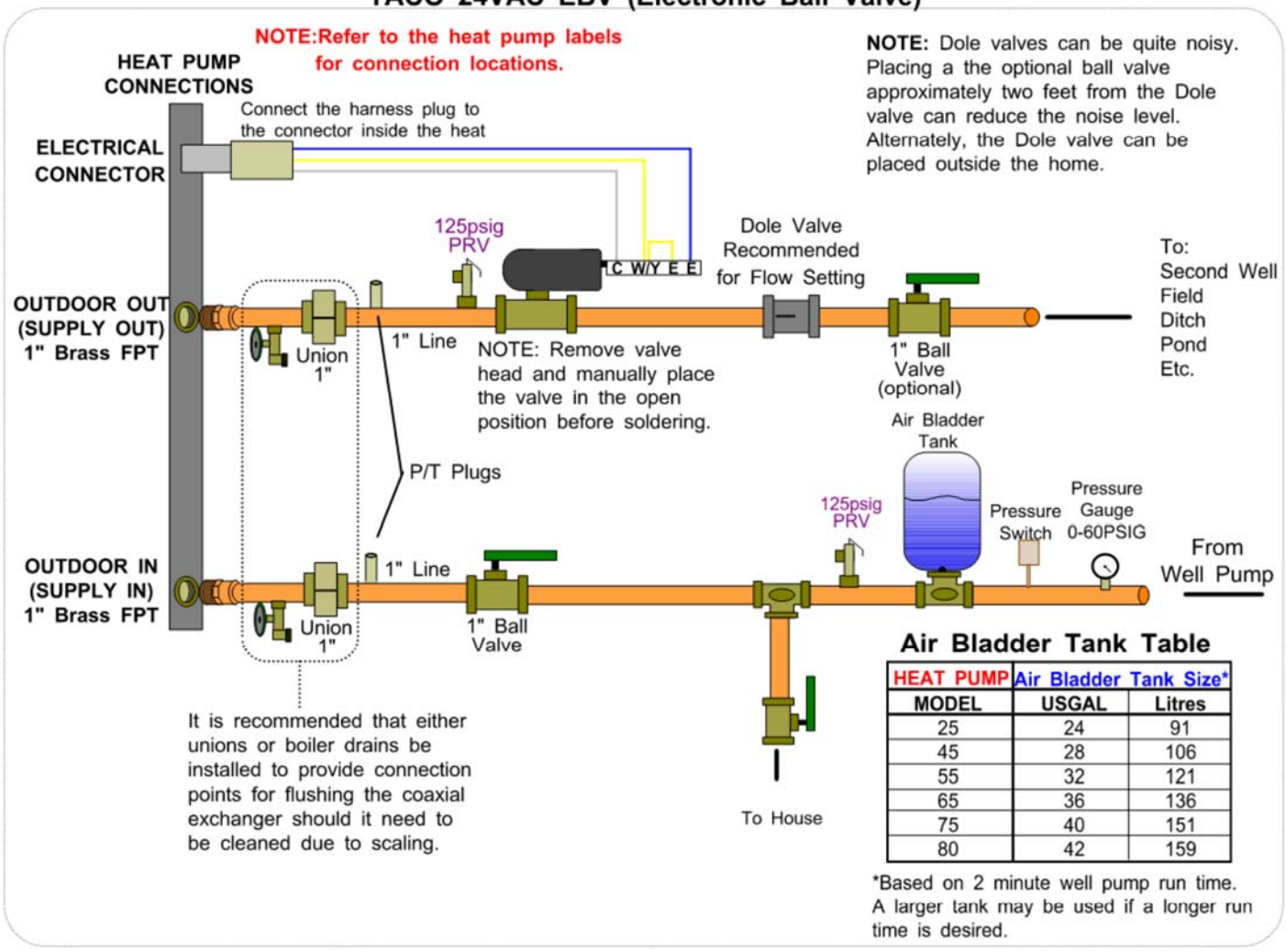
With proper flow, there should be **5-7°F (3-4°C)** delta T between the IN and OUT water temperatures of the heat pump when operating in the heating mode.

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)



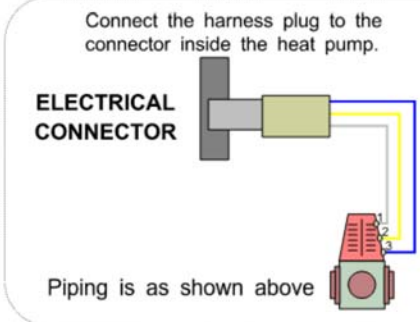
NOTE: Dole valves can be quite noisy. Placing a the optional ball valve approximately two feet from the Dole valve can reduce the noise level. Alternately, the Dole valve can be placed outside the home.

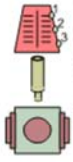
Air Bladder Tank Table

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

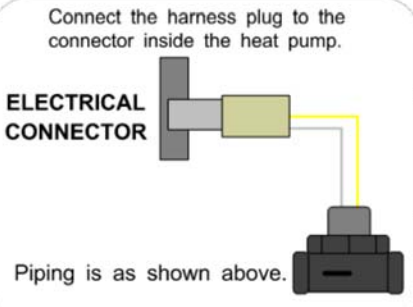




NOTE: Ensure the pin is installed in the proper orientation as shown here when re-installing the head.

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

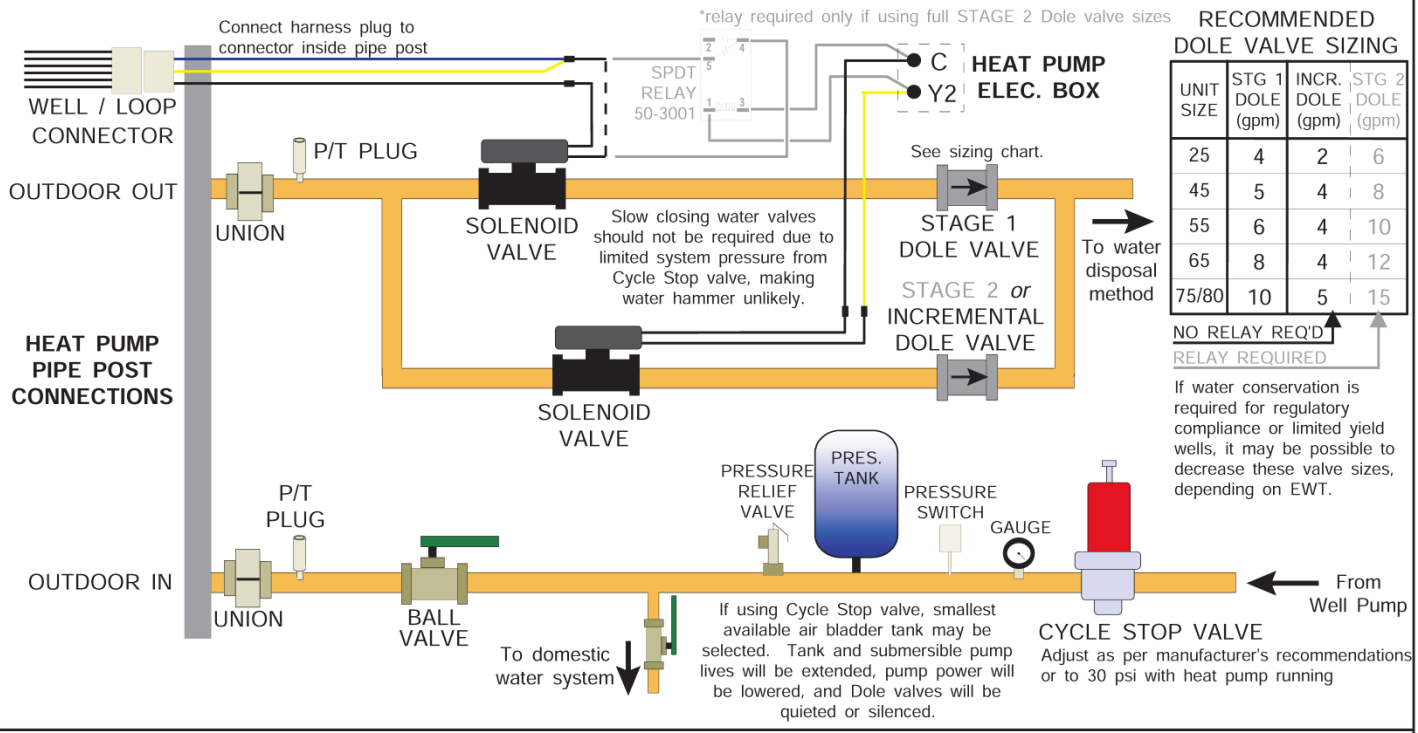
Drawn By: Chris Geddes — Date: 10 DEC 08
Checked By: Chris Geddes — Date: 10 DEC 08
Approved By (ENG): Chris Geddes — Date: 10 DEC 08
Approved By (MFG): — Date:
Approved By: — Date:

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

1. Dual-Flow Groundwater (Well) Installation



RECOMMENDED DOLE VALVE SIZING

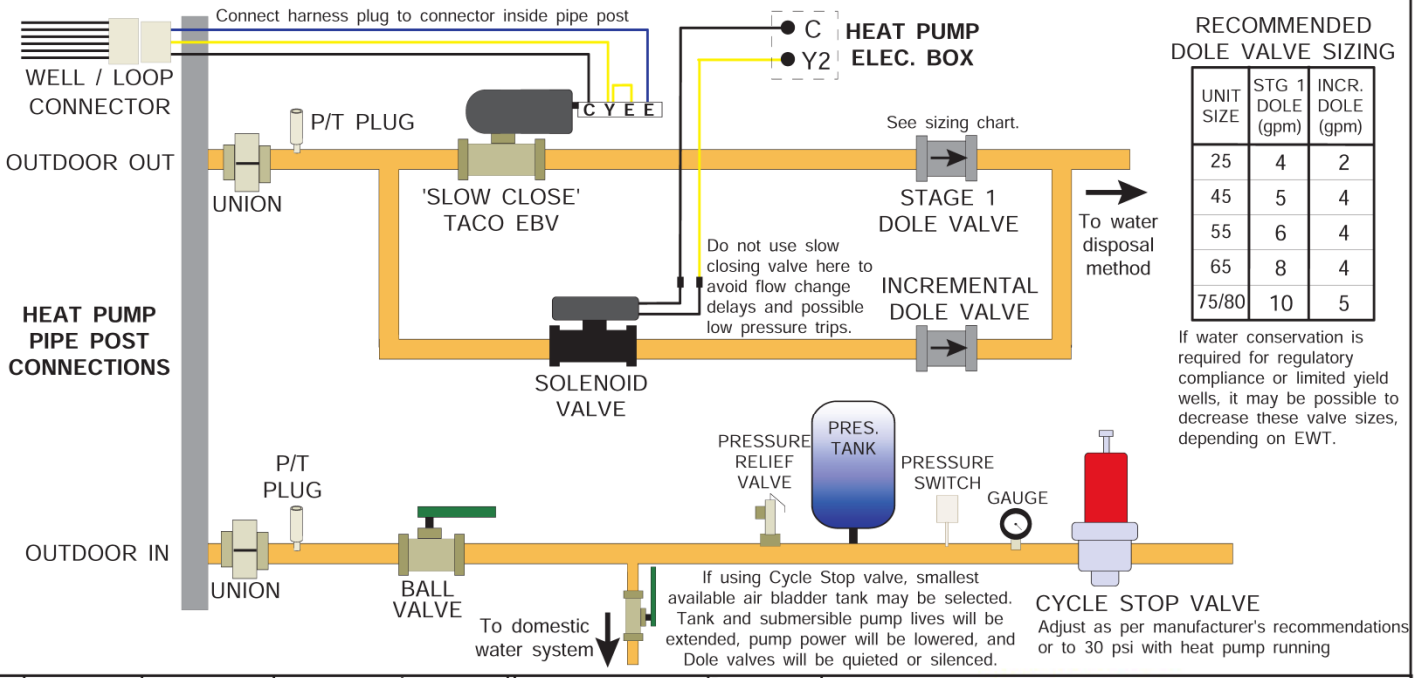
UNIT SIZE	STG 1 DOLE (gpm)	INCR. DOLE (gpm)	STG 2 DOLE (gpm)
25	4	2	6
45	5	4	8
55	6	4	10
65	8	4	12
75/80	10	5	15

NO RELAY REQ'D
RELAY REQUIRED

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

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

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



RECOMMENDED DOLE VALVE SIZING

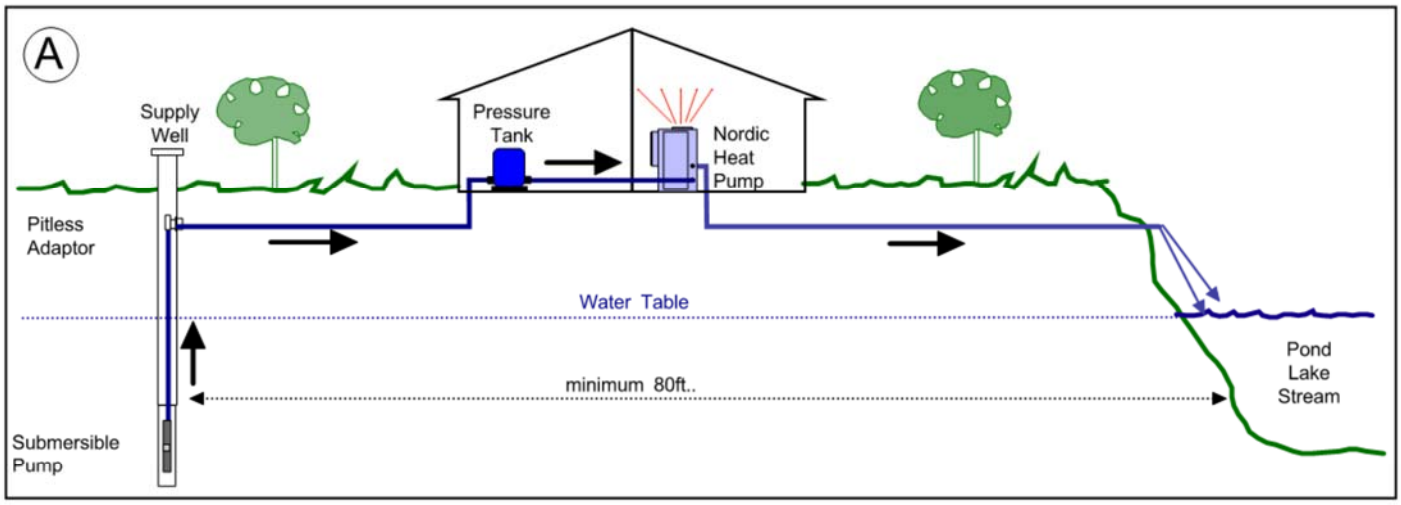
UNIT SIZE	STG 1 DOLE (gpm)	INCR. DOLE (gpm)
25	4	2
45	5	4
55	6	4
65	8	4
75/80	10	5

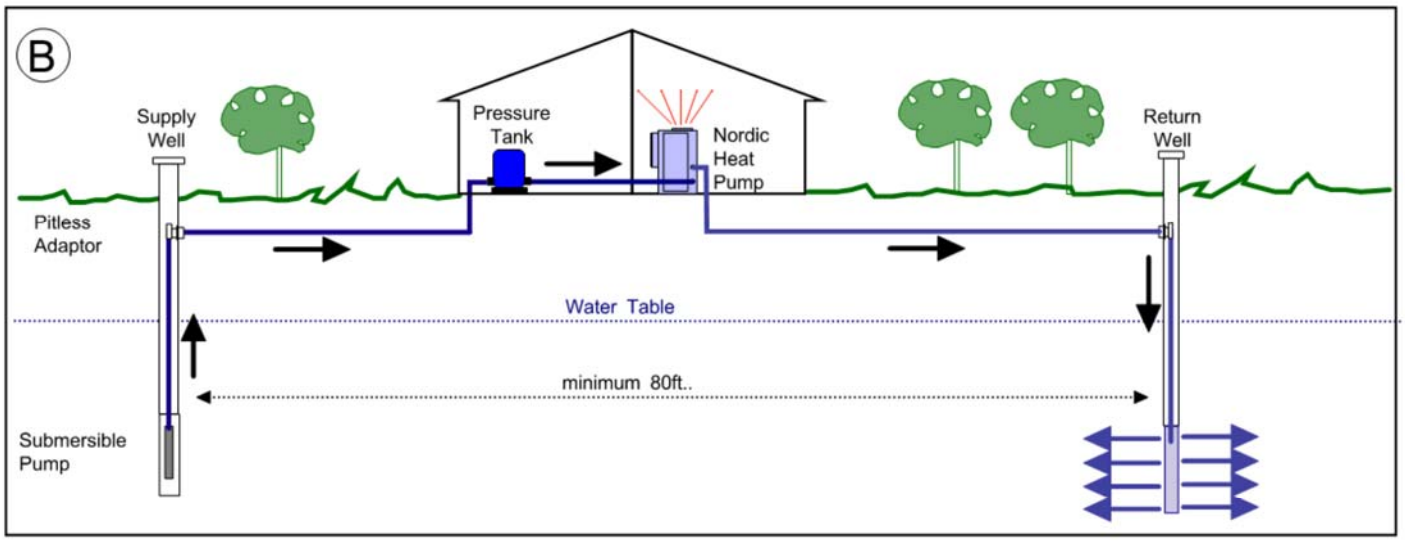
If water conservation is required for regulatory compliance or limited yield wells, it may be possible to decrease these valve sizes, depending on EWT.

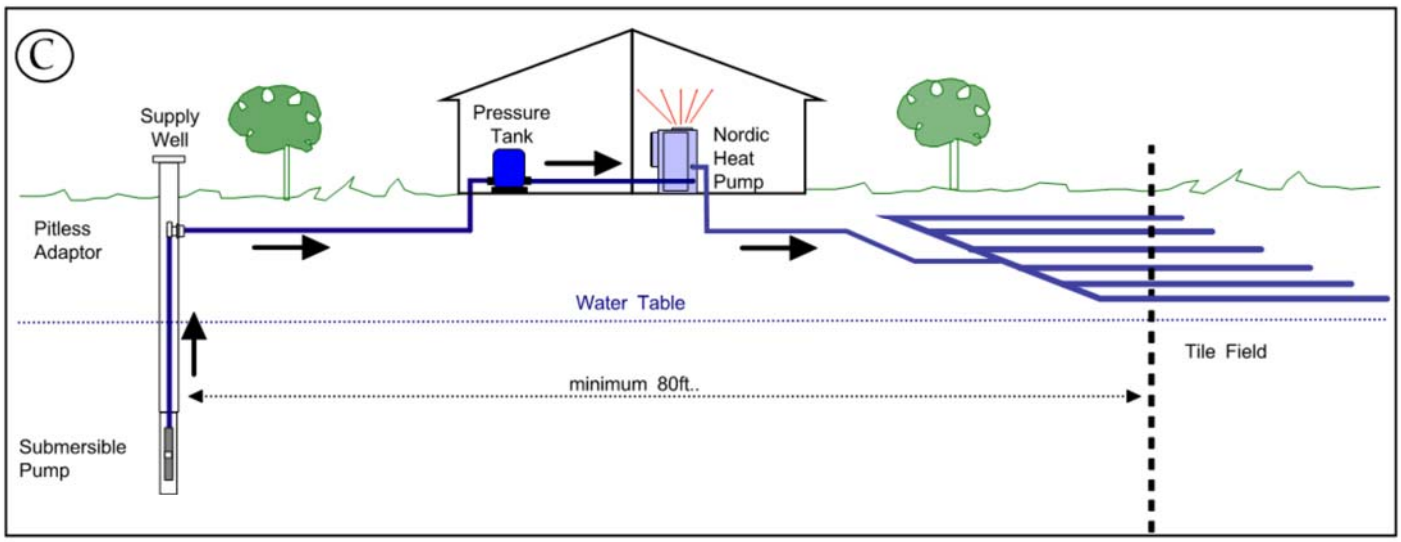
REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	22-Nov-2013

Drawn By: Dan Rheault	Date: 22-Nov-2013	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 22-Nov-2013	
Approved By (ENG)	Date	Drawing Name: Dual-Flow Groundwater (Well) Installation for Size 25-75 Heat Pumps
Approved By (MFG)	Date	
Approved By	Date	Size: A; Drawing Number: 001822CDG; REV: 01; SHEET: 1 of 1

GROUND WATER DISPOSAL METHODS







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

Operation

BACnet Control

If controlling the system via the BACnet interface, skip the entire **Operation** section. In this case, see the **BACnet Interface** section later in this manual for network specification and BACnet object names.

Setpoint Control

One of the features of the EMW's GEN2 Control Board is built in temperature control functionality known as "Setpoint Control". This is an internal routine to sample the water temperature between the heat pump section and the buffer tank to determine if hydronic heat is required.

Both water IN and OUT temperatures are measured using sensors on water lines inside the unit, but only the OUT temperature is used for control. The indoor circulator pump is turned on at regular intervals to refresh the water temperature. Its value is displayed in the **Tank Temperature** box on the PC App's **View --> Setpoint Control** screen and on the LCD. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it. (See following chapter for more details on using the PC App.)

The heat pump will cycle the indoor circulator on and off when the unit is idle to sample the water temperature. When hydronic 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** screen.

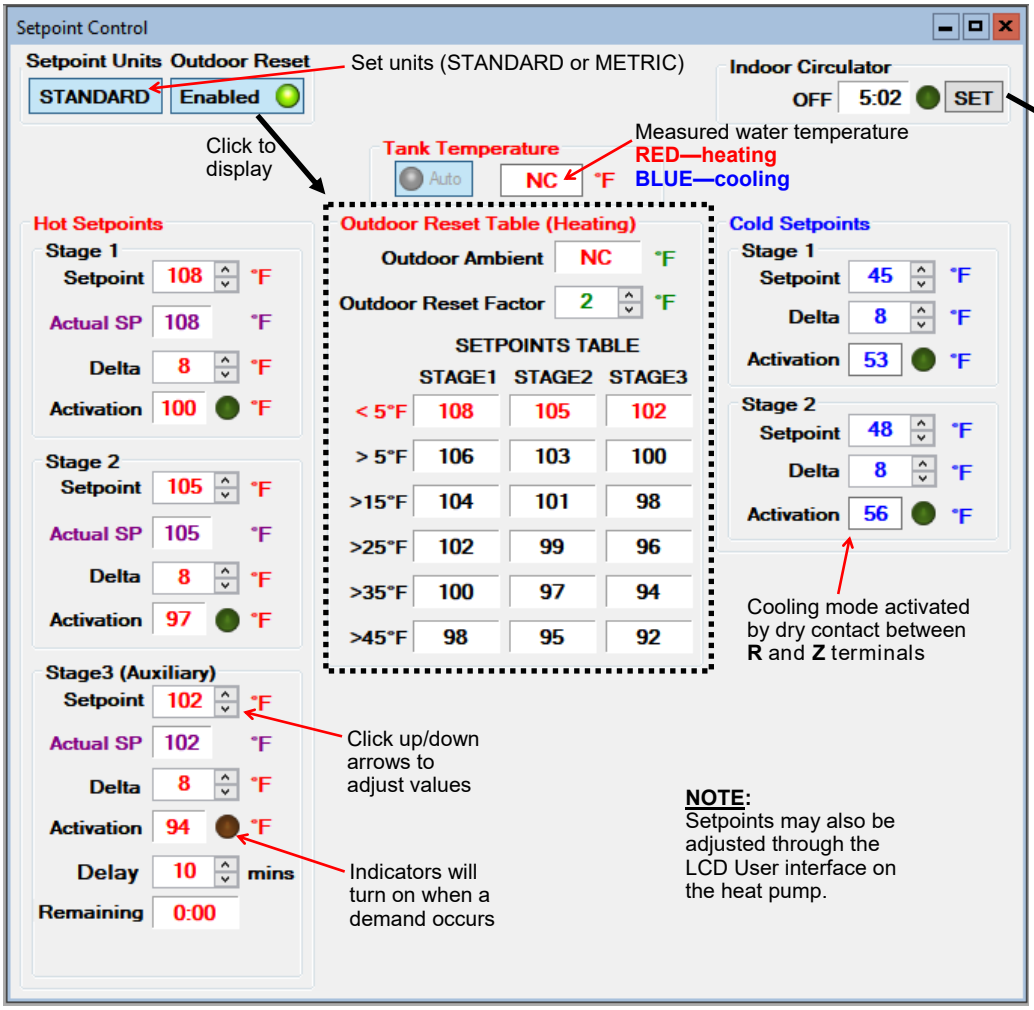
The timer counts down the time remaining before the next switch between ON/OFF. The indoor circulator indicator will indicate when the circulator is ON, OFF or SAMPLING. The default sampling times are 2 minutes ON and 6 minutes OFF. The LCD display will also indicate when the ICR is sampling (ON). The ***Timer Override*** button will reduce the countdown timer to 10 seconds.

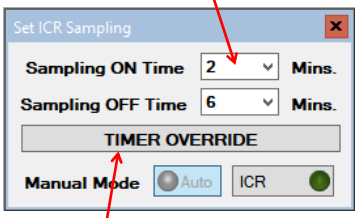
TABLE 8 - Typical Temperature Settings

HEATING						
	Stage 1		Stage 2		Stage 3 (AUX)	
Item	°F	°C	°F	°C	°F	°C
Setpoint	108	42	105	41	102	39
Delta	8	4	8	4	8	4
Activation *	100	38	97	37	94	35
Delay					10 minutes	

COOLING						
	Stage 1		Stage 2			
Item	°F	°C	°F	°C		
Setpoint	45	7	48	9		
Delta	8	4	8	4		
Activation *	53	11	56	13		

*Activation is determined by the Setpoint and Delta values





WARNING: When using Manual Override mode (activated by button on title bar of PC App), operation 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 1/2 buttons.

If the in-floor heating design is well done, the heating setpoints may be able to be lowered. They should be set to lowest value that still maintains an acceptable comfort level in order to achieve maximum hydronic mode efficiency. Increasing Delta values will also increase efficiency due to longer runtimes and hence a reduced number of compressor starts.

Outdoor Reset

An optional Outdoor Reset control algorithm is available for heating mode. This refers to built-in functionality which reduces the heating temperature setpoints at warmer outdoor temperatures, as measured by an accessory outdoor temperature sensor.

The first step after installing the outdoor sensor is to enable it in the **Tools-->Configuration** window.

Then to enable Outdoor Reset, click on the Outdoor Reset button at the bottom of the Setpoint Control screen. The button will change to say Enabled, the indicator will come on, and the Outdoor Reset table will appear.

The Heating Setpoints Adjustments will move to the top row of the Outdoor Reset Table. The Delta Adjustments will remain where they were. The current Setpoint Value based on the outdoor temperature is displayed where the Setpoint Adjustments were originally. The Outdoor Reset Table row in use based on outdoor temperature will turn red.

The Outdoor Reset Table is created by subtracting the value of the Outdoor Reset Factor from the original setpoints once for each table row . The original setpoints are located in table row 0 (<10F). The next row down equals the row above minus the Outdoor Reset Factor.

The original setpoints are the hottest temperature desired. The calculated row setpoints will decrease as the outdoor temperature rises, and increase back towards the original setpoints as the outdoor temperature drops. This improves system efficiency by maintaining a lower tank temperature when hotter tank temperatures are not needed due to the warmer weather.

Auxiliary Heat (Stage 3)

While stage 1 and stage 2 are the two stages of compressor (and therefore heat pump) operation, stage 3 operates the electric elements in the built-in buffer tank. These provide auxiliary heat in case the heat pump is sized to less than the maximum heat load, or backup heat in case of a heat pump problem.

The unit is shipped with the electric heat breaker in the off position. Before turning it on, ensure the tank is full of water and pressurized, since an electric element that is not under water will burn out in a matter of seconds.

To prevent element damage and also to protect against the risk of explosion should the tank be filled with flammable vapours from antifreeze instead of with water or water/antifreeze mixture, there is a safety pressure switch mounted to the side of the buffer tank. **Note that the electric heat contactor will not engage unless the pressure in the indoor loop is above 10 psig.**

Status Indicator Lights

The EMW-Series unit has three indicator lights on the front of the heat pump. They are described in the table.

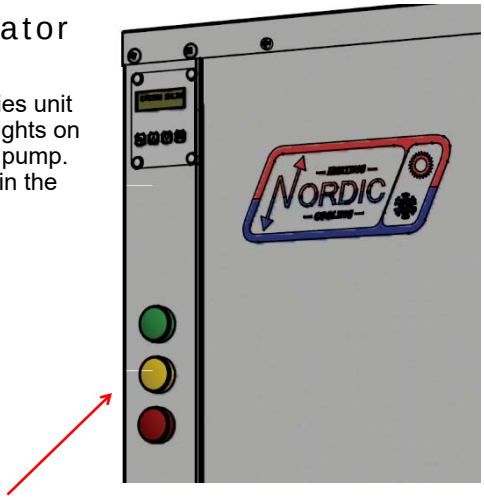


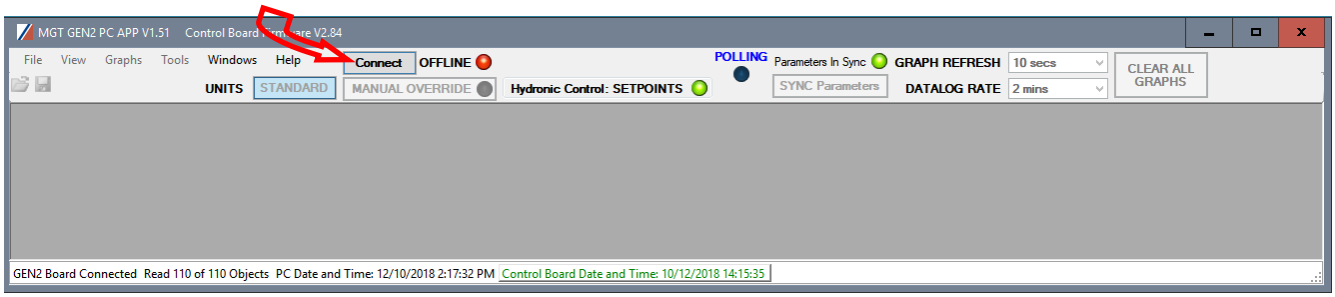
TABLE 9 - Indicator Lights

Colour	Indicates
Green	Compressor ON
Yellow	Electric Elements ON
Red	Trouble (Alarm - Locked out)

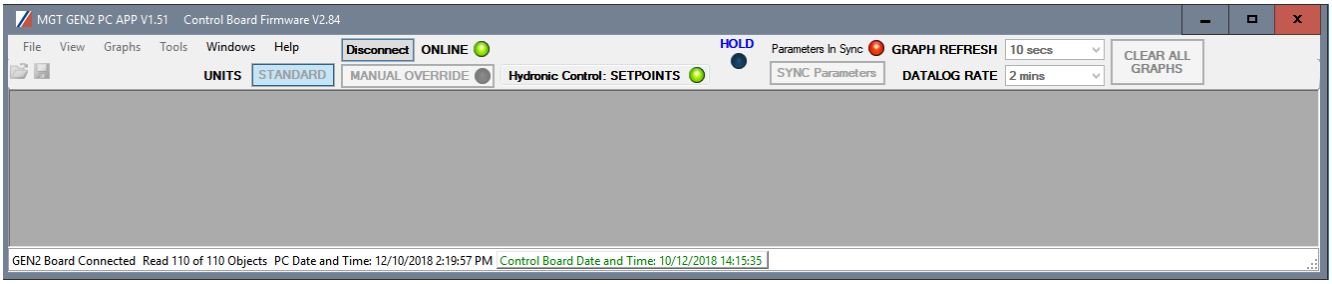
PC Application (PC App)

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.

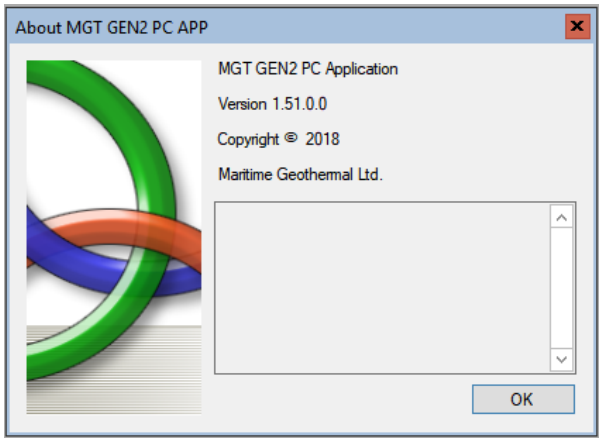
File-->Open: Opens a saved page arrangement.
File-->Save: Saves the current page arrangement under the current name.
File-->Save As: Save the current page arrangement under a new name.
File-->Exit: Exits the PC Application.

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.

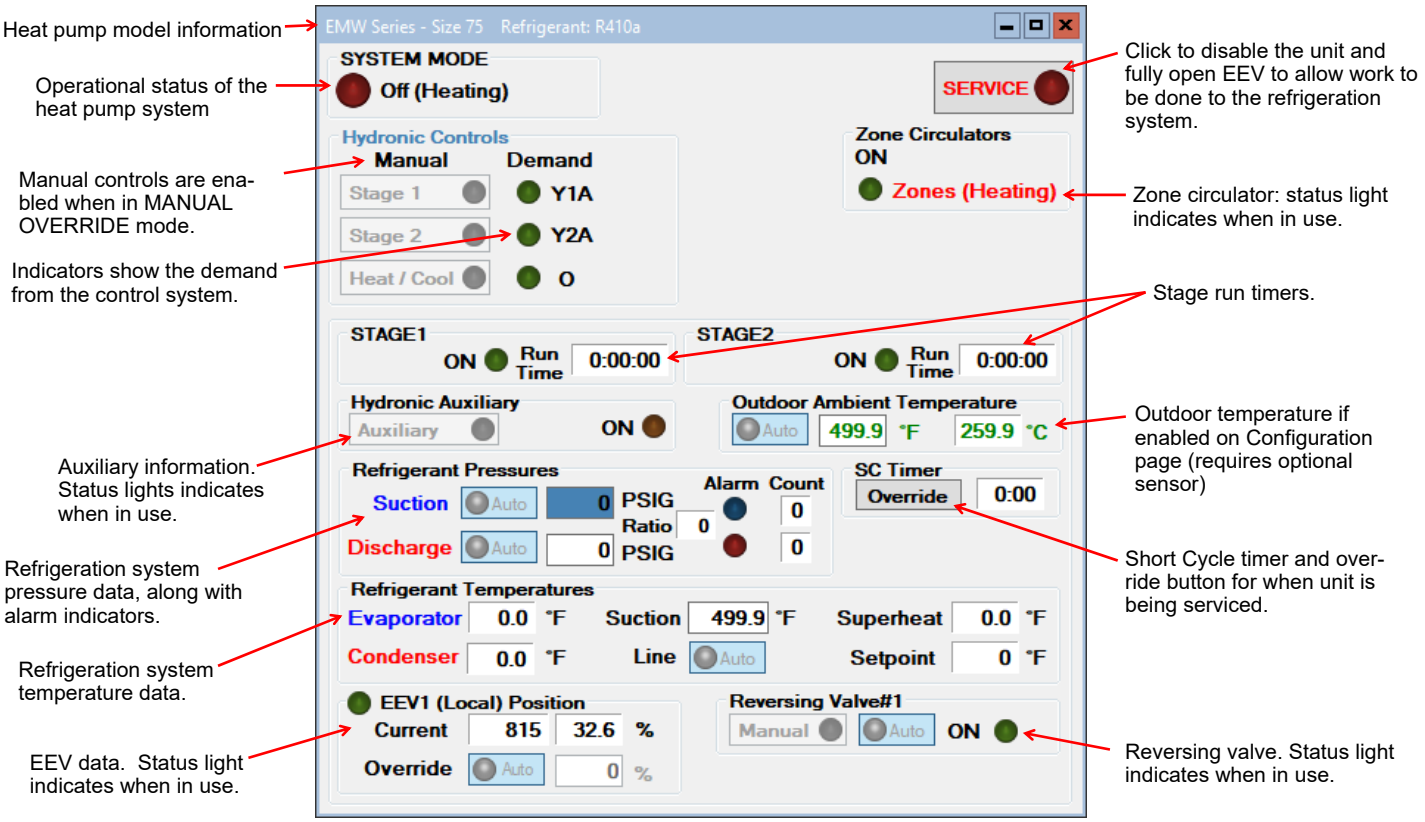
Help-->About: Displays the window shown to the right.



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**).

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

View-->Alarms, Limits and Faults

The alarms page has four tabs:

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

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

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

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

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

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

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

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

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

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

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

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

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

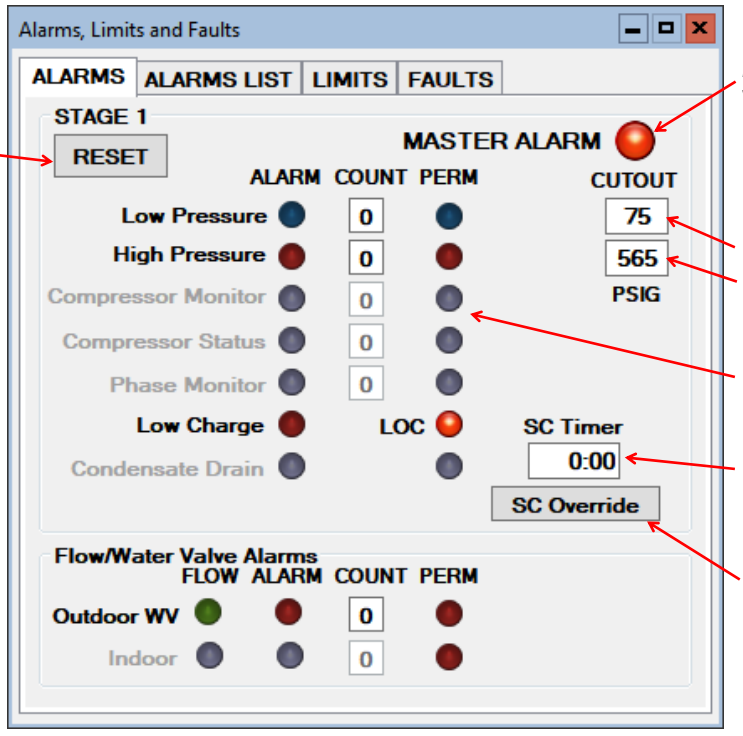
Loss of Charge (LOC): This alarm occurs if both the low pressure and high pressure sensors are below 30 psig (207kPa).

Outdoor WV: Outdoor loop water valve end switch did not close (open loop only).

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

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

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



Master Alarm occurs when any alarm occurs.

Low Pressure cut out.
High Pressure cut out.

Greyed out alarms are not applicable to the system.

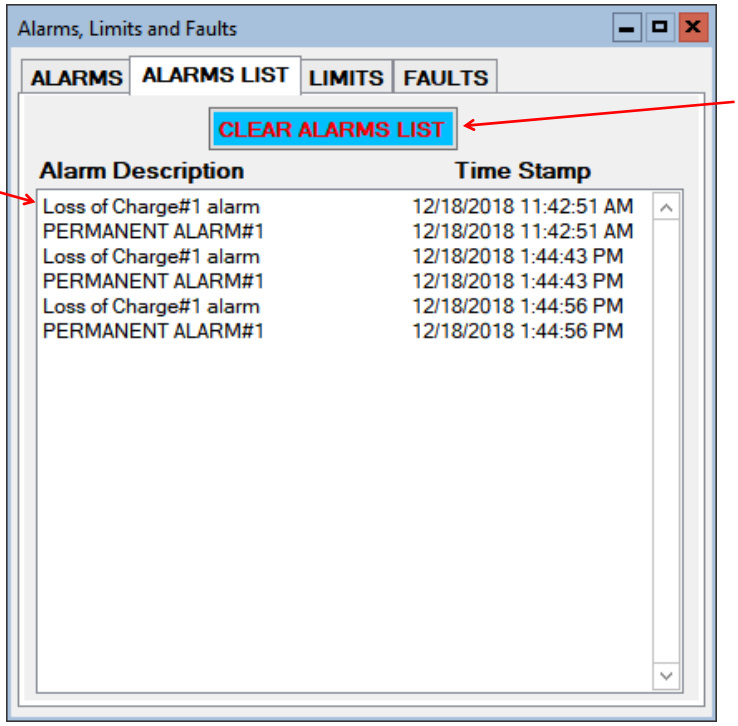
Short Cycle Timer counts down time until the next compressor start is allowed.

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

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

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

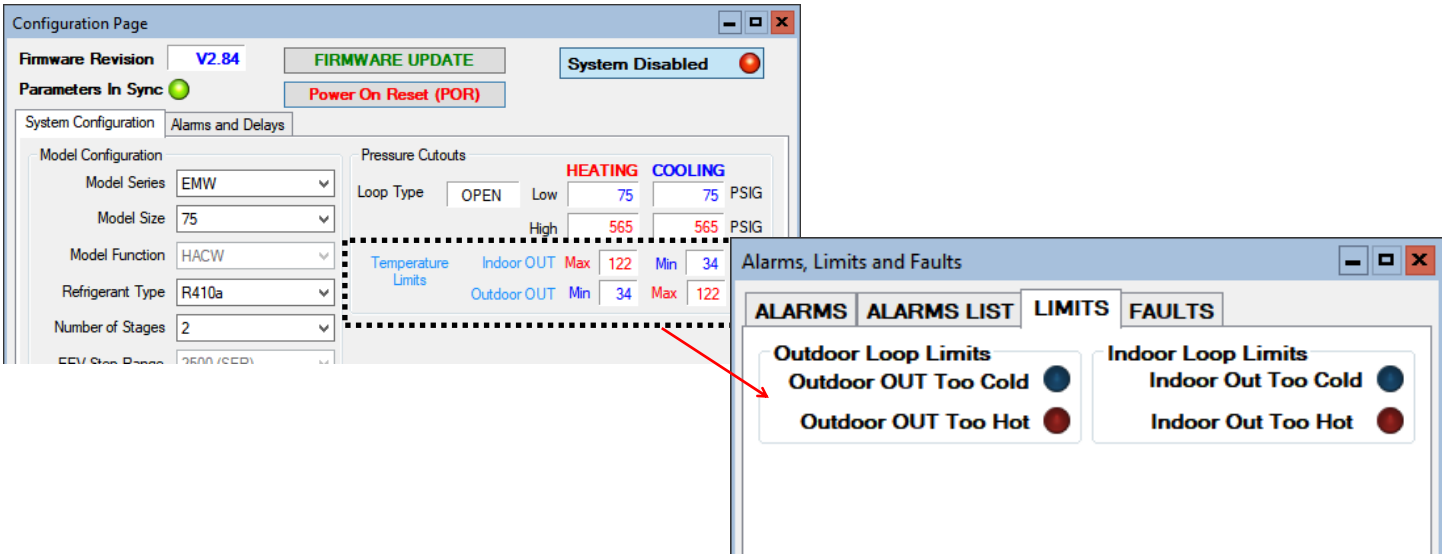
Each alarm that occurs while the PC APP is connected to the control board will appear here. The alarm type and a time stamp will be shown. The alarms list will be erased when the PC APP is disconnected from the control board.



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

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

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



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

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

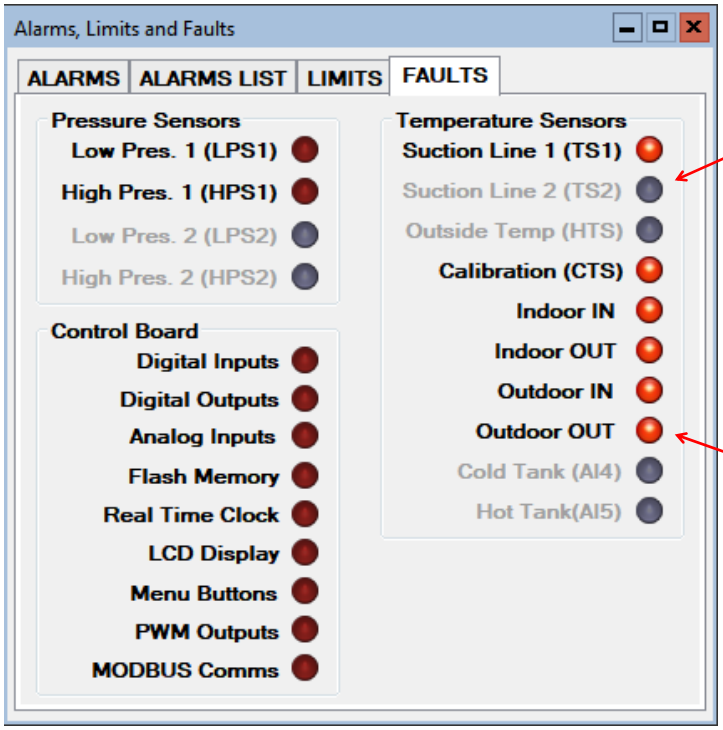
If a fault occurs, some things to try:

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

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

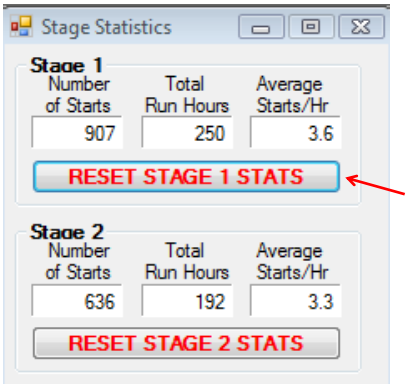
IMPORTANT NOTES: The heat pump will not operate if the Outdoor Ambient probe (HTS) is faulty or disconnected. The auxiliary will continue to operate but its setpoint value may be reduced if using the Outdoor Reset function.

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



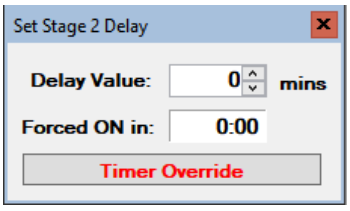
View-->Stage Stats:

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



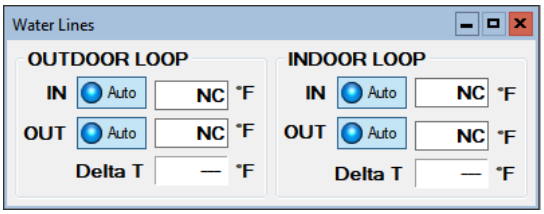
View-->Set Stage 2 Delay:

Sets the delay before stage 2 is engaged on a stage 1 demand. ("0"=no stage 2 engaged on a stage 1 call)



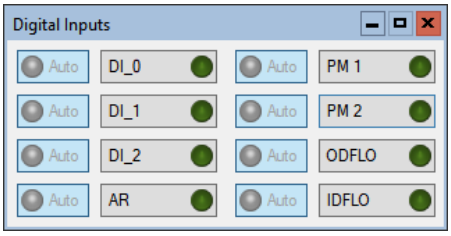
View-->Water Lines

Shows the water line temperatures.



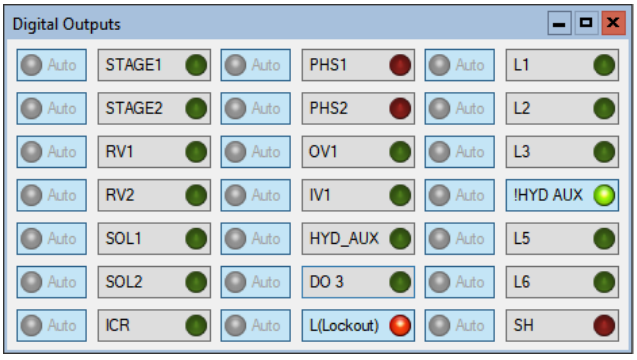
View-->Digital Inputs

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

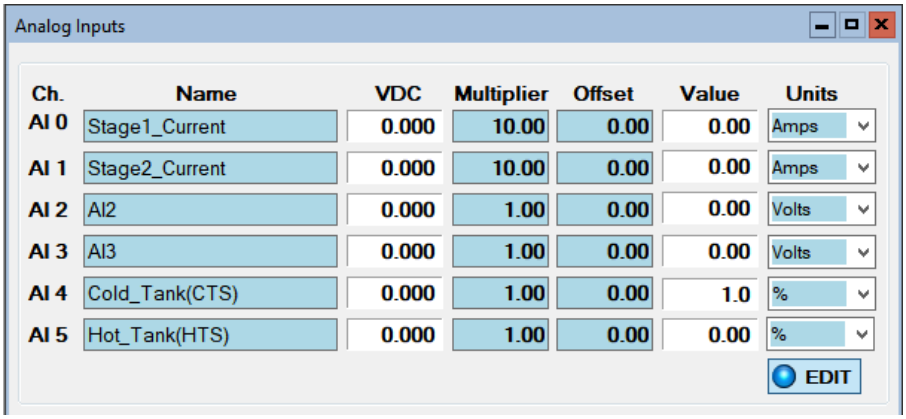
Shows the digital outputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.
.



View-->Analog Inputs

Shows the Analog inputs and their individual settings and values.

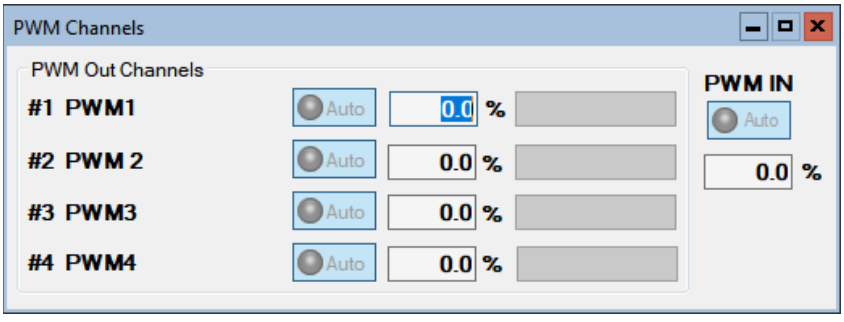
Click on the ***EDIT*** button to modify the blue boxes (button will now say ***SAVE***). For each channel a name may be selected (up to 16 characters), and the multiplier and Offset values may be set to accommodate the connected sensor scaling. Signals may be 4-20mA (channel jumper on board ON) or 0-10VDC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

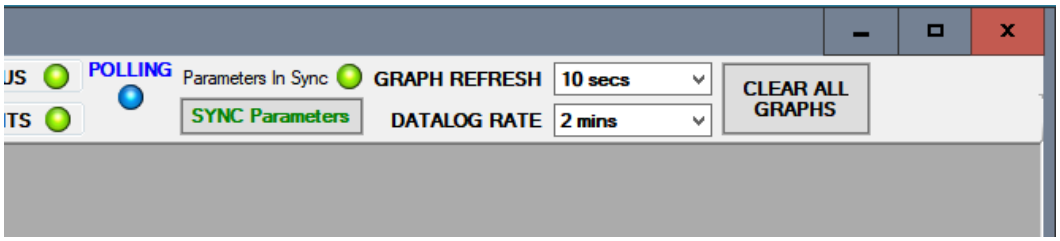
Shows the PWM channels and their individual status (0-100%). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.

EMW-series does not use any PWM channels.

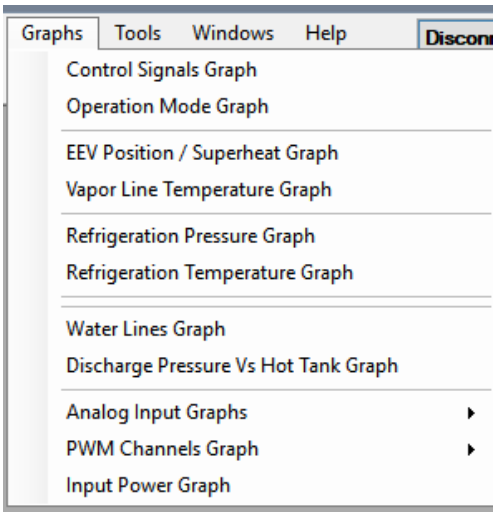


Graphs Menu:

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 and cooling modes.

EEV position and resulting superheat.

Suction temperature.

Suction and discharge pressures.

Evaporation and condensing temperatures.

2 tabs: one for indoor IN/OUT/Delta T, and one for outdoor IN/OUT/Delta T.

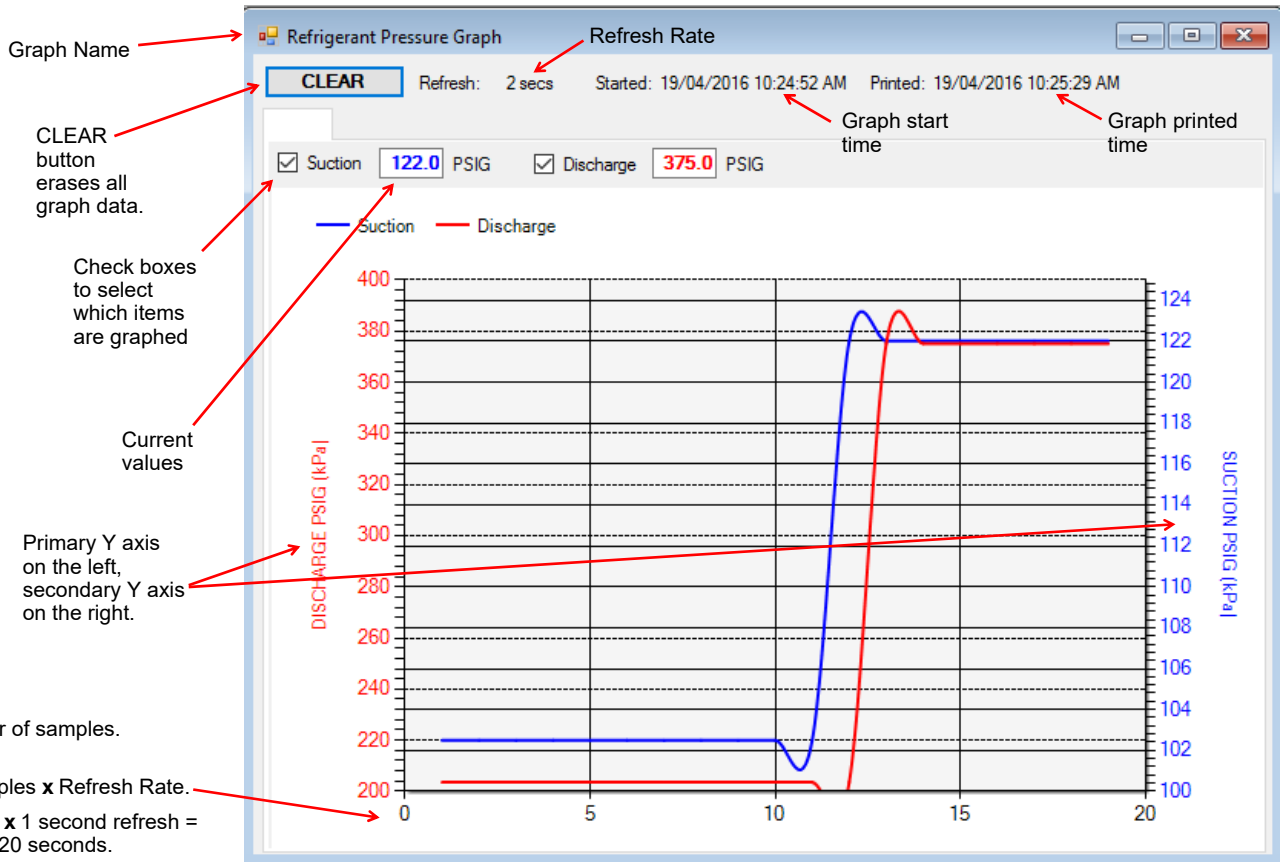
Discharge pressure vs tank temperature.

All analog input channels (0-10VDC or 4-20mA).

All PWM / 0-10VDC output channels and one PWM / 0-10VDC input channel.

For future use.

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.

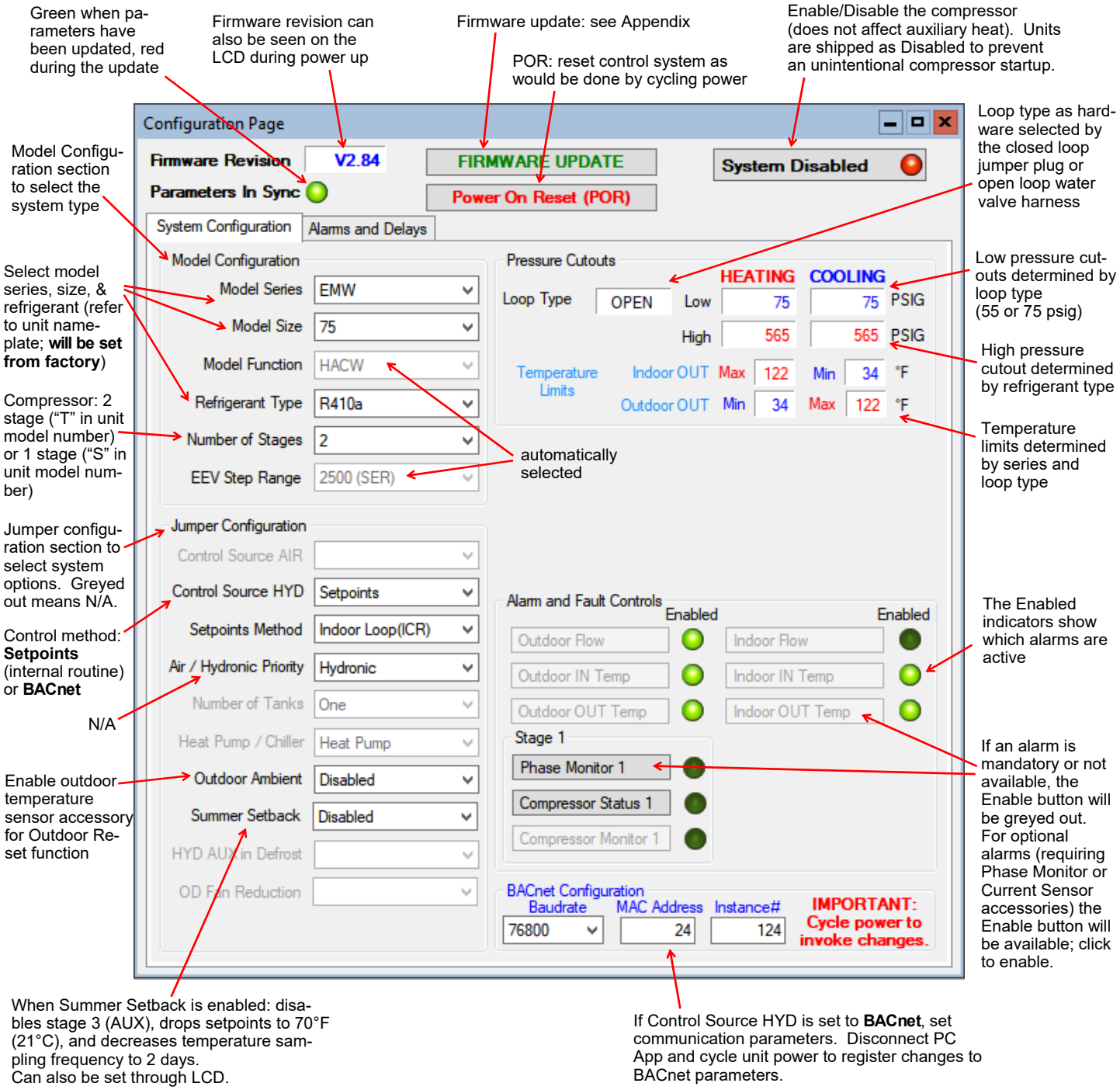


Tools Menu:

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.

The number of minutes before the unit can start again after various alarm shutdowns

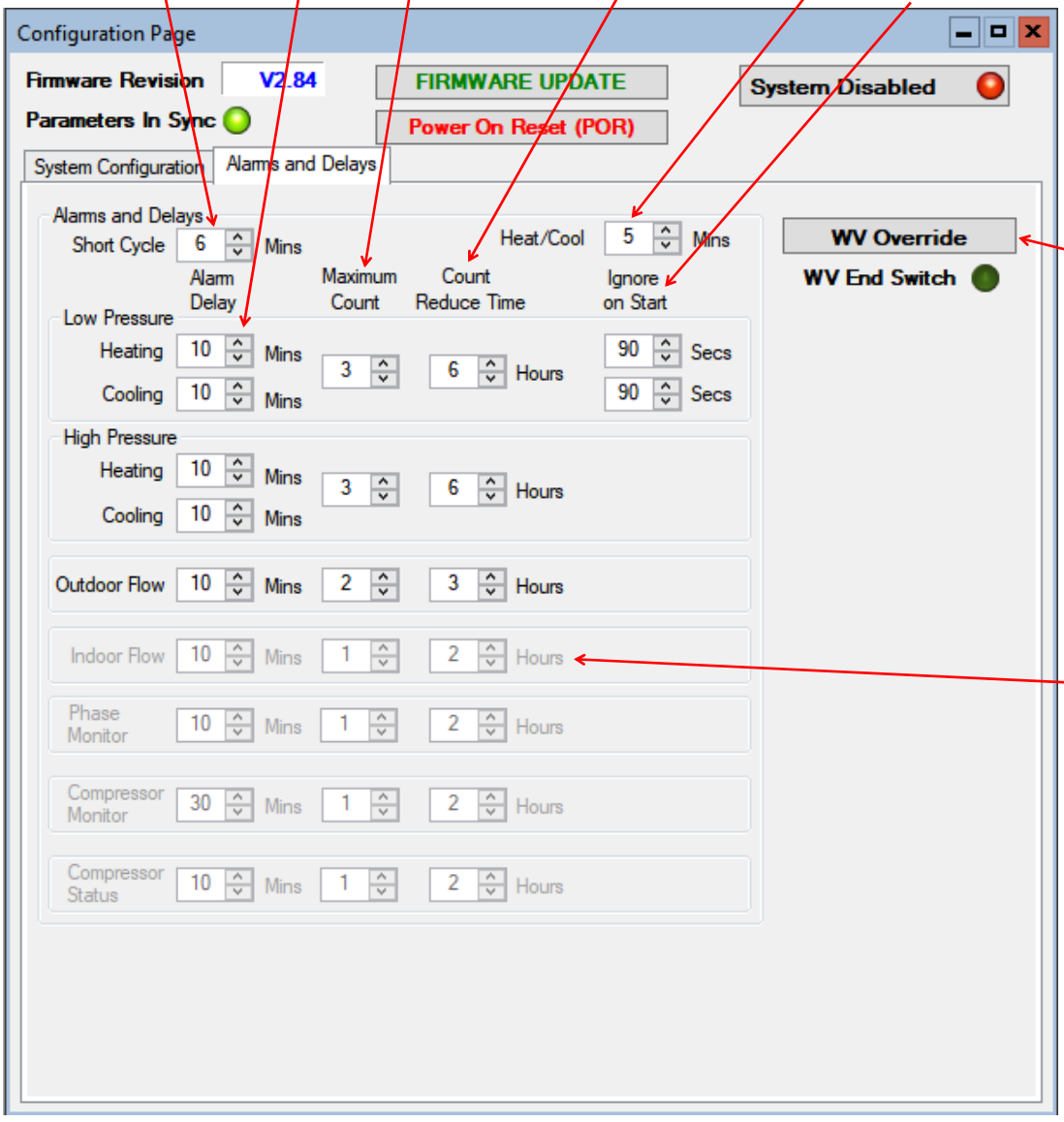
The number of minutes before the unit can start again after a normal shutdown.

Maximum Count is the number of alarms allowed before a permanent lockout occurs.

Count Reduce Time is the number of hours after which the alarm count is reduced by 1 if no other alarm occurred within the timeframe.

The minimum off time when switching between heating and cooling cycles

Ignore On Start is the number of seconds an alarm will not be monitored after a compressor start occurs.



Overrides the alarm indicating that the water valve end switch failed to close (Outdoor WV/ODFLOW)

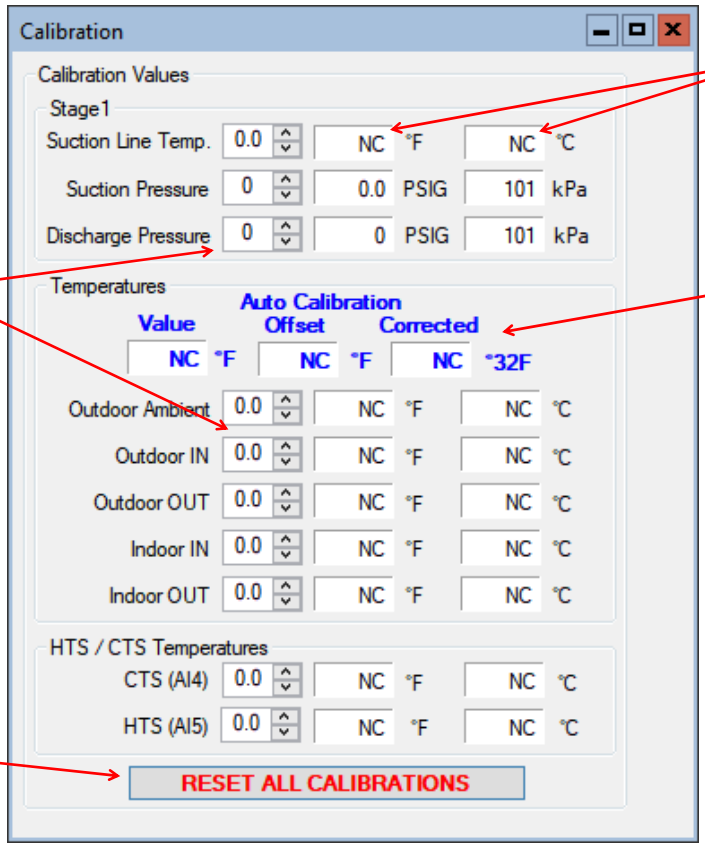
Items that do not apply to the model are greyed out.

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.

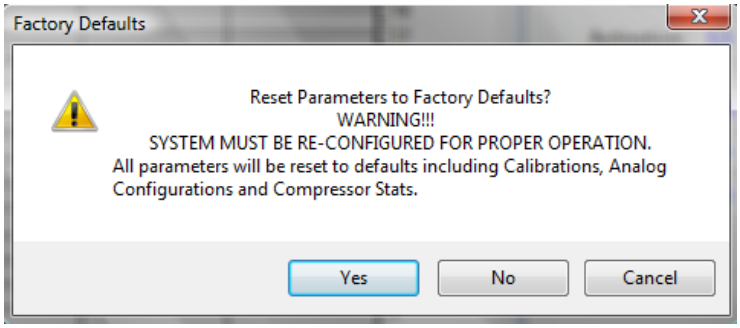
Click on the RESET ALL CALIBRATIONS button to clear all calibration data. A popup window will appear for confirmation.

Tools-->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-->Set Date and Time:

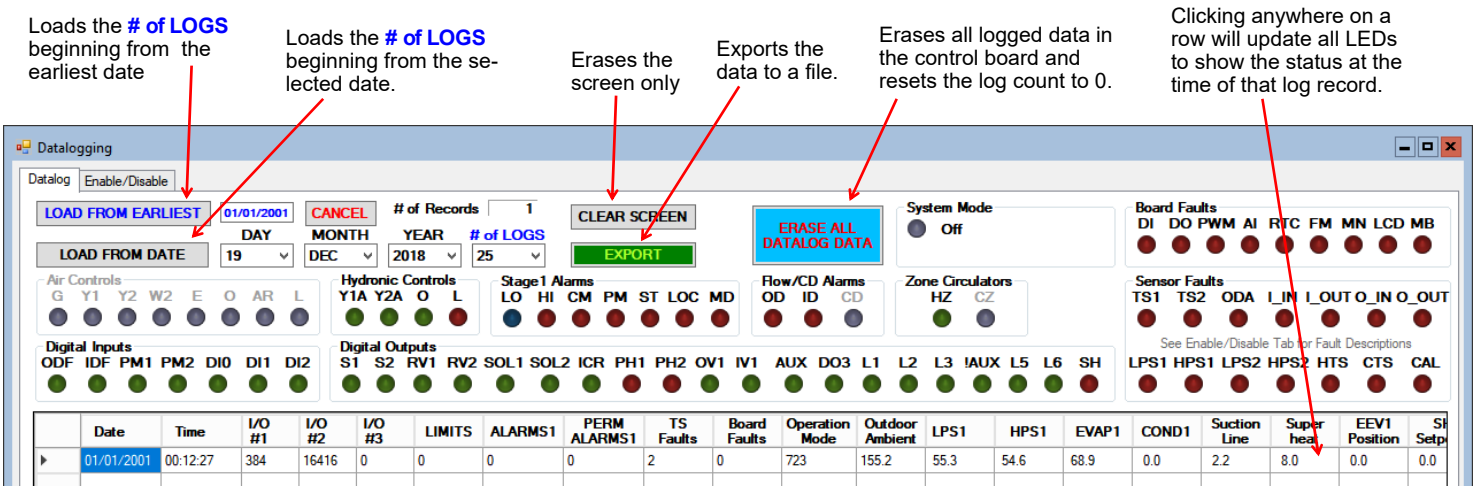
This will synchronize the date and time of the control board with the computer's date and time, and will be necessary for new units or units that have been powered off for several days or more.

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-->Datalogging (Datalog tab):

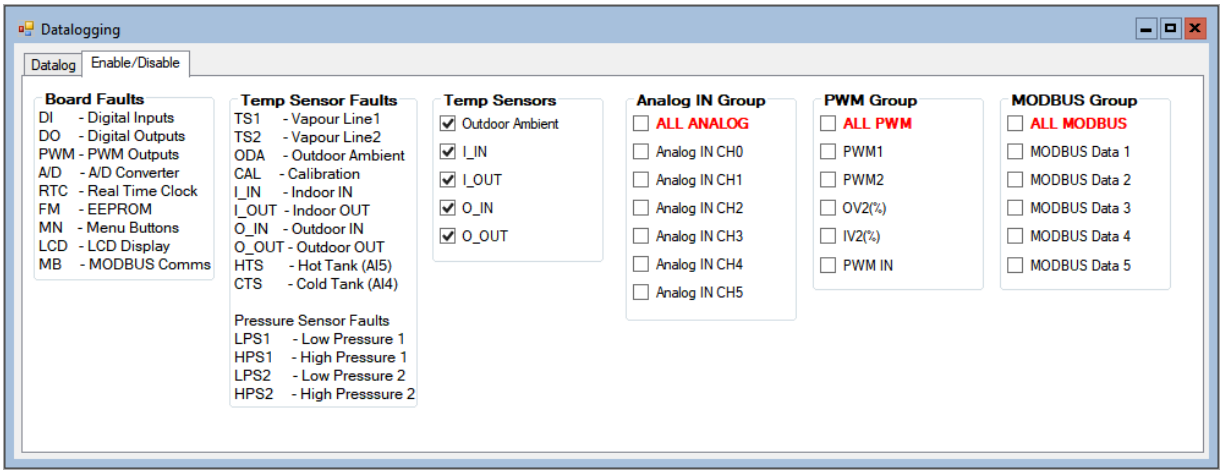
The datalog rate is set via the dropdown box at the top right of the PC App main window. Starting with firmware version 2.85, a log will be recorded at the datalog rate whenever the heat pump is powered on, making it easy to compare datalogs from multiple units . The maximum number of datalog records is 32,224, which will take 45 days to fill up at the default recording rate of 2 minutes.

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



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

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

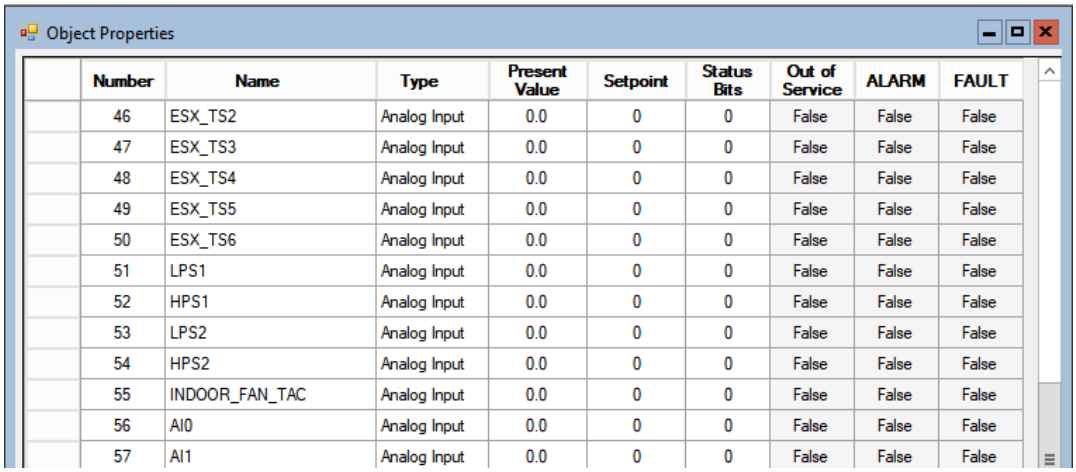


Tools-->MODBUS:

For future use.

Tools-->Objects:

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

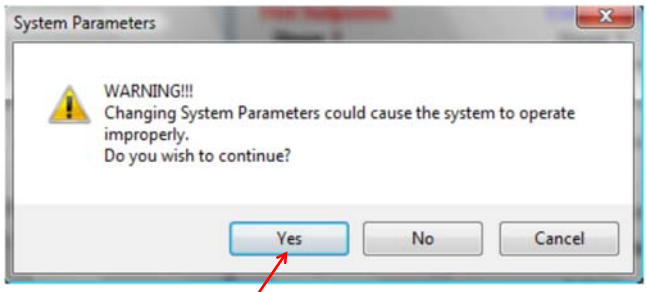


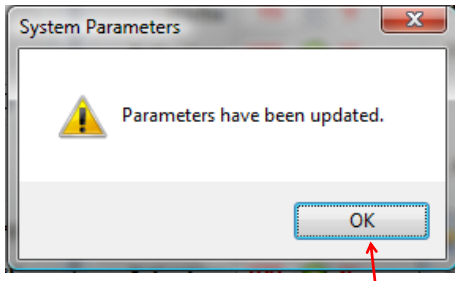
Number	Name	Type	Present Value	Setpoint	Status Bits	Out of Service	ALARM	FAULT
46	ESX_TS2	Analog Input	0.0	0	0	False	False	False
47	ESX_TS3	Analog Input	0.0	0	0	False	False	False
48	ESX_TS4	Analog Input	0.0	0	0	False	False	False
49	ESX_TS5	Analog Input	0.0	0	0	False	False	False
50	ESX_TS6	Analog Input	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.

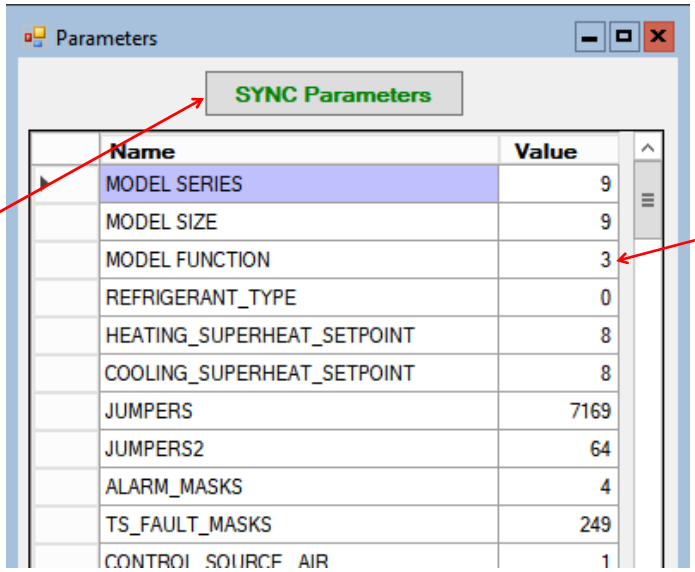
The parameters page shows all configurable memory spaces with their name and current value and allows them to be edited directly. To change a parameter value type in the new value and press ENTER.





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

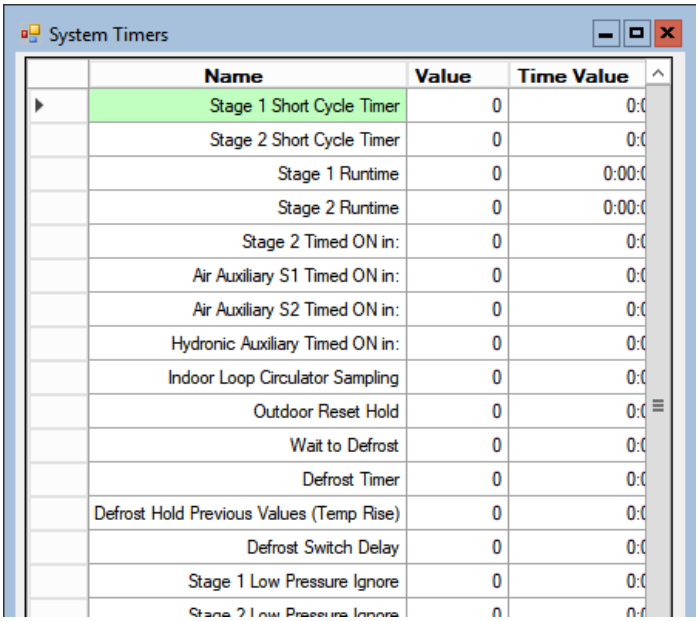
Click this button to reload the table with the values from the control board memory.



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

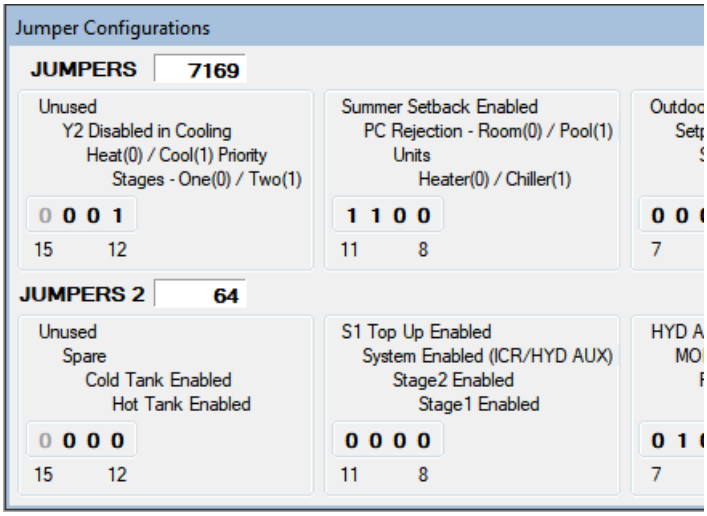
Tools-->SYSTEM TIMERS:

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



Tools-->Jumpers:

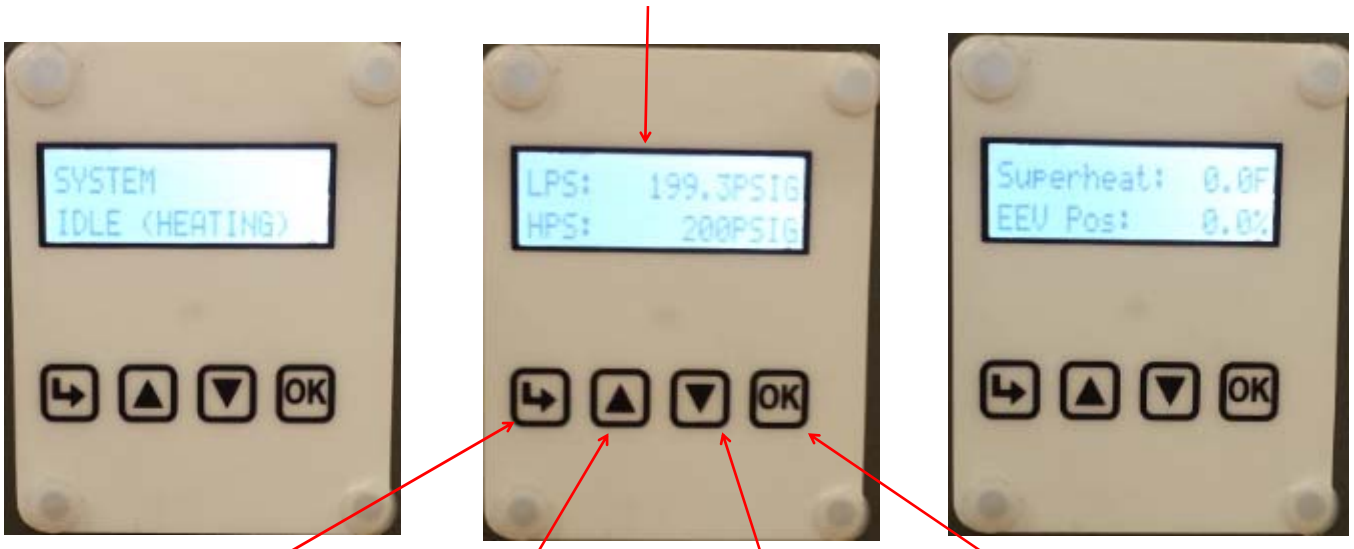
This page shows internal jumper configurations, for developers.



LCD Display & 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. Pressing OK will toggle between message auto scroll and manual scroll modes. UP and DOWN do not do anything if in auto scroll mode; they cycle through the messages if in manual scroll mode.

2x16 LCD Display



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

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

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

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

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

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

Main Menu Continued				
ENTER (From Main)	**ENTER (First Press)**	**ENTER (Second Press)**	**ENTER (Third Press)**	**Description**
Summer Setback	***— Enable Setback?***	***— Enable***		Enable summer setback.
		— Disable		Disable summer setback.
System EN/DIS	***— Enable System?***	***— Disable***		Enable compressor, auxiliary, and ICR.
		— Enable		Disable compressor, auxiliary, and ICR.
Service Mode	***— Service Mode?***	***— No***		Do not enter Service Mode.
		— Yes		Enter into Service Mode.
EEV Control	***— EEV1***	***— Auto/Manual***	***— Auto***	Puts EEV in Auto mode
			— Manual	Puts EEV in Manual mode
		— Manual Position	***— EEV Position (%)***	Enter desired EEV position
Configuration	***— Control HYD***	***— BACnet***		BACnet control—see BACnet section
		— Signals		N/A
		— Setpoints		On-board water temp. control—see SET-POINT CONTROL section.
	— OD Fan Reduction	***— OD Fan Reduction (%)***		Enter desired outdoor fan speed reduction
	— Time Delays	***— Short Cycle***	***— Short Cycle (min)***	Enter short-cycle timer value
		— Heat/Cool	***— Heat/Cool (min)***	Enter minimum off time between modes
	— Units	***— Standard***		Standard units
		— Metric		Metric units (does not affect calibration units)
	— Set Time	***— Hours***		Set the system hours.
		— Minutes		Set the system minutes.
	— Set Date	***— Day***		Set the system day.
		— Month		Set the system month.
		— Year		Set the system year.
Calibration	***— Suction 1***		Suction Pressure.	Calibration in 1PSI intervals.
	— Discharge 1		Discharge Pressure	Calibration in 1PSI intervals.
	— Vapour Line 1		Suction line temperature	Calibration in 0.1°F intervals
	— Outdoor Ambient		Outside air temperature	Calibration in 0.1°F intervals
	— Outdoor IN Temp			Calibration in 0.1°F intervals
	— Outdoor OUT Temp			Calibration in 0.1°F intervals
	— Indoor IN Temp			Calibration in 0.1°F intervals
	— Indoor OUT Temp			Calibration in 0.1°F intervals

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

BACnet Interface

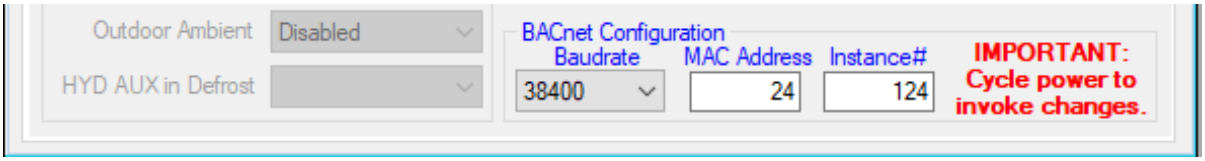
The BACnet interface is an MS/TP connection via RS-485 twisted pair. There is a termination jumper if required to terminate the connection. It is marked as TERM on the control board, and is located just above the BACnet connector.

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)

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

The following parameters can be set via the LED Display Configuration Menu or via the PC APP Configuration Page.

1) Baud rate
2) Instance number
3) MAC address



The data is available regardless of the selected control method. In order to control the unit via the BACnet interface, set the Control Source to BACnet either by using the PC APP configuration page or the display menus.

The following tables provide a list of the objects applicable to this model series, along with a description of each.
Note that there may be other objects available that do not apply to this model.

TABLE 10 - BACnet OBJECTS - CONTROL SIGNALS (READ/WRITE)

Name	Data Type	ID	Property	Description
SYSTEM_Y1A	Binary Value	BV0	Present Value	Stage 1 (compressor) (active is on)
SYSTEM_Y2A	Binary Value	BV1	Present Value	Compressor stage 2 solenoid (active is on)
SYSTEM_O	Binary Value	BV2	Present Value	Switch to cooling mode (RV#1). Inactive=HEATING, Active=COOLING
BACnet_Units	Binary Value	BV9	Present Value	Select the units to use for the BACnet objects
Note: object names may be subject to change without prior notice.				

TABLE 11 - BACnet OBJECTS - OPERATION MODE Description (Read Only)

Name	Data Type	ID	Present Value	Description
Operation Mode	Analog Value	AV5	-	Integer value represents operating mode.
			2	Hydronic heating
			3	Hydronic cooling
			11	Hydronic heating OFF
			12	Hydronic cooling OFF
Note: Object is type Analog Value but value will always be an integer value. Note: Objects may be subject to change without prior notice.				

TABLE 12 - BACnet OBJECTS - DATA (Read Only)				
Name	**ID**	**Property**	**Units**	**Description**
Data—Type Analog Input				
AI0 (Comp1_Current)	AI0	Present Value	Amps	Stage1 compressor current draw (AI0) - requires accessory
AI1 (Comp2_Current)	AI1	Present Value	User	User defined (0-5VDC or 4-20mA)
AI_2	AI2	Present Value	User	User defined (0-5VDC or 4-20mA)
AI_3	AI3	Present Value	User	User defined (0-5VDC or 4-20mA)
AI_4 (CTS)	AI4	Present Value	User	User defined (0-5VDC or 4-20mA)
AI_5 (HTS)	AI5	Present Value	User	User defined (0-5VDC or 4-20mA)
LPS1	AI6	Present Value	PSIG (kPa)	Low pressure value (suction pressure)
HPS1	AI7	Present Value	PSIG (kPa)	High pressure value (discharge pressure)
EVAP1	AI8	Present Value	degF (degC)	Evaporating Temperature
COND1	AI9	**Setpoint Value**	degF (degC)	Condensing Temperature
Suction Line 1	AI10	Present Value	degF (degC)	Suction line temperature
Superheat 1	AI11	**Setpoint Value**	degF (degC)	Superheat
EEV1 Position	AI12	Present Value	%	EEV position (% open)
LPS2	AI13	Present Value	PSIG (kPa)	N/A
HPS2	AI14	Present Value	PSIG (kPa)	N/A
EVAP2	AI15	Present Value	degF (degC)	N/A
COND2	AI16	**Setpoint Value**	degF (degC)	N/A
Suction Line 2	AI17	Present Value	degF (degC)	N/A
Superheat 2	AI18	**Setpoint Value**	degF (degC)	N/A
EEV2 Position	AI19	Present Value	%	N/A
Outside Ambient	AI20	Present Value	degF (degC)	Outdoor Ambient temperature - requires accessory
O_IN	AI21	Present Value	degF (degC)	Outdoor IN temperature
O_OUT	AI22	Present Value	degF (degC)	Outdoor OUT temperature
I_IN	AI23	Present Value	degF (degC)	Indoor IN temperature
I_OUT	AI24	Present Value	degF (degC)	Indoor OUT temperature
Data 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	Unit operation mode-refer to Operation Mode Table
Data Type—Binary Output				
STAGE1	BO0	Present Value	N/A	Compressor contactor
STAGE2	BO1	Present Value	N/A	Compressor stage 2 solenoid
ICR (Indoor Circ)	BO2	Present Value	N/A	Indoor circulator control
DO0 (OV1)	BO3	Present Value	N/A	NOT APPLICABLE
DO1 (IV1))	BO4	Present Value	N/A	IV1 (for 24VAC Indoor Loop water valve)
DO2 (HYD_AUX)	BO5	Present Value	N/A	Hydronic Auxiliary
DO3 (AUX_ONLY)	BO6	Present Value	N/A	Hydronic Auxiliary Only (without compressor)
PHS1	BO7	Present Value	N/A	Dry contact lockout pin for Stage 1
PHS2	BO8	Present Value	N/A	Dry contact lockout pin for Stage 2
Data Type—Binary Value				
CONTROLS (LOC/REM)	BV9	Present Value	N/A	Control Indicator, 0 = Local, 1 = Remote (BACnet)
Outdoor Flow	BV10	Present Value	N/A	Outdoor loop water valve
Indoor Flow	BV11	Present Value	N/A	Indoor Loop flow switch
Phase Monitor1	BV12	Present Value	N/A	Phase Monitor Stage 1
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
Note: available objects may be subject to change without prior notice.				

TABLE 13 - BACnet OBJECTS - ALARM Descriptions (Read Only)

Name	Data Type	ID	Description
AI0 (Comp1 Current)	Analog Input	AI0	Stage 1 Status alarm (Start / Stop Failure) - requires accessory
AI1 (Comp2 Current)	Analog Input	AI1	N/A
LPS1	Analog Input	AI6	Low pressure alarm
HPS1	Analog Input	AI7	High pressure alarm
LPS2	Analog Input	AI13	N/A
HPS2	Analog Input	AI14	N/A
Outdoor Flow	Binary Value	BV10	Outdoor loop water valve
Indoor Flow	Binary Value	BV11	Indoor loop flow alarm - requires accessory
Phase Monitor1	Binary Value	BV12	Phase Monitor alarm - requires accessory
Phase Monitor2	Binary Value	BV13	N/A
Comp Monitor1	Binary Value	BV14	N/A
Comp Monitor2	Binary Value	BV15	N/A

Name	ID	BIT #	VALUE*	Description
Permanent Alarms 1	**AV6**	-	-	Bit description is given below.
(Present Value)		0	1	Master permanent alarm (occurs when any alarm occurs)
		1	3	Low pressure heating mode alarm (suction pressure)
		2	5	Low pressure cooling mode alarm (suction pressure)
		3	9	High pressure heating mode alarm (discharge pressure)
		4	17	High pressure cooling mode alarm (discharge pressure)
		5	33	Loss of charge alarm
		6	65	Phase monitor alarm - requires accessory
		7	129	Compressor monitor alarm - N/A
		8	257	Status alarm
		14	16,385	Outdoor loop water valve
		15*	32,769	Indoor loop flow alarm - requires accessory)
Permanent Alarms 2	**AV7**	-	-	N/A
(Present Value)				

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: Objects may be subject to change without prior notice.

TABLE 14 - 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	N/A
LPS1	Analog Input	AI6	Low pressure sensor faulty or disconnected
HPS1	Analog Input	AI7	High pressure sensor faulty or disconnected
LPS2	Analog Input	AI13	N/A
HPS2	Analog Input	AI14	N/A
Suction Line1	Analog Input	AI10	Suction line 1 temperature sensor faulty or disconnected.
Suction Line2	Analog Input	AI17	N/A
Outside Ambient	Analog Input	AI20	Outside temperature sensor faulty or disconnected - requires accessory
O_IN	Analog Input	AI21	Outdoor IN temperature sensor faulty or disconnected.
O_OUT	Analog Input	AI22	Outdoor OUT temperature sensor faulty or disconnected.
I_IN	Analog Input	AI23	Indoor IN temperature sensor faulty or disconnected.
I_OUT	Analog Input	AI24	Indoor OUT temperature sensor faulty or disconnected.

Name	ID	BIT #	Value *	Description
Board Faults	**AV8**	-	-	Bit description is given below.
		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 Display
Sensor Faults	**AV9**	-	-	Indicates sensor failures. Bit description is given below.
		0	1	Suction line 1 temperature
		1	2	N/A
		2	4	Outdoor Ambient temperature (ACCESSORY)
		3	8	Calibration temperature
		4	16	Indoor IN temperature
		5	32	Indoor OUT temperature
		6	64	Outdoor IN temperature
		7	128	Outdoor OUT temperature
		8	256	N/A
		9	512	N/A

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: Objects may be subject to change without prior notice.

Startup Procedure

The EMW-Series Two-Stage R410a 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 and Zone Loops (Hydronic):

1. Verify that all shutoff valves inside the unit are fully open.
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. **The value must be above 12PSIG**. The electric heat will not function if the pressure is below this value.

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 return line.
2. Verify that there is flow control in the return line.

Domestic Hot Water (Desuperheater):

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

Electrical:

1. **Ensure the power to the unit is off.**
2. Verify all high voltage connections. Ensure that there are no stray wire strands, all connections are tight and the ground wire is connected tightly to the ground connector for the heat pump.
3. Record the fuse / circuit breaker size and wire gauge for the heat pump.
4. Verify that the control connections to the are properly connected and all control signals are off.
5. Turn both breakers off in the unit electrical box , so that the unit will not start when the power is turned on.
6. Verify that the circulator pumps are connected to the proper voltage terminals in the heat pump. Record the voltages of the circulator pumps.
7. 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 display 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 display should say "**MGT GEN2 VERx.xx**" on line 1 and "**Zeroing EEV's**" on line 2. You should be able to hear the EEV moving (a clicking sound).
2. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.
3. Connect a USB cable between the USB connector on the board and a laptop with the PC App installed (recommended but optional).
4. Select the desired Control Source HYD via the PC APP Configuration Page or via the LCD display Configuration Menu. **Set the water setpoints to a low value (e.g. 50°F) to prevent the compressor from coming on in heating mode.**
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 and stage 2 (or activate via BACnet 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 Display. The suction and discharge pressures will vary based on the outdoor temperature and the indoor loop temperature, but they should be **90-110PSIG** and **260-360PSIG** respectively for a typical start-up.
3. Monitor the unit via the PC APP or LCD Display while the unit runs, and record the following after 10 minutes of run time:
    1. Suction pressure
    2. Discharge pressure
    3. Four water line temperatures: Indoor IN, Indoor OUT, Outdoor IN, Outdoor OUT
    4. Outdoor Delta T (should be between **5-8°F, 3-4°C**)
    5. Indoor Delta T (should be between **8-12°F, 4-6°C**)
    6. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
4. Adjust the control setpoints to the desired buffer tank temperature and let the unit run through a cycle.
5. Turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown on the electrical box diagram. Turn the DHW switch in the unit post on. Turn the power to the unit on.
6. Open a zone (or zones) and let the tank cool down until stage 2 is activated. Close the zone(s) again.
7. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand **(caution: pipes get hot).** If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.
8. Activate stage 3 by changing the stage 3 setpoints. Be sure the electric heat breaker inside the unit is ON. The yellow light on the side of the unit should turn on. Measure the L1 current draw with an clamp meter and record the value. It should be between 45 and 52A.

Cooling Mode:

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

Final Inspection:

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

Startup Record:

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

Startup Record - EMW-Series Two-Stage R410a

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 and Zone Loops (Hydronic)	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 Loop System	All shut-off valve are open (full flow available)								
	Loop is full and purged of air								
	Antifreeze type								
	Antifreeze concentration		% Volume		% Weight				
	Loop static pressure		PSI	kPa					
Ground Water System	Water Valve installed in return line								
	Flow control installed in return line								
Domestic Hot Water	All shut-off valves are open								
	Lines are full and purged								
	Desuperheater pump wire is disconnected								
Electrical	High voltage connections are correct and securely fastened								
	Circuit breaker (or fuse) size and wire gauge for Heat Pump		A		Ga.				
	Circulator pump voltages (Outdoor 1, Outdoor 2)		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
	Green Light is ON								
Heating Mode (10 minutes)	Suction Pressure / Discharge Pressure						psig	kPa	
	Outdoor In (Supply In), Outdoor Out (Supply Out), and Delta T		In		Out		°F	°C	
	Outdoor Flow		lgpm	USgpm		L/s			
	Compressor L1 (black wire) current		A						
	Heating aquastat setpoint and discharge pressure at cycle end		°F	°C		psig	kPa		
	Domestic Hot Water functioning?								
	Yellow light is ON. Electric element L1 current draw			A					
Cooling Mode (10 minutes) (HACW only)	Suction Pressure / Discharge Pressure						psig	kPa	
	Outdoor In (Supply In), Outdoor Out (Supply Out), and Delta T		In		Out		°F	°C	
	Cooling aquastat setpoint and suction pressure at cycle end		°F	°C		psig	kPa		
Final Aquastat Settings	Heating S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C		
	Cooling S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C		

Date:		**Installer Signature:**		**Homeowner Signature:**	

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

GENERAL MAINTENANCE SCHEDULE		
Item	**Interval**	**Procedure**
Contactor	1 year	Inspect for pitted or burned points. Replace if necessary.
Heat exchanger	As required*	Clean as per HEAT EXHCANGER FLUSING PROCEDURE below.
***Generally not required for closed loop systems. Whenever system performance is reduced for open loop.**		

COAXIAL HEAT EXCHANGER FLUSHING PROCEDURE - OPEN LOOP (WELL WATER)	
STEP 1	Isolate the heat exchanger by closing the valves in the IN and OUT ports to the heat exchanger.
STEP 2	Blow out the heat exchanger into a clean 5 gallon bucket using compressed air.
STEP 3	If a purge cart is not available, use a 5 gallon plastic bucket, a circulator and some plastic piping to create a makeshift pump system. Connect a the inlet and outlet to the heat exchanger ports.*
STEP 4	Place 2 gallons of RYDLYME in the purge cart (or bucket). Circulate the fluid through the heat exchanger for at least 2 hours (3 recommended).
STEP 5	Disconnect the purge system dispose of the solution. RYDLYME is non-toxic and biodegradable and as such can be poured down a drain.
STEP 6	Connect fresh water and a drain to the heat exchanger ports and flush the exchanger for several minutes.
STEP 7	Return the plumbing to its original configuration and open the IN and OUT valves. Operate the system and check for improved performance.
*Depending on the plumbing, there should be either unions or boiler drains for to access the heat exchanger.	

COAXIAL HEAT EXCHANGER FLUSHING PROCEDURE - GROUND LOOP	
STEP 1	Isolate the heat exchanger by placing the pump module valves in the exchanger flushing position.
STEP 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.
STEP 3	Connect a purge cart to the pump module purge ports.
STEP 4	Place 2 gallons of RYDLYME in the purge cart. Circulate the fluid through the heat exchanger for at least 2 hours (3 recommended).
STEP 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.
STEP 6	Connect fresh water and a drain to the pump module purge ports and flush the exchanger for several minutes.
STEP 7	Blow the heat exchanger out with compressed air as per STEP 2 and dump the water down a drain.
STEP 8	Connect the purge cart to the pump module purge ports. Re-fill and purge the heat exchanger with as per standard procedures (the anti-freeze from STEP 2 can be re-used).
STEP 9	Disconnect the purge cart and set the pump module valves back to the original positions.
STEP 10	Operate the system and check for improved performance.
*Depending on the plumbing, there should be either unions or boiler drains for to access the heat exchanger.	

Troubleshooting Guide

The following steps are for troubleshooting the heat pump. If the problem is with the domestic hot water or the plenum heater, proceed to those sections at the end of the troubleshooting guide. Repair procedures and reference refrigeration circuit diagrams can be found later in this manual.

STEP 1: Verify that the LCD Display 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 Display or use the PC APP Alarms page to determine the alarm type. Proceed to the ALARMS TROUBLESHOOTING section.

STEP 3: If there are no alarms and STAGE1 is showing ON (LCD Display, 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.

STEP 7: If the heat pump appears to be operating properly but no hot or cold water is making it to the zones, proceed to the ZONE 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 air thermostat	No power from transformer.	See **No Heartbeat on control board**.	
	Faulty wiring between heat pump and thermostat.	24VAC is not present across R and C of the thermostat.	Correct the wiring.
	Faulty thermostat.	24VAC is present across R and C of the thermostat but thermostat has no display.	Replace thermostat .

ALARMS AND FAULTS 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.
High Pressure	A high pressure alarm occurs when the discharge pressure rises to or above the ***High Pressure Cutout*** value.	Go to the High Pressure section of the mode the unit was operating in at the time of the alarm.
Compressor Status (accessory)	This alarm occurs when there is a current draw on the compressor but no call for the compressor to be on (welded contactor) or when there is a call for the compressor to be on but there is no compressor current draw (manual high pressure control is open or contactor failure). Requires current sensor accessory.	Check contactor if compressor is staying on when it should be off. Go to Compressor section if compressor is not on when it should be.
Low Charge	This alarm occurs if the EEV has been at >99% for 20 minutes within first hour of a cycle.	Check system for refrigerant leak.
Loss of Charge	This alarm occurs if both the low pressure and high pressure sensors are below 30 psig (207 kPa).	Check system for refrigerant leak.

The following are hardware faults.		
Digital Inputs	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.
Digital Outputs		
Analog Inputs		
MODBUS Comms		
Real Time Clock		
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 Display 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 Display	A failure has occurred and display may show erratic data, no data or may not turn on at all.	
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.

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

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High or low suction or discharge pressure	Faulty sensor	Compare pressure sensor reading against a known reference such as a new refrigeration manifold set.	Check wiring, replace sensor. If problem persists, replace control board.
High discharge pressure	Low or no flow in heat exchanger to buffer tank circuit	Check that isolation flanges and ball valves are open. Verify 115VAC to pump. Check gauges for pressure drop. Check for high delta T with the PC APP. The EEV will be at a lower position than normal as well.	Ensure flow path is unrestricted. Replace pump if faulty.
	Temperature setpoint(s) too high (if using BACnet control)	Use PC APP to verify that Indoor OUT does not exceed 120°F (49°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. Low superheat and discharge 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.
Low suction pressure	Low or no Outdoor Loop flow	Delta T across the Outdoor Loop ports should be 5-7°F (3-4°C), or compare pressure drop to the tables for the unit.	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.	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 super heat and discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Faulty compressor, not pumping.	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. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
Random high pressure trip (may not occur while on site)	Faulty indoor circulator relay	Using the PC APP, manually turn the ICR on/off several times and ensure the circulator(s) start and stop.	Replace relay.
Random manual high pressure trip (may not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it should be off.	Replace contactor.

OPERATION TROUBLESHOOTING - COOLING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Heating instead of cooling	Zone thermostat interconnection or zone controller not set up properly.	Verify that there is 24VAC across O and C of the terminal strip when buffer tank should be cooled.	Correct setup.
	Faulty reversing valve solenoid coil.	Verify solenoid by removing it from the shaft while the unit is running. There should be a loud “whoosh” sound when it is removed.	Replace solenoid if faulty.
	Faulty reversing valve.	A click can be heard when the coil is energized but the unit continues to heat instead of cool.	Replace reversing valve.
High discharge pressure	Low or no Outdoor Loop flow	Delta T across the Outdoor Loop ports should be between 8-12°F (4-7°C), or compare pressure drop to the tables for the unit.	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 warm	Measure the entering liquid temperature. Most likely caused by undersized ground loop.	Increase the size of the ground loop.
	Dirty or fouled Outdoor Loop coaxial heat exchanger (typically for open loop, unlikely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Backflush the coaxial exchanger with a lime/calcium removing solution according to instructions in General Maintenance section.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Unit is overcharged (after servicing)	High subcooling, low Indoor Loop delta T.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces.

OPERATION TROUBLESHOOTING - COOLING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High suction pressure (may appear to not be pumping)	EEV stuck open	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Faulty compressor, not pumping	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Low suction pressure	Low or no flow in heat exchanger to buffer tank circuit	Check that isolation flanges and ball valves are open. Verify 115VAC to pump. Check gauges for pressure drop. Check for high delta T with the PC APP. The EEV will be at a lower position than normal as well.	Ensure flow path is unrestricted. Replace pump if faulty.
	Temperature setpoint(s) too low (if using BACnet control)	Use PC APP to verify that Indoor OUT is not less than the minimums listed in the **Model Specific Information** section.	Reduce setpoint(s).
	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
	TS1 temperature sensor not reading properly	If the sensor is reading low it will cause the superheat to appear high, which causes the EEV to continually close.	Verify EEV position is low compared to normal. Check temperature sensor, replace if necessary.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Low refrigerant charge	Entering air temperature and airflow are good but suction is low. Check static refrigeration pressure of unit for a low value.	Locate the leak and repair it. Spray Nine, a sniffer, and dye are common methods of locating a leak.
Compressor frosting up	See Low Suction Pressure in this section.		
EEV frosting up	EEV stuck almost closed or partially blocked by foreign object.	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
Random manual high pressure trip (may not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it should be off.	Replace contactor.

AUXILIARY ELECTRIC HEAT TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No Electric Heat	Tripped or faulty electric heat breaker in heat pump electrical box	Reset if tripped. If not tripped verify that there is 230VAC across L1 and L3 of the electric heat contactor.	Determine why breaker was tripped. Replace breaker if faulty.
	Insufficient Indoor Loop pressure	Verify Indoor Loop pressure. Must have at least 12PSIG to engage the safety pressure switch.	Increase Indoor Loop pressure.
	Control board settings.	Check Stage 3 temperature and timer settings using PC App or LCD. Adjust values to test elements.	Correct settings.
	Faulty electric heat 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.
	Faulty control board.	PC App or LCD show Stage 3 should be engaged, but no 24VAC output from board to engage backup heat contactor.	Replace control board.
	Faulty elements.	With power off to the unit, measure the resistance across the T1 and T3 terminals of the electric heat contactor . Under 6 ohms = both elements good Infinity = both elements bad.	Replace the faulty elements.
Low Electric Heat	One faulty element.	With power off to the unit, measure the resistance across the T1 and T3 terminals of electric heat contactor . 6 to 12ohms = one element bad	Measure each element individually to identify the faulty one, and replace it.

ZONE TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No hot/cold water to individual zone	Faulty zone thermostat, wiring, zone valve, or zone valve head.	Other zones work, 24VAC is present across Z and C of the heat pump terminal strip but no hot/cold water reaches the zone.	Correct wiring. Or replace zone valve, zone valve head, or thermostat.
No hot/cold water to any zones	Shut off valve closed inside heat pump	Verify that all valves in the zone loop are open, including isolation valves at the zone circulator inside the unit.	Open any valves that are closed.
	Faulty zone circulator contactor	24VAC is present across Z and C of the heat pump terminal strip but the contactor does not energize. Or, contactor is energized but 115VAC is not present across load terminal and ground.	Replace contactor.
	Faulty zone circulator	115VAC is present across the load terminal of the zone circulator contactor and ground but circulator pump is not working.	Close isolation valves and remove circulator pump head. Verify operation of the impeller. Clean or replace if faulty.

EEV TROUBLESHOOTING

If there is a refrigeration problem such as low charge, plugged filter-dryer, EEV stuck, or any other kind of restriction in the refrigeration system, the apparent EEV position will work its way towards 100% (full open). High superheat is also a symptom.

If an EEV is not working and is stuck partway open, the apparent EEV position will work its way either to 100% or to the 10% minimum.

If there is low suction and the EEV position is also low then the problem is generally not in the refrigeration system; check the water or air flow of the indoor or outdoor loop, whichever is currently being used as the source (evaporator).

To determine if an EEV is working, use the PC APP and 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 not working or is stuck. There are 3 possibilities: the control board is not working properly, the cable is faulty, or the EEV is faulty.

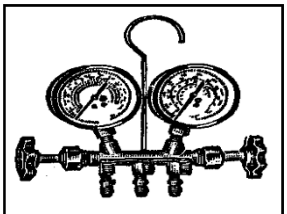
Set the EEV back to AUTO and then turn the heating or cooling demand off (but leave power on). Once the demand is off, if the EEV is working then the discharge pressure should remain significantly higher than the suction pressure, i.e. the system will not equalize (since EEV's are closed when there is no demand). If the system does equalize it is likely that the EEV is not working and is partially open. Manually set the EEV to 25% and wait for it to stop. Set the EEV to –1, this will cause it to overdrive. You should hear the valve clicking and then the clicking should change and get louder when the valve bottoms out.

If there is no clicking sound then either the control board is faulty, or the cable is faulty. The simplest method to check this 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 o 0 and 100% If the new EEV works then the EEV in the unit needs to be replaced.

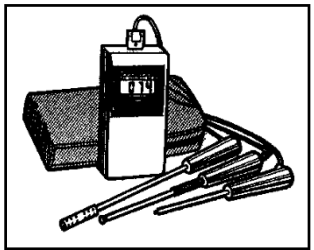
1) Connect a test EEV and test cable to the control board.
2) Set the EEV position to 0%.
3) Set the EEV position to 100% and then listen for clicking and watch to see if the pintle in the EEV moves open.
4) Set the EEV position to 0% and then listen for clicking and watch to see if the pintle in the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

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

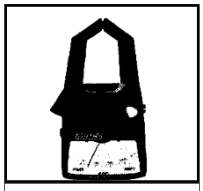
Troubleshooting Tools



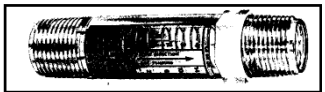
Refrigeration Gauges



Digital Thermometer



Multimeter - Voltmeter / Amprobe



In-line Flowmeter

PUMP DOWN PROCEDURE	
STEP 1	Place the unit in **SERVICE** mode via the PC App. This will open the EEV and solenoid valve.
STEP 2	Connect the refrigerant recovery unit to the service ports via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. **If there was a compressor burn out, the refrigerant cannot be reused and must be disposed of according to local codes.**
STEP 3	All water coil heat exchangers 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 double wall domestic hot water exchangers (desuperheater coils).
STEP 4	Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual.
STEP 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.
STEP 6	Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive pressure of 5-10PSIG is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected.
STEP 7	The heat pump is now ready for repairs. Always ensure nitrogen is flowing through the system during any brazing procedures to prevent oxidation inside the pipes. Maritime Geothermal Ltd. recommends replacing the liquid line filter-dryer any time the refrigeration system has been exposed to the atmosphere.

VACUUM AND CHARGING PROCEDURE	
STEP 1	After completion of repairs and nitrogen pressure testing, the refrigeration circuit is ready for vacuuming.
STEP 2	Release the refrigerant circuit 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.
STEP 3	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.
STEP 4	Weigh in the appropriate amount of refrigerant through the low pressure (suction) service port. Refer to the label on the unit or the **Refrigerant Charge** table in the **Model Specific Information** section for the proper charge amount.
STEP 5	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.

REPLACMENT PROCEDURE FOR A COMPRESSOR BURNOUT	
STEP 1	Pump down the unit as per the Pump Down Procedure above. Discard the refrigerant according to local codes.
STEP 2	Replace the compressor. Replace the liquid line filter-dryer.
STEP 3	Vacuum the unit until it remains under 500 microns for several minutes with the vacuum pump valve closed.
STEP 4	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 until it remains under 500 microns for several minutes with the vacuum pump valve closed.
STEP 5	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.
STEP 6	Charge the unit (refrigerant can be re-used) and operate it for 2 weeks. Perform an acid test. If it fails, pump down the unit and replace the filter-dryer.
STEP 7	Charge the unit a final time. Unit should now be clean and repeated future burn-outs can be avoided.

Model Specific Information

Table 15 - Shipping Information

MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
EMW-45	620 (281)	70 (178)	36 (91)	46 (117)
EMW-55	640 (290)	70 (178)	36 (91)	46 (117)
EMW-65	670 (304)	70 (178)	36 (91)	46 (117)
EMW-75	700 (318)	70 (178)	36 (91)	46 (117)
EMW-80	795 (360)	70 (178)	36 (91)	46 (117)

Table 16 - Refrigerant Charge

MODEL	lb	kg	Refrigerant	Oil Type
EMW-45	7.0	3.2	R410a	POE
EMW-55	7.0	3.2	R410a	POE
EMW-65	8.0	3.6	R410a	POE
EMW-75	9.0	4.1	R410a	POE
EMW-80	10.0	4.5	R410a	POE

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

Table 17 - Outdoor Loop Flow Rates

MODEL	gpm	L/s
EMW-45	10	0.63
EMW-55	12	0.76
EMW-65	14	0.88
EMW-75	16	1.01
EMW-80	17	1.07

Table 18 - Operating Temperature Limits

Loop	Mode	Parameter	(°F)	(°C)	Note
OUTDOOR (GROUND LOOP)	Heating	Minimum ELT	23	-5	Adequate freeze protection (antifreeze) required.
		Maximum LLT	120	49	
	Cooling	Minimum ELT	32	0	Adequate freeze protection (antifreeze) required.
		Maximum LLT	120	49	
OUTDOOR (OPEN LOOP)	Heating	Minimum ELT	39	4	
		Maximum LLT	120	49	
	Cooling	Minimum ELT	39	4	
		Maximum LLT	120	49	
INDOOR (ANTIFREEZE)	Heating	Minimum EWT	60	15	
		Maximum LWT	120	49	
	Cooling	Minimum LLT	32	0	Adequate freeze protection (antifreeze) required.
		Maximum EWT	80	27	
INDOOR (WATER)	Heating	Minimum EWT	60	15	
		Maximum LWT	120	49	
	Cooling	Minimum LWT	41	5	
		Maximum EWT	80	27	

Pressure Drop Data

Table 19: Outdoor Loop Pressure Drops

			OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% prop. glycol 32°F)	
	gpm	L/s	psi	kPa	psi	kPa	psi	kPa
EMW-45	4	0.25	0.9	6.2	1.0	6.9	1.3	9.0
	5	0.32	1.2	8.3	1.4	9.6	1.8	13
	6	0.38	1.7	12	2.0	14	2.6	18
	7	0.44	2.1	14	2.5	17	3.3	23
	8	0.50	2.8	19	3.0	21	4.0	27
	9	0.57	3.5	24	3.8	26	5.0	34
	10	**0.63**	**4.0**	**28**	**4.7**	**32**	**6.2**	**43**
	11	0.69	4.6	32	5.5	38	7.2	50
	12	0.76	5.5	38	6.6	45	8.7	60
	13	0.82	6.2	43	7.4	51	9.7	67
	14	0.88	7.0	48	8.6	59	11.3	78
	15	0.95	8.2	57	9.5	65	12.5	86
EMW-55	6	0.38	1.2	8.3	1.3	9.0	1.7	12
	7	0.44	1.6	11	1.6	11	2.1	14
	8	0.50	1.9	13	2.1	14	2.8	19
	9	0.57	2.4	17	2.4	17	3.2	22
	10	0.63	2.9	20	3.1	21	4.1	28
	11	0.69	3.1	21	3.6	25	4.7	33
	12	**0.76**	**3.7**	**26**	**4.4**	**30**	**5.8**	**40**
	13	0.82	4.3	30	5	34	6.6	45
	14	0.88	5	34	5.7	39	7.5	52
	15	0.95	5.8	40	6.4	44	8.4	58
	16	1.01	6.3	43	7.1	49	9.3	64

Table 19: Outdoor Loop (cont'd) Pressure Drops			OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% prop. glycol 32°F)	
	gpm	L/s	psi	kPa	psi	kPa	psi	kPa
EMW-65	6	0.38	1.2	8.3	1.3	9.0	1.7	12
	7	0.44	1.5	10	1.8	12	2.4	16
	8	0.50	1.9	13	2.2	15	2.9	20
	9	0.57	2.3	16	2.7	19	3.6	24
	10	0.63	2.6	18	3.3	23	4.3	30
	11	0.69	3.2	22	4	28	5.3	36
	12	0.76	3.9	27	4.6	32	6.0	42
	13	0.82	4.4	30	5.2	36	6.8	47
	14	**0.88**	**5**	**34**	**5.8**	**40**	**7.6**	**53**
	15	0.95	5.7	39	6.5	45	8.5	59
	16	1.01	6.5	45	7.3	50	9.6	66
EMW-75	6	0.38	0.7	4.8	0.9	6.2	1.2	8.2
	7	0.44	0.9	6.2	1.0	6.9	1.3	9.0
	8	0.50	1.3	9.0	1.3	9.0	1.7	12
	9	0.57	1.6	11	1.6	11	2.1	14
	10	0.63	1.9	13	2.1	14	2.8	19
	11	0.69	2.3	16	2.4	17	3.2	22
	12	0.76	2.6	18	2.9	20	3.8	26
	13	0.82	3.0	21	3.3	23	4.3	30
	14	0.88	3.2	22	3.7	26	4.9	33
	15	0.95	3.5	24	4.1	28	5.4	37
	16	**1.01**	**4.0**	**28**	**4.7**	**32**	**6.2**	**43**
	17	1.07	4.4	30	5.2	36	6.8	47
EMW-80	9	0.57	1.3	9.0	1.4	10	1.8	13
	10	0.63	1.6	11	1.7	12	2.2	15
	11	0.69	1.9	13	2.2	15	2.9	20
	12	0.76	2.4	17	2.6	18	3.4	24
	13	0.82	2.7	19	3.1	21	4.1	28
	14	0.88	3.1	21	3.5	24	4.6	32
	15	0.95	3.3	23	3.8	26	5.0	34
	16	1.01	3.6	25	4.1	28	5.4	37
	17	**1.07**	**4.1**	**28**	**4.6**	**32**	**6.0**	**42**
	18	1.14	4.5	31	4.9	34	6.4	44

Standard Capacity Ratings

Standards C13256-2 / ISO13256-2 / ARI 13256-2

Table 20 - Standard Capacity Ratings - Ground Loop Heating*									60Hz
EWT 104°F (40°C) * 15% NaCl by Weight Ground Loop Fluid						STAGE 1 - ELT 41°F (5°C) STAGE 2 - ELT 32°F (0°C)			
Model	Liquid Flow (Outdoor & Indoor)		Outdoor Pressure Drop		Mode	Input Energy	Capacity		COP_H
	gpm	L/s	psi	kPa		Watts	Btu/hr	kW	W/W
45	10.0	0.63	4.5	31.1	Stage 1	1,760	19,200	5.6	3.2
					Stage 2	2,455	26,000	7.6	3.1
55	12.0	0.76	4.1	28.5	Stage 1	2,740	29,000	8.5	3.1
					Stage 2	3,270	34,600	10.7	3.1
65	14.0	0.88	6.3	43.7	Stage 1	3,120	34,100	10.0	3.2
					Stage 2	4,025	42,600	12.5	3.1
75	16.0	1.01	4.9	33.8	Stage 1	3,765	41,100	12.0	3.2
					Stage 2	4,630	49,000	14.4	3.1
80	17.0	1.07	4.5	31.0	Stage 1	5,860	58,000	17.0	2.9

Table 21 - Standard Capacity Ratings - Ground Water Heating									60Hz
EWT 104°F (40°C)						ELT 50°F (10°C)			
Model	Liquid Flow (Outdoor & Indoor)		Outdoor Pressure Drop		Mode	Input Energy	Capacity		COP_H
	gpm	L/s	psi	kPa		Watts	Btu/hr	kW	W/W
45	10.0	0.63	3.9	27.0	Stage 1	1,855	22,800	6.7	3.6
					Stage 2	2,455	32,700	9.6	3.9
55	12.0	0.76	3.6	24.8	Stage 1	2,475	32,100	9.4	3.8
					Stage 2	3,565	45,000	13.2	3.7
65	14.0	0.88	5.1	34.9	Stage 1	3,200	39,300	11.5	3.6
					Stage 2	4,345	54,900	16.1	3.7
75	16.0	1.01	4.6	31.7	Stage 1	3,785	47,800	14.0	3.7
					Stage 2	4,845	64,500	18.9	3.9
80	17.0	1.07	4.2	28.8	Stage 1	6,095	77,000	22.6	3.7

Table 22 - Standard Capacity Ratings - Ground Loop Cooling*										60Hz
EWT 53.6°F (12°C) * 15% NaCl by Weight Ground Loop Fluid						STAGE 1 - ELT 68°F (20°C) STAGE 2 - ELT 77°F (25°C)				
Model	Liquid Flow (Outdoor & Indoor)		Outdoor Pressure Drop		Mode	Input Energy	Capacity		COP_C	EER
	gpm	L/s	psi	kPa		Watts	Btu/hr	kW	W/W	Btu/hr/W
45	10.0	0.63	3.6	24.9	Stage 1	1,205	23,000	6.7	5.6	19.1
					Stage 2	2,125	31,000	9.1	4.3	14.6
55	12.0	0.76	3.4	23.4	Stage 1	1,615	31,500	9.2	5.7	19.5
					Stage 2	2,685	40,300	11.8	4.4	15.0
65	14.0	0.88	4.9	33.9	Stage 1	1,975	39,100	11.5	5.8	19.8
					Stage 2	3,305	49,600	14.5	4.4	15.0
75	16.0	1.01	4.3	29.4	Stage 1	2,535	45,600	13.4	5.3	18.0
					Stage 2	3,750	55,900	16.4	4.4	14.9
80	17.0	1.07	4.4	30.1	Stage 1	4,460	66,000	19.3	4.3	14.8

Table 23 - Standard Capacity Ratings - Ground Water Cooling										60Hz
EWT 53.6°F (12°C)						ELT 59°F (15°C)				
Model	Liquid Flow (Outdoor & Indoor)		Outdoor Pressure Drop		Mode	Input Energy	Capacity		COP_C	EER
	gpm	L/s	psi	kPa		Watts	Btu/hr	kW	W/W	Btu/hr/W
45	10.0	0.63	3.6	24.6	Stage 1	985	24,500	7.2	7.3	24.8
					Stage 2	1,665	34,000	10.0	6.0	20.4
55	12.0	0.76	3.2	22.1	Stage 1	1,370	33,900	9.9	7.2	24.7
					Stage 2	2,180	44,700	13.1	6.0	20.5
65	14.0	0.88	5.2	35.7	Stage 1	1,755	41,300	12.1	6.9	23.5
					Stage 2	2,710	54,800	16.1	5.9	20.2
75	16.0	1.01	4.4	30.6	Stage 1	2,120	49,800	14.6	6.9	23.5
					Stage 2	3,105	62,400	18.3	5.9	20.1
80	17.0	1.07	3.9	26.8	Stage 1	3,725	73,000	21.4	5.7	19.6

Heating Mode (Full Load)

EMW-45-HACW-P-1T **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	**COPh**	EWT	Cond. Temp.	Flow	LWT	Delta T	**Net Output**
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps	Watts	**W/W**	°F	°F	gpm	°F	°F	**Btu/hr**
°C	°C	L/s	°C	°C	Watts					°C	°C	L/s	°C	°C	**Watts**
25.0	15	10.0	21.7	3.3	15,693	2,299	10.7	2,421	**2.87**	104.0	112	10.0	108.8	4.8	**23,734**
-3.9	-9.4	0.631	-5.7	1.8	4,598					40.0	44.4	0.631	42.6	2.6	**6,954**
31.0	20	10.0	27.3	3.7	17,499	2,326	10.8	2,448	**3.07**	104.0	113	10.0	109.1	5.1	**25,631**
-0.6	-6.7	0.631	-2.6	2.0	5,127					40.0	45.0	0.631	42.9	2.9	**7,510**
37.0	25	10.0	32.9	4.1	19,590	2,321	10.8	2,443	**3.32**	104.0	113	10.0	109.5	5.5	**27,705**
2.8	-3.9	0.631	0.5	2.3	5,740					40.0	45.0	0.631	43.1	3.1	**8,117**
42.0	30	10.0	37.4	4.6	21,692	2,344	10.9	2,465	**3.55**	104.0	114	10.0	110.0	6.0	**29,884**
5.6	-1.1	0.631	3.0	2.5	6,356					40.0	45.6	0.631	43.3	3.3	**8,756**
47.0	35	10.0	42.1	4.9	23,472	2,325	10.9	2,437	**3.80**	104.0	114	10.0	110.3	6.3	**31,595**
8.3	1.7	0.631	5.6	2.7	6,877					40.0	45.6	0.631	43.5	3.5	**9,257**
52.0	40	10.0	46.6	5.4	25,502	2,346	11.0	2,457	**4.02**	104.0	115	10.0	110.7	6.7	**33,696**
11.1	4.4	0.631	8.1	3.0	7,472					40.0	46.1	0.631	43.7	3.7	**9,873**
58.0	45	10.0	52.2	5.8	27,469	2,346	10.9	2,457	**4.25**	104.0	115	10.0	111.1	7.1	**35,662**
14.4	7.2	0.631	11.2	3.2	8,048					40.0	46.1	0.631	44.0	4.0	**10,449**
64.0	50	10.0	57.8	6.2	29,629	2,367	11.0	2,478	**4.48**	104.0	116	10.0	111.6	7.6	**37,894**
17.8	10.0	0.631	14.3	3.5	8,681					40.0	46.7	0.631	44.2	4.2	**11,103**

Compressor: ZPS30K5E-PFV

Cooling Mode (Full Load)

EMW-45-HACW-P-1T **R410a 60 Hz**

Source Data (Indoor Loop)						Power Consumption				Sink Data (Outdoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	**HAB**	Total		Effective	**Effi-ciency**	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejection
°F	°F	gpm	°F	°F	**Btu/hr**	Watts	Amps	Watts	**EER**	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	**Watts**				**COPc**	°C	°C	L/s	°C	°C	Watts
53.6	38	10.0	46.5	7.1	**35,366**	1,376	6.2	1,496	**6.93**	47	65	10.0	55.4	8.4	40,062
12.0	3.1	0.631	8.1	3.9	**10,362**				**23.6**	8.3	18.3	0.631	13.0	4.7	11,738
53.6	38	10.0	46.6	7.0	**34,860**	1,444	6.5	1,564	**6.53**	52	70	10.0	60.4	8.4	39,787
12.0	3.3	0.631	8.1	3.9	**10,214**				**22.3**	11.1	21.1	0.631	15.8	4.7	11,657
53.6	39	10.0	46.7	6.9	**34,355**	1,519	6.8	1,639	**6.14**	57	75	10.0	65.3	8.3	39,539
12.0	3.6	0.631	8.2	3.8	**10,066**				**21.0**	13.9	23.9	0.631	18.5	4.6	11,585
53.6	39	10.0	46.9	6.7	**33,375**	1,618	7.2	1,738	**5.63**	62	80	10.0	70.2	8.2	38,898
12.0	3.9	0.631	8.3	3.7	**9,779**				**19.2**	16.7	26.7	0.631	21.2	4.5	11,397
53.6	40	10.0	47.1	6.5	**32,427**	1,737	7.6	1,859	**5.11**	66	85	10.0	74.1	8.1	38,354
12.0	4.2	0.631	8.4	3.6	**9,501**				**17.4**	18.9	29.4	0.631	23.4	4.5	11,238
53.6	40	10.0	47.2	6.4	**31,903**	1,840	8.1	1,962	**4.76**	71	90	10.0	79.0	8.0	38,182
12.0	4.4	0.631	8.5	3.5	**9,347**				**16.3**	21.7	32.2	0.631	26.1	4.5	11,187
53.6	41	10.0	47.3	6.3	**31,354**	1,953	8.6	2,075	**4.43**	75	95	10.0	83.0	8.0	38,019
12.0	4.7	0.631	8.5	3.5	**9,187**				**15.1**	23.9	35.0	0.631	28.3	4.4	11,139
53.6	41	10.0	47.4	6.2	**30,774**	2,076	9.1	2,198	**4.10**	80	100	10.0	88.0	8.0	37,859
12.0	5.0	0.631	8.6	3.4	**9,017**				**14.0**	26.7	37.8	0.631	31.1	4.4	11,093

Compressor: ZPS30K5E-PFV

Heating Mode (Full Load)

EMW-55-HACW-P-1T — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	COPh	EWT	Cond. Temp.	Flow	LWT	Delta T	Net Output
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps	Watts	W/W	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts					°C	°C	L/s	°C	°C	Watts
25.0	15	12.0	21.4	3.6	20,563	3,128	15.8	3,264	**2.82**	104.0	115	12.0	109.2	5.2	**31,456**
-3.9	-9.4	0.757	-5.9	2.0	6,025					40.0	46.1	0.757	42.9	2.9	**9,216**
31.0	20	12.0	26.9	4.1	23,153	3,151	16.0	3,286	**3.04**	104.0	116	12.0	109.7	5.7	**34,123**
-0.6	-6.7	0.757	-2.8	2.3	6,784					40.0	46.7	0.757	43.2	3.2	**9,998**
37.0	25	12.0	32.5	4.5	25,909	3,185	15.9	3,320	**3.26**	104.0	116	12.0	110.2	6.2	**36,994**
2.8	-3.9	0.757	0.3	2.5	7,591					40.0	46.7	0.757	43.4	3.4	**10,839**
42.0	30	12.0	37.0	5.0	28,544	3,298	16.0	3,433	**3.42**	104.0	117	12.0	110.7	6.7	**40,015**
5.6	-1.1	0.757	2.8	2.8	8,363					40.0	47.2	0.757	43.7	3.7	**11,724**
47.0	35	12.0	41.5	5.5	31,313	3,413	16.0	3,532	**3.58**	104.0	117	12.0	111.2	7.2	**43,156**
8.3	1.7	0.757	5.3	3.1	9,175					40.0	47.2	0.757	44.0	4.0	**12,644**
52.0	40	12.0	45.9	6.1	34,509	3,447	16.1	3,567	**3.82**	104.0	118	12.0	111.8	7.8	**46,468**
11.1	4.4	0.757	7.7	3.4	10,111					40.0	47.8	0.757	44.3	4.3	**13,615**
58.0	45	12.0	51.3	6.7	37,950	3,436	16.1	3,556	**4.11**	104.0	118	12.0	112.3	8.3	**49,873**
14.4	7.2	0.757	10.7	3.7	11,119					40.0	47.8	0.757	44.6	4.6	**14,613**
64.0	50	12.0	56.7	7.3	41,393	3,471	16.2	3,591	**4.36**	104.0	119	12.0	112.9	8.9	**53,435**
17.8	10.0	0.757	13.7	4.0	12,128					40.0	48.3	0.757	45.0	5.0	**15,656**

Compressor: ZPS40K5E-PFV

Cooling Mode (Full Load)

EMW-55-HACW-P-1T — **R410a 60 Hz**

Source Data (Indoor Loop)						Power Consumption				Sink Data (Outdoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	Effi-ciency	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejection
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps	Watts	EER	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts				COPc	°C	°C	L/s	°C	°C	Watts
53.6	37.8	12.0	45.9	7.7	**46,286**	1,782	9.2	1,912	**7.1**	48	70	12.0	57.2	9.2	52,369
12.0	3.2	0.757	7.7	4.3	**13,562**				**24.2**	9	21.1	0.757	14.0	5.1	15,344
53.6	38.2	12.0	46.0	7.6	**45,602**	1,908	9.7	2,038	**6.6**	53	75	12.0	62.1	9.1	52,114
12.0	3.4	0.757	7.8	4.2	**13,361**				**22.4**	12	23.9	0.757	16.7	5.1	15,269
53.6	38.6	12.0	46.1	7.5	**44,860**	2,036	10.3	2,166	**6.1**	58	80	12.0	67.1	9.1	51,810
12.0	3.7	0.757	7.8	4.2	**13,144**				**20.7**	14	26.7	0.757	19.5	5.0	15,180
53.6	39.0	12.0	46.3	7.3	**43,594**	2,170	10.9	2,299	**5.6**	63	85	12.0	71.9	8.9	50,999
12.0	3.9	0.757	8.0	4.0	**12,773**				**19.0**	17	29.4	0.757	22.2	5.0	14,943
53.6	39.4	12.0	46.5	7.1	**42,315**	2,309	11.6	2,442	**5.1**	69	90	12.0	77.8	8.8	50,198
12.0	4.1	0.757	8.1	3.9	**12,398**				**17.3**	21	32.2	0.757	25.4	4.9	14,708
53.6	39.8	12.0	46.8	6.8	**41,036**	2,458	12.2	2,590	**4.6**	74	95	12.0	82.7	8.7	49,424
12.0	4.3	0.757	8.2	3.8	**12,023**				**15.8**	23	35.0	0.757	28.2	4.8	14,481
53.6	40.2	12.0	47.0	6.6	**39,816**	2,616	13.0	2,748	**4.2**	79	100	12.0	87.6	8.6	48,745
12.0	4.6	0.757	8.3	3.7	**11,666**				**14.5**	26	37.8	0.757	30.9	4.8	14,282
53.6	40.6	12.0	47.2	6.4	**38,487**	2,786	13.7	2,919	**3.9**	84	105	12.0	92.4	8.4	47,997
12.0	4.8	0.757	8.4	3.6	**11,277**				**13.2**	29	40.6	0.757	33.6	4.7	14,063

Compressor: ZPS40K5E-PFV

Heating Mode (Full Load)

EMW-65-HACW-P-1T — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	COPh	EWT	Cond. Temp.	Flow	LWT	Delta T	Net Output
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps	Watts	W/W	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts					°C	°C	L/s	°C	°C	Watts
26.0	15	14.0	22.1	3.9	26,095	3,809	18.6	4,028	**2.87**	104.0	117	14.0	109.6	5.6	**39,391**
-3.3	-9.4	0.883	-5.5	2.2	7,646					40.0	47.2	0.883	43.1	3.1	**11,541**
32.0	20	14.0	27.6	4.4	29,300	3,811	18.6	4,030	**3.10**	104.0	117	14.0	110.1	6.1	**42,604**
0.0	-6.7	0.883	-2.4	2.4	8,585					40.0	47.2	0.883	43.4	3.4	**12,483**
38.0	25	14.0	33.1	4.9	32,263	3,861	18.9	4,079	**3.28**	104.0	118	14.0	110.5	6.5	**45,735**
3.3	-3.9	0.883	0.6	2.7	9,453					40.0	47.8	0.883	43.6	3.6	**13,400**
43.0	30	14.0	37.6	5.4	35,681	3,858	18.8	4,077	**3.53**	104.0	118	14.0	111.0	7.0	**49,143**
6.1	-1.1	0.883	3.1	3.0	10,454					40.0	47.8	0.883	43.9	3.9	**14,399**
48.0	35	14.0	42.2	5.8	38,816	4,160	19.1	4,357	**3.59**	104.0	119	14.0	111.6	7.6	**53,324**
8.9	1.7	0.883	5.6	3.2	11,373					40.0	48.3	0.883	44.2	4.2	**15,624**
54.0	40	14.0	47.5	6.5	42,936	4,411	19.0	4,608	**3.71**	104.0	119	14.0	112.3	8.3	**58,302**
12.2	4.4	0.883	8.6	3.6	12,580					40.0	48.3	0.883	44.6	4.6	**17,082**
60.0	45	14.0	52.9	7.1	46,952	4,464	19.3	4,661	**3.93**	104.0	120	14.0	112.9	8.9	**62,500**
15.6	7.2	0.883	11.6	3.9	13,757					40.0	48.9	0.883	45.0	5.0	**18,312**
66.0	50	14.0	58.2	7.8	51,540	4,462	19.2	4,659	**4.22**	104.0	120	14.0	113.6	9.6	**67,079**
18.9	10.0	0.883	14.6	4.3	15,101					40.0	48.9	0.883	45.3	5.3	**19,654**

Compressor: ZPS51K5E-PFV

Cooling Mode (Full Load)

EMW-65-HACW-P-1T — **R410a 60 Hz**

Source Data (Indoor Loop)						Power Consumption				Sink Data (Outdoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	Effi-ciency	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejection
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps	Watts	EER	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts				COPc	°C	°C	L/s	°C	°C	Watts
53.6	36.4	14.0	45.4	8.2	**57,340**	2,240	10.7	2,452	**6.9**	49	70	14.0	58.8	9.8	64,985
12.0	2.4	0.883	7.4	4.6	**16,801**				**23.4**	9	21.1	0.883	14.9	5.4	19,040
53.6	36.8	14.0	45.6	8.0	**56,108**	2,370	11.3	2,582	**6.4**	54	75	14.0	63.7	9.7	64,197
12.0	2.7	0.883	7.5	4.5	**16,440**				**21.7**	12	23.9	0.883	17.6	5.4	18,810
53.6	37.2	14.0	45.8	7.8	**54,838**	2,509	12.0	2,721	**5.9**	59	80	14.0	68.5	9.5	63,400
12.0	2.9	0.883	7.6	4.4	**16,067**				**20.2**	15	26.7	0.883	20.3	5.3	18,576
53.6	37.6	14.0	46.0	7.6	**53,293**	2,657	12.7	2,869	**5.4**	64	85	14.0	73.4	9.4	62,361
12.0	3.1	0.883	7.8	4.2	**15,615**				**18.6**	18	29.4	0.883	23.0	5.2	18,272
53.6	38.0	14.0	46.2	7.4	**51,781**	2,847	13.4	3,050	**5.0**	70	90	14.0	79.2	9.2	61,497
12.0	3.3	0.883	7.9	4.1	**15,172**				**17.0**	21	32.2	0.883	26.2	5.1	18,019
53.6	38.4	14.0	46.4	7.2	**50,165**	3,021	14.2	3,223	**4.6**	75	95	14.0	84.1	9.1	60,474
12.0	3.6	0.883	8.0	4.0	**14,698**				**15.6**	24	35.0	0.883	28.9	5.1	17,719
53.6	38.8	14.0	46.6	7.0	**48,621**	3,208	15.1	3,411	**4.2**	80	100	14.0	89.0	9.0	59,572
12.0	3.8	0.883	8.1	3.9	**14,246**				**14.3**	27	37.8	0.883	31.6	5.0	17,454
53.6	39.2	14.0	46.8	6.8	**47,251**	3,411	16.0	3,614	**3.8**	85	105	14.0	93.9	8.9	58,895
12.0	4.0	0.883	8.2	3.8	**13,845**				**13.1**	29	40.6	0.883	34.4	4.9	17,256

Compressor: ZPS51K5E-PFV

Performance Tables - EMW-75

Heating Mode (Full Load)

EMW-75-HACW-P-1T — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	COPh	EWT	Cond. Temp.	Flow	LWT	Delta T	Net Output
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps	Watts	W/W	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts					°C	°C	L/s	°C	°C	Watts
24.0	15	16.0	20.2	3.8	28,577	4,419	22.8	4,635	**2.79**	104.0	112	16.0	109.5	5.5	**44,057**
-4.4	-9.4	1.009	-6.5	2.1	8,373					40.0	44.4	1.009	43.1	3.1	**12,909**
30.0	20	16.0	25.8	4.2	32,106	4,414	22.8	4,630	**3.01**	104.0	112	16.0	110.0	6.0	**47,569**
-1.1	-6.7	1.009	-3.5	2.3	9,407					40.0	44.4	1.009	43.3	3.3	**13,938**
36.0	25	16.0	31.2	4.8	36,549	4,462	23.0	4,677	**3.27**	104.0	113	16.0	110.5	6.5	**52,174**
2.2	-3.9	1.009	-0.4	2.7	10,709					40.0	45.0	1.009	43.6	3.6	**15,287**
42.0	30	16.0	36.5	5.5	41,744	4,451	23.0	4,666	**3.60**	104.0	113	16.0	111.2	7.2	**57,331**
5.6	-1.1	1.009	2.5	3.1	12,231					40.0	45.0	1.009	44.0	4.0	**16,798**
48.0	35	16.0	41.9	6.1	46,409	4,649	23.2	4,856	**3.78**	104.0	114	16.0	111.8	7.8	**62,622**
8.9	1.7	1.009	5.5	3.4	13,598					40.0	45.6	1.009	44.4	4.4	**18,348**
54.0	40	16.0	47.3	6.7	51,266	4,634	23.1	4,840	**4.08**	104.0	114	16.0	112.4	8.4	**67,427**
12.2	4.4	1.009	8.5	3.7	15,021					40.0	45.6	1.009	44.7	4.7	**19,756**
60.0	45	16.0	52.6	7.4	56,104	4,676	23.3	4,882	**4.35**	104.0	115	16.0	113.1	9.1	**72,408**
15.6	7.2	1.009	11.5	4.1	16,438					40.0	46.1	1.009	45.0	5.0	**21,215**
66.0	50	16.0	57.9	8.1	61,671	4,659	23.2	4,866	**4.69**	104.0	115	16.0	113.7	9.7	**77,917**
18.9	10.0	1.009	14.4	4.5	18,070					40.0	46.1	1.009	45.4	5.4	**22,830**

Compressor: ZPS60K5E-PFV

Cooling Mode (Full Load)

EMW-75-HACW-P-1T — **R410a 60 Hz**

Source Data (Indoor Loop)						Power Consumption				Sink Data (Outdoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	Effi-ciency	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejection
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps	Watts	EER	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts				COPc	°C	°C	L/s	°C	°C	Watts
53.6	38.0	16.0	45.5	8.1	**64,550**	2,666	15.0	2,884	**6.6**	53	70	16.0	62.7	9.7	73,647
12.0	3.3	1.009	7.5	4.5	**18,913**				**22.4**	12	21.1	1.009	17.1	5.4	21,578
53.6	38.5	16.0	45.8	7.8	**62,721**	2,853	15.7	3,071	**6.0**	58	75	16.0	67.5	9.5	72,458
12.0	3.6	1.009	7.6	4.4	**18,377**				**20.4**	14	23.9	1.009	19.7	5.3	21,230
53.6	39.0	16.0	46.0	7.6	**60,462**	3,043	16.5	3,262	**5.4**	64	80	16.0	73.3	9.3	70,849
12.0	3.9	1.009	7.8	4.2	**17,715**				**18.5**	18	26.7	1.009	23.0	5.2	20,759
53.6	39.5	16.0	46.3	7.3	**58,355**	3,240	17.3	3,458	**4.9**	69	85	16.0	78.1	9.1	69,413
12.0	4.2	1.009	7.9	4.1	**17,098**				**16.9**	21	29.4	1.009	25.6	5.1	20,338
53.6	40.0	16.0	46.5	7.1	**56,526**	3,462	18.2	3,678	**4.5**	75	90	16.0	84.0	9.0	68,343
12.0	4.4	1.009	8.1	3.9	**16,562**				**15.4**	24	32.2	1.009	28.9	5.0	20,024
53.6	40.5	16.0	46.7	6.9	**54,825**	3,679	19.1	3,894	**4.1**	80	95	16.0	88.9	8.9	67,382
12.0	4.7	1.009	8.2	3.8	**16,064**				**14.1**	27	35.0	1.009	31.6	4.9	19,743
53.6	41.0	16.0	47.0	6.6	**53,105**	3,909	20.0	4,124	**3.8**	85	100	16.0	93.7	8.7	66,445
12.0	5.0	1.009	8.3	3.7	**15,560**				**12.9**	29	37.8	1.009	34.3	4.9	19,468
53.6	41.5	16.0	47.2	6.4	**51,428**	4,153	21.1	4,369	**3.4**	90	105	16.0	98.6	8.6	65,603
12.0	5.3	1.009	8.4	3.6	**15,068**				**11.8**	32	40.6	1.009	37.0	4.8	19,222

Compressor: ZPS60K5E-PFV

Heating Mode

EMW-80-HACW-P-1S — **R410a 60 Hz**

Source Data (Outdoor Loop)						Power Consumption				Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	COPh	EWT	Cond. Temp.	Flow	LWT	Delta T	Net Output
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps	Watts	W/W	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts					°C	°C	L/s	°C	°C	Watts
26.0	15	17.0	21.8	4.2	34,067	5,634	27.5	5,823	**2.70**	104.0	112	17.0	110.3	6.3	**53,568**
-3.3	-9.4	1.073	-5.7	2.3	9,981					40.0	44.4	1.073	43.5	3.5	**15,695**
32.0	20	17.0	27.3	4.7	38,322	5,677	27.6	5,866	**2.90**	104.0	113	17.0	110.8	6.8	**57,969**
0.0	-6.7	1.073	-2.6	2.6	11,228					40.0	45.0	1.073	43.8	3.8	**16,985**
37.0	25	17.0	31.7	5.3	42,746	5,729	27.7	5,917	**3.10**	104.0	114	17.0	111.4	7.4	**62,569**
2.8	-3.9	1.073	-0.2	2.9	12,524					40.0	45.6	1.073	44.1	4.1	**18,333**
42.0	30	17.0	36.1	5.9	47,774	5,777	27.8	5,966	**3.33**	104.0	115	17.0	112.0	8.0	**67,763**
5.6	-1.1	1.073	2.3	3.3	13,998					40.0	46.1	1.073	44.4	4.4	**19,854**
47.0	35	17.0	40.5	6.5	52,814	5,822	27.9	6,011	**3.56**	104.0	116	17.0	112.6	8.6	**72,982**
8.3	1.7	1.073	4.7	3.6	15,474					40.0	46.7	1.073	44.8	4.8	**21,383**
51.0	40	17.0	43.8	7.2	57,881	5,893	28.0	6,082	**3.77**	104.0	117	17.0	113.2	9.2	**78,291**
10.6	4.4	1.073	6.6	4.0	16,959					40.0	47.2	1.073	45.1	5.1	**22,939**
57.0	45	17.0	49.2	7.8	62,859	6,031	28.0	6,220	**3.94**	104.0	118	17.0	113.9	9.9	**83,739**
13.9	7.2	1.073	9.6	4.3	18,418					40.0	47.8	1.073	45.5	5.5	**24,535**
62.0	50	17.0	53.6	8.4	67,755	6,218	28.0	6,407	**4.08**	104.0	119	17.0	114.5	10.5	**89,272**
16.7	10.0	1.073	12.0	4.7	19,852					40.0	48.3	1.073	45.8	5.8	**26,156**

Compressor: ZP70KWE-PFV

Cooling Mode

EMW-80-HACW-P-1S — **R410a 60 Hz**

Source Data (Indoor Loop)						Power Consumption				Sink Data (Outdoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Total		Effective	Effi-ciency	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejec-tion
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps	Watts	EER	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts				COPc	°C	°C	L/s	°C	°C	Watts
53.6	35.5	17.0	44.7	8.9	**75,484**	3,211	16.8	3,382	**6.5**	50	70	17.0	60.7	10.7	86,442
12.0	1.9	1.073	7.1	4.9	**22,116**				**22.3**	10	21.1	1.073	15.9	5.9	25,327
53.6	36.0	17.0	44.9	8.7	**74,161**	3,399	17.7	3,571	**6.1**	55	75	17.0	65.6	10.6	85,762
12.0	2.2	1.073	7.1	4.9	**21,729**				**20.8**	13	23.9	1.073	18.7	5.9	25,128
53.6	36.5	17.0	45.0	8.6	**72,642**	3,603	18.7	3,775	**5.6**	60	80	17.0	70.5	10.5	84,938
12.0	2.5	1.073	7.2	4.8	**21,284**				**19.2**	16	26.7	1.073	21.4	5.8	24,887
53.6	37.0	17.0	45.2	8.4	**70,929**	3,791	19.7	3,962	**5.2**	65	85	17.0	75.4	10.4	83,867
12.0	2.8	1.073	7.4	4.6	**20,782**				**17.9**	18	29.4	1.073	24.1	5.8	24,573
53.6	37.5	17.0	45.5	8.1	**68,881**	3,982	20.8	4,164	**4.8**	70	90	17.0	80.2	10.2	82,472
12.0	3.1	1.073	7.5	4.5	**20,182**				**16.5**	21	32.2	1.073	26.8	5.7	24,164
53.6	38.0	17.0	45.7	7.9	**66,803**	4,158	21.9	4,340	**4.5**	75	95	17.0	85.0	10.0	80,993
12.0	3.3	1.073	7.6	4.4	**19,573**				**15.4**	24	35.0	1.073	29.5	5.6	23,731
53.6	38.5	17.0	45.9	7.7	**65,065**	4,387	23.1	4,568	**4.2**	80	100	17.0	89.9	9.9	80,037
12.0	3.6	1.073	7.7	4.3	**19,064**				**14.2**	27	37.8	1.073	32.2	5.5	23,451
53.6	39.0	17.0	46.1	7.5	**63,356**	4,629	24.4	4,811	**3.9**	85	105	17.0	94.8	9.8	79,156
12.0	3.9	1.073	7.9	4.1	**18,563**				**13.2**	29	40.6	1.073	34.9	5.4	23,193

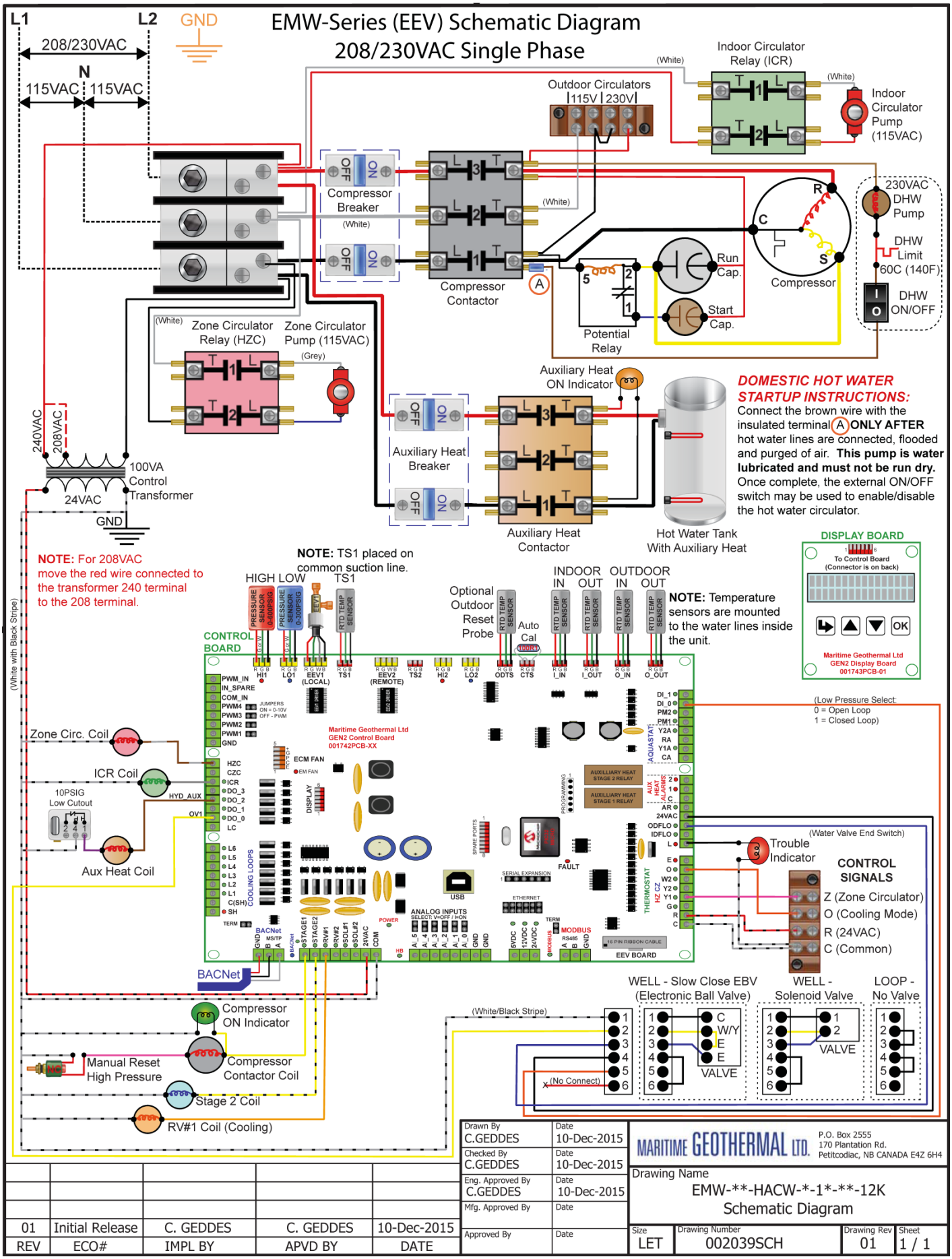
Compressor: ZP70KWE-PFV

Electrical Specifications

TABLE 24 - EMW-Series Electrical Data

	Code	Power Supply			Compressor		Internal Circulators	Electric Elements	Outdoor Circulators	FLA	MCA	Max. Breaker	Min. Wire Size
		V-ø-Hz	MIN	MAX	RLA	LRA	RLA	Max A	Max A	Amps	Amps	Amps	ga
EMW-45	1	230-1-60	187	253	**15.6**	**83**	2.5	48	4.0	**70.9**	**86.8**	**100**	**#3-3**
	2	208-3-60	187	229	**11.6**	**73**	2.5	43	4.0	**61.9**	**75.6**	**80**	**#4-4**
	6	220-1-50	187	253	**12.4**	**67**	2.5	43	4.0	**62.7**	**76.6**	**80**	**#4-2**
	7	380-3-50	342	418	**5.1**	**38**	2.5	43	4.0	**55.4**	**67.4**	**80**	**#4-4**
EMW-55	1	230-1-60	187	253	**21.2**	**104**	2.5	48	5.0	**77.5**	**94.8**	**100**	**#3-3**
	2	208-3-60	187	229	**14.0**	**83**	2.5	43	5.0	**65.3**	**79.6**	**80**	**#4-4**
	6	220-1-50	187	253	**15.5**	**100**	2.5	43	5.0	**66.8**	**81.4**	**100**	**#3-2**
	7	380-3-50	342	418	**6.1**	**43**	2.5	43	5.0	**57.4**	**69.7**	**80**	**#4-4**
EMW-65	1	230-1-60	187	253	**27.1**	**153**	2.5	48	5.0	**83.4**	**102.2**	**125**	**#1-3**
	2	208-3-60	187	229	**16.5**	**110**	2.5	43	5.0	**67.8**	**82.7**	**100**	**#3-4**
	6	220-1-50	187	253	**21.5**	**126**	2.5	43	5.0	**72.8**	**88.9**	**100**	**#3-2**
	7	380-3-50	342	418	**6.9**	**52**	2.5	43	5.0	**58.2**	**70.7**	**80**	**#4-4**
EMW-75	1	230-1-60	187	253	**29.7**	**179**	2.5	48	5.0	**86.0**	**105.4**	**125**	**#1-3**
	2	208-3-60	187	229	**17.6**	**136**	2.5	43	5.0	**68.9**	**84.1**	**100**	**#3-4**
	6	220-1-50	187	253	**29.5**	**176**	2.5	43	5.0	**80.8**	**98.9**	**125**	**#1-2**
	7	380-3-50	342	418	**8.5**	**67**	2.5	43	5.0	**59.8**	**72.7**	**80**	**#4-4**
EMW-80	1	230-1-60	187	253	**32.1**	**148**	2.5	48	5.0	**88.4**	**108.4**	**125**	**#1-3**
	2	208-3-60	187	229	**22.4**	**149**	2.5	43	5.0	**73.7**	**90.1**	**100**	**#3-4**
	7	380-3-50	342	418	**10.6**	**74**	2.5	43	5.0	**61.9**	**75.3**	**80**	**#4-4**

Wiring Diagram (208/230-1-60)



01	Initial Release	C. GEDDES	C. GEDDES	10-Dec-2015
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By C.GEDDES	Date 10-Dec-2015
Checked By C.GEDDES	Date 10-Dec-2015
Eng. Approved By C.GEDDES	Date 10-Dec-2015
Mfg. Approved By	Date
Approved By	Date

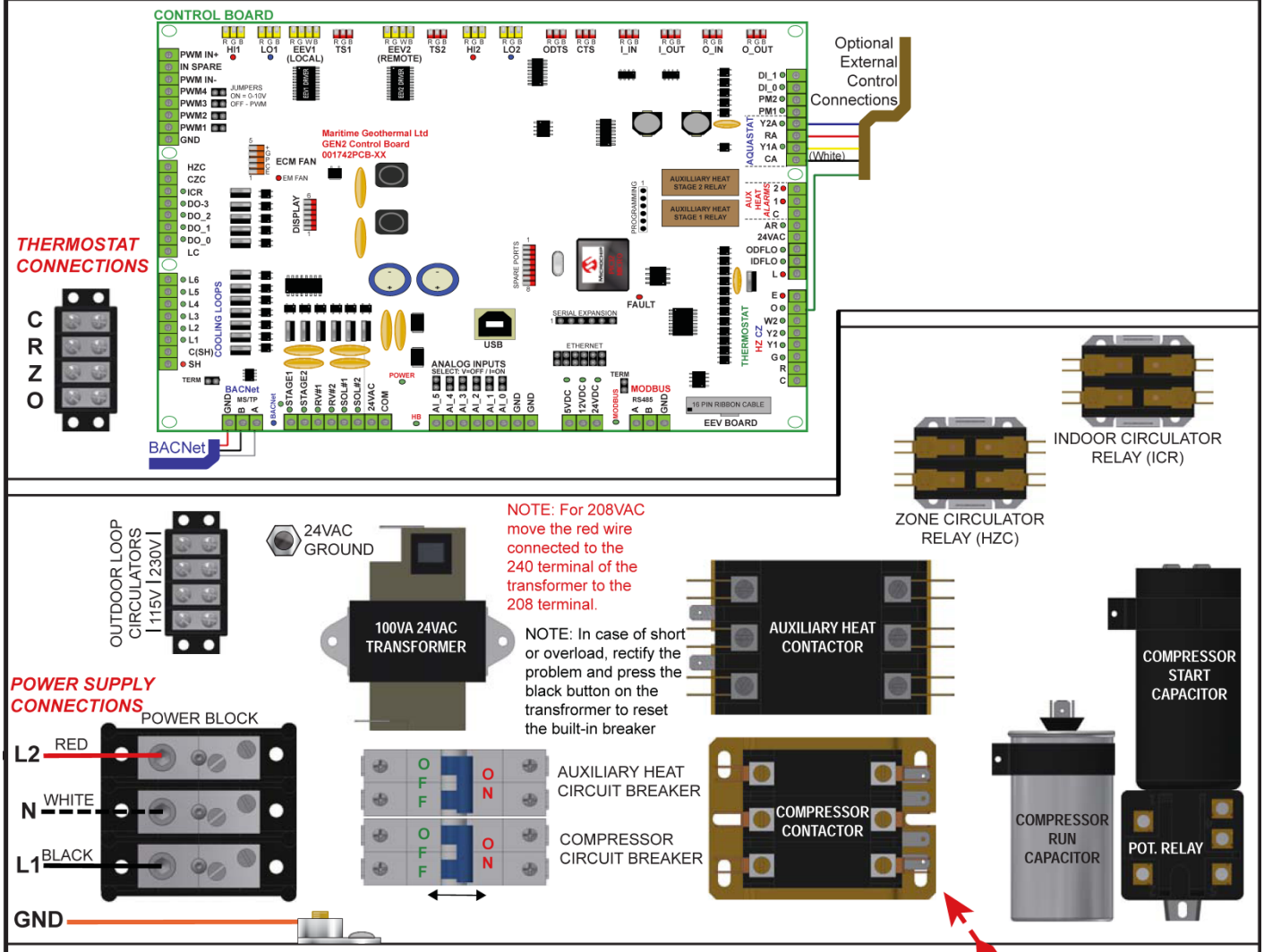
MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name
EMW-**-HACW-*-1*-**-12K
Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002039SCH	01	1 / 1

Electrical Box Layout (208/230-1-60)

EMW-Series (EEV) Electrical Box Diagram
208/230VAC Single Phase - One/Two Stage



BACNet CONTROL DESCRIPTION

BACNet Object	External	Activation
SYSTEM_O	O	Heating (OFF) / Cooling (ON)
SYSTEM_Y1A	-	Compressor ON
SYSTEM_Y2A	-	Compressor stage 2

MS/TP RS-485 connection - use twisted pair shielded cable to connect BACNet connections to the control board connector:

A - Communication (+)
B - Communication (-)
GND - Ground

208/230/115VAC CONNECTIONS

Wire	Colour	Contactor (Label)
Line 2	Red	L2
Neutral	White	N
Line 1	Black	L1

Connect "GND" to ground lug

DOMESTIC HOT WATER:

Connect the brown wire with the insulated terminal **ONLY AFTER** hot water lines are connected, flooded and purged of air. **This pump is water lubricated and must not be run dry.** Once complete, the external ON/OFF switch may be used to enable/disable the hot water circulator.

CIRCULATOR CONNECTIONS (230/115VAC)

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

EXTERNAL CONTROL CONNECTIONS (24VAC)

C - 24VAC Common
R - 24VAC Hot
Z - Zone Circulator
O - Cooling Mode (Active) - Heating Mode (Inactive)

A dry contact connection between R and any external control connection (Z or O) will activate the external control signal input to the control board. Use an 18-4 cable.

REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Release	Dan Rheault	Dan Rheault	10-Dec-2015

Drawn By: Dan Rheault	Date: 10-Dec-2015	
Checked By: Dan Rheault	Date: 10-Dec-2015	
Eng. Approved By: Dan Rheault	Date: 10-Dec-2015	
Mfg. Approved By	Date	
Approved By	Date	

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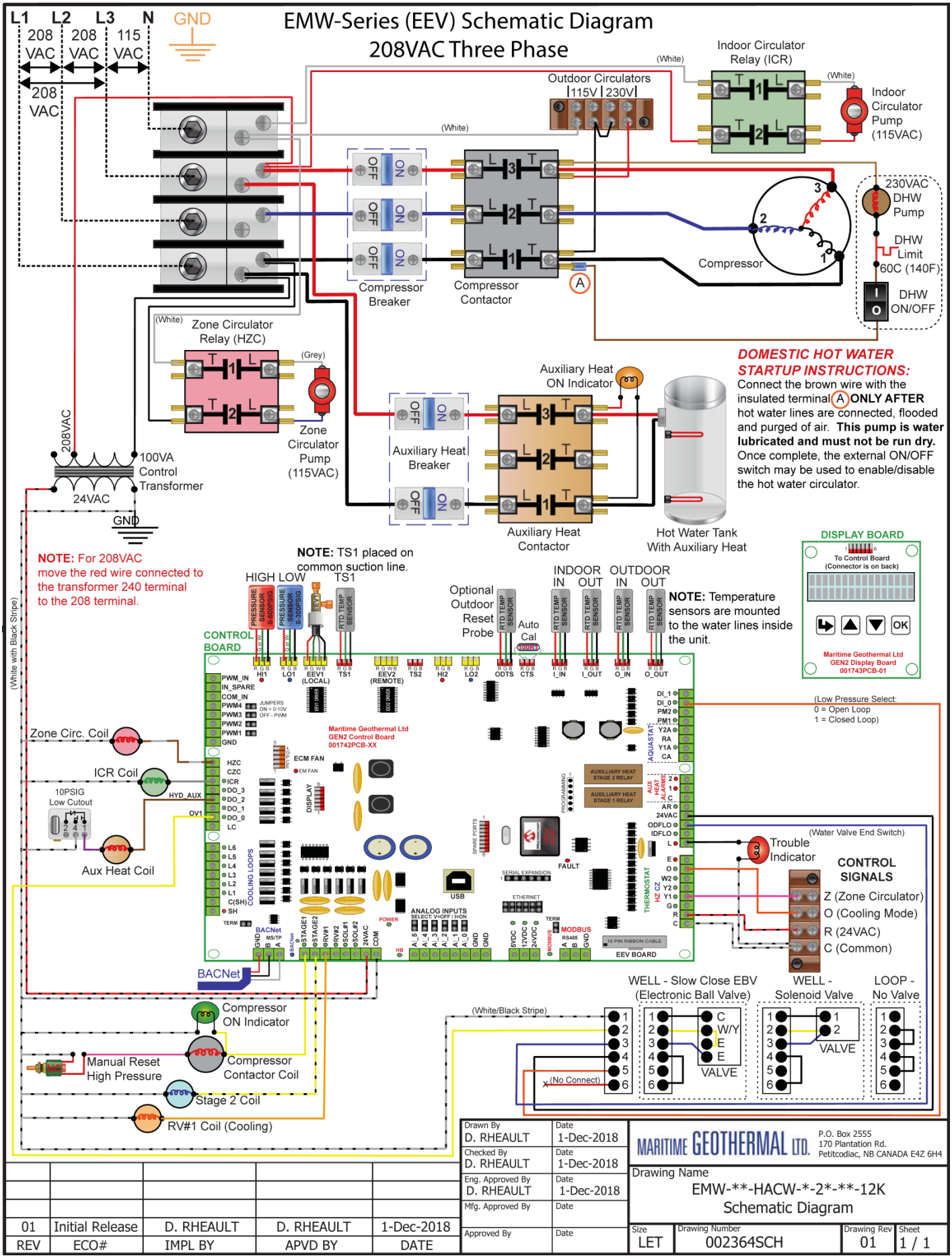
Drawing Name: EMW-**-HACW-P-1*-**-1K Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002040SCH	01	1 / 1

Wiring Diagram (208-3-60)



01	Initial Release	D. RHEAULT	D. RHEAULT	1-Dec-2018
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By: D. RHEAULT	Date: 1-Dec-2018
Checked By: D. RHEAULT	Date: 1-Dec-2018
Eng. Approved By: D. RHEAULT	Date: 1-Dec-2018
Mfg. Approved By:	Date:
Approved By:	Date:

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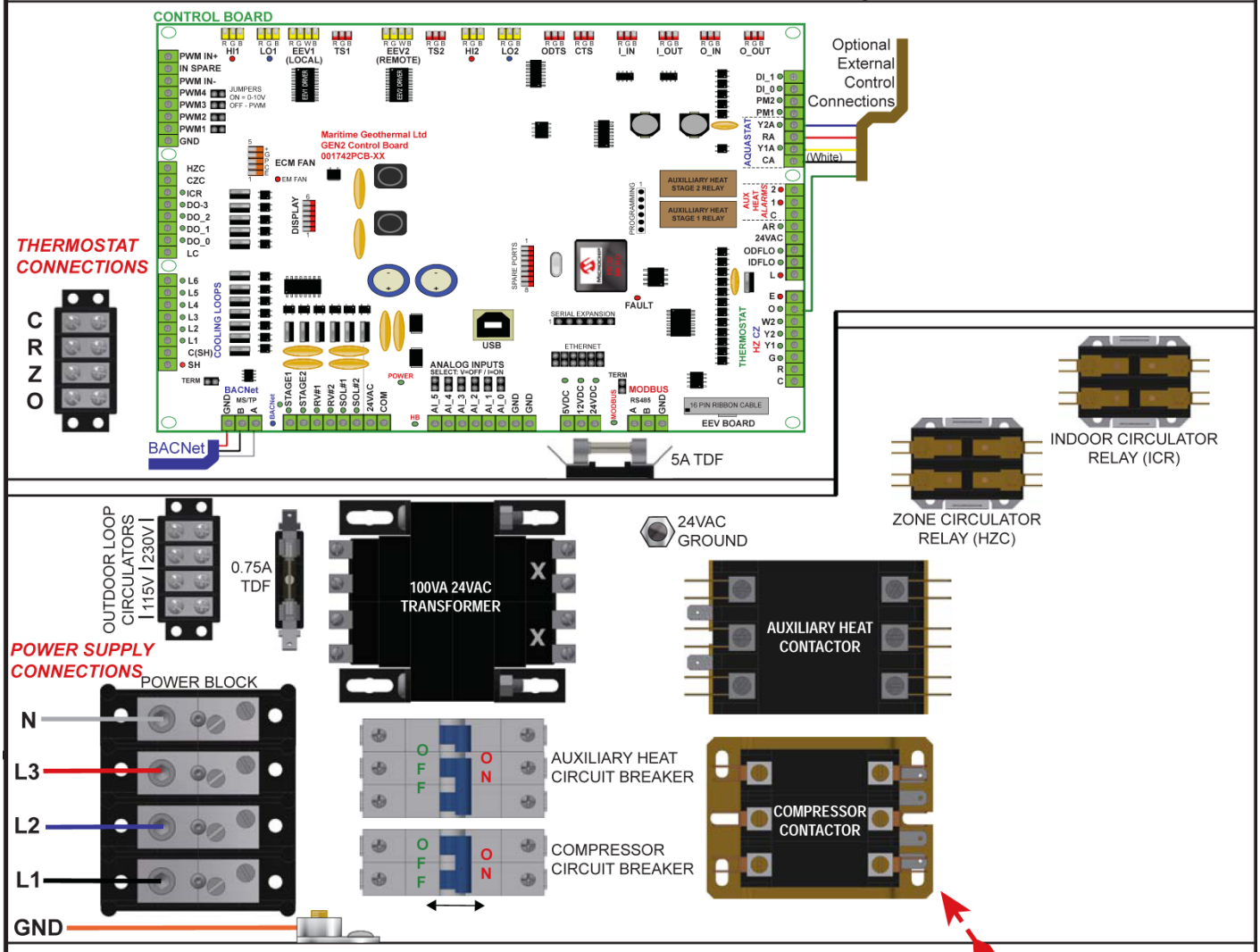
Drawing Name: EMW-**-HACW-*-2*-**-12K Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002364SCH	01	1 / 1

Electrical Box Layout (208-3-60)

EMW-Series (EEV) Electrical Box Diagram
208VAC Three Phase - One/Two Stage



BACNet CONTROL DESCRIPTION

BACNet Object	External	Activation
SYSTEM_O	O	Heating (OFF) / Cooling (ON)
SYSTEM_Y1A	-	Compressor ON
SYSTEM_Y2A	-	Compressor stage 2

MS/TP RS-485 connection - use twisted pair shielded cable to connect BACNet connections to the control board connector:

A - Communication (+)
B - Communication (-)
GND - Ground

208VAC 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

DOMESTIC HOT WATER:

Connect the brown wire with the insulated terminal **ONLY AFTER** hot water lines are connected, flooded and purged of air. **This pump is water lubricated and must not be run dry.** Once complete, the external ON/OFF switch may be used to enable/disable the hot water circulator.

CIRCULATOR CONNECTIONS (230/115VAC)

REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 115VAC circulators to 115V
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C - 24VAC Common
R - 24VAC Hot
Z - Zone Circulator
O - Cooling Mode (Active) - Heating Mode (Inactive)

A dry contact connection between R and any external control connection (Z or O) will activate the external control signal input to the control board. Use an 18-4 cable.

REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Release	Dan Rheault	Dan Rheault	1-Dec-2018

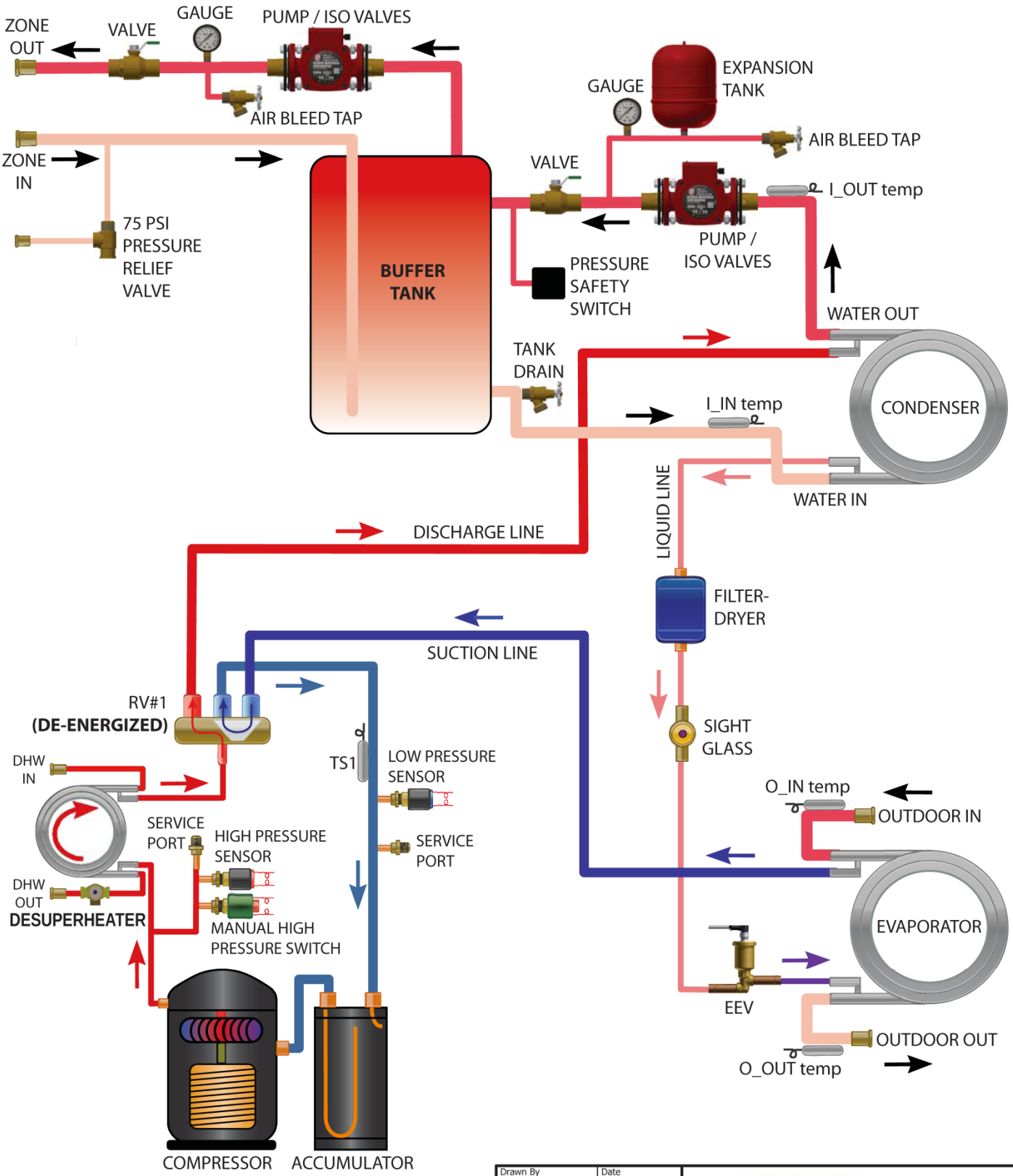
Drawn By: Dan Rheault	Date: 1-Dec-2018	
Checked By: Dan Rheault	Date: 1-Dec-2018	
Eng. Approved By: Dan Rheault	Date: 1-Dec-2018	
Mfg. Approved By:	Date:	
Approved By:	Date:	

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

Drawing Name: EMW-**-HACW-P-2*-**-12K Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002365SCH	01	1 / 1

EMW Series Refrigeration Circuit - Heating Mode



REV	ECO#	IMPL BY	APVD BY	DATE
01	000232	Dan Rheault	Dan Rheault	10-Dec-2015
01	000198	Chris Geddes	Chris Geddes	7-May-2012
01	Initial Release	Chris Geddes	Chris Geddes	12-Jun-2009

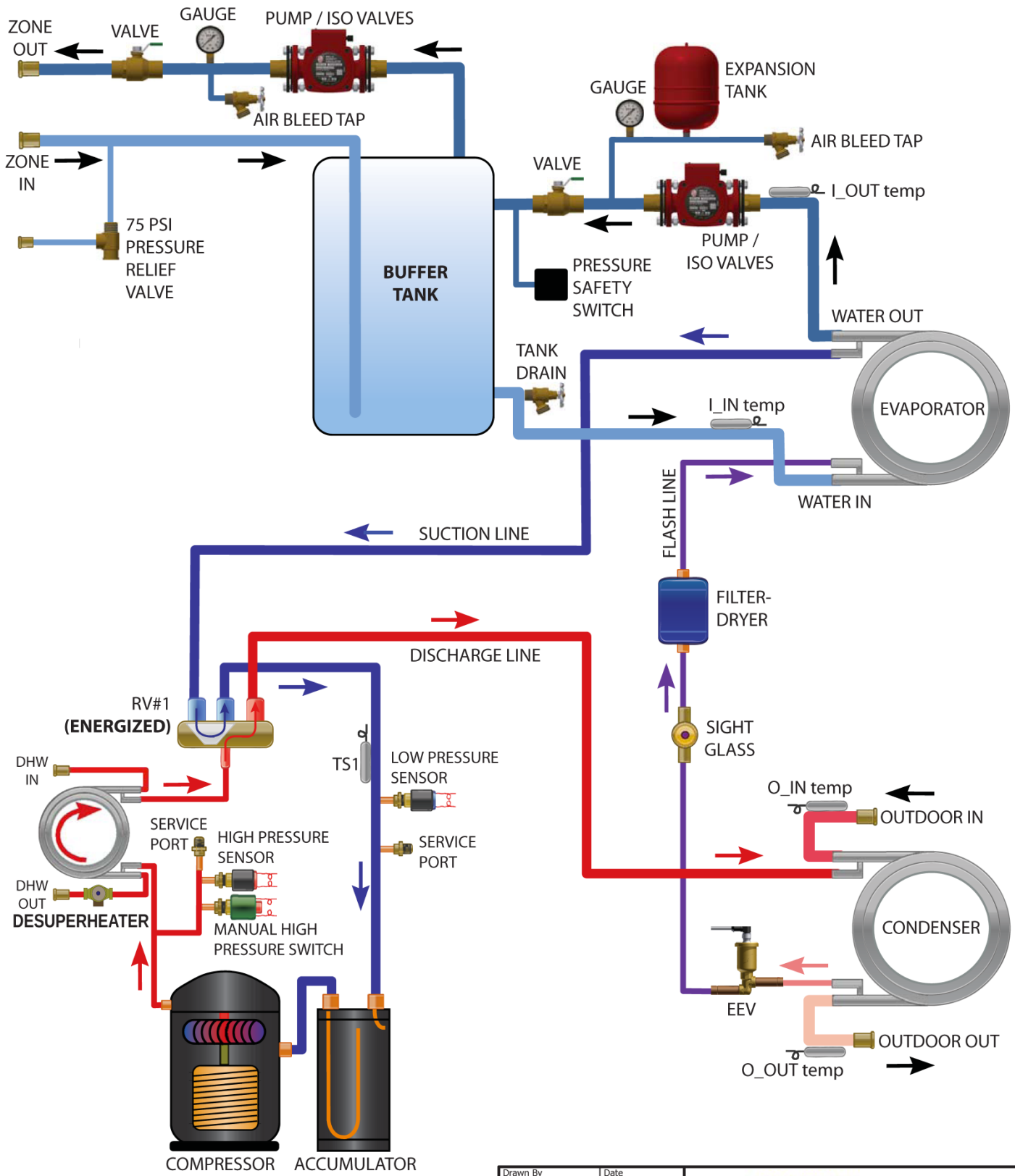
Drawn By: Dan Rheault	Date: 10-Dec-2015		
Checked By: Dan Rheault	Date: 10-Dec-2015		
Eng. Approved By: Dan Rheault	Date: 10-Dec-2015		
Mfg. Approved By	Date		
Approved By	Date		

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

Drawing Name: EMW-Series Refrigeration Circuit - Heating Mode

Size	Drawing Number	Drawing Revision	Sheet
LET	001047RCD	03	1 / 1

EMW Series Refrigeration Circuit - Cooling Mode

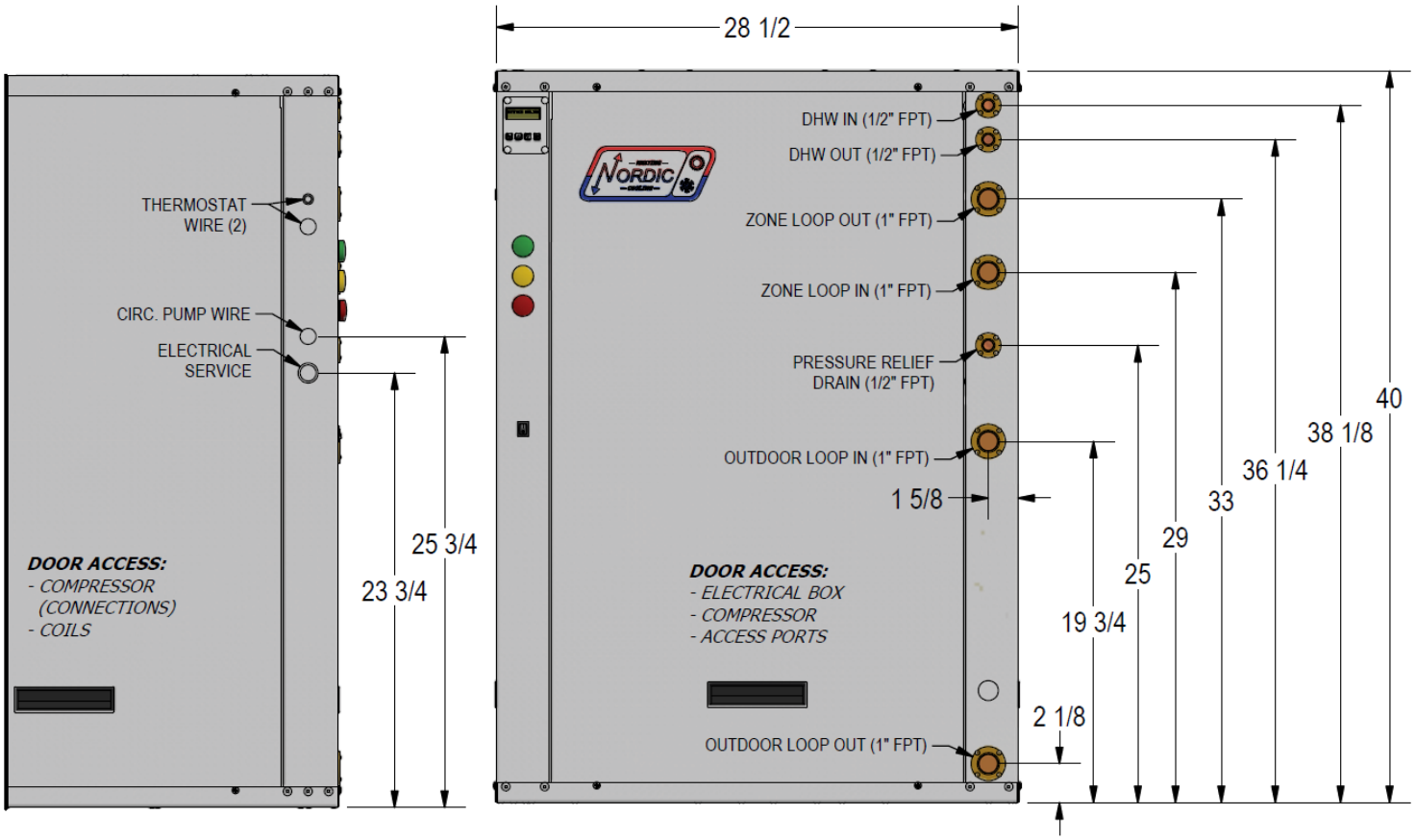


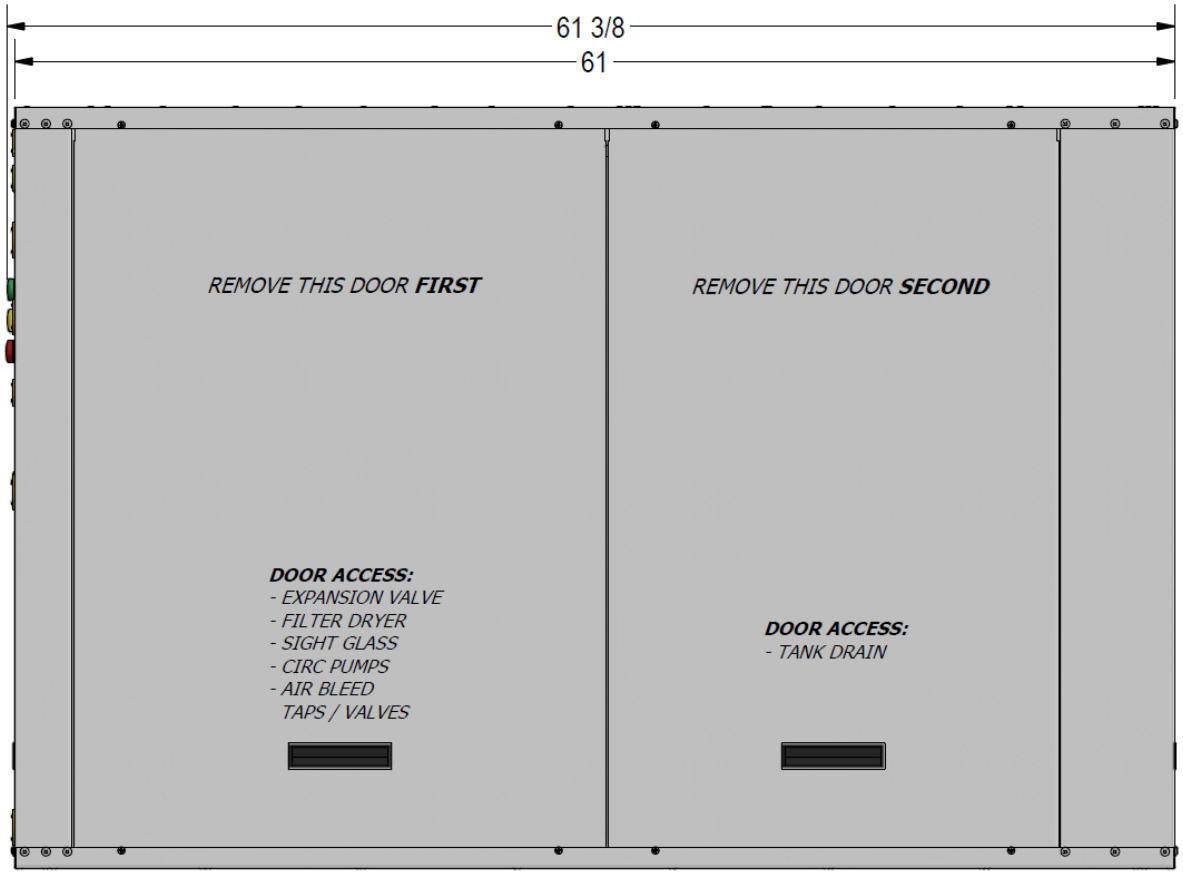
REV	ECO#	IMPL BY	APVD BY	DATE
01	000232	Dan Rheault	Dan Rheault	10-Dec-2015
01	000198	Chris Geddes	Chris Geddes	7-May-2012
01	Initial Release	Chris Geddes	Chris Geddes	12-Jun-2009

Drawn By: Dan Rheault	Date: 10-Dec-2015	MARITIME GEOTHERMAL LTD.	P.O. Box 2555, 170 Plantation Rd., Petitcodiac, NB CANADA E4Z 6H4
Checked By: Dan Rheault	Date: 10-Dec-2015	Drawing Name: EMW-Series Refrigeration Circuit - Cooling Mode	
Eng. Approved By: Dan Rheault	Date: 10-Dec-2015		
Mfg. Approved By	Date		
Approved By	Date		

Size	Drawing Number	Drawing Revision	Sheet
LET	001048RCD	03	1 / 1

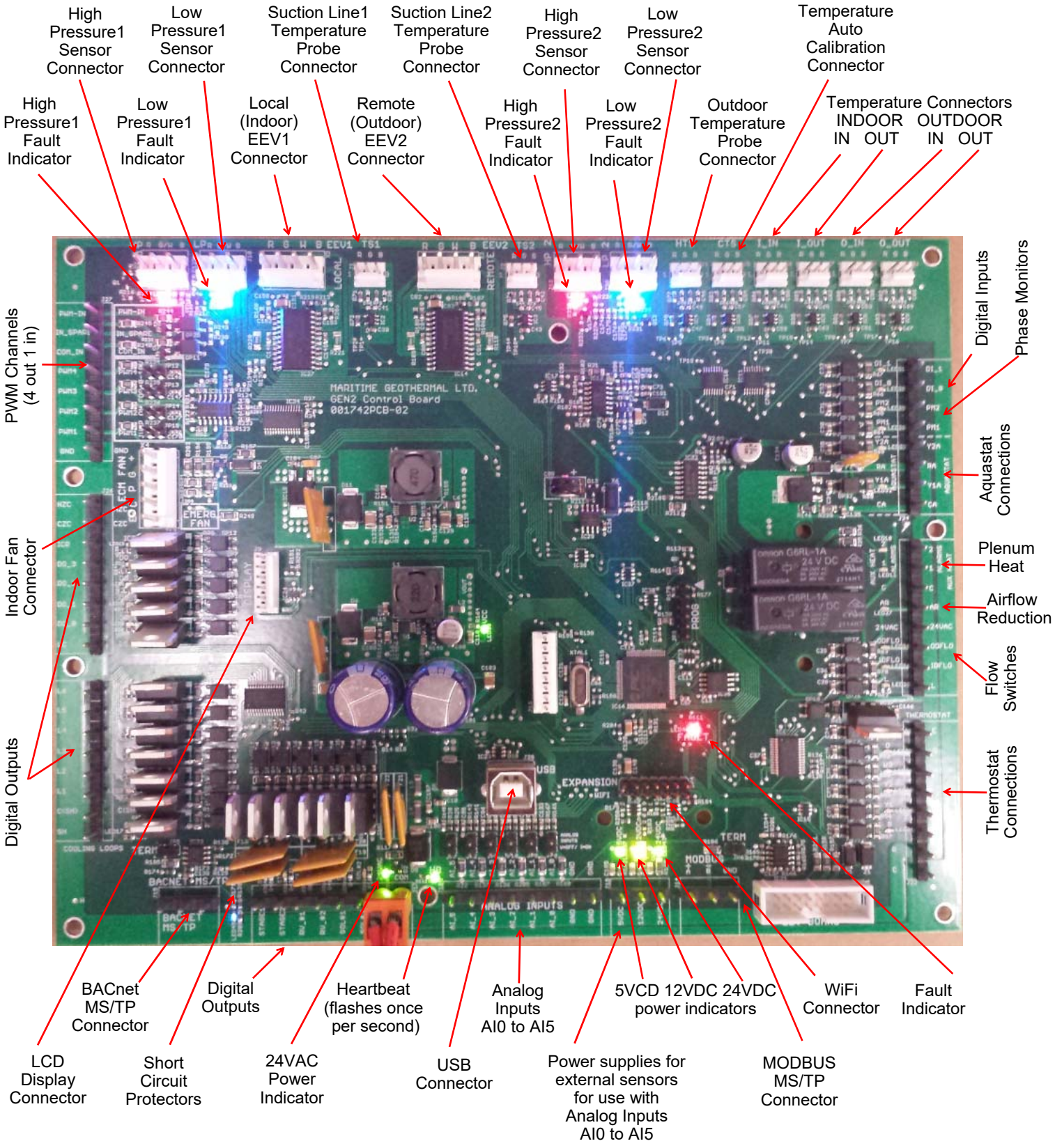
Dimensions


28 1/2
THERMOSTAT WIRE (2)
CIRC. PUMP WIRE
ELECTRICAL SERVICE
25 3/4
23 3/4
DOOR ACCESS:
- COMPRESSOR (CONNECTIONS)
- COILS
DHW IN (1/2" FPT)
DHW OUT (1/2" FPT)
ZONE LOOP OUT (1" FPT)
ZONE LOOP IN (1" FPT)
PRESSURE RELIEF DRAIN (1/2" FPT)
OUTDOOR LOOP IN (1" FPT)
1 5/8
OUTDOOR LOOP OUT (1" FPT)
2 1/8
19 3/4
25
29
33
36 1/4
38 1/8
40
DOOR ACCESS:
- ELECTRICAL BOX
- COMPRESSOR
- ACCESS PORTS


61 3/8
61
REMOVE THIS DOOR FIRST
REMOVE THIS DOOR SECOND
DOOR ACCESS:
- EXPANSION VALVE
- FILTER DRYER
- SIGHT GLASS
- CIRC PUMPS
- AIR BLEED TAPS / VALVES
DOOR ACCESS:
- TANK DRAIN

Appendix A - GEN2 Control Board Description

The picture below shows the locations of the connectors and LED indicators of the control board. The control board offers many features such as short circuit protection on all digital outputs, Real Time Clock with super capacitor for backup power, WiFi capability, relay outputs for plenum heater control (if equipped), USB port, PIC32 microcontroller, etc.



The tables describe the connections starting with the top of the board and working around the board counter clock-wise.

TABLE A1 - Control Board Connector Descriptions (Top)		
Name	**Description**	
HPS1/HI1	High Pressure Sensor 1	Measures discharge pressure.
LPS1/LO1	Low Pressure Sensor 1	Measures suction pressure.
EEV1	Local EEV	Control of Electronic Expansion Valve.
TS1	Suction Line Temperature 1	Mounted to common suction line inside unit.
EEV2	Remote EEV	Unused.
TS2	Suction Line Temperature 2	Unused.
HPS2/HI2	High Pressure Sensor 2	Unused.
LPS2/LO2	Low Pressure Sensor 2	Unused.
HTS/ODTS	Outdoor Temperature	Optional outdoor temperature sensor for outdoor reset feature.
CTS	Auto Calibration	Resistor in connector for auto-calibration reference (32°F—0°C).
I_IN	Indoor Loop IN	Mounted to pipe inside unit (in heat pump to tank circuit).
I_OUT	Indoor Loop OUT	Mounted to pipe inside unit (in heat pump to tank circuit).
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	Unused.
COM_IN	Common for PWM IN	Unused.
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	Unused.
HZC	Hot Zone Circulator	Operates the Zone Circulator.
CZC	Cold Zone Circulator	Unused.
ICR	Internal Circulator Relay	Operates the Indoor Circulator (in heat pump to tank circuit).
DO_3	Auxiliary Only	Unused.
DO_2	Hydronic Auxiliary	Operates the auxiliary heat electric elements in buffer tank.
DO_1	Digital output	Unused.
DO_0	Digital output	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	Loop4	Unused.
L3	Loop3	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 compressor.
STAGE2	Compressor Stage 2	Turns the compressor Stage 2 solenoid on/off.
RV_#1	Reversing Valve#1	Off in heating mode, on in cooling mode.
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	0 to 5VDC or 4-20mA user settable with board jumper.
AI_4	Analog In Channel 4	0 to 5VDC or 4-20mA user settable with board jumper.
AI_3	Analog In Channel 3	0 to 5VDC or 4-20mA user settable with board jumper.
AI_2	Analog In Channel 2	0 to 5VDC or 4-20mA user settable with board jumper.
AI_1	Analog In Channel 1	0 to 5VDC or 4-20mA user settable with board jumper.
AI_0	Analog In Channel 0	Optional compressor current sensor.
GND	Ground pin	Ground for analog sensors.
GND	Ground pin	Ground for analog sensors.
5VDC	Power for analog sensors	Provides 5VDC power supply for sensors.
12VDC	Power for analog sensors	Provides 12VDC power supply for sensors.
24VDC	Power for analog sensors	Provides 24VDC power supply for sensors.
A	MODBUS	RS-485.
B	MODBUS	RS-485.
GND	MODBUS	Ground for shield if required.

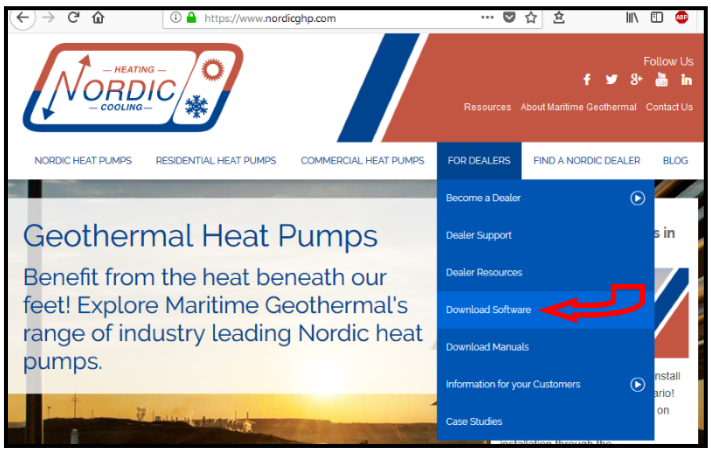
TABLE A4 - Control Board Connector Descriptions (Right Side)		
Name	**Description**	
DI_1	Digital Input1	Unused.
DI_0	Digital Input0	Low pressure select from open/closed loop harness (0=open loop, 1=closed loop)
PM2	Phase Monitor2	Unused.
PM1	Phase Monitor1	Accessory for 3 phase models.
Y2A*	Aquastat Stage2	Unused.
RA*	Aquastat Power (24VAC)	Unused.
Y1A*	Aquastat Stage1	Unused.
CA*	Aquastat Power (Ground)	Unused.
2	Plenum Heat Stage2	Unused.
1	Plenum Heat Stage1	Unused.
C	Plenum Heat Common	Unused.
AR	Airflow Reductions	Unused.
24VAC	Power	Power 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	Lockout Indicator	24VAC trouble LED.
E	Thermostat Emergency Heat	Unused.
O	Thermostat Heat/Cool	24VAC input to activate cooling mode.
W2	Thermostat Auxiliary Heat	Unused.
Y2	Thermostat Stage2	Unused.
Y1	Thermostat Stage1	24VAC input to run zone circulator.
G	Thermostat Fan Recirculation	Unused.
R	Thermostat Power (24VAC)	24VAC to terminal strip.
C	Thermostat Power (Ground)	24VAC to terminal strip.

Appendix B - USB Driver Installation

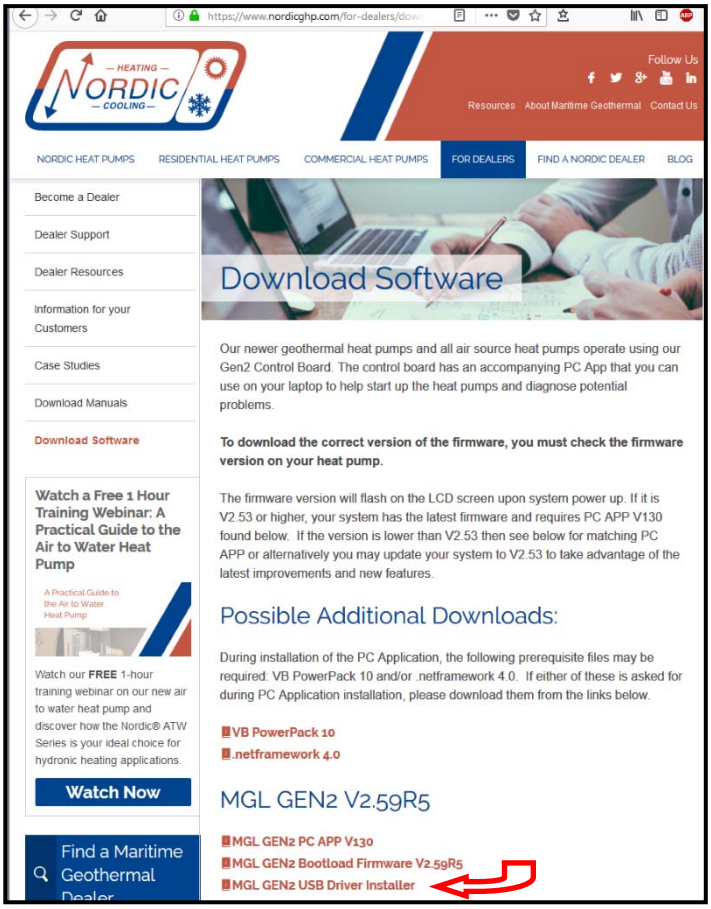
The first step in connecting a Windows laptop computer to the control board is to install the USB driver.

Any version of Windows from XP and onwards is compatible, including 7 & 10. Screenshots shown are from Windows 10.

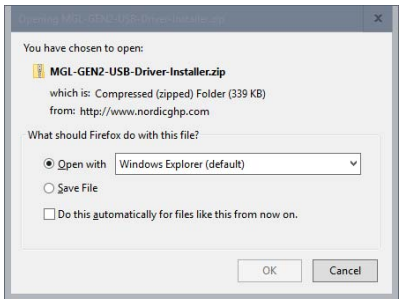
1. Go to www.nordicghp.com, Download Software page:



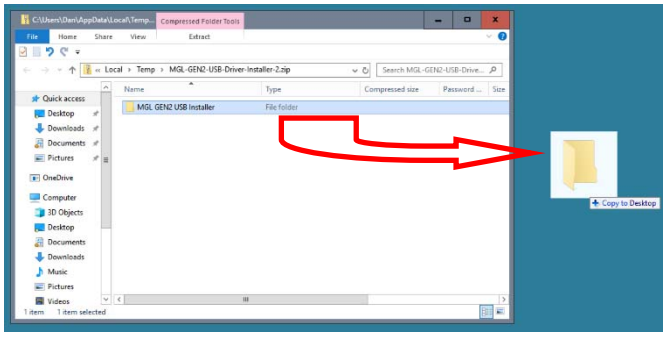
2. Click on MGL GEN2 USB Driver Installer to download it:



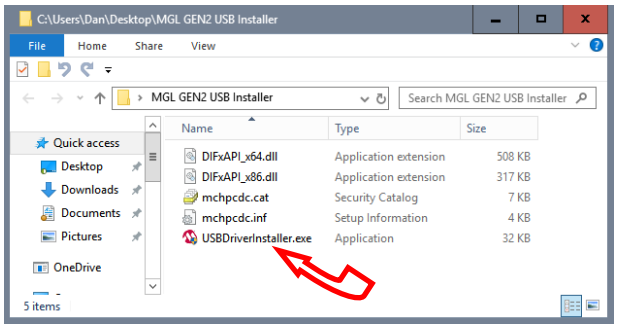
3. Choose “Open with Windows Explorer”, and hit “OK”:



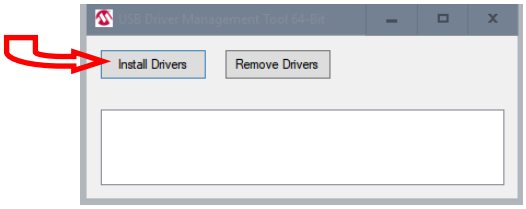
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



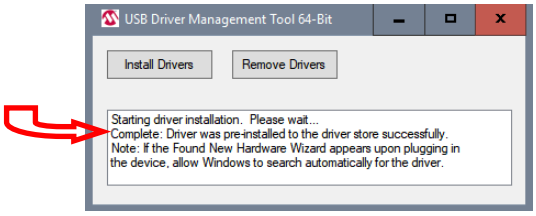
5. Double click on the folder you just dragged onto the desktop, then double click on the “USBDriverInstaller” file:



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



7. You will see a message indicating the driver was installed successfully. Proceed to the PC App Installation.

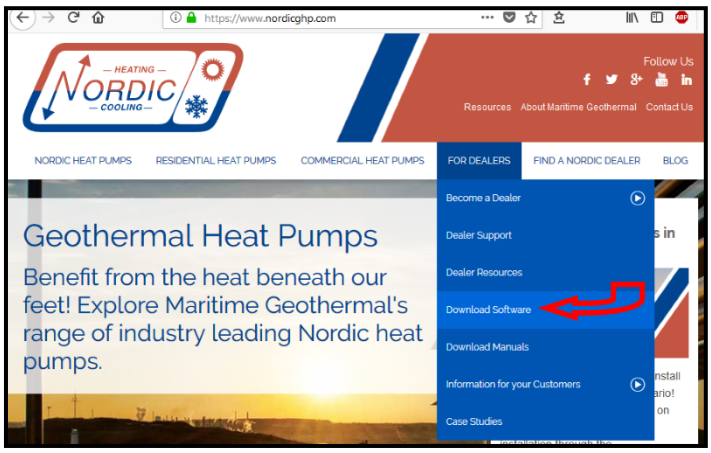


Appendix C - PC App Installation

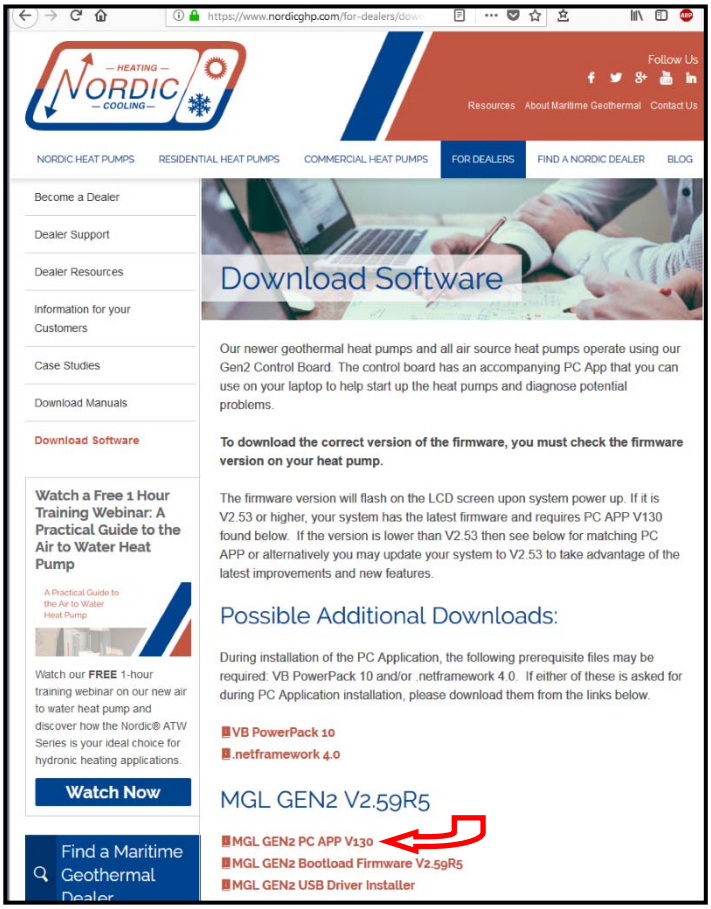
The second step in connecting a Windows laptop computer to the control board is to install the PC App. Be sure USB driver is already installed.

Any version of Windows from XP and onwards is compatible, including 7 & 10. Screenshots shown are from Windows 10.

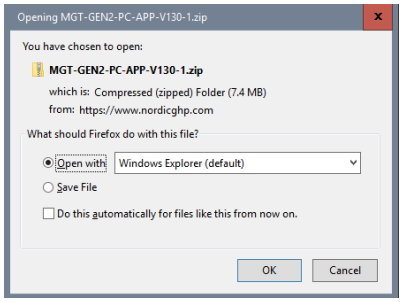
1. Go to www.nordicghp.com, ***Download Software*** page:



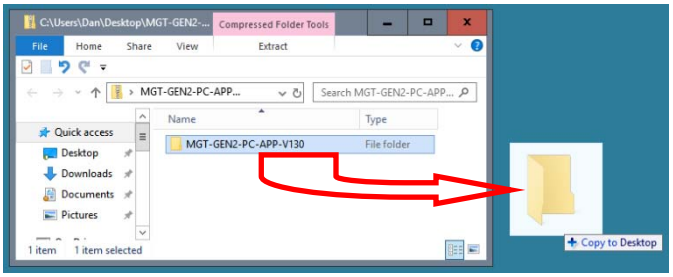
2. Click on ***MGL GEN2 PCAPP V__*** to download it. Choose the latest version, which has the highest number and appears highest in the list.



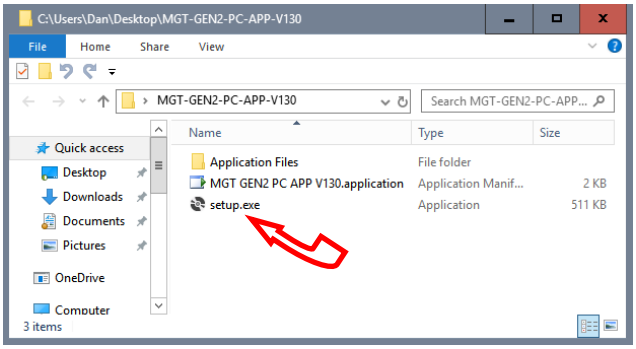
3. Choose “Open with Windows Explorer”, and hit “OK”:



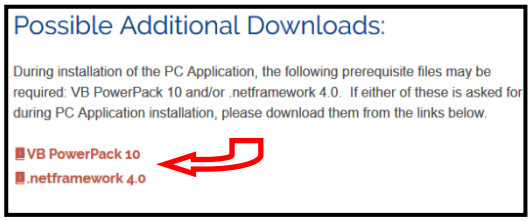
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



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 Visual Basic PowerPacks or .Netframework, exit the installation and use the links on the Download Software page to install the missing items:



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 D - Updating Firmware

METHOD 1: Updating Firmware Using PC App

The following provides step by step instructions to update the firmware in the control board to the latest release.

The firmware comes as a ZIP file named: ***MGT GEN2 Bootload Firmware Vxxx.zip*** where xxx is the version reference, e.g. 254 (version 2.54, this will be used for the remainder of this procedure). This file can be downloaded from our website www.nordicghp.com. Menu "For Dealers" --> "Download Software"; choose the latest (highest numbered) version.

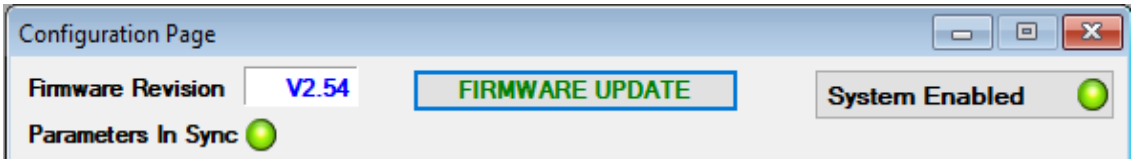
1. Download the file to your PC; we recommend creating a folder system such as: ***Desktop\MGT GEN2 Bootload Firmware\V2.54***

2. Unzip the file in the created folder. There will be three files:
   The firmware file: MGT_GEN2_V254.production.hex
   The programmer: PIC32UBL.exe
   Instruction sheet: USB Bootloader Instructions V2.pdf

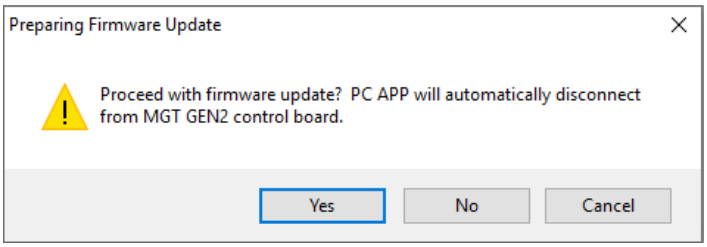
3. Connect a USB (printer) cable from the PC to the control board.

4. Launch the PC APP (V1.30 or higher) and click on the **Connect Button** to connect to the control board.

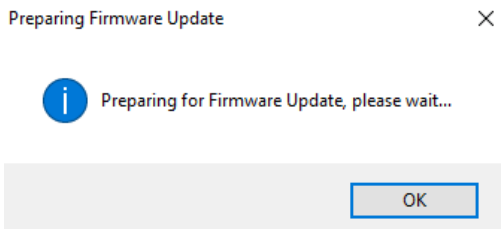
5. Go to menu ***Tools—Configuration Page*** *(picture to right)*



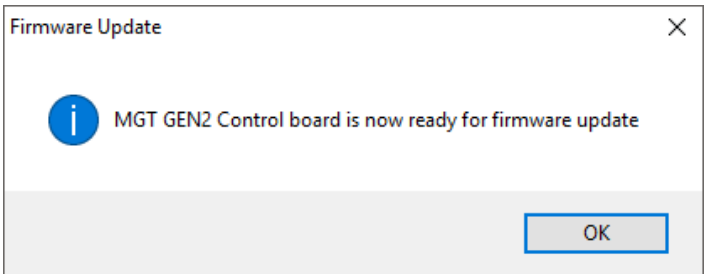
6. Click on the **FIRMWARE UPDATE** button. The following message will appear:



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

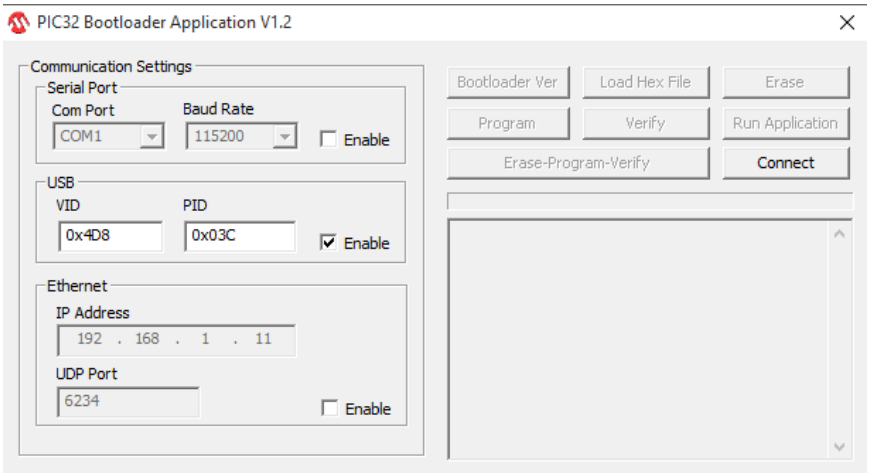


8. Click on **OK**. The following message will appear:

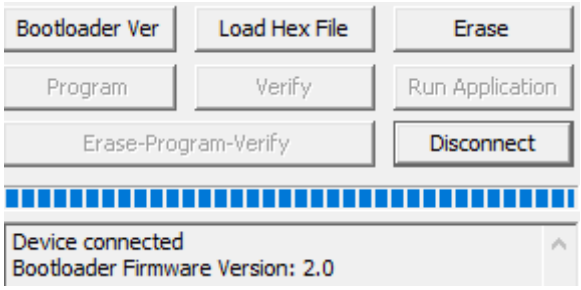


9. Click on **OK**. The control board is now in bootloader mode and is ready to be programmed.

10. Run PIC32UBL.exe. Click on the USB Enable check box. The screen should look like below.

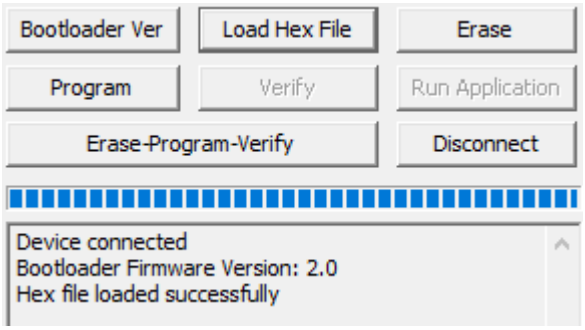


11. Click on **Connect.** The messages should read:

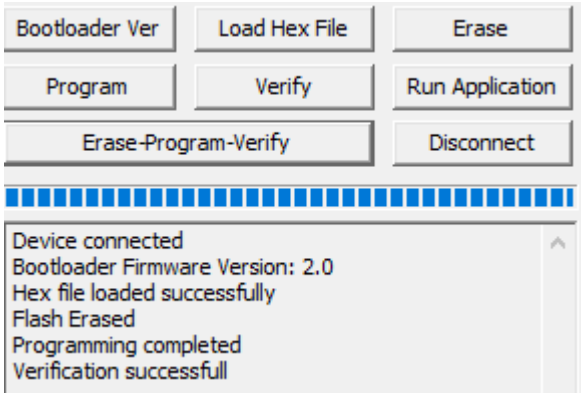


If device fails to connect and an error message is displayed, the board's bootloader may be older than v2.0. It will be necessary to instead update the firmware via jumper pins, as per the next section.

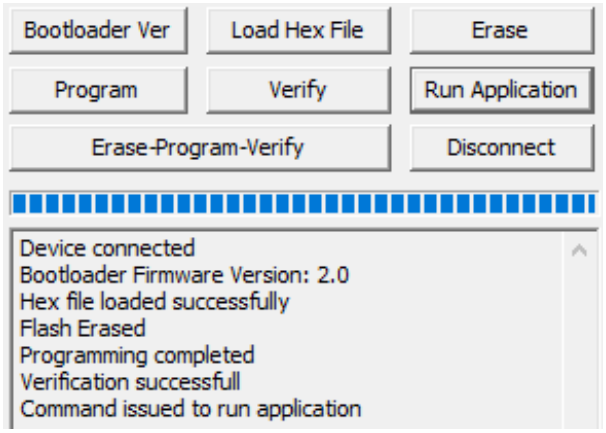
12. Click on **Load Hex File**. Select the ***MGT_GEN2_V254.production.hex*** file and click on **Open**. The messages should read:



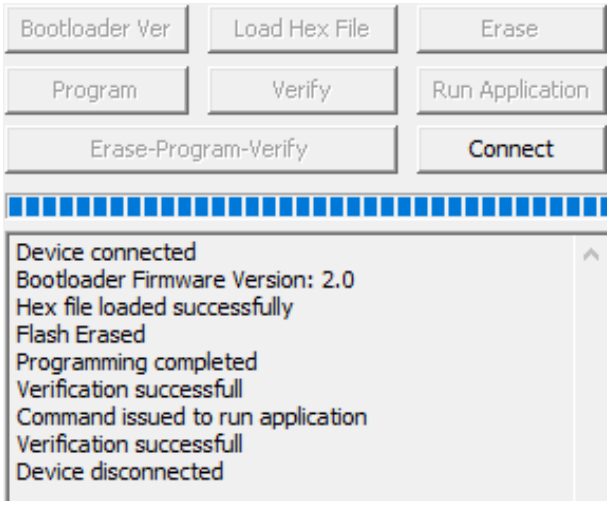
13. Click on **Erase—Program—Verify.** Programming…. Wait while status bar shows progress. The messages should read as below when finished:



14. Programmed and verified. Click on **Run Application.** The messages should read:



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

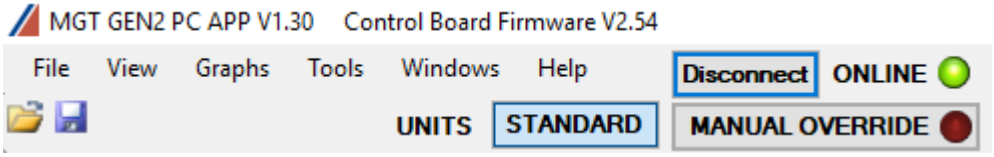


16. Close the program.

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 has been updated. Perform any configuration needed.

IMPORTANT NOTE: updating the firmware does not affect the configuration settings.



METHOD 2: Updating Firmware Using Jumper Pins

The following provides step by step instructions to update the firmware in the control board to the latest release.

The firmware comes as a ZIP file named:
MGT GEN2 Bootload Firmware Vxxx.zip
where xxx is the version reference, i.e. 255 (version 2.55, this will be used for the remainder of this procedure). This file can be downloaded from our website www.nordicghp.com. There is a table which lists the latest firmware by heat pump series, select the appropriate file to download.

1. Download the file to your PC, we recommend creating a folder system such as the following:

   Desktop\MGT GEN2 Bootload Firmware\V2.55

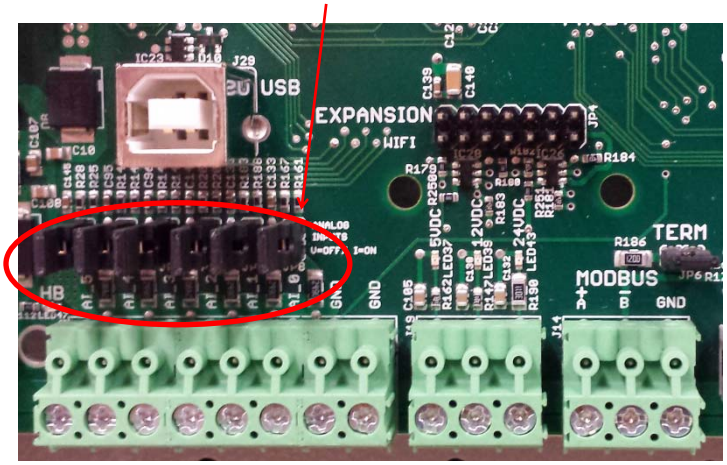
2. Unzip the file in the created folder. There will be two files:
   The firmware file: MGT_GEN2_V255.production.hex
   The programmer: PIC32UBL.exe

3. Connect a USB cable to the control board.

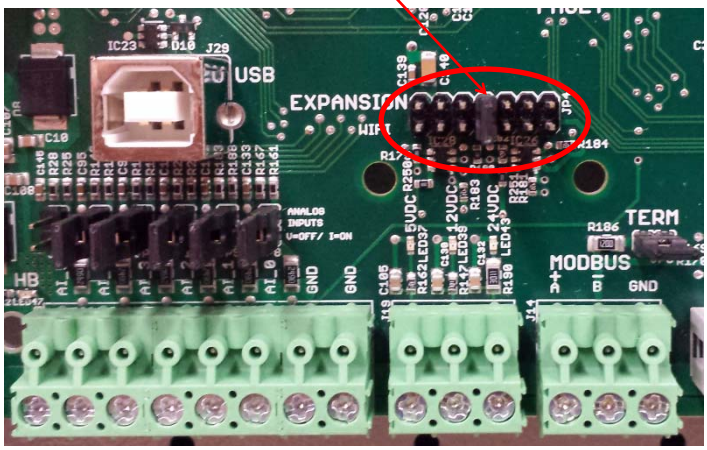
4. Turn the power off to the unit.

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.

Remove a jumper from here.

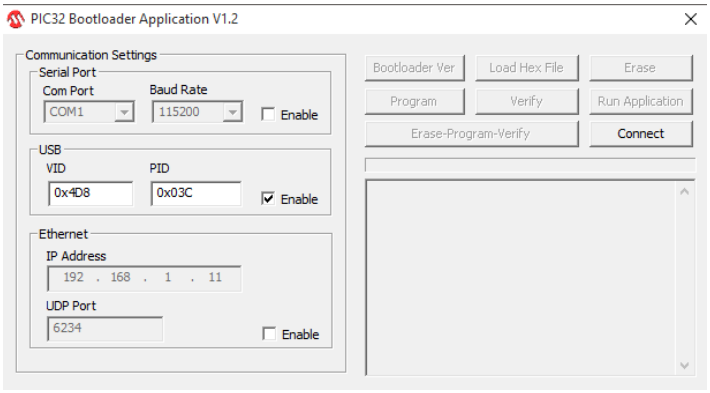


Place jumper here.

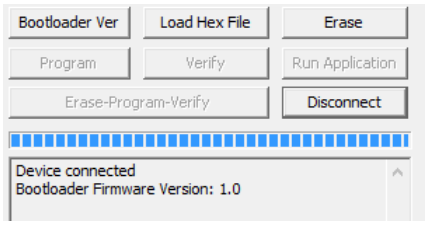


6. Turn the power back on. The control board is now in boot loader mode and is ready to be programmed.

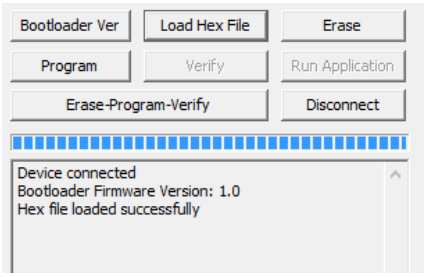
7. Run PIC32UBL.exe. Click on the USB Enable check box. The screen should look like the picture below.



8. Click on **Connect.**

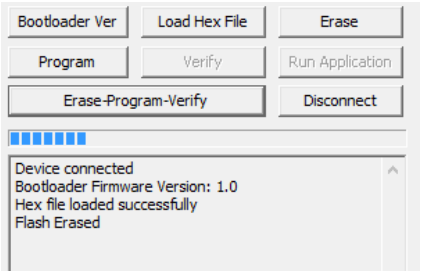


9. Click on **Load Hex File**. Select the MGT_GEN2_V255.production.hex file.

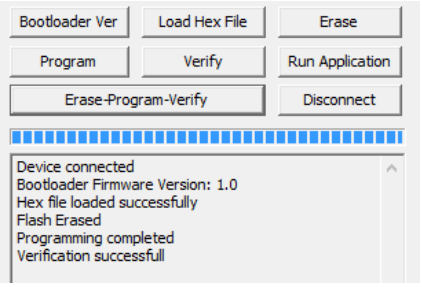


10. Click on **Erase—Program—Verify**

Programming…



11. "Programming completed. Verification successful." Click on **Disconnect** and close the program.



12. Turn the power off.

13. Move the jumper back to where it was taken from.

14. Turn the power back on. Check that the LCD Display shows MGT GEN2 V2.55 on the top line.

LIMITED EXPRESS WARRANTY

It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd., a corporation registered in New Brunswick, Canada, ("MG") or its representatives, relating to MG's products, whether oral, written or contained in any sales literature, catalogue or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely MG's opinion or commendation of MG's products.
EXCEPT AS SPECIFICALLY SET FORTH HEREIN, THERE IS NO EXPRESS WARRANTY AS TO ANY OF MG'S PRODUCTS. MG MAKES NO WARRANTY AGAINST LATENT DEFECTS. MG MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.

LIMITED EXPRESS RESIDENTIAL WARRANTY - PARTS
MG warrants its Residential Class products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows:
(1) Air conditioning, heating and/or heat pump units built or sold by MG ("MG Units") for five (5) years from the Warranty Inception Date (as defined below).
(2) Thermostats, auxiliary electric heaters and geothermal pumping modules built or sold by MG, when installed with MG Units, for five (5) years from the Warranty Inception Date (as defined below).
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for ten (10) years from the Warranty Inception Date (as defined below).
(4) Other accessories and parts built or sold by MG, when installed and purchased with MG Units, for five (5) years from the date of shipment from MG.
(5) Other accessories, when purchased separately, for (1) year from the date of shipment from MG.

The "Warranty Inception Date" shall be the date of original unit installation, as per the date on the installation Startup Record or six (6) months from date of unit shipment from MG, whichever comes first.

To make a claim under this warranty, parts must be returned to MG in Petitcodiac, New Brunswick, freight prepaid, no later than ninety (90) days after the date of the failure of the part. If MG determines the part to be defective and within MG's Limited Express Residential Warranty, MG shall, when such part has been either replaced or repaired, return such to a factory recognized distributor, dealer or service organization, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

LIMITED EXPRESS RESIDENTIAL WARRANTY - LABOUR
This Limited Express Residential Labour Warranty shall cover the **labour** incurred by MG authorized service personnel in connection with the installation of a new or repaired warranty part that is covered by this Limited Express Residential Warranty only to the extent specifically set forth in the current **labour** allowance schedule "A" provided by MG's Warranty Department and only as follows:
(1) MG Units for two (2) years from the Warranty Inception Date.
(2) Thermostats, auxiliary electric heaters and geothermal pump modules built or sold by MG, when installed with MG Units, for two (2) years from the Warranty Inception Date.
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for five (5) years from the Warranty Inception Date.

Labour costs are not covered by this Limited Express Residential Warranty to the extent they **exceed** the amount allowed under said allowance schedule, they are not specifically provided for in said allowance schedule, they are not the result of work performed by MG authorized service personnel, they are incurred in connection with a part not covered by this Limited Express Residential Warranty, or they are incurred more than the time periods set forth in this paragraph after the Warranty Inception Date.
This warranty does not cover and does not apply to:
(1) Air filters, fuses, refrigerant, fluids, oil.
(2) Products relocated after initial installation.
(3) Any portion or component of any system that is not supplied by MG, regardless of the cause of the failure of such portion or component.
(4) Products on which the unit identification tags or labels have been removed or defaced.
(5) Products on which payment to MG, or to the owner's seller or installing contractor, is in default.
(6) Products subjected to improper or inadequate installation, maintenance, repair, wiring or voltage conditions.
(7) Products subjected to accident, misuse, negligence, abuse, fire, flood, lightning, unauthorized alteration, misapplication, contaminated or corrosive liquid or air supply, operation at abnormal air or liquid temperatures or flow rates, or opening of the refrigerant circuit by unqualified personnel.
(8) Mold, fungus or bacteria damage
(9) Corrosion or abrasion of the product.
(10) Products supplied by others.
(11) Products which have been operated in a manner contrary to MG's printed instructions.
(12) Products which have insufficient performance as a result of improper system design or improper application, installation, or use of MG's products.
(13) Electricity or fuel, or any increases or unrealized savings in same, for any reason whatsoever.

Except for the limited **labour** allowance coverage set forth above, MG is not responsible for:
(1) The costs of fluids, refrigerant or system components **supplied by others**, or associated **labour** to repair or replace the same, which is incurred as a result of a defective part covered by MG's Limited Residential Warranty.
(2) The costs of **labour**, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part.
(3) Transportation costs of the defective part from the installation site to MG, or of the return of that part if not covered by MG's Limited Express Residential Warranty.
(4) The costs of normal maintenance.

This Limited Express Residential Warranty applies to MG Residential Class products manufactured on or after February 15, 2010. MG'S LIABILITY UNDER THE TERMS OF THIS LIMITED WARRANTY SHALL APPLY ONLY TO THE MG UNITS REGISTERED WITH MG THAT BEARS THE MODEL AND SERIAL NUMBERS STATED ON THE INSTALLATION START UP RECORD, AND MG SHALL NOT, IN ANY EVENT, BE LIABLE UNDER THE TERMS OF THIS LIMITED WARRANTY UNLESS THIS INSTALLATION START UP RECORD HAS BEEN ENDORSED BY OWNER & DEALER/INSTALLER AND RECIEVED BY MG LIMITED WITHIN 90 DAYS OF START UP.

Limitation: This Limited Express Residential Warranty is given in lieu of all other warranties. If, not withstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without imitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Residential Warranty.

LIMITATION OF REMEDIES In the event of a breach of the Limited Express Residential Warranty, MG will only be obligated at MG's option to repair the failed part or unit, or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to MG's factory in Petitcodiac, New Brunswick of each defect, mal-function or other failure, and a reasonable number of attempts by MG to correct the defect, malfunction or other failure, and the remedy fails of its essential purpose, MG shall refund the purchase price paid to MG in exchange for the return of the sold good(s). Said refund shall be the maximum liability of MG. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR PURCHASER AGAINST MG FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR MG'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY MG shall have no liability for any damages if MG's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, shortages of transportation, fuel, material, or labour, acts of God or any other reason beyond the sole control of MG. **MG EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR MG's NEGLIGENCE OR AS STRICT LIABILITY.**

OBTAINING WARRANTY PERFORMANCE Normally, the dealer or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any MG recognized distributor, dealer or service organization. If assistance is required in obtaining warranty performance, write or call: Maritime Geothermal Ltd • Customer Service • PO Box 2555 • Petitcodiac, New Brunswick E4Z 6H4 • (506) 756□8135 • or e-mail to info@nordicghp.com NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province. Please refer to the MG Installation, Installation and Service Manual for operating and maintenance instructions.

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