Installation and Service Manual

ATWC-Series
High Temperature Air to Water Heat Pump

R134a with Switchable R410a Cascade Mode
Model Sizes 45-100
Space Heating or Dedicated Domestic Hot Water Options

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SAFETY PRECAUTIONS

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

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

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

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

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

Model Nomenclature

ATWC—65—HAC—C—1D—P—xx

Series:
ATWC = high temperature cascade air to water heat pump

Nominal Size:
45 = nominal 3 ton
55 = nominal 4 ton
65 = nominal 5 ton
75 = nominal 6 ton
80 = nominal 6.5 ton
100 = nominal 8 ton

Functions:
H = Heating
AC = Active Cooling

Refrigerant:
C = cascade R410a/R134a

Revision:
01, 02 etc.

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

Compressor:
D = dual scroll

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

ACEC—65—C—1—KDE—xx

Series:
ACEC = All weather Condenser / Evaporator Cascade (air source outdoor unit)

Nominal Size:
45 = for ATWC-45
55 = for ATWC-55
65 = for ATWC-65
75 = for ATWC-75
80 = for ATWC-80
100 = for ATWC-100

Refrigerant:
C = cascade R410a/R134a

Revision:
01, 02 etc.

Fan Motor:
E = ECM (Variable Speed)

Fan Type:
D = Direct Drive

Air Coil:
S = Standard
K = Coated

Voltage Code:
1 = 208/230-1-60

APPLICATION TABLE - INDOOR UNIT									
SIZE	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESSOR	INDOOR COIL	REVISIONS			
ATWC-45	H A C	C	1 2 4 6 7	D	P D	00			
ATWC-55	H A C	C	1 2 4 6 7	D	P D	00			
ATWC-65	H A C	C	1 2 6 7	D	P D	00			
ATWC-75	H A C	C	1 2 6 7	D	P D	00			
ATWC-80	H A C	C	1 2 6 7	D	P D	00			
ATWC-100	H A C	C	2 7	D	P D	00			
This manual applies only to the models and revisions listed in this table.									

APPLICATION TABLE - OUTDOOR UNIT									
MODEL	REFRIGERANT	VOLTAGE	AIR COIL	BLOWER TYPE	BLOWER MOTOR	REVISIONS			
ACEC-45	C	1	K	D	E	00			
ACEC-55	C	1	K	D	E	00			
ACEC-65	C	1	K	D	E	00			
ACEC-75	C	1	K	D	E	00			
ACEC-80	C	1	K	D	E	00			
ACEC-100	C	1	K	D	E	00			
This manual applies only to the models and revisions listed in this table.									

APPLICATION TABLE - FIRMWARE AND PC APP			
Firmware	Version*	Associated PC APP	Version
MGT GEN2 Bootload Firmware	V4.00+	MGT GEN2 PC APP	V2.20+

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

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ATWC System Description

General Overview

The NORDIC **ATWC-Series** heat pump is a ***high temperature switchable cascade*** air source heat pump that can heat water to a higher temperature than a standard hydronic heat pump, or cool water for hydronic cooling applications. Applications include heating through higher-temperature radiators or hydronic baseboards, heating domestic hot water to its final temperature with the optional built-in double wall condenser, and heating and cooling through hydronic air handlers. Models range from 3 to 8 tons in size.

Being an air source heat pump, it does not require a ground loop, instead using an outdoor fan unit to exchange heat with the outdoor air. Unlike most air source outdoor units on the market, this outdoor unit contains only an air coil, ECM hub motor fans, expansion valves (EEVs), and outdoor temperature sensor. The remaining components, including the compressors and control board, are contained in the indoor unit. This has several advantages: minimal installation and service work must be performed outdoors, important components are in the conditioned space for longevity, antifreeze is not required in the hydronic loop, and no electric compressor heater is required.

Cascade heat pumps like the ATWC use two refrigerant circuits. In heating mode, heat is extracted from the outdoor air by the R410a circuit, and passes that heat on to the R134a circuit which puts that heat in the indoor water loop. With each circuit only doing part of the temperature lift, a higher indoor water temperature is possible. However, normally this means that the COP is not as good as a standard heat pump when the temperature lift is low (i.e. when it is not very cold outside). *The ATWC overcomes this problem by switching into non-cascade mode, only using the R134a circuit, during periods of mild outdoor temperature.* Cooling/defrost mode does not have a high temperature requirement, so always uses non-cascade mode.

The heat pump will be set up to heat or cool water in a buffer tank to a user-selectable setpoint temperature; when a zone thermostat requires heat or cooling, it will receive water flow from that tank by opening a zone valve or starting a zone pump. (Two buffer tanks, heated and chilled, may be used instead where heating and cooling demands may occur simultaneously or close together; see next chapter.) Water temperature control is usually performed by a built-in routine that maintains the buffer tank temperature without external sensors ('Setpoint Control'). Optionally, BACnet, external tank sensors, or an external aquastat or controller can be used.

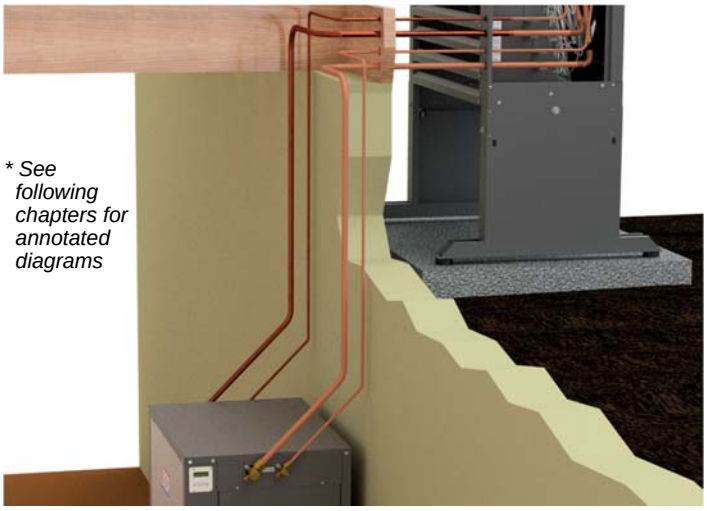
Single stage scroll compressors for both circuits and brazed plate heat exchangers are standard. The cabinets are powder coated galvanized sheet metal. Control is overseen by the Nordic GEN2 programmable control board, which has many advanced features like laptop connectivity via the free PC App software, data logging & graphing, and real time readout from electronic temperature & pressure sensors.

Unlike many other NORDIC heat pumps, there is no DHW desuperheater on the ATWC series. Instead there is the option for a double wall condenser for dedicated DHW heating.

Note that there is a significant electrical service requirement for ATWC series, with its 2 compressors. 3-phase power is recommended, and required for size ATWC-100. An electrician should be consulted during the planning phase of any project to verify the building's electrical panel capacity.

1. Heating Mode

In heating mode, heat is extracted from the outdoor air and transferred to water in the buffer tank. This causes the air coil to eventually frost up to the point that a defrost cycle is required;



** See following chapters for annotated diagrams*

refer to the ***Defrost Operation*** section below.

If the outdoor temperature is above 34°F(1°C), the outdoor unit fan starts and stops when the heat pump starts and stops. If the temperature is below 34°F(1°C), the outdoor fan will remain on at a very slow speed when the heat pump is off to minimize the chance of a fan freeze up, and to prevent snow from entering the unit. The outdoor fan will slowly ramp up to the required speed upon start.

Auxiliary Heat

Any air source heat pump will need auxiliary heat; see **Sizing** section. This can be almost any heating device, but the most convenient is electric elements in the buffer tank controlled by the heat pump's stage 2 temperature control (stage 1 being the compressors). The heat pump will turn off and only the auxiliary heating system will operate if the outdoor temperature drops below -7°F (-22°C).

Defrost Operation

The heat pump has an advanced defrost control algorithm, using outdoor temperature and suction pressure to determine when a defrost cycle should occur and how long it should be. Precise fan control allows the defrost heat to rise quickly and then be maintained at a setpoint for quick defrosting.

The outdoor unit has a unique physical arrangement for combatting the ice build up that is a common problem with air source heat pumps. The air coil is installed on a 15° angle and the area below the coil is open (no drip tray). The angle causes the melting frost/snow to run down the back of the coil to a single point of runoff rather than along the entire bottom side of the coil. It is not possible for runoff to remain between coil pipes and re-freeze between them, which a common cause of air coil failure in air source heat pumps.

2. Cooling Mode

In cooling mode, heat is extracted from the buffer tank and rejected to the outdoor air. There is no defrost cycle in cooling mode.

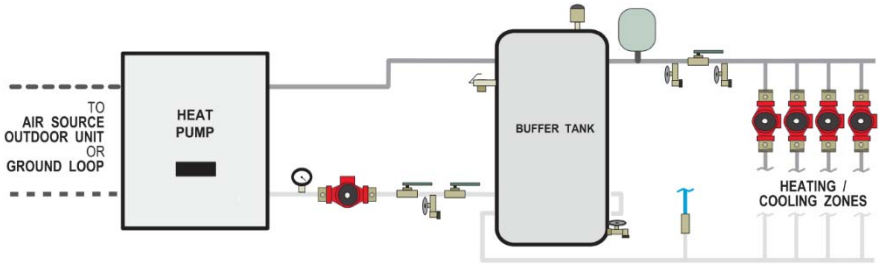
The outdoor fan is controlled based on the discharge pressure and will slowly ramp up to the required speed when the system starts. During operation, the fan speed will automatically adjust up or down to in order to maintain the discharge pressure setpoint value.

One or Two Buffer Tanks?

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

Single Buffer Tank Systems

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

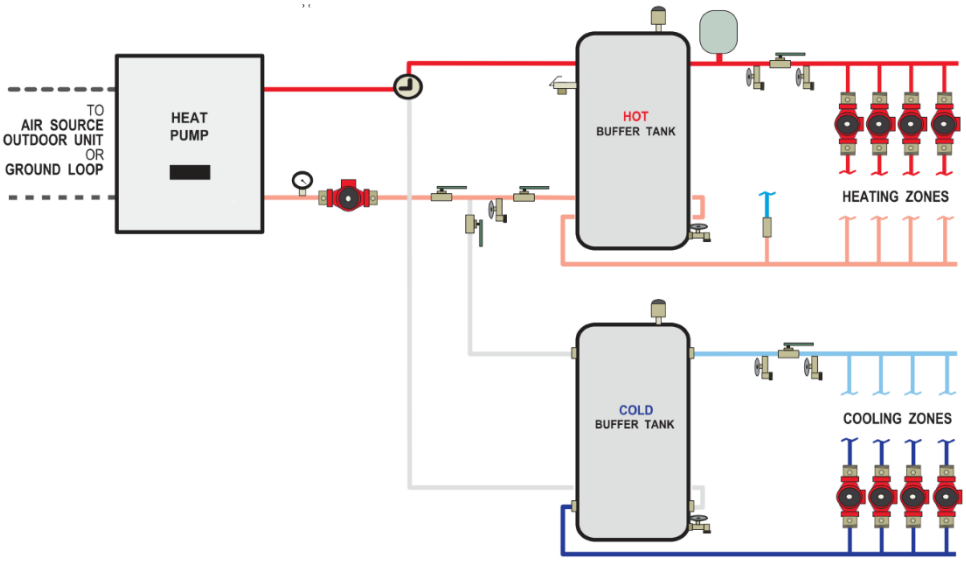


Advantages	Drawbacks
Simplest piping and control.	Seasonal switchover from heating to cooling required, either automatically through a zone controller or via a manual switch.
Is the go-to option for heating-only or dedicated domestic hot water (DHW) heating systems.	Simultaneous heating and cooling is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

Dual Buffer Tank Systems

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

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



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

Air Source Heat Pumps

Since it is harder to extract heat from colder outdoor air, any air source heat pump will have its lowest heating capacity on cold days when building heat load is the highest. It is not generally possible to oversize an air source heat pump to cover 100% of the coldest day heat load, since this would mean excessive compressor short-cycling during moderate outdoor weather when heat pump capacity is much higher and heat load is much lower.

For these reasons, it should be expected that ***any air source heat pump will need auxiliary heat on the coldest days.***

Heat Pump Sizing for Space Heating/Cooling

The table shows the size of home each air source heat pump model size is generally suitable for, in northern climates.

TABLE 1 - Heat Pump Size vs. Heated Area

Model	sq.ft.	m^2
45	**1,400**	**130**
55	**2,000**	**185**
65	**2,600**	**240**
75	**3,100**	**290**
80	**3,500**	**325**
100 *(3 phase only)*	**4,200**	**390**

This is an ***estimate*** of which unit size is required for a *typical* two-level home (main level and below grade basement) with R-20 walls, R-40 ceiling and average size and number of windows. The Heated Area is the area of the main level. The table accounts for a basement the same size as the heated area.

It is highly recommended that a heat loss/gain analysis be performed by a qualified person with software using the CSA F-280 or Manual J methods before selecting a heat pump size. 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-out basement, and coldest outdoor temperature for the region.

In northern climates, a heat pump model size can be selected by matching the calculated heat load to the heat pump's heating capacity at an outdoor temperature of **35°F (1.7°C)** and the expected indoor water temperature of **140°F (60°C)** to **160°F (71°C)**. These numbers can be found in the detailed performance tables in the **Model Specific Information** section later in this manual. This sizing will result in a good compromise between covering as much of the cold weather heat load as possible without utilizing backup heat, while minimizing excessive cycling (turning on and off frequently) during moderate outdoor temperatures.

It should be noted that sizing an air source heat pump is always a compromise between covering coldest-day heat load and minimizing cycling due to over-capacity in warm weather.

In cooling dominant climates, the heat pump should be similarly sized, by matching the calculated cooling load to the standard capacity rating at an outdoor temperature that matches the local maximum outdoor temperature. The difference here is that it is necessary to cover all of the cooling load, since there is no backup cooling.

Even in northern heating dominant climates, it should be ensured that 100% of the cooling load will be covered when sizing the heat pump. (Note that ATWC models with the double wall condenser option, used for dedicated DHW heating, should not be used for space cooling since the double wall heat exchanger is not optimized for extended periods of cooling operation.)

Auxiliary Heat Sizing

The easiest way to provide backup heat for new installations is by installing a buffer tank that has electric elements. Buffer tanks with elements that are certified for space heating use are available as accessories from Maritime Geothermal Ltd., or others may be used.

An element size should be chosen that covers 100% of the coldest day heat load, according to the heat loss analysis mentioned in the last section. This is because the elements will take over heating duty if the outdoor temperature falls below the minimum for heat pump operation (-7°F/-22°C), or if the heat pump experiences a problem. If a heat loss analysis is not available, the following table may be used as a guide.

TABLE 2 - Auxiliary Heat Sizing

Model	Tank Element Size	
	Recommended	AltSource Tank Available
45	**10 kW**	**12 kW (50 gal)**
55	**12 kW**	**15 kW (70 gal)**
65	**15 kW**	**15 kW (70 gal)**
75	**20 kW**	**20 kW (70 gal)**
80	**20 kW**	**20 kW (70 gal)**
100 *(3ph only)*	**28 kW**	**-**

For retrofits, the existing heating device (e.g. an electric or gas boiler) may be used for auxiliary heat. It should be set up to be activated as **heating stage 2** by the heat pump as described in the **Wiring** section, and piped in a parallel arrangement as per the diagram in the **Piping** section.

Sample Bill of Materials - ATWC Series

FROM MARITIME GEOTHERMAL
- ATWC SERIES HEAT PUMP W/ACEC OUTDOOR UNIT
- SHIELDED DOUBLE TWISTED PAIR WIRE
- BUFFER TANK W/ELEMENTS 12/15/20 kW

OPTIONAL FROM MARITIME GEOTHERMAL
- ANTI-VIBRATION PAD
- COMPRESSOR SOUND JACKETS (2)
- COMPRESSOR SECURE STARTS (2)
- AHW-65 AIR HANDLER(S)

ELECTRICAL
- HEAT PUMP SERVICE WIRE: 3-3, 4-3, 6-3, OR 8-3
- BUFFER TANK ELEMENT SERVICE WIRE
- 14-2 OUTDOOR RATED WIRE W/ DISCONNECT SWITCH FOR OUTDOOR UNIT
- HEAT PUMP BREAKER: 40 TO 100A
- BUFFER TANK ELEMENT BREAKER
- ELEMENT CONTACTOR & ELEC. BOX (IF NOT USING TANK W/ DRY CONTACTS)
- THERMOSTAT WIRE 18-4
- THERMOSTAT WIRE 18-2
- FORK TERMINALS FOR TSTAT WIRE (6)

REFRIGERATION
- 1/2" & 7/8" (OR 3/8" & 3/4") ACR TUBING
- PIPE INSULATION
- EXTRA R410A & R134a REFR. FOR LINESETS >20 FT

HYDRONICS
- CIRCULATOR: HEAT PUMP TO TANK
- PIPE & FITTINGS: HEAT PUMP TO TANK
- ZONES CIRCULATOR(S)
- ZONE TRANSFORMER & CIRC CONTACTOR
- ZONE VALVES (IF NOT INDIVIDUAL PUMPS)
- ZONE PIPING
- OTHER AIR HANDLERS, DUCTING
- ZONE THERMOSTATS
- RELAYS OR ZONE CONTROLLER
- ZONE SUPPLY & RETURN HEADERS: 1" COPPER PIPE & FITTINGS
- PIPE & FITTINGS TO ZONES
- EXPANSION TANK
- 2" STYROFOAM INSUL. (IF PAD NOT PURCHASED)

Unpacking the Unit

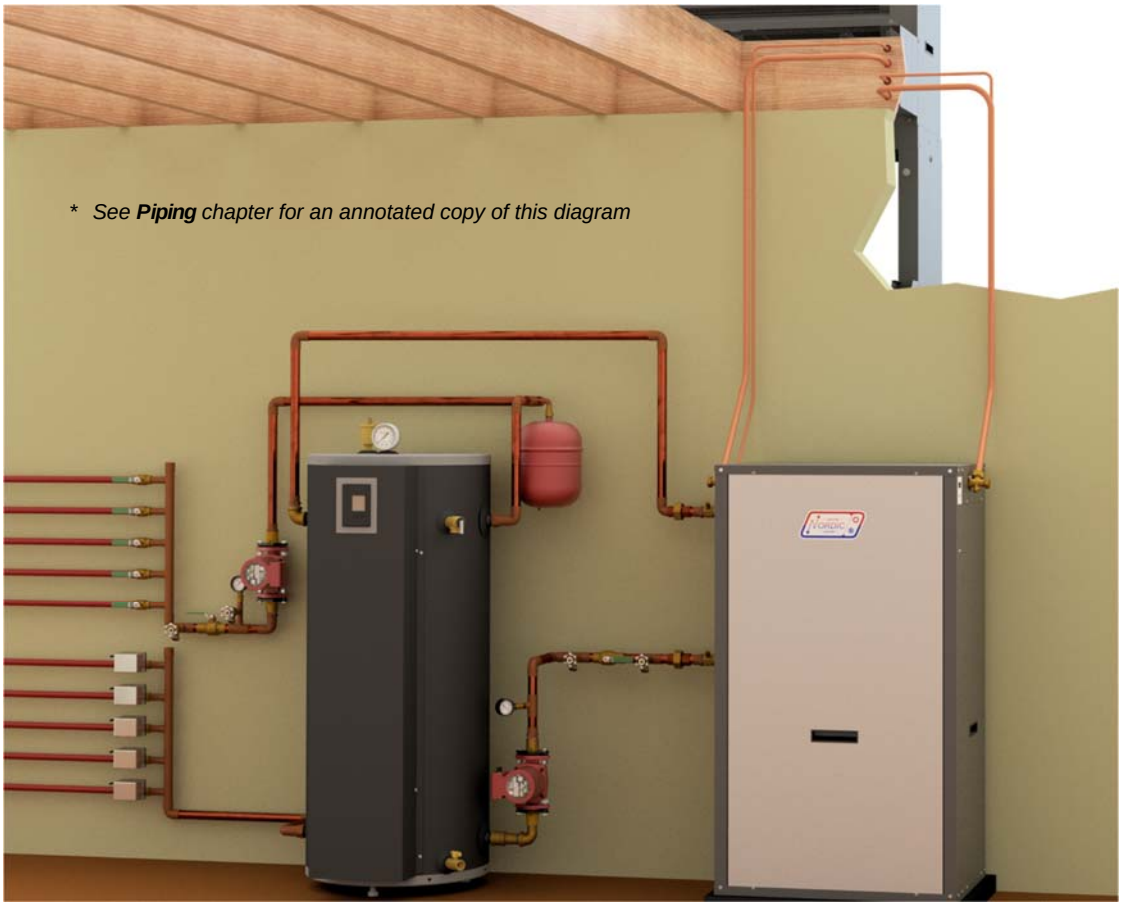
When the 2-piece heat pump reaches its destination it should be unpacked to determine if any damage has occurred during shipment. Any visible damage should be noted on the carrier's freight bill and a suitable claim filed at once.

Indoor Unit Placement

The the indoor unit should be placed near the outdoor unit to keep the two refrigerant line sets as short as possible. The line sets have a maximum length of 70 ft (21 m) but should be as short as possible for maximum efficiency.

The front and two side access panels should remain clear of obstruction for a distance of **two feet** to facilitate servicing and general maintenance. No access is required on the back side.

An anti-vibration pad, available as an accessory, or a piece of 2" styrofoam should be placed under the unit. This will deaden vibrations and protect the cabinet from rusting.



Outdoor Unit Placement

The ACEC unit must be placed outdoors, with the fans pointing away from the building. There is a detachable cover for the piping and wiring which automatically places the unit **12 inches (30 cm)** away from the building, which is the recommended spacing. If necessary, the unit can be placed **8 inches (20 cm)** from the building: the cover can be shortened by cutting the tabs and removing one section. Be aware that if mounted at less than 12 inches from building, there is a risk of frost forming on the wall during defrost under certain conditions. Be sure there are no obstructions around the perimeter of the back, so that return airflow is unimpeded.

There should be little or no obstruction in the fan (front) direction for at least **10 ft (3 m)**, and preferably **16 ft (5 m)**, otherwise airflow and therefore overall performance will be reduced.

In addition, there should be at least **two feet (0.6 m)** of clearance on the electrical box and refrigeration piping side of the unit to facilitate servicing and general maintenance.

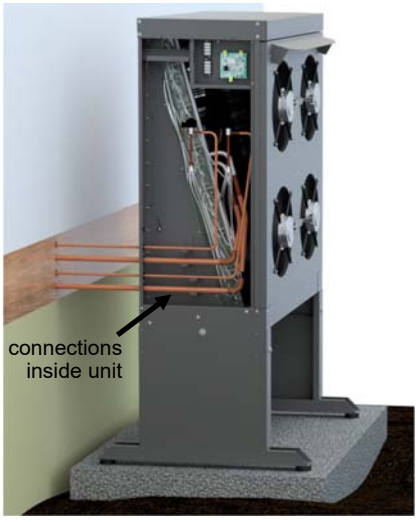
The outdoor unit **must be bolted down** to prevent a tipping hazard. See next section.

Note that **no field installed filter-dryer is required.**

Outdoor Unit Fan Orientation

Line Sets

The ATWC-series is different than most split air source heat pumps in that **2** field installed line sets (**4** refrigerant pipes total) are required to transport the 2 different refrigerants used in the cascade refrigeration system. See **Outdoor Unit Line Sets** chapter.



IMPORTANT NOTE:
The line set between the indoor and outdoor units must not be longer than **70 ft (21 m).**

Outdoor Unit Mounting Height

The outdoor unit must remain clear of snow and ice at all times. Good performance depends on good airflow, which of course cannot be achieved if the unit is buried in snow and re-frozen defrost condensate.

1. If there is less than ~4" (10 cm) of snow accumulation expected, the unit could be mounted directly on a concrete pad. This is **not recommended** in cold climates, since ongoing care would be required to ensure re-frozen condensate does not build up under unit.
2. The unit can be mounted on angle brackets attached to the side of a building. Be sure to adhere to the minimum clearance requirement of **8-12" (20-30 cm),** and use brackets designed for twice the unit weight.
3. Two leg kits which add either **15" (38 cm)** or **30" (76 cm)** of additional height are available as an accessory. For ATWC-65 and larger which use a larger outdoor unit, only the shorter leg kit is available.

To attach the legs, slide the leg over the outside of the two existing cabinet legs and affix with the kit's three SS bolts and flat washers.

Whether or not a foot kit is used, be sure to mount the unit using the 4 rubber grommets included with the unit, to dampen any vibration. **The unit must be fastened to its mounting surface with four bolts through these grommets to prevent a tipping hazard due to impact or high wind.**

Leg Kit Installation

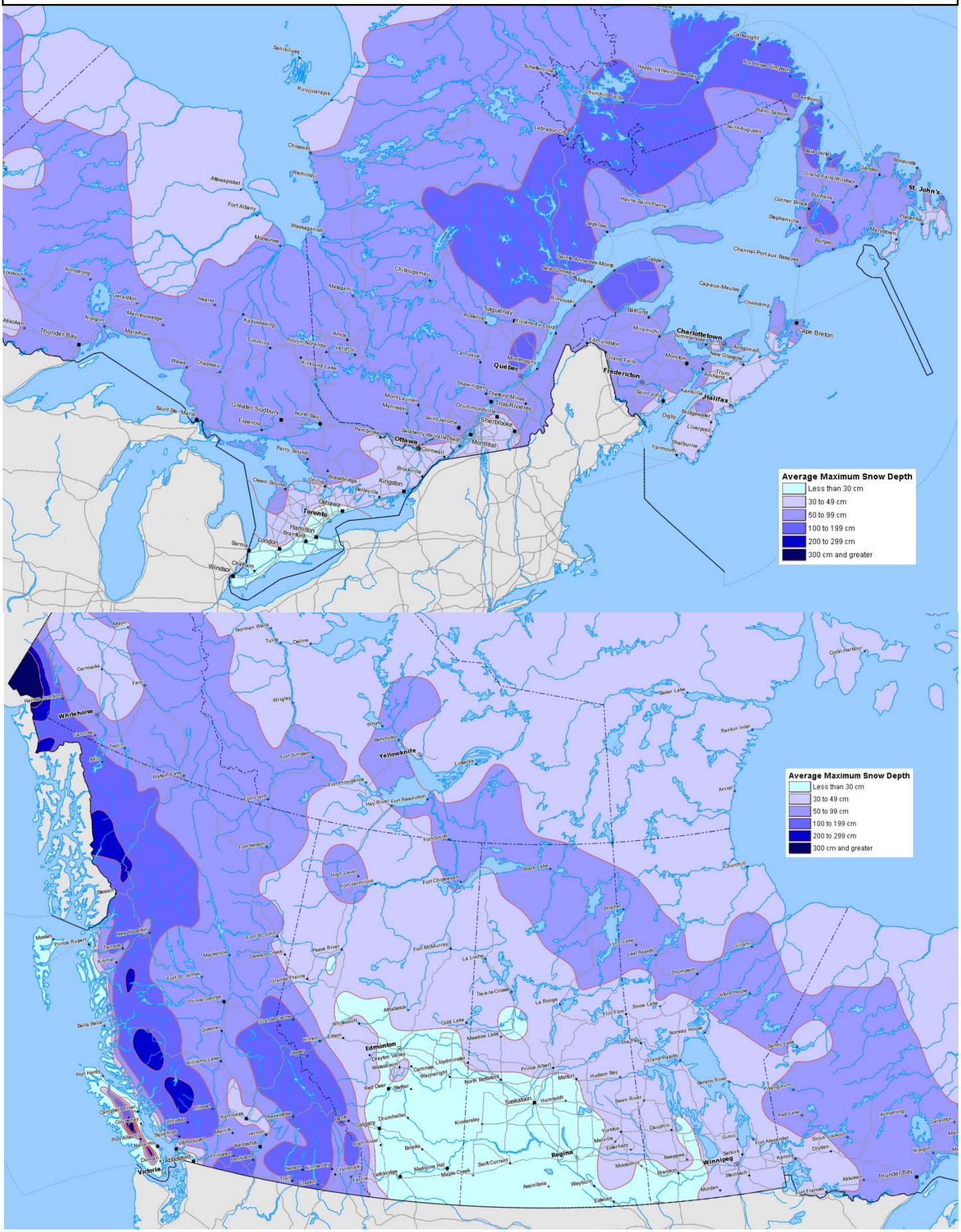
Outdoor Fan Speed Reduction

Should fan noise be a concern, for example if the outdoor unit is mounted near a frequently open window, the outdoor fan speed can be reduced (up to a maximum of 25%). This should only be done if necessary, since a small loss in efficiency will result.

The fan speed can be reduced via the LCD (see **LCD Interface & Menus** section) or PC App (see **PC Application** section).

Average Maximum Snow Depth - Canada (1979-1997)

Source: Natural Resources Canada



Wiring

Indoor Unit Power Supply Connections

Power supply for the heat pump from the breaker panel is supplied to the indoor unit. The unit has a concentric power supply knockouts, as well as knockouts and holes for connections to circulation pumps, controls, optional aquastat, and power and signal connections to the outdoor unit. **All wiring is connected to the indoor unit at the top rear, and fed to the front electrical box through a wire channel under the top.**

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.

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

TABLE 3 - Power Supply Connections

Line	Description	Voltages
L1	Line 1	All
L2	Line 2	All
L3	Line 3	3-phase only
N	Neutral	For 208/230-1-60, 208-3-60: only required if connecting 115v circulators. Required for 460-3-60, 380-3-50.
GND	Ground	All (connect to ground lug)

Outdoor Unit: Power Connections

The ACEC outdoor unit **must be** powered from the indoor unit. The power supply for the ACEC-45/55 unit is 208-277VAC, 50/60Hz, and for ACEC-65 to100 is 208/230-1-60. The ATWC and ACEC units have matching terminal strips for these connections. Use a two conductor, minimum 14ga **outdoor rated cable** for this connection. Refer to diagram.

TABLE 4 - Outdoor Unit Power Supply Connections

Line	Description
L1	Supply line
L2	Supply line
GND	Ground
Use a 2-conductor outdoor rated 14ga cable.	

IMPORTANT NOTE: Most codes require a disconnect switch visible and/or reachable from the outdoor unit to be installed in the power supply cable. If the switch has fuses or breakers they must be no more than 10A.

OUTDOOR DISCONNECT SWITCH IS A SAFETY DEVICE ONLY. *Turn off breaker to indoor unit before servicing to avoid costly damage to electronic control board.*

Indoor Loop Circulator Pump Wiring

The indoor unit has provisions for connecting the indoor circulator pump (between the heat pump and buffer/DHW tank) so that it will be turned on whenever the compressor(s) operate. Connect the circulator pump module to the appropriate terminals (115V or 230V) on the terminal strip marked **Indoor Circulator Pumps**, as per the voltage of the circulator pump. Ground wires should be connected to the ground lug in the electrical box. Ensure that the total current draw does not exceed the value indicated on the label in the heat pump electrical box.

For **460VAC models**, only 277VAC circulators may be powered directly from the heat pump. If other voltage circulators are used, they must be powered using an external contactor actuated by the ICR terminal on the left side of the control board and the **C** (24V ground) terminal.

TABLE 5 - Indoor Loop Circulator Connections

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

Control Transformer

The low voltage controls, including the control board, are powered by a 100VA class II transformer. 208/230-1-60 and 208-3-60 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 it.

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

TABLE 6 - Control Transformer

Voltage	Low Voltage Circuit Protection
(1) 208/230-1-60	Resettable breaker on transformer
(2) 208-3-60	Resettable breaker on transformer
(4) 460-3-60	Primary / Secondary fuses
(6) 220-1-50	Primary / Secondary fuses
(7) 380-3-50	Primary / Secondary fuses

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.

BACnet Connections

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

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

TABLE 7 - BACnet Connections	
Line	**Description**
A	**Communication +**
B	**Communication -**
GND	**Ground**
Use a shielded twisted pair cable.	

Setpoint Control Connections

If using the on-board Setpoint Control routine with sampling to control buffer tank temperature, no external temperature probe or aquastat is required. In this case, only one control connection is required, a dry contact from **R** to **O** on terminal strip to switch the heat pump into cooling mode. **C** may be used in powering relays as shown in diagrams on following pages.

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

TABLE 8 - Setpoint Control Connections	
Signal	**Description**
C	**24VAC common (ground)**
R	**24VAC hot**
O	**Cooling Mode (Reversing Valve)**
Use a 3-conductor 18ga cable.	

An external temperature probe may be used with the on-board Setpoint Control routine; **this is the required method if using an ultra-high temperature boiler in parallel with heat pump on terminals H1-H2**. Or two probes (one for hot tank and one for cold tank) may be used. This is HTS/CTS Setpoint Control; see **Piping** and **Operation** sections for details.

Setpoint Control: Aux. Connections

When using Setpoint Control, there are **3 methods** for activating hydronic auxiliary heat. See diagram on a following page.

First, if using a heating device that doesn't have its own electronic controller or control transformer, e.g. a bare heating element in the buffer tank: connect coil of an external contactor to **R** and **D2** on terminal strip, and jumper **R** to **D1** as shown. This contactor can then be used by the heat pump to toggle high voltage power to the heating device when auxiliary heat is required. Default will be **OFF** when heat pump is powered off.

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

Third, a dry contact is available on terminals **H1** and **H2**. It operates similarly to **D1-D2** above, but is only activated when auxiliary heat is requested AND the compressor is off (i.e. when the outdoor temperature has dropped below the selectable minimum operating temperature). This should be used to actuate very high temperature heating devices that would interfere with heat pump operation if run simultaneously. HTS/CTS control with tank sensor should be used. Like D1-D2, **H1-H2** defaults to **ON**.

D1-D2 and H1-H2 default to ON and so must be used with an auxiliary heating device that has a HIGH TEMPERATURE LIMITER to avoid a serious safety hazard.

If it is not desired to have **D1-D2** default to **ON** when heat pump is powered off, make the following wiring changes in the heat pump's electrical box, while referring to the **Wiring/ Schematic** diagram in the **Model Specific Information** chapter.

- Find the light brown wire connected between terminal strip terminal **D1** and the **Elec. Aux. Relay**. Move it from pin **5** to pin **2** of the relay.
- Find the purple wire connected between the left side of the control board and the **Elec. Aux. Relay**. Move if from terminal **L4** (NOT_HYD_AUX) to **DO_2** (HYD_AUX) on the control board.

Now D1-D2 will work as before, but will default to OFF when heat pump is off.

TABLE 9 - Setpoint Control: Aux. Connections	
Signal	**Description**
R	**Connect with wire jumper and also connect to Hydronic Auxiliary Contactor**
D1	
D2	**Hydronic Auxiliary Contactor**
D1	**Hydronic Auxiliary dry contacts**
D2	
H1	**Hydronic Auxiliary ONLY dry contacts (for high temperature auxiliary heat)**
H2	
Use a 2-conductor 18ga cable.	

Outdoor Unit: Signal Connections

The speed of the fans and the two heating mode expansion valves (EEVs) in the outdoor unit must be controlled by the control board in the indoor unit, and a temperature sensor must be read. For ATWC/ATW2 series, this is done by MODBUS communications between the main control board in the indoor unit and a small daughter board in the outdoor unit. So the number of required signal wires is reduced.

Connect the supplied **double twisted pair shielded outdoor rated cable** between the terminal strips in the indoor and outdoor units. **The shield itself is connected only to the indoor unit; do not connect the shield ground to the outdoor unit (there is no terminal for it).** Cut the shield short at the cable sheath in the outdoor unit.

TABLE 10 - Outdoor Unit Signal Connections

Signal	Description
A	MODBUS Communications (use 1 twisted pair)
B	
12VDC	Power to MODBUS board in outdoor unit
GND	
Shield	Cable shield: connect only to the indoor unit. In the outdoor unit, cut the shield short at the cable sheath.
Use provided double twisted pair *shielded* outdoor rated cable.	

AVOID INSULATION NICKS ON INDIVIDUAL OUTDOOR UNIT SIGNAL WIRES

SLICE A LINE ALONG WIRE SHEATHING TOWARDS THE END, THEN PULL IT AWAY FROM THE WIRES BEFORE CUTTING OFF.

DO NOT CUT A CIRCLE WITH UTILITY KNIFE BEFORE SEPARATING SHEATHING FROM BUNDLED SIGNAL WIRES.

Aquastat Connections (Optional)

Most installations will use the internal ***Setpoint Control*** routine to control buffer tank temperature, in which case no aquastat is required. However, an aquastat or aquastats can be used if required, for example if heating two loops with different setpoint temperatures. This is ***Signals*** or ***Hardwired Control***.

C, R, and **O** connections are located on the main terminal strip. **Y1A** is located at right side towards the top of the control board. This is shown on the wiring (SCH) diagram in the **Model Specific Information** section. The external device needs to send the 24VAC signal from **R** back to **Y1A** to call for the single capacity stage of hydronic heating, and **R** back to **O** to activate cooling mode. **C** is the common or ground terminal for use in powering the external device.

TABLE 11 - Aquastat (Signals Control) Connections

Signal	Description
O	Cooling Mode (Reversing Valve)
C	24VAC common (ground)
R	24VAC hot
Y1A	Compressor ON (Part Load)
Use an 18ga cable.	

Disable Switch (field installed)

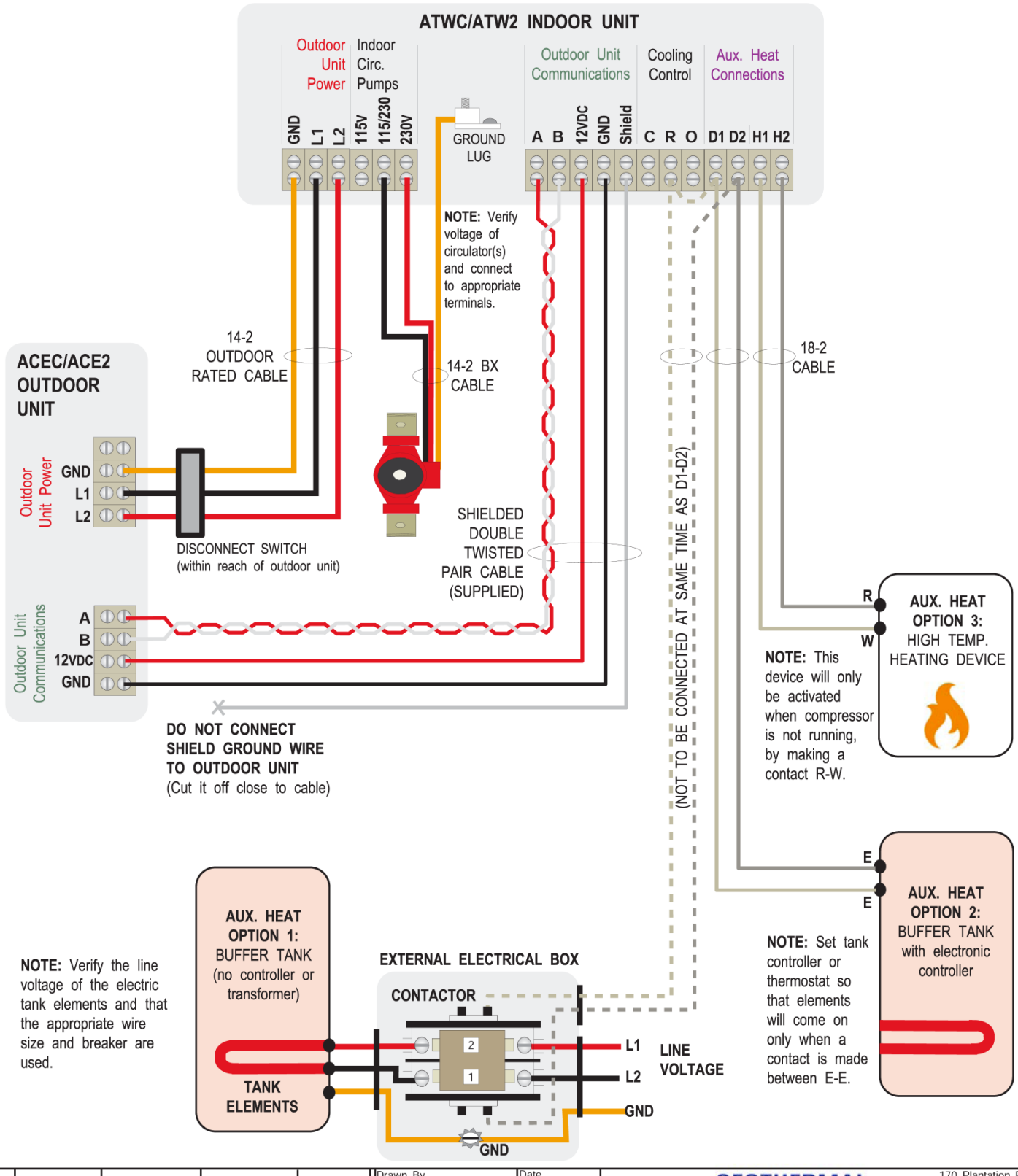
A switch to disable demand from the control system may be installed. On control board, jumper COM_IN to GND, and toggle 12VDC to IN_SPARE to disable. See the main wiring diagram in the **Model Specific Information** section.

Defrost Indicator (field installed)

A 24VAC signal is available for an externally installed indicator, which is active when the heat pump is in defrost mode. This may be useful for the building operator or homeowner, to know when buffer tank is being cooled instead of heated.

The indicator may be installed between terminals **SH** and **C(SH)** at the lower left side of control board.

Typical ATWC/ATW2-Series Outdoor Unit, Auxiliary Heat, & Indoor Circulator Wiring



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	Dan Rheault	Dan Rheault	16-Sep-2021

Drawn By	Dan Rheault	Date 16-Sep-2021
Checked By	Dan Rheault	Date 16-Sep-2021
Approved By	(ENG)	Date
Approved By	(MFG)	Date
Approved By		Date

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170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical ATWC/ATW2 Outdoor Unit, Auxiliary Heat, & Indoor Circulator Wiring

Size	Drawing Number	Drawing Rev	Sheet
A	002543CDG	01	1 of 1

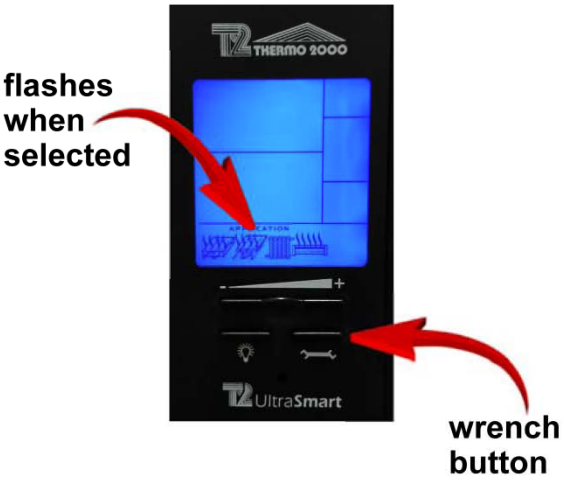
AltSource Tanks: Getting Started

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

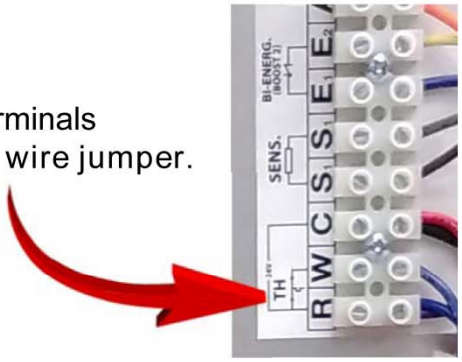
1. Put the tank in "Bi-Energy" rather than "Electric" mode, with switch on back of controller.

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

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



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



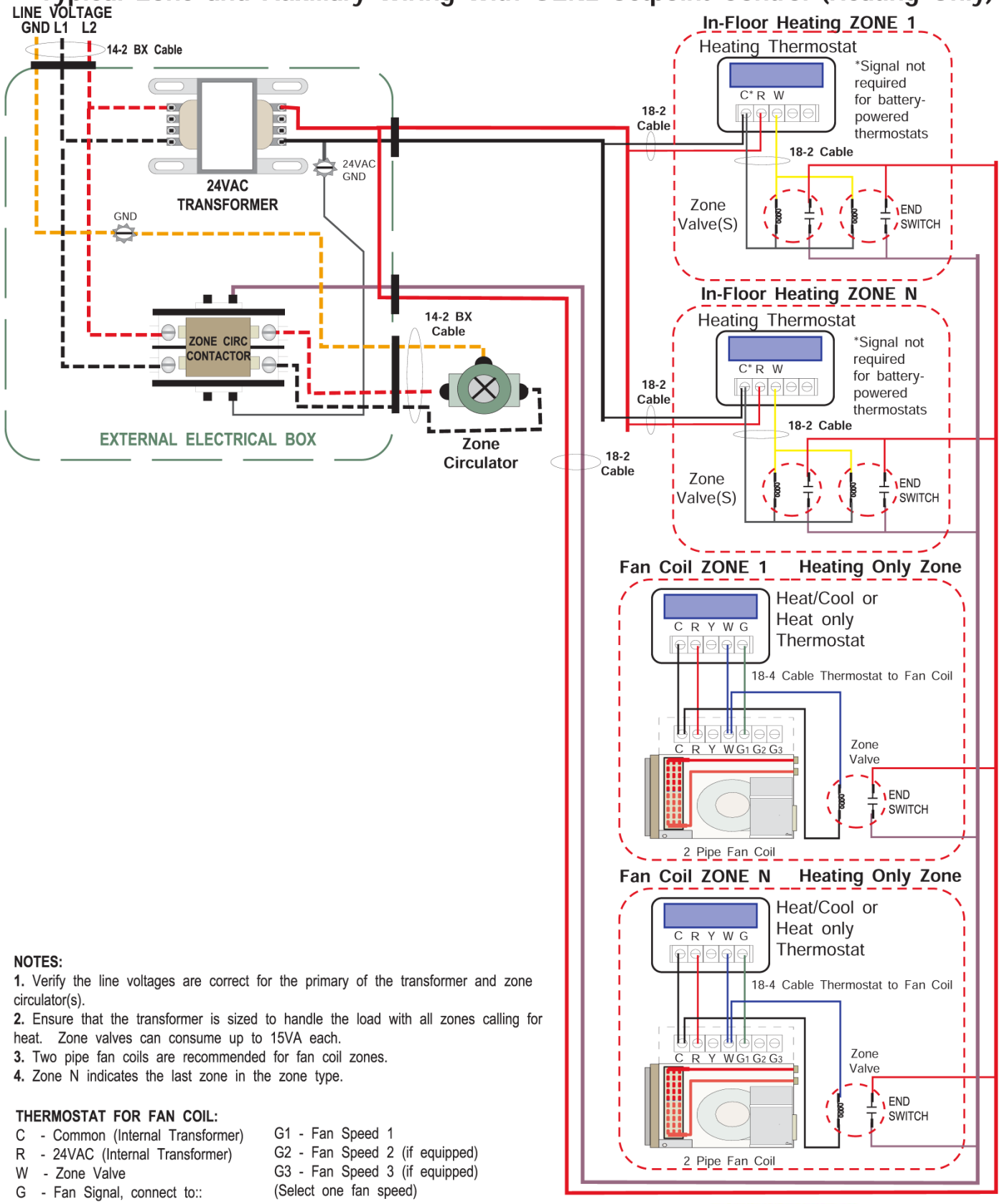
4. Now the tank elements will only be activated by a connection between the E_1-E_2 tank terminals, up to the 125°F maximum. This will be done by an 18-2 wire to the **D1-D2** terminals in the heat pump, activating the elements only when ***AUX*** heat is required.

See heat pump manual for further explanation.

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

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

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



NOTES:

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

THERMOSTAT FOR FAN COIL:

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

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

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

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

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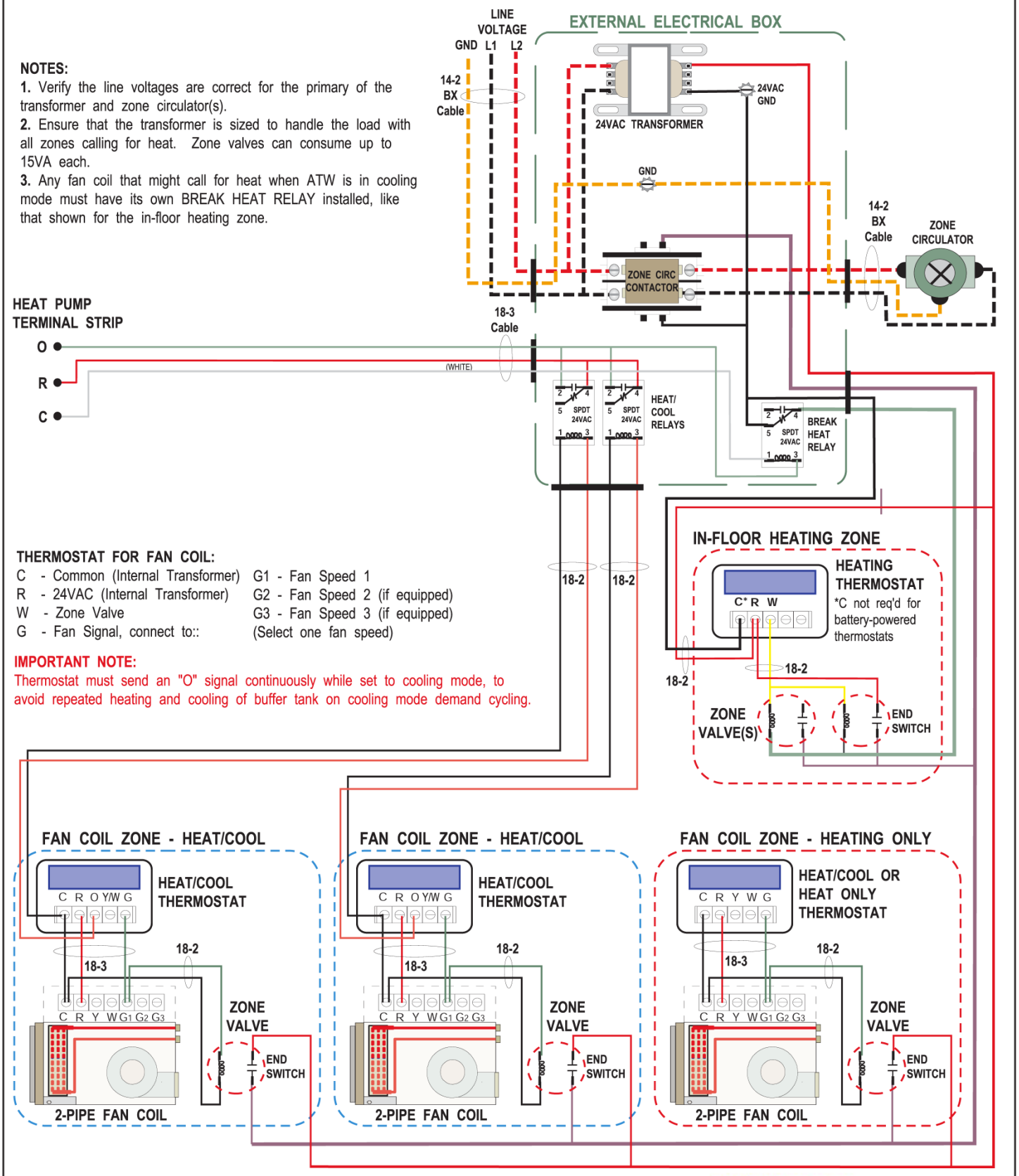
Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating Only)

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

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



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

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

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

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

Number of Tanks

All dedicated DHW heat pumps (with the double wall condenser option) require one DHW holding tank, equivalent in function to the single buffer tank systems discussed below.

All space heating/cooling heat pumps with single wall condenser require at least **one buffer tank**. If there is one buffer tank, it will contain the heated or chilled water. The water in the tank will be chilled when the "**O"** signal is activated. This buffer tank may have electric elements for auxiliary heat, or an existing boiler may be used. See piping diagrams on following pages.

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

See the chapter **One or Two Buffer Tanks?** near the beginning of this manual for a discussion of this topic.

TABLE 12 - Buffer Tank Size

Heat Pump Size	Minimum Size gal (L)	Recommended Size gal (L)
45	24 (90)	50 (190)
55	32 (120)	70 (265)
65	40 (150)	70 (265)
75	48 (180)	70 (265)
80	52 (200)	70 (265)
100	70 (265)	100 (380)

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

Indoor Loop Water Lines

The connections for the Indoor Loop circuit are 1" or 1-1/4" brass FNPT. They are labelled as INDOOR IN and INDOOR OUT. The ports are located on the left side of the unit near the back.

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

Note there is a separate set of piping diagrams for DHW heating heat pumps with the double wall condenser option.

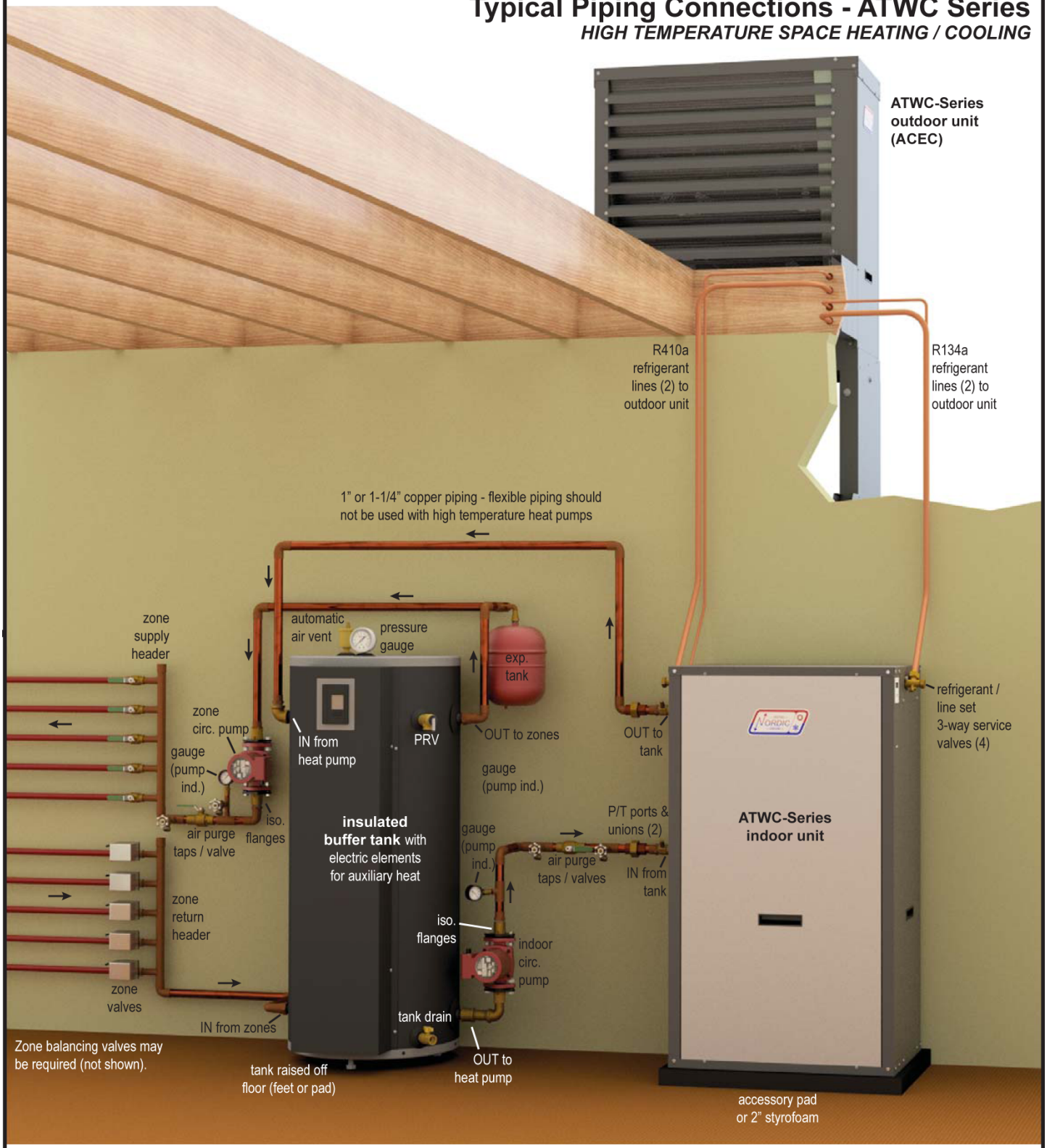
NOTE: It is recommended that the water lines between the heat pump and the buffer tank be copper or other high temperature piping.

NOTE: Care should be taken when routing the water lines to ensure that adequate access to the heat pump is maintained so as to not compromise ease of serviceability.

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

Typical Piping Connections - ATWC Series

HIGH TEMPERATURE SPACE HEATING / COOLING



See other diagrams and instructions in the manual for selection and installation of hydronic heating accessories.

There are multiple valid connection methods or details which differ from those shown, including:
- Zones that use one pump per zone instead of zone valves.
- Piping routed differently, or different piping & component types.

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01	Initial Rel.	Dan Rheault	Dan Rheault	14-Sep-2021

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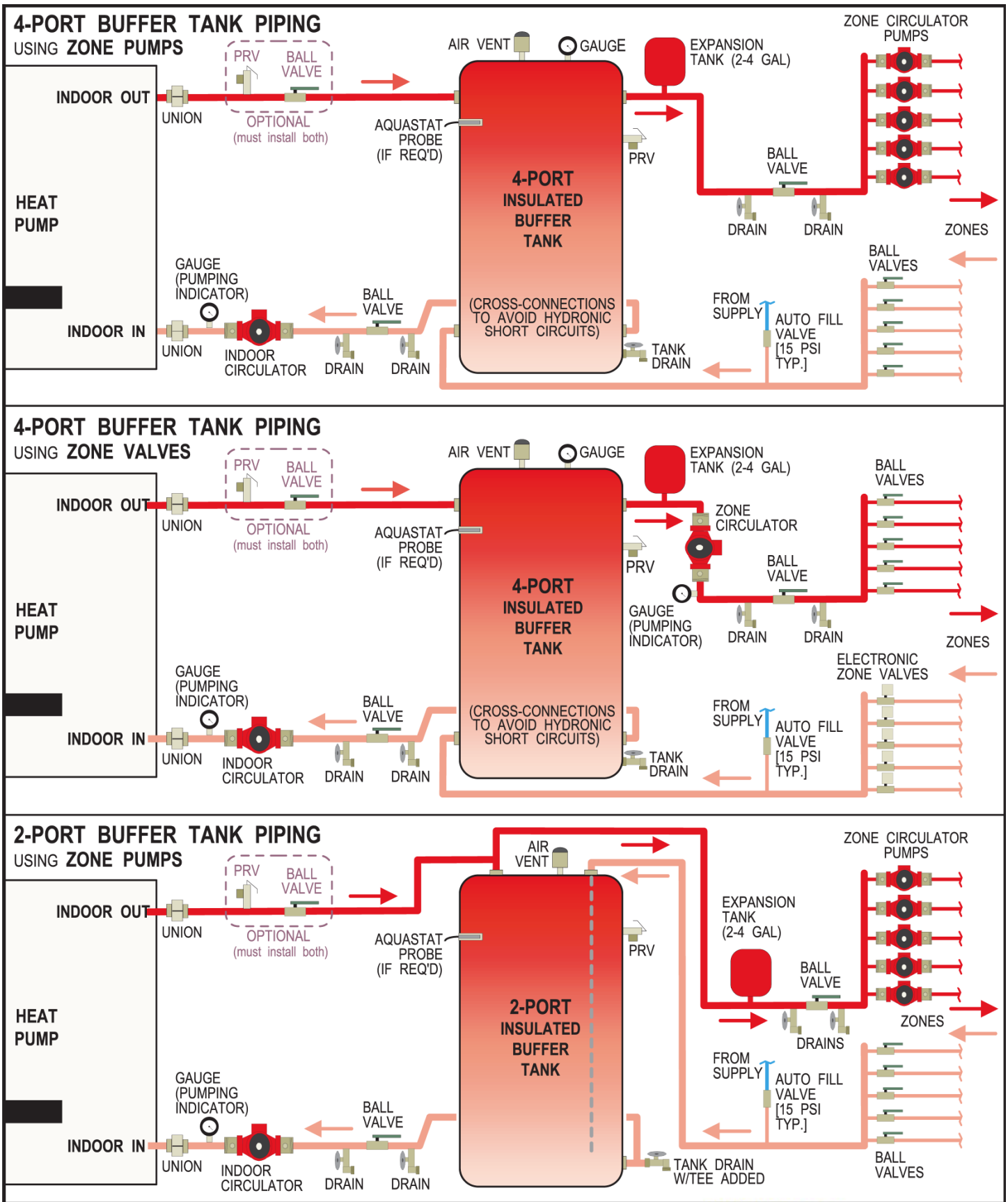
Eng. Approved By		Date
Mfg. Approved By		Date
Approved By		Date

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

Drawing Name: **Typical Piping Connections - ATWC Space Heating/Cooling**

Size	Drawing Number	Revision	Sheet
LET	002540PDG	01	1 / 1



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

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

MARITIME GEOTHERMAL LTD.
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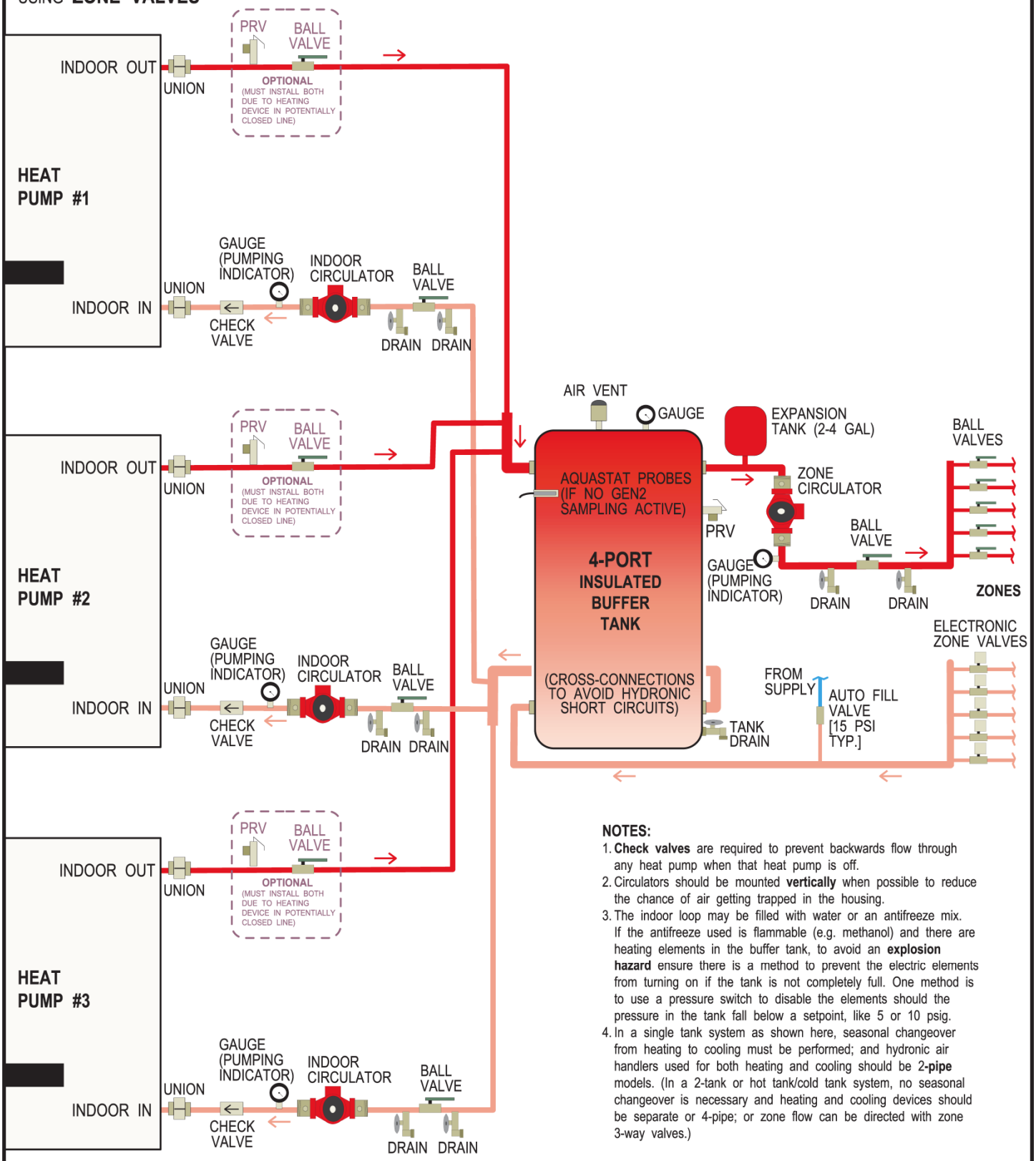
E4Z 6H4

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

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

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



NOTES:

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

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01	Initial Release	D. RHEAULT	D. RHEAULT	9-Aug-2021

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Approved By (MFG)	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
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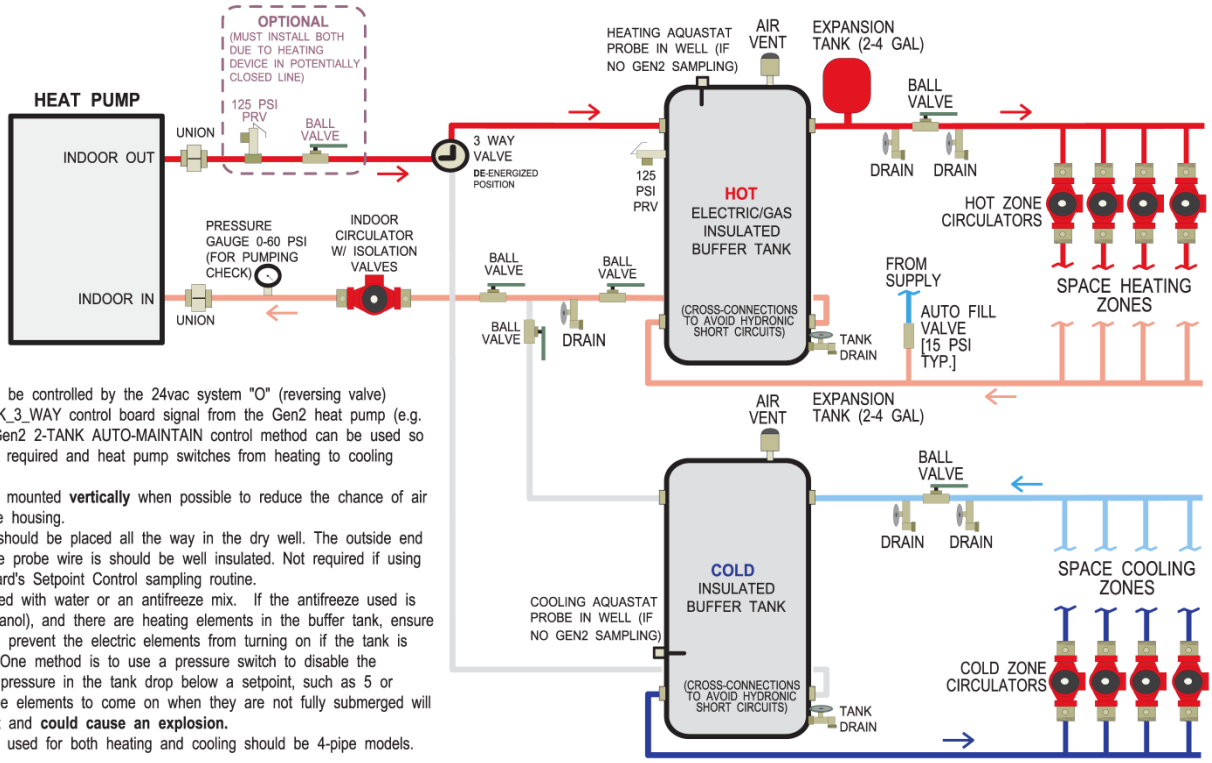
E4Z 6H4

Drawing Name: **Buffer Tank Piping - Multiple Units**

Size	Drawing Number	REV	SHEET
A	002528PDG	01	1 of 1

Two Tank System Piping with a Reversing Heat Pump

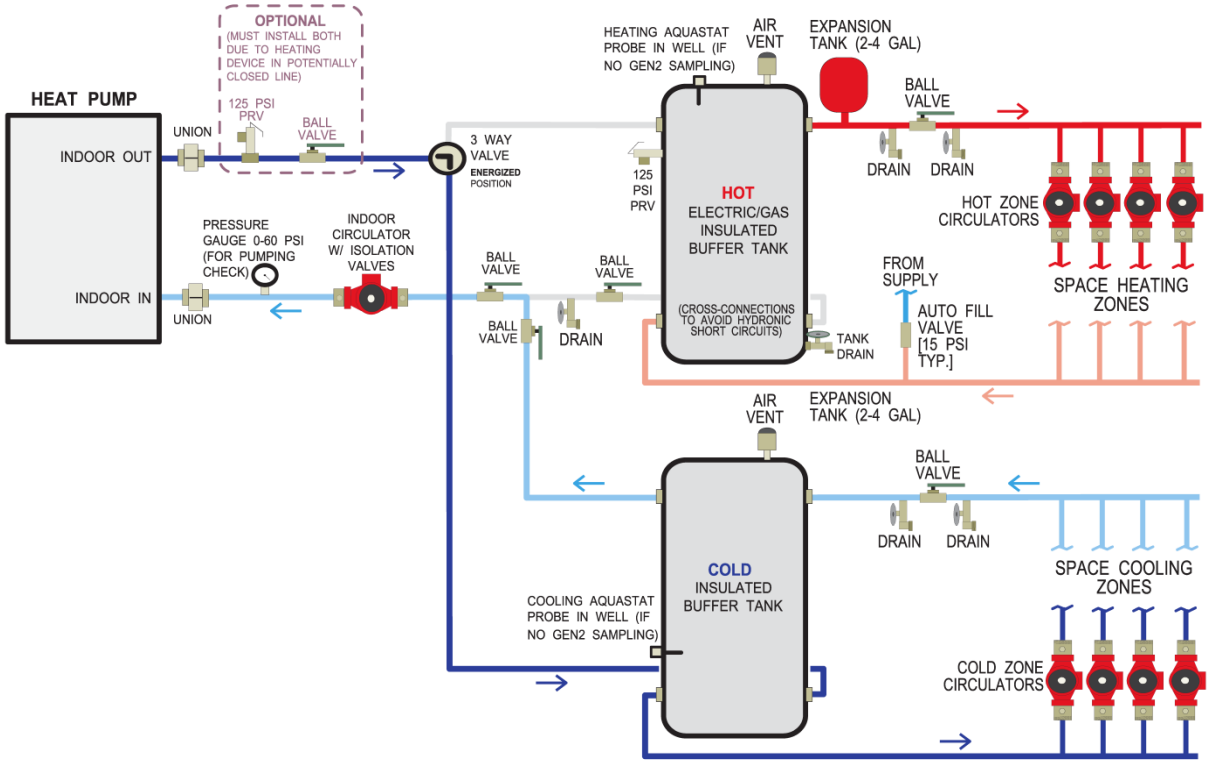
HEATING MODE



NOTES:

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

COOLING MODE



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

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

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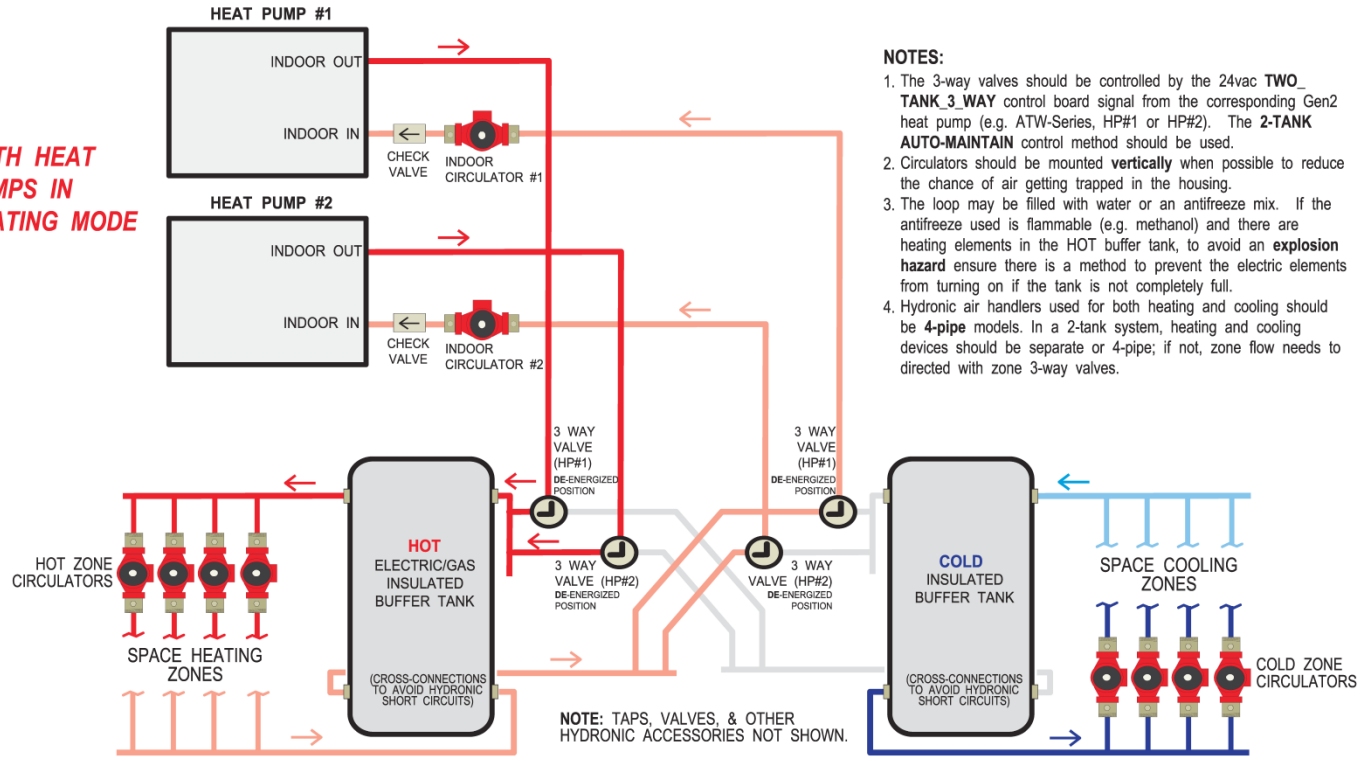
E4Z 6H4

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

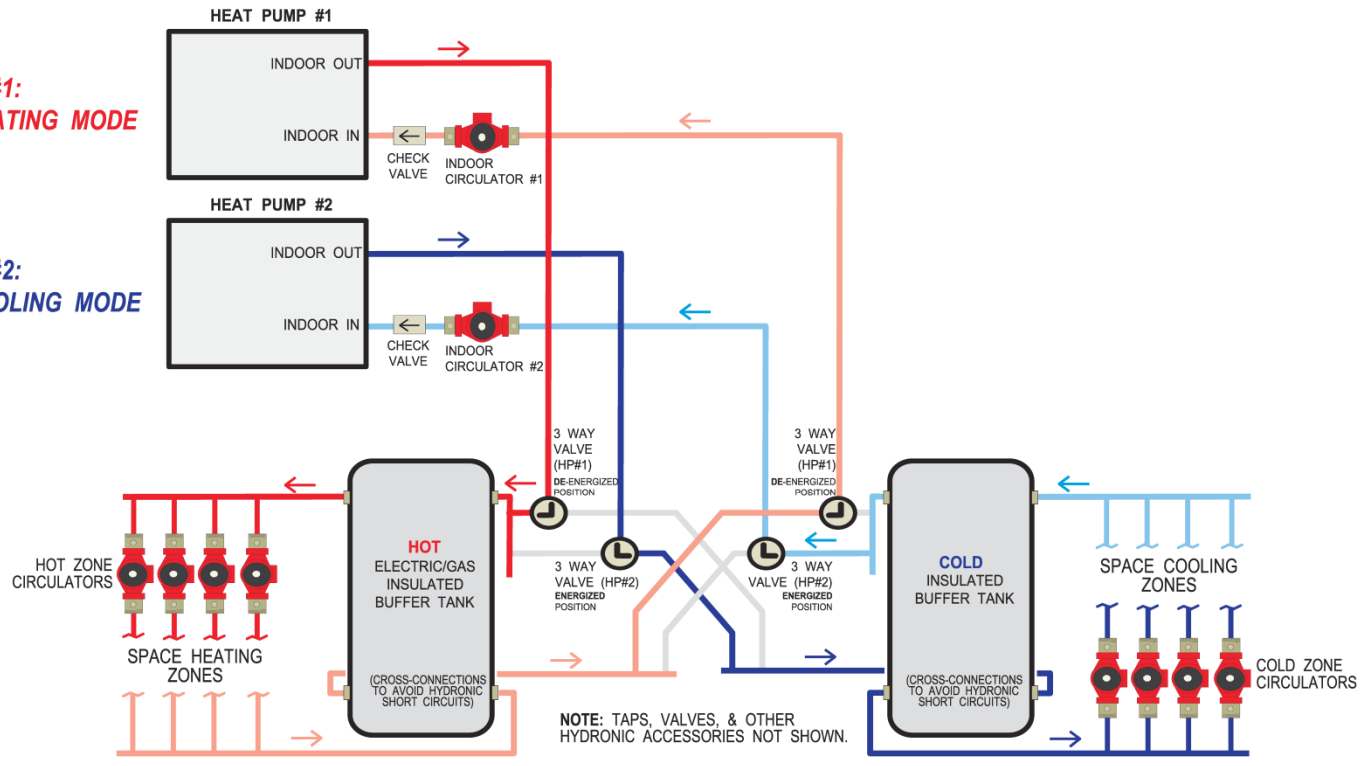
Size	Drawing Number	REV	SHEET
A	002252PDG	03	1 of 1

Two Tank System Piping with Multiple Reversing Heat Pumps



NOTES:

1. The 3-way valves should be controlled by the 24vac **TWO_TANK_3_WAY** control board signal from the corresponding Gen2 heat pump (e.g. ATW-Series, HP#1 or HP#2). The **2-TANK AUTO-MAINTAIN** control method should be used.
2. Circulators should be mounted **vertically** when possible to reduce the chance of air getting trapped in the housing.
3. The loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (e.g. methanol) and there are heating elements in the HOT buffer tank, to avoid an **explosion hazard** ensure there is a method to prevent the electric elements from turning on if the tank is not completely full.
4. Hydronic air handlers used for both heating and cooling should be **4-pipe** models. In a 2-tank system, heating and cooling devices should be separate or 4-pipe; if not, zone flow needs to directed with zone 3-way valves.



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

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Approved By (MFG)		Date
Approved By		Date

MARITIME GEOTHERMAL LTD.
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E4Z 6H4

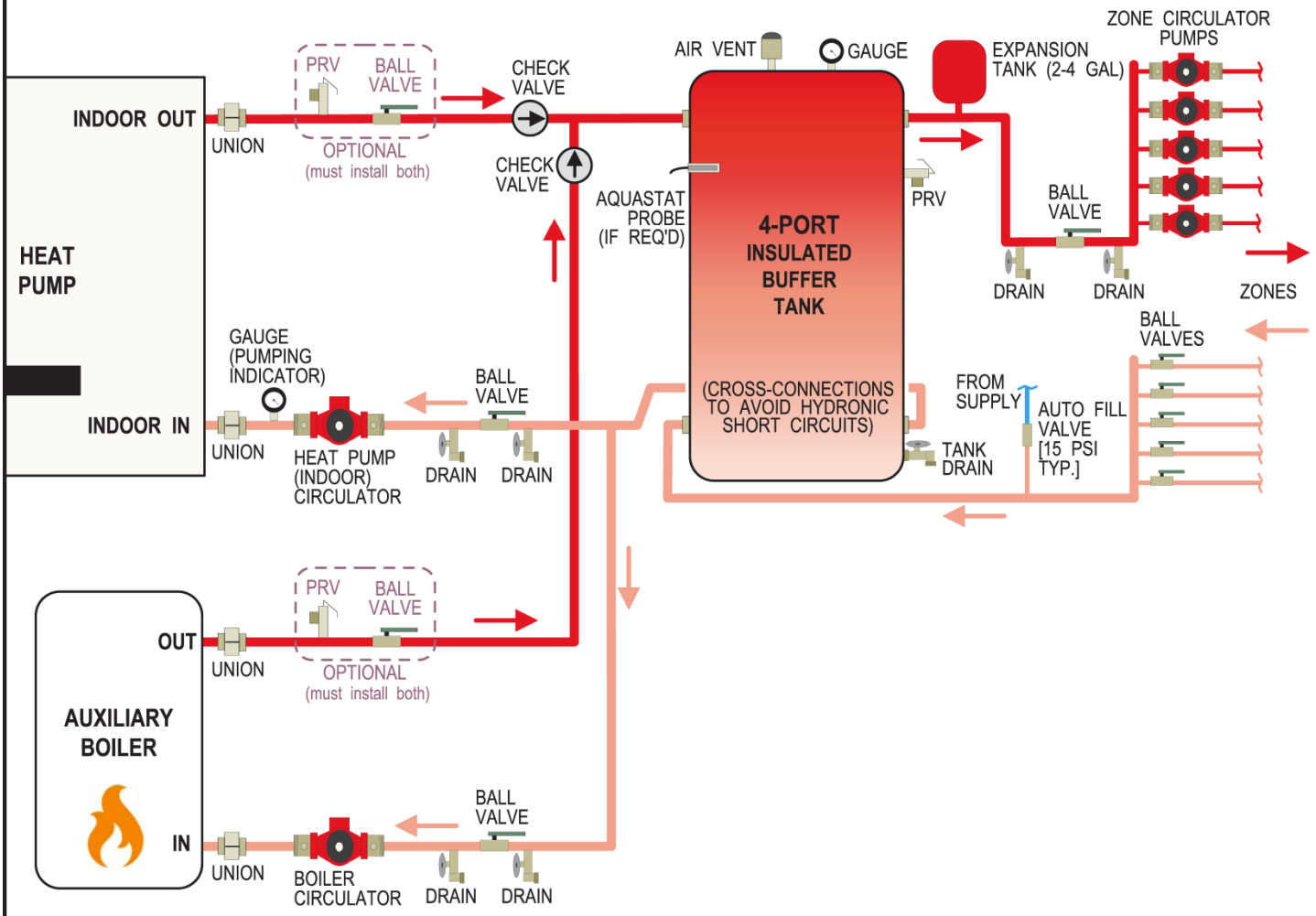
Drawing Name: Two Tank System Piping with Multiple Reversing Heat Pumps

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

Auxiliary Boiler Piping

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

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



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

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

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

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

MARITIME GEOTHERMAL LTD.
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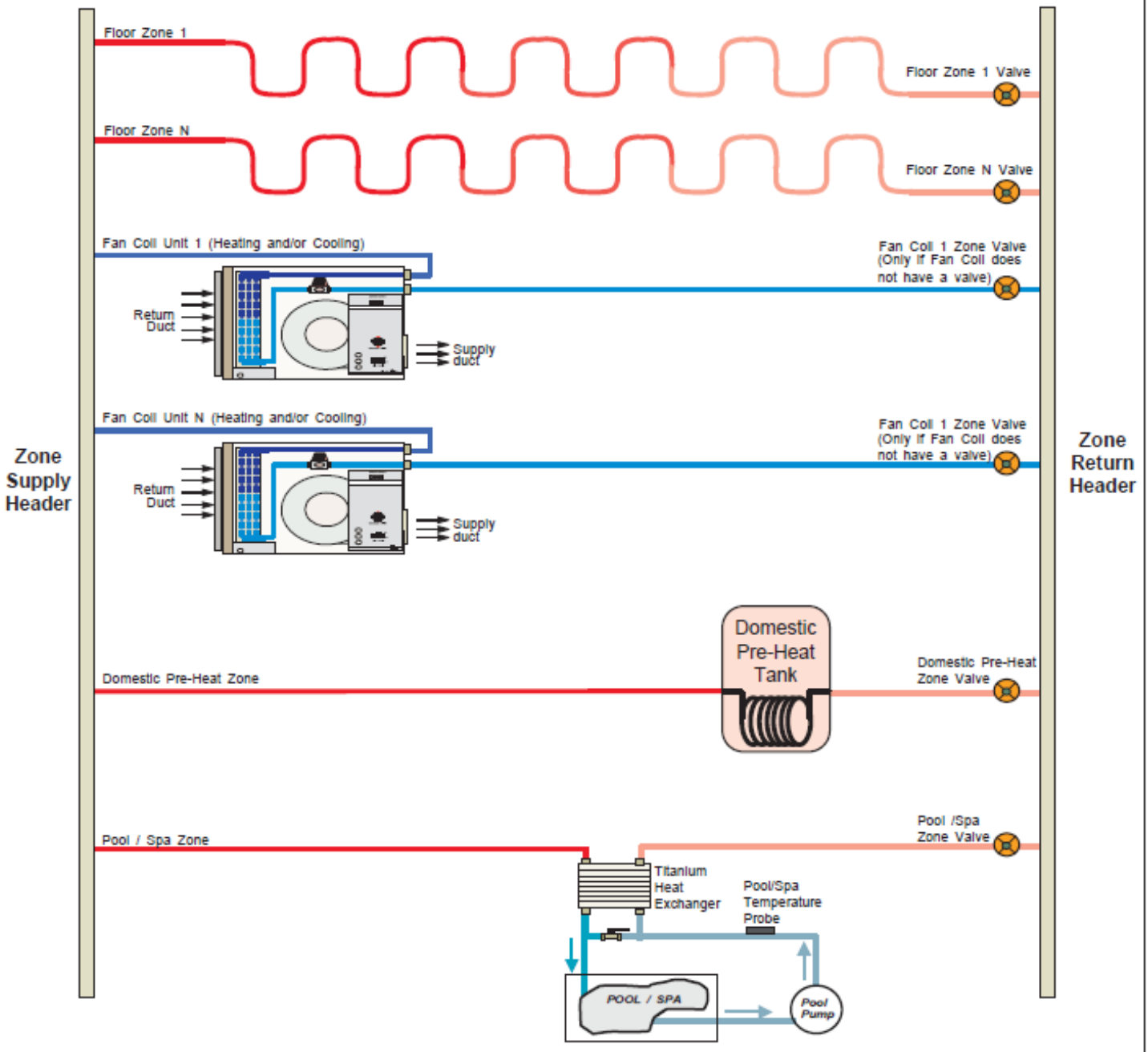
E4Z 6H4

Drawing Name: **Auxiliary Boiler Piping**

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

Typical Zone Types for Hydronic Applications



NOTES:

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

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

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

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

Drawing Name: Typical Zone Types for Hydronic Applications

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

Typical Piping Connections - ATWC Series

DIRECT DOMESTIC HOT WATER HEATING with DOUBLE WALL CONDENSER OPTION

01	Initial Rel.	Dan Rheault	Dan Rheault	21-Sep-2021
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By: Dan Rheault	Date: 21-Sep-2021	
Checked By: Dan Rheault	Date: 21-Sep-2021	
Eng. Approved By	Date	
Mfg. Approved By	Date	
Approved By	Date	

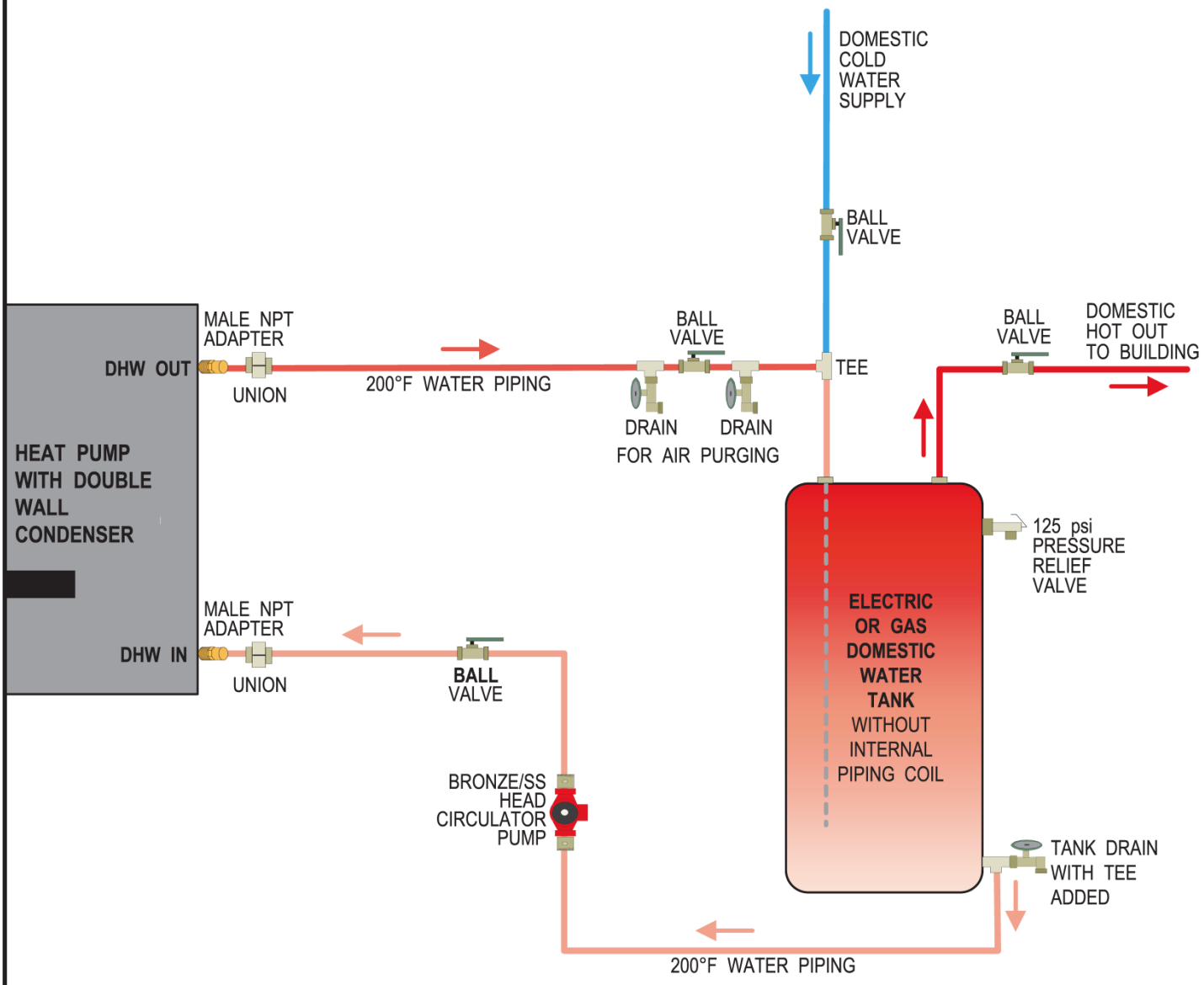
MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

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

Size	Drawing Number	Revision	Sheet
LET	002541PDG	01	1 / 1

DHW Tank Piping for Direct Domestic Water Heating

For Heat Pumps with Double Wall Condenser



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

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

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

Drawing Name: Piping for Direct DHW Heating

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

Outdoor Unit Line Set

Line Set Interconnect Tubing

Once both the indoor and outdoor units have been mounted, the 2 line sets may be run between them: one for R410a and one for R134a. ***There are 2 liquid lines and 2 vapour lines that carry different refrigerants, and care must be taken not to mismatch connections.***

ACR refrigeration tubing (cleaned & dehydrated) should be used. Every effort must be made to insure that the tubing does not become contaminated during installation. Caps should be placed on the open ends of tubing immediately after cuts are made, and only removed after all bends have been made and the pipe fixed in its permanent location ready to make the silver soldered joints. It is very important to keep a refrigeration system perfectly clean and dry. Removing caps just prior to silver soldering or flaring will ensure minimum exposure to humidity in the atmosphere.

TABLE 13 - Line Set Sizing

	R410a (ATWC indoor unit left side)		R134a (ATWC indoor unit right side)	
	Liquid line O.D.	Vapour line O.D.	Liquid line O.D.	Vapour line O.D.
ATWC-45	3/8"	3/4"	3/8"	3/4"
ATWC-55	3/8"	3/4"	3/8"	3/4"
ATWC-65	3/8"	3/4"	1/2"	7/8"
ATWC-75	1/2"	7/8"	1/2"	7/8"
ATWC-80	1/2"	7/8"	1/2"	7/8"
ATWC-100	1/2"	7/8"	1/2"	7/8"

IMPORTANT NOTE: The line set between the indoor and outdoor units must not exceed 70 ft. (21 m) in length.

Indoor Unit Connections

The indoor unit connections for the interconnecting line set are 3-way brass service valves with flare connections. After the line set is installed, the tubing can be vacuumed through the Schrader charging port on the 3-way valve, then the valve opened to let refrigerant contained in the indoor unit into the line set and outdoor unit.

The indoor unit comes pre-charged with enough refrigerant for a 20 ft. (6.1 m) line set. Longer line sets will require added charge; see next page.

Copper flare to solder adapters are included with the indoor unit, to remove the requirement to do an accurate flare in the field, especially on the larger 7/8" pipe. These are shipped along with the mounting feet for the outdoor unit and shielded wire near the compressor in the indoor unit.

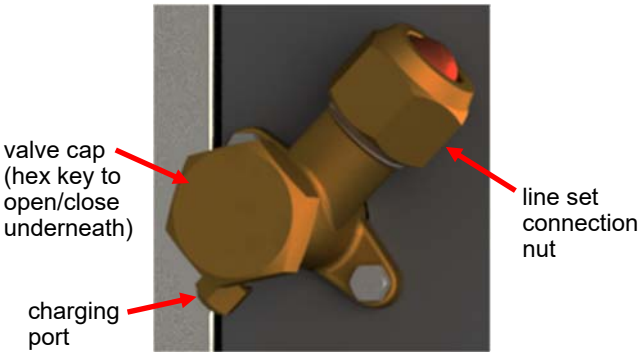


TABLE 14a - 3-way Service Valve Tooling

Nominal Size	Line set connection nut wrench	Hex key to open/ close	Valve cap wrench	Charging port cap wrench
3/8"	22 mm *(7/8")*	5 mm *(3/16")*	19 mm *(3/4")*	14 mm (9/16")
1/2"	24 mm *(1")*	5 mm *(3/16")*	19 mm *(3/4")*	14 mm (9/16")
3/4"	32 mm *(1-3/8")*	5 mm *(3/16")*	30 mm *(1-1/4")*	14 mm (9/16")
7/8"	38 mm *(1-1/2")*	8 mm *(5/16")*	42 mm *(1-3/4")*	14 mm (9/16")

TABLE 14b - 3-way Service Valve Torques

Nominal Size	Line set connection nut torque	Hex key torque	Valve cap torque	Charging port cap torque
3/8"	30-35 N.m *(22-26 ft.lb)*	5-7 N.m *(4-5 ft.lb)*	20-25 N.m *(15-18 ft.lb)*	10-12 N.m *(7-9 ft.lb)*
1/2"	40-45 N.m *(30-33 ft.lb)*	7-9 N.m *(5-7 ft.lb)*	25-30 N.m *(18-22 ft.lb)*	10-12 N.m *(7-9 ft.lb)*
3/4"	60-65 N.m *(44-48 ft.lb)*	11-13 N.m *(8-10 ft.lb)*	35-40 N.m *(26-29 ft.lb)*	10-12 N.m *(7-9 ft.lb)*
7/8"	110-120 N.m *(81-88 ft.lb)*	28-32 N.m *(21-24 ft.lb)*	47-53 N.m *(35-39 ft.lb)*	10-12 N.m *(7-9 ft.lb)*

Outdoor Unit Connections

The outdoor unit has capped off (soldered) pipes from the factory and is charged with 15 - 25 psig of nitrogen. Remove the side panel from the outdoor unit so that the piping is accessible, and connect each of the 4 refrigerant pipes inside the outdoor unit. There is an illustration for a typical installation on a following page.

CAUTION REQUIRED:
Mismatching R410a/R134a refrigerant lines between the indoor and outdoor units will result in refrigerant contamination.
In case of mismatched lines, refrigerant disposal and replacement will be required.

Oil Traps

If the line set has a vertical rise of over 20 ft (6 m), then an oil trap must be placed in the line set every 20 ft (6 m) of rise as shown in diagram.

Filter-Dryer

Note that **no field installed filter-dryers are required**, since they are included inside the indoor unit.

Pipe Insulation

All line set piping between the indoor and outdoor units should be insulated with 3/8" thick closed cell pipe insulation to prevent condensation and dripping onto floors or walls during the heating season. It can be slid onto the capped tubing without having to slice it down the side for the most part. Ensure that any joints in in the line sets are accessible for leak testing.

Liquid and vapour ports and any remaining exposed tubing should be insulated with 3/8" thick closed cell pipe insulation once the silver soldering and pressure testing is complete. Ensure that all individual pieces of pipe insulation are glued to each other so there are no air gaps.

Silver Soldering Line Sets

All joints should be brazed with 5% silver solder. **It is absolutely required that dry nitrogen be bled through each line set during all silver soldering procedures so that no oxidation occurs on the inside of the copper tubing.** Connect a set of refrigeration gauges to the service ports (Schrader ports) on the access valves of the indoor unit, the low side (blue hose) to the vapour line and the high side (red hose) to the liquid line. Connect the charge line (yellow hose) to a nitrogen source. Disconnect the high side (red) hose at the manifold so that nitrogen may flow freely though the line set. Adjust the nitrogen pressure through the low side (blue hose) so that it can be very lightly felt when a finger is placed on the disconnected high side (red) hose.

A wet rag may be wrapped around each of the line set pipes inside the outdoor unit to prevent melting the grommet when silver soldering. Ensure that no water enters any of the ports or tubing.

Pressure Testing

Once all connections are complete, each line set should be pressure tested to a final test pressure of **125 psig (860 kPa)** with dry nitrogen. Reconnect the high side (red) hose to the manifold and pressurize the line set. It is recommended to pressure test in stages, listening and inspecting for leaks along the way. For example, 10 psig (70 kPa) , 25 psig (170kPa), 75 psig (520kPa) and then finally 125PSIG (860kPa). Check all joints at the unit and any made in the interconnect tubing for leaks using soap suds, Spray Nine, etc. It is important not to bypass this step as vacuuming the system with a leak will be impossible and attempting to do so will introduce moisture into the system, making the vacuum process take much longer than if the leak had been found and repaired first. It is recommended that the system be left under pressure for a minimum of two hours to ensure there are no small leaks that were undetected.

Vacuuming the System

Remove the pressure from the system and connect the vacuum pump to the charge line (yellow hose) of the refrigeration manifold. Tighten all hose connections, open the valves on the manifold and start the vacuum pump.

Vacuum the system until the reading on an electronic vacuum gauge remains below 500 microns for a period of 5 minutes after the vacuum pump is shut off and the system sealed.

Charging the System

The indoor unit is pre-charged for line sets up to **20 ft** long. Once the system has been vacuumed, if additional amounts of each refrigerant are required due to the length of the line set, it may be added before opening the access valves. Close off the charge valve on the refrigeration manifold set and disconnect the vacuum pump. Connect the charge (yellow) hose to the **liquid port** of a refrigerant tank and place the tank on a scale. Open the liquid valve of the refrigerant tank and then slightly loosen the charge (yellow) hose at the manifold until liquid comes out, then quickly re-tighten the hose. This will ensure that no air enters the system. Zero the scale and then add the amount of refrigerant calculated from the tables below.

Once the additional charge (if any) has been added, disconnect both hoses from the service ports of the access valves and place the caps back on them, tighten with a wrench.

Remove the caps from the access valves and open both valves with a hex key. Open the valves (counter-clockwise) until they stop turning. Replace the caps and tighten with a wrench.

The system is now ready for startup. Clean up the area, and install all access panels except the one which gives access to the electrical box. Proceed to the Startup Section of the manual before turning the power on to the unit.

TABLE 15 - Extra Charge for 3/8" / 3/4" Line Sets

Extra charge for line sets >20 ft (6 m)	1.1 oz per ft OR 0.10 kg per m		
Line set length (ft)	Extra Charge		
	(oz)	(lb)	(kg)
22	2	0.1	0.06
24	4	0.3	0.12
26	7	0.4	0.19
28	9	0.6	0.25
30	11	0.7	0.31
32	13	0.8	0.37
34	15	1.0	0.44
36	18	1.1	0.50
38	20	1.2	0.56
40	22	1.4	0.62
42	24	1.5	0.69
44	26	1.7	0.75
46	29	1.8	0.81
48	31	1.9	0.87
50	33	2.1	0.94
52	35	2.2	1.00
54	37	2.3	1.06
56	40	2.5	1.12
58	42	2.6	1.19
60	44	2.8	1.25
62	46	2.9	1.31
64	48	3.0	1.37
66	51	3.2	1.43
68	53	3.3	1.50
70	55	3.4	1.56

TABLE 16 - Extra Charge for 1/2" / 7/8" Line Sets

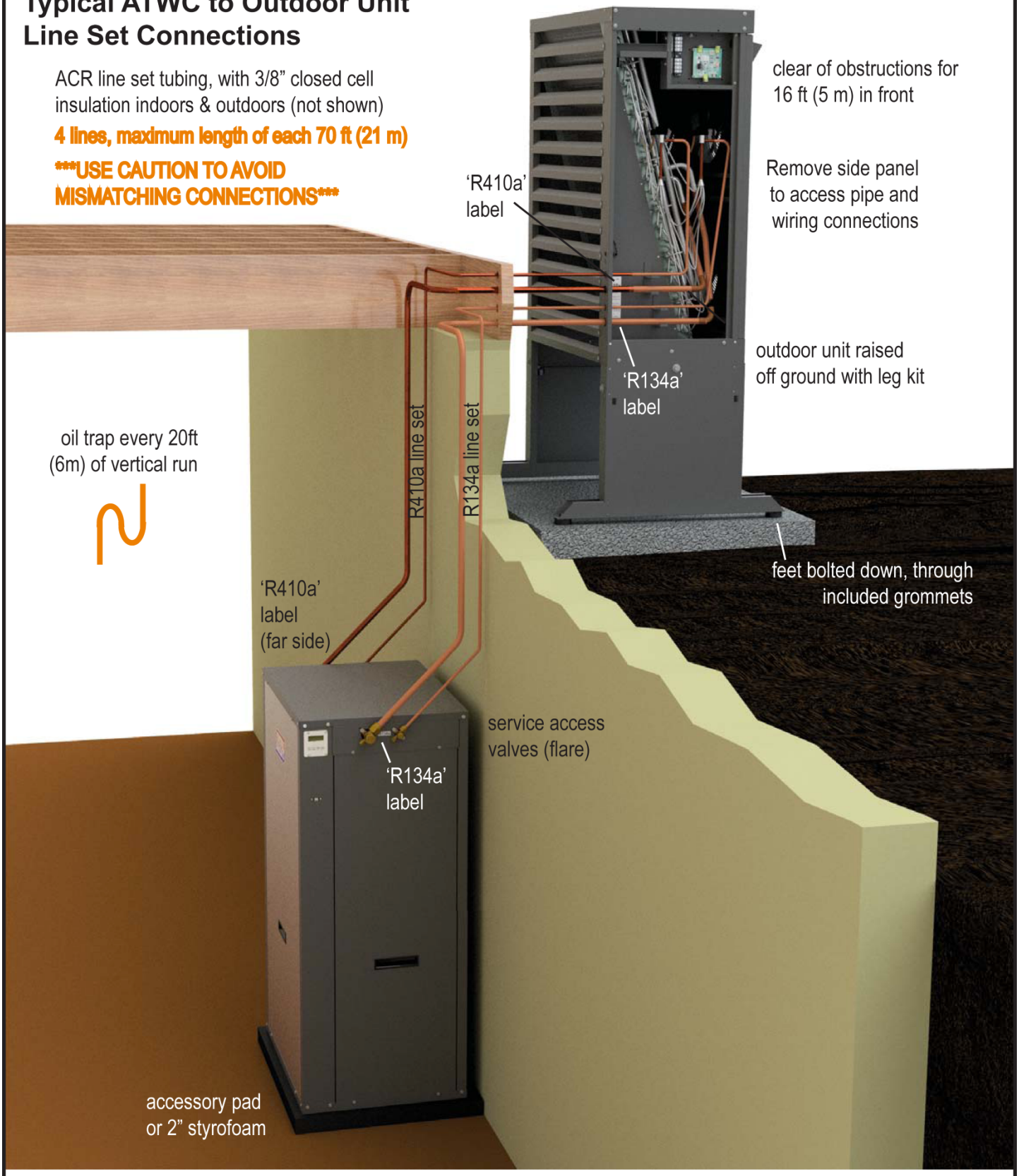
Extra charge for line sets >20 ft (6 m)	2.1 oz per ft OR 0.18 kg per m		
Line set length (ft)	Extra Charge		
	(oz)	(lb)	(kg)
22	4	0.3	0.12
24	8	0.5	0.24
26	13	0.8	0.36
28	17	1.1	0.48
30	21	1.3	0.60
32	25	1.6	0.71
34	29	1.8	0.83
36	34	2.1	0.95
38	38	2.4	1.07
40	42	2.6	1.19
42	46	2.9	1.31
44	50	3.2	1.43
46	55	3.4	1.55
48	59	3.7	1.67
50	63	3.9	1.79
52	67	4.2	1.91
54	71	4.5	2.02
56	76	4.7	2.14
58	80	5.0	2.26
60	84	5.3	2.38
62	88	5.5	2.50
64	92	5.8	2.62
66	97	6.0	2.74
68	101	6.3	2.86
70	105	6.6	2.98

Typical ATWC to Outdoor Unit Line Set Connections

ACR line set tubing, with 3/8" closed cell insulation indoors & outdoors (not shown)

4 lines, maximum length of each 70 ft (21 m)

*****USE CAUTION TO AVOID MISMATCHING CONNECTIONS*****



01	Initial Rel.	Dan Rheault	Dan Rheault	20-Sep-2021
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By	Dan Rheault	Date	20-Sep-2021
Checked By	Dan Rheault	Date	20-Sep-2021
Eng. Approved By		Date	
Mfg. Approved By		Date	
Approved By		Date	

MARITIME GEOTHERMAL LTD.
P.O. Box 2555
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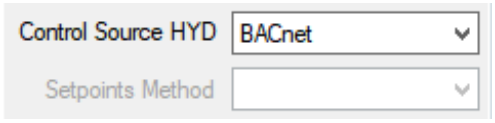
Drawing Name: **Typical ATWC to Outdoor Unit Line Set Connections**

Size	Drawing Number	Revision	Sheet
LET	002544CDG	01	1 / 1

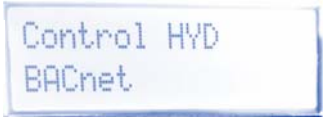
1. BACnet Control

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

PC APP: Tools-->Configuration



LCD Interface: Configuration



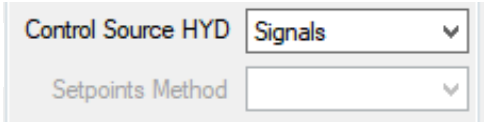
2. Signals / Hardwired Control

Similar to BACnet control, with **Signals Control** the heat pump will turn the compressor(s) on and off and activate cooling mode when it is told to by 24VAC signals. These are provided via external dry contacts, most often from an aquastat or aquastats (available as accessories). See **Wiring** section. The heat pump's internal control logic will not be used, except to limit temperatures and report operating data and alarms.

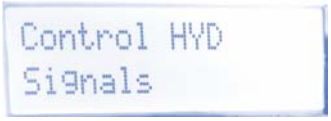
Most installations will instead use **Setpoint Control**; however, **Signals Control** provides control flexibility for certain situations, for example if two water loops with different setpoints are being heated. Temperature settings similar to those outlined in the following **Setpoint Control** section should be used.

When using Signals Control, the backup tank element thermostat can be set to a maximum, allowing the electric elements to be controlled by the 2nd stage of a 2-stage aquastat via an external contactor placed in the power supply connections.

PC APP: Tools-->Configuration



LCD Interface: Configuration



3. Setpoint Control

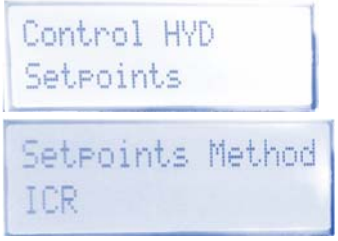
One of the features of the ATWC's GEN2 Control Board is built in temperature control functionality called "**Setpoint Control**". It is recommended that this method be used to control the system's hydronic heating and cooling demand since it eliminates the need for an external aquastat or temperature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

There are four options for Setpoint Control, outlined as follows.

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

PC APP: Tools-->Configuration

LCD Interface: Configuration



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

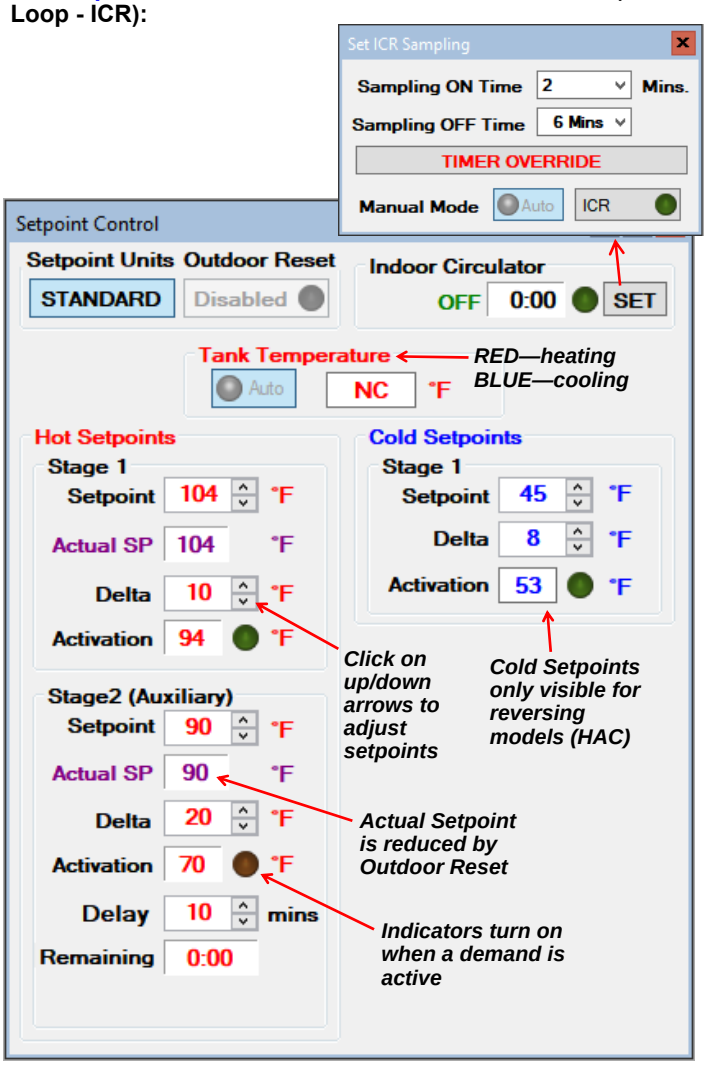
The heat pump will cycle the indoor circulator on and off when the unit is idle to sample the water temperature. When heating mode ends, the indoor circulator will continue to run for 30 seconds. It will then cycle with an OFF time and ON time as set by the **Set ICR Sampling** popup which appears when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

Cooling mode is selected by making a dry contact connection between the **R** and **O** terminals on the terminal strip in the electrical box. This is the one external control requirement.

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

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

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



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

TABLE 17 - Typical ATWC-series Setpoints

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

*Activation is determined by the Setpoint and Delta values

Heating setpoints will vary widely by application. Lower indoor loop water temperatures may be able to be used, or higher ones may be required. Lower heating setpoints will translate directly into a higher COP (efficiency). Increasing Delta values will also increase efficiency due to longer runtimes, and lead to less wear on compressor due to a reduced number of compressor starts.

The maximum water temperature heating setpoint for the cascade **ATWC-series** is **160°F / 71°C**, while the minimum setpoint for cooling is **45°F (7°C)**. The heating setpoint is de-rated at cold outdoor temperatures according to the following table, to keep the compressors operating within their envelopes. The de-rated setpoint will be shown as "**Actual SP**" in the **Setpoint Control** window. (**Actual SP** will also be reduced by the **Outdoor Reset** feature, described shortly.)

TABLE 18 - Maximum Output Temperature

Outdoor temp. °F	Max. output temp. °F	Outdoor temp. °C	Max. output temp.°C
above 15°F	160°F	above -9°C	71°C
11 to 15°F	155°F	-11 to -9°C	68°C
6 to 10°F	150°F	-15 to -12°C	65°C
below 6°F	145°F	below -15°C	63°C

Top Up S1 Function

Enabling this feature allows the stage 1 setpoint to be reached when the actual setpoint is de-rated due to the outdoor temperature being cold (refer to previous table). When disabled, the compressor(s) and stage 2 auxiliary operate normally and shut off at their actual setpoints. When enabled, the heat pump will shut off the compressor(s) at the actual setpoint as usual. The auxiliary will now turn on (if already on, it will continue to be on) and continue up to the stage 1 setpoint. This creates a hybrid system that can maintain the stage1 setpoint even when the heat pump is in de-rated mode for systems that need hotter water than **145°F (63°C)** at all times (although it may result in a significant portion of heat load on a cold day being met by auxiliary heat only).

IMPORTANT NOTE: Do not enable unless auxiliary is operational, since if no auxiliary the compressor will never be re re-enabled (as the setpoint will never be reached).

Summer Setback

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

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

Hydronic Auxiliary in Defrost

AUX (stage 2) heat can be set to come on automatically when the heat pump enters defrost mode via the PC App's **Tools-->Configuration** window.

This may be used to counter the cooling of the tank that will occur during defrost. However, it is not normally required, since changes in the buffer tank temperature of a short duration will not be felt in most living spaces, and the temperature will usually recover quickly after defrost.

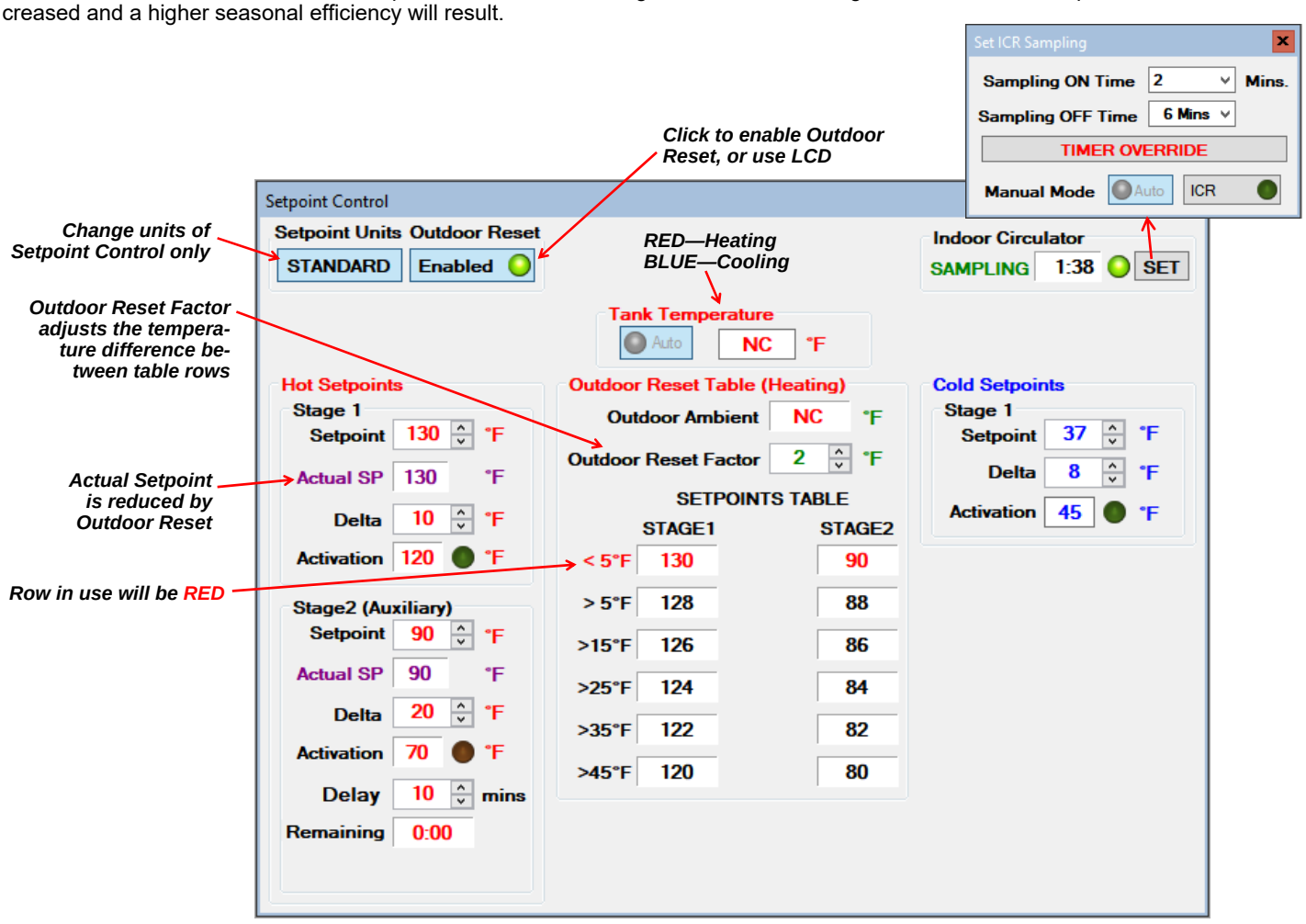
Outdoor Reset

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

When **Control Source HYD** is set to **Setpoints**, an optional Outdoor Reset control algorithm is available for heating mode, which reduces the heating temperature setpoints at warmer outdoor temperatures as measured by the outdoor unit. To enable it, simply click on the **Outdoor Reset** button at the top of the **Setpoint Control** window. The button will change to say Enabled, the indicator will come on and the Outdoor Reset Table will appear.

The table is created by subtracting the value of the Outdoor Reset Factor from the original setpoints once for each table row . The user-selected Hot Setpoints are located in the top row(<5°F), and the next row down equals the row above minus the Outdoor Reset Factor. The table row in use based on current outdoor temperature is shown in red.

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



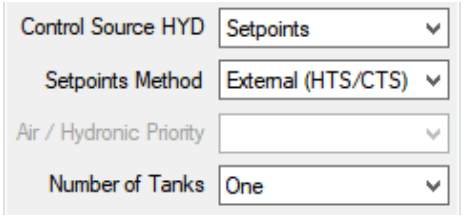
Setpoint Control Method 2 - Indoor Loop (ICR) Two Tanks

It is possible to use all of the **Setpoint Control Method 1** settings, and operate two buffer tanks: one for heated water and one for chilled water. The heat pump will switch over to cooling tank when it receives an external "**O**" signal, and this signal (along with **C/GND**) will also energize a 3-way valve to divert flow to the cold tank (see **Piping** section).

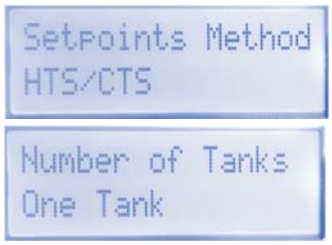
However, it is suggested to use **Method 4** (External HTS/CTS with two tanks) for this purpose. This will require two external tank temperature sensors, but has the benefit of both tank temperatures being constantly monitored and also has the added **Auto Maintain** option (maintaining both hot and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

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

PC APP:
Tools-->Configuration



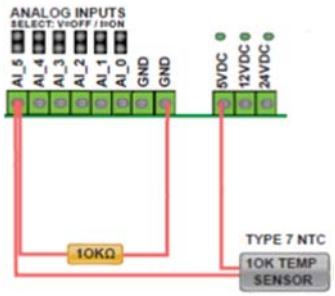
LCD Interface:
Configuration



This is the required method for when an ultra-high temperature (>160°F/71°C) auxiliary boiler is connected in parallel with the heat pump, and connected via **H1-H2** to run only when the heat pump is off. In this case, **ICR sampling should not be used** so that high temperature water is not sent through the heat pump where it could increase refrigeration system pressure beyond rated limits. It can also be used any time sampling is not desired.

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

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

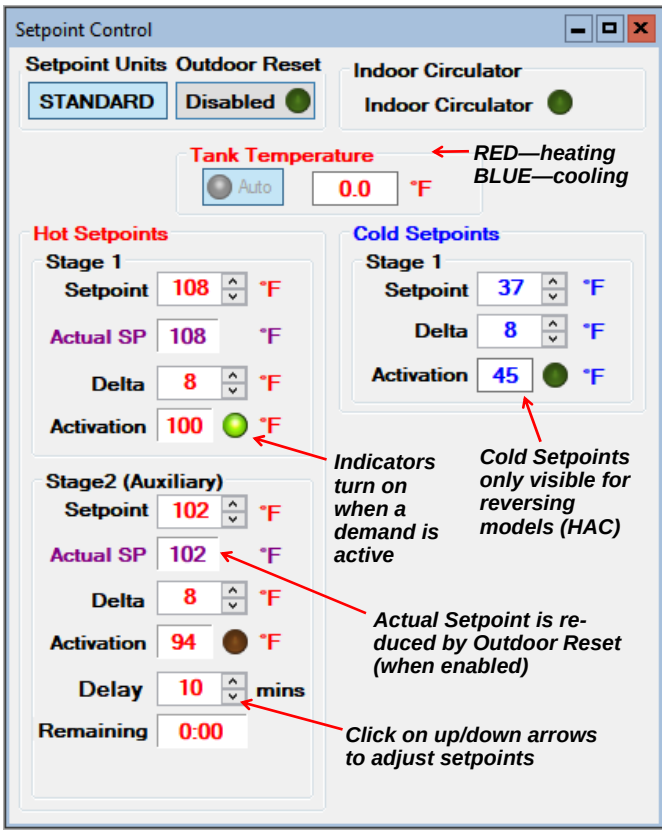


Cooling mode is selected by making a dry contact connection between the **R** and **O** terminals on the terminal strip in the electrical box. This is the one external control requirement.

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

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

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



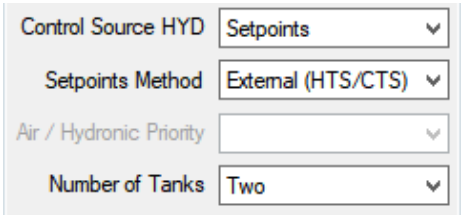
WARNING: When in Manual Override mode, Activation no longer responds to Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached). Go to the PC App's Control Panel to turn demand ON/OFF with the Stage buttons.

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

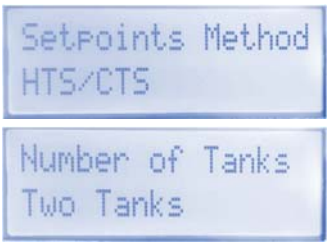
- **Typical Temperature Settings**
- **De-rating due to outdoor temperature**
- **Outdoor Reset function**
- **Top Up S1 function**
- **Summer Setback**
- **Hydronic Auxiliary in Defrost**

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

PC APP:
Tools-->Configuration

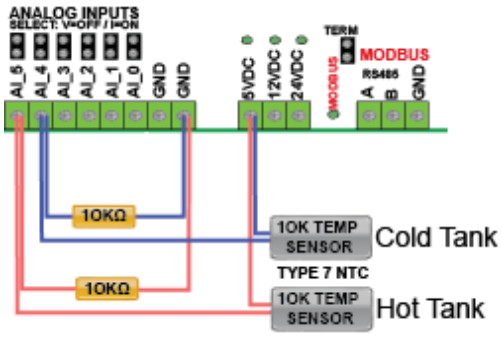


LCD Interface:
Configuration



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

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



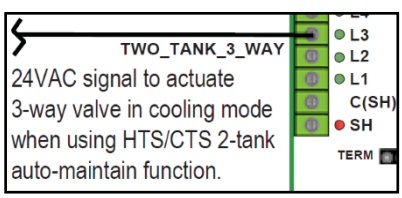
a) O Signal Control

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

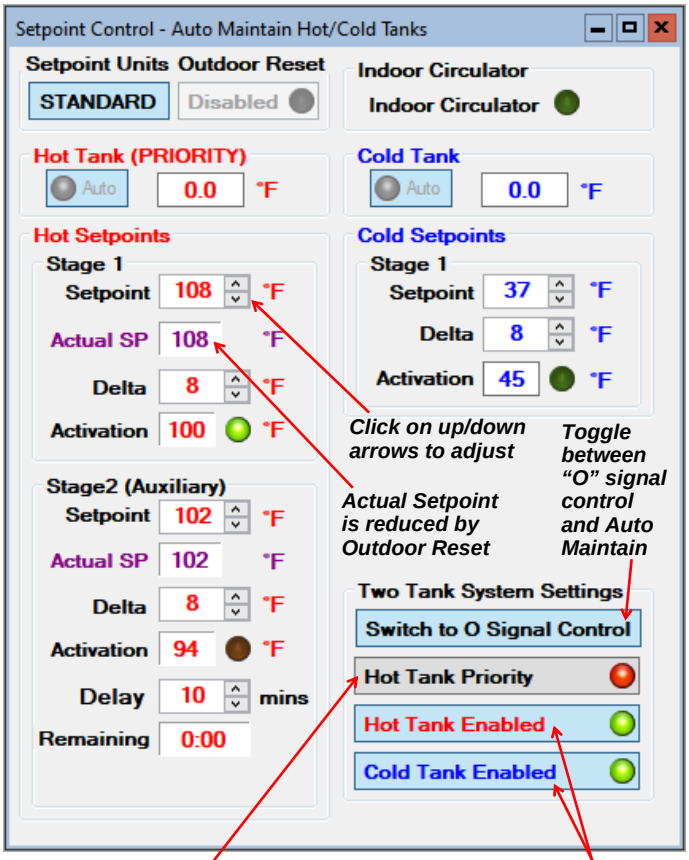
b) Auto Maintain

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

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



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



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

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

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

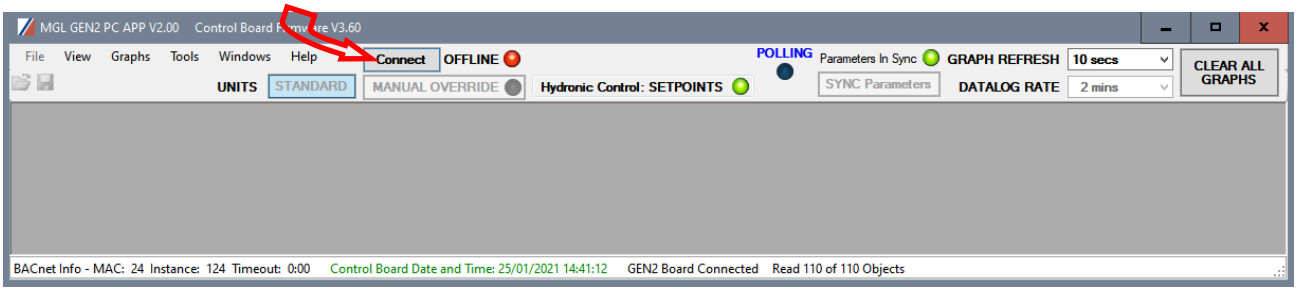
The features explained in **Setpoint Control Method 1 - Indoor Loop ICR with One Tank** also apply to **Setpoint Control Method 4 - External HTS/CTS with Two Tanks:**

- **Typical Temperature Settings**
- **De-rating due to outdoor temperature**
- **Outdoor Reset function**
- **Top Up S1 function**
- **Summer Setback**
- **Hydronic Auxiliary in Defrost**

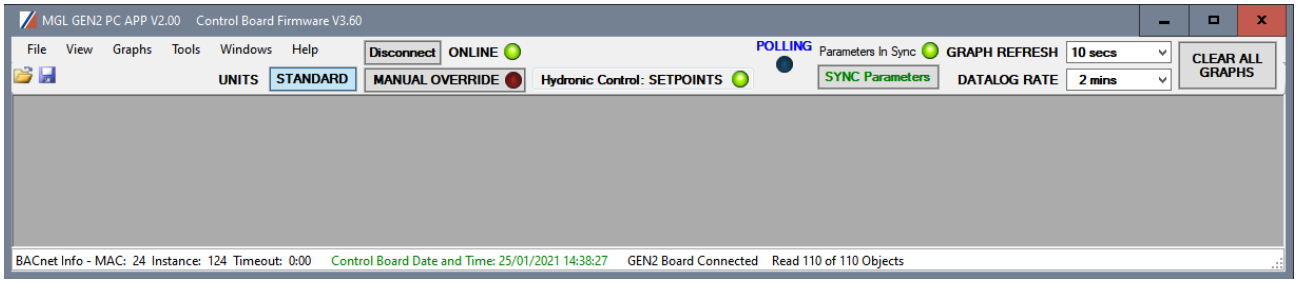
PC Application (PC App)

NOTE: Before using the PC Application, refer to **Appendix B & C** 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.

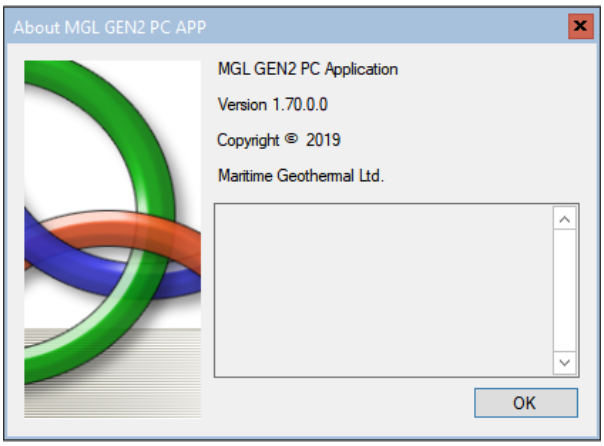
File-->Open: Opens a saved page arrangement.
File-->Save: Saves the current page arrangement under the current name.
File-->Exit: Exits the PC Application.

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.

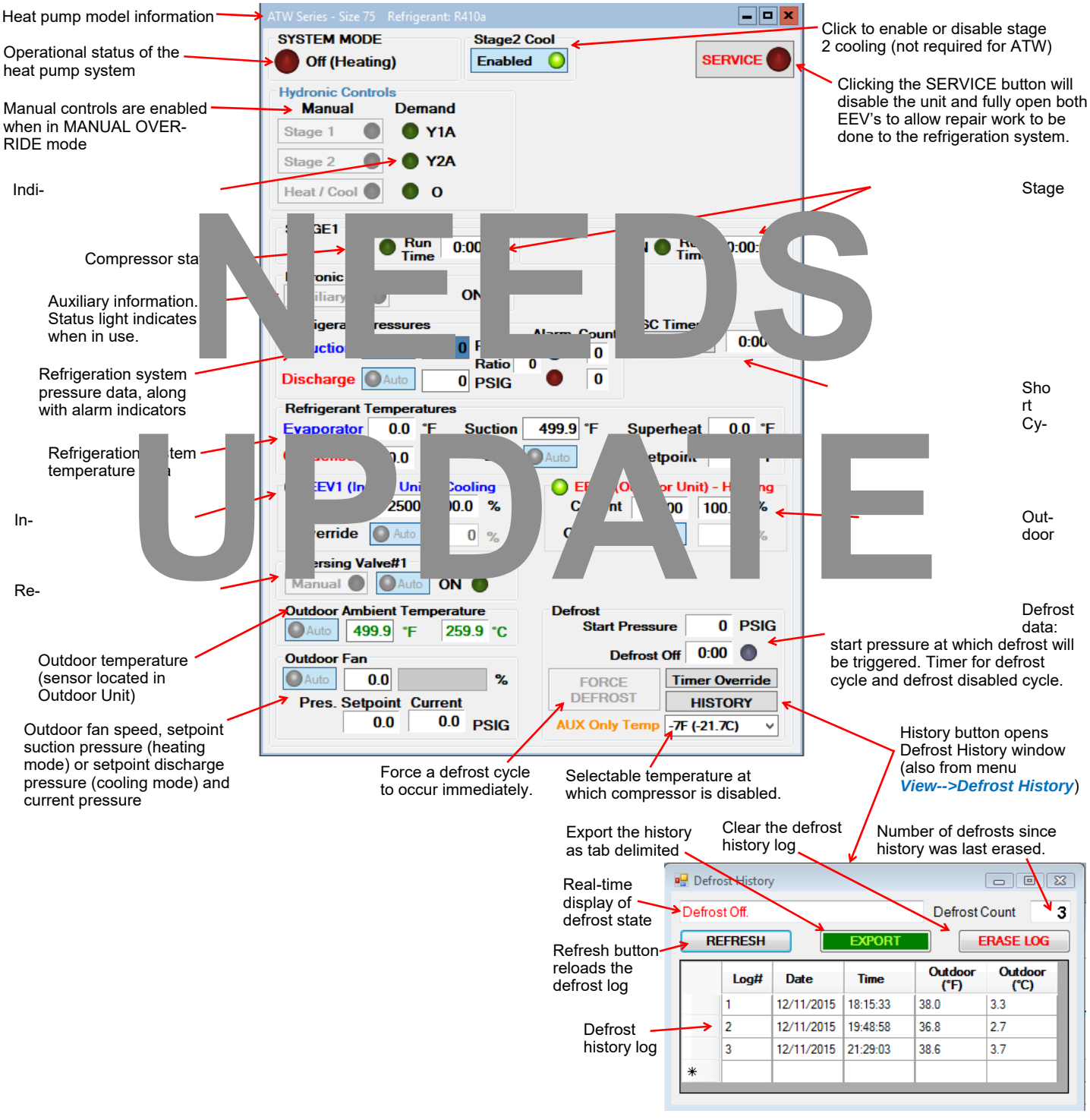
Help-->About: Displays the window shown to the right.



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 **Signals** or **BACnet**).

Refer to the **Operation** section 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: The alarm output will turn on per alarm occurrence. It is used to signal/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, 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 enabled. This allows the suction pressure to drop low enough during start-up 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 Status: This alarm occurs when there is current draw but no call for the compressor to be on (i.e. welded contactor) or when there is no call for the compressor to be on but compressor current draw (i.e. manual high pressure control is open or contactor failure). Requires current sensor accessory.

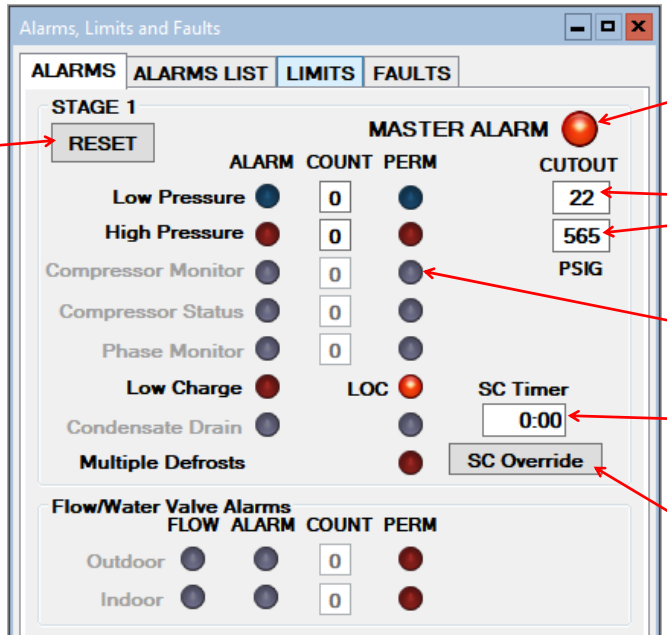
Phase Monitor: This alarm occurs when the Phase Monitor detects a fault condition and sends a fault signal to the control board. For three phase units only and requires Phase Monitor accessory.

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

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

Multiple Defrosts: This alarm occurs if a second defrost occurs immediately after the defrost disabled timer expires from a previous defrost cycle. It indicates abnormally low suction pressure.

Go the Alarms Troubleshooting section of the Troubleshooting section 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.

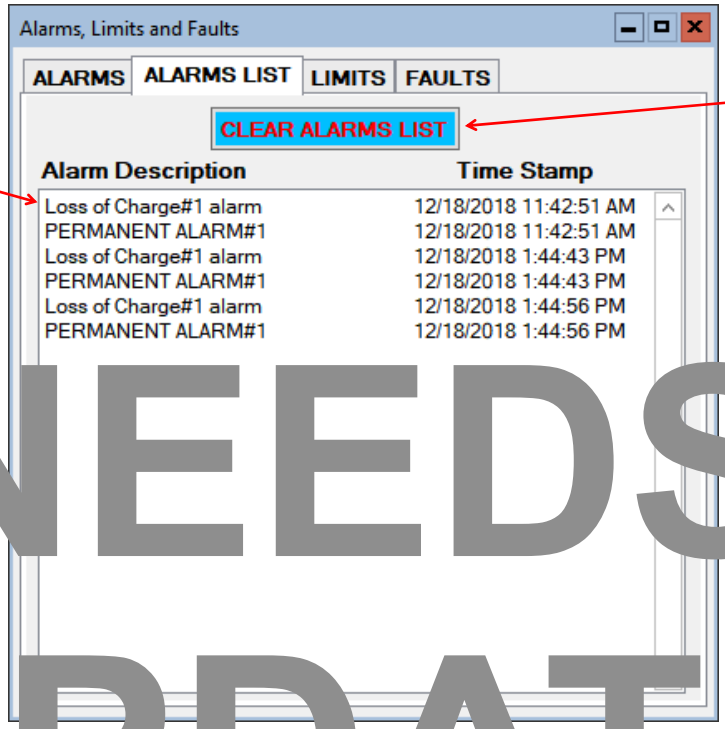
Short Cycle Timer counts down time until the next compressor start is allowed.

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.

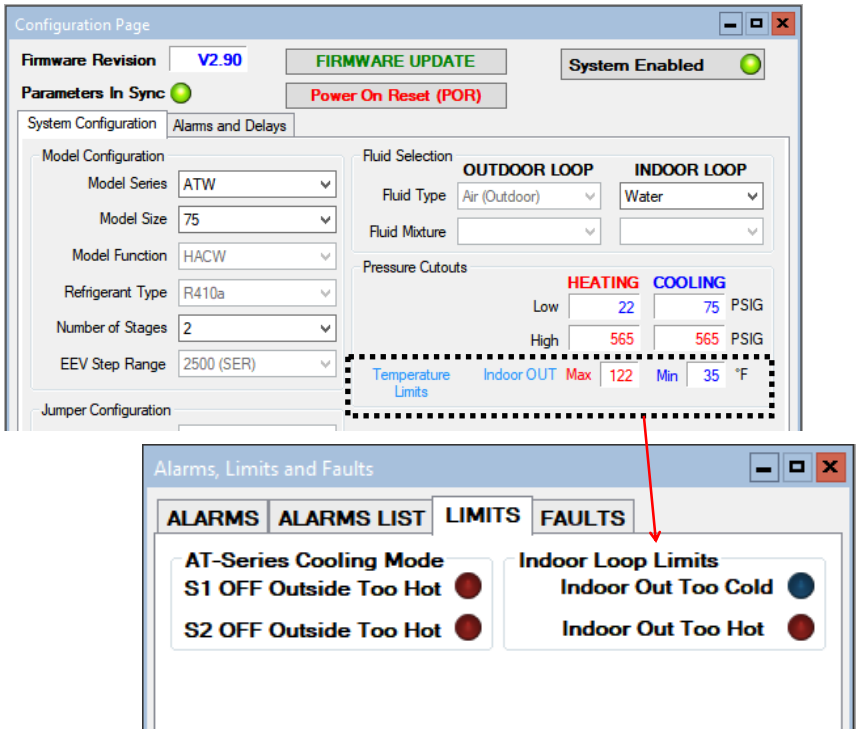
Each alarm that occurs while the PC APP is connected to the control board will appear here. The alarm type and a time stamp will be shown. The alarms list will be erased when the PC APP is disconnected from the control board.



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):

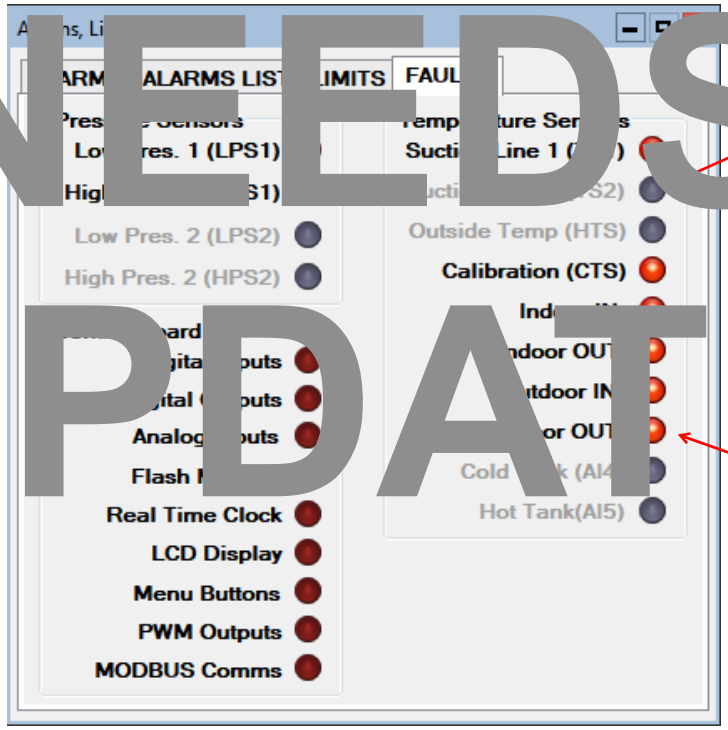
This tab shows hardware faults that could occur. If one of these faults occurs there may be a problem with the control board hardware, with LCD Display and buttons, or with a sensor.

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



greyed out do not apply.

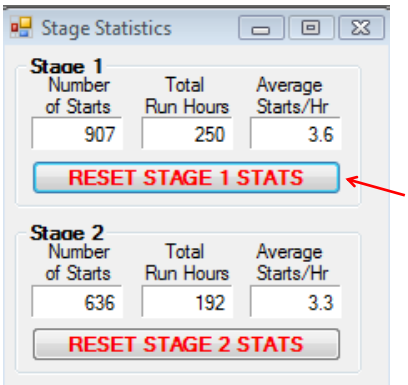
cators

View-->Defrost History:

Same as clicking on HISTORY button in **Control Panel** window (see previous page).

View-->Stage Stats:

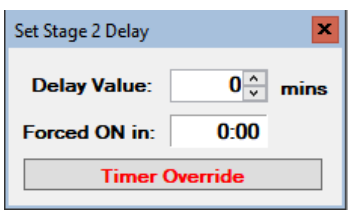
The compressor information: number of starts, run hours and starts per hour.



Erase the compressor statistics (only for if a compressor should need to be replaced).

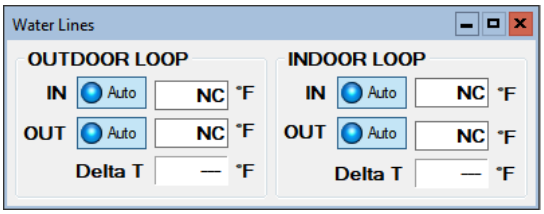
View-->Set Stage 2 Delay:

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



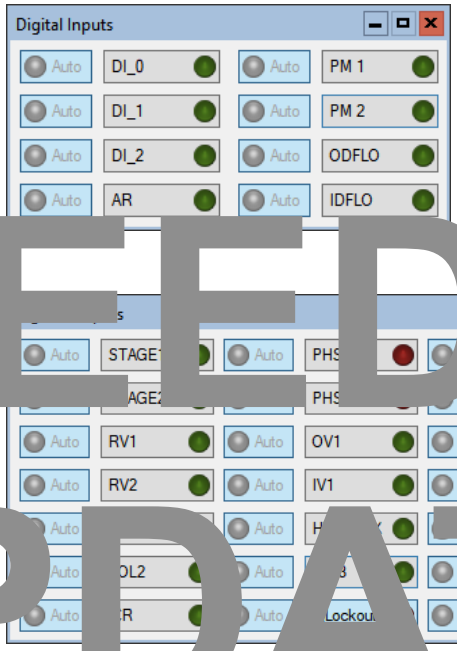
View-->Water Lines

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 th vid-ual status (ON/OFF). Th may b ivid-ually controlled when in Manual Ov de Mode in order to facilitate troubleshooting.

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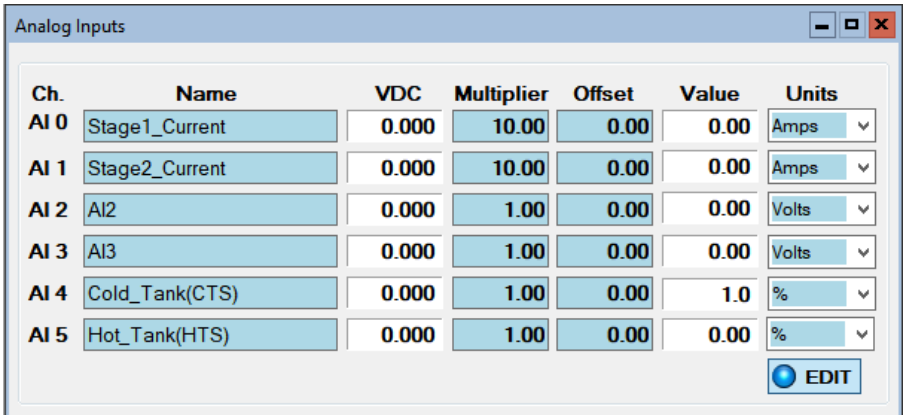
View-->Analog Inputs

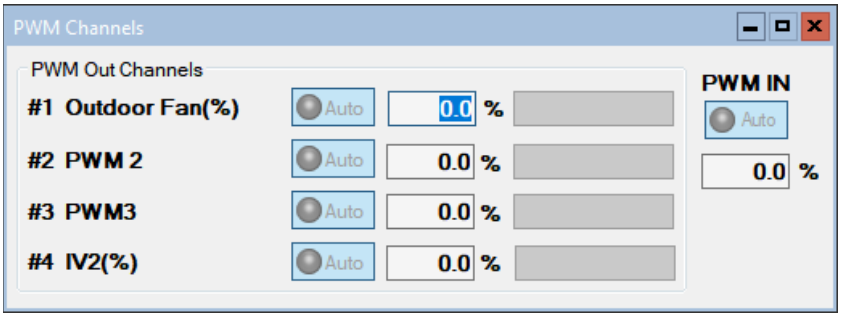
Shows the Analog inputs and their individual settings and values.

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.



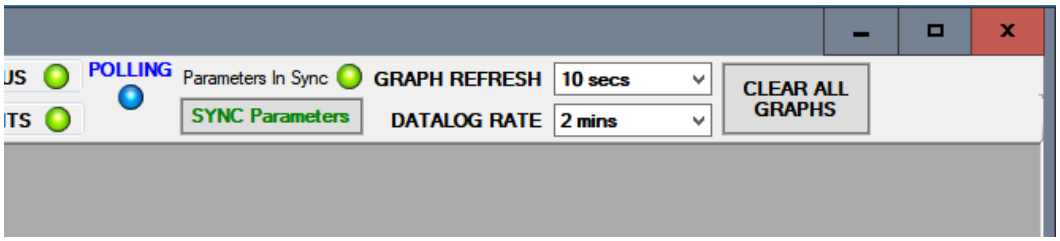
View-->PWM Channels

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.

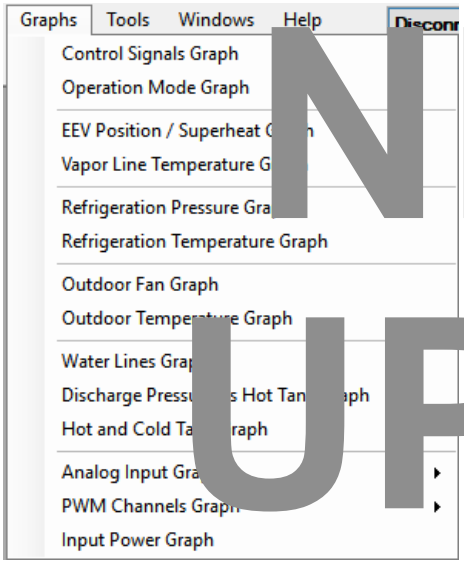


Graphs Menu:

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, hold down the Windows key and press Print Screen on the key-board. The image on the screen will be saved to the folder C:\Users\Username\Pictures\Screenshots.

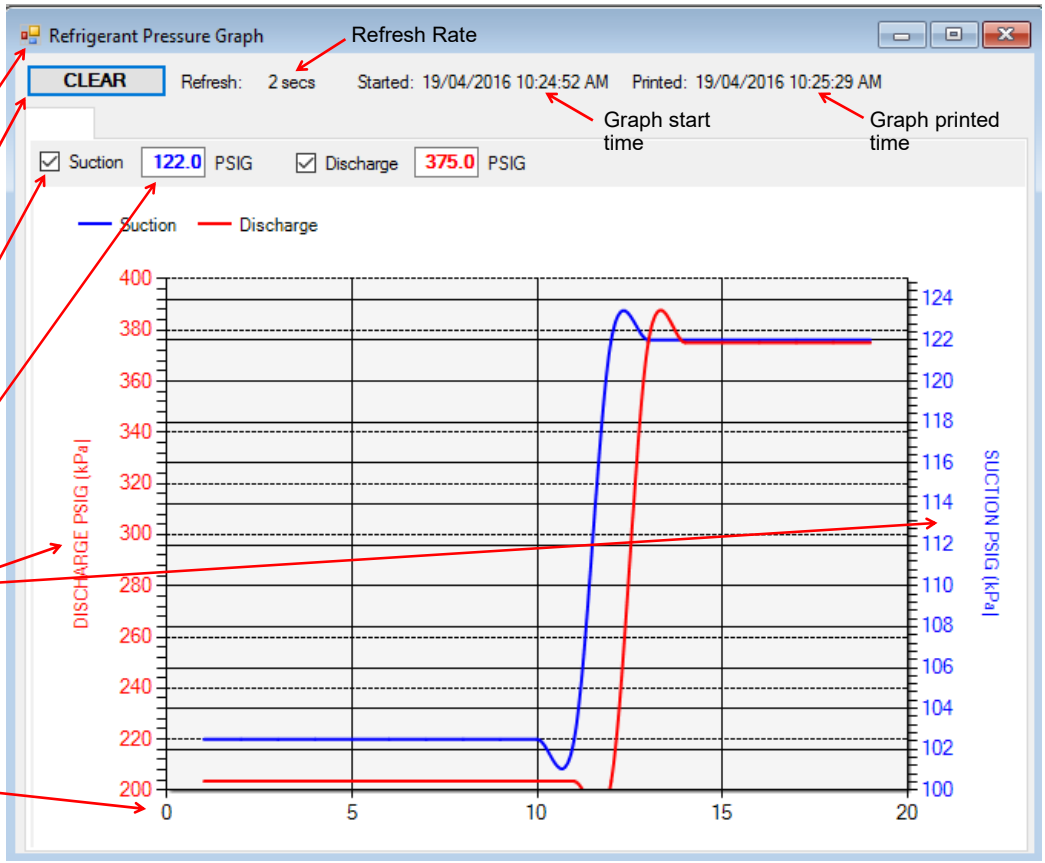


NEEDS UPDATE

/OFF status
eating and co g mode
ction tempera
res
Evaporating and condensing temperatures

Suction (heating) or discharge (cooling/defrost) pressure vs. outdoor fan speed
Suction (heating) or discharge (cooling/defrost) pressure vs. outdoor temperature
a T
ank te
HTS/CT ethod with 2 tanks
All analo ut ch els (0VDC o 20mA)
All PWM / 0-10VDC output channels and one PWM / 0-10VDC input channel.
For troubleshooting synchronization with 3rd party BACnet controllers.

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.



Graph Name

CLEAR button erases all graph data

Check boxes to select which items are graphed

Current values

Primary Y axis on the left, secondary Y axis on the right.

X axis = Number of samples.

Elapsed time =
Number of Samples **x** Refresh Rate.

e.g. 20 samples **x** 1 second refresh = elapsed time of 20 seconds.

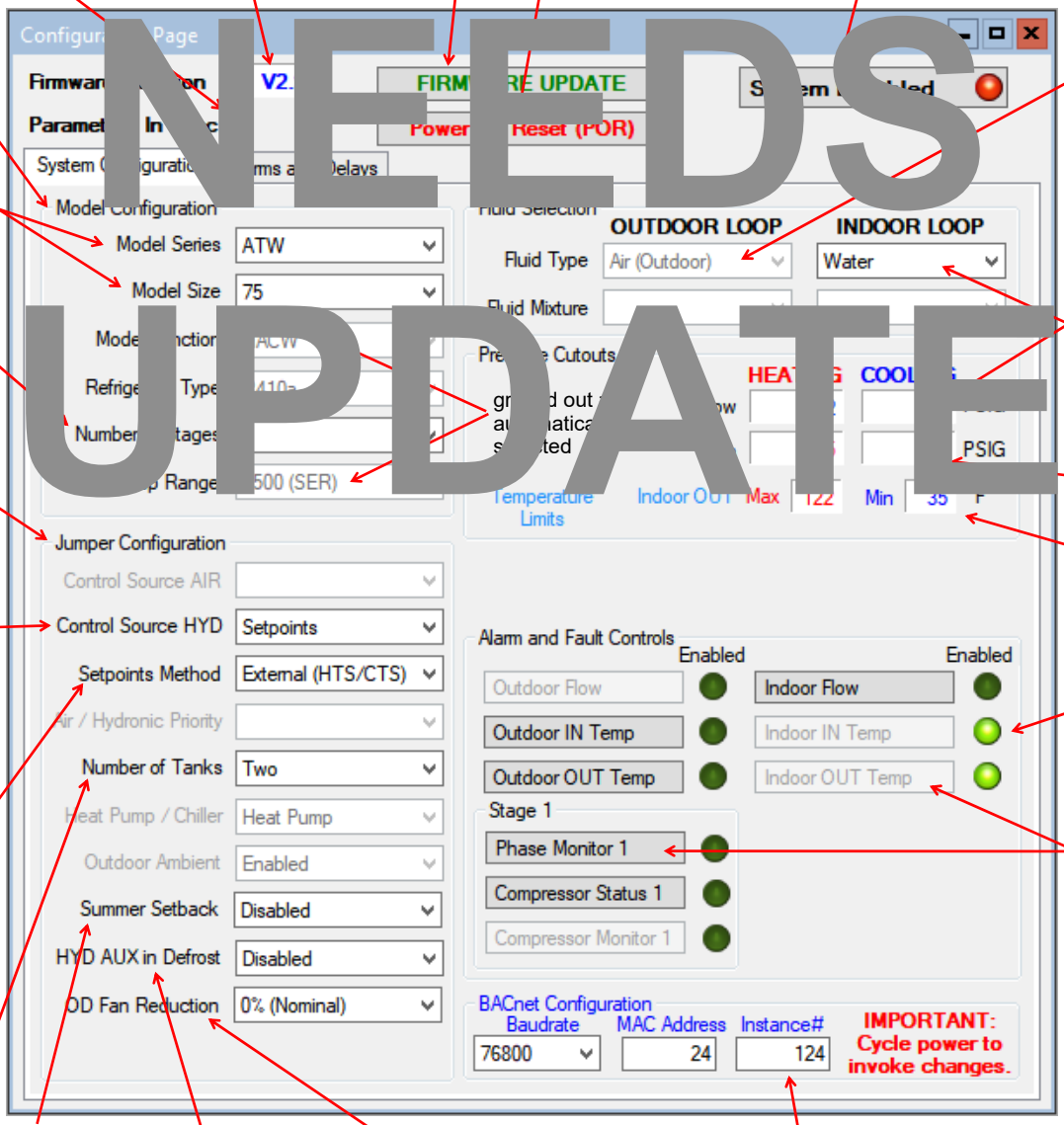
Tools Menu:

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.

WARNING: Selecting the wrong Fluid Type and/or Fluid Mixture can cause the heat exchanger to freeze, possibly rupturing it and destroying the heat pump, VOIDING THE WARRANTY. Ensure the Fluid Type and Fluid mixture match the fluids and mixtures that have actually been put into the system.



Green when parameters have been updated, red during the update

Firmware revision can also be seen on the LCD during power up

Firmware update: see Appendix

POR: reset control system as would be done by cycling power

Enable/Disable the compressor (does not affect auxiliary heat). Units are shipped as Disabled to prevent an unintentional compressor startup.

Model Configuration section to select the system type

Select model series & size (refer to unit nameplate; **will be set from factory**)

Compressor: 2 stage ("T" in unit model number) or 1 stage ("S" in unit model number)

Jumper configuration section to select system options. Greyed out means N/A.

Selects how the heating/cooling demand will be controlled: BACnet, Setpoints, or Signals.

Selects whether to use the internal temp sensor (Indoor Loop/ICR) or external sensor (External HTS/CTS). **This is for Setpoint Control operation only.**

Selects whether there are one or two tanks (hot and cold) in the system. Default value is One. **This is for Setpoint Control operation with HTS/CTS method only.**

When Summer Setback is enabled: disables stage 3 (AUX), drops setpoints to 70°F (21°C), and decreases temperature sampling frequency to 2 days. Can also be set through LCD.

Selects whether or not AUX Heat is activated when in defrost mode. Default value is disabled. **This is for Setpoint Control operation only.**

Outdoor fan reduction: outdoor fan speed can be reduced if fan noise is a concern.

If Control Source HYD is set to **BACnet**, set communication parameters. Disconnect PC App and cycle unit power to register changes to BACnet parameters.

Outdoor Loop fluid type is always Air for air source units

Low pressure cutout determined by Fluid Type & Mixture

High pressure cutout determined by refrigerant type

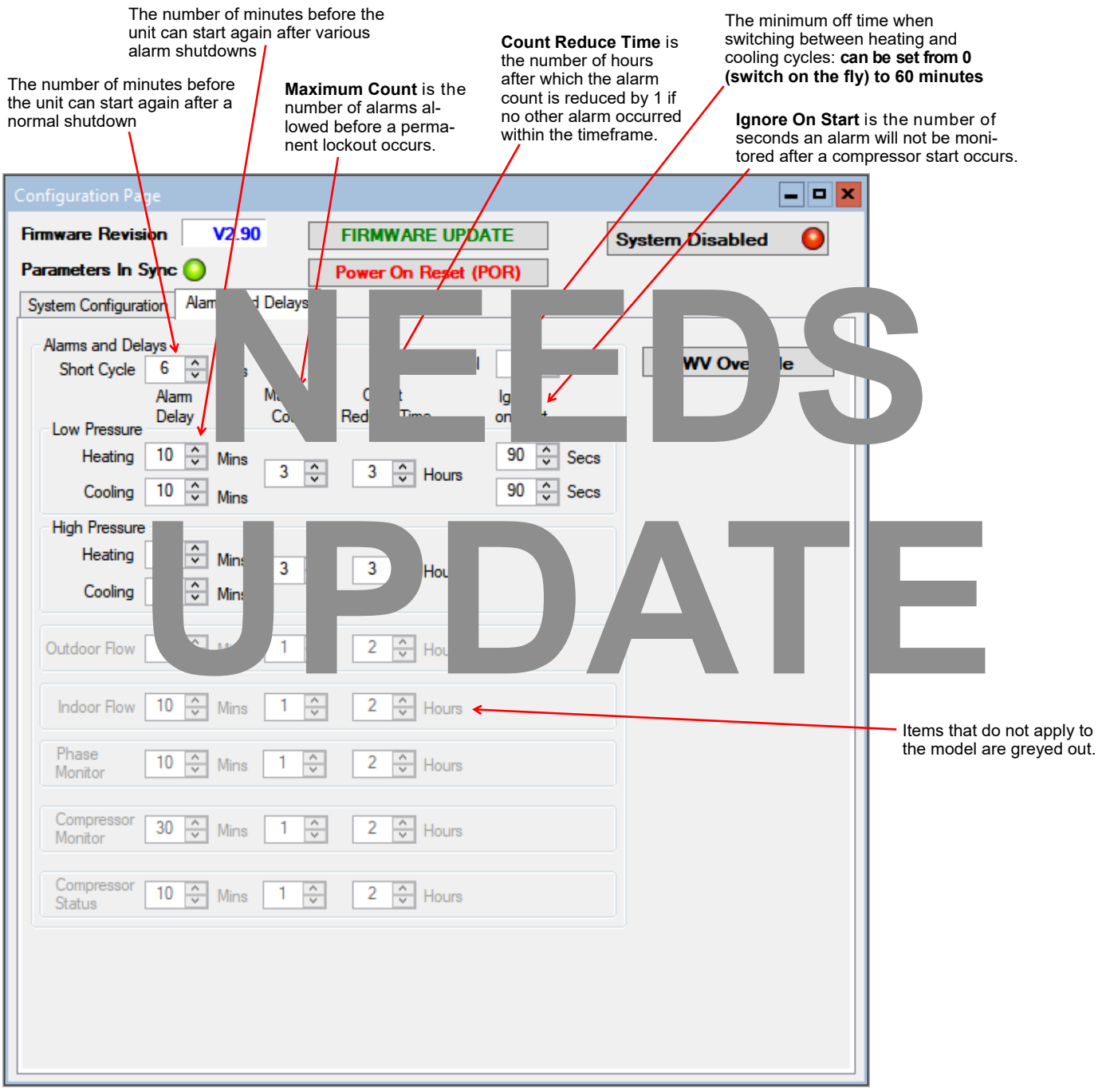
Temperature limits determined by Model Series and Fluid Type/ Mixture

The Enabled indicators show which alarms are enabled

If an alarm is mandatory or not available, the Enable button will be greyed out. For optional alarms (requiring Phase Monitor or Current Sensor accessories) the Enable button will be available; click to enable.

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

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

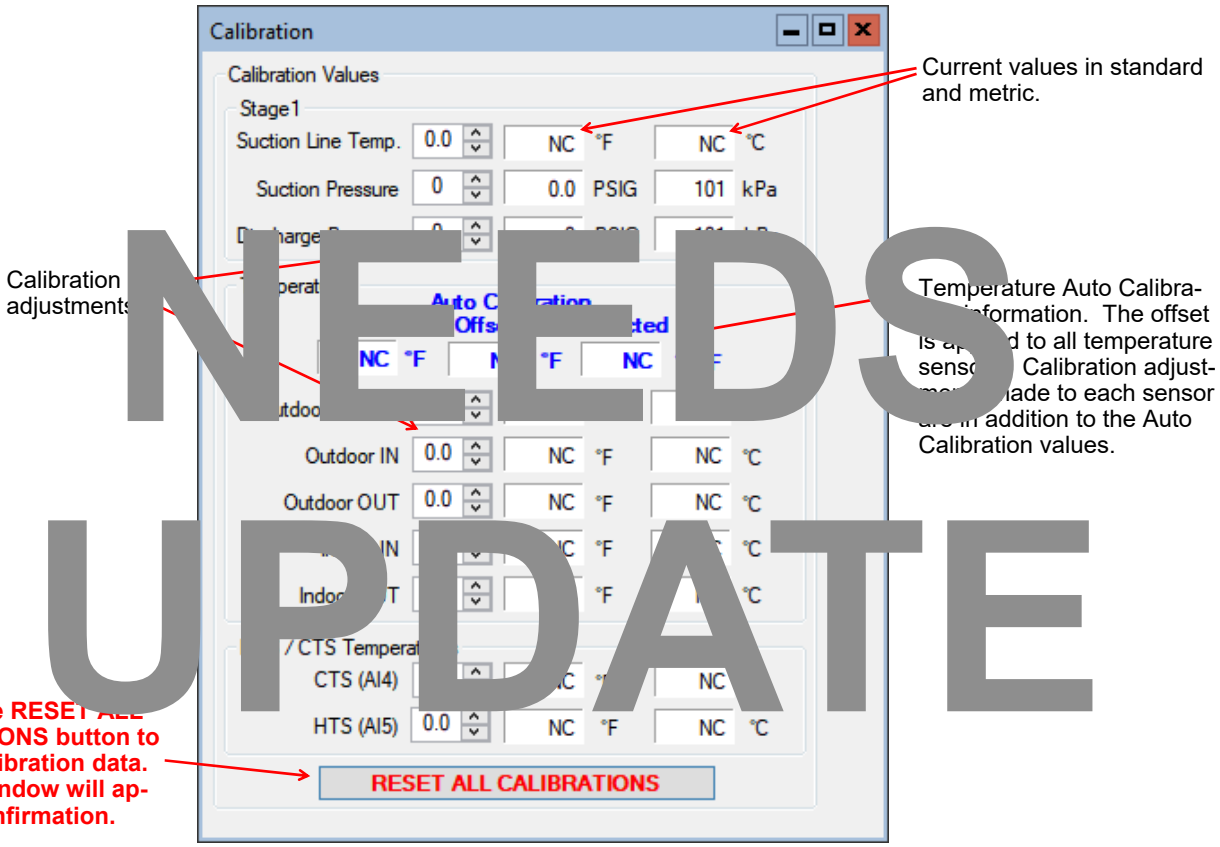


Tools-->Calibration:

Generally there is no need for calibration.

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

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

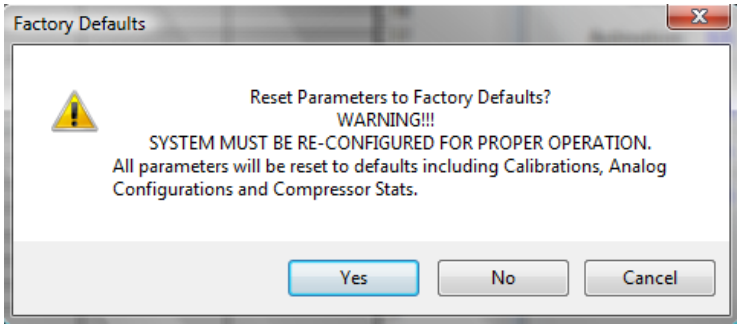


Tools-->Reset to Factory Defaults:

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:

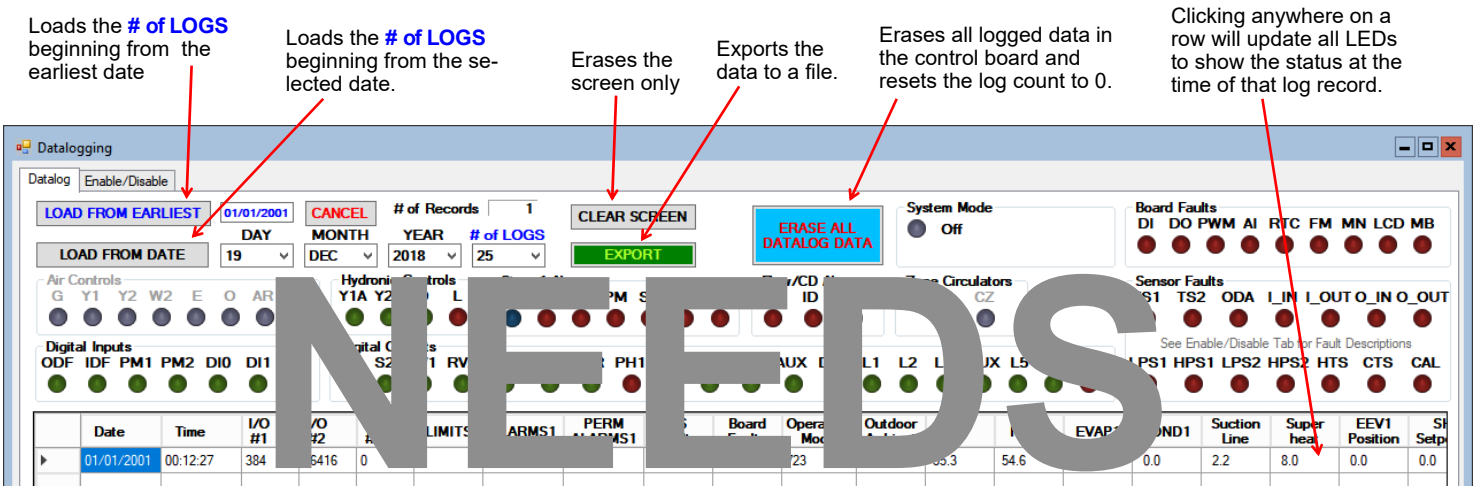
This will synchronize the date and time of the control board with the computer's date and time, and will be necessary for new units or units that have been powered off for several days or more.

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):

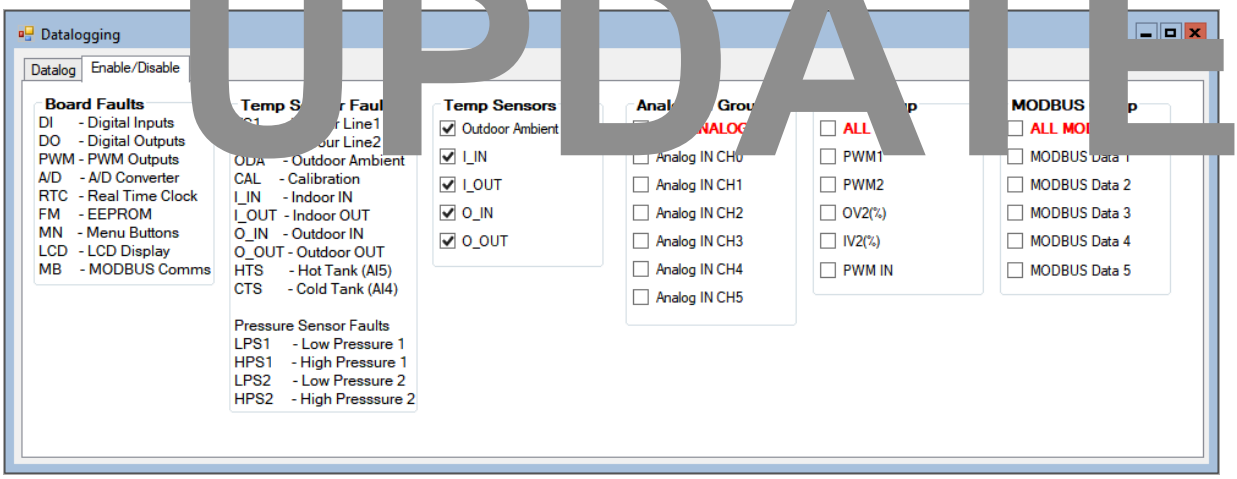
The datalog rate is set via the dropdown box at the top right of the PC App main window. Starting with firmware version 2.85, a log will be recorded at the datalog rate whenever the heat pump is powered on, making it easy to compare datalogs from multiple units . The maximum number of datalog records 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 chec xes to tomi lumn /hidden in atalog

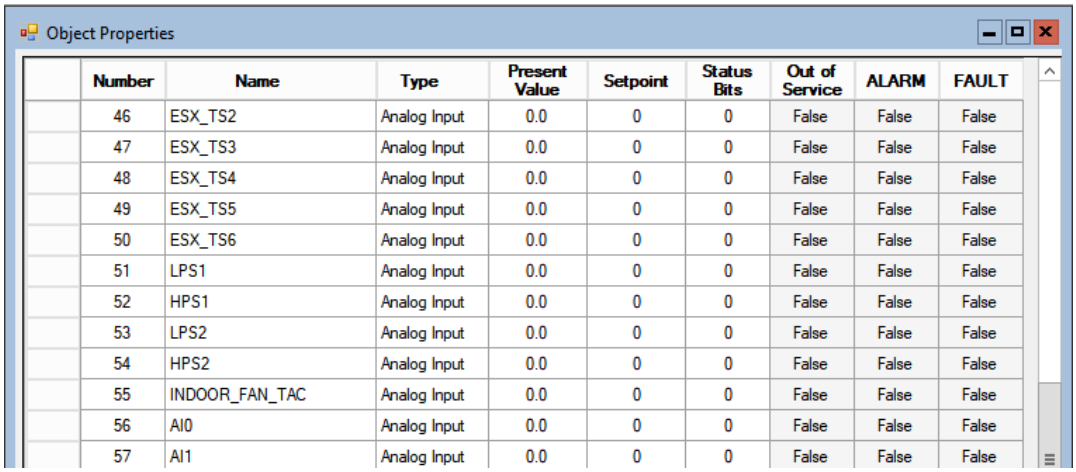


Tools-->MODBUS:

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.

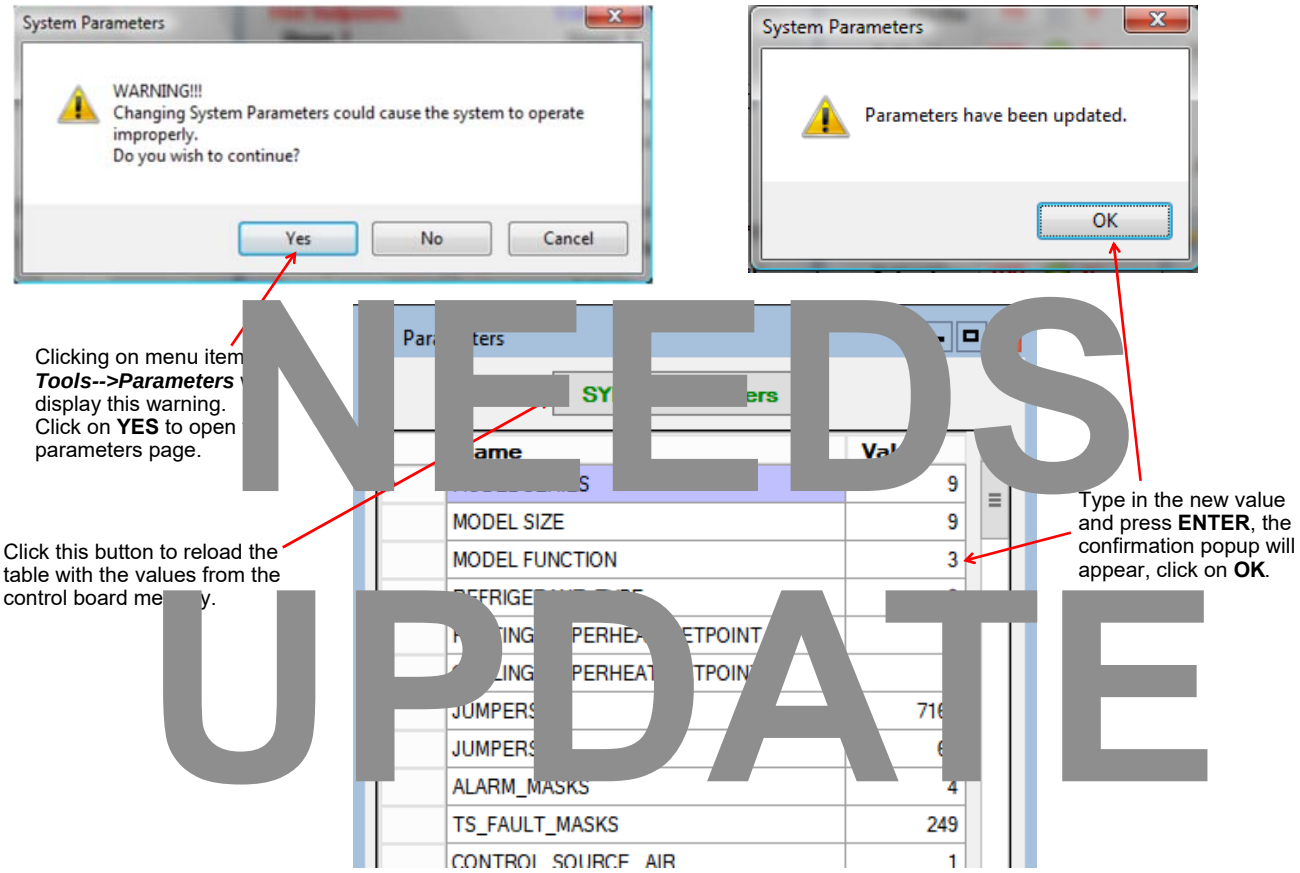


Number	Name	Type	Present Value	Setpoint	Status Bits	Out of Service	ALARM	FAULT
46	ESX_TS2	Analog Input	0.0	0	0	False	False	False
47	ESX_TS3	Analog Input	0.0	0	0	False	False	False
48	ESX_TS4	Analog Input	0.0	0	0	False	False	False
49	ESX_TS5	Analog Input	0.0	0	0	False	False	False
50	ESX_TS6	Analog Input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

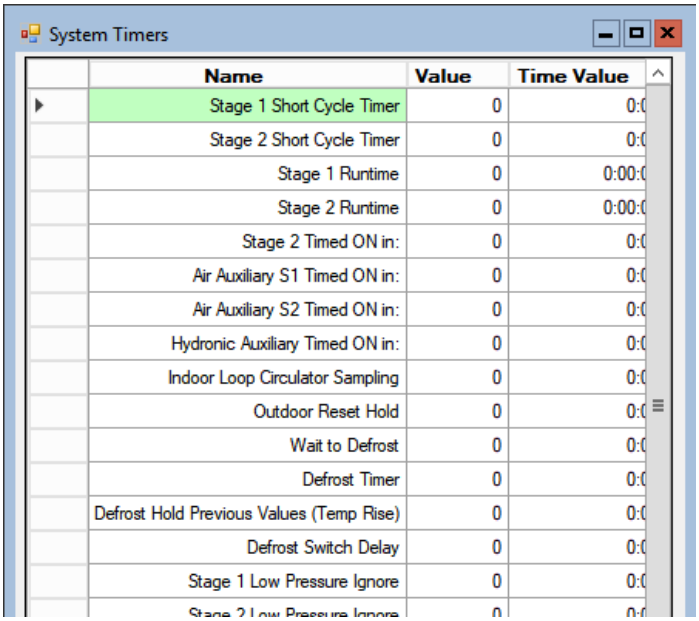
WARNING! The Parameters page is for advanced use only.
Changing parameter values can cause the system to stop functioning properly.

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.



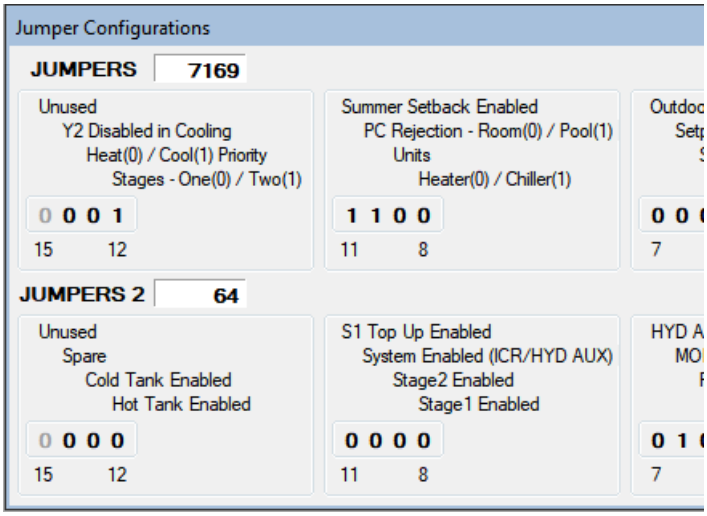
Tools-->SYSTEM TIMERS:

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



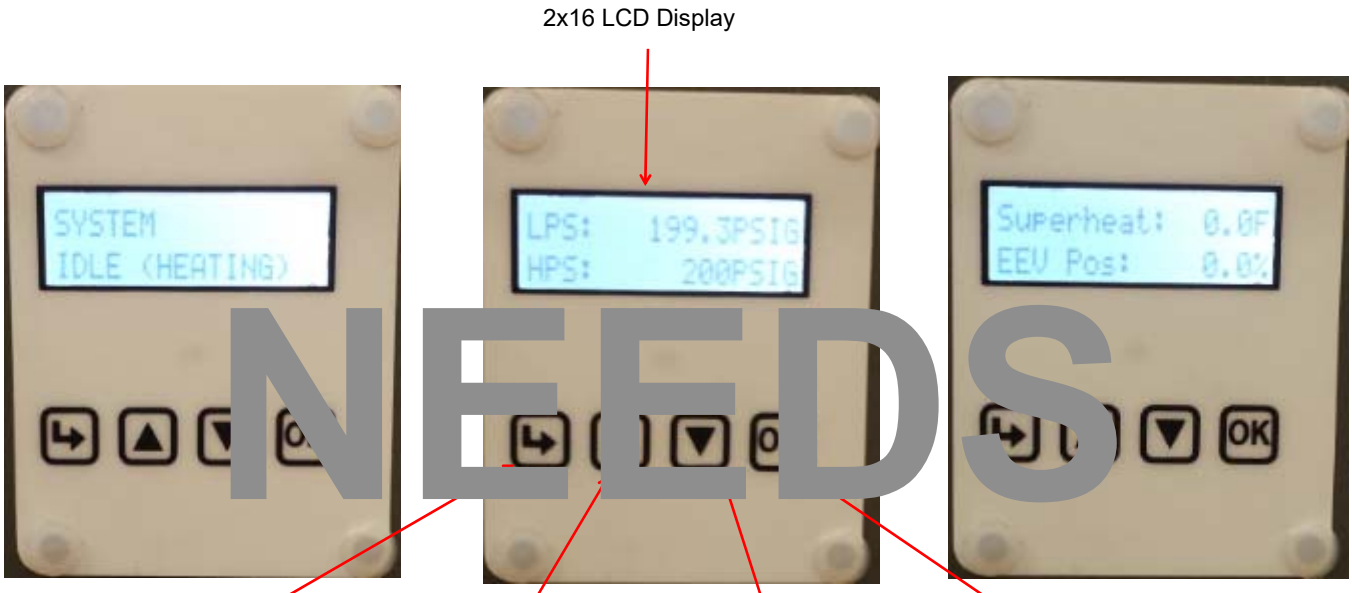
Tools-->Jumpers:

This page shows internal jumper configurations, for developers.



LCD Interface & Menus

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



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

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

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

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

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

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

Menu Tree Continued

ENTER (From Main)	ENTER (First Press)	ENTER (Second Press)	ENTER (Third Press)	Description
Summer Setback *(only if using Setpoint Control)*	***— Enable Setback?***	***— Enable***		Enable summer setback.
		— Disable		Disable summer setback.
System EN/DIS	***— Enable System?***	***— Disable***		Disable compressor, auxiliary and ICR.
		— Enable		Enable compressor, auxiliary and ICR.
Service Mode	***— Service Mode?***	***— No***		Do not enter Service Mode.
		— Yes		Enter into Service Mode.
EEV Control	***— EEV1 (Local)***	***— Auto/Manual***	***— Auto***	Puts EEV in Auto mode
			— Manual	Puts EEV in Manual mode
		— Manual Position	***— EEV Position (%)***	Sets EEV to manual position
	— EEV2 (Remote)	***— Auto/Manual***	***— Auto***	Puts EEV in Auto mode
			— Manual	Puts EEV in Manual mode
		— Manual Position	***— EEV Position (%)***	Sets EEV to manual position
Configuration	***— Control YYD***	***— Setpoint***		BACnet - see **BACnet** section
		— Signals		Hardwired Signal control
		— Setpoints		On-board temperature control - see **Setpoint Control** section.
	— Outdoor Reset *(only if using Setpoint Control)*	***— Enable***		Enables Outdoor Reset functionality
		— Disable		Disables Outdoor Reset functionality
	— Setpoints Method *(only if using Setpoint Control)*	***— ICR***		Use Indoor Circulator Relay sampling
		— HTS/CTS		Use external temperature sensors
	— OD Fan Reduction	***— Reduction (%)***		Outdoor fan speed reduction in %.
	— Number of Tanks *(only if using Setpoint control with HTS/CTS)*	***— One Tank***		Use tank for heating/cooling functions
		— Two Tanks		Separate hot and cold tanks
	— Time Delays	***— Short Cycle***	***— Delay (min)***	Short-cycle timer delay in minutes
		— Heat/Cool	***— Delay (min)***	Heat / Cool timer delay in minutes
	— Units	***— Standard***		Standard units
		— Metric		Metric units (does not affect calibration units)
	— Set Time	***— Hours***	***— Hours value***	Set the system hours.
		— Minutes	***— Minutes value***	Set the system minutes.
	— Set Date	***— Day***	***— Day value***	Set the system day.
		— Month	***— Month value***	Set the system month.
		— Year	***— Year value***	Set the system year.
Calibration	***— Suction 1***	***— calibration adj.***		Calibration in 1PSI intervals.
	— Discharge 1	***— calibration adj.***		Calibration in 1PSI intervals.
	— Vapour Line 1	***— calibration adj.***		Calibration in 0.1°F intervals
	— Outdoor Ambient	***— calibration adj.***		Calibration in 0.1°F intervals
	— Outdoor IN Temp	***— calibration adj.***		Calibration in 0.1°F intervals
	— Outdoor OUT Temp	***— calibration adj.***		Calibration in 0.1°F intervals
	— Indoor IN Temp	***— calibration adj.***		Calibration in 0.1°F intervals
	— Indoor OUT Temp	***— calibration adj.***		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. Recommended wire: 22-24 AWG single twisted pair, 100-120 Ohms impedance, 17pF/ft or lower capacitance, with braided or aluminum foil shield, such as Belden 9841 or 89841.

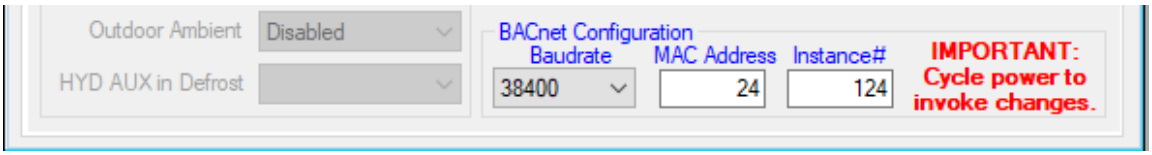
The connector on the control board is a three wire removable screw connector. The signals are as follows:
A: Communications line (+) (right pin)
B: Communications line (-) (middle pin)
C: Ground connection (left pin)

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

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

The following parameters can be set via the PC APP Configuration Page:

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



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 19 - BACnet OBJECTS - CONTROL SIGNALS (READ/WRITE)

Name	Data Type	ID	Property	Description
SYSTEM_O	Binary Value	BV2	Present Value	Switch to cooling mode. Inactive=HEATING, Active=COOLING
SYSTEM_Y1A	Binary Value	BV0	Present Value	Demand for water heating or cooling (active is on)
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 20 - 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 21 - BACnet OBJECTS - DATA (Read Only)				
Name	**ID**	**Property**	**Units**	**Description**
Data—Type Analog Input				
AI0 (Comp1_Current)	AI0	Present Value	Amps	R410a compressor current draw (AI0)
AI1 (Comp2_Current)	AI1	Present Value	User	R134a compressor current draw (AI1)
AI2	AI2	Present Value	User	User defined (0-5VDC or 4-20mA)
AI3	AI3	Present Value	User	User defined (0-5VDC or 4-20mA)
AI4 (CTS)	AI4	Present Value	degF (degC)	Cold tank temperature from sensor - requires accessory
AI5 (HTS)	AI5	Present Value	degF (degC)	Hot tank temperature from sensor - requires accessory
LPS1	AI6	Present Value	PSIG (kPa)	R410a low pressure value (suction pressure)
HPS1	AI7	Present Value	PSIG (kPa)	R410a high pressure value (discharge pressure)
EVAP1	AI8	Present Value	degF (degC)	R410a evaporating temperature
COND1	AI9	Present Value	degF (degC)	R410a condensing temperature
Suction Line 1	AI10	Present Value	degF (degC)	R410a suction line temperature
Superheat 1	AI11	**Setpoint Value**	degF (degC)	R410a superheat
EEV1 Position	AI12	Present Value	%	R410a EEV position (% open)
LPS2	AI13	Present Value	PSIG (kPa)	R134a low pressure value (suction pressure)
HPS2	AI14	Present Value	PSIG (kPa)	R134a high pressure value (discharge pressure)
EVAP2	AI15	Present Value	degF (degC)	R134a evaporating temperature
COND2	AI16	Present Value	degF (degC)	R134a condensing temperature
Suction Line 2	AI17	Present Value	degF (degC)	R134a suction line temperature
Superheat 2	AI18	**Setpoint Value**	degF (degC)	R134a superheat
EEV2 Position	AI19	Present Value	%	R134a active EEV position (% open)
Outside Ambient	AI20	Present Value	degF (degC)	Outdoor Ambient temperature
O_IN	AI21	Present Value	degF (degC)	N/A
O_OUT	AI22	Present Value	degF (degC)	N/A
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	%	Outdoor fan speed
PWM2	AV2	Present Value	%	PWM output value (spare)
PWM3 (OV2)	AV3	Present Value	%	N/A
PWM4 (IV2)	AV4	Present Value	%	N/A
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	R410a compressor contactor
STAGE2	BO1	Present Value	N/A	R134a compressor contactor
ICR (Indoor Circ)	BO2	Present Value	N/A	Indoor circulator control
DO0 (OV1)	BO3	Present Value	N/A	N/A
DO1 (IV1))	BO4	Present Value	N/A	N/A
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	R410a dry contact pin for locked out on alarm
PHS2	BO8	Present Value	N/A	R134a dry contact pin for locked out on alarm
Data Type—Binary Value				
CONTROLS (LOC/REM)	BV9	Present Value	N/A	Control Indicator, 0 = Local (manual override), 1 = Remote
Outdoor Flow	BV10	Present Value	N/A	N/A
Indoor Flow	BV11	Present Value	N/A	Indoor Loop flow switch
Phase Monitor1	BV12	Present Value	N/A	N/A
Phase Monitor2	BV13	Present Value	N/A	N/A
Comp Monitor1	BV14	Present Value	N/A	N/A
Comp Monitor2	BV15	Present Value	N/A	N/A
Note: available objects may be subject to change without prior notice.				

TABLE 22 - BACnet OBJECTS - ALARM Descriptions (Read Only)			
Name	**Data Type**	**ID**	**Description**
AI0 (Comp1 Current)	Analog Input	AI0	R410a status alarm (start / stop failure, from current sensor)
AI1 (Comp2 Current)	Analog Input	AI1	R134a status alarm (start / stop failure, from current sensor)
LPS1	Analog Input	AI6	R410a low pressure alarm
HPS1	Analog Input	AI7	R410a high pressure alarm
LPS2	Analog Input	AI13	R134a low pressure alarm
HPS2	Analog Input	AI14	R134a high pressure alarm
Outdoor Flow	Binary Value	BV10	N/A
Indoor Flow	Binary Value	BV11	Indoor loop flow alarm
Phase Monitor1	Binary Value	BV12	N/A
Phase Monitor2	Binary Value	BV13	N/A
Comp Monitor1	Binary Value	BV14	N/A
Comp Monitor2	Binary Value	BV15	N/A

Name	**ID**	**BIT #**	**DECIMAL VALUE***	**Description**
Permanent Alarms 1	**AV6**	-	-	Bit description is given below.
(Present Value)		0	1	R410a master permanent alarm (occurs when any alarm occurs)
		1	3	R410a low pressure heating mode alarm (suction pressure)
		2	5	R410a low pressure cooling mode alarm (suction pressure)
		3	9	R410a high pressure heating mode alarm (discharge pressure)
		4	17	R410a high pressure cooling mode alarm (discharge pressure)
		5	33	R410a loss of charge alarm
		6	65	N/A
		7	129	N/A
		8	257	R410a status alarm (start / stop failure, from current sensor)
		14	16,385	N/A
		15*	32,769	Indoor loop flow switch alarm
Permanent Alarms 2	**AV7**	-	-	Bit description is given below.
(Present Value)		0	1	R134a master permanent alarm (occurs when any alarm occurs)
		1	3	R134a low pressure heating mode alarm (suction pressure)
		2	5	R134a low pressure cooling mode alarm (suction pressure)
		3	9	R134a high pressure heating mode alarm (discharge pressure)
		4	17	R134a high pressure cooling mode alarm (discharge pressure)
		5	33	R134a loss of charge alarm
		6	65	N/A
		7	129	N/A
		8	257	R134a status alarm (start / stop failure, from current sensor)
		14	16,385	N/A
		15*	32,769	Indoor loop flow switch alarm

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 23 - BACnet OBJECTS - FAULT Descriptions (Read Only)			
Name	**Data Type**	**ID**	**Description**
AI4 (Cold Tank)	Analog Input	AI0	Cold tank temperature sensor faulty or disconnected - requires accessory
AI5 (Hot Tank)	Analog Input	AI1	Hot tank temperature sensor faulty or disconnected - requires accessory
LPS1	Analog Input	AI6	R410a low pressure sensor faulty or disconnected
HPS1	Analog Input	AI7	R410a high pressure sensor faulty or disconnected
LPS2	Analog Input	AI13	R134a low pressure sensor faulty or disconnected
HPS2	Analog Input	AI14	R134a high pressure sensor faulty or disconnected
Suction Line1	Analog Input	AI10	R410a suction line temperature sensor faulty or disconnected
Suction Line2	Analog Input	AI17	R134a suction line temperature sensor faulty or disconnected
Outside Ambient	Analog Input	AI20	Outside temperature sensor faulty or disconnected
O_IN	Analog Input	AI21	N/A
O_OUT	Analog Input	AI22	N/A
I_IN	Analog Input	AI23	Indoor IN temperature sensor faulty or disconnected
I_OUT	Analog Input	AI24	Indoor OUT temperature sensor faulty or disconnected

Name	**ID**	**BIT #**	**DECIMAL VALUE***	**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 Interface
Sensor Faults	**AV9**	-	-	Indicates sensor failures. Bit description is given below.
		0	1	R410a suction line temperature sensor
		1	2	R134a suction line temperature sensor
		2	4	Outdoor Ambient temperature sensor
		3	8	Calibration temperature resistor plug
		4	16	Indoor IN temperature sensor
		5	32	Indoor OUT temperature sensor
		6	64	N/A
		7	128	N/A
		8	256	Cold tank temperature sensor on AI4 - accessory
		9	512	Hot tank temperature sensor on AI5 - accessory

Note: Board and Sensor Fault objects are type Analog Value but values are bit coded and may be decoded as such (integer value).
Note * : Value is for a single fault and reference only.
Note: Objects may be subject to change without prior notice.

Startup Procedure

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

Check the boxes or fill in the data as each step is completed. For data boxes, circle the appropriate units. Fill in the top section of all three copies, or one copy if photocopies can be made after the startup has been completed.

Pre-Start Inspection

Outdoor Unit:

1. Ensure both circuits have been pressure tested, vacuumed to 500 microns and any extra charge required has been added.
2. Ensure all 4 access valves have been fully opened and the caps have put been back on and tightened. Check the caps for leaks.
3. Ensure the outdoor unit is securely mounted in place.
4. Ensure the power and controls signals to the outdoor unit are properly connected, neat, and securely fastened.
5. Ensure fan outlet is clear of obstructions.

Indoor Loop (Hydronic Loop):

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

Electrical:

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

Unit Startup

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

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

The LCD interface will show the outdoor temperature, suction pressures, discharge pressures, superheats, EEV positions, and water in/out temperatures.

Preparation:

1. Turn the power on to the heat pump. All LED's on the control board should turn on, the LCD interface should say "**MGT GEN2 VERx.xx**" on line 1 and "**Zeroing EEV's**" on line 2. You should be able to hear the EEV's moving (a clicking sound).
2. Measure the following voltages on the power block and record them on the startup sheet: L1-L2, L2-L3, L1-L3.
3. Connect a USB cable between the USB connector on the board and a laptop computer (if available).
4. Select the desired Control Source HYD via the PC APP Configuration Page or via the LCD display Configuration Menu.
5. Enable the system either with the Configuration Page **System Enable/Disable** button or via the LCD display. **(IMPORTANT NOTE: compressor(s) may start on their own if Setpoint Control is selected).**

Heating Mode:

1. Activate Stage 1. The outdoor EEV(s) will begin to open and the compressor(s) will start, as will the circulator pumps.

   Note that the system will start in cascade mode if the outdoor temperature is below ~50°F (meaning both refrigeration circuits will be active), and in R134a mode only if outdoor temperature is warmer.

2. Check the PC APP or LCD interface. The suction and discharge pressures will vary based on the outdoor temperature and the indoor loop temperature, and in warm weather only circuit 2 (R134a) will be active.
3. Monitor the unit via the PC APP or LCD while the unit runs, and record the following after 10 minutes of run time:
   1. R410a suction & discharge pressures (only active if in cascade mode)
   2. R134a suction & discharge pressures
   3. Indoor Loop In (Hot In) temperature
   4. Indoor Loop Out (Hot Out) temperature
   5. Indoor Delta T (should be **8-12°F / 4-6°C**)
   6. Indoor flow (if available)
   7. Outdoor air temperature
   8. Compressor 1 & 2 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. Record the setpoint and R134a discharge pressure just before the unit shuts off.

Cooling Mode:

1. Set the unit to cooling mode and adjust the cooling setpoints to activate stage 1.

   Note that in cooling mode, only the R134a circuit will be active.

2. Monitoring the unit via the PC APP or LCD display while the unit runs, record the following after 10 minutes of run time:
   1. R134a suction pressure
   2. R134a discharge pressure
   3. Indoor Loop In temperature
   4. Indoor Loop Out temperature
   5. Indoor Delta T
   6. Outdoor air temperature
3. Adjust the cooling setpoints to the desired tank temperature, and allow the unit to run through a cycle. Record the setpoint and the suction pressure when the unit shuts off.

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 in the indoor loop piping and ensure the area is clean.
4. Turn the power on to the unit. Set the Setpoints Control (or aquastat) to the final settings and record the values.

Startup Record:

1. The installer should sign and date the Startup Record and have the startup witness or appropriate site personnel sign as well. The startup personnel should leave the Startup Record at the site, retain a copy for filing, and send a copy to Maritime Geothermal Ltd. for warranty registration.

Startup Record - ATWC-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 #**								
Homeowner Name		**Homeowner Phone #**									

PRE-START INSPECTION

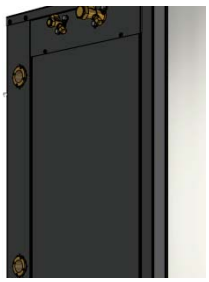
Outdoor Unit	Unit is securely mounted at least 8” from building, fans facing out										
	Fan outlet is clear of obstructions										
Line Sets (2)	Line set length, extra charge added (only if needed)		ft.	m		lb	kg				
	Both line sets are pressure tested, vacuumed										
	All inter-connect piping is insulated and properly supported										
	Wiring is neat and securely fastened										
	4 service valves are open and caps installed with torque wrench										
Indoor Loop (Hydronic)	All shut-off valves are open (full flow available)										
	Loop is full and purged of air										
	Antifreeze type (if any)										
	Antifreeze concentration (if any)		% Volume		% Weight						
	Loop static pressure		psi	kPa							
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		V		V		V				
	Low voltage connections are correct and securely fastened										

STARTUP DATA

Preparation	Power block voltage across: L1/L2 L1/ L3 L2/L3						VAC				
Heating Mode (10 minutes)	R410a suction pressure / discharge pressure					psig	kPa				
	R134a suction pressure / discharge pressure					psig	kPa				
	Indoor IN, Indoor OUT, and Delta T		In		Out		°F	°C			
	Outdoor air temperature		°F	°C							
	Compressor 1 L1(black wire) current		A								
	Compressor 2 L1 (black wire) current		A								
	Heating setpoint and R134a discharge pressure at cycle end		°F	°C		psig	kPa				
Cooling Mode (10 minutes)	R134a suction pressure / discharge pressure					psig	kPa				
	Indoor IN, Indoor OUT, and delta T		In		Out		°F	°C			
	Outdoor air temperature		°F	°C							
	Cooling setpoint and R134a suction pressure at cycle end		°F	°C		psig	kPa				
Final Setpoints	Heating S1 setpoint, S1 delta					°F	°C				
	Heating S2 (aux) setpoint, S2 (aux) delta, S2 time delay			°F	°C		min				
	Cooling S1 setpoint, S1 delta					°F	°C				

Date:		**Startup Personnel Signature:**	**Witness/Site Signature:**

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

MAINTENANCE SCHEDULE			
Item		**Interval**	**Procedure**
Outdoor Unit		Weekly	Inspect for and clear away debris or leaves in air coil intake, and ice buildup under unit that is approaching air coil.
Compressor Contactors (2)		1 year	Inspect for pitted or burned points. Replace if necessary.
LCD Interface or PC App		When heat pump problem is suspected	Check for alarms and faults (only necessary if alarms not reported through a BACnet system). Rectify problem if alarms found. See **Troubleshooting** chapter.
Brazed Plate Refrigerant to Water Heat Exchanger		When experiencing performance degradation that is not explained by a refrigeration circuit problem or low loop flow rate	Disconnect the indoor loop and flush heat exchanger with a calcium removing solution. Generally not required for closed indoor loop systems; whenever system performance is reduced for domestic hot water heating applications.

Troubleshooting Guide

WARNING: WHEN SERVICING THE OUTDOOR UNIT, BE SURE TO TURN OFF POWER TO THE INDOOR UNIT. The outdoor disconnect switch will not cut low voltage power, and damage to the control board will occur if the main heat pump breaker is not turned off during service.

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 screen is functioning . If it is not, proceed to POWER SUPPLY TROUBLE SHOOTING, otherwise proceed to STEP 2.

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

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

STEP 4: If the compressor(s) start and sound normal, they are most likely OK. Proceed to the OPERATION TROUBLESHOOTING section.

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

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

ALARM TROUBLESHOOTING

Alarm/Fault	Description	Recommended Action
The data logging function of the GEN2 Control Board is a very useful tool for troubleshooting alarms. It provides a history of the unit operation up to and including the time at which the alarm(s) occurred.		
Low Pressure: Stage 1 - R410a or Stage 2 - R134a	A low pressure alarm occurs when the suction pressure drops to or below the ***Low Pressure Cutout*** value. The low pressure is checked just before a compressor start; if it is OK the compressor will start, otherwise an alarm will occur. When the compressor starts, the low pressure alarm will be ignored for the number of seconds that ***Low Pressure Ignore*** is set to, after which the low pressure alarm will be re-enabled. This allows a dip in suction pressure below the cutout point during startup without causing a nuisance alarm.	Go to the Low Pressure section of the mode the unit was operating in at the time of the alarm. (In practice, low pressure in heating mode will result in a Multiple Defrosts alarm, since a defrost will occur before the unit trips on a low pressure alarm.)
High Pressure: Stage 1 - R410a or Stage 2 - R134a	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: Stage 1 - R410a or Stage 2 - R134a	This alarm occurs when there is a current draw on the compressor as measured by the current sensor 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).	Check contactor if compressor is staying on when it should be off. Go to Compressor section if compressor is not on when it should be. Also check for tripped manual high pressure control.
Comp. Not Pumping: Stage 1 - R410a or Stage 2 - R134a	Discharge pressure is less than 30 psi higher than suction pressure after 1 minute run time. It indicates leaking reversing valve, manual high pressure control trip, bad contactor, or defective compressor.	Check for reversing valve not seated properly, tripped manual high pressure control, or a contactor or compressor problem.
Low Charge / EEV: Stage 1 - R410a or Stage 2 - R134a	EEV position has been above 99% for 20 minutes within the first hour of cycle.	Check system for refrigerant leak. Also check EEV for proper operation (see **EEV Troubleshooting** section)
LOC [Loss of Charge]: **Stage 1 - R410a or Stage 2 - R134a**	This alarm occurs if the low pressure and/or high pressure sensors are below 30 psig (207 kPa).	Check system for refrigerant leak. Check for incorrect pressure sensor reading.
Indoor Flow	Low or no indoor loop flow from flow switch. Ignored on compressor start for number of seconds the Indoor Flow ***Ignore on Start*** is set to. Alarm monitoring will begin when timer expires.	Check indoor flow switch. Check indoor loop flow.
Multiple Defrosts	This alarm occurs if a second defrost occurs immediately after the defrost disabled timer expires from a previous defrost cycle.	Go to **Low suction pressure** or **Outdoor temperature reading incorrect** in the **Operation Troubleshooting - Heating Mode** section.

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

COMPRESSOR TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Compressor will not start: Stage 1 - R410a or Stage 2 - R134a	Faulty control board.	No 24vac output on STAGE1 or STAGE2 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.

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Outdoor temperature reading is incorrect by a large amount	Outdoor EEV is mechanically faulty and causing electromagnetic interference	Verify EEV operation (EEV3 or EEV4) - see **EEV Troubleshooting** section	Replace outdoor EEV if faulty.
	Faulty outdoor temperature sensor or outdoor MODBUS board	Outdoor EEV verified to be good, no loose connections in indoor to outdoor control wiring	Replace outdoor temperature sensor or outdoor MODBUS board.
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: Stage 1 - R410a or Stage 2 - R134a	Low indoor loop flow rate	Verify that indoor delta T is 8-12°F (4-7°C)	Increase flow rate if new installation, check for fouled heat exchanger if existing installation.
	Outdoor unit's EEV3 or EEV4 stuck almost closed or partially blocked by foreign object	Manually adjusting the outdoor EEV does not affect the superheat or the suction pressure. High superheat, low suction pressure.	Go to EEV troubleshooting section.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Unit is overcharged	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: Stage 1 - R410a or Stage 2 - R134a	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.
	Low or no outdoor unit airflow	Visually check outdoor fan to see if it is operating.	Go to Outdoor Fan Troubleshooting section.
	TS1 or TS2 temperature sensors not reading properly	If the sensor is reading low it will cause the superheat to appear high, which causes the EEV to continually close.	Verify EEV position is low compared to normal. Check temperature sensor, replace if necessary.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes high discharge pressure.	Replace filter-dryer.
	Outdoor unit's EEV3 or EEV4 stuck almost closed or partially blocked by foreign object	Manually adjusting the outdoor EEV does not affect the superheat or the suction pressure. High superheat and high discharge pressure.	Go to EEV troubleshooting section.
	Low refrigerant charge	Superheat is high, outdoor EEV position is high.	Locate the leak and repair it. Spray Nine, a sniffer, and/or dye are common methods of locating a leak.

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High suction pressure (may appear to not be pumping): Stage 1 - R410a or Stage 2 - R134a	Outdoor unit's EEV3 or EEV4 stuck open	Manually adjusting the outdoor EEV does not affect the superheat or the suction pressure. Low superheat and low discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve (Stage 2 R134a only)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	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		
Outdoor unit EEV frosting up	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the outdoor EEV does not affect the superheat or the suction pressure. High superheat, low suction 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 - DEFROST & COOLING MODES			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Heating instead of cooling	Thermostat or zone controller not set up properly	Verify that there is 24VAC across O and C of the terminal strip when calling for cooling.	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: Stage 1 - R410a or Stage 2 - R134a	Low or no outdoor unit airflow	Visually check fan to see if it is operating.	Go to Outdoor Fan 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	High subcooling.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces.

OPERATION TROUBLESHOOTING - DEFROST & COOLING MODES			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High suction pressure (may appear to not be pumping): Stage 1 - R410a or Stage 2 - R134a	Indoor unit's EEV1 or EEV2 stuck open	Manually adjusting the indoor EEV does not affect the superheat or the suction pressure. Low superheat and low discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve (Stage 2 R134a only)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	Replace reversing valve.
	Faulty compressor, not pumping	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Low suction pressure: Stage 1 - R410a or Stage 2 - R134a	Low indoor loop liquid flow	Check for high delta T with the PC APP. The EEV will be at a lower position than normal as well.	Correct the problem.
	Indoor unit's EEV1 or EEV2 stuck almost closed or partially blocked by foreign object	Manually adjusting the indoor EEV does not affect the superheat or the suction pressure. High superheat and high discharge pressure.	Go to EEV troubleshooting section.
	TS1 or TS2 temperature sensor not reading properly	If the sensor is reading low it will cause the superheat to appear high, which causes the EEV to continually close.	Verify EEV position is low compared to normal. Check temperature sensor, replace if necessary.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes high discharge pressure.	Replace filter-dryer.
	Low refrigerant charge	Water flow rate is good but suction is still 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		
Indoor unit's EEV frosting up	Indoor unit's EEV1 or EEV2 stuck almost closed or partially blocked by foreign object	Manually adjusting the indoor EEV does not affect the superheat or the suction pressure. High superheat and high 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.

OPERATION TROUBLESHOOTING - DEFROST & COOLING MODES			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Outdoor temperature reading is incorrect by a large amount	Outdoor EEV is mechanically faulty and causing electromagnetic interference	Verify EEV operation (EEV3 or EEV4) - see **EEV Troubleshooting** section	Replace outdoor EEV if faulty.
	Faulty outdoor temperature sensor or outdoor MODBUS board	Outdoor EEV verified to be good, no loose connections in indoor to outdoor control wiring	Replace outdoor temperature sensor or outdoor MODBUS board.

OUTDOOR FAN TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Outdoor fan not operating or operating intermittently	Fan power connections	Check for 230VAC across L1 and L2 of the outdoor unit. Proceed to next step if voltage present.	If no voltage present, verify that the connections are tight in both the indoor and outdoor units. Gently tug on each wire to verify connection is good. Repair any loose connections.
	Faulty PWM signal on GEN2 control board	Use manual mode of the PC APP to set the outdoor fan to 50%. Using a multi-meter set to VDC, measure PWM1 to GND of the GEN2 control board in the Indoor Unit. It should be ~5VDC. Proceed to next step if voltage present.	If signal is not present the control board may be faulty. Try cycling the power and retesting. If this does not correct the problem replace the control board.
	Fan PWM Signal connections	Use manual mode of PC APP to set the outdoor fan to 50%. Using a multi-meter set to VDC, measure PWM to ground in the Outdoor Unit. It should be ~5VDC. Proceed to next step if voltage present.	If signal is not present, check connections of PWM wire and ground wire. Replace wiring if connections are good.
	Faulty fan motor	All of the above checks have been performed and everything is OK.	Replace fan motor.

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.

Repair Procedures

WARNING: WHEN SERVICING THE OUTDOOR UNIT, BE SURE TO TURN OFF POWER TO THE INDOOR UNIT. The outdoor disconnect switch will not cut low voltage power, and damage to the control board will occur if the main heat pump breaker is not turned off during service.

Pumpdown Procedure

1. Place the unit in SERVICE mode via the PC App or LCD interface; this will open the EEVs and start the indoor circulator (as long that circulator is powered and controlled by the heat pump). **DO NOT** turn off electrical power at the breaker panel, since the brazed plate **must have full water flow** during refrigerant recovery. Be sure to **TURN OFF POWER** to indoor unit after pumpdown is completed, as per above warning.
2. Connect the refrigerant recovery unit to the heat pump's internal service ports (using the appropriate ports for the R410a or R134a circuits) via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. Plan to dispose of refrigerant if there was a compressor burnout.
3. All refrigerant to water heat exchangers (coaxial coils, brazed plates) **must either have full flow or be completely drained** of fluid before recovery begins. Failure to do so can freeze and rupture the heat exchanger, voiding its warranty. (Note that this does not apply to desuperheater coils.)
4. Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual.
5. Allow the recovery unit suction pressure to reach a vacuum. Once achieved, close the charging manifold valves. Shut down, purge and disconnect the recovery unit as per the instructions in its manual. Ensure the recovery tank valve is closed before disconnecting the hose to it.
6. Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive gauge pressure of 5-10 psig is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected.

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

General Repair Procedure

1. Perform repairs to system.
   - Always ensure nitrogen is flowing through the system at the lowest flow rate that can be felt at the discharge during any brazing procedures to prevent soot buildup inside the pipes.
   - It is recommended to replace the liquid line filter-dryer any time the refrigeration system has been exposed to the atmosphere.
   - Place a wet rag around any valves being installed, as almost all valve types have non-metallic seats or seals that will be damaged by excessive heat, and aim the torch flame away from the valve body. Solder only one joint at a time and cool joints down in between.
2. Pressure test the system with nitrogen. It is recommended to check for leaks using leak detection spray, Spray Nine, or soapy water. Check at 10, 25, 50 and 100 psig. Allow the system to sit at 100 psig for at least an hour, then re-check.

Vacuuming & Charging Procedure

After completion of repairs and pressure testing, the refrigeration circuit (either R410a or R134a) is ready for vacuuming.

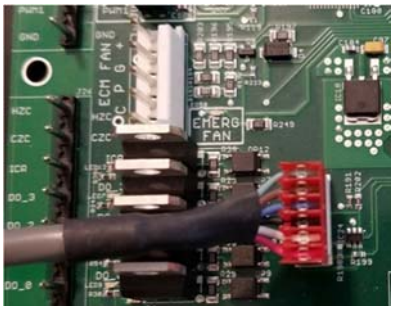
1. Release the nitrogen pressure and connect the vacuum pump to the charging manifold. Start the vacuum pump and open the charging manifold valves. Vacuum until the vacuum gauge remains at less than 500 microns for at least 1 minute with the vacuum pump valve closed.
2. Close the charging manifold valves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

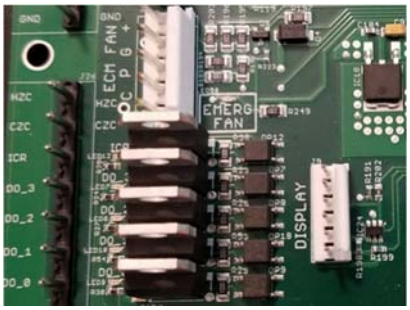
Compressor Replacement Procedure

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

Control Board Replacement Procedure

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



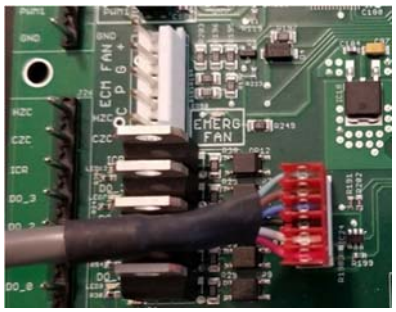


5. Remove all connectors from the top of the control board. Each connector (or wire) should be marked already from the factory, e.g. HPS1, LP1, TS1, etc.. This matches the marking on the control board.
6. The control board is held in place at its four corners. Squeeze each standoff by hand or with needle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

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

LCD Interface (Display) Board Replacement Procedure

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



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

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

Model Specific Information

Table 24 - Shipping Information - Indoor Unit

MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
ATWC-45				
ATWC-55				
ATWC-65				
ATWC-75				
ATWC-80				
ATWC-100				

Table 25 - Shipping Information - Outdoor Unit

MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
ACEC-45				
ACEC-55				
ACEC-65				
ACEC-75				
ACEC-80				
ACEC-100				

Table 16 - Refrigerant Charge

MODEL	R410a		R134a	
	lb.	*kg*	lb.	*kg*
ATWC-45	4.0	1.8	4.0	1.8
ATWC-55	5.0	2.3	5.0	2.3
ATWC-65	6.0	2.7	6.0	2.7
ATWC-75	7.0	3.2	7.0	3.2
ATWC-80	8.0	3.6	8.0	3.6
ATWC-100	9.5	*4.3*	9.5	*4.3*

Refrigerant charge is subject to revision; actual charge is indicated on the unit nameplate. Oil type is POE.

Table 27 - Indoor Loop Flow Rates

SIZE	gpm	*L/s*
ATWC-45	10	*0.63*
ATWC-55	12	*0.76*
ATWC-65	14	*0.88*
ATWC-75	16	*1.0*
ATWC-80	17	*1.1*
ATWC-100	21	*1.3*

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

Table 28 - Operating Temperature Limits

Loop	Mode	Parameter	(°F)	*(°C)*	Note
Indoor	Heating	Minimum ELT	60	*15*	Reduce flow if necessary during startup.
	Heating	Maximum LLT	160	*71*	De-rated at cold outdoor temperatures; see Operation chapter.
	Cooling	Minimum LLT	41	*5*	Water system (no antifreeze).
	Cooling	Minimum LLT	32	*0*	Antifreeze system. Adequate freeze protection required.
	Cooling	Maximum ELT	80	*27*	
Outdoor	Heating	Minimum EAT	-7	*-22*	ACE Outdoor Unit automatically stops compressor below this temp.
	Cooling	Maximum EAT	120	*49*	ACE Outdoor Unit automatically stops compressor above this temp.

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

Table 29 - Outdoor Unit Sound Levels (dBA)*

MODEL	1 ft distance		3 ft distance		5 ft distance		10 ft distance	
	Front	Side	Front	Sides	Front	Sides	Front	Sides
ATWC-45								
ATWC-55								
ATWC-65								
ATWC-75								
ATWC-80								
ATWC-100								

* At maximum fan speed. This occurs in heating mode, or in cooling mode with outdoor greater than ~27°C.

Table 30 - Indoor Unit Sound Levels

MODEL	1 ft distance	3 ft distance
ATWC-45		
ATWC-55		
ATWC-65		
ATWC-75		
ATWC-80		
ATWC-100		

* With all doors installed.

Pressure Drop Data

Table 31: Indoor Loop Pressure Drop Data

			Water 104°F		Water 50°F	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*
ATWC-45	5	*0.32*				
	6	*0.38*				
	7	*0.44*				
	8	*0.50*				
	9	*0.57*				
	10	***0.63***				
	11	*0.69*				
	12	*0.76*				
	13	*0.82*				
	14	*0.88*				
ATWC-55	6	*0.38*				
	7	*0.44*				
	8	*0.50*				
	9	*0.57*				
	10	*0.63*				
	11	*0.69*				
	12	***0.76***				
	13	*0.82*				
	14	*0.88*				
	15	*0.95*				
	16	*1.01*				
ATWC-65	7	*0.44*				
	8	*0.50*				
	9	*0.57*				
	10	*0.63*				
	11	*0.69*				
	12	*0.76*				
	13	*0.82*				
	14	***0.88***				
	15	*0.95*				
	16	*1.01*				

			Water 104°F		Water 50°F	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*
ATWC-75	8	*0.50*				
	9	*0.57*				
	10	*0.63*				
	11	*0.69*				
	12	*0.76*				
	13	*0.82*				
	14	*0.88*				
	15	*0.95*				
	16	***1.01***				
	17	*1.07*				
	18	*1.14*				
ATWC-80	8	*0.50*				
	9	*0.57*				
	10	*0.63*				
	11	*0.69*				
	12	*0.76*				
	13	*0.82*				
	14	*0.88*				
	15	*0.95*				
	16	*1.01*				
	17	***1.07***				
	18	*1.14*				
	19	*1.20*				
ATWC-100	11	*0.69*				
	12	*0.76*				
	13	*0.82*				
	14	*0.88*				
	15	*0.95*				
	16	*1.01*				
	17	*1.07*				
	18	*1.14*				
	19	*1.20*				
	20	*1.26*				
	21	***1.32***				
	22	*1.39*				
	23	*1.45*				

Performance Tables **ATWC-45-HAC-C-1D-*** *R410a/R134a, 60 Hz*

HEATING

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP_H
0°F	Cascade							10	**120°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade							10	**140°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade	-	-	-	-	-	-	10	**160°F**	*LLT is limited to 145°F at these outdoor temperatures*		
10°F	Cascade	-	-	-	-	-	-					
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											

COOLING

Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (gpm)	LLT	Delta T	Cooling (Btu/hr)	EER	COP_C
50°F					**54°F**		10					
60°F												
70°F												
80°F												
90°F												
100°F												
110°F												
120°F												

METRIC

HEATING (METRIC)

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (W)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	Heating (W)	COP_H
-18°C	Cascade							0.63	**49°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade							0.63	**60°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade	-	-	-	-	-	-	0.63	**71°C**	*LLT is limited to 63°C at these outdoor temperatures*		
-12°C	Cascade	-	-	-	-	-	-					
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											

COOLING

Outdoor Air Temperature	Condensing Temperature	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (L/s)	LLT	Delta T	Cooling (W)	EER	COP_C
10°C					**12°C**		0.63					
16°C												
21°C												
27°C												
32°C												
38°C												
43°C												
49°C												

Performance Tables **ATWC-55-HAC-C-1D-*** *R410a/R134a, 60 Hz*

	OUTDOOR				ELECTRICAL		INDOOR						
	Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP_H
HEATING	**0°F**	Cascade							12	**120°F**			
	10°F	Cascade											
	20°F	Cascade											
	30°F	Cascade											
	40°F	Cascade											
	50°F	Warm Weather											
	60°F	Warm Weather											
	70°F	Warm Weather											
	0°F	Cascade							12	**140°F**			
	10°F	Cascade											
	20°F	Cascade											
	30°F	Cascade											
	40°F	Cascade											
	50°F	Warm Weather											
	60°F	Warm Weather											
	70°F	Warm Weather											
	0°F	Cascade	-	-	-	-	-	-	12	**160°F**	*LLT is limited to 145°F at these outdoor temperatures*		
	10°F	Cascade	-	-	-	-	-	-					
	20°F	Cascade											
	30°F	Cascade											
	40°F	Cascade											
	50°F	Warm Weather											
	60°F	Warm Weather											
	70°F	Warm Weather											

	Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (gpm)	LLT	Delta T	Cooling (Btu/hr)	EER	COP_C
COOLING	**50°F**					**54°F**		12					
	60°F												
	70°F												
	80°F												
	90°F												
	100°F												
	110°F												
	120°F												

METRIC

	OUTDOOR				ELECTRICAL		INDOOR						
	Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (W)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	Heating (W)	COP_H
HEATING (METRIC)	**-18°C**	Cascade							0.76	**49°C**			
	-12°C	Cascade											
	-7°C	Cascade											
	-1°C	Cascade											
	4°C	Cascade											
	10°C	Warm Weather											
	16°C	Warm Weather											
	21°C	Warm Weather											
	-18°C	Cascade							0.76	**60°C**			
	-12°C	Cascade											
	-7°C	Cascade											
	-1°C	Cascade											
	4°C	Cascade											
	10°C	Warm Weather											
	16°C	Warm Weather											
	21°C	Warm Weather											
	-18°C	Cascade	-	-	-	-	-	-	0.76	**71°C**	*LLT is limited to 63°C at these outdoor temperatures*		
	-12°C	Cascade	-	-	-	-	-	-					
	-7°C	Cascade											
	-1°C	Cascade											
	4°C	Cascade											
	10°C	Warm Weather											
	16°C	Warm Weather											
	21°C	Warm Weather											

	Outdoor Air Temperature	Condensing Temperature	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (L/s)	LLT	Delta T	Cooling (W)	EER	COP_C
COOLING	**10°C**					**12°C**		0.76					
	16°C												
	21°C												
	27°C												
	32°C												
	38°C												
	43°C												
	49°C												

Performance Tables **ATWC-65-HAC-C-1D-*** *R410a/R134a, 60 Hz*

HEATING

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP_H
0°F	Cascade							14	**120°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade							14	**140°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade	-	-	-	-	-	-	14	**160°F**	*LLT is limited to 145°F at these outdoor temperatures*		
10°F	Cascade	-	-	-	-	-	-					
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											

COOLING

Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (gpm)	LLT	Delta T	Cooling (Btu/hr)	EER	COP_C
50°F					**54°F**		14					
60°F												
70°F												
80°F												
90°F												
100°F												
110°F												
120°F												

METRIC

HEATING (METRIC)

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (W)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	Heating (W)	COP_H
-18°C	Cascade							0.88	**49°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade							0.88	**60°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade	-	-	-	-	-	-	0.88	**71°C**	*LLT is limited to 63°C at these outdoor temperatures*		
-12°C	Cascade	-	-	-	-	-	-					
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											

COOLING

Outdoor Air Temperature	Condensing Temperature	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (L/s)	LLT	Delta T	Cooling (W)	EER	COP_C
10°C					**12°C**		0.88					
16°C												
21°C												
27°C												
32°C												
38°C												
43°C												
49°C												

Performance Tables **ATWC-75-HAC-C-1D-*** *R410a/R134a, 60 Hz*

HEATING

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP_H
0°F	Cascade							16	**120°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade							16	**140°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade	-	-	-	-	-	-	16	**160°F**	*LLT is limited to 145°F at these outdoor temperatures*		
10°F	Cascade	-	-	-	-	-	-					
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											

COOLING

Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (gpm)	LLT	Delta T	Cooling (Btu/hr)	EER	COP_C
50°F					**54°F**		16					
60°F												
70°F												
80°F												
90°F												
100°F												
110°F												
120°F												

METRIC

HEATING (METRIC)

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (W)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	Heating (W)	COP_H
-18°C	Cascade							1.0	**49°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade							1.0	**60°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade	-	-	-	-	-	-	1.0	**71°C**	*LLT is limited to 63°C at these outdoor temperatures*		
-12°C	Cascade	-	-	-	-	-	-					
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											

COOLING (METRIC)

Outdoor Air Temperature	Condensing Temperature	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (L/s)	LLT	Delta T	Cooling (W)	EER	COP_C
10°C					**12°C**		1.0					
16°C												
21°C												
27°C												
32°C												
38°C												
43°C												
49°C												

Performance Tables **ATWC-80-HAC-C-1D-*** *R410a/R134a, 60 Hz*

HEATING

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP_H
0°F	Cascade							17	**120°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade							17	**140°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade	-	-	-	-	-	-	17	**160°F**	*LLT is limited to 145°F at these outdoor temperatures*		
10°F	Cascade	-	-	-	-	-	-					
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											

COOLING

Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (gpm)	LLT	Delta T	Cooling (Btu/hr)	EER	COP_C
50°F					**54°F**		17					
60°F												
70°F												
80°F												
90°F												
100°F												
110°F												
120°F												

METRIC

HEATING (METRIC)

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (W)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	Heating (W)	COP_H
-18°C	Cascade							1.1	**49°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade							1.1	**60°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade	-	-	-	-	-	-	1.1	**71°C**	*LLT is limited to 63°C at these outdoor temperatures*		
-12°C	Cascade	-	-	-	-	-	-					
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											

COOLING

Outdoor Air Temperature	Condensing Temperature	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (L/s)	LLT	Delta T	Cooling (W)	EER	COP_C
10°C					**12°C**		1.1					
16°C												
21°C												
27°C												
32°C												
38°C												
43°C												
49°C												

Performance Tables **ATWC-100-HAC-C-2D-*** *R410a/R134a, 60 Hz*

HEATING

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP_H
0°F	Cascade							21	**120°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade							21	**140°F**			
10°F	Cascade											
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											
0°F	Cascade	-	-	-	-	-	-	21	**160°F**	*LLT is limited to 145°F at these outdoor temperatures*		
10°F	Cascade	-	-	-	-	-	-					
20°F	Cascade											
30°F	Cascade											
40°F	Cascade											
50°F	Warm Weather											
60°F	Warm Weather											
70°F	Warm Weather											

COOLING

Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (gpm)	LLT	Delta T	Cooling (Btu/hr)	EER	COP_C
50°F					**54°F**		21					
60°F												
70°F												
80°F												
90°F												
100°F												
110°F												
120°F												

METRIC

HEATING (METRIC)

OUTDOOR				ELECTRICAL		INDOOR						
Outdoor Air Temperature	MODE	Evaporating Temperature	Heat Absorbed (W)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	Heating (W)	COP_H
-18°C	Cascade							1.3	**49°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade							1.3	**60°C**			
-12°C	Cascade											
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											
-18°C	Cascade	-	-	-	-	-	-	1.3	**71°C**	*LLT is limited to 63°C at these outdoor temperatures*		
-12°C	Cascade	-	-	-	-	-	-					
-7°C	Cascade											
-1°C	Cascade											
4°C	Cascade											
10°C	Warm Weather											
16°C	Warm Weather											
21°C	Warm Weather											

COOLING

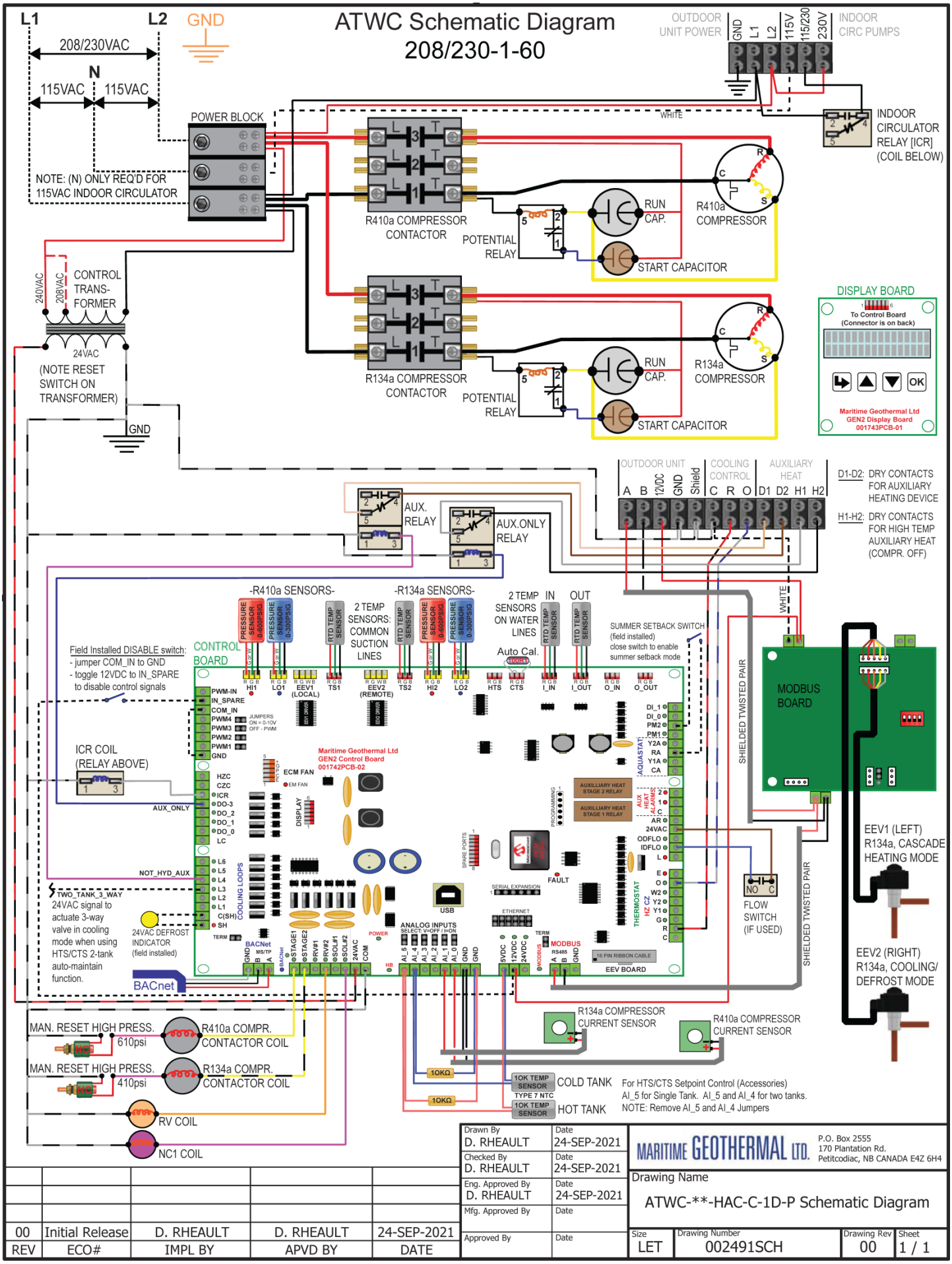
Outdoor Air Temperature	Condensing Temperature	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temperature	Liquid Flow (L/s)	LLT	Delta T	Cooling (W)	EER	COP_C
10°C					**12°C**		1.3					
16°C												
21°C												
27°C												
32°C												
38°C												
43°C												
49°C												

Electrical Specifications

TABLE 32 - ATWC-Series Electrical Specifications

	Code	Power Supply			Compressor (R410a)		Compressor (R134a)		Indoor Circ.	Outdoor Unit	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	RLA	LRA	Max A	Max A	Amps	Amps	Amps	ga
ATWC-45	1	230-1-60	187	253	13.5	72	15.4	87	3.0	3.0	35.1	39.0	50	#8-2*
	2	208-3-60	187	229	8.9	58	10.8	73	3.0	3.0	25.9	28.6	40	#8-3*
	4	460-3-60	414	506	4.2	38	5.8	38	3.0	3.0	16.2	17.7	25	#10-4
	6	220-1-50	187	253	11.2	60	12.8	79	3.0	3.0	30.2	33.4	40	#8-2
	7	380-3-50	342	418	4.0	38	5.8	38	3.0	3.0	16.0	17.5	25	#10-4
ATWC-55	1	230-1-60	187	253	19.2	124	19.9	104	4.0	3.0	46.3	51.3	60	#6-2*
	2	208-3-60	187	229	13.5	88	12.8	93	4.0	3.0	33.5	36.9	50	#8-3*
	4	460-3-60	414	506	6.0	44	5.8	48	4.0	3.0	19.0	20.5	25	#10-4
	6	220-1-50	187	253	16.0	87	17.3	122	4.0	3.0	40.5	44.8	60	#6-2
	7	380-3-50	342	418	6.0	46	5.8	48	4.0	3.0	19.0	20.5	25	#10-4
ATWC-65	1	230-1-60	187	253	19.6	130	25.3	146	4.0	3.4	52.5	58.8	80	#4-2*
	2	208-3-60	187	229	13.7	83	15.4	114	4.0	3.4	36.7	40.6	50	#8-3*
	6	220-1-50	187	253	15.9	98	19.2	133	4.0	3.4	42.7	47.5	60	#6-2
	7	380-3-50	342	418	6.1	43	7.1	52	4.0	3.4	20.8	22.6	30	#10-4
ATWC-75	1	230-1-60	187	253	24.7	166	23.7	144	4.0	3.4	56.0	62.2	80	#4-2*
	2	208-3-60	187	229	15.6	110	18.6	128	4.0	3.4	41.8	46.5	60	#6-3*
	6	220-1-50	187	253	20.2	128	25.6	150	4.0	3.4	53.4	59.8	80	#4-2
	7	380-3-50	342	418	7.8	52	9.0	66	4.0	3.4	24.4	26.7	40	#8-4
ATWC-80	1	230-1-60	187	253	30.8	178	28.8	176	4.0	3.4	67.2	74.9	100	#3-2*
	2	208-3-60	187	229	19.6	136	18.6	156	4.0	3.4	45.8	50.7	60	#6-3*
	6	220-1-50	187	253	26.3	147	27.6	150	4.0	3.4	61.5	68.4	100	#3-2
	7	380-3-50	342	418	8.0	67	9.0	74	4.0	3.4	24.6	26.9	40	#8-4
ATWC-100	2	208-3-60	187	229	23.2	164	22.4	164	4.0	3.4	53.2	59.0	80	#4-3*
	7	380-3-50	342	418	11.2	75	10.9	101	4.0	3.4	29.7	32.5	40	#8-4

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



REV	ECO#	IMPL BY	APVD BY	DATE
00	Initial Release	D. RHEAULT	D. RHEAULT	24-SEP-2021

Drawn By	D. RHEAULT	Date	24-SEP-2021
Checked By	D. RHEAULT	Date	24-SEP-2021
Eng. Approved By	D. RHEAULT	Date	24-SEP-2021
Mfg. Approved By		Date	
Approved By		Date	

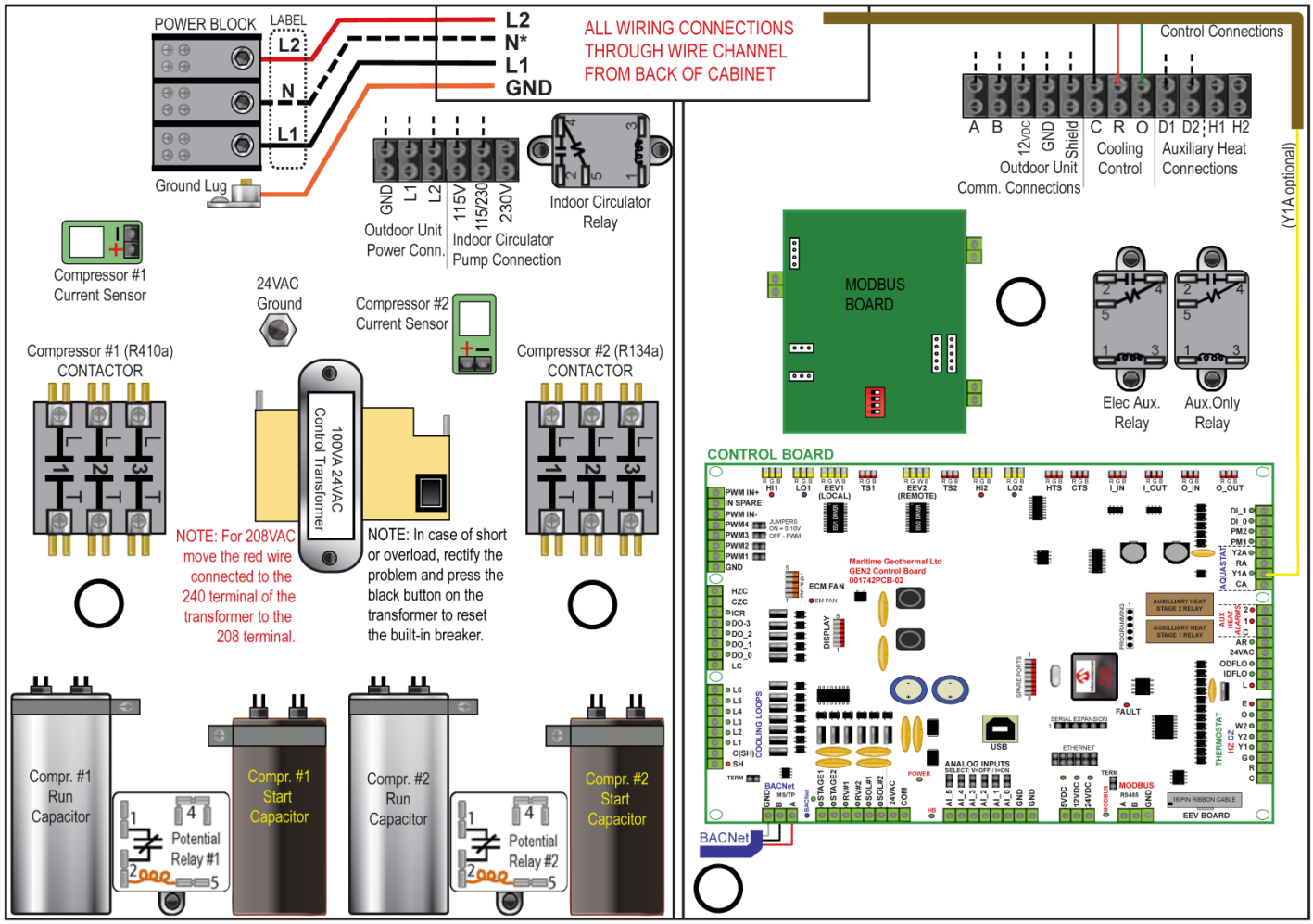
MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: ATWC-**-HAC-C-1D-P Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002491SCH	00	1 / 1

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

*NOTE: Neutral (N) is only required if connecting 115VAC circulators.
The heat pump itself does not require a neutral.



SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	**External**	**Activation**
SYSTEM_Y1A	Y1A	Heating or Cooling ON
SYSTEM_O	O	Heating (OFF) / Cooling (ON)

EXTERNAL CONTROL CONNECTIONS (24VAC)

For cooling mode activation, use 18-2 wire to terminal strip to connect on terminal strip:
R - 24VAC Hot
O - Cooling Mode (Active) / Heating Mode (Inactive)

If using an external aquastat ("Signals" control method), use these connections in addition:
C - 24VAC common for powering external device
Y1A - compressor(s) ON (right side of control board)

A dry contact connection between R and any external control connection (Y1A or O) will activate.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of 2 types of auxiliary heat connections:
D1 ¦ Dry contacts, closed when ATWC calls for aux. heat
D2 ¦ (defaults to ON, verify ext. temp. limiter is present)
H1 ¦ Dry contacts, closed when ATWC calls for aux. heat
H2 ¦ (only when compressor OFF; use for higher temperature backup heating devices)

CIRCULATOR CONNECTIONS (230/115VAC)

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

OUTDOOR UNIT POWER CONNECTIONS (230VAC)

Use a #14-2 outdoor rated cable to connect the power supply of the outdoor unit to the matching terminals L1/L2/GND of the Outdoor Unit Power terminal strip in the electrical box of the heat pump.

OUTDOOR UNIT SIGNAL CONNECTIONS

Use the supplied **double twisted pair shielded** cable to connect A/B/12VDC/GND termnials in the outdoor unit to matching terminals in the heat pump electrical box. Connect the shield ground to GND at the heat pump end only.

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

Use twisted pair shielded cable to connect the BACNet connections to the control board connector.
A - Communication (+)
B - Communication (-)
GND - Ground

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

Drawn By	D. RHEAULT	Date	9-SEP-2021
Checked By	D. RHEAULT	Date	9-SEP-2021
Eng. Approved By	D. RHEAULT	Date	9-SEP-2021
Mfg. Approved By		Date	
Approved By		Date	

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Drawing Name: ATWC-**-HAC-P-1D-* Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
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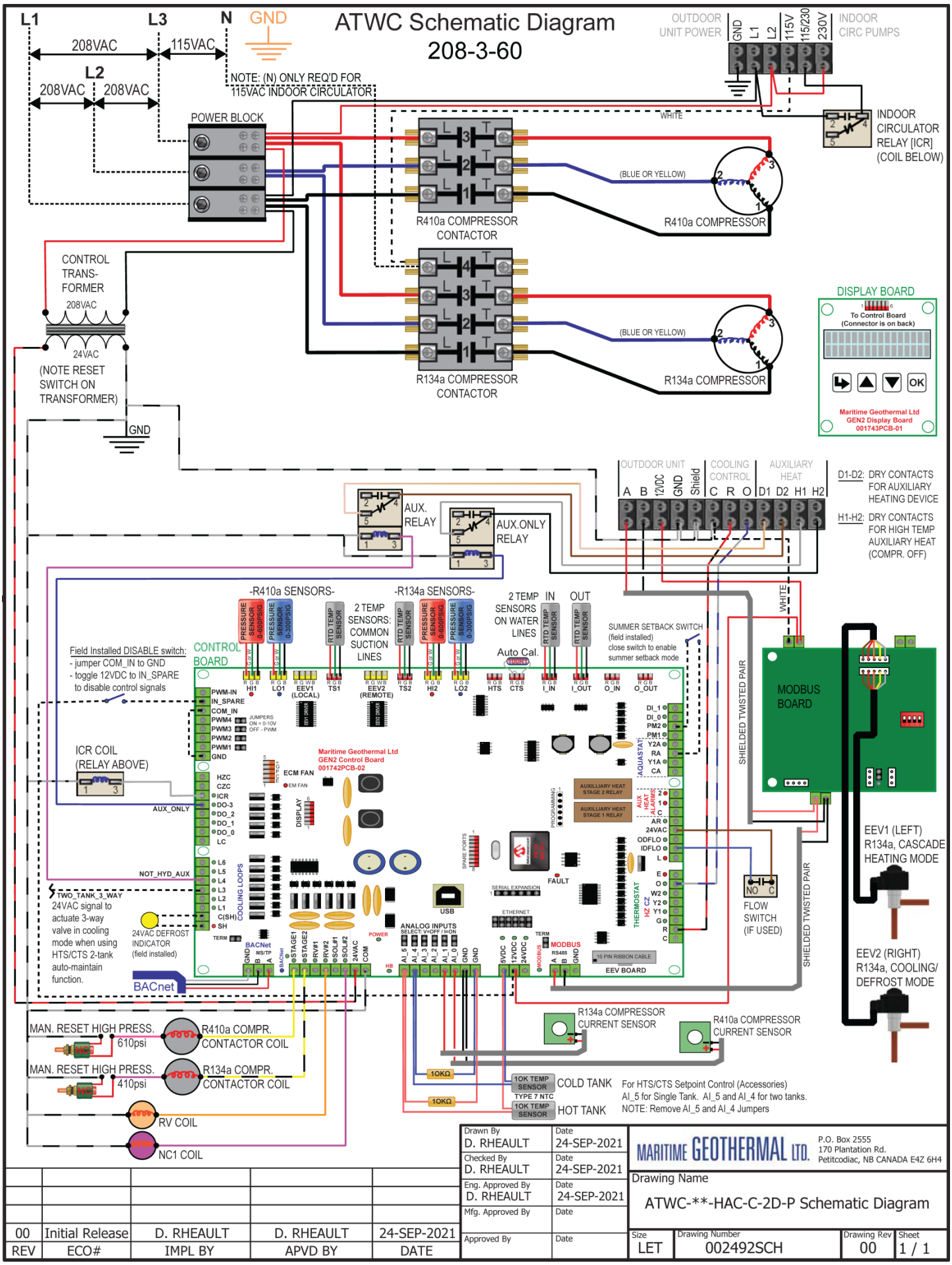

REV	ECO#	IMPL BY	APVD BY	DATE
00	Initial Release	D. RHEAULT	D. RHEAULT	24-SEP-2021

Drawn By	D. RHEAULT	Date	24-SEP-2021
Checked By	D. RHEAULT	Date	24-SEP-2021
Eng. Approved By	D. RHEAULT	Date	24-SEP-2021
Mfg. Approved By		Date	
Approved By		Date	

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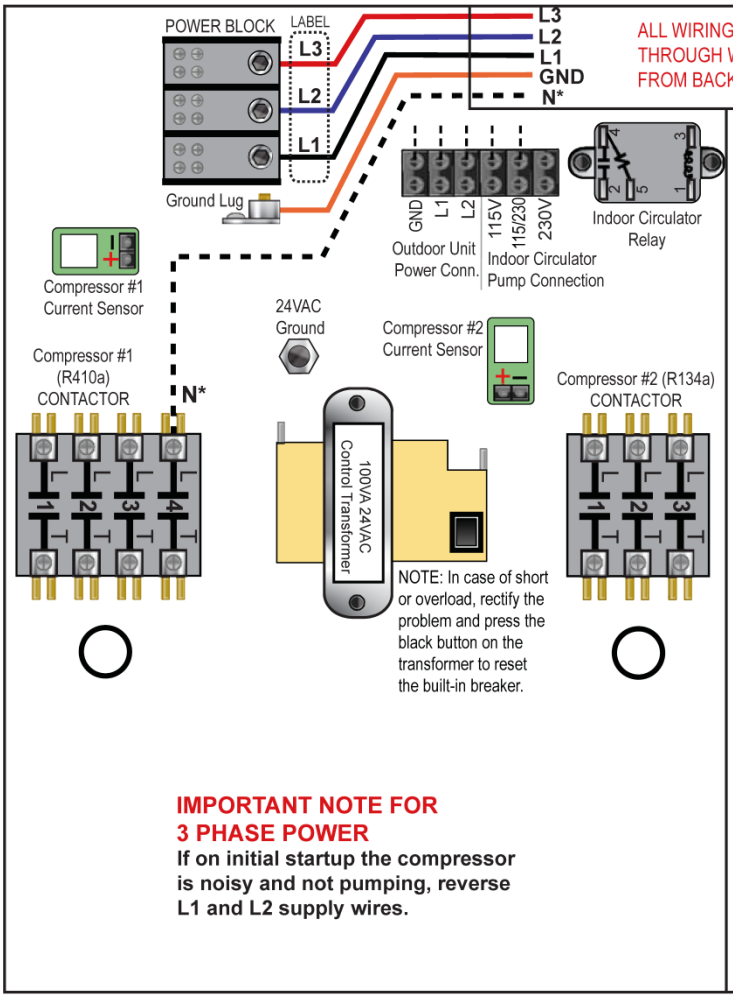
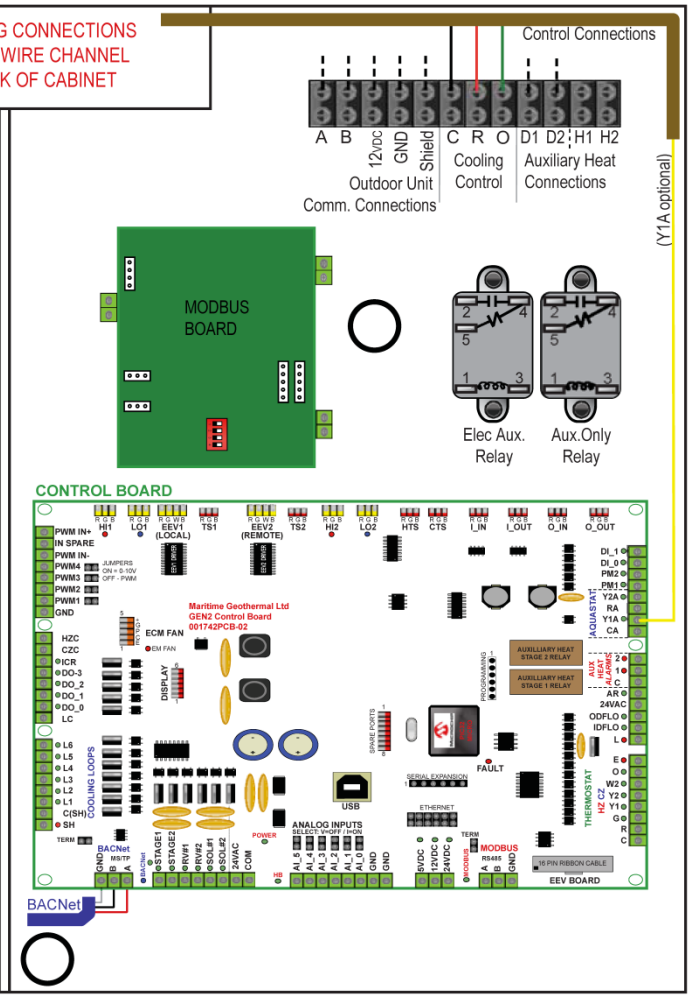
Drawing Name: ATWC-**-HAC-C-2D-P Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002492SCH	00	1 / 1

ATWC-Series Electrical Box Diagram
208-3-60

*NOTE: Neutral (N) is only required if connecting 115VAC circulators.
The heat pump itself does not require a neutral.





IMPORTANT NOTE FOR 3 PHASE POWER

If on initial startup the compressor is noisy and not pumping, reverse L1 and L2 supply wires.

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	**External**	**Activation**
SYSTEM_Y1A	Y1A	Heating or Cooling ON
SYSTEM_O	O	Heating (OFF) / Cooling (ON)

EXTERNAL CONTROL CONNECTIONS (24VAC)

For cooling mode activation, use 18-2 wire to terminal strip to connect:
R - 24VAC Hot
O - Cooling Mode (Active) / Heating Mode (Inactive)

If using an external aquastat ("Signals" control method), use these connections in addition:
C - 24VAC Common (terminal strip)
Y1A - Compressor(s) ON (right board connector)

A dry contact connection between R and any external control connection (Y1A or O) will activate.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of 2 types of auxiliary heat connections:

D1, D2 - Dry contacts, closed when ATWC calls for aux. heat

H1, H2 - Dry contacts, closed when ATWC calls for aux. heat (only when compressor OFF; use for higher temperature backup heating devices)

CIRCULATOR CONNECTIONS (230/115VAC)

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

OUTDOOR UNIT POWER CONNECTIONS (230VAC)

Use a #14-2 outdoor rated cable to connect the power supply of the outdoor unit to the matching terminals L1/L2/GND of the Outdoor Unit Power terminal strip in the electrical box of the heat pump.

OUTDOOR UNIT SIGNAL CONNECTIONS

Use the supplied **double twisted pair shielded** cable to connect A/B/12VDC/GND termnials in the outdoor unit to matching terminals in the heat pump electrical box. Connect the shield ground to GND at the heat pump end only.

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

Use twisted pair shielded cable to connect the BACNet connections to the control board connector.
A - Communication (+)
B - Communication (-)
GND - Ground

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

Drawn By: D. RHEAULT	Date: 9-SEP-2021	
Checked By: D. RHEAULT	Date: 9-SEP-2021	
Eng. Approved By: D. RHEAULT	Date: 9-SEP-2021	
Mfg. Approved By:	Date:	
Approved By:	Date:	

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Drawing Name: ATWC-**-HAC-P-2D-* Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
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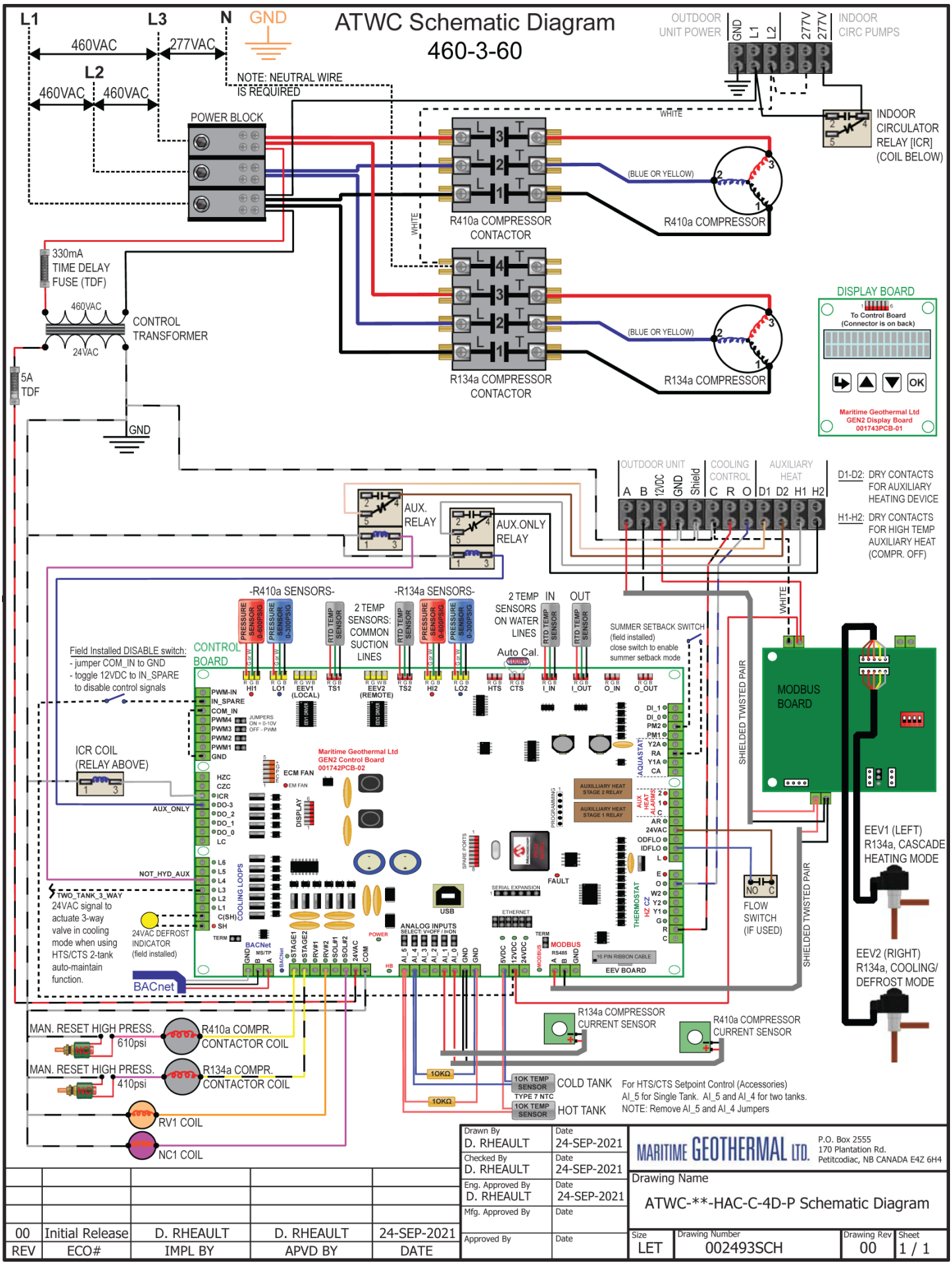

00	Initial Release	D. RHEAULT	D. RHEAULT	24-SEP-2021
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By: D. RHEAULT	Date: 24-SEP-2021
Checked By: D. RHEAULT	Date: 24-SEP-2021
Eng. Approved By: D. RHEAULT	Date: 24-SEP-2021
Mfg. Approved By	Date
Approved By	Date

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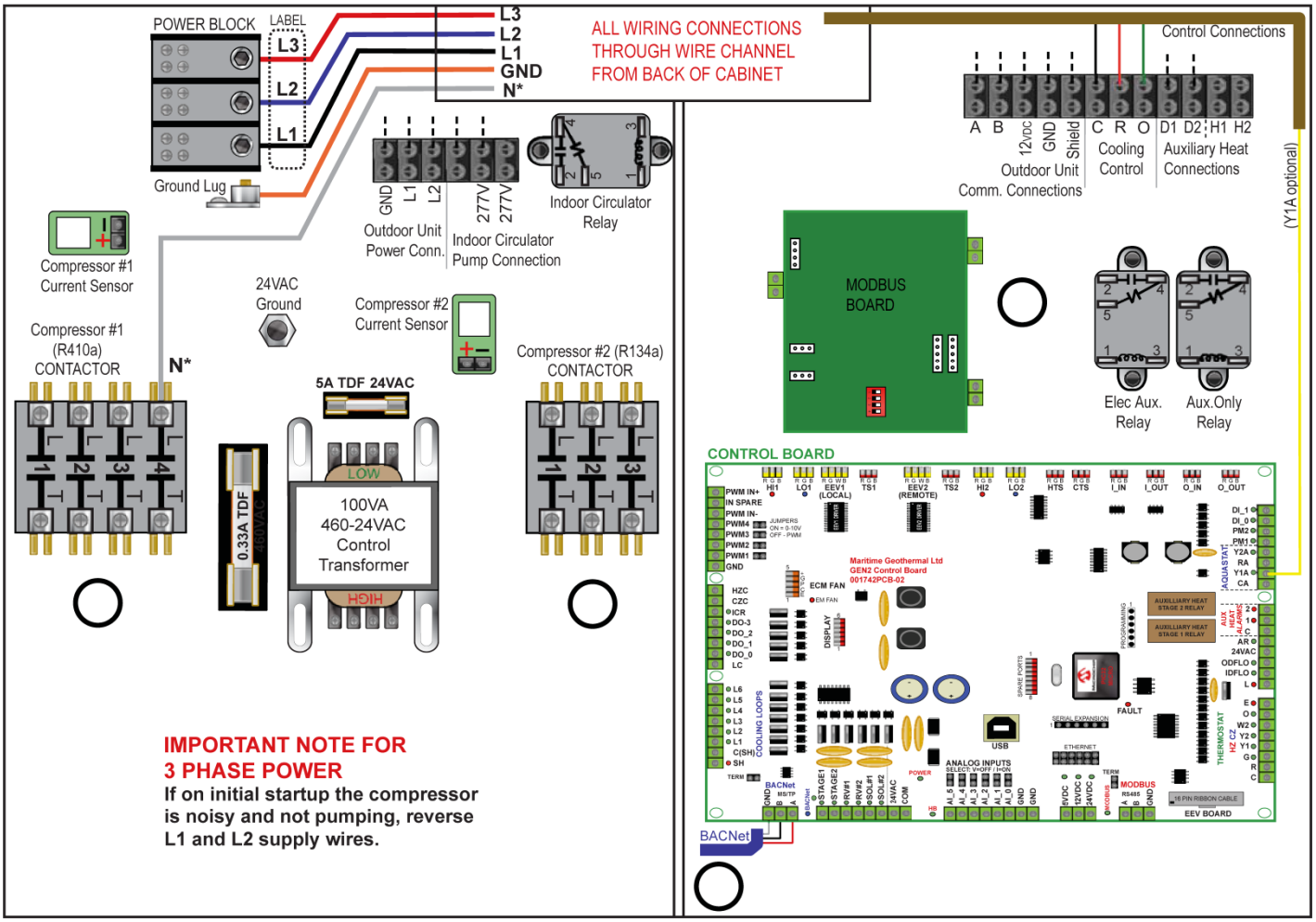
Drawing Name: ATWC-**-HAC-C-4D-P Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002493SCH	00	1 / 1

ATWC-Series Electrical Box Diagram

460-3-60

*NOTE: Neutral (N) is **required** for heat pump operation.



IMPORTANT NOTE FOR 3 PHASE POWER

If on initial startup the compressor is noisy and not pumping, reverse L1 and L2 supply wires.

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	**External**	**Activation**
SYSTEM_Y1A	Y1A	Heating or Cooling ON
SYSTEM_O	O	Heating (OFF) / Cooling (ON)

EXTERNAL CONTROL CONNECTIONS (24VAC)

For cooling mode activation, use 18-2 wire to terminal strip to connect:

R - 24VAC Hot

O - Cooling Mode (Active) / Heating Mode (Inactive)

If using an external aquastat ("Signals" control method), use these connections in addition:

C - 24VAC Common (terminal strip)

Y1A - Compressor(s) ON (right board connector)

A dry contact connection between R and any external control connection (Y1A or O) will activate.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.

Choose one of 2 types of auxiliary heat connections:

D1, D2 - Dry contacts, closed when ATWC calls for aux. heat

H1, H2 - Dry contacts, closed when ATWC calls for aux. heat (only when compressor OFF; use for higher temperature backup heating devices)

CIRCULATOR CONNECTIONS (230/115VAC)

REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)

Connect 115VAC circulators to terminals 115V-115/230.

Connect 230VAC circulators to terminals 230V-115/230.

OUTDOOR UNIT POWER CONNECTIONS (230VAC)

Use a #14-2 outdoor rated cable to connect the power supply of the outdoor unit to the matching terminals L1/L2/GND of the Outdoor Unit Power terminal strip in the electrical box of the heat pump.

OUTDOOR UNIT SIGNAL CONNECTIONS

Use the supplied **double twisted pair shielded** cable to connect A/B/12VDC/GND termnials in the outdoor unit to matching terminals in the heat pump electrical box. Connect the shield ground to GND at the heat pump end only.

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

Use twisted pair shielded cable to connect the BACNet connections to the control board connector.

A - Communication (+)

B - Communication (-)

GND - Ground

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

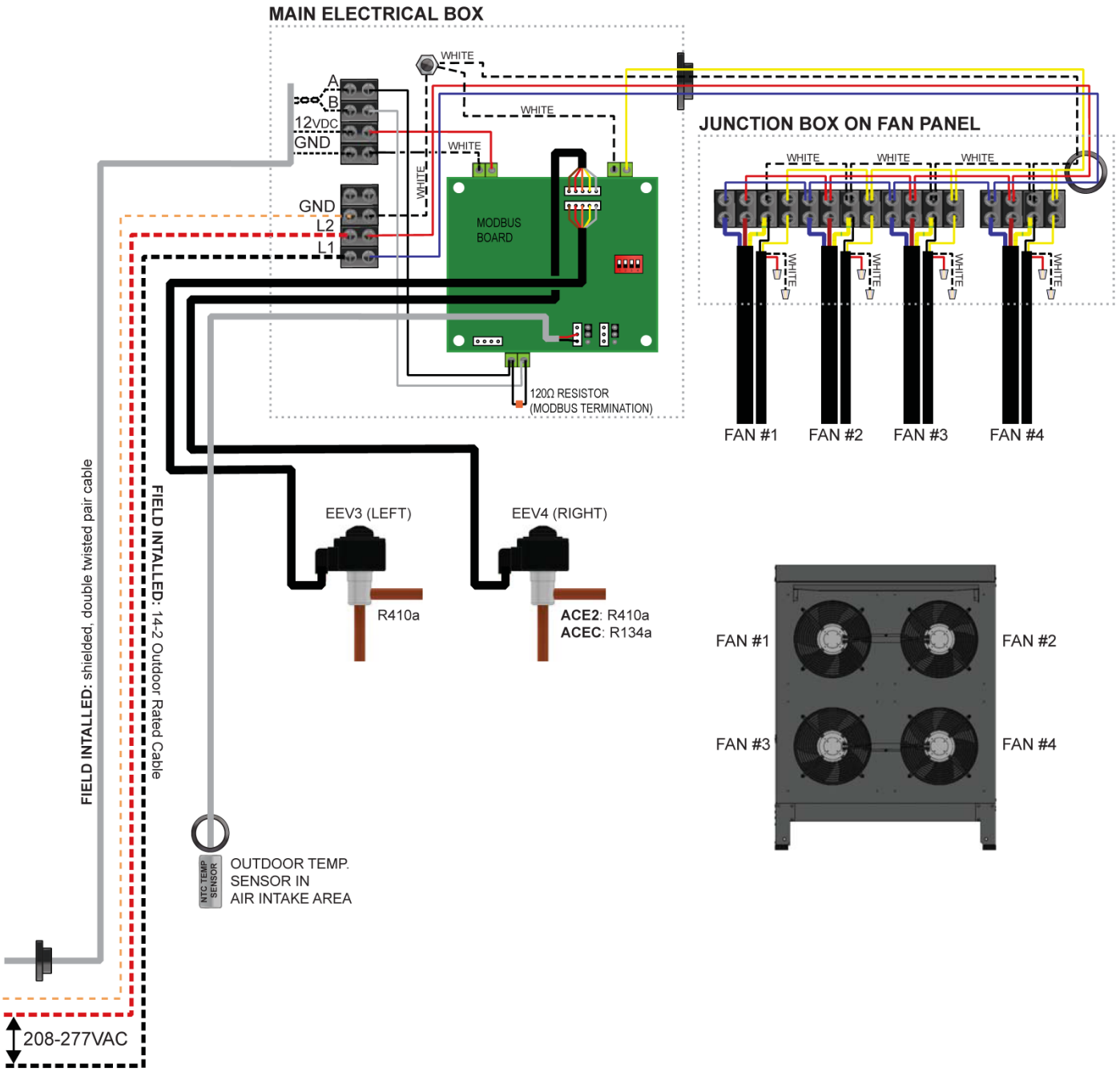
Drawn By: D. RHEAULT	Date: 9-SEP-2021	
Checked By: D. RHEAULT	Date: 9-SEP-2021	
Eng. Approved By: D. RHEAULT	Date: 9-SEP-2021	
Mfg. Approved By:	Date:	
Approved By:	Date:	

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

Drawing Name: ATWC-**-HAC-P-4D-* Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002539ELB	01	1 / 1

ACE2 45-80 / ACEC 16-55 Schematic Diagram



Connect power and communication wires to matching terminal strip connectors in electrical box of indoor unit.

REV	ECO#	IMPL BY	APVD BY	DATE
00	Prototype Rel.	D. RHEAULT	D. RHEAULT	17-Dec-2020

Drawn By	D. RHEAULT	Date 17-Dec-2020
Checked By	D. RHEAULT	Date 17-Dec-2020
Eng. Approved By	D. RHEAULT	Date 17-Dec-2020
Mfg. Approved By		Date
Approved By		Date

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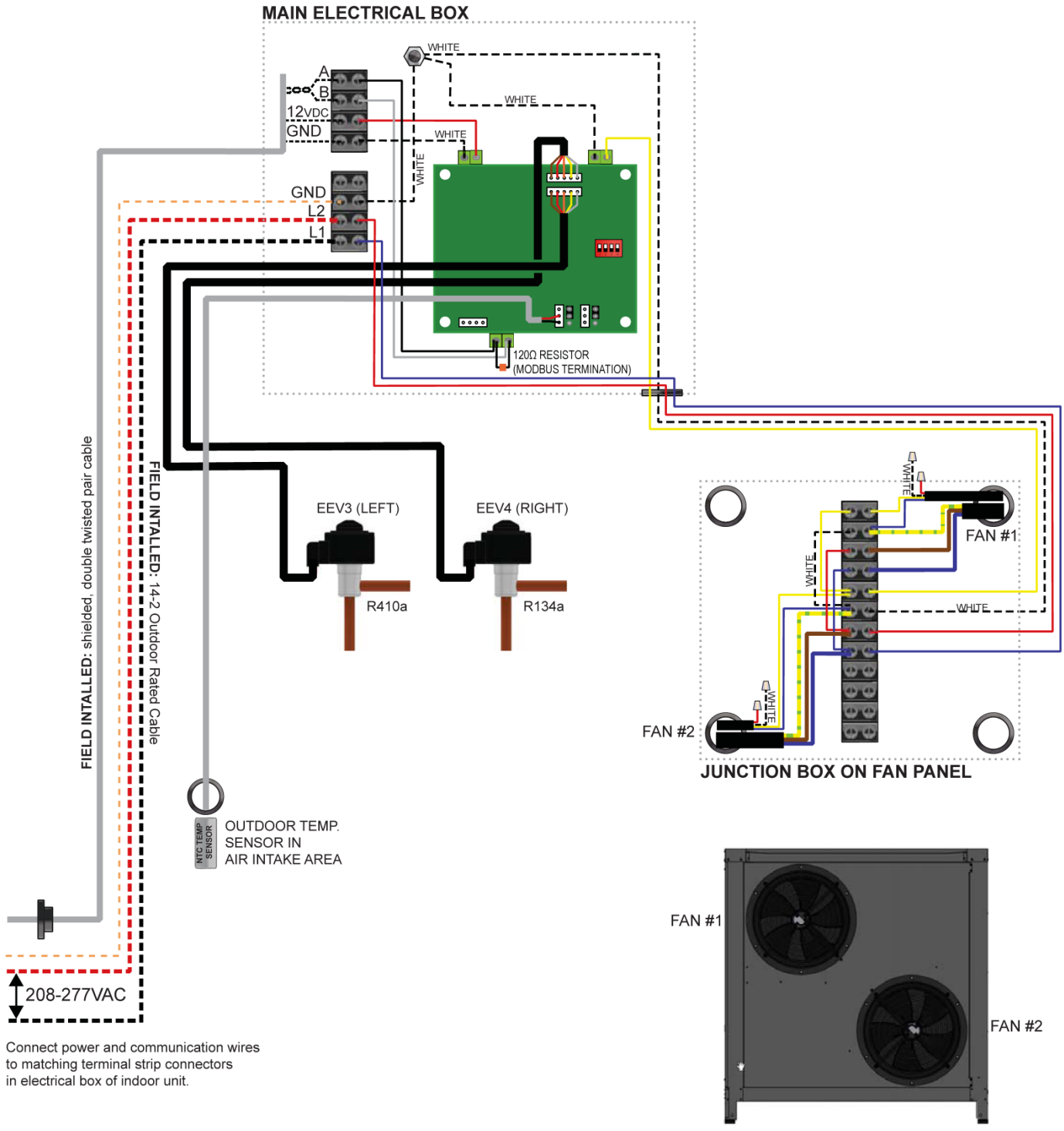
Drawing Name: ACE2 45-80 / ACEC 16-55 Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002441SCH	00	1 / 1

ACEC 65-100 Schematic Diagram



REV	ECO#	IMPL BY	APVD BY	DATE
00	Prototype Rel.	D. RHEAULT	D. RHEAULT	17-Dec-2020

Drawn By	D. RHEAULT	Date	17-Dec-2020
Checked By	D. RHEAULT	Date	17-Dec-2020
Eng. Approved By	D. RHEAULT	Date	17-Dec-2020
Mfg. Approved By		Date	
Approved By		Date	

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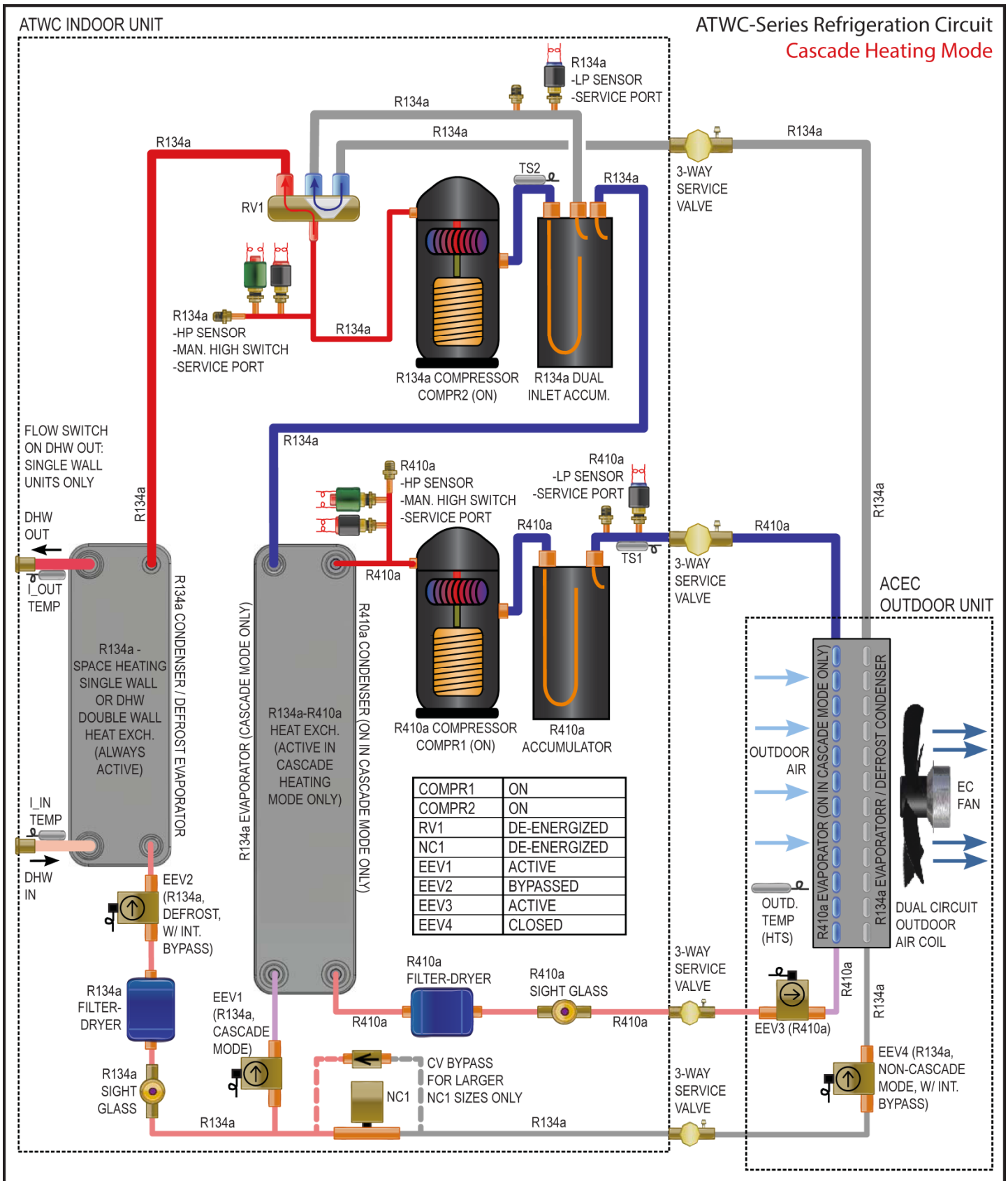
Drawing Name: ACEC 65-100 Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002488SCH	00	1 / 1



COMPR1	ON
COMPR2	ON
RV1	DE-ENERGIZED
NC1	DE-ENERGIZED
EEV1	ACTIVE
EEV2	BYPASSED
EEV3	ACTIVE
EEV4	CLOSED

SEE REV00 OF THIS DOCUMENT FOR DESIGN NOTES

REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	20-SEP-2021
00	Prelim. Rel.	D. RHEAULT	D. RHEAULT	11-SEP-2020

Drawn By	D. RHEAULT	Date 11-SEP-2020
Checked By	D. RHEAULT	Date 11-SEP-2020
Eng. Approved By	D. RHEAULT	Date 11-SEP-2020
Mfg. Approved By		Date
Approved By		Date

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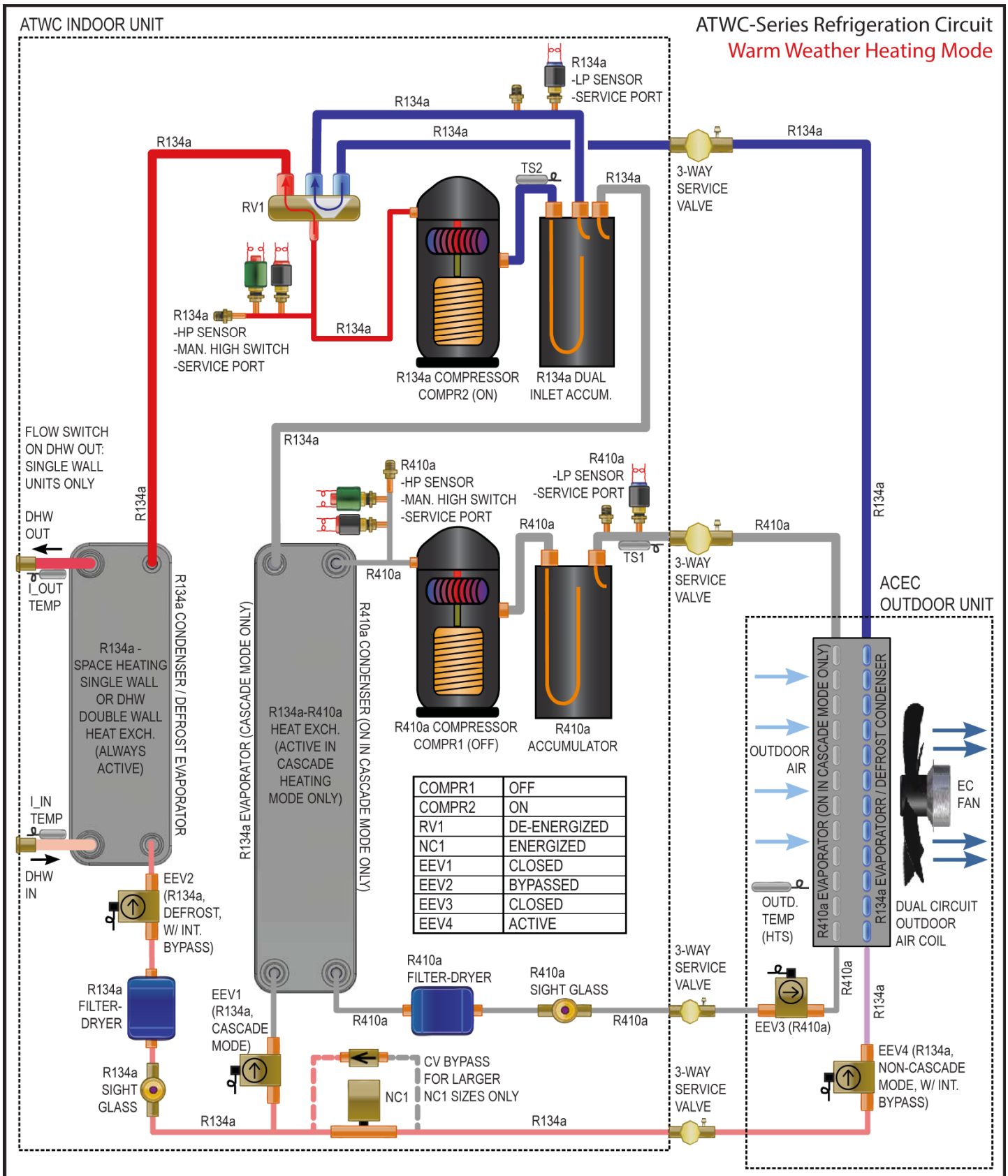
Drawing Name
ATWC-Series Refrigeration Circuit
Cascade Heating Mode

Size	Drawing Number	Drawing Revision	Sheet
LET	002454RCD	01	1 / 1



COMPR1	OFF
COMPR2	ON
RV1	DE-ENERGIZED
NC1	ENERGIZED
EEV1	CLOSED
EEV2	BYPASSED
EEV3	CLOSED
EEV4	ACTIVE

SEE REV00 OF THIS DOCUMENT FOR DESIGN NOTES

REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	20-SEP-2021
00	Prelim. Rel.	D. RHEAULT	D. RHEAULT	11-SEP-2020

Drawn By	D. RHEAULT	Date 11-SEP-2020
Checked By	D. RHEAULT	Date 11-SEP-2020
Eng. Approved By	D. RHEAULT	Date 11-SEP-2020
Mfg. Approved By		Date
Approved By		Date

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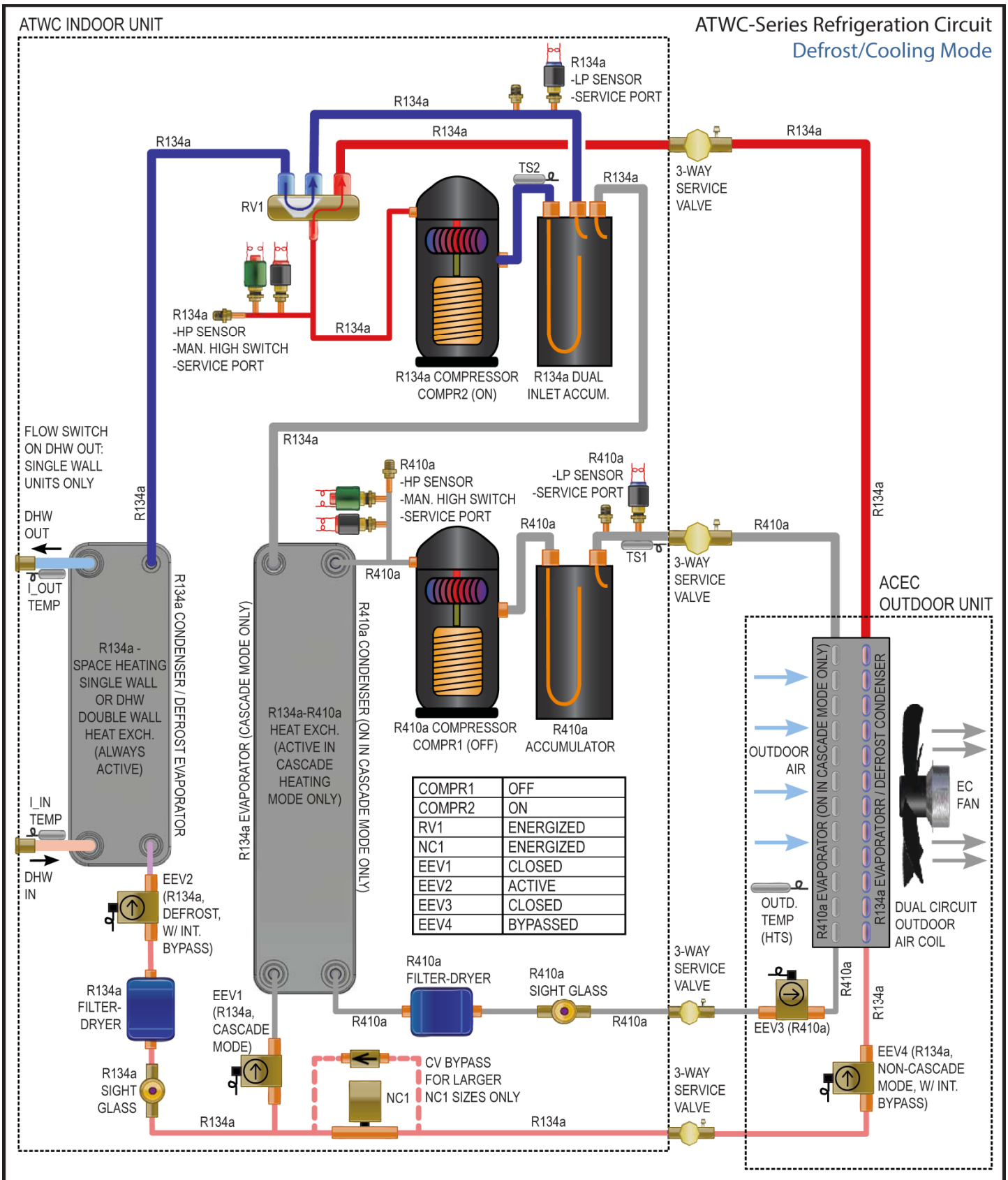
Drawing Name
ATWC-Series Refrigeration Circuit
Warm Weather Heating Mode

Size	Drawing Number	Drawing Revision	Sheet
LET	002455RCD	01	1 / 1



COMPR1	OFF
COMPR2	ON
RV1	ENERGIZED
NC1	ENERGIZED
EEV1	CLOSED
EEV2	ACTIVE
EEV3	CLOSED
EEV4	BYPASSED

SEE REV00 OF THIS DOCUMENT FOR DESIGN NOTES

REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	20-SEP-2021
00	Prelim. Rel.	D. RHEAULT	D. RHEAULT	11-SEP-2020

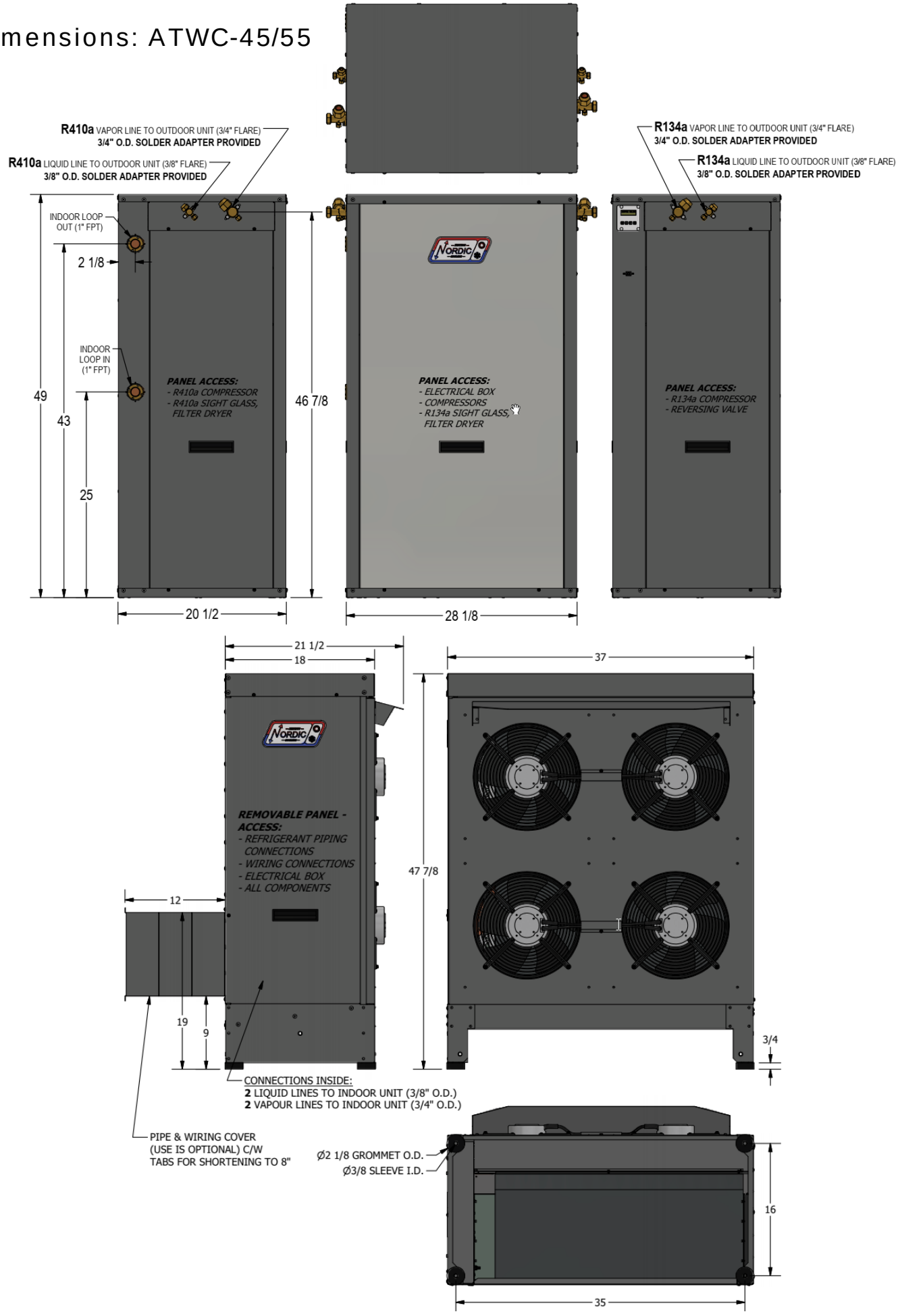
Drawn By	D. RHEAULT	Date	11-SEP-2020
Checked By	D. RHEAULT	Date	11-SEP-2020
Eng. Approved By	D. RHEAULT	Date	11-SEP-2020
Mfg. Approved By		Date	
Approved By		Date	

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

Drawing Name: ATWC-Series Refrigeration Circuit Defrost/Cooling Mode

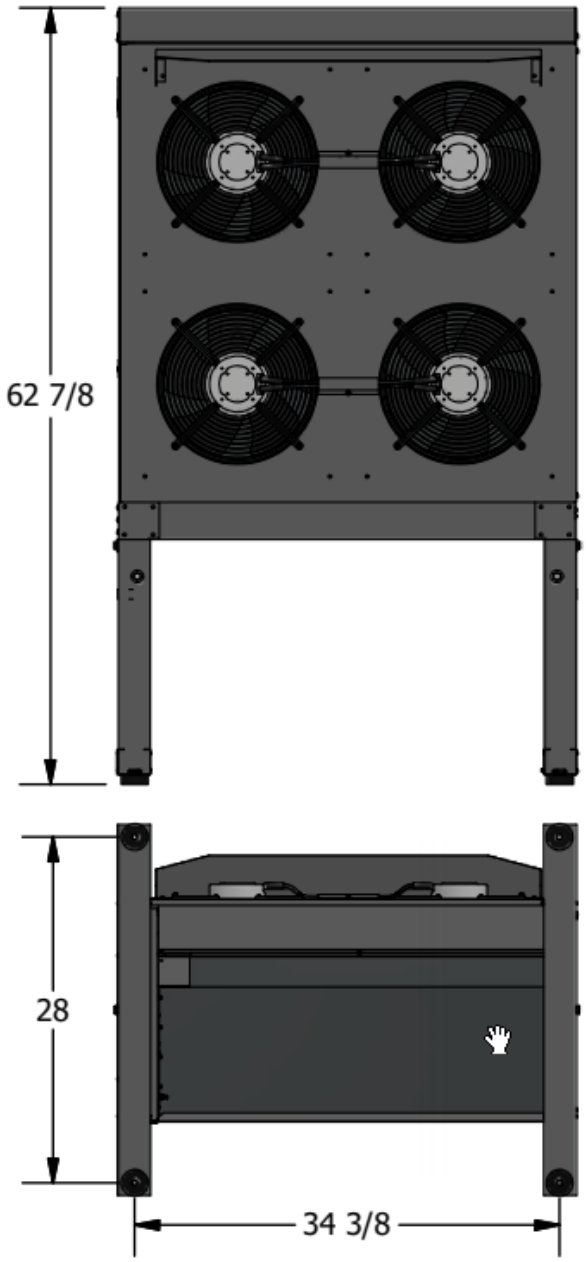
Size	Drawing Number	Drawing Revision	Sheet
LET	002456RCD	01	1 / 1

Dimensions: ATWC-45/55

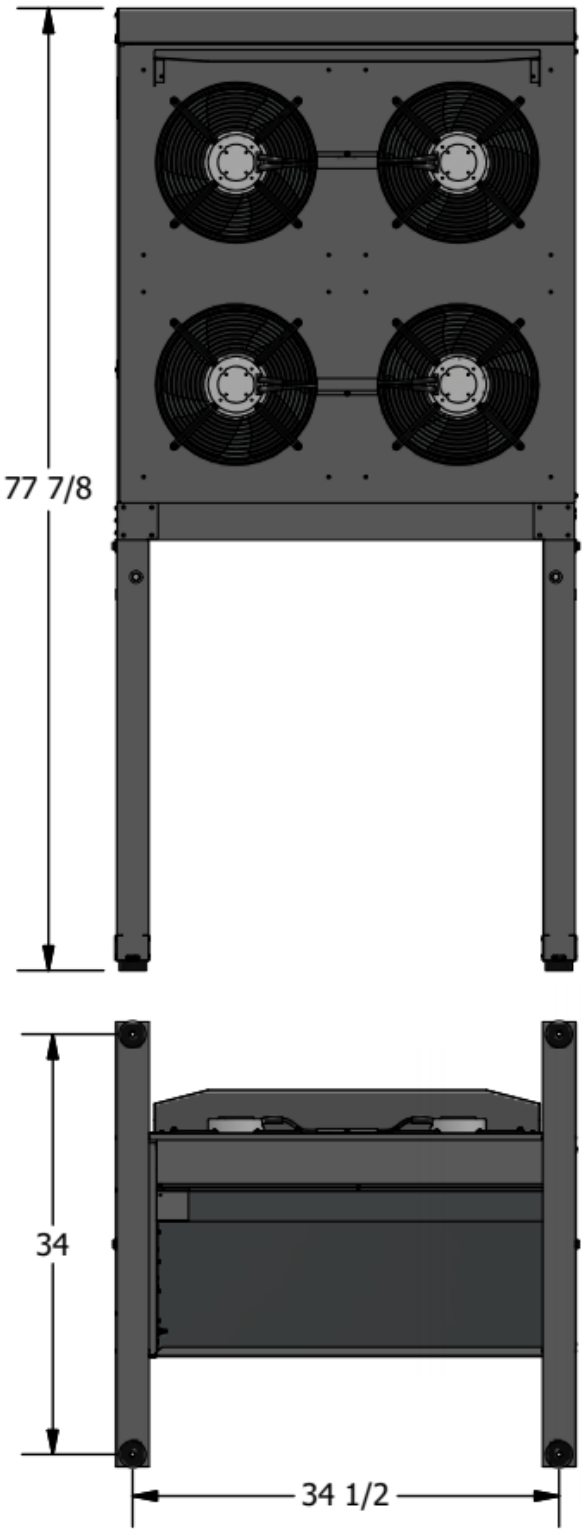


Dimensions: ATWC-45/55

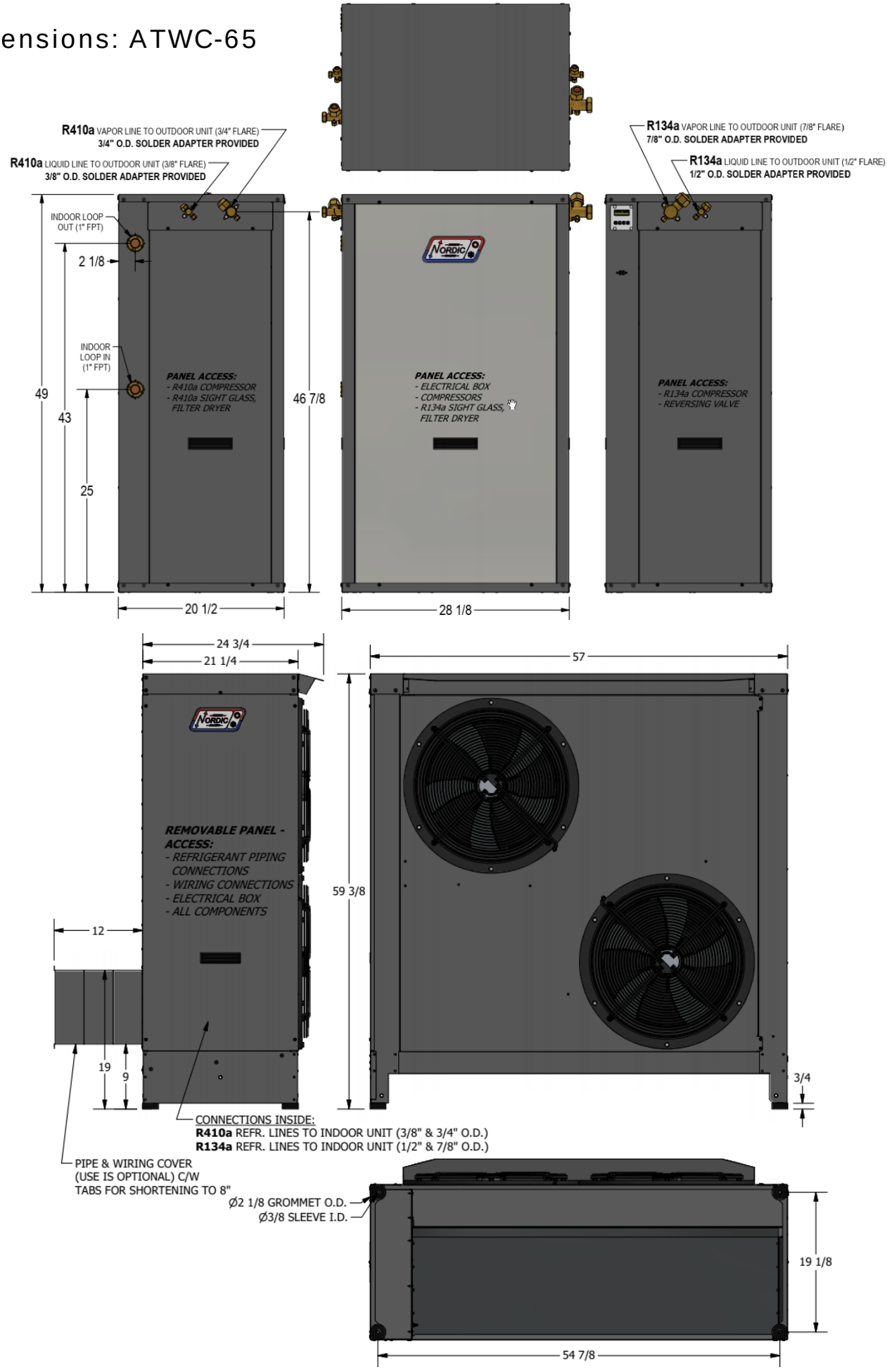
WITH LEG KIT



WITH TALL LEG KIT

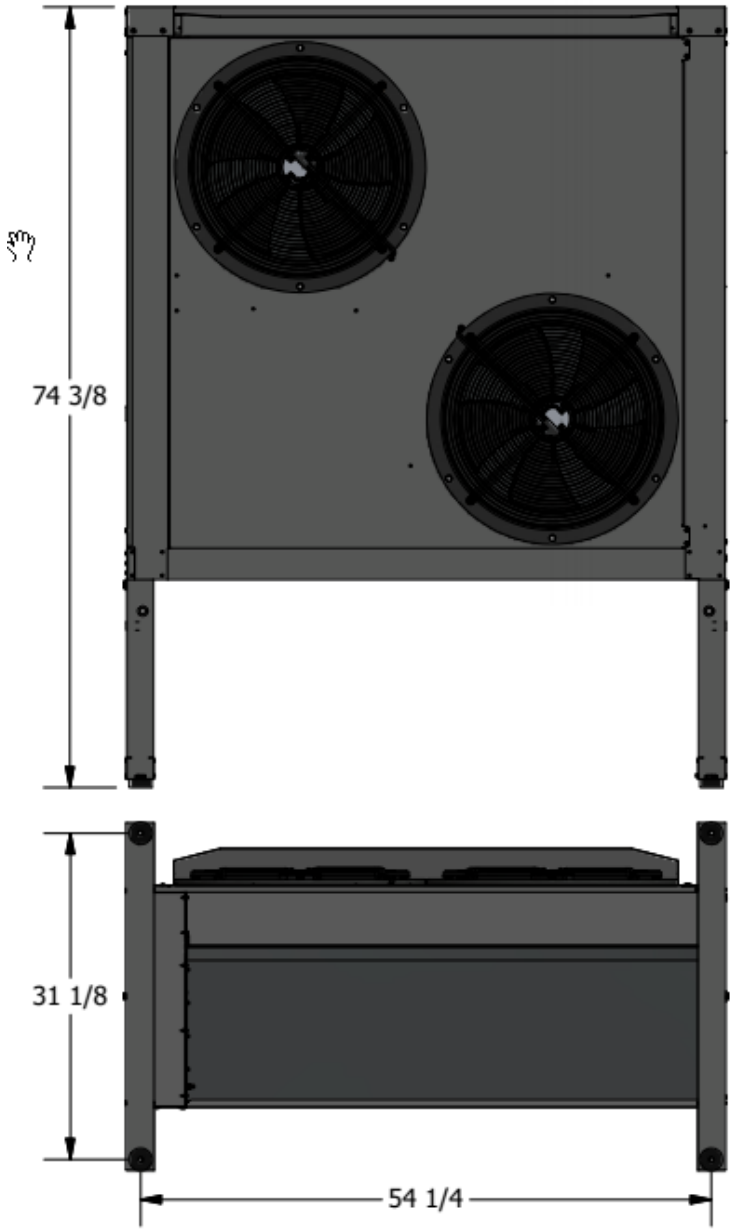


Dimensions: ATWC-65



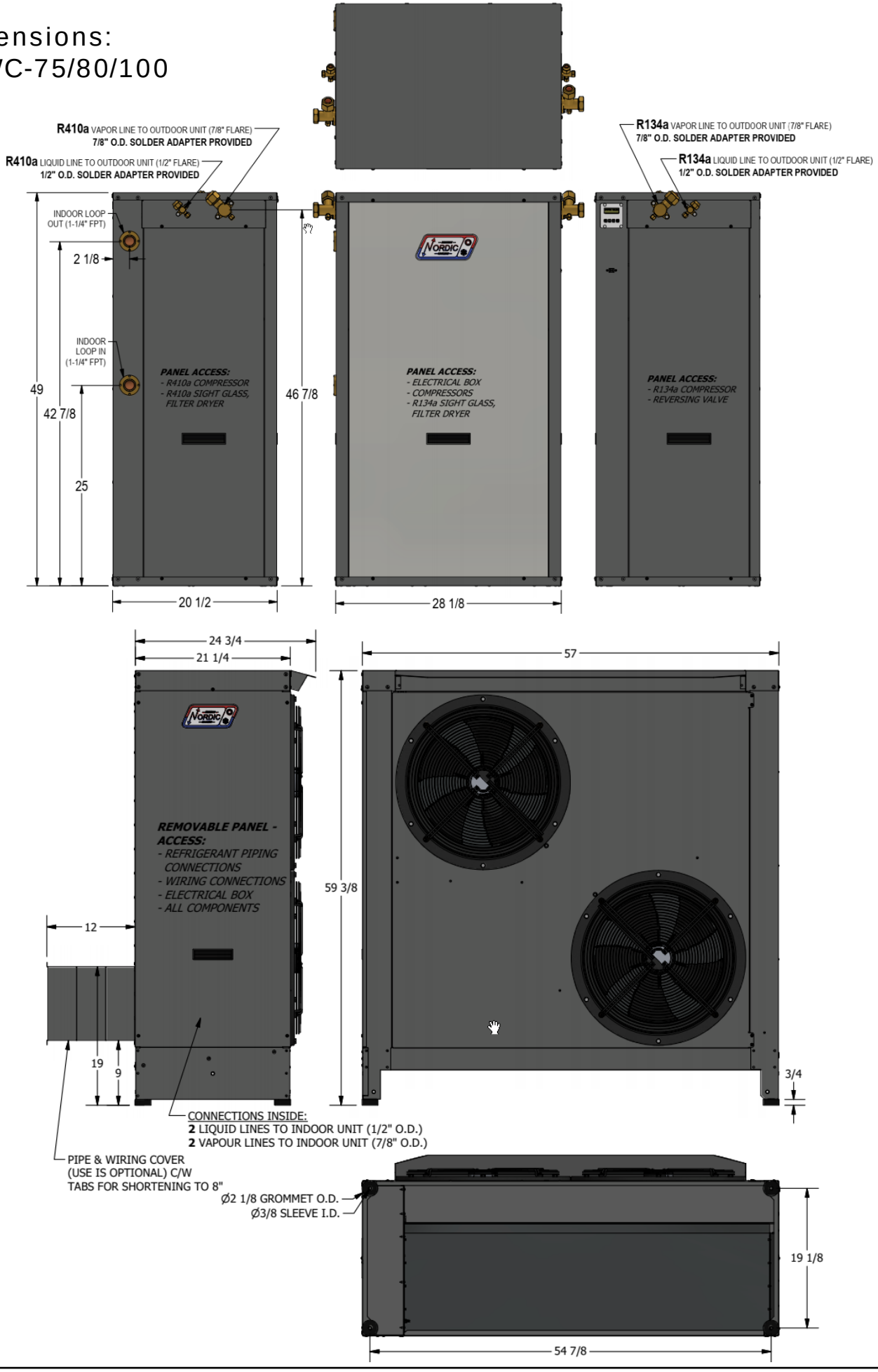
Dimensions: ATWC-65

WITH LEG KIT



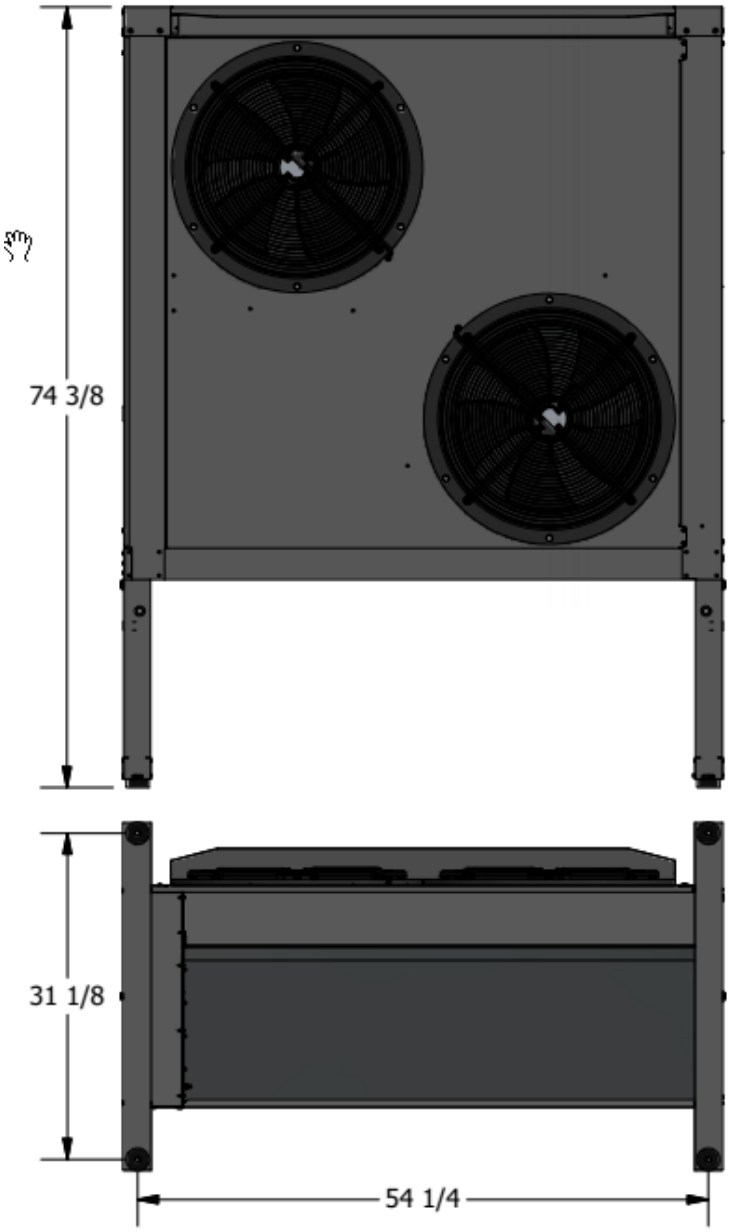
NOTE:
LEG KITS ARE ATTACHED WITH
SIX 3/8"x0.5" SS BOLTS &
SIX 3/8" SS WASHERS,
INCLUDED WITH KIT.

Dimensions:
ATWC-75/80/100



Dimensions:
ATWC-75/80/100

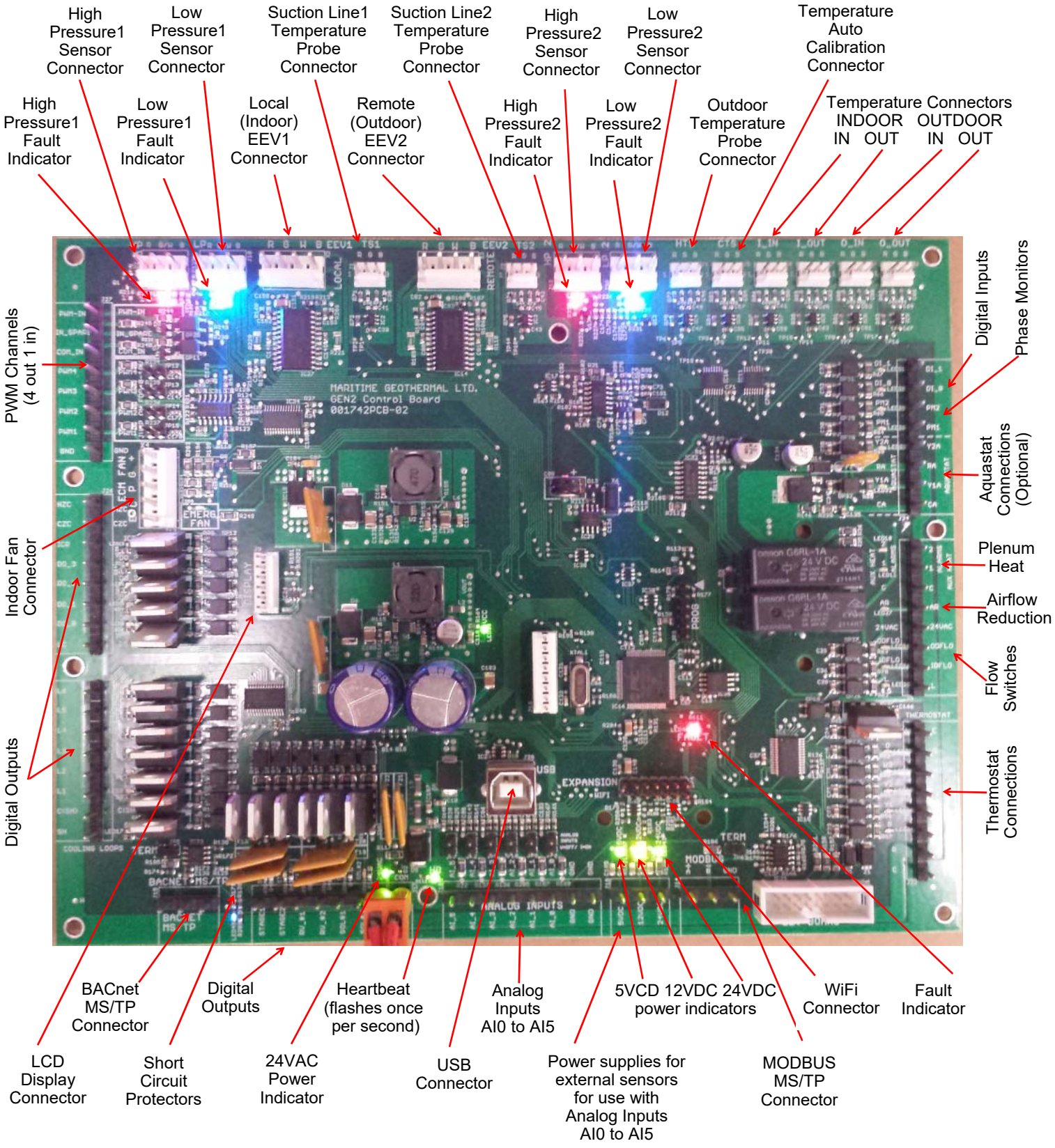
WITH LEG KIT



NOTE:
LEG KITS ARE ATTACHED WITH
SIX 3/8"x0.5" SS BOLTS &
SIX 3/8" SS WASHERS,
INCLUDED WITH KIT.

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	Mounted in indoor unit, measures R410a discharge pressure.
LPS1/LO1	Low Pressure Sensor 1	Mounted in indoor unit, measures R410a suction pressure.
EEV1	Local EEV	Unused (all unipolar EEV's controlled through MODBUS boards)
TS1	Suction Line Temperature 1	Mounted to R410a indoor unit common suction line.
EEV2	Remote EEV	Unused (all unipolar EEV's controlled through MODBUS boards)
TS2	Suction Line Temperature 2	Mounted to R134a indoor unit common suction line.
HPS2/HI2	High Pressure Sensor 2	Mounted in indoor unit, measures R134a discharge pressure.
LPS2/LO2	Low Pressure Sensor 2	Mounted in indoor unit, measures R134a suction pressure.
HTS/ODTS	Outdoor Temperature	Unused (outdoor temperature acquired through outdoor MODBUS board)
CTS	Auto Calibration	Resistor in connector for auto-calibration reference (32°F—0°C).
I_IN	Indoor Loop IN	Mounted to pipe inside unit.
I_OUT	Indoor Loop OUT	Mounted to pipe inside unit.
O_IN	Outdoor Loop IN	Unused.
O_OUT	Outdoor Loop OUT	Unused.

TABLE A2 - Control Board Connector Descriptions (Left Side)		
Name	**Description**	
PWM_IN	Signal for PWM IN	Unused.
IN_SPARE	Spare digital input	Switch or dry contact from 12VDC to disable unit (also COM_IN to GND).
COM_IN	Common for PWM IN	Jumper to GND for disable functionality.
PWM4	PWM / 0-10VDC output	Unused.
PWM3	PWM / 0-10VDC output	Unused.
PWM2	PWM / 0-10VDC output	Unused.
PWM1	PWM / 0-10VDC output	Unused (PWM sent to outdoor fan through outdoor MODBUS board).
GND	Ground	Jumper to COM_IN for disable functionality.
HZC	Hot Zone Circulator	Unused.
CZC	Cold Zone Circulator	Unused.
ICR	Internal Circulator Relay	Operates the Indoor Circulator.
DO_3	AUX_ONLY	Output OFF when auxiliary to be run without compressor; operates H1-H2.
DO_2	HYD_AUX	ON when hydronic auxiliary ON (Setpoint Control only).
DO_1	Digital output	Unused.
DO_0	Digital output	Unused.
LC	Loop common (ground)	Ground.
L6	Loop6	Unused.
L5	Loop5	Unused.
L4	NOT_HYD_AUX	Output OFF when auxiliary heat required; operates D1-D2 dry contacts.
L3	TWO_TANK_3_WAY	Energizes 3-way valve to direct flow to cold tank when using HTS/CTS with 2 tanks
L2	Loop2	Unused.
L1	Loop1	ON when outdoor fan is operating.
C(SH)	Soaker Hose common	Ground for SH pin.
SH	Soaker Hose	Defrost indicator: ON when unit in defrost mode.

TABLE A3 - Control Board Connector Descriptions (Bottom)		
Name	**Description**	
GND	BACnet MS/TP	Ground for shield if required.
B	BACnet MS/TP	RS-485.
A	BACnet MS/TP	RS-485.
STAGE1	Compressor Stage 1	Starts / stops the R410a compressor.
STAGE2	Compressor Stage 2	Starts / stops the R134a compressor.
RV#1	Reversing Valve#1	Unused.
RV#2	Reversing Valve#2	R134a reversing valve: OFF in heating mode, ON in cooling mode.
SOL#1	Solenoid#1	Unused.
SOL#2	Solenoid#2	NC1 solenoid valve coil: OFF in cascade heating mode, ON in other modes
24VAC	Power supply for board	24VAC power for control board.
COM	Power supply for board	GND for control board.
AI_5	Analog In Channel 5	Optional type 3/7 10k hot tank temperature sensor for HTS/CTS Setpoint Control.
AI_4	Analog In Channel 4	Optional type 3/7 10k cold tank temperature sensor for HTS/CTS Setpoint Control.
AI_3	Analog In Channel 3	0 to 5VDC or 4-20mA user settable with board jumper.
AI_2	Analog In Channel 2	0 to 5VDC or 4-20mA user settable with board jumper.
AI_1	Analog In Channel 1	R134a compressor current sensor.
AI_0	Analog In Channel 0	R410a compressor current sensor.
GND	Ground pin	Ground for analog sensors.
GND	Ground pin	Ground for analog sensors.
5VDC	Power for analog sensors	Provides 5VDC regulated power supply for sensors.
12VDC	Power for analog sensors	Provides 12VDC regulated power supply for indoor & outdoor MODBUS boards.
24VDC	Power for analog sensors	Provides 24VDC unregulated power supply for sensors.
A	MODBUS	RS-485 for indoor & outdoor MODBUS boards.
B	MODBUS	RS-485 for indoor & outdoor MODBUS boards.
GND	MODBUS	Unused.

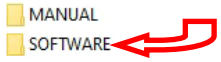
TABLE A4 - Control Board Connector Descriptions (Right Side)		
Name	**Description**	
DI_1	Digital Input1	Unused.
DI_0	Digital Input0	Unused.
PM2	Phase Monitor2	Switch or dry contact from R to activate Summer Setback mode.
PM1	Phase Monitor1	Unused.
Y2A	Aquastat Stage2	Unused.
RA*	Aquastat Power (24VAC)	Optional 24VAC power supply for aquastat used with Signals/Hardwired control.
Y1A*	Aquastat Stage1	Optional stage 1 24VAC input for use with Signals/Hardwired control.
CA*	Aquastat Power (Ground)	Optional 24VAC ground for aquastat used with Signals/Hardwired control.
2	Stage 2 alarm	Dry contact to indicate R134a circuit alarm, used with C
1	Stage 1 alarm	Dry contact to indicate R410a circuit alarm, used with C
C	Alarm Common	Used with 2 and 1 above.
AR	Airflow Reductions	Unused.
24VAC	Power	24VAC to indoor flow switch.
ODFLO	Outdoor Flow Switch	Unused.
IDFLO	Indoor Flow Switch	Return signal from indoor loop flow switch.
L	Thermostat Lockout Indicator	24VAC output for trouble LED
E	Thermostat Emergency Heat	Unused.
O	Thermostat Heat/Cool	24VAC input from external dry contact via terminal strip; activates cooling mode.
W2	Thermostat Auxiliary Heat	Unused.
Y2	Thermostat Stage2	Unused.
Y1	Thermostat Stage1	Unused.
G	Thermostat Fan Recirculation	Unused.
R	Thermostat Power (24VAC)	Unused.
C	Thermostat Power (Ground)	Unused.

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

Appendix B - USB Driver Installation

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 should be compatible, but Windows 10 (as found on any recent laptop computer) is recommended.

The easiest way to install the USB driver is from the **USB drive included with the unit**. Insert the USB stick into a Windows computer, and open a File Explorer window to view its contents:

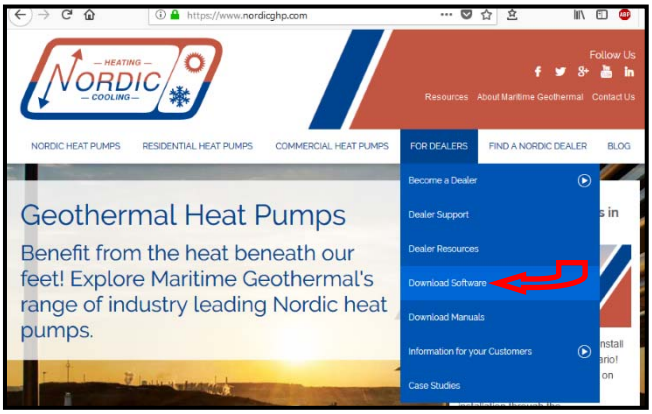


Double click on the SOFTWARE folder to show its contents:

Double click on **Step 1** to install the USB driver, clicking "allow" or "yes" as required.

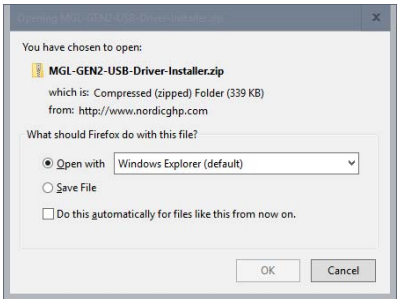
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

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

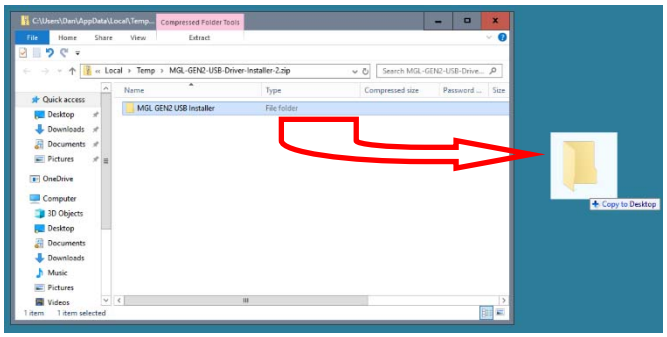


2. Click on **MGL GEN2 USB Driver Installer** to download it:

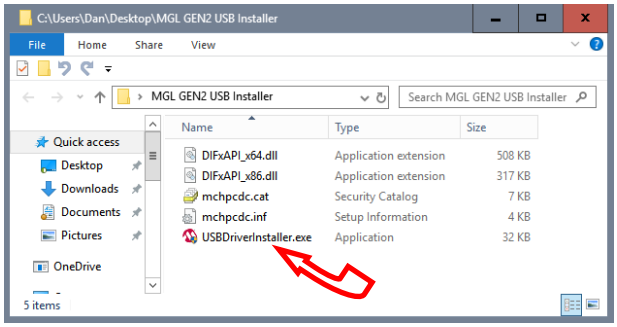
3. Choose "Open with Windows Explorer", and hit "OK":



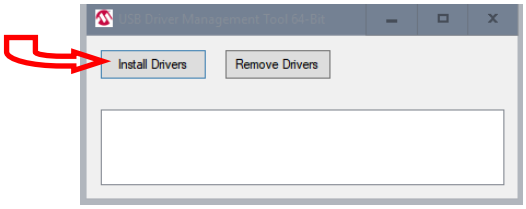
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



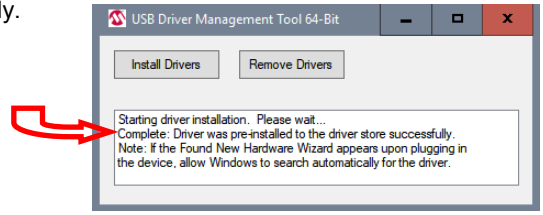
5. Double click on the folder you just dragged onto the desktop, then double click on the "USBDriverInstaller" file:



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



7. You will see a message indicating the driver was installed successfully.

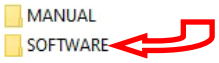


8. You are now ready to install the PC App.

Appendix C - PC App Installation

The PC App allows detailed interfacing with the control board using a Windows laptop computer. Any Windows from XP and onwards should be compatible, but Windows 10 (as found on any recent laptop computer) is recommended. First, install the USB driver as per the previous appendix.

The easiest way to install the Pc App is from the **USB drive included with the unit**. Insert the USB stick into a Windows computer, and open a File Explorer window to view its contents:

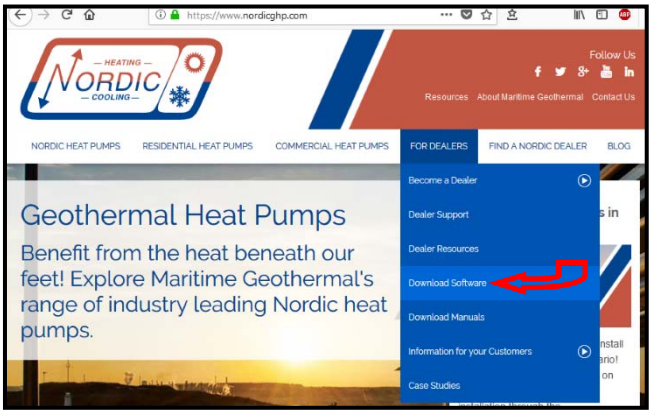


Double click on the SOFTWARE folder to show its contents:

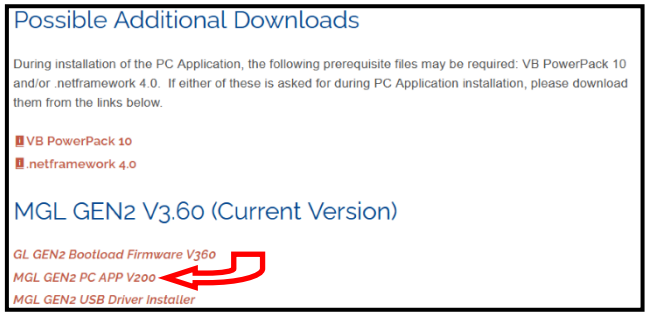
Double click on **Step 2** and follow the prompts, clicking "allow" or "yes" as required. If you get a warning that .NET framework is required, go back and double click on step **z**, then try **Step 2** again.

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

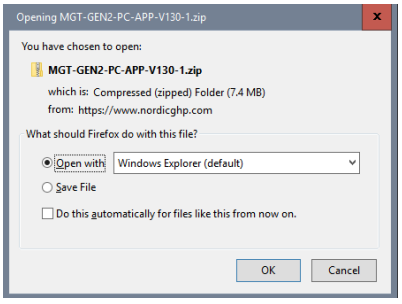
1. Go to www.nordicghp.com, Download Software page:



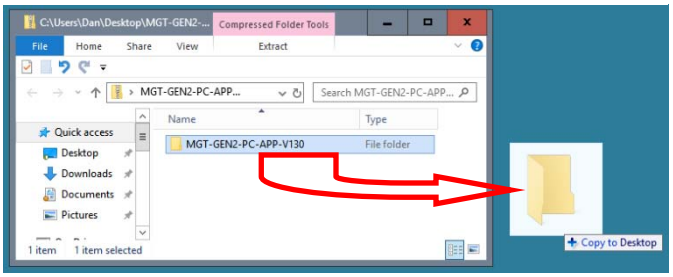
2. Click on **MGL GEN2 PC APP V2__** to download it:



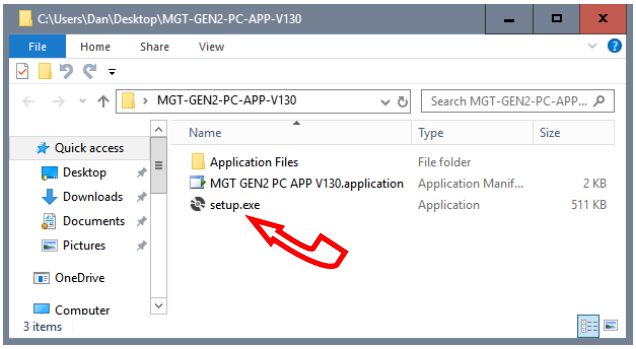
3. Choose "Open with Windows Explorer", and hit "OK":



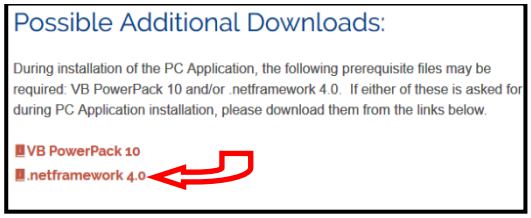
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



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



6. Click "Yes", "Run", "Install", or similar on any warning windows which pop up. If an error message is encountered regarding .NET framework, exit the installation and use the link on the Download Software page to install the missing item:



Then go back to step 5.

7. The PC App will open when it is finished installing. You are now ready to connect a USB cord between the laptop computer and GEN2 control board, and connect.

Appendix D: Updating Firmware

The firmware comes as a .ZIP file named:
MGL GEN2 Bootload Firmware Vxxx.zip
where xxx is the version reference, e.g. 400 (version 4.00).
This file can be downloaded from **www.nordicghp.com**, menu *For Dealers --> Download Software*.

1. Download the file to your PC. When prompted, "Open" the zip file. If the zip file is *Saved* instead of *Opened*, find it in the web browser's Downloads list or at the bottom of browser window and click on it to open. In the window that comes up, drag the folder containing the required files onto your desktop so that it can be found easily, e.g.:

   \Desktop\MGL GEN2 Bootload Firmware V400

   Also be sure the latest PC App version is installed, which is listed alongside the firmware on the web page. If needed, install a new version as per those instructions, and uninstall older PC App versions to avoid their accidental use (which can corrupt control board parameters).

2. In that folder on the Desktop, there will be three files:

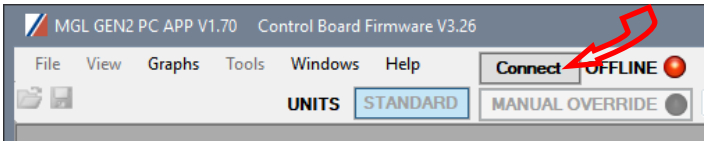
MGL_GEN2_V400.production.hex	(firmware file)
PIC32UBL.exe	(the programmer)
USB Bootloader Instructions.pdf	(these instructions)

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

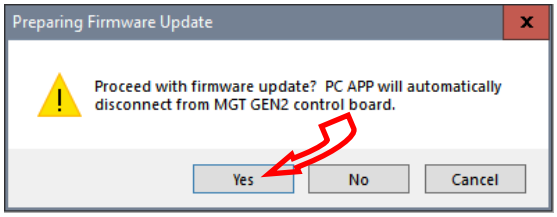
3. Connect a USB (printer) cable between computer and control board.

4. Launch the PC App version that matches the firmware (e.g. PC App 2.20 for firmware V4.00). After it is installed, the PC App can be started using the entry found under the "M" section in the Windows **START** menu, which is accessed using the 4-rectangles icon normally found at the bottom left corner of the computer screen.

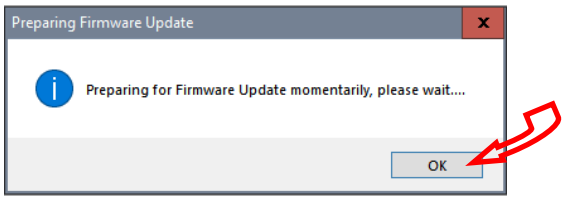
5. In the PC App, click on the **Connect** button to connect to the control board.



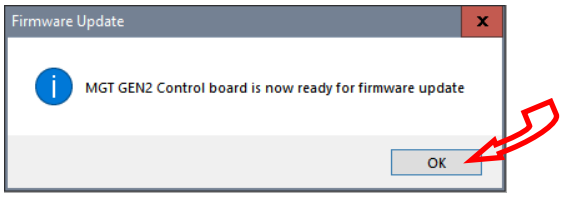
6. Go to menu **Tools --> Update Firmware**. The following message box will appear:



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

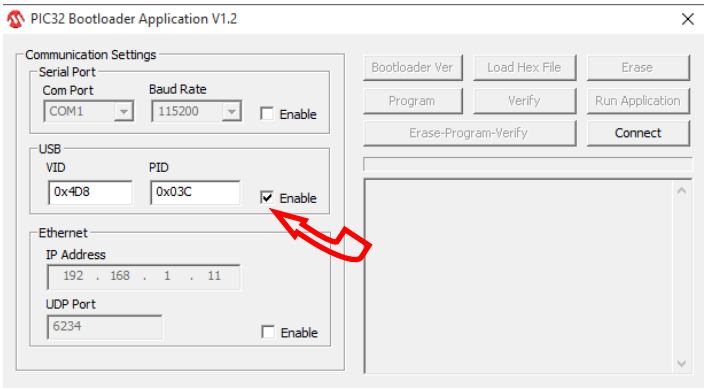


8. Click on **OK**. After a minute, the following message box will appear:

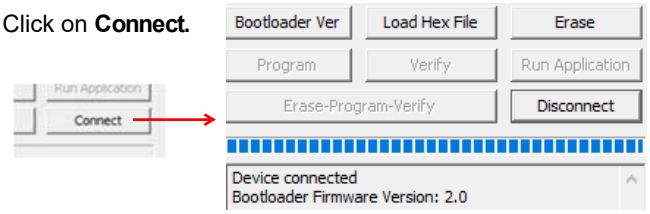


9. Click on **OK**. The control board is now in bootloader mode and is ready to be programmed.

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

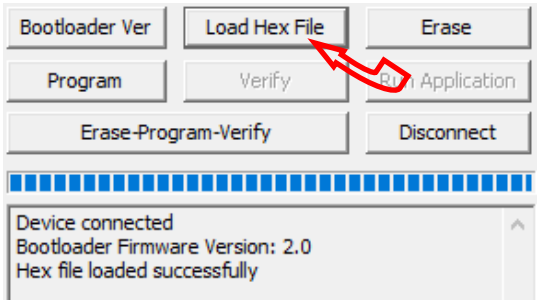


11. Click on **Connect.**

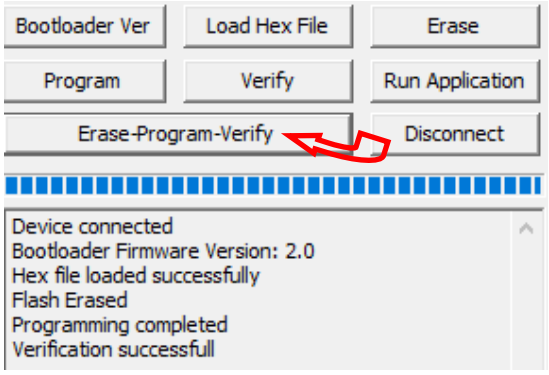


*If device fails to connect and an error message is displayed, the board's bootloader may be older than v2.0. It will be necessary to instead update the firmware via jumper pins (**METHOD 2**), as per the next section.*

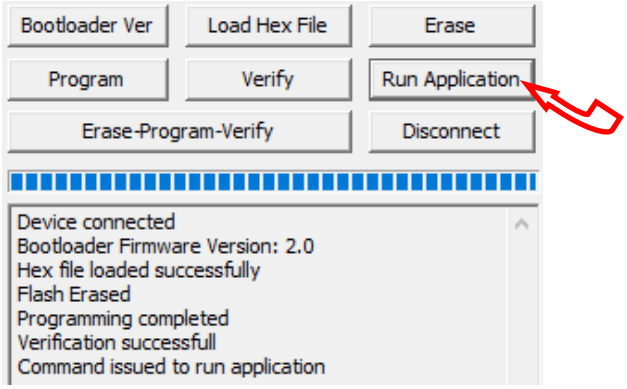
12. Click on **Load Hex File**. Select the *MGL_GEN2_V400.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.



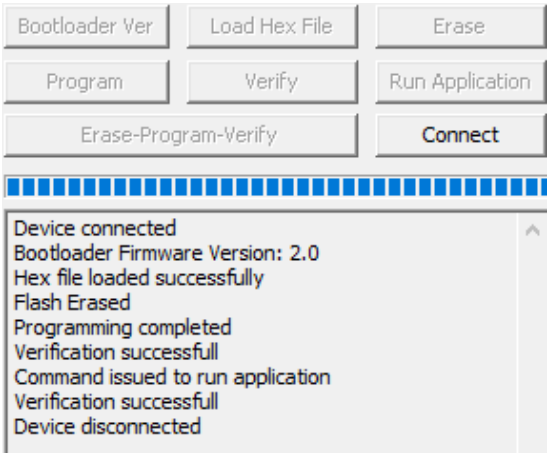
13. Click on **Erase—Program—Verify.** Programming…. Wait while status bar shows progress. The messages should read as below when finished:



11. "Programming completed. Verification successful." Click on **Run Application.** This will take the control board out of bootloader mode and back into normal operational mode, so that the PC App can connect again.



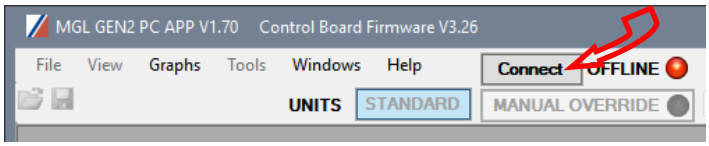
15. **Wait until the programmer disconnects itself.** The messages should read as follows:



16. Close the PIC32 program.

17. **WAIT APPROXIMATELY 10 SECONDS.** This gives the control board time to reset, initialize and re-connect to the PC USB port.

18. Go back to the PC APP and click on the **Connect** button. Verify that the firmware version, shown in the title bar after connection, has been updated. Perform any configuration needed.

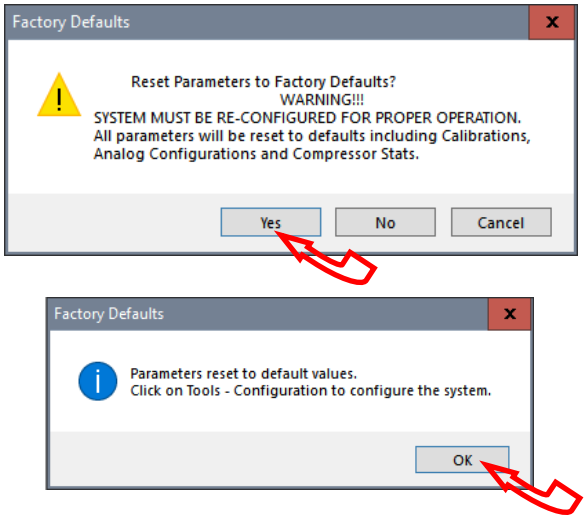


NOTE: Updating the firmware does not affect the configuration settings.

Reset to Defaults

These steps may be performed for troubleshooting, when the control system is not acting as it should.

1. With PC App connected, go to menu **Tools --> Configuration** and note all settings. They will need to be re-set later.
2. Go to menu **Tools --> Reset To Factory Defaults.** Click **YES** in the pop up window, and OK in the next window.



3. Go back to menu **Tools --> Configuration**. Re-select the Model Series even if it already indicates the proper series, as clicking on it will load the parameters for that series.
4. Select the Model Size and make any other changes that apply to the particular system setup such as number of stages, control method, etc.

Warranty: ATWC-Series

COMMERCIAL LIMITED EXPRESS WARRANTY

Unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd. ("MG") or its representatives relating to MG's products, whether oral, written or contained in any sales literature, catalogue or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely MG's opinion or commendation of MG's products.
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LIMITED EXPRESS COMMERCIAL WARRANTY - PARTS
MG warrants its Commercial Class products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows:
(1) Air conditioning, heating and/or heat pump units built or sold by MG ("MG Units") for one (1) year from the Warranty Inception Date (as defined below).
(2) Thermostats, auxiliary electric heaters and geothermal pumping modules built or sold by MG, when installed with MG Units, for five (5) years from the Warranty Inception Date (as defined below).
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for one (1) year from the Warranty Inception Date (as defined below).
(4) Other accessories, when purchased separately, for (1) year from the date of shipment from MG.

The "Warranty Inception Date" shall be the date of original unit installation, as per the date on the installation Startup Record; or sixty (60) days from date of unit shipment from MG, whichever comes first.

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

LIMITED EXPRESS COMMERCIAL WARRANTY - LABOUR
MARITIME GEOTHERMAL LTD. will not be responsible for any consequential damages or labour costs incurred.

This warranty does not cover and does not apply to:
(1) Air filters, fuses, refrigerant, fluids, oil.
(2) Products relocated after initial installation.
(3) Any portion or component of any system that is not supplied by MG, regardless of the cause of the failure of such portion or component.
(4) Products on which the unit identification tags or labels have been removed or defaced.
(5) Products on which payment to MG, or to the owner's seller or installing contractor, is in default.
(6) Products subjected to improper or inadequate installation, including but not limited to:
- Indoor or outdoor loop flow lower than listed in engineering specification or as expressly approved by MARITIME GEOTHERMAL LTD.
- Operating the heat pump either manually or with automated controls so that the unit is forced to function outside its normal operating range
- Disabling of safety controls
- Insufficient loop antifreeze concentration for loop temperature, or antifreeze concentration incorrectly set in control board
- Fouled heat exchangers due to poor water quality
- Failure to use strainers or clean them regularly
- Impact or physical damage sustained by the heat pump
- Poor refrigeration maintenance practices, including brazing without nitrogen flow, or using wrong braze/flux
- Incorrect voltage or missing phase supplied to unit
- Unit modified electrically or mechanically from factory supplied condition
- Water quality outside of recommended limits (e.g. salinity or pH)
- Unit not mounted with supplied anti-vibration grommets when specified for use
- Corrosion damage due to corrosive ambient environment
- Failure due to excessive cycling caused by improper mechanical setup or improperly programmed external controller
- Physical loads or pressures placed on unit from external equipment

(7) Mold, fungus or bacteria damage
(8) Corrosion or abrasion of the product.
(9) Products supplied by others.
(10) Electricity or fuel, or any increases or unrealized savings in same, for any reason whatsoever.

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

MG'S LIABILITY UNDER THE TERMS OF THIS LIMITED WARRANTY SHALL APPLY ONLY TO THE MG UNITS REGISTERED WITH MG THAT BEAR THE MODEL AND SERIAL NUMBERS STATED ON THE INSTALLATION START UP RECORD, AND MG SHALL NOT, IN ANY EVENT, BE LIABLE UNDER THE TERMS OF THIS LIMITED WARRANTY UNLESS THIS INSTALLATION START UP RECORD HAS BEEN ENDORSED BY OWNER & DEALER/INSTALLER AND RECIEVED BY MG LIMITED WITHIN 90 DAYS OF START UP.

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

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

OBTAINING WARRANTY PERFORMANCE
Normally, the dealer or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any MG recognized distributor, dealer or service organization. If assistance is required in obtaining warranty performance, write or call Maritime Geothermal Ltd.

NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province.