Application, Installation, & Service Manual

ATW-Series
Reversing Air to Water Heat Pump

Two-Stage R454b
Model Sizes 25-75

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LOOK FOR GREY TEXT BOXES LIKE THIS ONE THROUGHOUT MANUAL FOR
A2L-SPECIFIC WARNINGS / INSTRUCTIONS.

A2L refrigerant: mildly flammable.

Installation and service work should only be performed by properly certified technicians with A2L-specific training. See also Service Procedures chapter.

Refrigerant does NOT have an odour so is only detectable with suitable field instruments.

Do NOT pierce or burn. Do NOT use flame to defrost or clean. Check for presence of refrigerant using a detector before initiating any service work, especially work involving torches.

Unit equipped with electrically powered A2L leak detection system, so must be electrically powered at all times (other than during temporary outages or installation / service).

Installation of a unit with A2L refrigerant may require calculations involving the size of the mechanical room and/or rooms served by the unit. These calculations may affect installation procedures used and ventilation provided, and should be fully understood and considered to ensure code compliance.

Field installed piping should be kept to a minimum and protected from damage. See also Refrigeration Line Set chapter.

GENERAL SAFETY PRECAUTIONS

To avoid electric shock, which can cause serious injury or death, ensure all access panels are in place and properly secured before applying power to the unit. Before performing service or maintenance on the heat pump system, ensure all power sources are DISCONNECTED.

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.

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

This appliance is not intended for intervention by persons with reduced physical, sensory, or mental capabilities or lack of experience and knowledge, unless suitably supervised. Children should be prevented from playing with appliance.

Partial (split) refrigeration units comply with partial unit requirements of UL/IEC 60335-2-40, and must only be connected to similarly certified matching units specified by manufacturer.

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Model Nomenclature

ATW—75—HACW—X—1T—C—xx

Series:
ATW = Air To Water heat pump

Nominal Size:
25 = 020 compressor
45 = 030 compressor
55 = 040 compressor
65 = 051 compressor
75 = 060 compressor

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

Refrigerant:
X = R454b **[A2L]**

Revision:
01, 02 etc.

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

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

Voltage Code:
1 = 230-1-60 VAC
2 = 208-3-60 VAC
4 = 460-3-60 VAC

ACE—75—X—1/6—KDE—xx

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

Nominal Size:
25 = for AT_-25
45 = for AT_-45
55 = for AT_-55
65 = for AT_-65
75 = for AT_-75

Refrigerant:
X = R454b **[A2L]**

Revision:
01, 02 etc.

Fan Motor:
E = ECM (Variable Speed)

Fan Type:
D = Direct Drive

Air Coil:
S = Standard
K = Coated

Voltage Code:
1/6 = 220~277-1-50/60

APPLICATION/AVAILABILITY TABLE - INDOOR UNIT

MODEL SERIES	MODEL SIZE	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESSOR	INDOOR COIL	REVISIONS			
ATW	25 45 55 65 75	HACW	X	1 2 4	T	C Y Z	01			

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

APPLICATION/AVAILABILITY TABLE TABLE - OUTDOOR UNIT

MODEL SERIES	MODEL SIZE	REFRIGERANT	VOLTAGE	AIR COIL	BLOWER TYPE	BLOWER MOTOR	REVISIONS			
ACE	25 45 55 65 75	X	1/6	K	D	E	01			

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

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

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ATW System Description

General Overview

The **Nordic ATW-Series** heat pump is an air source heat pump with a history of over 10 years that can heat or cool water for a hydronic heating/cooling system. Applications include in-floor heating, heating through low-temperature radiators, pre-heating domestic hot water through the use of an indirect tank with hydronic coil, and heating/cooling via hydronic air handlers.

Being an air source heat pump, it uses an outdoor fan unit to exchange heat with the outdoor air. Unlike most or all other air to water heat pumps on the market, the Nordic ATW is a **split** system with separate indoor and outdoor units rather than a single unit **outdoor monoblock** system.

So unlike in competing units, there is an outdoor unit containing only an air coil, ECM hub motor fan, expansion valve (EEV), and outdoor temperature sensor. All other components, including compressor and all electronics, 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, no electric compressor heater is required, and directly heating domestic hot water is possible (through a desuperheater circuit) since the fresh water lines are indoors and will never freeze.

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.

In additional to the main hydronic water heating/cooling functions, there is a double-wall desuperheater for pre-heating domestic hot water with ~5% of the heat pump's capacity. This function is only active when the heat pump is running for space heating or cooling purposes. An energy-efficient bronze head ECM circ pump for the desuperheater circuit is built in, along with a temperature control to turn the pump off when the DHW temperature reaches 140°F/60°C.

The ATW uses a 2-stage scroll compressor. The outdoor air coil is e-coated for corrosion protection, and the coaxial hydronic heat exchanger is copper / steel with optional CuNi inner tube available for applications where water quality may be an issue. The cabinet is galvanized and powder coated. 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.

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; refer to the ***Defrost Operation*** section below. Refrigerant flow is controlled by the EEV located in the outdoor unit while the EEV in the indoor unit is fully open.

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 3 temperature control (stages 1 & 2 being the two compressor stages). 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. Refrigerant flow is controlled by the EEV located in the indoor unit while the EEV in the outdoor unit is fully open. There is no defrost cycle in cooling mode.

The outdoor fan is controlled based on the discharge pressure. During operation, the fan speed will automatically adjust up or down to in order to maintain a discharge pressure value.

* *See **Piping** chapter for an annotated copy of this diagram*

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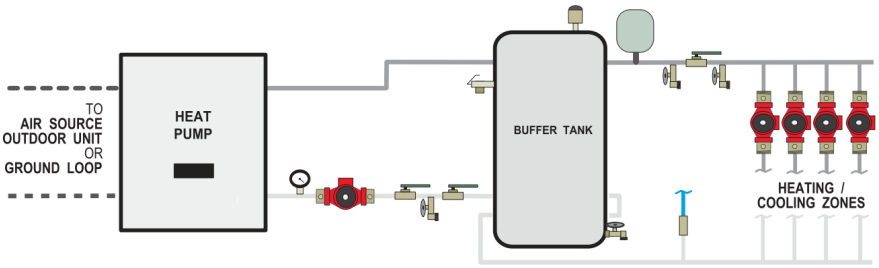
One or Two Buffer Tanks?

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

Single Buffer Tank Systems

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

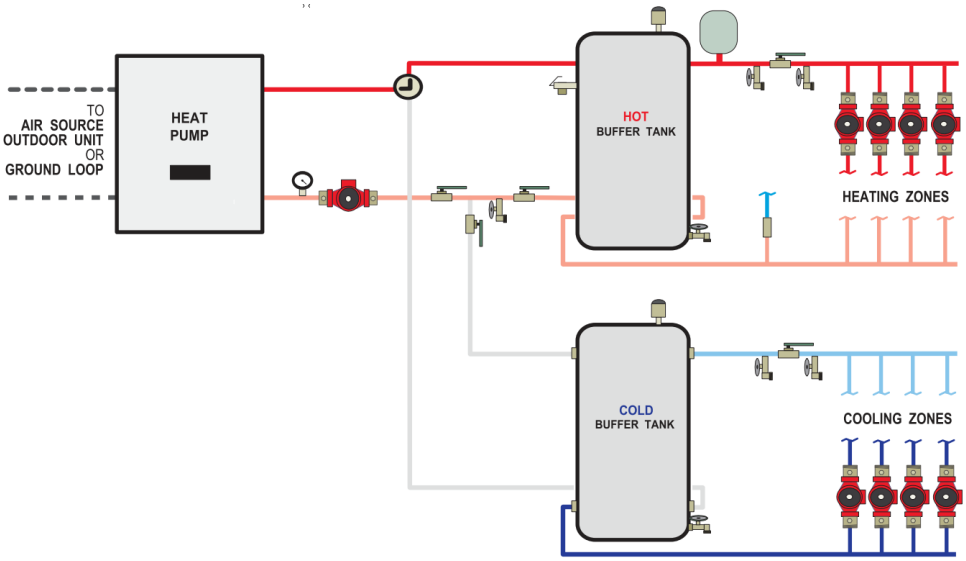


Advantages	Drawbacks
Simplest piping and control.	Seasonal switchover from heating to cooling required, either automatically through a zone controller or via a manual switch.
Is the go-to option for heating-only systems.	Simultaneous heating and cooling is not possible; heating and cooling in close proximity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

Dual Buffer Tank Systems

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

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



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

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ATW Sizing

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

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
25	800	75
45	1,400	130
55	2,000	185
65	2,600	240
75	3,100	290

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 an indoor water temperature of **105°F (40.5°C)** for concrete in-floor heating or **120°F (49°C)** for other heating types. 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.

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
25	7 kW	12 kW (50 gal)
45	10 kW	12 kW (50 gal)
55	12 kW	15 kW (70 gal)
65	15 kW	15 kW (70 gal)
75	20 kW	20 kW (70 gal)

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 3** by the heat pump as described in the **Wiring** section, and piped in a parallel arrangement as per the diagram in the **Piping** section.

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Installation Basics

***A2L*-SPECIFIC WARNING / INSTRUCTION**

These units use **R454b**, an **A2L** refrigerant which is a classification meaning “mildly flammable”.

Safety measures to mitigate **A2L** refrigerant leaks are outlined in standard **UL/CSA 60335-2-40** and also **CSA B52:23.**

*It is highly recommended that a **mechanical consulting engineer** be involved in any project involving **A2L** refrigerating units, whether for new installation or replacement of non-A2L units.* This is because the mechanical room requirements can be onerous and also difficult to decipher for the layperson.

The heat pump can be considered an “enhanced tightness refrigerating system” with refrigerant charge $m_1 < m_c < m_2$ for the purposes of UL/CSA 60335-2-40, clause GG.10.

A2L heat pumps like these with refrigerant charge $>m_1$ (as defined by UL/CSA 60335-2-40) are equipped with a refrigerant detector. In case refrigerant is detected inside the enclosure, the heat pump will shut down and display a permanent alarm as well as activate a 24VAC control board output. This output signal can be used to activate external fans or alarms when such action is required by codes.

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

For air to water models, the placement of the unit has negligible effect on the operation and efficiency of the system. It is recommended that the unit be placed near where the interconnect piping to the outdoor unit will be to keep the piping distance to a minimum. See the 3D diagram in the **Piping** section for a detailed typical component layout.

The front and right side access panels should remain clear of obstruction for a distance of **two feet** to facilitate servicing and general maintenance. Left side access is optional (since the compressor may be accessed by swinging out the front-side electrical box), and 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.

* *See **Piping** chapter for an annotated copy of this diagram*

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Outdoor Unit Placement

The ACE unit must be placed outdoors, with the fan pointing away from the building.

Since there is no drip tray and defrost condensate will drip straight down under the unit, it should be mounted where **moisture or ice under the unit will not be considered to be unsightly**, as might be the case on a paved walkway to the front door. Also, **multiple outdoor units should not be stacked** due to the certainty that defrost condensate from the upper unit with fall onto the lower unit and cause ice encasement. (Note that the lack of a drip tray is an intentional design feature that dramatically improves longevity of the outdoor heat exchanger.)

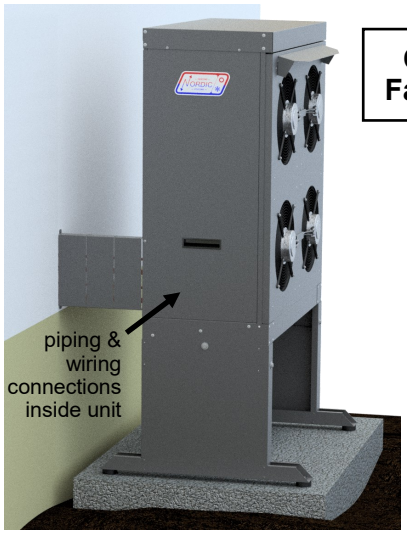
For ACE-65/75, there is a detachable cover for the piping and wiring which automatically places the unit **12 inches (30 cm)** away from the building, which is the recommended spacing. If necessary, the unit can be placed **8 inches (20 cm)** from the building: the cover can be shortened by cutting the 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 or screwed down** to prevent a tipping hazard. See next section.

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

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



Outdoor Unit Fan Orientation

***A2L*-SPECIFIC WARNING / INSTRUCTION**

The ACE unit must be located outdoors, since it is not equipped with a refrigerant leak sensor.

All field installed refrigerant piping must be in accordance with instructions in **Refrigerant Line Set** chapter.

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).

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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.

There are several ways to accomplish this. First, look up how much snowfall is expected in your area, either from local knowledge or weather data. The snowfall map included on next page can be used as a rough guide for Canada.

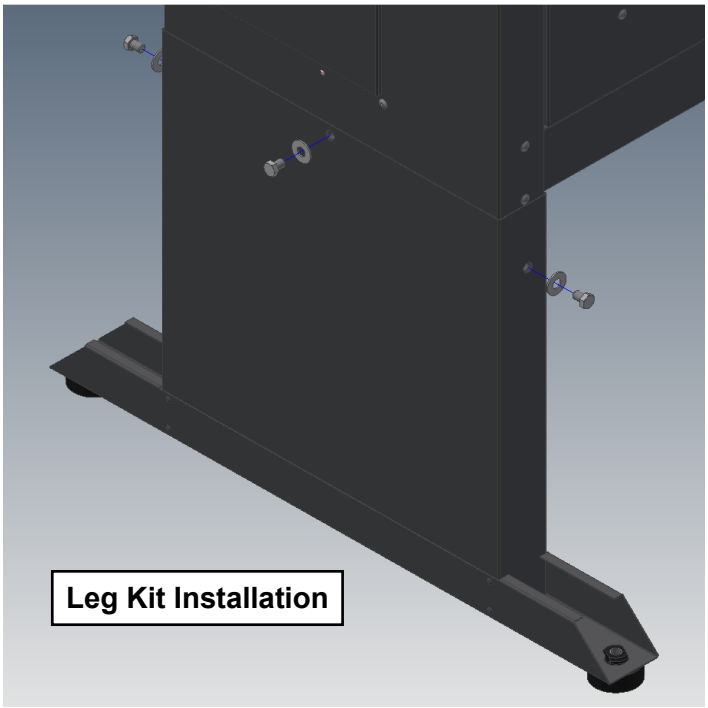
1. If there is less than ~4" (10 cm) of snow accumulation expected, the unit could be mounted directly on a concrete pad. This is **not recommended** in cold climates, since ongoing care would be required to ensure re-frozen condensate does not build up under unit.
2. The unit can be mounted on angle 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:

ACE-25/45/55 - first remove the three bolts with flat washers that hold each foot plate in place. Leaving the foot plate in place on the inside of the cabinet panel, slide the leg over the outside of the panel and re-install the three bolts and flat washers.

ACE-65/75 -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

Sample Bill of Materials - ATW Series

FROM MARITIME GEOTHERMAL
- ATW SERIES HEAT PUMP W/ACE OUTDOOR UNIT
- SHIELDED 18-8 WIRE
- BUFFER TANK W/ELEMENTS 12/15/20 kW

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

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

ELECTRICAL
- HEAT PUMP SERVICE WIRE: 6-3, 8-3, OR 10-3
- BUFFER TANK ELEMENT SERVICE WIRE
- 14-2 OUTDOOR RATED WIRE W/ DISCONNECT SWITCH FOR OUTDOOR UNIT
- HEAT PUMP BREAKER
- 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 R454B REFRIGERANT FOR LINESETS >20 FT

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

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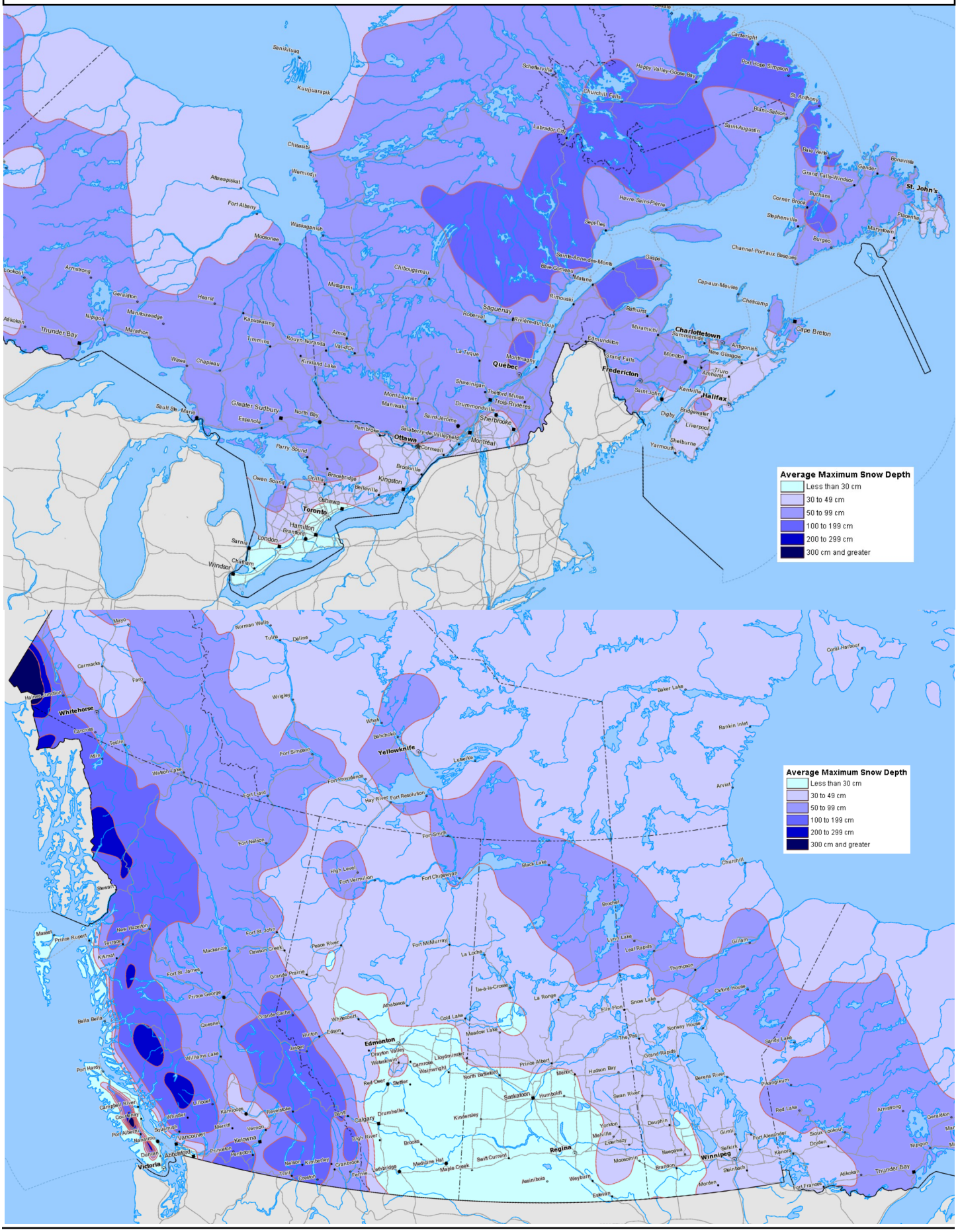
Average Maximum Snow Depth - Canada (1979-1997)

Source: Natural Resources Canada



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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 1.093" / 0.875" knockout for main power supply connection to the electrical box. There are also five 7/8" knockouts and a 1/2" opening with plastic grommet (grommet hole is 3/8") for connections to circulation pumps, controls, optional aquastat, and power and signal connections to the outdoor unit.

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	208/230-1-60*, 208-3-60*, 460-3-60
GND	Ground	All (connect to ground lug)

* Only required if connecting 115VAC circulators.

Outdoor Unit: Power Connections

The ACE outdoor unit is powered from the indoor unit. The power supply for the ACE unit is 208 to 277VAC, 50/60Hz. The ATW and ACE 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 tank) so that it will be turned on whenever the compressor operates. Connect the circulator pump module to the appropriate terminal pair (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 *(requires **N** neutral connection to heat pump)*
115V	
230V	Connection for 230V circulator
230V	
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 in on 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

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.

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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 a 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, 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.

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

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 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, D2-CD, 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**
D1	**Hydronic Auxiliary dry contacts**
D2	
R	**Jumper R and D1**
D1	
D2	**24vac to actuate aux. heat contactor coil**
CD	**Contactor coil ground**
H1	**Hydronic Auxiliary ONLY dry contacts (for high temperature auxiliary heat)**
H2	
Use a 2-conductor 18ga cable.	

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Outdoor Unit: Signal Connections

The speed of the fan and the heating mode expansion valve (EEV) in the outdoor unit are controlled by the control board in the ATW indoor unit, and a temperature sensor is read. Therefore, communication wiring is required.

Connect the supplied 8 conductor **shielded outdoor rated cable** between the terminal strips in the indoor and outdoor units. **The shield ground wire 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 ground wire short at the cable sheath in the outdoor unit.

TABLE 10 - Outdoor Unit Signal Connections	
Signal	**Description**
EEVR	Electronic Expansion Valve (Red)
EEVG	Electronic Expansion Valve (Green)
EEVW	Electronic Expansion Valve (White)
EEVB	Electronic Expansion Valve (Black)
TR	Outdoor Temperature Sensor (Power)
TG	Outdoor Temperature Sensor (Signal)
TB	Outdoor Temperature Sensor (Ground)
PWM+	Outdoor Fan Control
Shield GND*	Cable shield: see note
Use provided 8 conductor *shielded* outdoor rated cable. * Connect only to the indoor unit. In the outdoor unit, leave this wire unconnected and cut it short at the cable sheath.	

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***.

The **CA, RA, Y1A, and Y2A** connections are located on the right side towards the top of the control board. The **O** terminal is found on the terminal strip (along with an alternate **R** and **C** connection). This is shown on the wiring (SCH) diagram in the **Model Specific Information** section. The external device needs to send the 24VAC signal from **RA** back to the **Y1A** and **Y2A** terminals to call for the two stages of hydronic heating, and **RA** 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)
CA	24VAC common (ground)
RA	24VAC hot
Y1A	Compressor ON (Part Load)
Y2A	Compressor bump up to Stage 2 (Full Load)
Use an 18ga cable.	

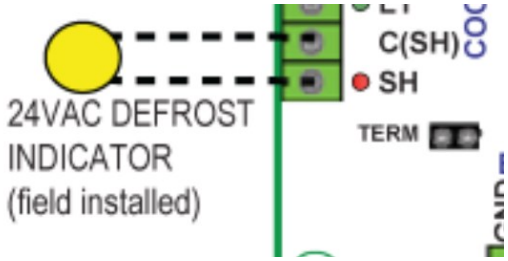
Disable Switch (field installed)

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.



Refrigerant Vent Fan Connections

A 24VAC board output (labelled SOL#2) is available for activating a ventilation fan or alarm in case refrigerant is detected inside the enclosure.

See wiring diagram in the **Model Specific Information** chapter.

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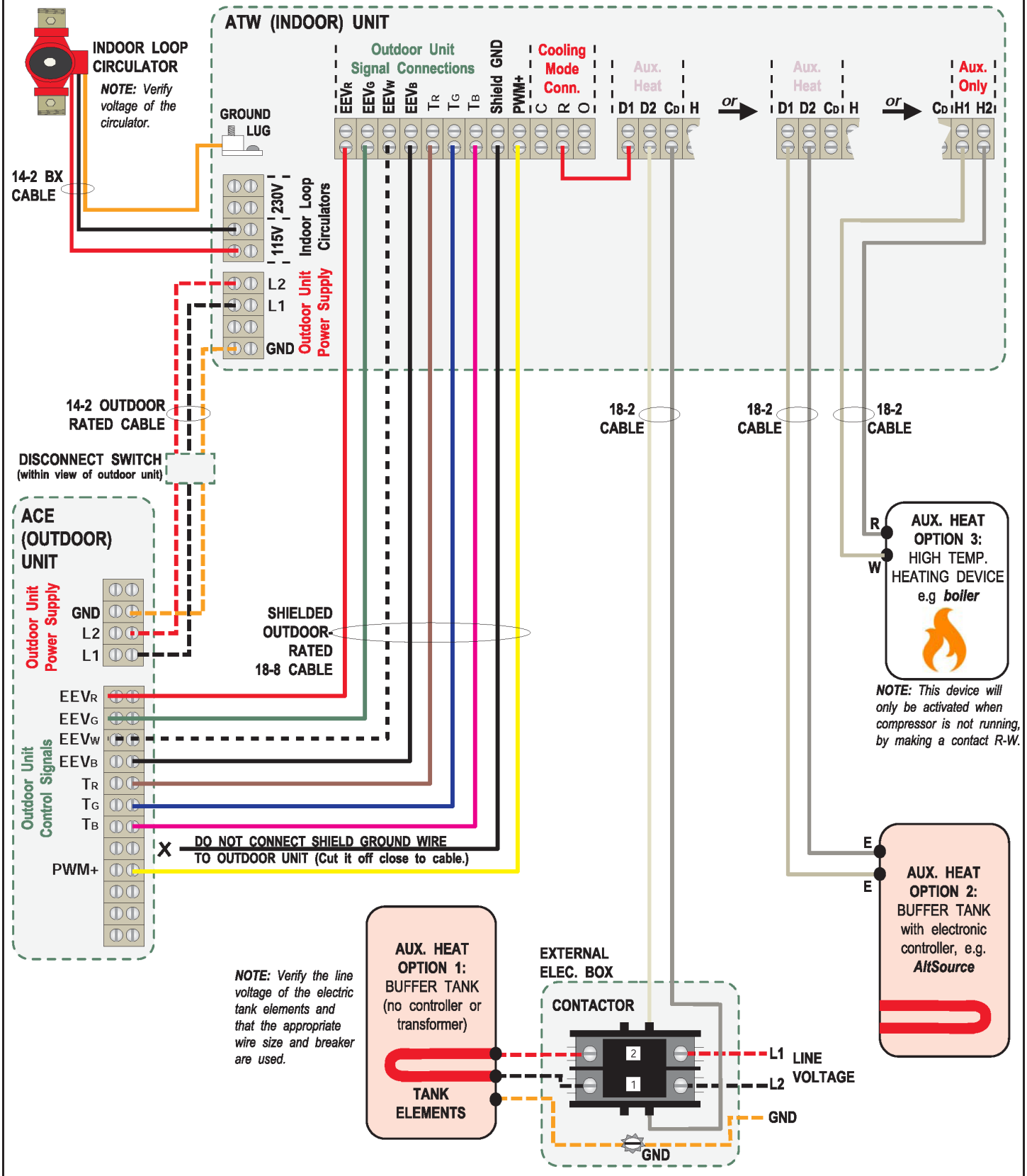
Typical ATW Series Outdoor Unit, Auxiliary Heat, and Circulator Wiring



REV	ECO #	IMPL BY	APVD BY	DATE
03	000309	Dan Rheault	Dan Rheault	1-Feb-2023
02	000253	Dan Rheault	Dan Rheault	1-Jul-2017
01	Initial Release	Dan Rheault	Dan Rheault	4-Sep-2015

Drawn By	Dan Rheault	Date 4-Sep-2015
Checked By	Dan Rheault	Date 4-Sep-2015
Approved By	(ENG)	Date
Approved By	(MFG)	Date
Approved By		Date

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

Drawing Name: Typical ATW Outdoor Unit, Auxiliary Heat and Indoor Circulator Wiring

Size	Drawing Number	Drawing Rev	Sheet
A	002019CDG	03	1 of 1

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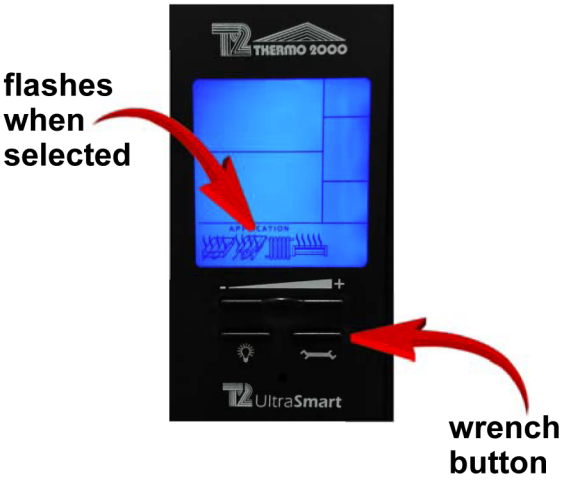
AltSource Tanks: Getting Started

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

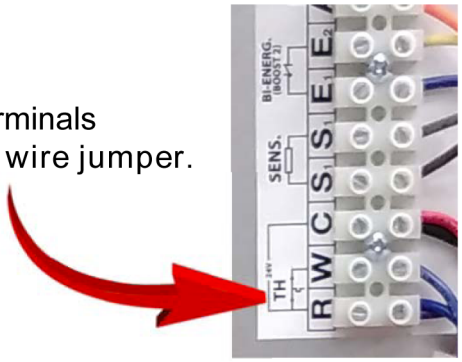
1. Put the tank in “Bi-Energy” rather than “Electric” mode, with switch on back of controller.

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

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



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



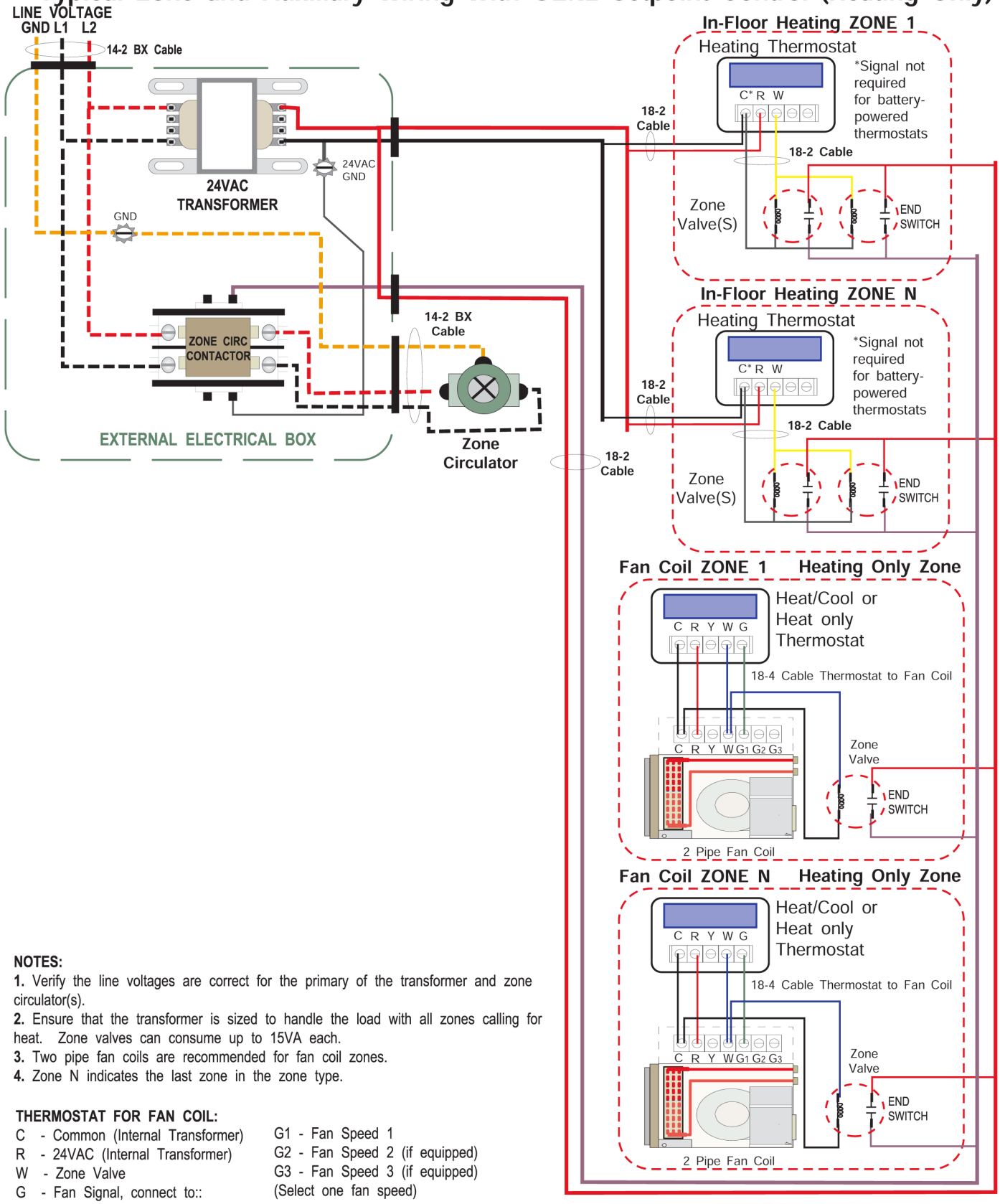
4. Now the tank elements will only be activated by a connection between the E_1-E_2 tank terminals, up to the 125°F maximum. This will be done by an 18-2 wire to the **D1-D2** terminals in the heat pump, activating the elements only when ***AUX*** heat is required.

See heat pump manual for further explanation.

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

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

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



NOTES:

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

THERMOSTAT FOR FAN COIL:

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

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

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

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

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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

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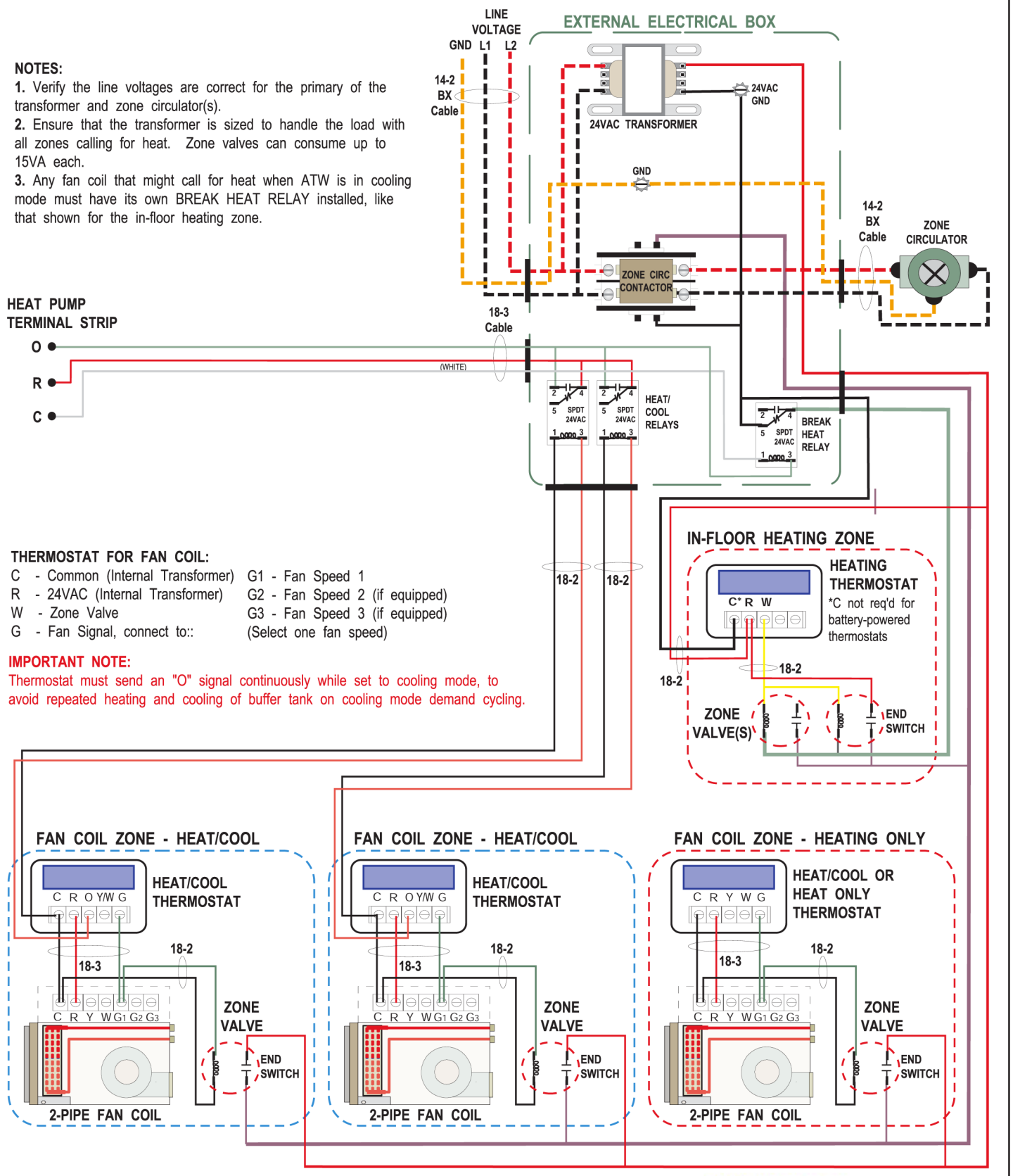
Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating & Cooling)



REV	ECO #	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
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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

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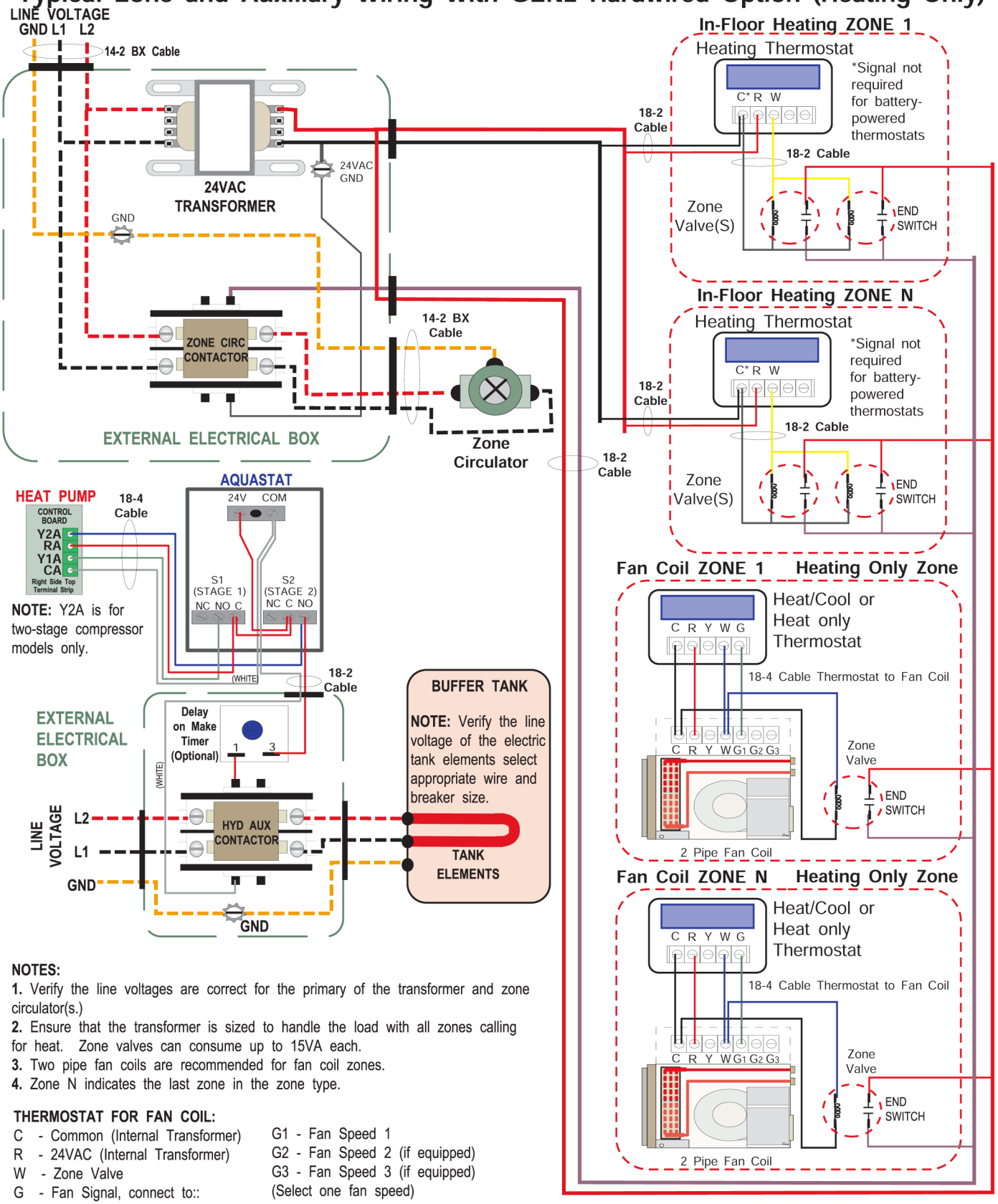
Typical Zone and Auxiliary Wiring With GEN2 Hardwired Option (Heating Only)



NOTES:

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

THERMOSTAT FOR FAN COIL:

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

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

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

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

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

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

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

NOTES:

1. Verify the line voltages are correct for the primary of the transformer and zone circulator(s).
2. Ensure that the transformer is sized to handle the load with all zones calling for heat. Zone valves consume up to 15VA each.
3. Any fan coil that might call for heat when ATW is in cooling mode must have its own BREAK HEAT RELAY installed, like that shown for the in-floor heating zone.

THERMOSTAT FOR FAN COIL:

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

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

LINE VOLTAGE GND L1 L2
14-2 BX Cable
EXTERNAL ELECTRICAL BOX
24VAC TRANSFORMER
24VAC GND
GND
ZONE CIRC CONTACTOR
ZONE CIRCULATOR
18-3 Cable
HEAT PUMP
O
HEATING AQUASTAT COOLING AQUASTAT
24V COM
S1 (STAGE 1) NC NO C
S2 (STAGE 2) NC C NO
CONTROL BOARD
Y2A RA Y1A CA
Right Side Top Terminal Strip
NOTE: Y2A is for two-stage compressor models only.
HEAT/ COOL RELAYS
AQUASTAT SELECT RELAY
BREAK HEAT RELAY
SPDT 24VAC
18-2 Cable
(WHITE)
EXTERNAL ELECTRICAL BOX
Delay on Make Timer (Optional)
HYD AUX CONTACTOR
LINE VOLTAGE L2 L1 GND
BUFFER TANK
NOTE: Verify the line voltage of the electric tank elements select appropriate wire and breaker size.
TANK ELEMENTS
IN-FLOOR HEATING ZONE
HEATING THERMOSTAT
C* R W
*C not req'd for battery-powered thermostats
ZONE VALVE(S)
END SWITCH
FAN COIL ZONE - HEAT/COOL
HEAT/COOL THERMOSTAT
C R O Y/W G
C R Y W G1 G2 G3
ZONE VALVE
END SWITCH
2-PIPE FAN COIL
FAN COIL ZONE - HEAT/COOL
HEAT/COOL THERMOSTAT
C R O Y/W G
C R Y W G1 G2 G3
ZONE VALVE
END SWITCH
2-PIPE FAN COIL
FAN COIL ZONE - HEATING ONLY
HEAT/COOL OR HEAT ONLY THERMOSTAT
C R Y W G
C R Y W G1 G2 G3
ZONE VALVE
END SWITCH
2-PIPE FAN COIL

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

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
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Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Hardwired Option (Heating & Cooling)

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

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Piping

Number of Tanks

All systems will 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.

In addition to buffer tanks, domestic hot water **preheat** and **final** heating tanks are recommended, for use with the desuperheater. These are part of the building's domestic water system, which is totally separate from the closed loop hydronic heating/cooling system. See diagram at end of this section. Note that connection of the desuperheater is not mandatory.

Indoor Loop Water Lines

The connections for the Indoor Loop circuit are 1" brass FNPT. They are labelled as INDOOR IN and INDOOR OUT. The ports are located on the front of the unit.

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

NOTE: 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.

TABLE 12 - Buffer Tank Size

Heat Pump Size	Minimum Size gal (L)	Recommended Size gal (L)
25	16 (61)	50 (190)
45	24 (91)	50 (190)
55	32 (121)	70 (265)
65	40 (151)	70 (265)
75	48 (182)	70 (265)
If a tank size is not available, use the next size larger tank.		

Domestic Hot Water (Desuperheater) Connections

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

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

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

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

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

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

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

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

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

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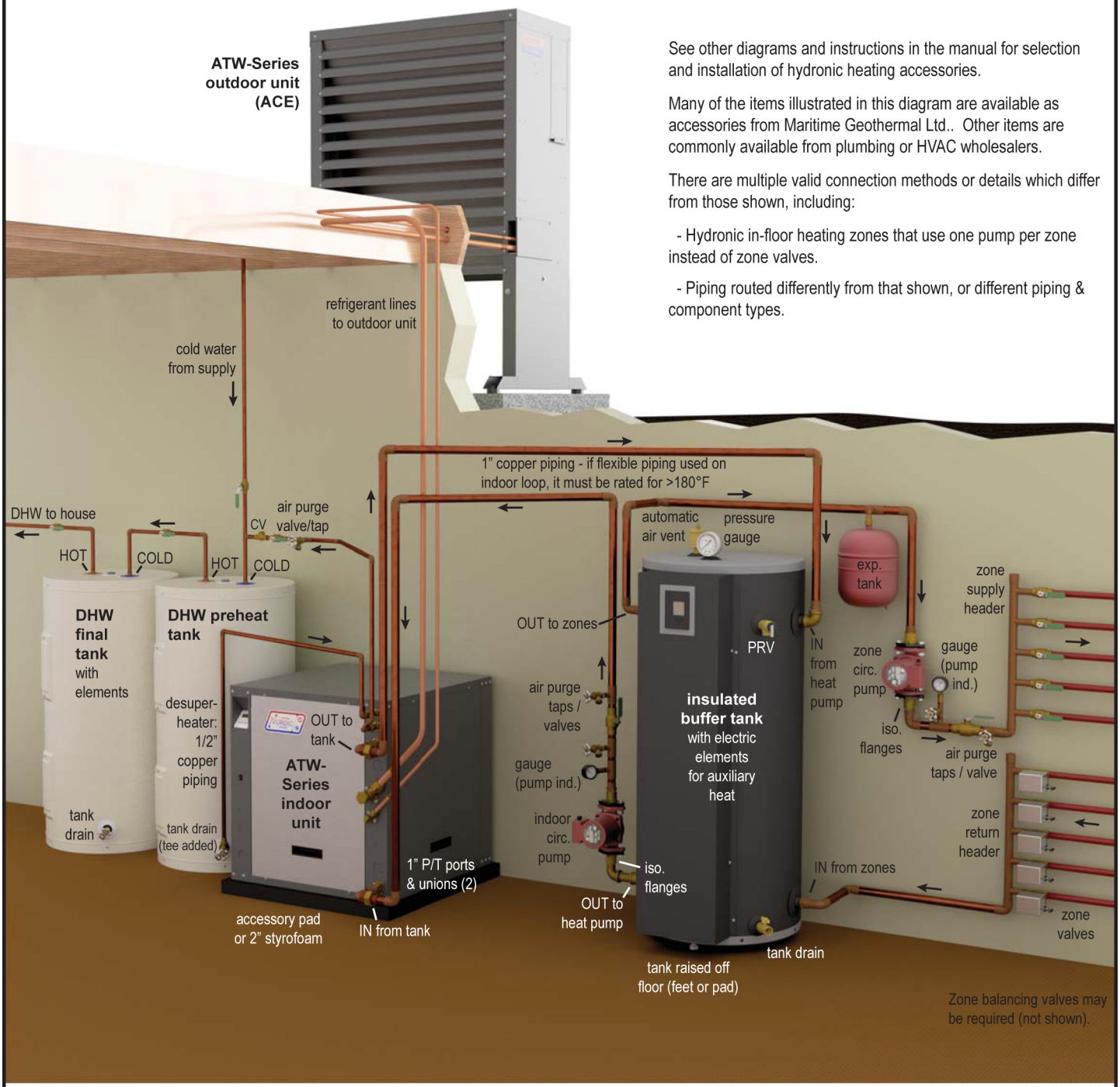
Typical Piping Connections - ATW Series



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

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

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

- Hydronic in-floor heating zones that use one pump per zone instead of zone valves.

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

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02	-	Dan Rheault	Dan Rheault	12-Feb-2019
01	Initial Rel.	Dan Rheault	Dan Rheault	23-Aug-2017

Drawn By: Dan Rheault	Date: 23-Aug-2017	MARITIME GEOTHERMAL LTD.	P.O. Box 2555, 170 Plantation Rd., Petitcodiac, NB CANADA E4Z 6H4
Checked By: Dan Rheault	Date: 23-Aug-2017	Drawing Name: Typical Piping Connections - ATW Series	
Eng. Approved By	Date		
Mfg. Approved By	Date		
Approved By	Date	Size: LET	Drawing Number: 002239PDG / Revision: 02 / Sheet: 1 / 1

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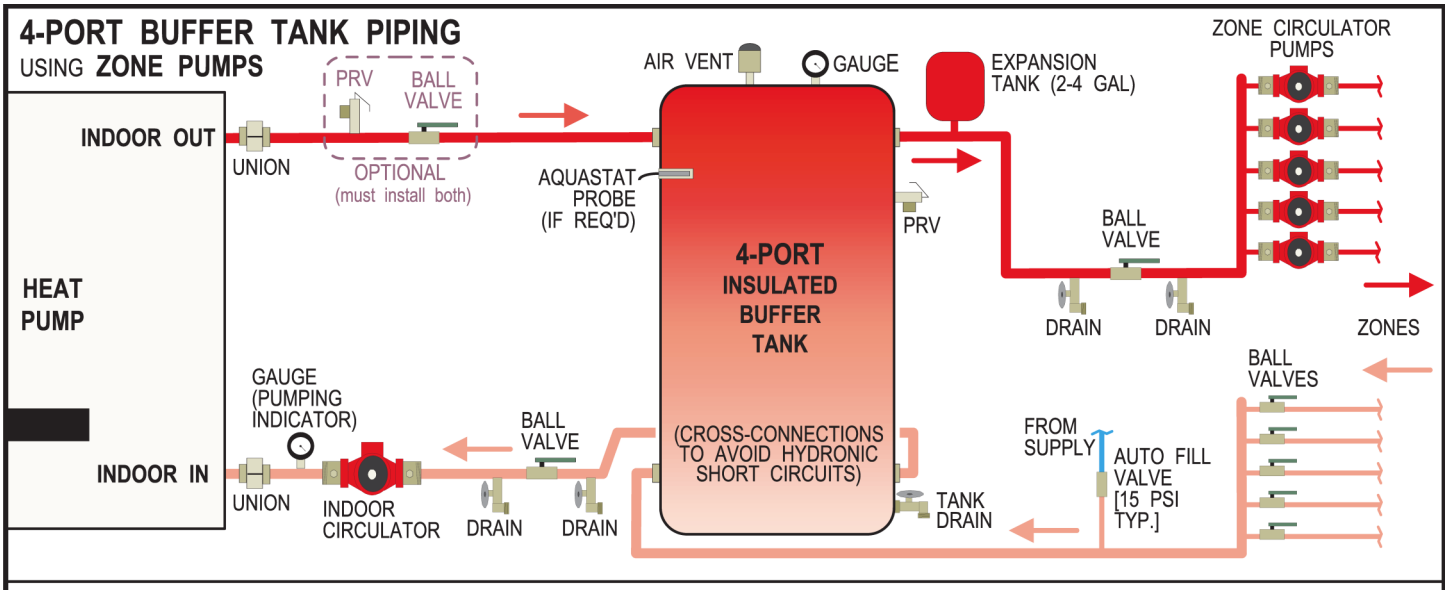

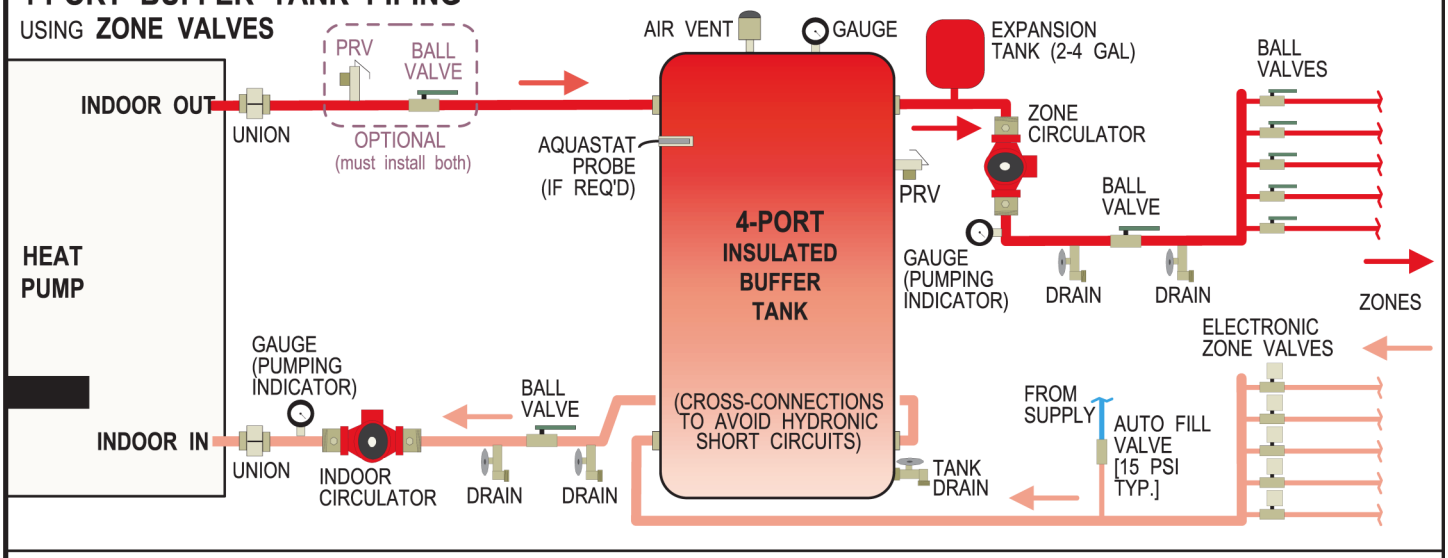

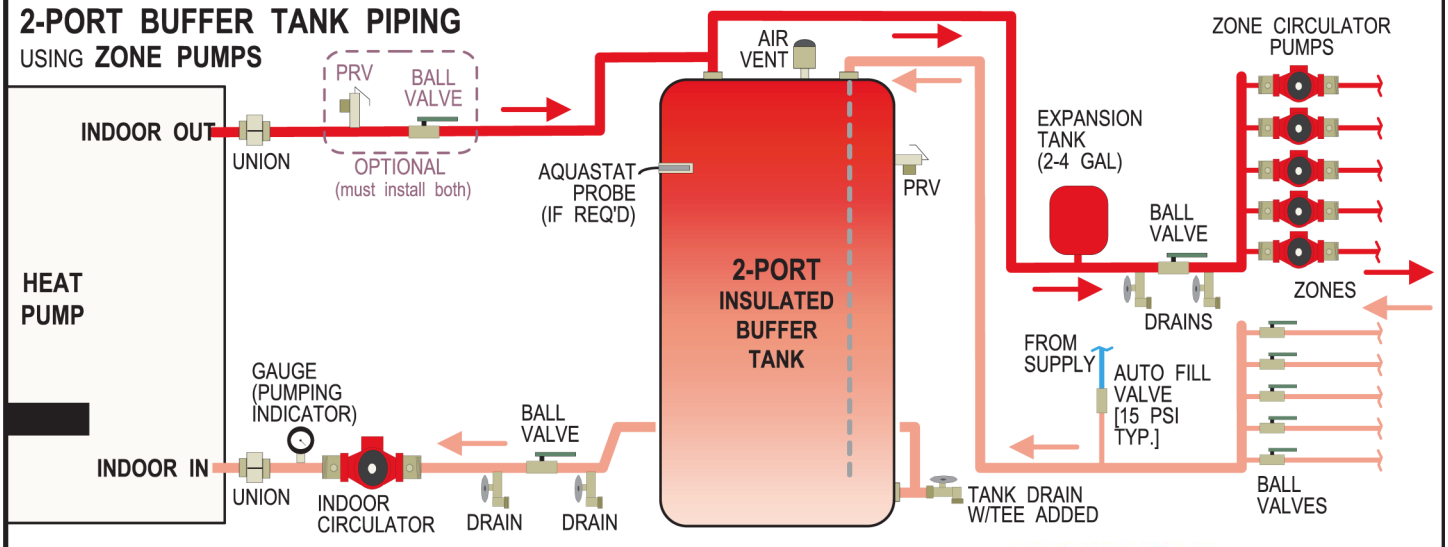

REV	ECO #	IMPL BY	APVD BY	DATE
02	(add fill valve)	D. RHEAULT	D. RHEAULT	1-Feb-2021
01	Initial Release	D. RHEAULT	D. RHEAULT	14-Dec-2018

Drawn By: Dan Rheault	Date: 14-Dec-2018	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 14-Dec-2018	
Approved By (ENG)	Date	Drawing Name: Recommended Hydronic Buffer Tank Piping
Approved By (MFG)	Date	Size: A | Drawing Number: 002366PDG | REV: 02 | SHEET: 1 of 1
Approved By	Date	

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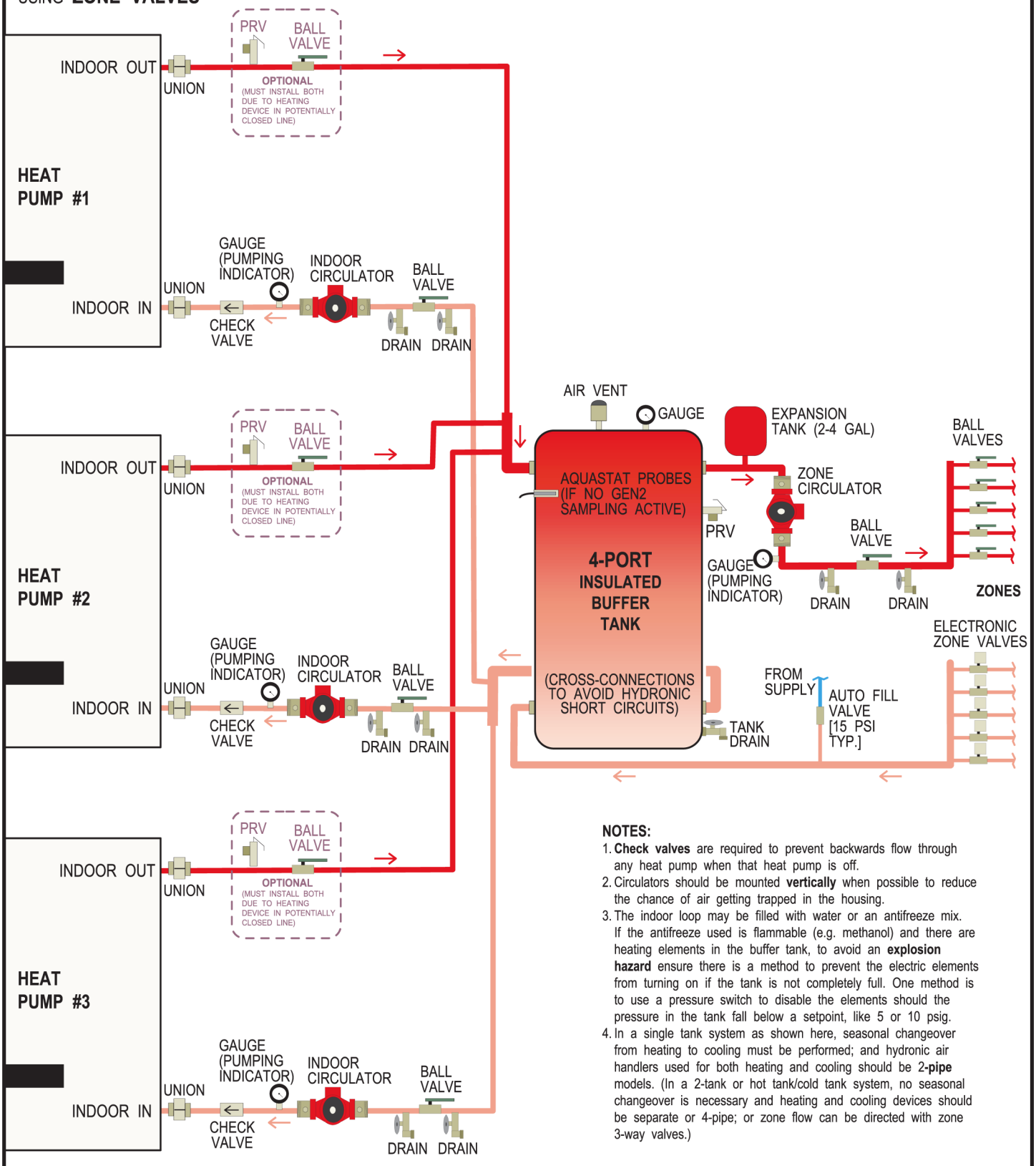
4-PORT BUFFER TANK PIPING FOR MULTIPLE HEAT PUMPS
USING ZONE VALVES



NOTES:

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

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

Drawn By: Dan Rheault	Date: 9-Aug-2021	MARITIME GEOTHERMAL LTD.	170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 9-Aug-2021	Drawing Name: **Buffer Tank Piping - Multiple Units**	
Approved By (ENG)	Date		
Approved By (MFG)	Date		
Approved By	Date		

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

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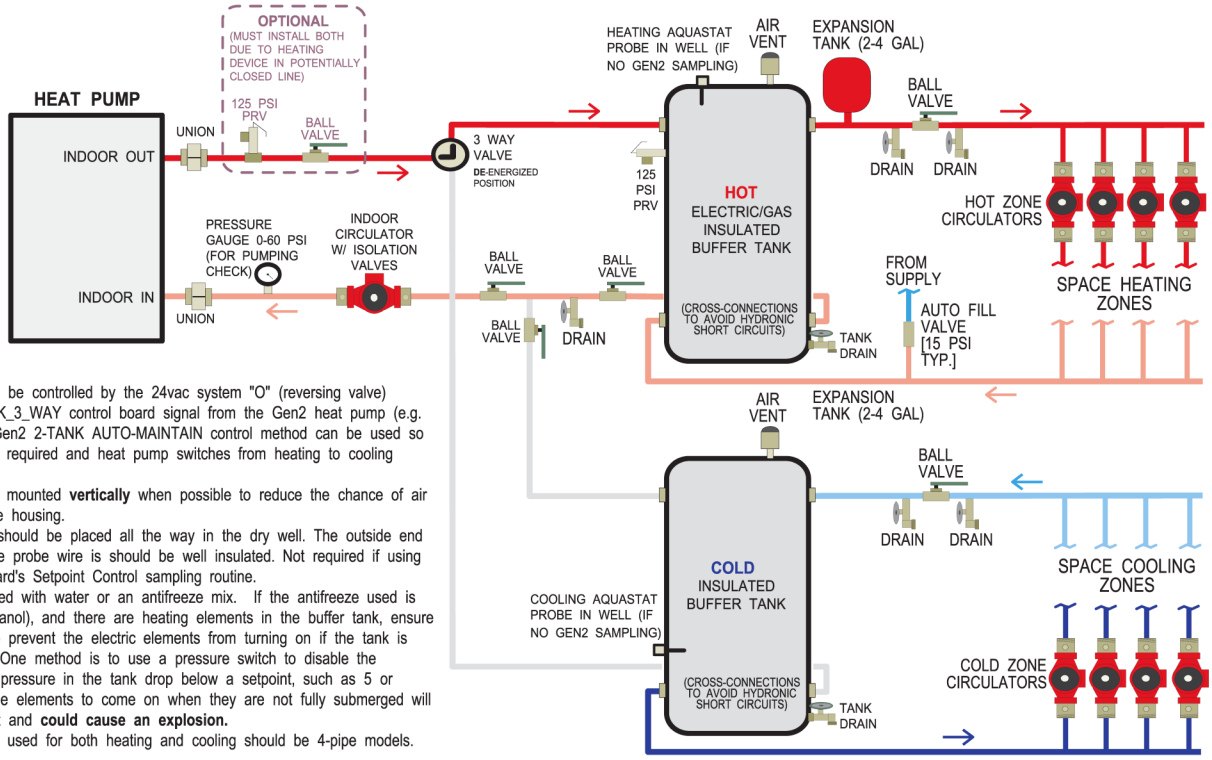
Two Tank System Piping with a Reversing Heat Pump

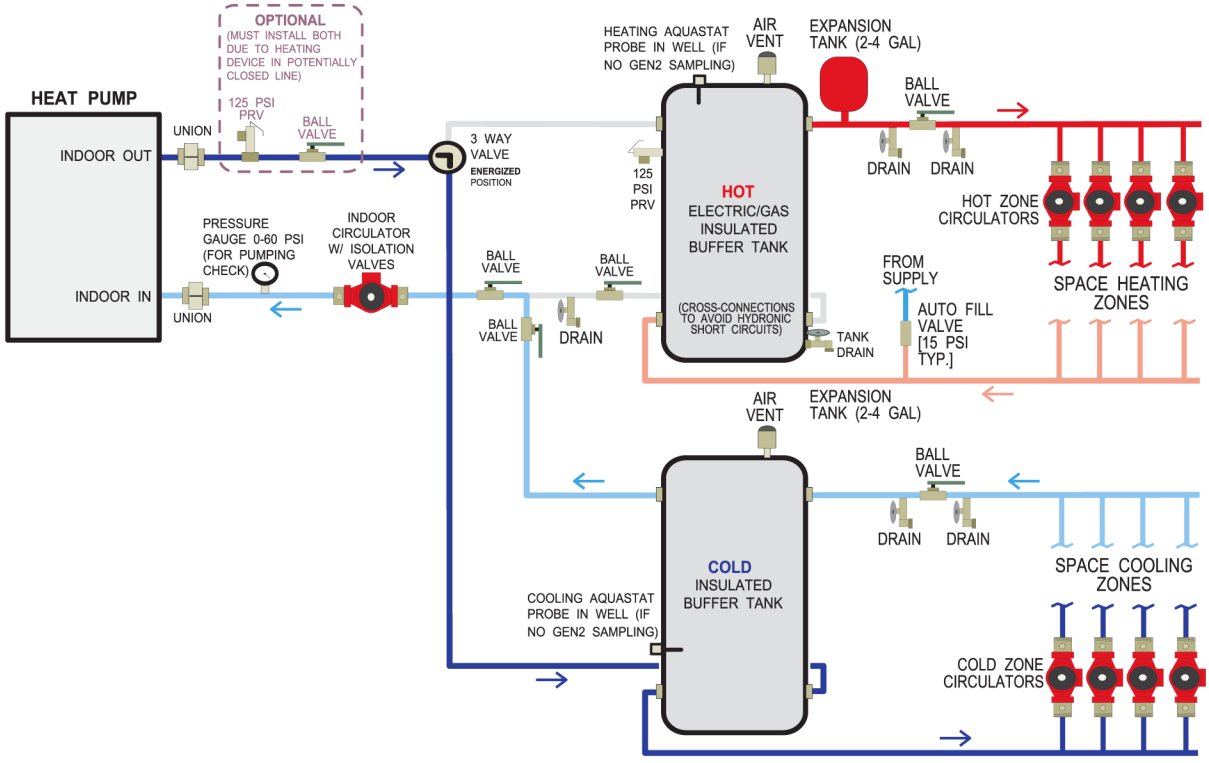
HEATING MODE



NOTES:

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

COOLING MODE



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

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

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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

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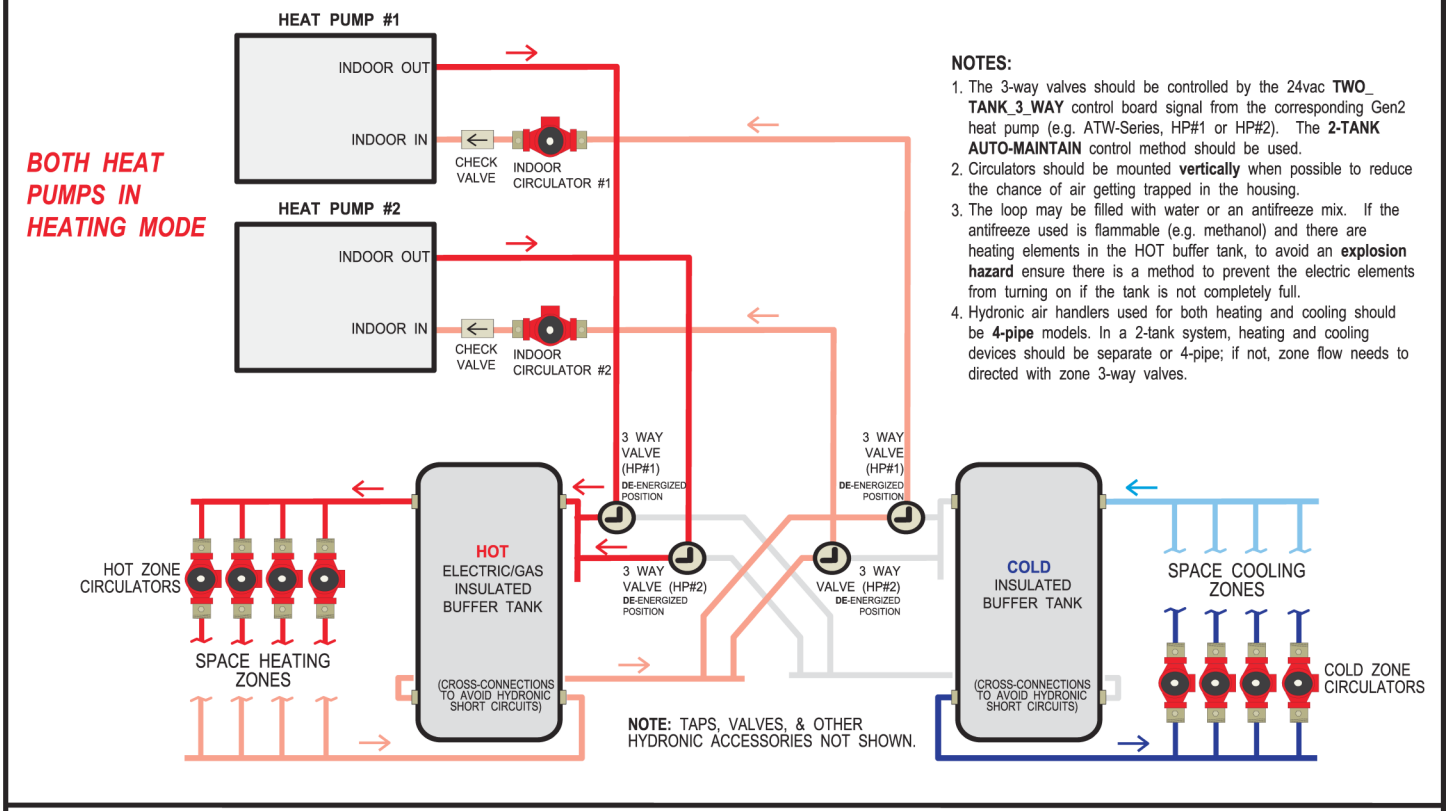
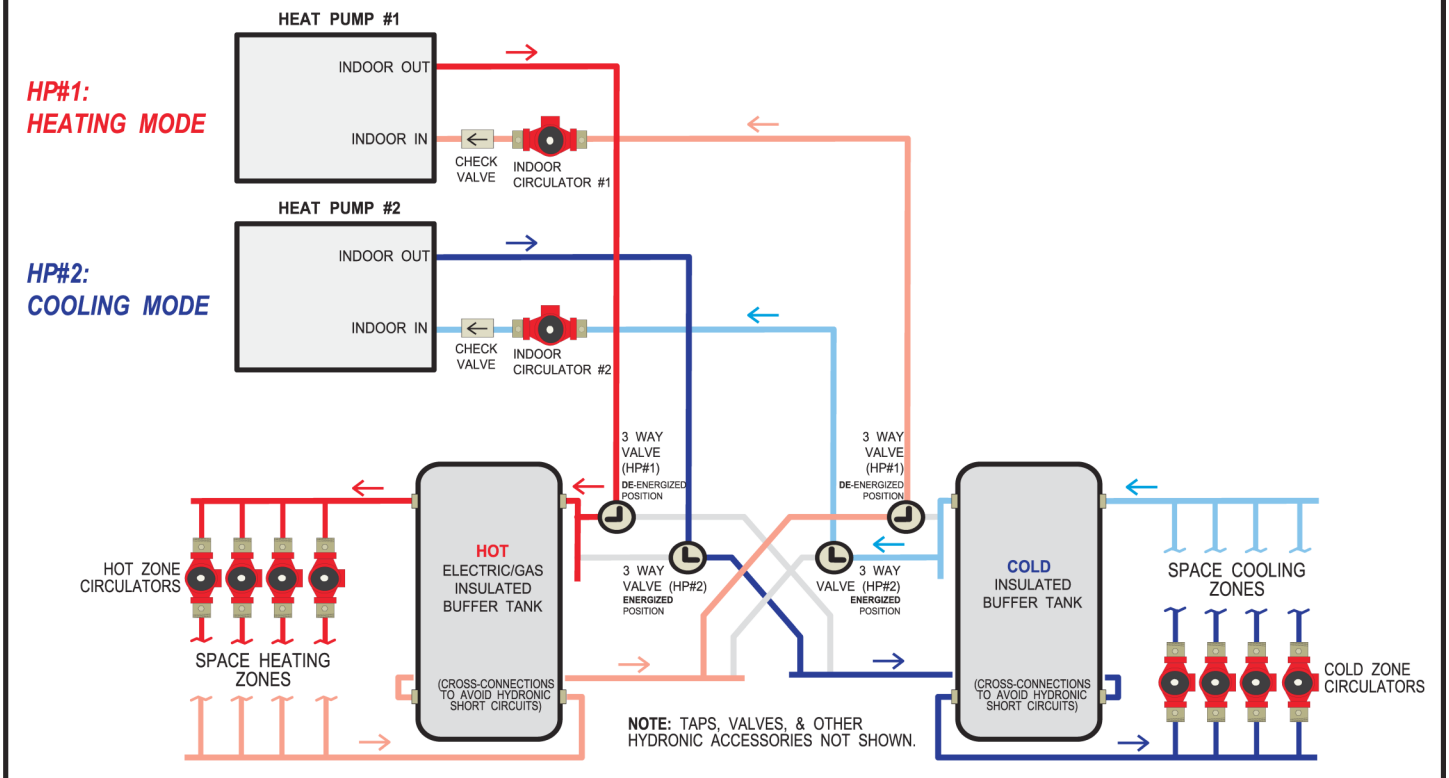
Two Tank System Piping with Multiple Reversing Heat Pumps



NOTES:

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



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

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

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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

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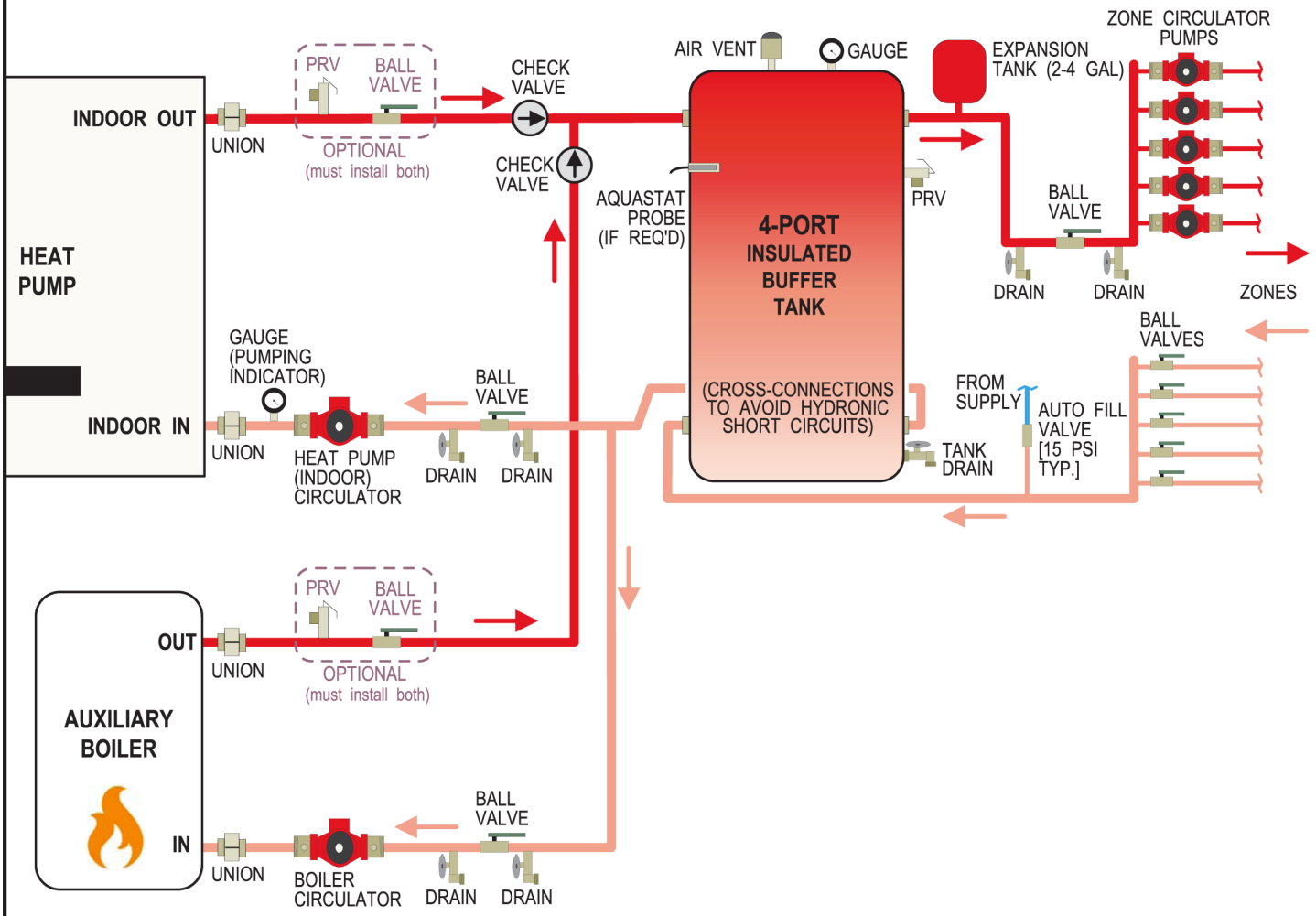
Auxiliary Boiler Piping

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

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

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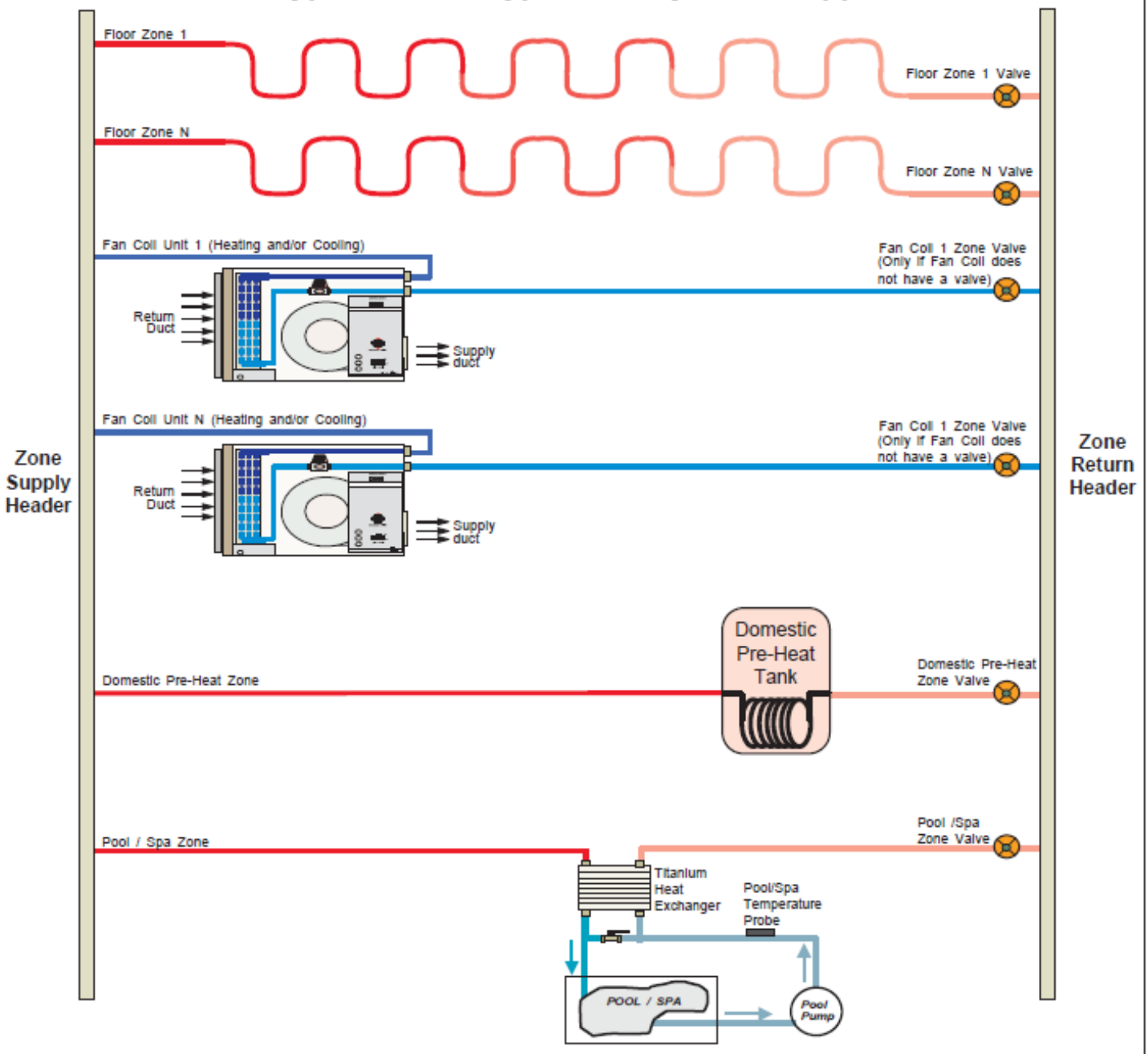
Typical Zone Types for Hydronic Applications



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

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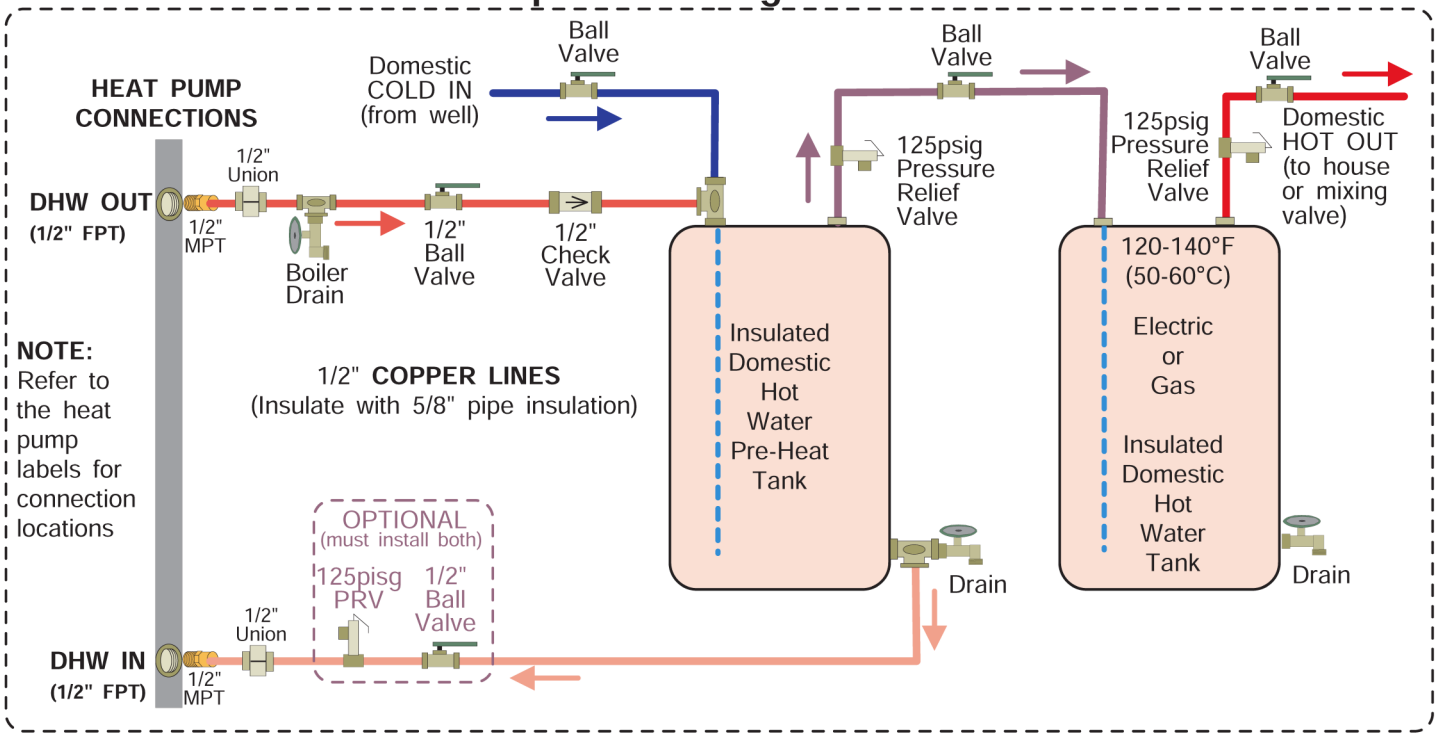
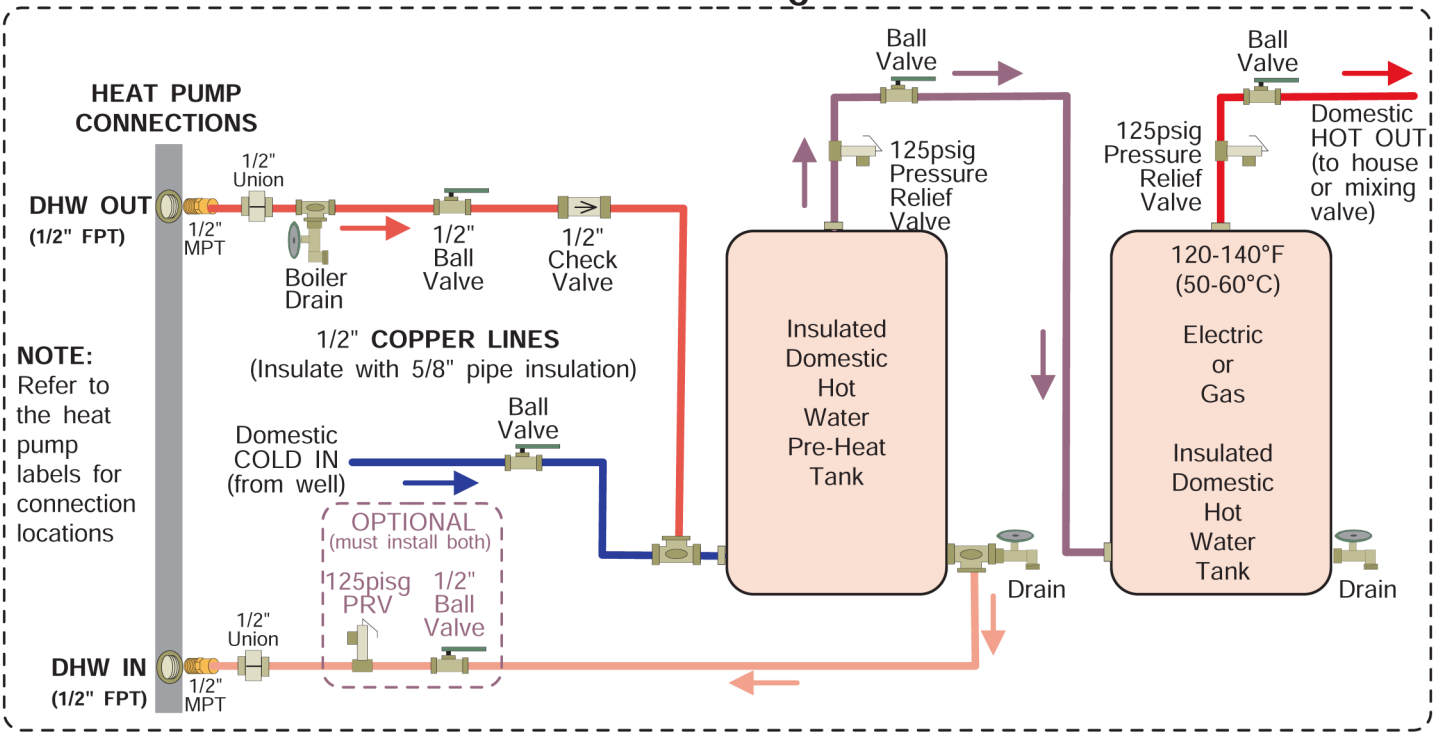
Desuperheater Connection to DHW Pre-Heat Tank

Top Port Configuration



Side Port Configuration



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

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

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

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

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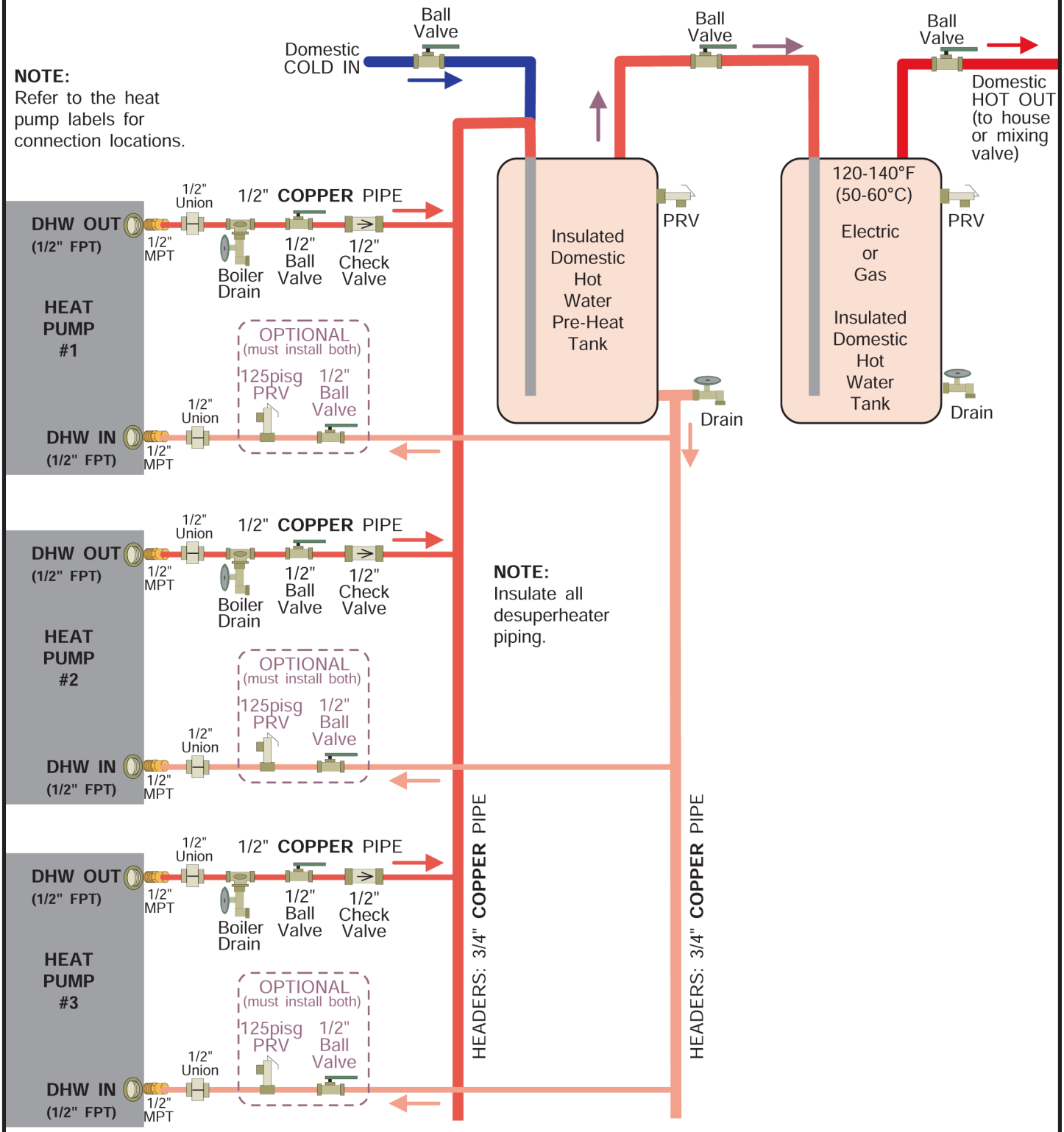
Desuperheater Connection to DHW Pre-Heat Tank - Multiple Units



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

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

MARITIME GEOTHERMAL LTD.
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E4Z 6H4

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

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

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Refrigeration Line Set

***A2L*-SPECIFIC WARNING / INSTRUCTION**

To avoid hazard, field installed line sets should:

- have no connecting joints other than at each end
- have no bends with centreline bend radius less than 2.5 times the external pipe diameter (for 1/2" lines R_{min}=1.25", and for 7/8" lines R_{min}=2.25")
- be enclosed or otherwise protected from potential damage during normal operation, service, and maintenance.

Mechanical pipe field joints must comply with **ISO 14903**. Properly constructed brazed or flared joints, or those using certified mechanical connectors, should comply with this requirement.

When flared joints are reused indoors, the flare part should be refabricated.

Line Set Interconnect Tubing

Once both the indoor and outdoor units have been mounted, the line set may be run between them. The line set consists of a liquid line and a vapour line.

The tubing used for this procedure must be ACR refrigeration tubing (cleaned & dehydrated). Every effort must be made to insure that the tubing does not become contaminated during installation. It is recommended that caps be placed on the open ends of tubing immediately after cuts are made and that these caps are 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 the caps just prior to silver soldering or flaring will ensure minimum exposure to humidity in the atmosphere.

TABLE 13 - Line Set Sizing		
ATW-25/45	Vapour line O.D.	3/4"
	Liquid line O.D.	3/8"
ATW-55/65/75	Vapour line O.D.	7/8"
	Liquid line O.D.	1/2"

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

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")

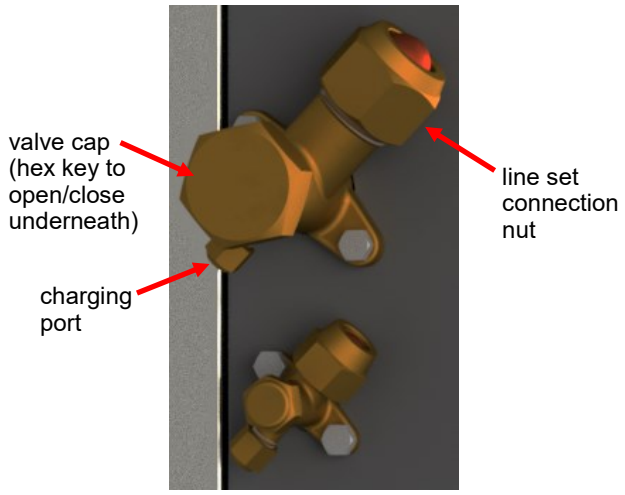
TABLE 14b - 3-way Service Valve Torques				
Nominal Size	Line set connection nut torque	Hex key torque	Valve cap torque	Charging port cap torque
3/8"	30-35 N.m *(22-26 ft.lb)*	5-7 N.m *(4-5 ft.lb)*	20-25 N.m *(15-18 ft.lb)*	10-12 N.m *(7-9 ft.lb)*
1/2"	40-45 N.m *(30-33 ft.lb)*	7-9 N.m *(5-7 ft.lb)*	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)*

Indoor Unit Connections

The indoor unit connections for the interconnect 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 18-8 wire near the compressor in the indoor unit.



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 cover from the outdoor unit so that the piping is accessible. There is an illustration for a typical installation on a following page.

IMPORTANT: Power up the unit and engage ***SERVICE MODE*** via the LCD or PC App before any post-installation service: pressure testing, vacuuming, or charging the line set.
This will ensure all electronic valves are open and there are no sections of trapped/isolated piping.

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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.

Filter-Dryer

Note that **no field installed filter-dryer is required**, since one is included in 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 joints in the line set 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 are to be silver soldered with 5% silver solder. **It is absolutely required that dry nitrogen be bled through the system 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 outdoor unit ports to prevent melting the grommet when silver soldering; however this may not be necessary for a skilled welder due to the distance from the grommet. Ensure that no water enters any of the ports or tubing.

Pressure Testing

Once all connections are complete, the system 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 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 extra refrigerant is 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 Model Sizes 25-45

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 Model Sizes 55-75

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

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Typical ATW to Outdoor Unit Line Set Connections

REV	ECO#	IMPL BY	APVD BY	DATE
02	-	Dan Rheault	Dan Rheault	1-Jul-2017
01	IR 000211	Chris Geddes	Chris Geddes	9-Jun-2015

Drawn By	Chris Geddes	Date	9-Jun-2015
Checked By	Chris Geddes	Date	9-Jun-2015
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 ATW to Outdoor Unit Line Set Connections**

Size	Drawing Number	Revision	Sheet
LET	001983CDG	02	1 / 1

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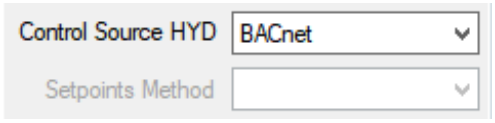
Operation

1. BACnet Control

If using **BACnet Control**, the heat pump will turn the 2 compressor stages 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

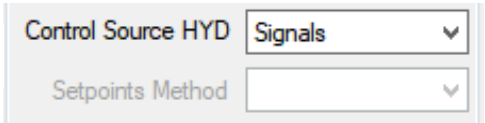
2. Signals / Hardwired Control

Similar to BACnet control, with **Signals Control** the heat pump will turn the 2 compressor stages on and off and activate cooling mode when it is told to by 24VAC signals. These are provided via external dry contacts, most often from a 2-stage aquastat 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 maximum, allowing the electric elements to be controlled by an external contactor placed in the power supply connections (see diagrams in **Wiring** section). The contactor can be connected to stage 2 of the heating aquastat via an optional 0-2 hour timer. Alternatively, tanks with their own programmable controller can be set to run independently with a lower temperature setpoint than the aquastat(s).

PC APP: Tools-->Configuration



LCD Interface: Configuration

3. Setpoint Control

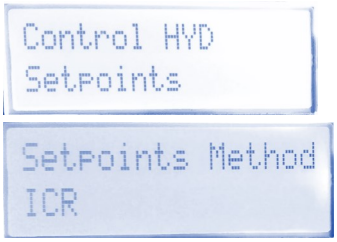
One of the features of the ATW's GEN2 Control Board is built in temperature control functionality called "**Setpoint Control**". It is recommended that this method be used to control the system's hydronic heating and cooling demand since it eliminates the need for an external aquastat or temperature 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.

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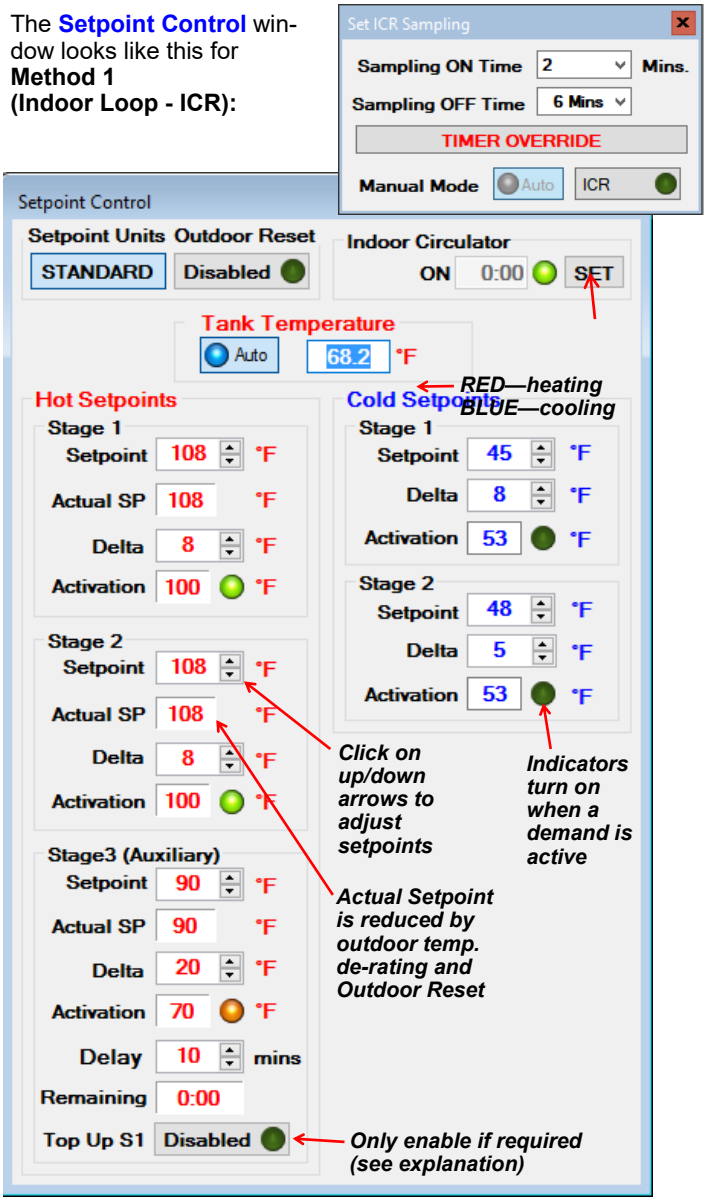
The **Setpoint Control** window looks like this for **Method 1 (Indoor Loop - ICR):**



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 Temperature Setpoints

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

For example, in heating mode: when water temp falls by the "Delta" amount below the "Setpoint", the stage is activated (at the board-calculated "Activation" temp). The stage stays on until water is heated to the "Setpoint".

If using well-designed in-concrete-floor heating, the heating setpoints may be able to be lowered. Lower heating setpoints will translate directly into a higher COP (efficiency). Heating setpoints should be set to the lowest values that still maintain an acceptable temperature in the building on the coldest day of the year; this may take some trial and error. Increasing Delta values will also increase efficiency due to longer runtimes, and lead to less wear on compressor due to a reduced number of compressor starts.

The maximum water temperature setpoint is **120°F / 49°C**. This is de-rated at cold outdoor temperatures according to the following table, to keep the compressor operating within its envelope. 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	120°F	above -9°C	49°C
11 to 15°F	115°F	-11 to -9°C	46°C
6 to 10°F	110°F	-15 to -12°C	43°C
below 6°F	105°F	below -15°C	40°C

The minimum setpoint for cooling with water as the indoor loop fluid is **45°F (7°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 two compressor stages and stage 3 auxiliary operate normally and shut off at their actual setpoints. When enabled, the heat pump will shut off the compressor at its 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 **105°F (41°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 3 (AUX), drops setpoints to 70°F (21°C), and decreases temperature sampling frequency to 2 days. This minimizes electric power usage while keeping cast iron head circulation pumps operational.

Hydronic Auxiliary in Defrost

AUX (stage 3) 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.

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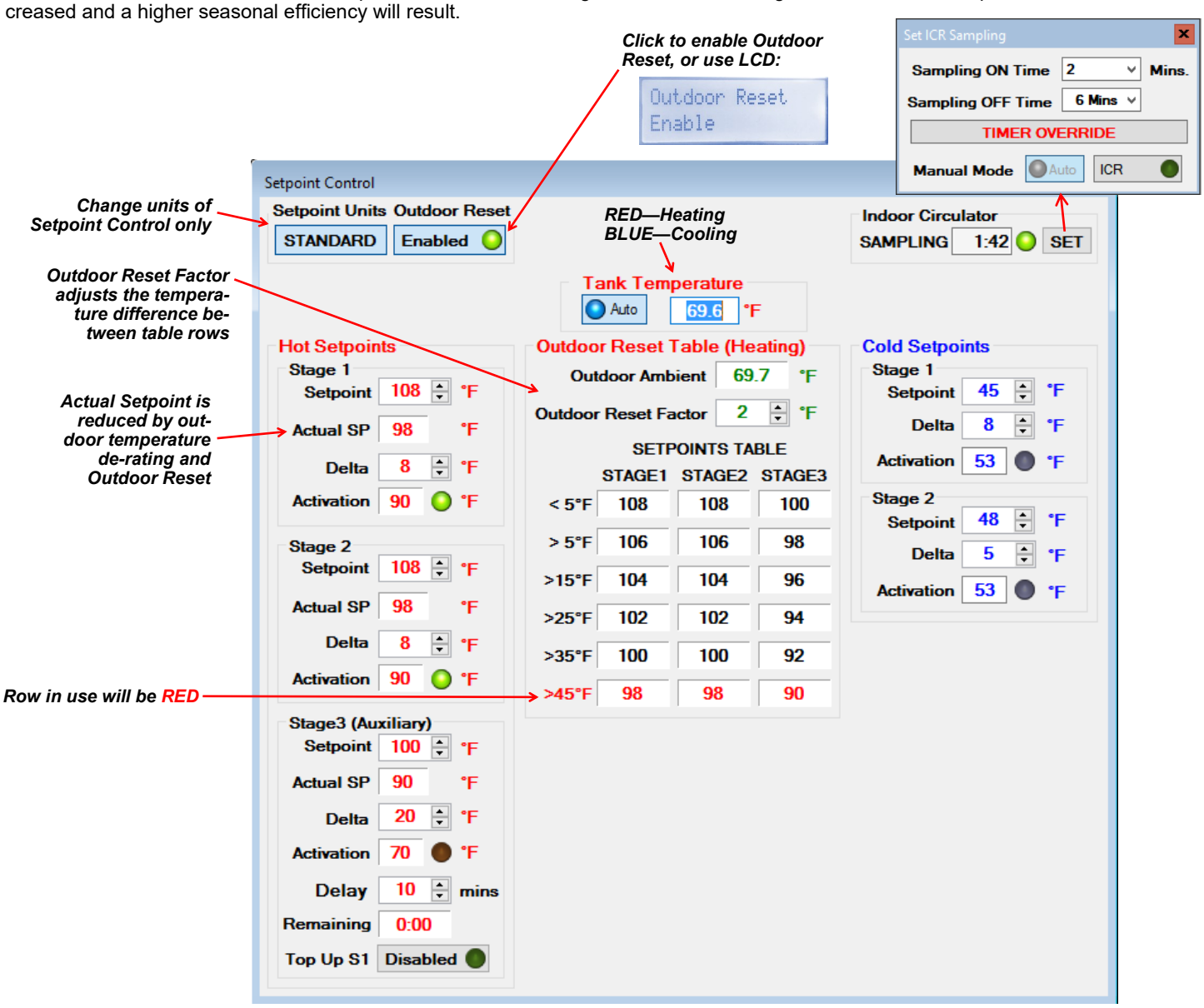
Outdoor Reset

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).

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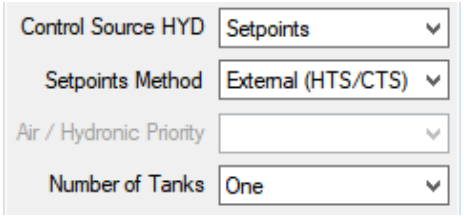
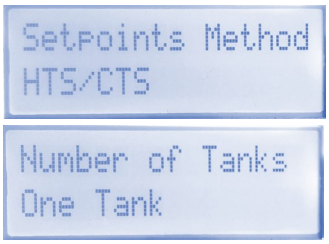
Setpoint Control Method 3 - External (HTS/CTS) One Tank

PC APP:
Tools-->Configuration



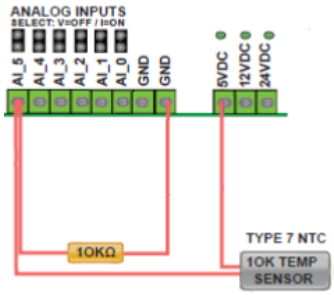
LCD Interface:
Configuration



This is the required method for when a high temperature 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.***

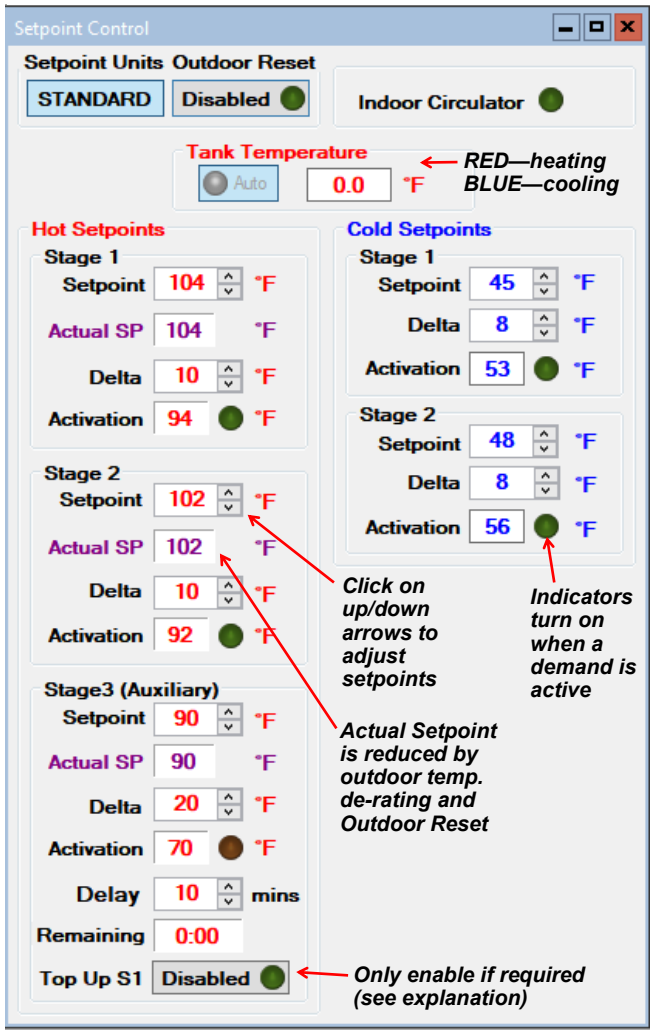


Cooling mode is selected by making a dry contact connection between the **R** and **O** terminals on the terminal strip in the electrical box. This is the one external control requirement.

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**

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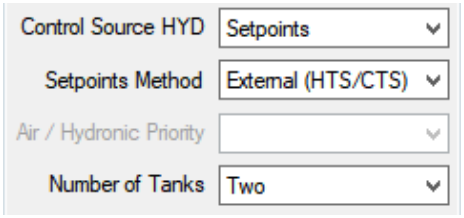
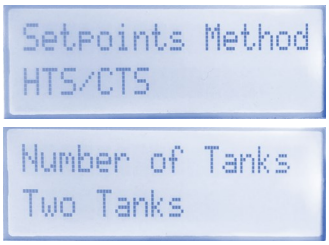
Setpoint Control Method 4 - External (HTS/CTS) Two Tanks

PC APP: Tools-->Configuration

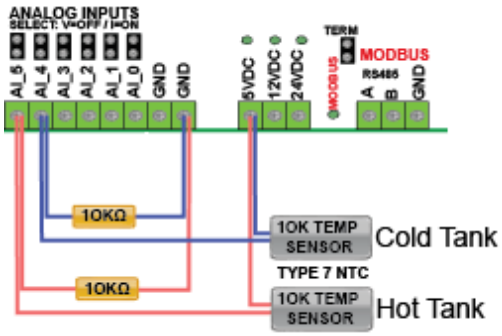


LCD Interface: Configuration



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.***



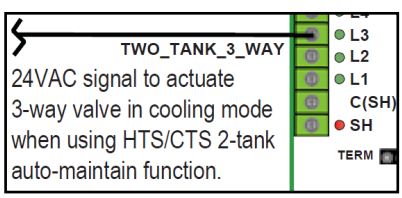
a) O Signal Control

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).

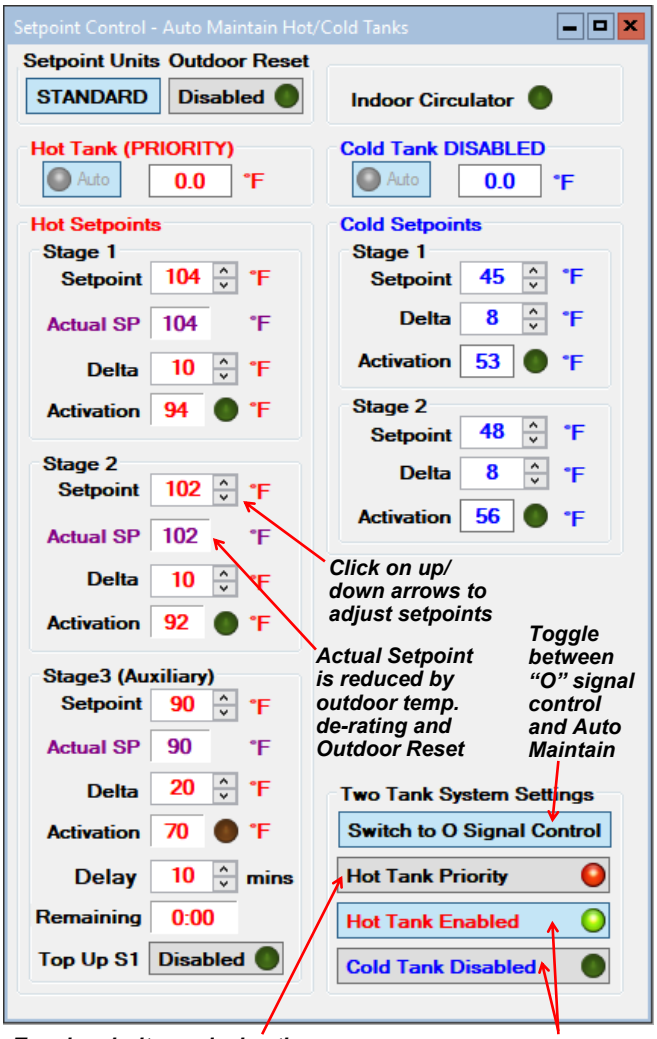
b) Auto Maintain

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**

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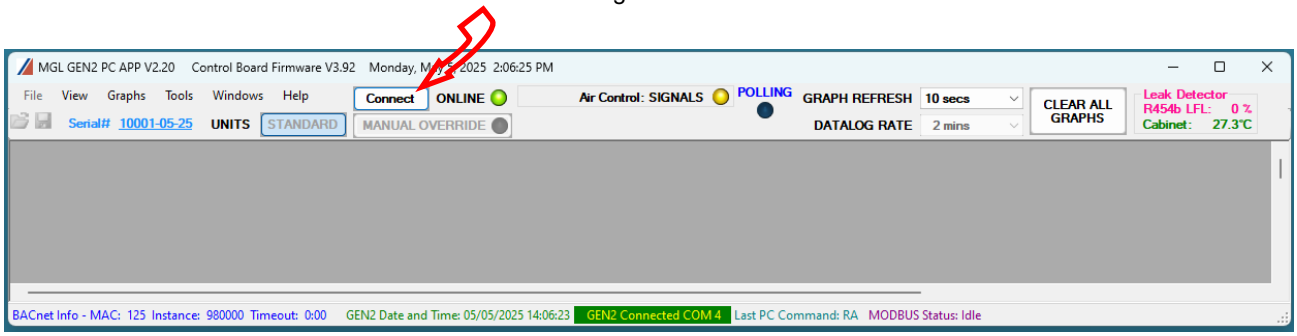
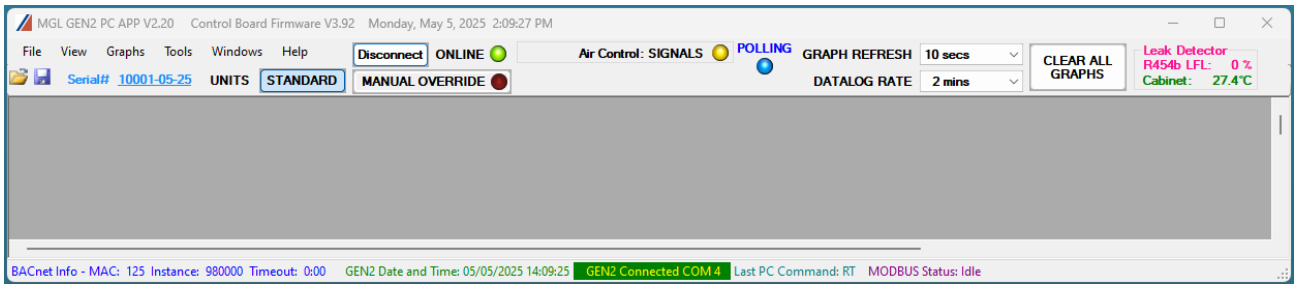
PC Application (PC App)

NOTE: Before using the PC Application, refer to **Appendices** for installation instructions for the PC App and USB driver.

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 and the Polling LED will begin to flash. The PC time and date will appear at the bottom left corner of the screen. If the date and time need to be adjusted, click on menu ***Tools-->Set Date and Time***. The control board date and time will be set to that of the PC.



PC Application Menus

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

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

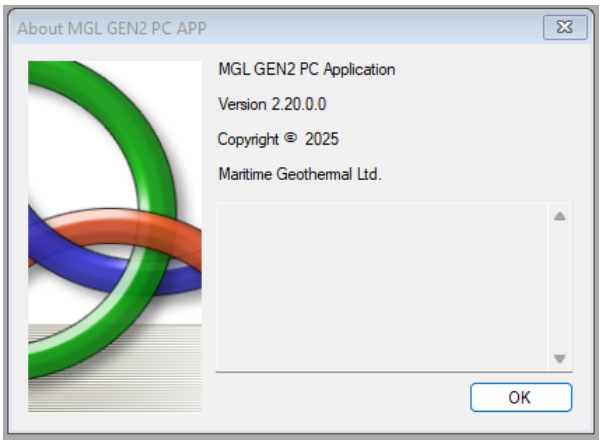
File-->Open: Opens a saved page arrangement.
File-->Save: Saves the current page arrangement.
File-->Exit: Exits the PC Application.

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

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

Help Menu: This shows information about the PC Application.

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



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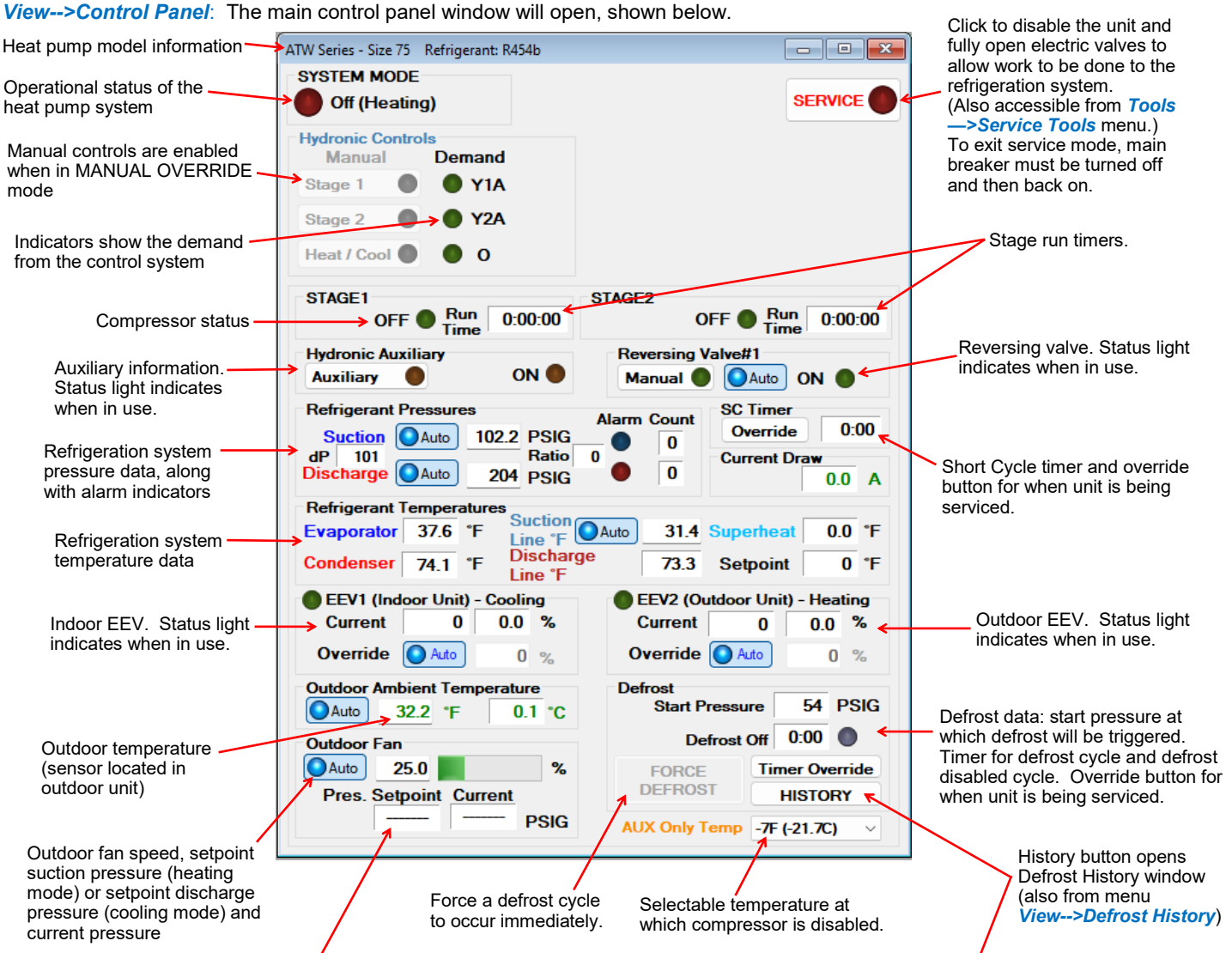
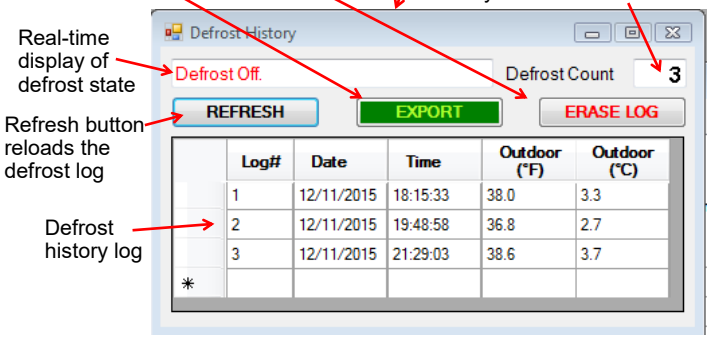
View Menu:

This menu handles all of the operational viewing screens.

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.

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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 (SC) Timer*** will start. When the ***SC Timer*** expires the compressor will re-start. If no further alarms occur within the ***REDUCE*** time (listed on 2nd tab of the **Configuration Page**), the alarm count will be reduced by 1. If another alarm occurs within ***REDUCE*** time, the count will increase by 1. If alarms continue to occur, when the alarm count reaches the ***Maximum Count*** value a ***Permanent Alarm*** will occur.

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

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

Low Pressure: A low pressure alarm occurs when the suction pressure drops to or below the ***Low Pressure Cutout*** value. The low pressure is checked just before a compressor start; if it is OK the compressor will start, otherwise an alarm will occur. When the compressor starts, the low pressure alarm will be ignored for the number of seconds that low pressure ***Ignore on Start*** (listed on 2nd tab of the **Configuration Page**) is set to, after which the low pressure alarm will be re-enabled. This allows a dip in suction pressure below the cutout point during startup without causing a nuisance alarm.

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

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

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.

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

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

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

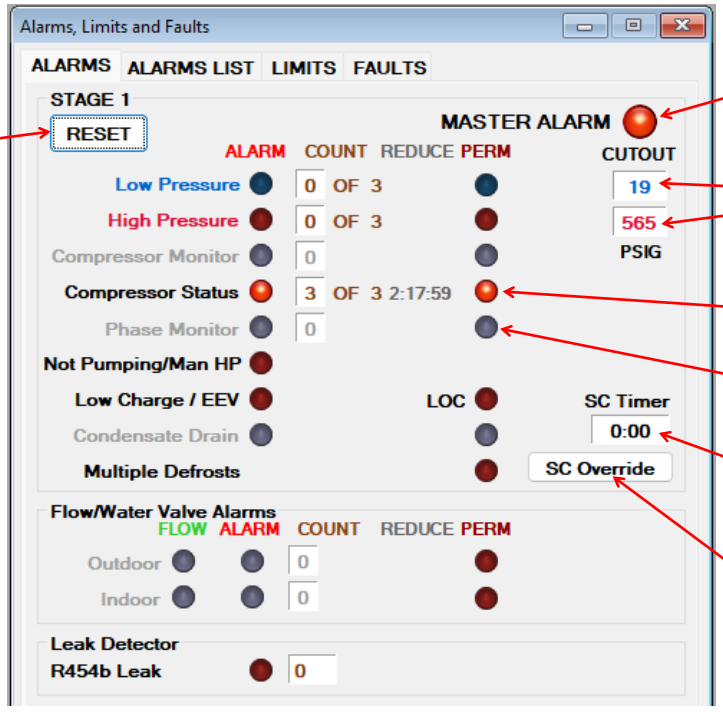
Multiple Defrosts: This alarm occurs if a second defrost occurs immediately after the defrost disabled timer expires from a previous defrost cycle. It indicates abnormally low suction pressure.

R454b Leak: The leak detector has detected the presence of A2L refrigerant inside cabinet.

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

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

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



Master Alarm occurs when any alarm occurs.

Low Pressure cut out.
High Pressure cut out.

Active alarms are indicated by red light.

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.

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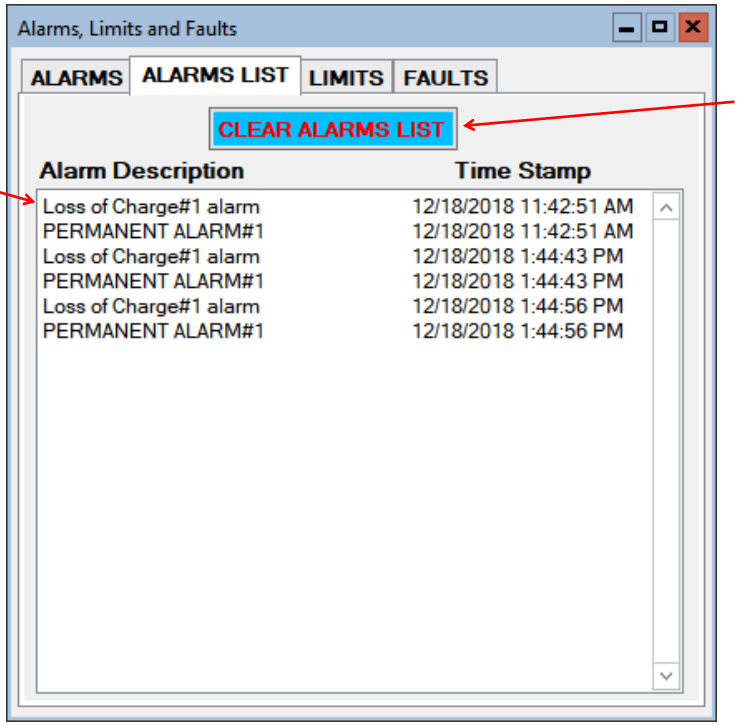
View-->Alarms, Limits and Faults (ALARMS LIST Tab)

This tab show a history of alarms that have occurred while the PC App is connected, since it was last cleared.

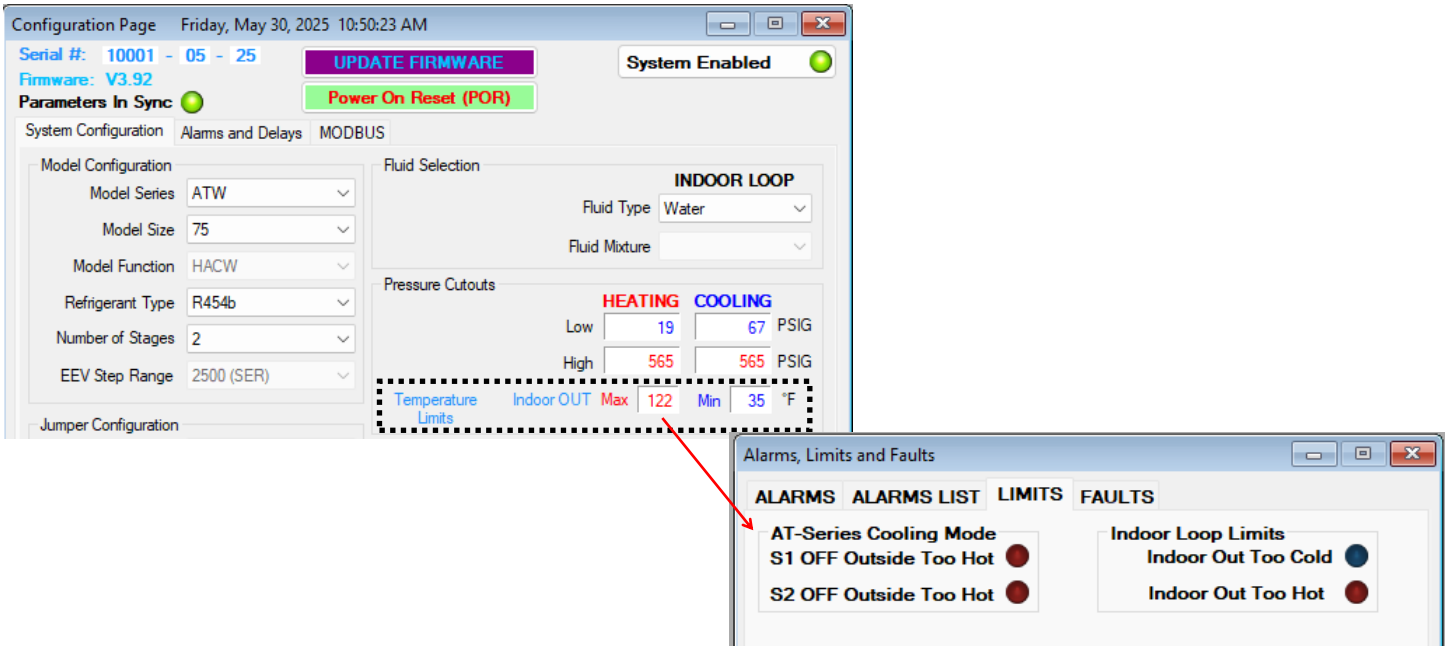
Each alarm that occurs while the PC APP is connected to the control board will appear here. The alarm type and a time stamp will be shown.



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.



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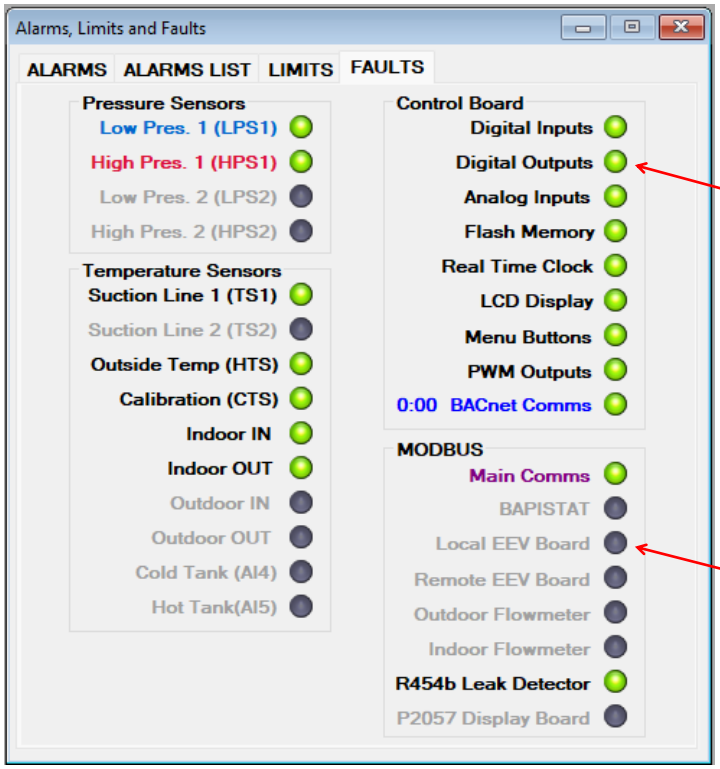
View-->Alarms, Limits and Faults (FAULTS tab)

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 interface 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 interface or Menu Button faults, turn off the power, disconnect and reconnect the cable between the LCD interface 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 interface board will need to be replaced.

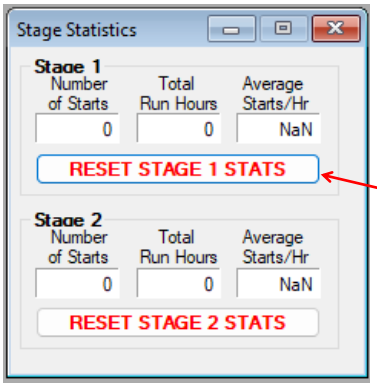


View-->Defrost History

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

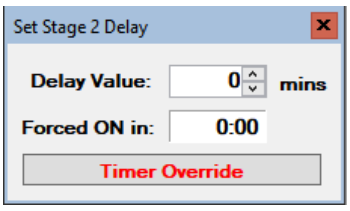
View-->Stage Stats

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



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)



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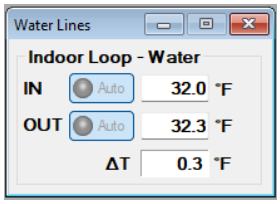
View-->Water Lines

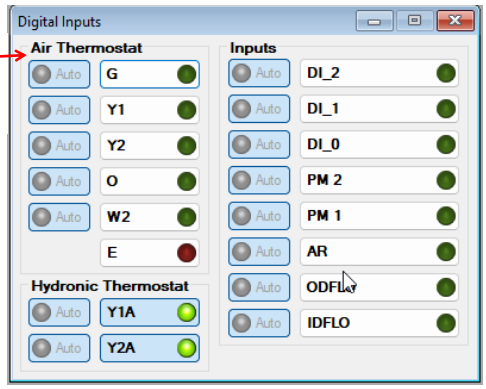
Displays the indoor loop in, out, and delta temperatures.



View-->Digital Inputs

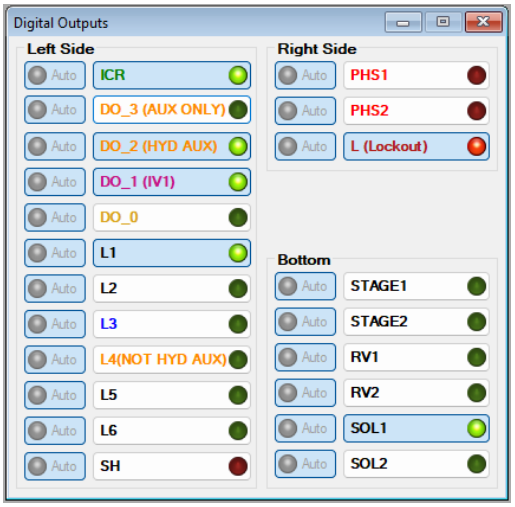
Shows the digital inputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.

N/A for ATW series



View-->Digital Outputs

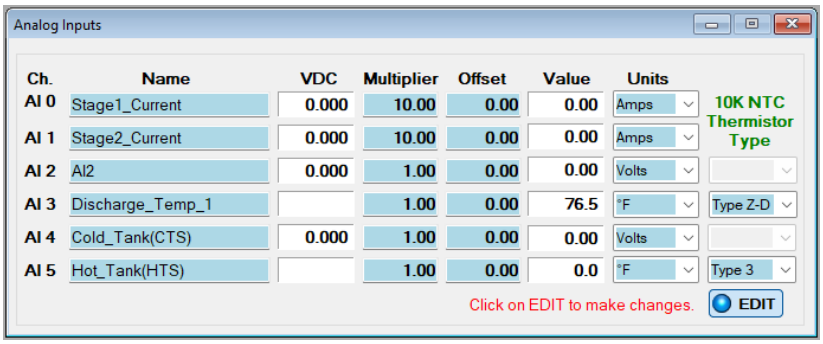
Shows the digital outputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode to facilitate troubleshooting.



View-->Analog Inputs

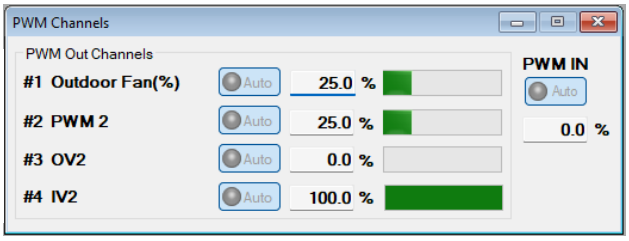
Shows the Analog inputs and their individual settings and values.

Click on the ***EDIT*** button to modify the blue boxes (button will now say ***SAVE***). For each channel a name may be selected, 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.



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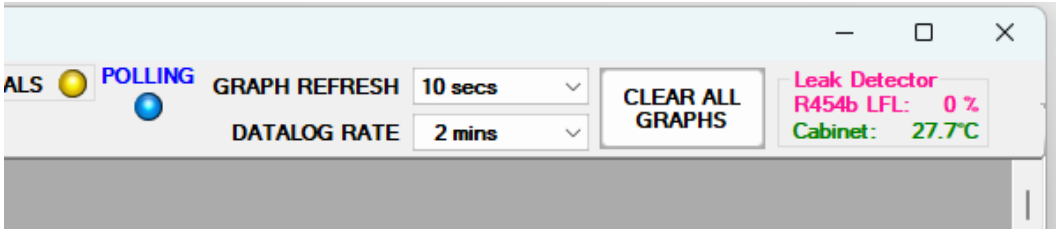
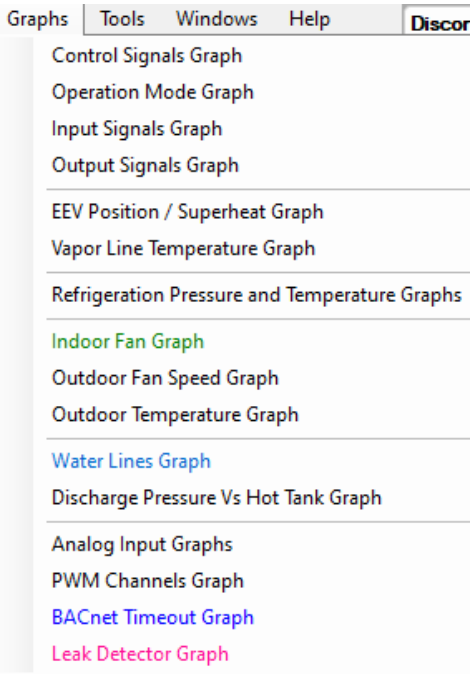
Graphs Menu:

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

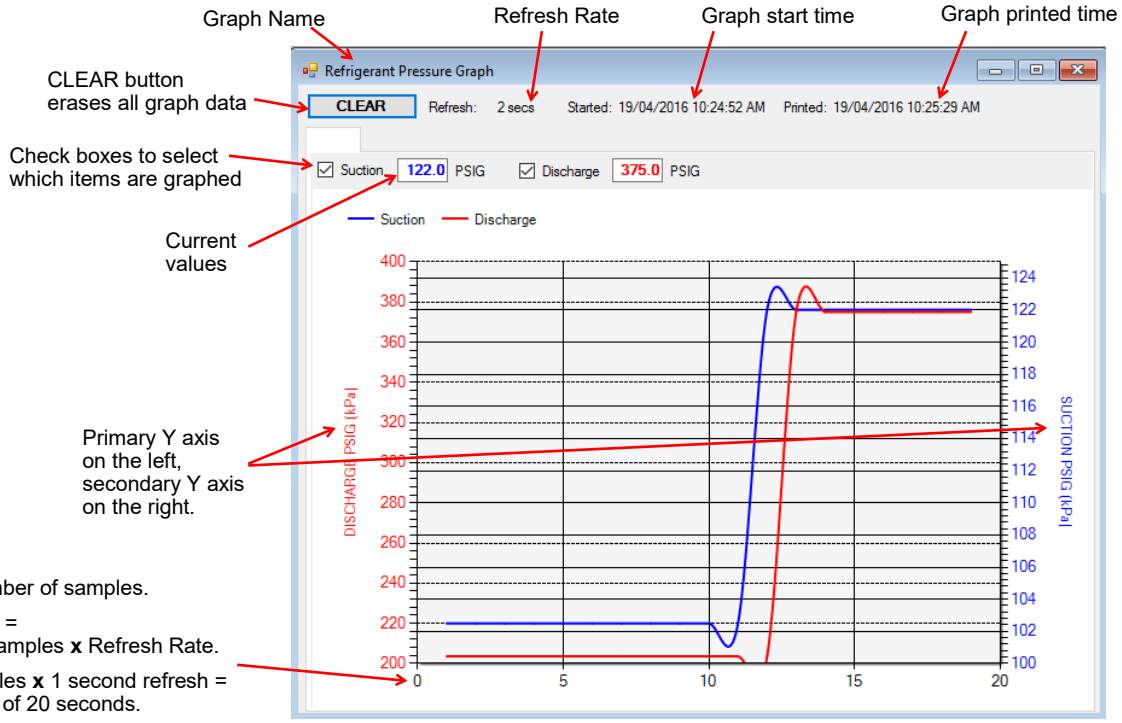


TIP: To screen print a graph and save it as a picture, press Print Screen on the keyboard and then paste into MS Paint or other graphics program. Select the desired graph with the selection tool and copy it to a new MS Paint, then save the file as the desired name.



ON/OFF status of the system control signals (demands)
ON/OFF status of heating and cooling modes
ON/OFF status of digital inputs
ON/OFF status of digital outputs
EEV position and resulting superheat
Suction temperature
Suction and discharge pressures, evaporating and condensing temperatures
Indoor blower airflow demand % and speed feedback in rpm
Outdoor fan demand % and suction pressure
Outdoor temperature and suction pressure
Indoor IN/OUT temperatures and delta T
Discharge pressure vs tank temperature
All analog input channels (0-10VDC or 4-20mA).
All PWM / 0-10VDC output channels and one PWM / 0-10VDC input channel.
For troubleshooting synchronization with 3rd party BACnet controllers.
LFL and cabinet temperature (cabinet temperature may read higher than actual)

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



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.

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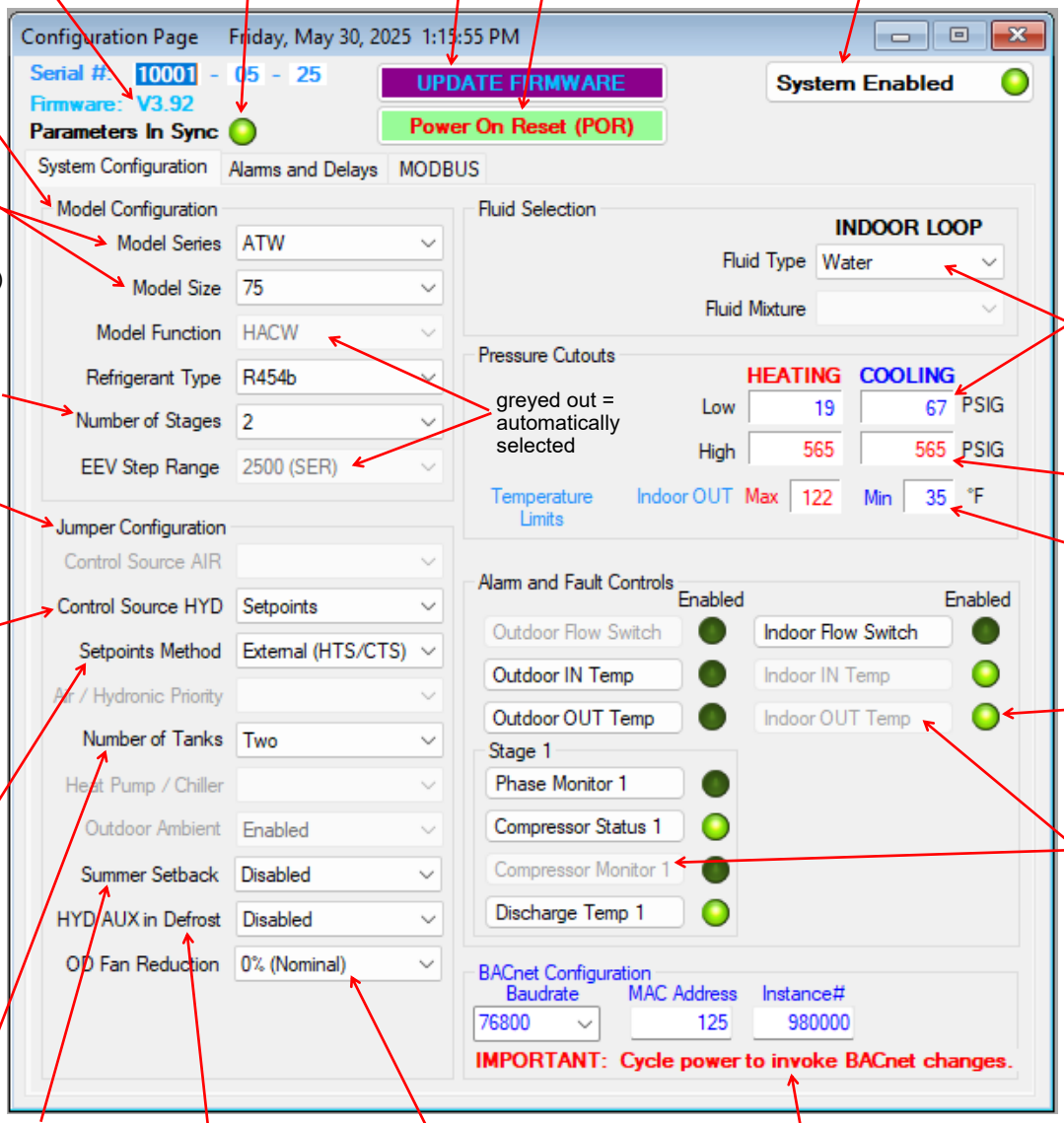
Tools Menu:

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.



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

Green when parameters have been updated, red during update

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 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 items are N/A.

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

Setpoint Control only: Selects whether to use the internal temp sensor (Indoor Loop/ICR) or external sensor (External HTS/CTS).

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

Setpoint Control 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.

Setpoint Control only: Selects whether or not AUX Heat is activated when in defrost mode. Default value is disabled.

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

If used, set BACnet communication parameters. Disconnect PC App and cycle unit power to register changes to BACnet parameters.

greyed out = automatically selected

Cooling mode 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.

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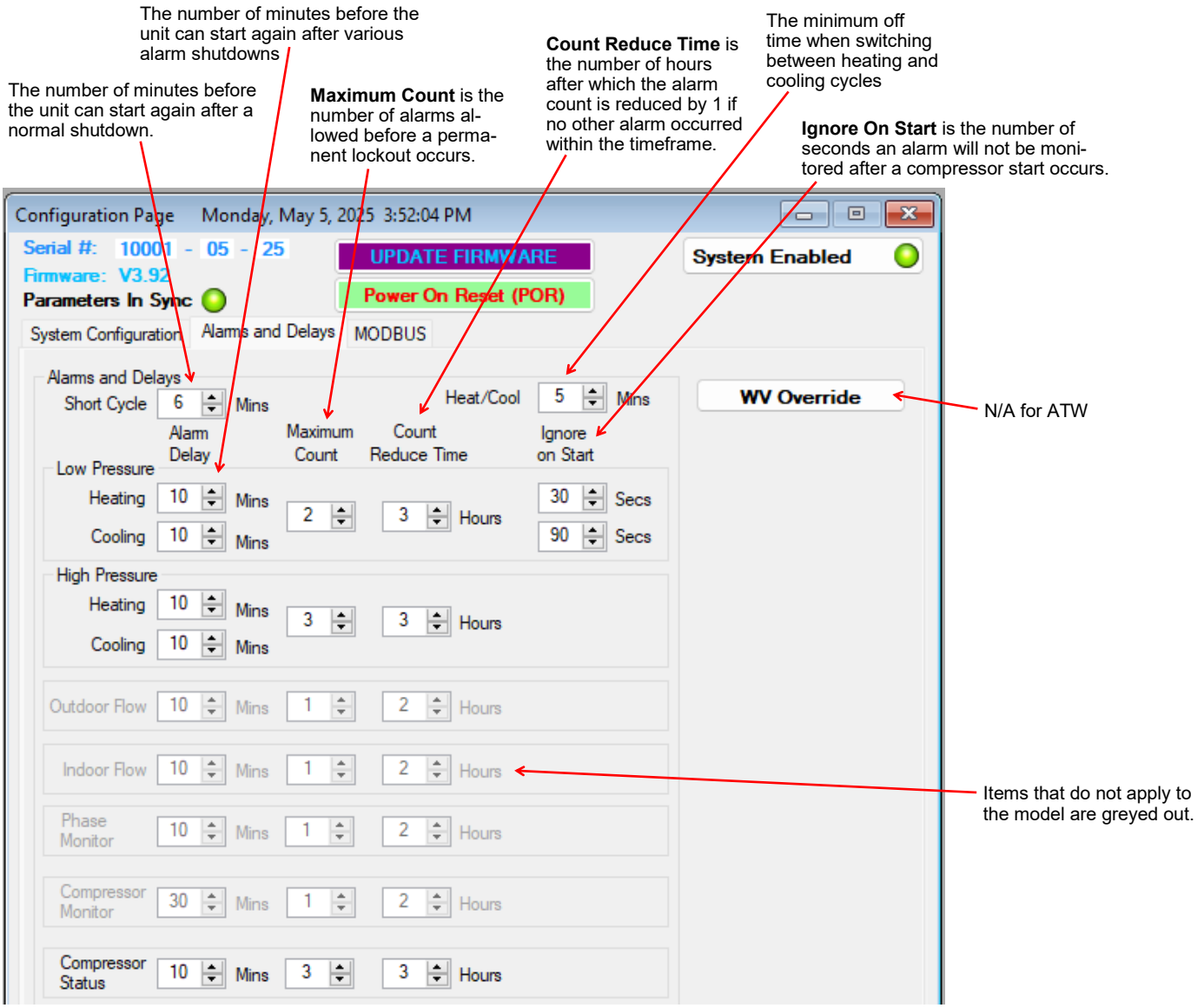
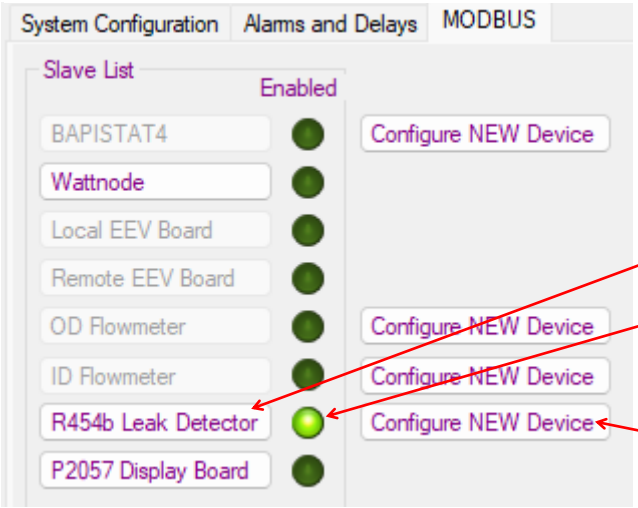
Tools-->Configuration (Alarms and Delays tab)

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



Tools-->Configuration (MODBUS tab)

Use this tab to enable MODBUS accessories, or to initialize a replacement MODBUS device (e.g. refrigerant leak detector).



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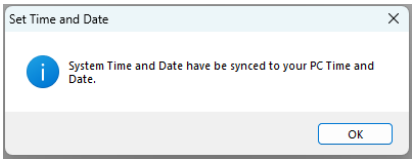
Tools-->Set Date and Time

This will synchronize the control board's time and date to that of the connected Windows PC. It is normally only necessary at installation or if electrical power has been off for several days.



Tools-->Datalogging (Datalog tab)

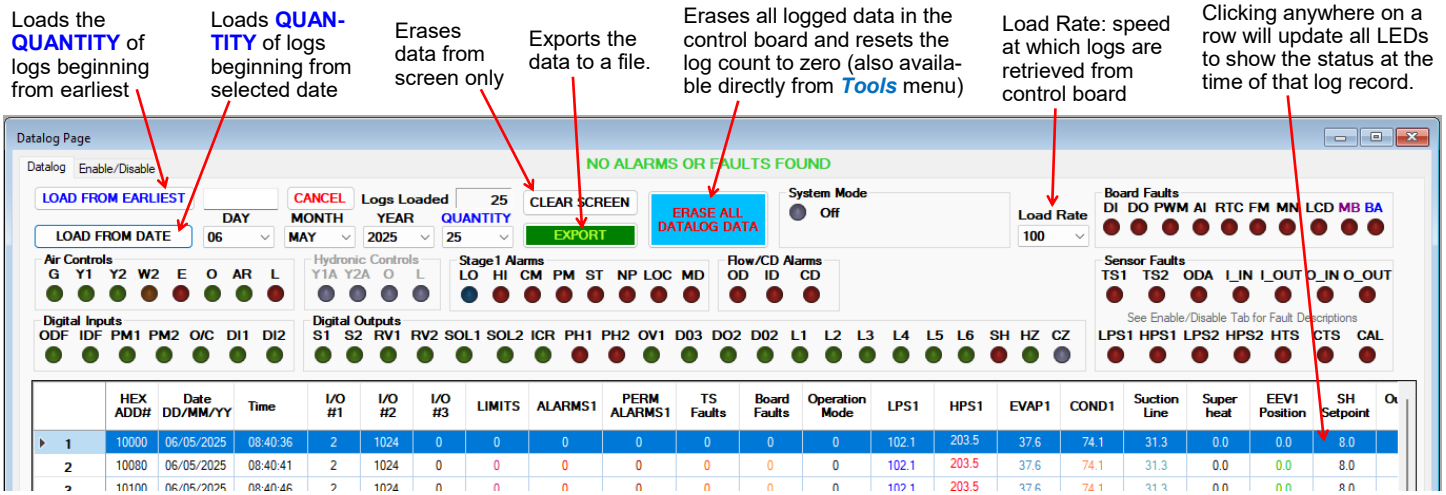
A log will be automatically recorded at the following rates:

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

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

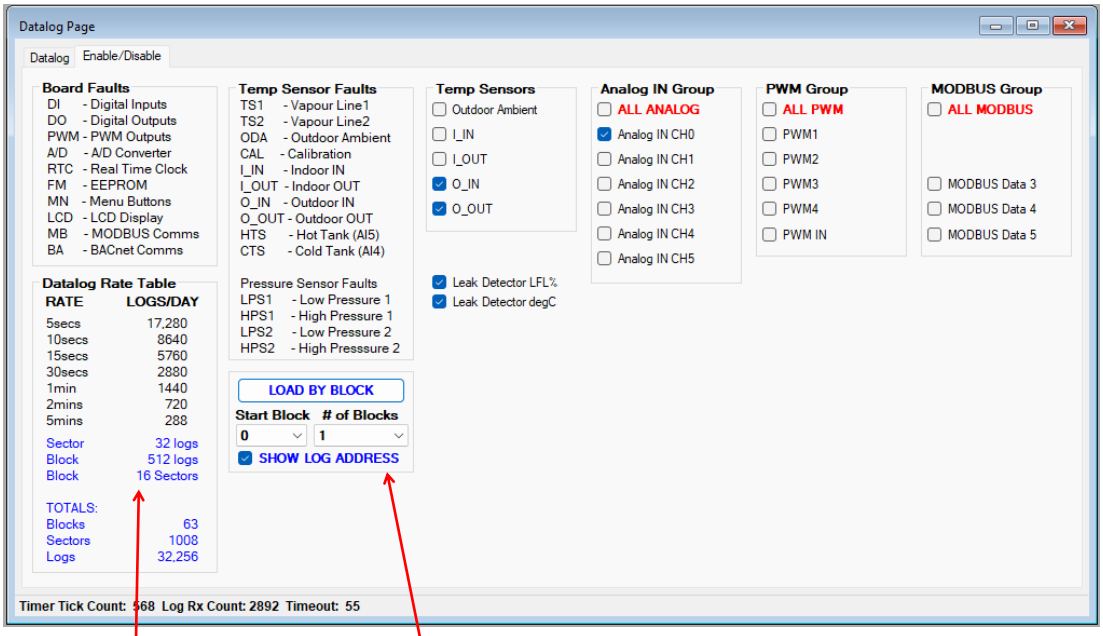
Note that loading datalogs at the standard **Load Rate** is time-consuming. It is suggested to leave **QUANTITY** at **25** until it is shown that the start date selected contains data and that any relevant alarm has been located in time.

For large data sets, **Load Rate** can be increased from the default rate of 100, but may result in less reliable loading.



Tools-->Datalogging (Enable/Disable tab)

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



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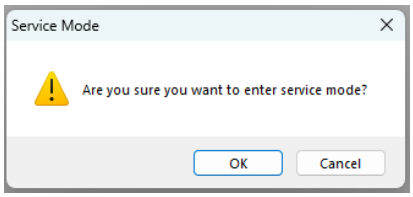
Tools-->Service Tools



Tools-->Service Tools-->System Service Mode

Disables the unit and fully opens electric valves to allow work to be done to the refrigeration system. (Also accessible via **SERVICE** button in *View -->Control Panel* window.)

To exit service mode, main breaker must be turned off and then back on.

Tools-->Service Tools-->Manual Override

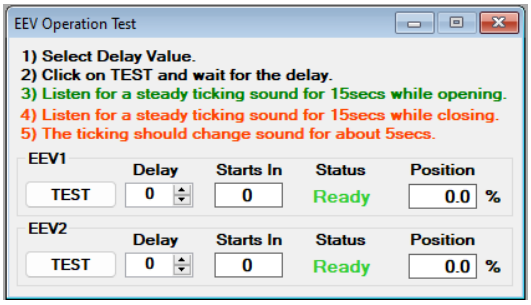
Allows individual control system demands or sensor values to be manually overridden for troubleshooting or service purposes. Also accessible via **MANUAL OVERRIDE** button in main window top bar—->

Tools-->Service Tools-->EEV Operation Test

Facilitates the audible EEV test described in the **Troubleshooting** chapter.

The EEV is operated through its range to OPEN and back to CLOSED, without an operator having to command it by using *Manual Override* mode.

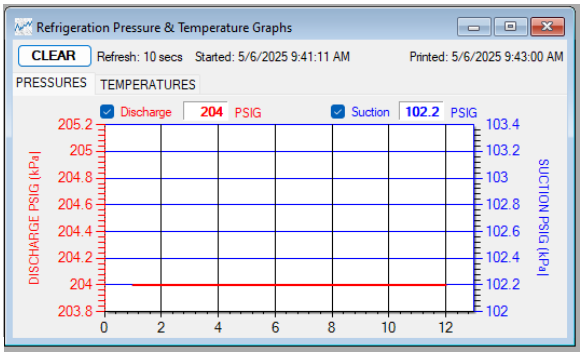
In addition, there is an adjustable delay so that the listener can go to the EEV's location before it starts to move. This is necessary when the EEV is in a remote location, as in air source split units like ATW-series.



Tools-->Service Tools-->Pressure Test Graphs

Opens an auto-scaling pressure and temperature graph to monitor pressure decline during nitrogen pressure tests which are typically performed after refrigeration system service.

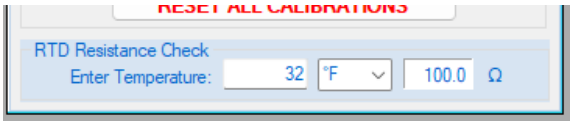
A declining pressure line (which is not associated with a declining temperature line) may indicate a leak.



Tools-->Service Tools-->RTD Resistance Check

This brings up the (rarely used) *Calibration* window, which at the bottom has a calculator for checking RTD temperature probes.

Enter the temperature of the probe, and the calculator will predict the resistance of the probe.

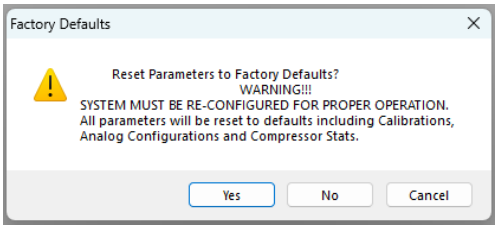


Tools-->Reset to Factory Defaults

This will reset all settings to default values.

THE SYSTEM MUST BE RECONFIGURED AFTER A RESET IS PERFORMED.

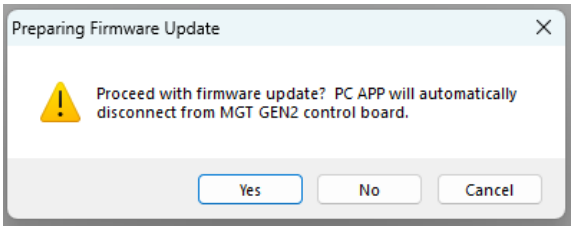
A reset will default the system to an ATW-65. Calibrations, alarm delays, analog configurations, compressor statistics, and Setpoint Control values will be returned to defaults as well.



Tools-->Update Firmware

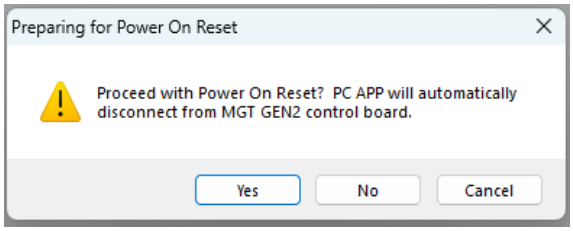
New function or bug fixes can be accessed by updating the firmware. This PC App function prepares the control board for a firmware update, by putting the board in boot loader mode and then disconnecting. The actual firmware update is done by a separate program which is downloaded along with the new firmware.

See appendix for details.



Tools-->Power On Reset (POR)

This function resets the control board as a power cycle off-on would.



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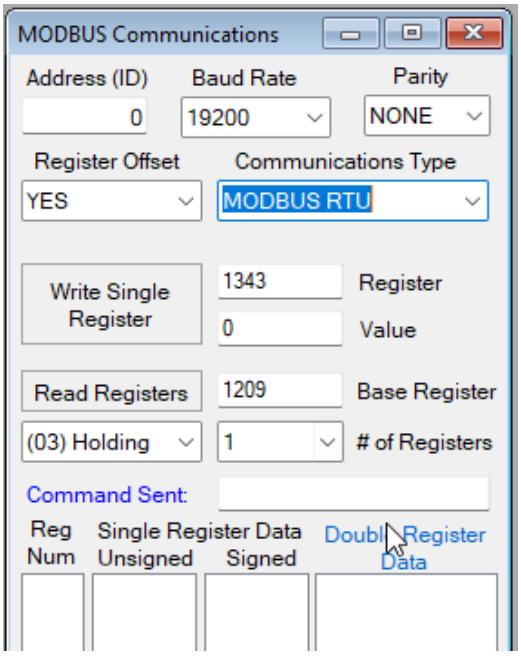
Tools-->MODBUS-->Generic MODBUS

This window is for developer use.

The one useful function for users is that when troubleshooting MODBUS communications faults, *Communications Type* may be set to **SERIAL (Debug)** for a short time and then back to **MODBUS RTU** to see if that resets the fault and prevents fault re-occurrence.



Tools-->MODBUS-->Configuration

This brings up the 3rd tab of the ***Tools-->Configuration*** window, which is detailed on a previous page.

Tools-->Advanced

WARNING! This menu is for developer use only.
Changing parameter values can cause the system to stop functioning properly.

Tools-->Advanced-->Calibration

Tools-->Advanced-->Parameters

Tools-->Advanced-->EEV PID Parameters

Tools-->Advanced-->Objects

Tools-->Advanced-->Jumpers

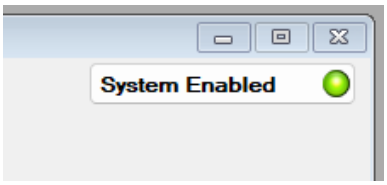
Tools-->Advanced-->SYSTEM TIMERS

Tools-->Advanced-->Performance

Tools-->System Enable/Disable

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

This is the same function as button at the top right of the 1st tab of the ***Tools-->Configuration*** window.



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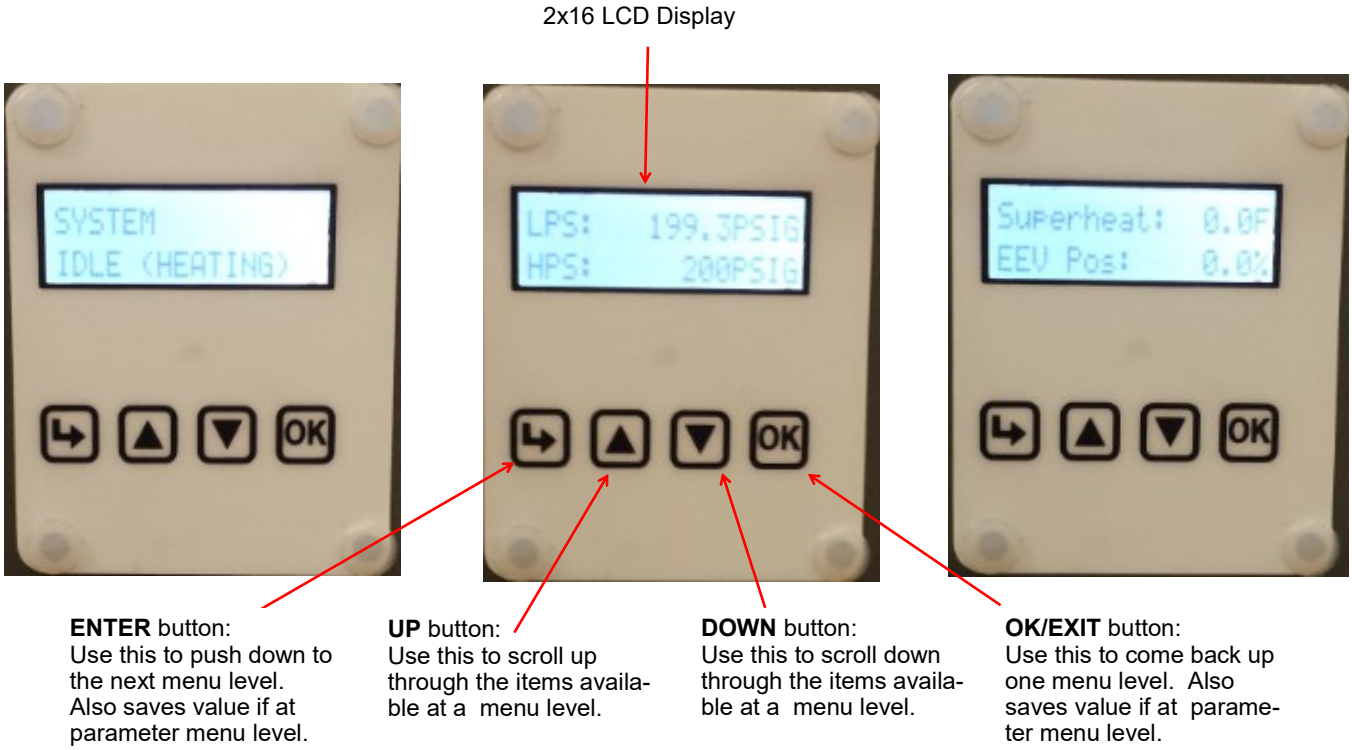
LCD Interface & Menus

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



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

ENTER (From Main)	ENTER (First Press)	ENTER (Second Press)	ENTER (Third Press)	Description
Setpoint Control *(only if using Setpoint Control)*	***— Setpoints***	***— Heating***	***— Stage 1 Setpoint***	Stage 1 stops when water temperature rises to this point.
			— Stage 1 Delta	Stage 1 starts when water temperature drops below setpoint by this amount.
			— 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.

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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 HYD***	***— BACnet***		BACnet control - see **BACnet** section
		— Signals		Hardwired Signal control
		— Setpoints		On-board water 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***		One 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.

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BACnet Interface

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

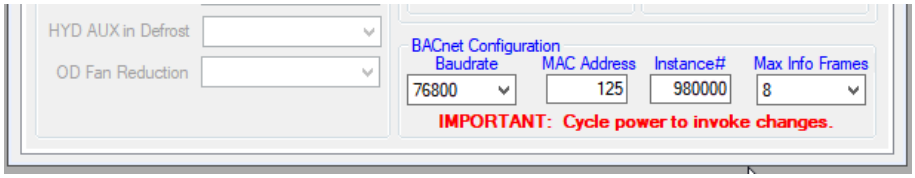
The connector on the control board is a three wire removable screw connector. The signals are as follows:
A: Communications line (+) (right pin)
B: Communications line (-) (middle pin)
C: Ground connection (left pin)

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

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

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

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



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

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

IMPORTANT: When constructing BACnet code to control the heat pump/chiller, give careful consideration to
MINIMIZING CYCLING and MAXIMIZING RUN TIMES.
The heat pump/chiller can't do its work properly and will incur excessive wear if it is turning on and off every few minutes.

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

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

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

TABLE 20 - BACnet OBJECTS - OPERATION MODE Description (Read Only)

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

TABLE 21 - BACnet OBJECTS - LIMITS Description (Read Only)

Name	ID	BIT #	Decimal Value*	Bit Description
Limits (Present Value)	**AV6**	0	1	Low Indoor OUT temperature
		1	2	High Indoor OUT temperature
		12	4,096	Stage 1 disabled - Outdoor Ambient too hot
		13	8,192	Stage 2 disabled - Outdoor Ambient too hot
Note: Limits object is type Analog Value but value is bit coded and may be decoded as such (integer value). Note * : Value is for a single alarm and reference only.				

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TABLE 22 - BACnet OBJECTS - DATA (Read Only)					
	Name	**ID**	**Property**	**Units**	**Description**
Type - Analog Input	AI0 (Comp1_Current)	AI0	Present Value	Amps	Compressor current draw
	AI1 (Comp2_Current)	AI1	Present Value	User	N/A
	AI2	AI2	Present Value	User	N/A
	AI3	AI3	Present Value	degF (degC)	Compressor discharge line temperature
	AI4 (CTS)	AI4	Present Value	degF (degC)	Cold tank temperature from sensor - requires accessory
	AI5 (HTS)	AI5	Present Value	degF (degC)	Hot tank temperature from sensor - requires accessory
	LPS1	AI6	Present Value	PSIG (kPa)	Low pressure value (suction pressure)
	HPS1	AI7	Present Value	PSIG (kPa)	High pressure value (discharge pressure)
	EVAP1	AI8	Present Value	degF (degC)	Evaporating Temperature
	COND1	AI9	Present Value	degF (degC)	Condensing Temperature
	Suction Line 1	AI10	Present Value	degF (degC)	Suction line temperature
	Superheat 1	AI11	**Setpoint Value**	degF (degC)	Evaporator superheat
	EEV1 Position	AI12	Present Value	%	EEV1 position (% open)
	LPS2	AI13	Present Value	PSIG (kPa)	N/A
	HPS2	AI14	Present Value	PSIG (kPa)	N/A
	EVAP2	AI15	Present Value	degF (degC)	N/A
	COND2	AI16	**Setpoint Value**	degF (degC)	N/A
	Suction Line 2	AI17	Present Value	degF (degC)	N/A
	Superheat 2	AI18	**Setpoint Value**	degF (degC)	N/A
	EEV2 Position	AI19	Present Value	%	EEV2 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
Type - Analog Value	PWM_IN	AV0	Present Value	%	N/A
	PWM1 (OD Fan)	AV1	Present Value	%	Outdoor fan speed
	PWM2	AV2	Present Value	%	N/A
	PWM3 (OV2)	AV3	Present Value	%	N/A
	PWM4 (IV2)	AV4	Present Value	%	IV2 - PWM or 0-10VDC for indoor loop water valve
	Operation Mode	AV5	Present Value	N/A	Description of mode - see Operation Mode Description table
	Limits description	AV6	Present Value	N/A	Description of active limits - see Limits Description table
	Permanent Alarms 1	AV7	Present Value	N/A	Description of active alarms - see Alarm Descriptions table
	Permanent Alarms 2	AV8	Present Value	N/A	N/A
	Board Faults	AV9	Present Value	N/A	Description of active faults - see Fault Descriptions table
	Sensor Faults	AV10	Present Value	N/A	Description of active faults - see Fault Descriptions table
	Defrost Mode	AV11	Present Value	N/A	Descr. of defrost status - see Defrost Mode Description table
Type - Binary Output	STAGE1	BO0	Present Value	N/A	Compressor contactor
	STAGE2	BO1	Present Value	N/A	Compressor stage 2 solenoid
	ICR (Indoor Circ)	BO2	Present Value	N/A	Indoor circulator control
	DO0 (OV1)	BO3	Present Value	N/A	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	Stage 1 dry contact pin for locked out on alarm
	PHS2	BO8	Present Value	N/A	N/A
Type - Binary Value	CONTROLS	BV9	Present Value	N/A	Control Indicator, 0 = Local (manual override), 1 = Remote
	Outdoor Flow	BV10	Present Value	N/A	N/A
	Indoor Flow	BV11	Present Value	N/A	Indoor Loop flow switch - requires accessory
	Phase Monitor1	BV12	Present Value	N/A	Phase Monitor Stage 1 - requires accessory
	Phase Monitor2	BV13	Present Value	N/A	N/A
	Comp Monitor1	BV14	Present Value	N/A	N/A
	Comp Monitor2	BV15	Present Value	N/A	N/A

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TABLE 23 - BACnet OBJECTS - DEFROST MODE Description (Read Only)				
Name	**Data Type**	**ID**	**Present Value**	**Description**
Defrost Mode	Analog Value	AV11	0	Off (normal heating operation)
			1	Waiting to re-check low pressure
			2	Entering Defrost Mode
			3	Waiting for EEV's
			4	Waiting for pressures to equalize
			5	Defrosting
			6	Completing Defrost Mode
			7	Exiting Defrost Mode
			8	Defrost disabled
Note: Object is type Analog Value but value will always be an integer value. Note: Unit is in Defrost Mode when value is >= 2 and <= 7.				

TABLE 24 - BACnet OBJECTS - ALARM Descriptions (Read Only)				
Name	**Data Type**	**ID**	**Description**	
AI0 (Comp1 Current)	Analog Input	AI0	Status alarm (start / stop failure, from current sensor)	
AI1 (Comp2 Current)	Analog Input	AI1	N/A	
LPS1	Analog Input	AI6	Low pressure alarm	
HPS1	Analog Input	AI7	High pressure alarm	
LPS2	Analog Input	AI13	N/A	
HPS2	Analog Input	AI14	N/A	
Outdoor Flow	Binary Value	BV10	N/A	
Indoor Flow	Binary Value	BV11	Indoor loop flow alarm - requires accessory	
Phase Monitor1	Binary Value	BV12	Phase Monitor alarm - requires accessory	
Phase Monitor2	Binary Value	BV13	N/A	
Comp Monitor1	Binary Value	BV14	N/A	
Comp Monitor2	Binary Value	BV15	N/A	
Name	**ID**	**BIT #**	**Decimal Value***	**Bit Description**
Permanent Alarms 1 (Present Value)	**AV7**	0	1	Master permanent alarm (occurs when any alarm occurs)
		1	3	Low pressure heating mode alarm (suction pressure)
		2	5	Low pressure cooling mode alarm (suction pressure)
		3	9	High pressure heating mode alarm (discharge pressure)
		4	17	High pressure cooling mode alarm (discharge pressure)
		5	33	Loss of charge alarm
		6	65	Phase monitor alarm - requires accessory
		7	129	Compressor monitor alarm - N/A
		8	257	Status alarm from current sensor
		15*	32,769	Indoor loop flow alarm - requires accessory
Permanent Alarms 2 (Present Value)	**AV8**	13	8192	A2L refrigerant leak detector alarm (may or may not be a permanent 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				

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TABLE 25 - BACnet OBJECTS - FAULT Descriptions (Read Only)				
Name	**Data Type**	**ID**	**Description**	
AI3 (Disch Temp)	Analog Input	AI3	Compressor discharge line temperature sensor faulty or disconnected	
AI4 (Cold Tank)	Analog Input	AI4	Cold tank temperature sensor faulty or disconnected - requires accessory	
AI5 (Hot Tank)	Analog Input	AI5	Hot tank temperature sensor faulty or disconnected - requires accessory	
LPS1	Analog Input	AI6	Low pressure sensor faulty or disconnected	
HPS1	Analog Input	AI7	High pressure sensor faulty or disconnected	
LPS2	Analog Input	AI13	N/A	
HPS2	Analog Input	AI14	N/A	
Suction Line1	Analog Input	AI10	Suction line 1 temperature sensor faulty or disconnected.	
Suction Line2	Analog Input	AI17	N/A	
Outdoor Ambient	Analog Input	AI20	Outdoor 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***	**Bit Description**
Board Faults (Present Value)	**AV9**	0	1	Digital inputs
		1	2	Digital outputs
		2	4	PWM outputs
		3	8	Analog to digital conversion
		4	16	Real time clock
		5	32	EEPROM memory
		6	64	Menu buttons
		7	128	LCD interface
Sensor Faults (Present Value)	**AV10**	0	1	Suction line temperature
		1	2	N/A
		2	4	Outdoor Ambient temperature
		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.				

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

Startup Procedure

The ATW-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 and a copy kept on file by the installer.

A copy of the detailed startup record no longer needs to be sent to Maritime Geothermal Ltd..
Instead, submit the brief warranty registration form found on last page of this manual and printed copy included with unit.

Pre-Start Inspection

Outdoor Unit:

1. Ensure the system has been pressure tested, vacuumed to 500 microns and any extra charge required has been added.
2. Ensure both 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.

Domestic Hot Water:

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

Electrical:

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

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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 compressor 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, low (suction) pressure, high (discharge) pressure, superheat, EEV position 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 compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.
3. Connect a USB cable between the USB connector on the board and a laptop 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 may start on its own if Setpoint Control is selected).**

Heating Mode:

1. Activate Stage 1 and Stage 2. The EEV will begin to open and the compressor will start, as will the circulator pumps.
2. Check the PC APP or LCD interface. The suction and discharge pressures will vary based on the outside temperature and the indoor loop temperature, but they should be about **90-110PSIG** and **260-360PSIG** respectively for a typical start-up.
3. Monitor the unit via the PC APP or LCD while the unit runs, and record the following after 10 minutes of run time:
    1. Suction pressure
    2. Discharge pressure
    3. 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 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 the discharge pressure just before the unit shuts off.
5. For units with a desuperheater, turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown in the electrical box diagram. Turn the DHW switch in the unit post on. Turn the power to the unit back on.
6. Open a zone (or zones) and let the tank cool down until Stage 2 is activated. Close the zone(s) again.
7. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand **(caution: pipes get hot).** If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.

Cooling Mode:

1. Set the unit to cooling mode and adjust the cooling setpoints to activate stage 1 and stage 2.
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. Suction pressure
    2. 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.

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Startup Record: ATW-Series

A copy of this detailed startup record no longer needs to be sent to Maritime Geothermal Ltd.. Instead, submit the brief warranty registration form (last page of manual & printed copy with unit).

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 Set	Line set length, extra charge added (only if needed)		ft.	m		lb	kg	
	System is pressure tested, vacuumed							
	All inter-connect piping is insulated and properly supported							
	Wiring is neat and securely fastened							
	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							
	Antifreeze concentration		% Volume		% Weight			
	Loop static pressure		psi	kPa				
Domestic Hot Water	All shut-off valves are open							
	Lines are full and purged							
	Desuperheater pump wire is disconnected							
Electrical	High voltage connections are correct and securely fastened							
	Circuit breaker (or fuse) size and wire gauge for heat pump		A		Ga.			
	Circulator pump voltages (Indoor 1, Indoor 2)		V		V		V	
	Low voltage connections are correct and securely fastened							

STARTUP DATA

Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3							VAC
Heating Mode (10 minutes)	Suction Pressure / Discharge Pressure					psig	kPa	
	Indoor In (Hot In), Indoor Out (Hot Out), and Delta T		In		Out		°F	°C
	Outdoor Air Temperature		°F	°C				
	Compressor L1 (black wire) current		A					
	Heating setpoint and discharge pressure at cycle end		°F	°C		psig	kPa	
	Domestic Hot Water functioning							
Cooling Mode (10 minutes)	Suction Pressure / Discharge Pressure					psig	kPa	
	Indoor In (Hot In), Indoor Out (Hot Out), and Delta T		In		Out		°F	°C
	Outdoor Air Temperature		°F	°C				
	Cooling setpoint and suction pressure at cycle end		°F	°C		psig	kPa	
Final Setpoints	Heating S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C	
	Heating S3 Setpoint, S3 Delta, S3 Time Delay			°F	°C		min	
	Cooling S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C	

Date:		**Startup Personnel Signature:**	**Site Personnel Signature:**

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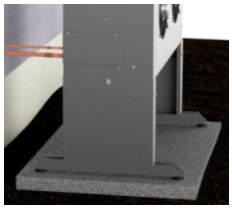
Routine Maintenance

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 Contactor		1 year	Inspect for pitted or burned points. Replace if necessary.
LCD Interface or PC App		When heat pump problem is suspected	Check for alarms and faults (only necessary if alarms not reported through a BACnet system). Rectify problem if alarms found. See **Troubleshooting** chapter.
Coaxial Heat 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 loop or cold water open loop systems or closed indoor loops; whenever system performance is reduced for hot water open indoor loop systems (unusual).

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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 is not operating, does not attempt to start, attempts to start but cannot, starts hard, or starts but does not sound normal, proceed to the COMPRESSOR TROUBLESHOOTING section.

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

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

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

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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	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	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 (current sensor)	This alarm occurs when there is a current draw on the compressor but no call for the compressor to be on (welded contactor) or when there is a call for the compressor to be on but there is no compressor current draw (manual high pressure control is open or contactor failure). Current sensor is now standard.	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.
Not Pumping / Man HP	Discharge pressure is less than 30 psi higher than suction pressure after 2 minutes run time. It indicates leaking reversing valve, compressor very hot and tripped on internal overload, manual high pressure control trip, bad contactor, or defective compressor.	Check for reversing valve not seated properly, tripped manual high pressure control, or a contactor or compressor problem.
Low Charge / EEV	EEV position has been above 99% for 20 minutes within the first hour of cycle.	Check system for refrigerant leak. Also check EEV for proper operation (see **EEV Troubleshooting** section)
LOC (Loss of Charge)	This alarm occurs if the low pressure and/or high pressure sensors are below 30 psig (207 kPa).	Check system for refrigerant leak. Check for incorrect pressure sensor reading.
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.
Leak Detector / R454b Leak	Refrigerant sensor detected the presence of refrigerant inside the PC cabinet.	Locate and fix leak, taking all necessary precautions associated with **A2L** refrigerants. See **Service Procedures** chapter.

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FAULT TROUBLESHOOTING

Alarm/Fault	Description	Recommended Action
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.
Control Board: *- Digital Inputs* *- Digital Outputs* *- Analog Inputs* *- Real Time Clock* *- PWM Outputs*	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.
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.
Control Board: *- Menu Buttons*	A failure has occurred and the control board may no longer respond to menu button key presses.	Try turning off the power, disconnecting and reconnecting the cable between the LCD Interface board and the Control Board, and then turning the power back on again. If this does not work then either the LDC Display board, the cable, or the driver section of the Control Board may be faulty.
Control Board: *- LCD Interface / LCD Display*	A failure has occurred and display may show erratic data, no data or may not turn on at all.	
Control Board: *- BACnet Comms*	BACnet communications experienced a timeout.	See **BACnet TROUBLESHOOTING** on next page.
MODBUS: *- Main Comms*	Hardware problem on heat pump control board.	24V**DC** is not present across **24VDC** and **GND** at the lower right of control board. Replace board if voltage not correct.
		Remove MODBUS screw terminal connector from board as well as jumper from **TERM** (located just above the MODBUS connector). Using a multimeter set to DC volts with negative probe on **B** and positive probe on **A**, confirm there is **+2.5VDC**. Replace board if voltage not correct.
	MODBUS termination problem.	Verify MODBUS **TERM** jumper is in place on control board. Install jumper if missing.
MODBUS: *- R454b Leak Detector*	Refrigerant detector communications experienced a timeout.	See **LEAK DETECTOR TROUBLESHOOTING** on next page.

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

LEAK DETECTOR TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Refrigerant detector not working properly **or** **MODBUS R454b Leak Detector fault indication**	Hardware problem on heat pump control board	5V**DC** is not present across **5VDC** and **GND** at the lower right of control board.	Replace board if voltage not correct.
		Remove MODBUS screw terminal connector from board & jumper from TERM (located above BACnet connector). Using multimeter set to DC volts with black probe on **B** and red probe on **A**, confirm there is **+2.5VDC**.	Replace board if voltage not correct.
	New / replacement refrigerant leak detector not initialized.	Go to **Tools-->Configuration** window, **MODBUS** tab and press the "Configure NEW Device" button beside **R454b Leak Detector.**	
	MODBUS termination problem	Verify MODBUS **TERM** jumper is in place on control board.	Install jumper if missing.
	Faulty refrigerant leak detector	5V**DC** is present on board as per above, termination is correct, but problem persists.	Replace leak detector.

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

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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 (EEV2) - see **EEV Troubleshooting** section	Replace outdoor EEV if faulty.
	Faulty outdoor temperature sensor	Outdoor EEV verified to be good, no loose connections in indoor to outdoor control wiring	Replace outdoor temperature sensor.
High or low suction or discharge pressure	Faulty sensor	Compare pressure sensor reading against a known reference such as a new refrigeration manifold set.	Check wiring, replace sensor. If problem persists, replace control board.
High discharge pressure	Low 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.
	Temperature setpoint(s) too high (if using external Signals or BACnet control)	Use PC APP to verify that Indoor OUT does not exceed 120°F (49°C)	Reduce setpoint(s).
	Outdoor unit's 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.
	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 air delta T.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces.
	Refrigerant contaminated with air or nitrogen	Possibility of procedural error during line set vacuuming and charging.	Replace refrigerant.
Low suction pressure	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 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.
	Outdoor unit's 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 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.

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OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High suction pressure (may appear to not be pumping)	Outdoor unit's EEV 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 (can cause compressor to overheat and trip internal overload)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	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	Outdoor unit's 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	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, low air delta T.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces.
	Refrigerant contaminated with air or nitrogen	Possibility of procedural error during line set vacuuming and charging.	Replace refrigerant.

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OPERATION TROUBLESHOOTING - DEFROST & COOLING MODES			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High suction pressure (may appear to not be pumping)	Indoor unit's EEV 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 (can cause compressor to overheat and trip internal overload)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	Replace reversing valve.
	Faulty compressor, not pumping	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Low suction pressure	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 EEV 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 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 EEV 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.

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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 outdoor EEV operation (EEV2) - see **EEV Troubleshooting** section	Replace outdoor EEV if faulty.
	Faulty outdoor temperature sensor	Outdoor EEV verified to be good, no loose connections in indoor to outdoor control wiring	Replace outdoor temperature sensor.

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.

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EEV (Electronic Expansion Valve) TROUBLESHOOTING

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

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

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

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

Tests to determine if an EEV is working

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

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

The EEV can be checked electrically:

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

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

Check with a new EEV:

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

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

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

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Service Procedures

A2L-SPECIFIC WARNING / INSTRUCTION

Servicing a Unit with an A2L Refrigerant

1. Work procedure

Work should be undertaken under a controlled procedure, for example according to an ordered checklist. This may be in contrast to how refrigeration service work has normally been performed in the past, and is to minimize the risk of flammable gas being present while the work is being performed .

2. General work area

All maintenance staff and others working in the local area should be instructed on the nature of work being carried out. Work in confined spaces should be avoided.

3. Checking for presence of refrigerant

The area should be checked with a refrigerant detector prior to and during work, to ensure the technician is aware of potentially oxygen-deprived or flammable atmospheres.

Ensure that the leak detection equipment being used is suitable for use with A2L refrigerants, i.e. non-sparking, and adequately sealed or intrinsically safe. Under no circumstances should a torch or flame be used in the searching for refrigerant leaks.

Electronic leak detectors may be used but for A2L's they may need re-calibration in a refrigerant-free area. Leak detection equipment should be set at a percentage of the LFL (lower flammability limit) of the refrigerant (25% maximum). The worst-case LFL for R454b is **0.296 kg/m³** or **11.3%** by volume.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine should be avoided as the chlorine can react with the refrigerant and corrode the copper pipe-work.

If a leak is suspected at any time, all naked flames should be removed/extinguished.
If a leakage of refrigerant is found which requires brazing, all of the refrigerant should be first recovered from the system, or isolated (by means of shut-off valves) in a part of the system remote from the leak.

5. Presence of fire extinguisher

If any torch work (brazing) or refrigerant charging or removal is to be conducted, a dry powder or CO2 fire extinguisher should be ready at hand.

6. No ignition sources

Sources of ignition should be eliminated in the vicinity of work being carried out on a system containing an A2L refrigerant. Prior to work taking place, the area around the equipment should be surveyed to make sure that there are no flammable hazards or ignition risks. "No Smoking" signs should be displayed .

6. Ventilation of area

Ensure that the area is open to the outdoors or that it is adequately ventilated before breaking into the system or conducting any hot work. Ventilation should continue during the work, and can function to disperse any released refrigerant into a large space or preferably expel it into the outdoors.

7. Checks of the refrigeration equipment

- The refrigerant charge is in accordance with the size of the room within which the system is installed.
- The ventilation equipment (if any) is operating adequately and is not obstructed.
- The water/glycol/pool water loop should be checked for the presence of refrigerant, which might show up with a refrigerant detector or by over-pressure in that loop.
- Equipment markings continue to be visible and legible. Illegible signs or markings should be corrected.
- Refrigeration piping is installed in a position where it is unlikely to be exposed to corrosive substances, unless the piping is constructed of materials which are inherently resistant to corrosion from that substance.

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A2L-SPECIFIC WARNING / INSTRUCTION

Servicing a Unit with an A2L Refrigerant (continued)

8. Checks to electrical devices & wiring

Where electrical components are being changed, they should be as specified by Maritime Geothermal Ltd.. If in doubt, consult technical support for assistance.

Electrical components should be inspected. If a fault is found, electrical supply should not be connected to the circuit until the fault is rectified. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution should be used. This should be reported to the owner of the equipment so all parties are advised.

Initial safety checks should include:

- Capacitors are discharged - this should be done in a safe manner to avoid possibility of sparking.
- No live electrical components and wiring are exposed while charging, recovering or purging the system.
- There is continuity of earth grounding/bonding.
- Check cabling for wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check should take into account the effects of aging or continual vibration from sources such as compressors or fans.

9. Refrigerant removal and circuit evacuation

When breaking into the refrigerant circuit to make repairs - or for any other purpose - conventional procedures should be used. However, with flammable refrigerants it is important that best practice is followed:

a) Safely remove refrigerant following local and national regulations, recovering into the correct recovery cylinders.
b) Evacuate (vacuum). Ensure that the outlet of the vacuum pump is not close to any potential ignition sources and that ventilation is available.
c) Purge the circuit by breaking the vacuum in the system with dry nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere.
d) Evacuate (vacuum) again, then vent to atmospheric pressure to enable work to take place.
e) Open the circuit with torch, continuously flushing with dry nitrogen.

10. Charging

In addition to conventional charging procedures, the following should be observed.

- Ensure that contamination between different refrigerants does not occur when using charging equipment. Hoses should be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders should be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating system is grounded prior to charging the system with refrigerant.
- Label the system when charging is complete (if final refrigerant charge is different from factory label).
- Extreme care should be taken not to over-charge the refrigerating system.

Prior to recharging the system, it should be pressure-tested with dry nitrogen. In addition, the system should be A2L leak-tested on completion of charging but prior to commissioning. A final A2L leak test should be carried out prior to leaving the site.

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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 unit breaker is not turned off during service.

IMPORTANT: Power up the unit and engage ***SERVICE MODE*** via the LCD or PC App before any post-installation service: pressure testing, vacuuming, or charging the line set.
This will ensure all electronic valves are open and there are no sections of trapped/isolated piping.

Pumpdown Procedure

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

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

General Repair Procedure

1. Perform repairs to system.
   - Always ensure nitrogen is flowing through the system at the lowest flow rate that can be felt at the discharge during any brazing procedures to prevent soot buildup inside the pipes.
   - It is recommended to replace the liquid line filter-dryer any time the refrigeration system has been exposed to the atmosphere.
   - Place a wet rag around any valves being installed, as almost all valve types have non-metallic seats or seals that will be damaged by excessive heat, and aim the torch flame away from the valve body. Solder only one joint at a time and cool joints down in between.
2. Pressure test the system with nitrogen. It is recommended to check for leaks using leak detection spray, Spray Nine, or soapy water. Check at 10, 25, 50 and 100 psig. Allow the system to sit at 100 psig for at least an hour, then re-check. With a laptop connected, the **PC App** may be used to graph the nitrogen pressure (**Graphs** menu--> **Refrigeration Pressure and Temperature Graphs**) to make any downward trend due to a leak apparent. Be aware that changing room temperature can also cause upward or downward trends in nitrogen pressure.

Vacuuming & Charging Procedure

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

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

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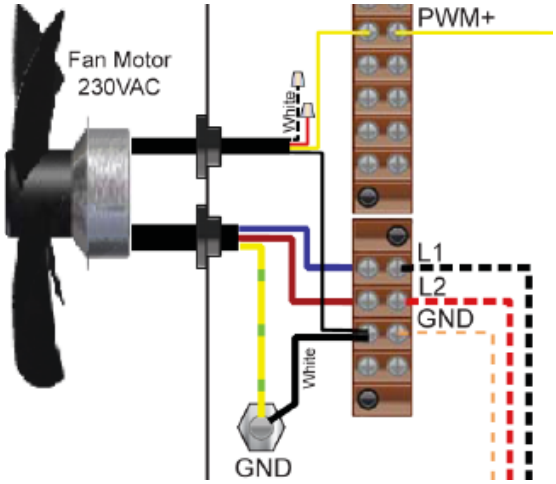
Compressor Replacement Procedure

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.

Outdoor Fan Replacement Procedure

1. Turn of the power to the Indoor Unit. This will ensure that power and control signals are off in the outdoor unit.
2. Remove the two screws that hold the electrical box cover in place and remove the cover.
3. Remove the two bolts that secure the front cover in place.
4. Loosen the four bolts that hold the fan guard in place.
5. Swing the front cover open.

6. For the fan signal cable: remove the **YELLOW** wire from the **PWM** terminal and remove the **BLACK** wire from the **GND** terminal.
7. For the fan power cable: remove the **BLUE** wire from **L1**, the **RED** wire from **L2** and the **YELLOW/GREEN** wire from **GND**.
8. Pull the cables out of the electrical box, noting the path for installation of the new fan. Cut wire ties if necessary.
9. Remove the four fan guard bolts and remove the fan and guard as one.
10. Installation is the reverse of removal.



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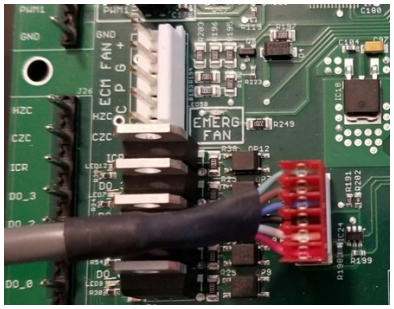
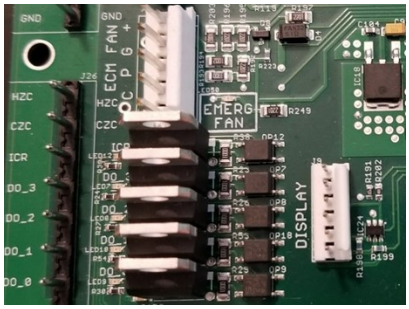
Control Board Replacement Procedure

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.

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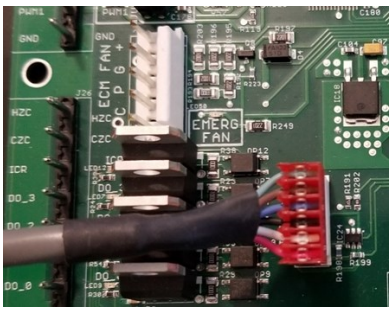
LCD Interface (Display) Board Replacement Procedure

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.

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Decommissioning

When the heat pump has reached the end of its useful lifetime after many years of service, it must be decommissioned.

Before carrying out this procedure, it is essential that the technician is completely familiar with the system and all its connected equipment. It is good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample should be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Examine all parts of the system to become familiar with the equipment and its operation.
2. Isolate system electrically.

3. Before starting the procedure, ensure that:
   a) equipment is available for handling refrigerant and refrigerant cylinders.
   b) recovery equipment and cylinders conform to the appropriate standards.
   c) all personal protective equipment is available and being used correctly.
   d) personnel are appropriately qualified.

4. Pump down refrigerant system.
5. If solenoid valves are closed and can't be powered open or there are other obstructions in the refrigeration system, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that the cylinder is situated on a scale before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80 % volume liquid charge).
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When all the refrigerant has been removed and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant should not be charged into another refrigerating system unless it has been checked and/or cleaned.

Equipment should be labelled stating that it has been de-commissioned and emptied of refrigerant. The label should be dated and signed.

Every effort should be made to check and **RE-USE** refrigerant and **RECYCLE** mechanical equipment.

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Model Specific Information

Table 26 - Refrigerant Charge				
MODEL	lb	*kg*	Refrigerant	Oil Type
ATW-25	5.5	*2.5*	R454b	POE
ATW-45	7.5	*3.4*	R454b	POE
ATW-55	8.0	*3.6*	R454b	POE
ATW-65	10.0	*4.5*	R454b	POE
ATW-75	11.0	*5.0*	R454b	POE

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

Table 27 - Shipping Information - Indoor Unit				
MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm) L	W	H
ATW-25	270 (122)	34 (86)	34 (86)	35 (89)
ATW-45	294 (133)	34 (86)	34 (86)	35 (89)
ATW-55	318 (144)	34 (86)	34 (86)	35 (89)
ATW-65	334 (151)	34 (86)	34 (86)	35 (89)
ATW-75	362 (164)	34 (86)	34 (86)	35 (89)

Table 28 - Shipping Information - Outdoor Unit				
MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm) L	W	H
ATW-25	230 (104)	36 (91)	70 (178)	45 (114)
ATW-45	230 (104)	36 (91)	70 (178)	45 (114)
ATW-55	230 (104)	36 (91)	70 (178)	45 (114)
ATW-65	295 (134)	36 (91)	70 (178)	56 (142)
ATW-75	295 (134)	36 (91)	70 (178)	56 (142)

Table 29 - Indoor Loop Flow Rates		
SIZE	gpm	L/s
ATW-25	8	0.50
ATW-45	10	0.63
ATW-55	12	0.76
ATW-65	14	0.88
ATW-75	16	1.01

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

Table 30 - Operating Temperature Limits					
Loop	Mode	Parameter	(°F)	(°C)	Note
Indoor	Heating	Minimum ELT	60	15	Reduce flow if necessary during startup.
	Heating	Maximum LLT	120	49	Note that this may be de-rated to as low as 105°F (41°C) depending on outdoor temperature. See table in **Operation** chapter.
	Cooling	Minimum LLT	35	2	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 31 - 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
ATW-25	68.0	61.1	66.4	59.7	63.5	57.4	59.3	56.7
ATW-45	68.0	61.1	66.4	59.7	63.5	57.4	59.3	56.7
ATW-55	72.4	66.8	71.1	64.8	68.0	62.9	64.6	61.1
ATW-65	70.3	62.9	65.9	60.5	62.2	58.1	56.6	54.0
ATW-75	71.7	66.8	68.7	63.7	65.7	61.2	60.0	57.1

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

Table 32 - Indoor Unit Sound Levels (dBA)*		
MODEL	1 ft distance	3 ft distance
ATW-25	57.1	55.8
ATW-45	57.2	56.0
ATW-55	56.4	54.9
ATW-65	55.7	53.0
ATW-75	55.7	53.0

* With all doors installed.

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Pressure Drop Data

Table 33: Loop Pressure Drop Data			Water 104°F		Water 50°F		15% Methanol 32°F		35% prop. glycol 32°F	
	gpm	L/s	psi	kPa	psi	kPa	psi	kPa	psi	kPa
ATW-25	4	0.25	0.8	5.5	0.9	6.2	0.9	6.2	1.2	8.2
	5	0.32	1.3	9.0	1.4	10	1.4	9.6	1.8	13
	6	0.38	1.6	11	1.7	12	1.9	13	2.5	17
	7	0.44	2.1	14	2.3	16	2.4	17	3.2	22
	8	**0.50**	**3.0**	**21**	**3.2**	**22**	**3.0**	**21**	**4.0**	**27**
	9	0.57	3.1	21	3.4	23	3.9	27	5.1	35
	10	0.63	4.1	28	4.4	30	4.8	33	6.3	43
	11	0.69	4.8	33	5.1	35	5.7	39	7.5	52
	12	0.76	5.7	39	6.0	41	6.6	45	8.7	60
	13	0.82	6.7	46	6.9	48	7.7	53	10.1	70
ATW-45	4	0.25	0.8	5.5	0.9	6.2	1.0	6.9	1.3	9.0
	5	0.32	1.1	7.6	1.2	8.3	1.4	9.6	1.8	13
	6	0.38	1.6	11	1.7	12	2.0	14	2.6	18
	7	0.44	1.9	13	2.1	14	2.5	17	3.3	23
	8	0.50	2.6	18	2.8	19	3.0	21	4.0	27
	9	0.57	3.2	22	3.5	24	3.8	26	5.0	34
	10	**0.63**	**3.8**	**26**	**4.0**	**28**	**4.7**	**32**	**6.2**	**43**
	11	0.69	4.3	30	4.6	32	5.5	38	7.2	50
	12	0.76	5.2	36	5.5	38	6.6	45	8.7	60
	13	0.82	5.9	41	6.2	43	7.4	51	9.7	67
	14	0.88	6.7	46	7.0	48	8.6	59	11.3	78
	15	0.95	8.0	55	8.2	57	9.5	65	12.5	86
ATW-55	6	0.38	1.1	7.6	1.2	8.3	1.3	9.0	1.7	12
	7	0.44	1.5	10	1.6	11	1.6	11	2.1	14
	8	0.50	1.8	12	1.9	13	2.1	14	2.8	19
	9	0.57	2.2	15	2.4	17	2.4	17	3.2	22
	10	0.63	2.7	19	2.9	20	3.1	21	4.1	28
	11	0.69	2.8	19	3.1	21	3.6	25	4.7	33
	12	**0.76**	**3.4**	**23**	**3.7**	**26**	**4.4**	**30**	**5.8**	**40**
	13	0.82	4	28	4.3	30	5	34	6.6	45
	14	0.88	4.7	32	5	34	5.7	39	7.5	52
	15	0.95	5.6	39	5.8	40	6.4	44	8.4	58
	16	1.01	6.1	42	6.3	43	7.1	49	9.3	64

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Table 33: Loop Pressure Drop Data (cont'd)			Water 104°F		Water 50°F		15% Methanol 32°F		35% prop. glycol 32°F	
	gpm	L/s	psi	kPa	psi	kPa	psi	kPa	psi	kPa
ATW-65	6	0.38	1.1	7.6	1.2	8.3	1.3	9.0	1.7	12
	7	0.44	1.4	10	1.5	10	1.8	12	2.4	16
	8	0.50	1.8	12	1.9	13	2.2	15	2.9	20
	9	0.57	2.1	14	2.3	16	2.7	19	3.6	24
	10	0.63	2.4	17	2.6	18	3.3	23	4.3	30
	11	0.69	2.9	20	3.2	22	4	28	5.3	36
	12	0.76	3.6	25	3.9	27	4.6	32	6.0	42
	13	0.82	4.1	28	4.4	30	5.2	36	6.8	47
	14	**0.88**	**4.7**	**32**	**5.0**	**34**	**5.8**	**40**	**7.6**	**53**
	15	0.95	5.5	38	5.7	39	6.5	45	8.5	59
	16	1.01	6.3	43	6.5	45	7.3	50	9.6	66
ATW-75	6	0.38	0.6	4.1	0.7	4.8	0.9	6.2	1.2	8.2
	7	0.44	0.8	5.5	0.9	6.2	1.0	6.9	1.3	9.0
	8	0.50	1.2	8.3	1.3	9.0	1.3	9.0	1.7	12
	9	0.57	1.5	10	1.6	11	1.6	11	2.1	14
	10	0.63	1.8	12	1.9	13	2.1	14	2.8	19
	11	0.69	2.1	14	2.3	16	2.4	17	3.2	22
	12	0.76	2.4	17	2.6	18	2.9	20	3.8	26
	13	0.82	2.8	19	3.0	21	3.3	23	4.3	30
	14	0.88	2.9	20	3.2	22	3.7	26	4.9	33
	15	0.95	3.2	22	3.5	24	4.1	28	5.4	37
	16	**1.01**	**3.8**	**26**	**4.0**	**28**	**4.7**	**32**	**6.2**	**43**
	17	1.07	4.2	29	4.4	30	5.2	36	6.8	47

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Standard Capacity Ratings

The tables show the heat pump performance at the standard rating conditions specified in ***AHRI standard 550/590 with Addendum 1, September 2017***. There is currently no AHRI certification program for air to water heat pumps in heating mode; therefore, the blue **AHRI CERTIFIED** mark is not applicable to any manufacturer's air to water heat pumps in heating duty.

All data is for ***60 Hz operation*** with ***water*** as the indoor loop fluid.

Table 34 - Standard Capacity Ratings: HEATING

Model	Loop Flow (gpm)	ΔP (psi)	LLT	Outdoor Air Temp	Input Energy (W)	Capacity (Btu/hr)	COP_H
ATW-25	8.0	3.0	105°F	47°F	1,400	20,300	4.25
				17°F	1,625	13,200	2.38
			120°F	47°F	1,696	19,500	3.37
				17°F	1,934	13,000	1.97
ATW-45	10.0	3.8	105°F	47°F	2,087	30,900	4.34
				17°F	2,488	20,800	2.45
			120°F	47°F	2,517	29,800	3.47
				17°F	2,974	20,700	2.04
ATW-55	12.0	3.4	105°F	47°F	2,802	41,200	4.31
				17°F	3,294	27,200	2.42
			120°F	47°F	3,354	39,600	3.46
				17°F	3,869	26,800	2.03
ATW-65	14.0	4.7	105°F	47°F	3,533	51,600	4.28
				17°F	4,201	34,400	2.40
			120°F	47°F	4,247	49,700	3.43
				17°F	4,928	33,800	2.01
ATW-75	16.0	3.8	105°F	47°F	4,048	59,400	4.30
				17°F	4,767	39,200	2.41
			120°F	47°F	4,851	57,100	3.45
				17°F	5,586	38,500	2.02

METRIC

Table 34a - Standard Capacity Ratings: HEATING (METRIC)

Model	Loop Flow (L/s)	ΔP (kPa)	LLT	Outdoor Air Temp	Input Energy (W)	Capacity (kW)	COP_H
ATW-25	0.50	21	41°C	8°C	1,400	5.9	4.25
				-8°C	1,625	3.9	2.38
			49°C	8°C	1,696	5.7	3.37
				-8°C	1,934	3.8	1.97
ATW-45	0.63	26	41°C	8°C	2,087	9.1	4.34
				-8°C	2,488	6.1	2.45
			49°C	8°C	2,517	8.7	3.47
				-8°C	2,974	6.1	2.04
ATW-55	0.76	23	41°C	8°C	2,802	12.1	4.31
				-8°C	3,294	8.0	2.42
			49°C	8°C	3,354	11.6	3.46
				-8°C	3,869	7.9	2.03
ATW-65	0.88	32	41°C	8°C	3,533	15.1	4.28
				-8°C	4,201	10.1	2.40
			49°C	8°C	4,247	14.6	3.43
				-8°C	4,928	9.9	2.01
ATW-75	1.0	26	41°C	8°C	4,048	17.4	4.30
				-8°C	4,767	11.5	2.41
			49°C	8°C	4,851	16.7	3.45
				-8°C	5,586	11.3	2.02

Table 35 - Standard Capacity Ratings: COOLING

Model	Loop Flow (gpm)	ΔP (psi)	ELT	Outdoor Air Temp	Input Energy (W)	Capacity (Btu/hr)	EER COP_C
ATW-25	8.0	3.2	54°F	95°F	1,670	16,200	9.7 2.84
ATW-45	10.0	4.0	54°F	95°F	2,422	24,700	10.2 2.99
ATW-55	12.0	3.7	54°F	95°F	3,260	32,600	10.0 2.93
ATW-65	14.0	5.0	54°F	95°F	4,079	41,200	10.1 2.96
ATW-75	16.0	4.0	54°F	95°F	4,758	47,100	9.9 2.90

Table 35a - Standard Capacity Ratings: COOLING (METRIC)

Model	Loop Flow (L/s)	ΔP (kPa)	ELT	Outdoor Air Temp	Input Energy (W)	Capacity (kW)	EER COP_C
ATW-25	0.50	22	12°C	35°C	1,670	4.7	9.7 2.84
ATW-45	0.63	28	12°C	35°C	2,422	7.2	10.2 2.99
ATW-55	0.76	26	12°C	35°C	3,260	9.6	10.0 2.93
ATW-65	0.88	34	12°C	35°C	4,079	12.1	10.1 2.96
ATW-75	1.0	28	12°C	35°C	4,758	13.8	9.9 2.90

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Performance Tables ATW-25-HACW-X-1T

R454b, 60 Hz, YAS20K1E-PFV

HEATING

OUTDOOR			ELECTRICAL		INDOOR						
Outdoor Air Temperature	Evaporating Temp. (°F)	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°F)	Liquid Flow (gpm)	LLT	Delta T (°F)	Heating (Btu/hr)	COP_H
-5°F	-16	4,600	7.4	1,840	102	111	8.0	**105°F**	2.6	**10,200**	**1.62**
5°F	-8	6,100	6.8	1,734	102	110			2.9	**11,400**	**1.93**
15°F	1	7,900	6.4	1,642	102	110			3.3	**12,900**	**2.30**
25°F	9	10,000	6.0	1,560	101	110			3.7	**14,700**	**2.76**
35°F	17	12,500	5.7	1,485	101	110			4.3	**16,900**	**3.34**
45°F	26	15,500	5.4	1,413	100	110			5.0	**19,700**	**4.09**
55°F	34	19,000	5.1	1,343	99	109			5.8	**22,900**	**5.00**
65°F	43	23,100	4.8	1,272	98	109			6.8	**26,800**	**6.17**
-5°F	-	-	-	-	-	-	8.0	**120°F**	*LLT is limited to 105°F at these outdoor temperatures*		
5°F	-	-	-	-	-	-					
15°F	2	6,700	7.8	1,952	117	125			3.2	**12,700**	**1.91**
25°F	10	8,700	7.4	1,862	116	124			3.6	**14,400**	**2.27**
35°F	19	11,000	7.1	1,783	116	124			4.1	**16,400**	**2.70**
45°F	28	13,800	6.7	1,709	115	124			4.8	**19,000**	**3.26**
55°F	36	17,000	6.4	1,641	114	124			5.6	**22,000**	**3.93**
65°F	45	20,700	6.2	1,576	114	124			6.4	**25,400**	**4.72**

COOLING

Outdoor Air Temperature	Condensing Temp. (°F)	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temp. (°F)	Liquid Flow (gpm)	LLT	Delta T (°F)	Cooling (Btu/hr)	EER	COP_C
50°F	63	24,500	2.7	773	**54°F**	39	8.0	49	-5.5	**21,900**	**28.3**	**8.3**
60°F	73	23,700	3.6	984		39		49	-5.1	**20,300**	**20.6**	**6.0**
70°F	84	23,000	4.4	1,176		40		49	-4.7	**19,000**	**16.2**	**4.7**
80°F	94	22,500	5.2	1,364		40		50	-4.4	**17,800**	**13.0**	**3.8**
90°F	105	22,000	6.1	1,563		40		50	-4.2	**16,700**	**10.7**	**3.1**
100°F	115	21,800	7.1	1,789		40		50	-3.9	**15,700**	**8.8**	**2.6**
110°F	126	21,600	8.3	2,059		40		50	-3.6	**14,600**	**7.1**	**2.1**
120°F	136	21,800	9.8	2,393		41		51	-3.4	**13,600**	**5.7**	**1.7**

METRIC

HEATING (METRIC)

OUTDOOR			ELECTRICAL		INDOOR						
Outdoor Air Temperature	Evaporating Temp. (°C)	Heat Absorbed (kW)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°C)	Liquid Flow (L/s)	LLT	Delta T (°C)	Heating (kW)	COP_H
-21°C	-26.8	1.4	7.4	1,840	39.1	43.7	0.51	**40.5°C**	1.4	**3.0**	**1.62**
-15°C	-22.1	1.8	6.8	1,734	38.9	43.6			1.6	**3.3**	**1.93**
-9°C	-17.4	2.3	6.4	1,642	38.7	43.4			1.8	**3.8**	**2.30**
-4°C	-12.8	2.9	6.0	1,560	38.5	43.3			2.1	**4.3**	**2.76**
2°C	-8.1	3.7	5.7	1,485	38.2	43.2			2.4	**5.0**	**3.34**
7°C	-3.4	4.5	5.4	1,413	37.8	43.1			2.8	**5.8**	**4.09**
13°C	1.2	5.6	5.1	1,343	37.3	43.0			3.2	**6.7**	**5.00**
18°C	5.9	6.8	4.8	1,272	36.8	42.9			3.8	**7.9**	**6.17**
-21°C	-	-	-	-	-	-	0.51	**49°C**	*LLT is limited to 40.5°C at these outdoor temperatures*		
-15°C	-	-	-	-	-	-					
-9°C	-16.8	2.0	7.8	1,952	47.1	51.4			1.8	**3.7**	**1.91**
-4°C	-12.1	2.6	7.4	1,862	46.9	51.3			2.0	**4.2**	**2.27**
2°C	-7.3	3.2	7.1	1,783	46.6	51.2			2.3	**4.8**	**2.70**
7°C	-2.5	4.0	6.7	1,709	46.2	51.1			2.7	**5.6**	**3.26**
13°C	2.3	5.0	6.4	1,641	45.8	50.9			3.1	**6.5**	**3.93**
18°C	7.1	6.1	6.2	1,576	45.3	50.8			3.6	**7.4**	**4.72**

COOLING (METRIC)

Outdoor Air Temperature	Condensing Temp. (°C)	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temp. (°C)	Liquid Flow (L/s)	LLT	Delta T (°C)	Cooling (W)	EER	COP_C
10°C	17	7.2	2.7	773	**12°C**	3.9	0.51	9.1	-3.1	**6.4**	**28.30**	**8.29**
16°C	23	7.0	3.6	984		4.1		9.4	-2.8	**6.0**	**20.60**	**6.04**
21°C	29	6.7	4.4	1,176		4.2		9.6	-2.6	**5.6**	**16.20**	**4.75**
27°C	35	6.6	5.2	1,364		4.3		9.8	-2.4	**5.2**	**13.00**	**3.81**
32°C	41	6.5	6.1	1,563		4.4		9.9	-2.3	**4.9**	**10.70**	**3.14**
38°C	46	6.4	7.1	1,789		4.5		10.0	-2.2	**4.6**	**8.80**	**2.58**
43°C	52	6.3	8.3	2,059		4.6		10.2	-2.0	**4.3**	**7.10**	**2.08**
49°C	58	6.4	9.8	2,393		4.7		10.3	-1.9	**4.0**	**5.70**	**1.67**

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Performance Tables ATW-45-HACW-X-1T

R454b, 60 Hz, YAS30K1E-PFV

	OUTDOOR			ELECTRICAL		INDOOR						
	Outdoor Air Temperature	Evaporating Temp. (°F)	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°F)	Liquid Flow (gpm)	LLT	Delta T (°F)	Heating (Btu/hr)	COP_H
HEATING	**-5°F**	-16	7,100	11.5	2,736	102	110	10	**105°F**	3.2	**15,800**	**1.69**
	5°F	-8	9,600	10.9	2,632	101	109			3.6	**17,900**	**1.99**
	15°F	1	12,300	10.3	2,512	101	109			4.1	**20,200**	**2.36**
	25°F	9	15,600	9.7	2,385	100	109			4.7	**23,100**	**2.84**
	35°F	18	19,200	9.2	2,252	100	109			5.3	**26,200**	**3.41**
	45°F	26	23,500	8.6	2,113	99	108			6.1	**30,100**	**4.17**
	55°F	35	28,400	8.0	1,976	98	108			7.0	**34,500**	**5.12**
	65°F	43	34,000	7.4	1,841	97	108			8.0	**39,600**	**6.30**
	-5°F	-	-	-	-	-	-	10	**120°F**	*LLT is limited to 105°F at these outdoor temperatures*		
	5°F	-	-	-	-	-	-					
	15°F	2	10,600	12.6	3,003	116	124			4.1	**20,200**	**1.97**
	25°F	11	13,600	11.9	2,859	115	123			4.6	**22,700**	**2.33**
	35°F	19	17,000	11.2	2,706	115	123			5.2	**25,600**	**2.77**
	45°F	28	21,000	10.5	2,550	114	123			5.9	**29,100**	**3.34**
	55°F	36	25,600	9.8	2,388	113	122			6.7	**33,100**	**4.06**
	65°F	45	30,900	9.1	2,226	112	122			7.6	**37,800**	**4.98**

	Outdoor Air Temperature	Condensing Temp. (°F)	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temp. (°F)	Liquid Flow (gpm)	LLT	Delta T (°F)	Cooling (Btu/hr)	EER	COP_C
COOLING	**50°F**	62	36,800	5.4	1,365	**54°F**	39	10	48	-6.4	**32,100**	**23.5**	**6.89**
	60°F	72	35,700	6.2	1,548		40		48	-6.1	**30,400**	**19.6**	**5.74**
	70°F	83	34,800	7.2	1,754		40		48	-5.7	**28,800**	**16.4**	**4.81**
	80°F	93	34,000	8.2	1,991		40		49	-5.4	**27,200**	**13.7**	**4.02**
	90°F	104	33,200	9.4	2,267		40		49	-5.1	**25,500**	**11.2**	**3.28**
	100°F	114	32,600	10.8	2,592		40		49	-4.7	**23,800**	**9.2**	**2.70**
	110°F	125	32,300	12.4	2,975		41		50	-4.4	**22,100**	**7.4**	**2.17**
	120°F	135	32,000	14.5	3,425		41		50	-4.0	**20,300**	**5.9**	**1.73**

METRIC

	OUTDOOR			ELECTRICAL		INDOOR						
	Outdoor Air Temperature	Evaporating Temp. (°C)	Heat Absorbed (kW)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°C)	Liquid Flow (L/s)	LLT	Delta T (°C)	Heating (kW)	COP_H
HEATING (METRIC)	**-21°C**	-26.6	2.1	11.5	2,736	38.8	43.1	0.63	**40.5°C**	1.8	**4.6**	**1.69**
	-15°C	-21.9	2.8	10.9	2,632	38.6	42.9			2.0	**5.3**	**1.99**
	-9°C	-17.3	3.6	10.3	2,512	38.3	42.8			2.3	**5.9**	**2.36**
	-4°C	-12.6	4.6	9.7	2,385	37.9	42.7			2.6	**6.8**	**2.84**
	2°C	-7.9	5.6	9.2	2,252	37.6	42.6			2.9	**7.7**	**3.41**
	7°C	-3.3	6.9	8.6	2,113	37.2	42.4			3.4	**8.8**	**4.17**
	13°C	1.4	8.3	8.0	1,976	36.7	42.3			3.9	**10.1**	**5.12**
	18°C	6.1	10.0	7.4	1,841	36.1	42.2			4.4	**11.6**	**6.30**
	-21°C	-	-	-	-	-	-	0.63	**49°C**	*LLT is limited to 40.5°C at these outdoor temperatures*		
	-15°C	-	-	-	-	-	-					
	-9°C	-16.7	3.1	12.6	3,003	46.6	50.8			2.3	**5.9**	**1.97**
	-4°C	-11.9	4.0	11.9	2,859	46.3	50.7			2.6	**6.7**	**2.33**
	2°C	-7.2	5.0	11.2	2,706	46.0	50.5			2.9	**7.5**	**2.77**
	7°C	-2.5	6.2	10.5	2,550	45.6	50.4			3.3	**8.5**	**3.34**
	13°C	2.2	7.5	9.8	2,388	45.2	50.2			3.7	**9.7**	**4.06**
	18°C	6.9	9.1	9.1	2,226	44.7	50.1			4.2	**11.1**	**4.98**

	Outdoor Air Temperature	Condensing Temp. (°C)	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temp. (°C)	Liquid Flow (L/s)	LLT	Delta T (°C)	Cooling (W)	EER	COP_C
COOLING (METRIC)	**10°C**	17	10.8	5.4	1,365	**12°C**	4.1	0.63	8.6	-3.6	**9.4**	**23.5**	**6.89**
	16°C	22	10.5	6.2	1,548		4.2		8.8	-3.4	**8.9**	**19.6**	**5.74**
	21°C	28	10.2	7.2	1,754		4.3		9.0	-3.2	**8.4**	**16.4**	**4.81**
	27°C	34	10.0	8.2	1,991		4.4		9.2	-3.0	**8.0**	**13.7**	**4.02**
	32°C	40	9.7	9.4	2,267		4.5		9.4	-2.8	**7.5**	**11.2**	**3.28**
	38°C	46	9.6	10.8	2,592		4.6		9.6	-2.6	**7.0**	**9.2**	**2.70**
	43°C	52	9.5	12.4	2,975		4.7		9.8	-2.4	**6.5**	**7.4**	**2.17**
	49°C	57	9.4	14.5	3,425		4.8		10.0	-2.2	**6.0**	**5.9**	**1.73**

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Performance Tables ATW-55-HACW-X-1T *R454b, 60 Hz, YAS40K1E-PFV*

HEATING

OUTDOOR			ELECTRICAL		INDOOR						
Outdoor Air Temperature	Evaporating Temp. (°F)	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°F)	Liquid Flow (gpm)	**LLT**	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
-5°F	-16	10,000	15.6	3,535	101	110	12	**105°F**	3.6	**21,200**	**1.76**
5°F	-8	12,700	14.7	3,446	101	110			4.0	**23,600**	**2.01**
15°F	1	16,100	13.9	3,324	101	109			4.5	**26,600**	**2.35**
25°F	9	20,300	13.1	3,173	100	109			5.1	**30,200**	**2.79**
35°F	18	25,300	12.3	3,006	99	109			5.8	**34,700**	**3.38**
45°F	26	31,200	11.6	2,838	98	109			6.7	**40,000**	**4.13**
55°F	34	38,100	10.9	2,667	97	108			7.8	**46,300**	**5.09**
65°F	43	45,900	10.3	2,505	96	108			9.0	**53,600**	**6.27**
-5°F	-	-	-	-	-	-	12	**120°F**	*LLT is limited to 105°F at these outdoor temperatures*		
5°F	-	-	-	-	-	-					
15°F	2	13,800	16.9	3,899	116	124			4.4	**26,200**	**1.97**
25°F	10	17,600	15.8	3,748	115	123			5.0	**29,500**	**2.31**
35°F	19	22,200	14.8	3,575	114	123			5.6	**33,500**	**2.75**
45°F	27	27,800	13.9	3,394	114	123			6.5	**38,500**	**3.32**
55°F	36	34,400	13.1	3,204	113	123			7.5	**44,400**	**4.06**
65°F	44	42,000	12.3	3,019	111	122			8.7	**51,400**	**4.99**

COOLING

Outdoor Air Temperature	Condensing Temp. (°F)	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	**ELT**	Evaporating Temp. (°F)	Liquid Flow (gpm)	LLT	Delta T (°F)	**Cooling** (Btu/hr)	**EER**	**COP_C**
50°F	62	48,500	7.6	2,037	**54°F**	39	12	47	-6.9	**41,500**	**20.4**	**5.98**
60°F	73	47,100	8.8	2,149		39		47	-6.6	**39,800**	**18.5**	**5.42**
70°F	83	45,900	10.0	2,356		40		48	-6.3	**37,900**	**16.1**	**4.72**
80°F	94	45,000	11.3	2,655		40		48	-6.0	**35,900**	**13.5**	**3.96**
90°F	104	44,100	12.8	3,039		40		48	-5.6	**33,700**	**11.1**	**3.25**
100°F	115	43,500	14.6	3,504		40		49	-5.2	**31,500**	**9.0**	**2.64**
110°F	125	42,900	16.8	4,045		40		49	-4.8	**29,100**	**7.2**	**2.11**
120°F	136	42,700	19.5	4,655		41		50	-4.5	**26,800**	**5.8**	**1.70**

METRIC

HEATING (METRIC)

OUTDOOR			ELECTRICAL		INDOOR						
Outdoor Air Temperature	Evaporating Temp. (°C)	Heat Absorbed (kW)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°C)	Liquid Flow (L/s)	**LLT**	Delta T (°C)	**Heating** (kW)	**COP_H**
-21°C	-26.7	2.9	15.6	3,535	38.6	43.3	0.76	**40.5°C**	2.0	**6.2**	**1.76**
-15°C	-22.0	3.7	14.7	3,446	38.3	43.1			2.2	**6.9**	**2.01**
-9°C	-17.3	4.7	13.9	3,324	38.1	43.0			2.5	**7.8**	**2.35**
-4°C	-12.7	6.0	13.1	3,173	37.7	42.8			2.8	**8.9**	**2.79**
2°C	-8.0	7.4	12.3	3,006	37.3	42.7			3.2	**10.2**	**3.38**
7°C	-3.3	9.1	11.6	2,838	36.8	42.6			3.7	**11.7**	**4.13**
13°C	1.3	11.2	10.9	2,667	36.2	42.4			4.3	**13.6**	**5.09**
18°C	6.0	13.5	10.3	2,505	35.6	42.2			5.0	**15.7**	**6.27**
-21°C	-	-	-	-	-	-	0.76	**49°C**	*LLT is limited to 40.5°C at these outdoor temperatures*		
-15°C	-	-	-	-	-	-					
-9°C	-16.7	4.0	16.9	3,899	46.4	50.9			2.4	**7.7**	**1.97**
-4°C	-12.0	5.2	15.8	3,748	46.1	50.8			2.8	**8.7**	**2.31**
2°C	-7.3	6.5	14.8	3,575	45.8	50.6			3.1	**9.8**	**2.75**
7°C	-2.6	8.1	13.9	3,394	45.3	50.5			3.6	**11.3**	**3.32**
13°C	2.2	10.1	13.1	3,204	44.7	50.3			4.2	**13.0**	**4.06**
18°C	6.9	12.3	12.3	3,019	44.1	50.2			4.8	**15.1**	**4.99**

COOLING (METRIC)

Outdoor Air Temperature	Condensing Temp. (°C)	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	**ELT**	Evaporating Temp. (°C)	Liquid Flow (L/s)	LLT	Delta T (°C)	**Cooling** (W)	**EER**	**COP_C**
10°C	17	14.2	7.6	2,037	**12°C**	3.9	0.76	8.4	-3.8	**12.2**	**20.4**	**5.98**
16°C	23	13.8	8.8	2,149		4.1		8.5	-3.7	**11.7**	**18.5**	**5.42**
21°C	28	13.5	10.0	2,356		4.2		8.7	-3.5	**11.1**	**16.1**	**4.72**
27°C	34	13.2	11.3	2,655		4.3		8.9	-3.3	**10.5**	**13.5**	**3.96**
32°C	40	12.9	12.8	3,039		4.4		9.1	-3.1	**9.9**	**11.1**	**3.25**
38°C	46	12.7	14.6	3,504		4.5		9.3	-2.9	**9.2**	**9.0**	**2.64**
43°C	52	12.6	16.8	4,045		4.6		9.5	-2.7	**8.5**	**7.2**	**2.11**
49°C	58	12.5	19.5	4,655		4.7		9.7	-2.5	**7.9**	**5.8**	**1.70**

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Performance Tables ATW-65-HACW-X-1T

R454b, 60 Hz, YAS51K1E-PFV

	OUTDOOR			ELECTRICAL		INDOOR						
	Outdoor Air Temperature	Evaporating Temp. (°F)	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°F)	Liquid Flow (gpm)	LLT	Delta T (°F)	Heating (Btu/hr)	COP_H
HEATING	**-5°F**	-16	12,500	20.9	4,719	101	110	14	**105°F**	4.0	**27,500**	**1.71**
	5°F	-8	15,900	19.7	4,476	101	110			4.3	**30,100**	**1.97**
	15°F	1	20,200	18.7	4,249	100	109			4.8	**33,600**	**2.32**
	25°F	9	25,400	17.6	4,021	100	109			5.5	**38,000**	**2.77**
	35°F	18	31,700	16.5	3,798	99	109			6.3	**43,600**	**3.36**
	45°F	26	39,000	15.5	3,579	98	109			7.2	**50,100**	**4.10**
	55°F	34	47,500	14.4	3,357	97	108			8.3	**57,900**	**5.05**
	65°F	43	57,300	13.4	3,133	95	108			9.6	**66,900**	**6.26**
	-5°F	-	-	-	-	-	-	14	**120°F**	*LLT is limited to 105°F at these outdoor temperatures*		
	5°F	-	-	-	-	-	-					
	15°F	2	17,200	21.9	4,979	115	124			4.8	**33,100**	**1.95**
	25°F	11	22,000	20.8	4,742	115	124			5.4	**37,100**	**2.29**
	35°F	19	27,800	19.7	4,513	114	123			6.1	**42,100**	**2.73**
	45°F	28	34,800	18.7	4,293	113	123			7.0	**48,400**	**3.30**
	55°F	36	42,900	17.7	4,071	112	123			8.0	**55,700**	**4.01**
	65°F	45	52,400	16.6	3,849	111	122			9.3	**64,400**	**4.90**

	Outdoor Air Temperature	Condensing Temp. (°F)	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temp. (°F)	Liquid Flow (gpm)	LLT	Delta T (°F)	Cooling (Btu/hr)	EER	COP_C
COOLING	**50°F**	62	60,200	9.2	2,120	**54°F**	39	14	46	-7.6	**53,000**	**25.0**	**7.3**
	60°F	73	59,100	10.7	2,525		40		47	-7.2	**50,500**	**20.0**	**5.9**
	70°F	83	58,000	12.3	2,928		40		47	-6.8	**48,000**	**16.4**	**4.8**
	80°F	94	56,800	14.2	3,352		40		48	-6.5	**45,400**	**13.5**	**4.0**
	90°F	104	55,600	16.4	3,822		40		48	-6.1	**42,600**	**11.1**	**3.3**
	100°F	115	54,600	18.9	4,363		40		48	-5.7	**39,700**	**9.1**	**2.7**
	110°F	125	53,800	21.7	5,002		41		49	-5.2	**36,700**	**7.3**	**2.1**
	120°F	136	53,300	25.0	5,768		41		49	-4.8	**33,600**	**5.8**	**1.7**

METRIC

	OUTDOOR			ELECTRICAL		INDOOR						
	Outdoor Air Temperature	Evaporating Temp. (°C)	Heat Absorbed (kW)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°C)	Liquid Flow (L/s)	LLT	Delta T (°C)	Heating (kW)	COP_H
HEATING (METRIC)	**-21°C**	-26.7	3.7	20.9	4,719	38.3	43.2	0.88	**40.5°C**	2.2	**8.1**	**1.71**
	-15°C	-22.1	4.7	19.7	4,476	38.2	43.1			2.4	**8.8**	**1.97**
	-9°C	-17.4	5.9	18.7	4,249	37.9	42.9			2.7	**9.9**	**2.32**
	-4°C	-12.7	7.4	17.6	4,021	37.5	42.8			3.1	**11.1**	**2.77**
	2°C	-8.1	9.3	16.5	3,798	37.1	42.6			3.5	**12.8**	**3.36**
	7°C	-3.4	11.4	15.5	3,579	36.6	42.5			4.0	**14.7**	**4.10**
	13°C	1.3	13.9	14.4	3,357	35.9	42.3			4.6	**17.0**	**5.05**
	18°C	5.9	16.8	13.4	3,133	35.2	42.2			5.3	**19.6**	**6.26**
	-21°C	-	-	-	-	-	-	0.88	**49°C**	*LLT is limited to 40.5°C at these outdoor temperatures*		
	-15°C	-	-	-	-	-	-					
	-9°C	-16.6	5.0	21.9	4,979	46.2	51.0			2.7	**9.7**	**1.95**
	-4°C	-11.9	6.4	20.8	4,742	45.9	50.8			3.0	**10.9**	**2.29**
	2°C	-7.2	8.1	19.7	4,513	45.5	50.7			3.4	**12.3**	**2.73**
	7°C	-2.4	10.2	18.7	4,293	45.0	50.6			3.9	**14.2**	**3.30**
	13°C	2.3	12.6	17.7	4,071	44.4	50.4			4.4	**16.3**	**4.01**
	18°C	7.0	15.4	16.6	3,849	43.7	50.2			5.2	**18.9**	**4.90**

	Outdoor Air Temperature	Condensing Temp. (°C)	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temp. (°C)	Liquid Flow (L/s)	LLT	Delta T (°C)	Cooling (W)	EER	COP_C
COOLING (METRIC)	**10°C**	17	10.0	16.7	2,120	**12°C**	4.1	0.88	8.0	-4.2	**15.5**	**25.0**	**7.3**
	16°C	23	15.6	22.5	2,525		4.2		8.2	-4.0	**14.8**	**20.0**	**5.9**
	21°C	28	21.1	28.3	2,928		4.3		8.4	-3.8	**14.1**	**16.4**	**4.8**
	27°C	34	26.7	34.2	3,352		4.4		8.6	-3.6	**13.3**	**13.5**	**4.0**
	32°C	40	32.2	40.0	3,822		4.5		8.8	-3.4	**12.5**	**11.1**	**3.3**
	38°C	46	37.8	45.8	4,363		4.6		9.0	-3.2	**11.6**	**9.1**	**2.7**
	43°C	52	43.3	51.7	5,002		4.7		9.3	-2.9	**10.8**	**7.3**	**2.1**
	49°C	58	48.9	57.5	5,768		4.8		9.5	-2.7	**9.9**	**5.8**	**1.7**

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Performance Tables ATW-75-HACW-X-1T

R454b, 60 Hz, YAS60K1E-PFV

HEATING

OUTDOOR			ELECTRICAL		INDOOR						
Outdoor Air Temperature	Evaporating Temp. (°F)	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°F)	Liquid Flow (gpm)	LLT	Delta T (°F)	Heating (Btu/hr)	COP_H
-5°F	-16	12,800	22.8	5,305	101	110	16	**105°F**	3.7	**29,600**	**1.64**
5°F	-8	17,600	21.8	5,059	101	110			4.2	**33,600**	**1.95**
15°F	1	23,000	20.7	4,817	100	109			4.8	**38,100**	**2.32**
25°F	9	29,400	19.6	4,573	100	109			5.5	**43,700**	**2.80**
35°F	17	36,600	18.5	4,335	99	109			6.3	**50,100**	**3.39**
45°F	26	45,000	17.4	4,098	98	108			7.3	**57,700**	**4.13**
55°F	34	54,700	16.3	3,856	97	108			8.4	**66,600**	**5.06**
65°F	43	65,800	15.1	3,618	95	108			9.7	**76,800**	**6.22**
-5°F	-	-	-	-	-	-	16	**120°F**	*LLT is limited to 105°F at these outdoor temperatures*		
5°F	-	-	-	-	-	-					
15°F	2	19,600	24.2	5,635	115	124			4.7	**37,500**	**1.95**
25°F	11	25,500	23.2	5,394	115	124			5.4	**42,600**	**2.31**
35°F	19	32,200	22.1	5,152	114	123			6.1	**48,500**	**2.76**
45°F	28	40,100	21.0	4,903	113	123			7.0	**55,500**	**3.32**
55°F	36	49,300	19.8	4,643	112	123			8.1	**63,800**	**4.03**
65°F	45	59,900	18.6	4,381	111	122			9.3	**73,600**	**4.92**

COOLING

Outdoor Air Temperature	Condensing Temp. (°F)	Heat Rejected (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temp. (°F)	Liquid Flow (gpm)	LLT	Delta T (°F)	Cooling (Btu/hr)	EER	COP_C
50°F	62	69,300	12.8	2,730	**54°F**	39	16	47	-7.5	**60,000**	**22.0**	**6.45**
60°F	72	68,100	13.4	3,046		39		47	-7.2	**57,700**	**18.9**	**5.54**
70°F	83	66,800	14.7	3,428		40		47	-6.9	**55,100**	**16.1**	**4.72**
80°F	93	65,400	16.6	3,890		40		48	-6.5	**52,100**	**13.4**	**3.93**
90°F	104	64,000	19.0	4,444		40		48	-6.1	**48,800**	**11.0**	**3.22**
100°F	114	62,700	22.0	5,105		40		48	-5.6	**45,300**	**8.9**	**2.61**
110°F	125	61,900	25.5	5,889		40		49	-5.2	**41,800**	**7.1**	**2.08**
120°F	135	61,300	29.5	6,810		41		49	-4.8	**38,100**	**5.6**	**1.64**

METRIC

HEATING (METRIC)

OUTDOOR			ELECTRICAL		INDOOR						
Outdoor Air Temperature	Evaporating Temp. (°C)	Heat Absorbed (kW)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temp. (°C)	Liquid Flow (L/s)	LLT	Delta T (°C)	Heating (kW)	COP_H
-21°C	-26.8	3.8	22.8	5,305	38.5	43.3	1.0	**40.5°C**	2.1	**8.7**	**1.64**
-15°C	-22.1	5.2	21.8	5,059	38.2	43.2			2.3	**9.9**	**1.95**
-9°C	-17.4	6.7	20.7	4,817	37.9	43.0			2.7	**11.2**	**2.32**
-4°C	-12.8	8.6	19.6	4,573	37.5	42.8			3.1	**12.8**	**2.80**
2°C	-8.1	10.7	18.5	4,335	37.1	42.6			3.5	**14.7**	**3.39**
7°C	-3.4	13.2	17.4	4,098	36.5	42.4			4.1	**16.9**	**4.13**
13°C	1.2	16.0	16.3	3,856	35.9	42.2			4.7	**19.5**	**5.06**
18°C	5.9	19.3	15.1	3,618	35.2	42.1			5.4	**22.5**	**6.22**
-21°C	-	-	-	-	-	-	1.0	**49°C**	*LLT is limited to 40.5°C at these outdoor temperatures*		
-15°C	-	-	-	-	-	-					
-9°C	-16.7	5.7	24.2	5,635	46.3	51.1			2.6	**11.0**	**1.95**
-4°C	-11.9	7.5	23.2	5,394	45.9	50.8			3.0	**12.5**	**2.31**
2°C	-7.2	9.4	22.1	5,152	45.5	50.7			3.4	**14.2**	**2.76**
7°C	-2.5	11.8	21.0	4,903	45.0	50.5			3.9	**16.3**	**3.32**
13°C	2.2	14.4	19.8	4,643	44.4	50.3			4.5	**18.7**	**4.03**
18°C	6.9	17.6	18.6	4,381	43.7	50.1			5.2	**21.6**	**4.92**

COOLING (METRIC)

Outdoor Air Temperature	Condensing Temp. (°C)	Heat Rejected (W)	Compressor Current (A)	Input Power (W)	ELT	Evaporating Temp. (°C)	Liquid Flow (L/s)	LLT	Delta T (°C)	Cooling (W)	EER	COP_C
10°C	17	20.3	12.8	2,730	**12°C**	4.0	1.0	8.0	-4.2	**17.6**	**22.0**	**6.45**
16°C	22	20.0	13.4	3,046		4.1		8.2	-4.0	**16.9**	**18.9**	**5.54**
21°C	28	19.6	14.7	3,428		4.2		8.4	-3.8	**16.1**	**16.1**	**4.72**
27°C	34	19.2	16.6	3,890		4.3		8.6	-3.6	**15.3**	**13.4**	**3.93**
32°C	40	18.8	19.0	4,444		4.4		8.8	-3.4	**14.3**	**11.0**	**3.22**
38°C	46	18.4	22.0	5,105		4.6		9.1	-3.1	**13.3**	**8.9**	**2.61**
43°C	52	18.1	25.5	5,889		4.7		9.3	-2.9	**12.3**	**7.1**	**2.08**
49°C	57	18.0	29.5	6,810		4.8		9.5	-2.7	**11.2**	**5.6**	**1.64**

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Electrical Specifications

TABLE 36 - ATW-Series (R454b) Electrical Specifications												
	Code	Power Supply			Compressor		Indoor Circulators	Outdoor Unit	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	Max A	Max A	Amps	Amps	Amps	ga
ATW-25	1	208/230-1-60	187	253	10.3	62	3.0	1.6	15.7	18.3	30	#10-2*
	2	208-3-60	187	229	6.3	56	3.0	1.6	11.7	13.3	20	#12-3*
	4	460-3-60	414	506	3.8	29	3.0	1.6	9.2	10.2	15	#14-4
ATW-45	1	208/230-1-60	187	253	14.6	90	3.0	1.6	20.0	23.7	40	#8-2*
	2	208-3-60	187	229	9.9	82	3.0	1.6	15.3	17.8	30	#10-3*
	4	460-3-60	414	506	4.8	44	3.0	1.6	10.2	11.4	15	#14-4
ATW-55	1	208/230-1-60	187	253	18.3	138	4.0	1.6	24.7	29.3	50	#8-2*
	2	208-3-60	187	229	11.9	112	4.0	1.6	18.3	21.3	30	#10-3*
	4	460-3-60	414	506	6.8	62	4.0	1.6	13.2	14.9	20	#12-4
ATW-65	1	208/230-1-60	187	253	25.2	147	4.0	3.0	33.0	39.3	60	#6-2*
	2	208-3-60	187	229	13.8	150	4.0	3.0	21.6	25.1	40	#8-3*
	4	460-3-60	414	506	6.9	58	4.0	3.0	14.7	16.4	20	#12-4
ATW-75	1	208/230-1-60	187	253	28.0	166	4.0	3.0	35.8	42.8	60	#6-2*
	2	208-3-60	187	229	19.2	162	4.0	3.0	27.0	31.8	50	#8-3*
	4	460-3-60	414	506	9.1	71	4.0	3.0	16.9	19.2	30	#10-4

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

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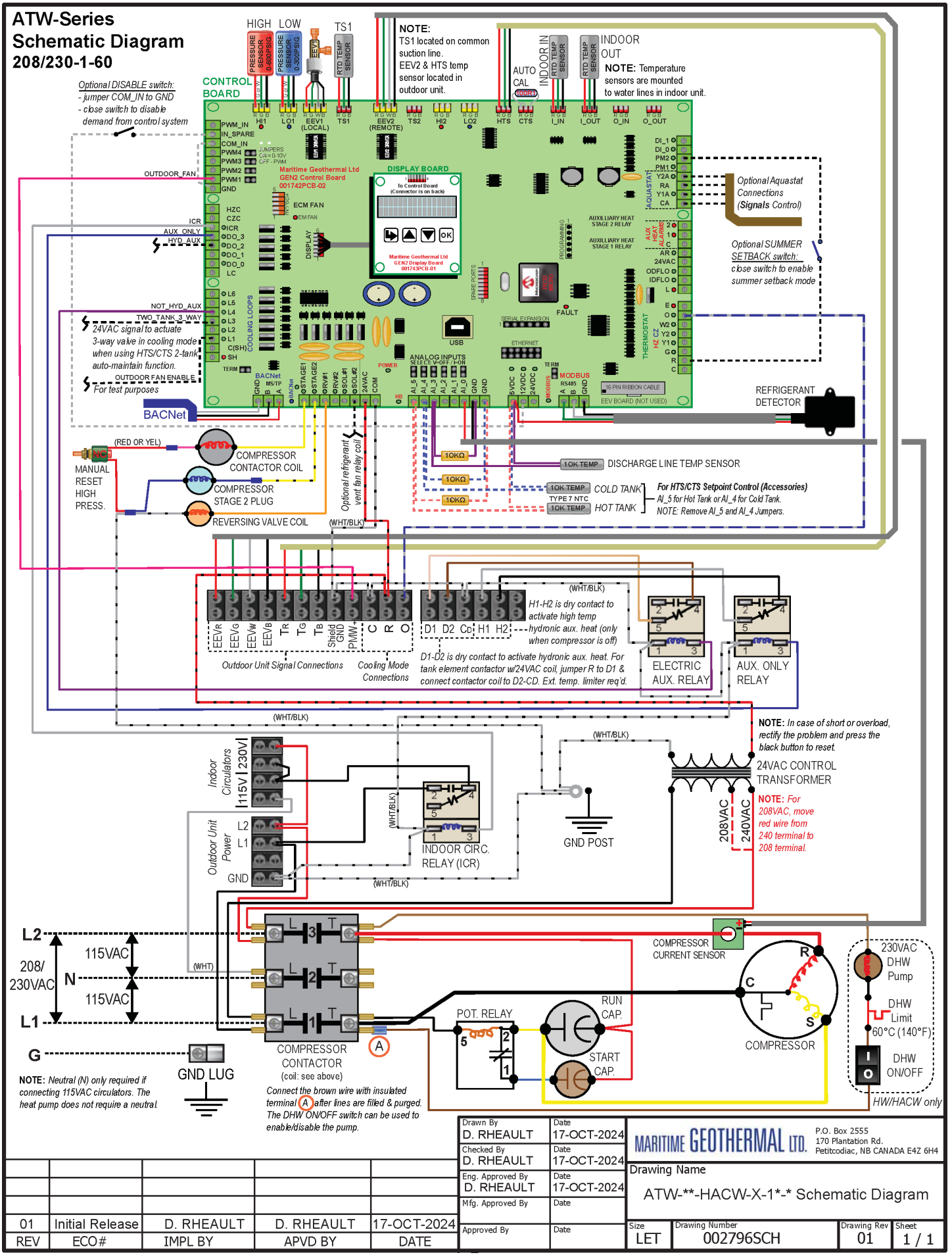
ATW-Series Schematic Diagram 208/230-1-60



REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	17-OCT-2024

Drawn By	D. RHEAULT	Date	17-OCT-2024
Checked By	D. RHEAULT	Date	17-OCT-2024
Eng. Approved By	D. RHEAULT	Date	17-OCT-2024
Mfg. Approved By		Date	
Approved By		Date	

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

Drawing Name: ATW-**-HACW-X-1*-* Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
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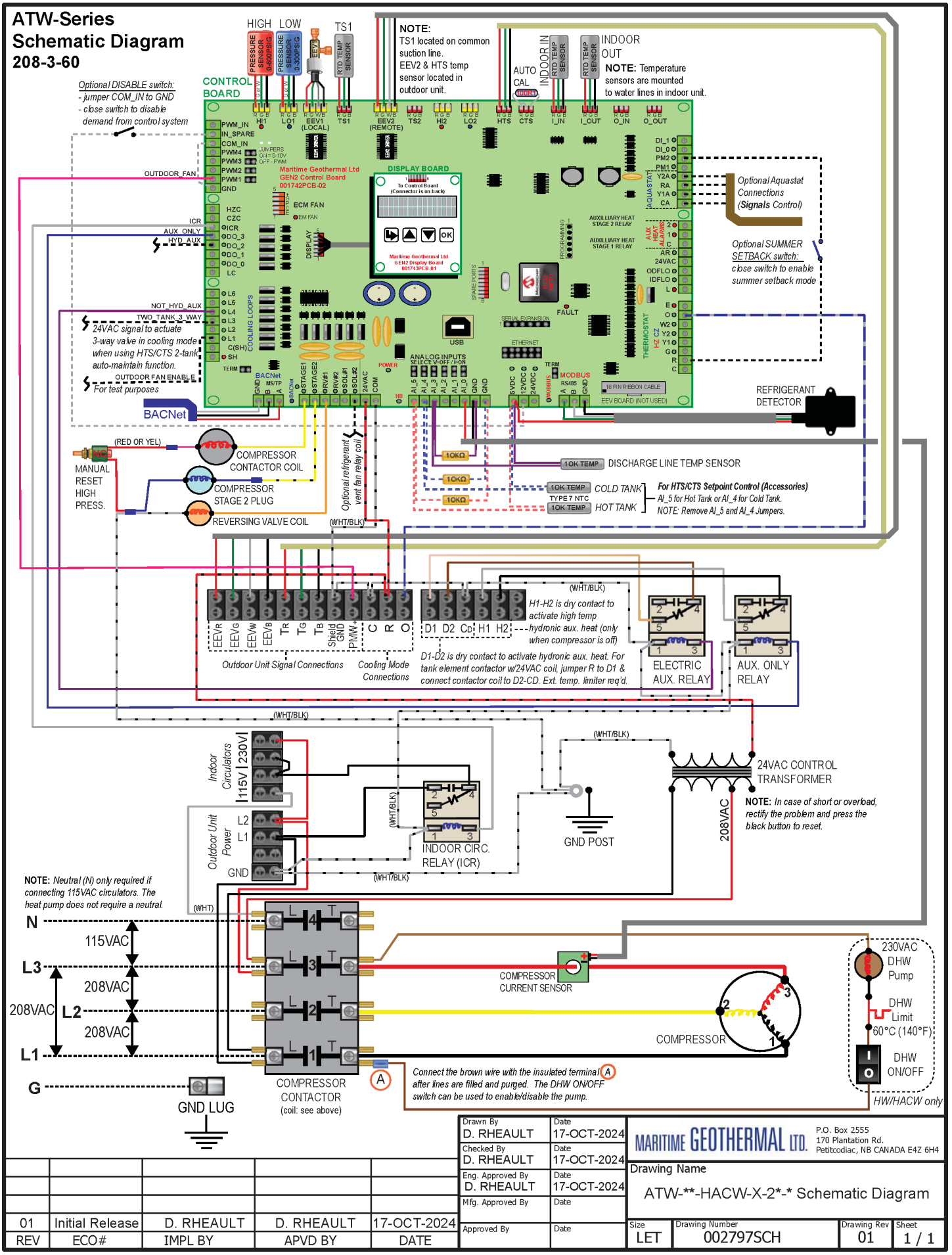
ATW-Series Schematic Diagram 208-3-60



01	Initial Release	D. RHEAULT	D. RHEAULT	17-OCT-2024
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By: D. RHEAULT	Date: 17-OCT-2024
Checked By: D. RHEAULT	Date: 17-OCT-2024
Eng. Approved By: D. RHEAULT	Date: 17-OCT-2024
Mfg. Approved By	Date
Approved By	Date

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

Drawing Name: ATW-**-HACW-X-2*-* Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
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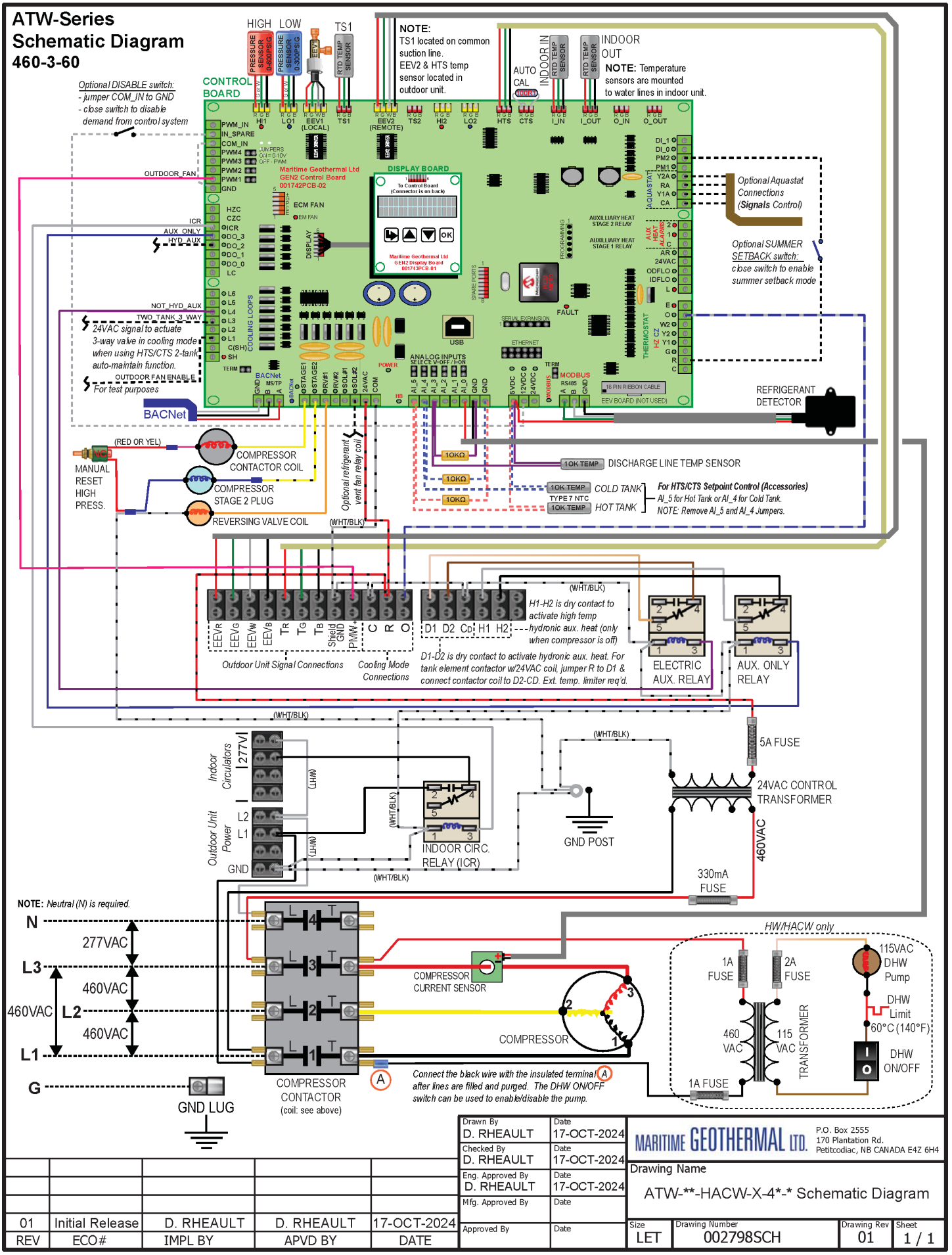
ATW-Series Schematic Diagram 460-3-60



01	Initial Release	D. RHEAULT	D. RHEAULT	17-OCT-2024
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By: D. RHEAULT	Date: 17-OCT-2024
Checked By: D. RHEAULT	Date: 17-OCT-2024
Eng. Approved By: D. RHEAULT	Date: 17-OCT-2024
Mfg. Approved By	Date
Approved By	Date

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

Drawing Name: ATW-**-HACW-X-4*-* Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
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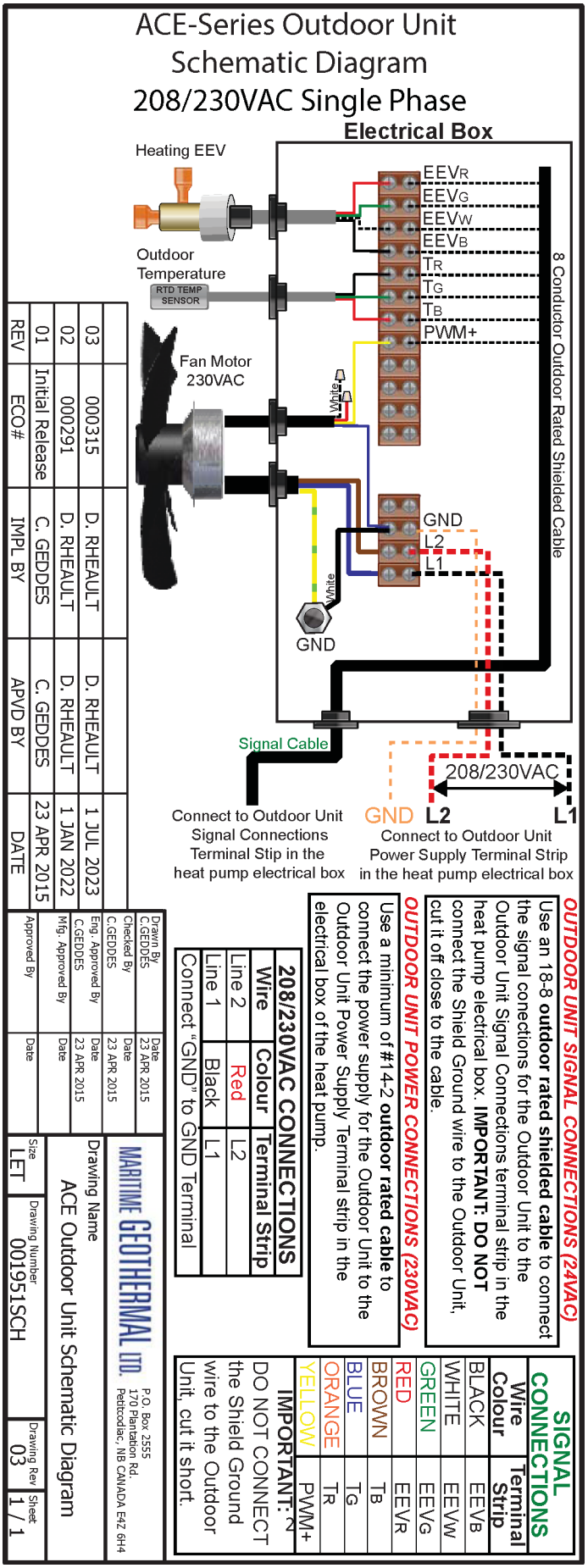
ACE-25/45/55 Wiring Diagram



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03	000315	D. RHEAULT	D. RHEAULT	1 JUL 2023
02	000291	D. RHEAULT	D. RHEAULT	1 JAN 2022
01	Initial Release	C. GEDDES	C. GEDDES	23 APR 2015

Drawn By C.GEDDES Date 23 APR 2015
Checked By C.GEDDES Date 23 APR 2015
Eng. Approved By C.GEDDES Date 23 APR 2015
Mfg. Approved By Date
Approved By Date

OUTDOOR UNIT SIGNAL CONNECTIONS (24VAC)

Use an 18-8 **outdoor rated shielded cable** to connect the signal conections for the Outdoor Unit to the Outdoor Unit Signal Connections terminal strip in the heat pump electrical box. **IMPORTANT: DO NOT** connect the Shield Ground wire to the Outdoor Unit, cut it off close to the cable.

OUTDOOR UNIT POWER CONNECTIONS (230VAC)

Use a minimum of #14-2 **outdoor rated cable** to connect the power supply for the Outdoor Unit to the Outdoor Unit Power Supply Terminal strip in the electrical box of the heat pump.

208/230VAC CONNECTIONS

Wire	Colour	Terminal Strip
Line 2	Red	L2
Line 1	Black	L1
Connect "GND" to GND Terminal		

SIGNAL CONNECTIONS

Wire Colour	Terminal Strip
BLACK	EEVB
WHITE	EEVW
GREEN	EEVG
RED	EEVR
BROWN	TB
BLUE	TG
ORANGE	TR
YELLOW	PWM+

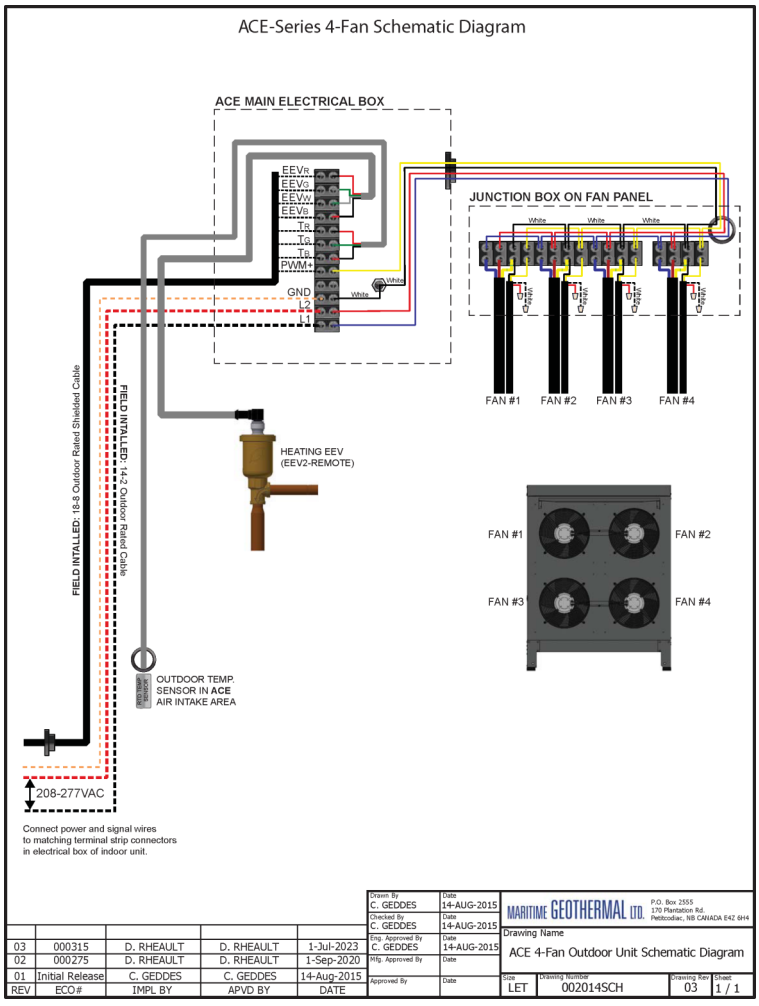
IMPORTANT: DO NOT CONNECT the Shield Ground wire to the Outdoor Unit, cut it short.

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

Drawing Name: ACE Outdoor Unit Schematic Diagram

Size: LET | Drawing Number: 001951SCH | Drawing Rev: 03 | Sheet: 1 / 1

ACE-65/75 Wiring Diagram



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03	000315	D. RHEAULT	D. RHEAULT	1-Jul-2023
02	000275	D. RHEAULT	D. RHEAULT	1-Sep-2020
01	Initial Release	C. GEDDES	C. GEDDES	14-Aug-2015

Drawn By C. GEDDES Date 14-AUG-2015
Checked By C. GEDDES Date 14-AUG-2015
Eng. Approved By C. GEDDES Date 14-AUG-2015
Mfg. Approved By Date
Approved By Date

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

Drawing Name: ACE 4-Fan Outdoor Unit Schematic Diagram

Size: LET | Drawing Number: 002014SCH | Drawing Rev: 03 | Sheet: 1 / 1

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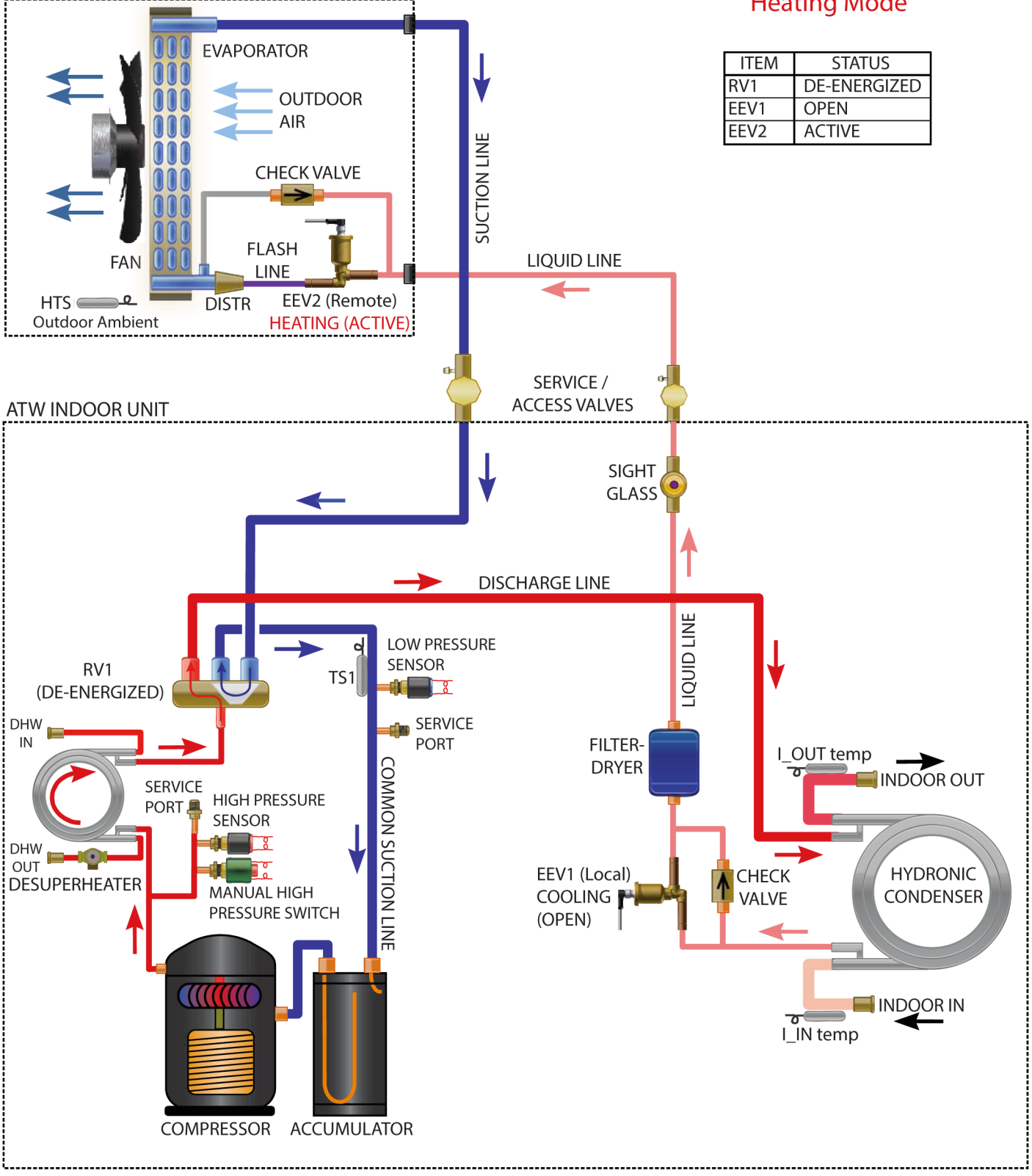
ATW Series Refrigeration Circuit
Heating Mode

ITEM	STATUS
RV1	DE-ENERGIZED
EEV1	OPEN
EEV2	ACTIVE



REV	ECO#	IMPL BY	APVD BY	DATE
03	000270	D. RHEAULT	D. RHEAULT	12-FEB-2019
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	Initial Release	C. GEDDES	C. GEDDES	16-JUL-2014

Drawn By C.GEDDES	Date 16-JUL-2014	
Checked By C.GEDDES	Date 16-JUL-2014	
Eng. Approved By C.GEDDES	Date 16-JUL-2014	
Mfg. Approved By	Date	
Approved By	Date	

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

Drawing Name: ATW-Series Refrigeration Circuit Heating Mode

Size	Drawing Number	Drawing Revision	Sheet
LET	001840RCD	03	1 / 1

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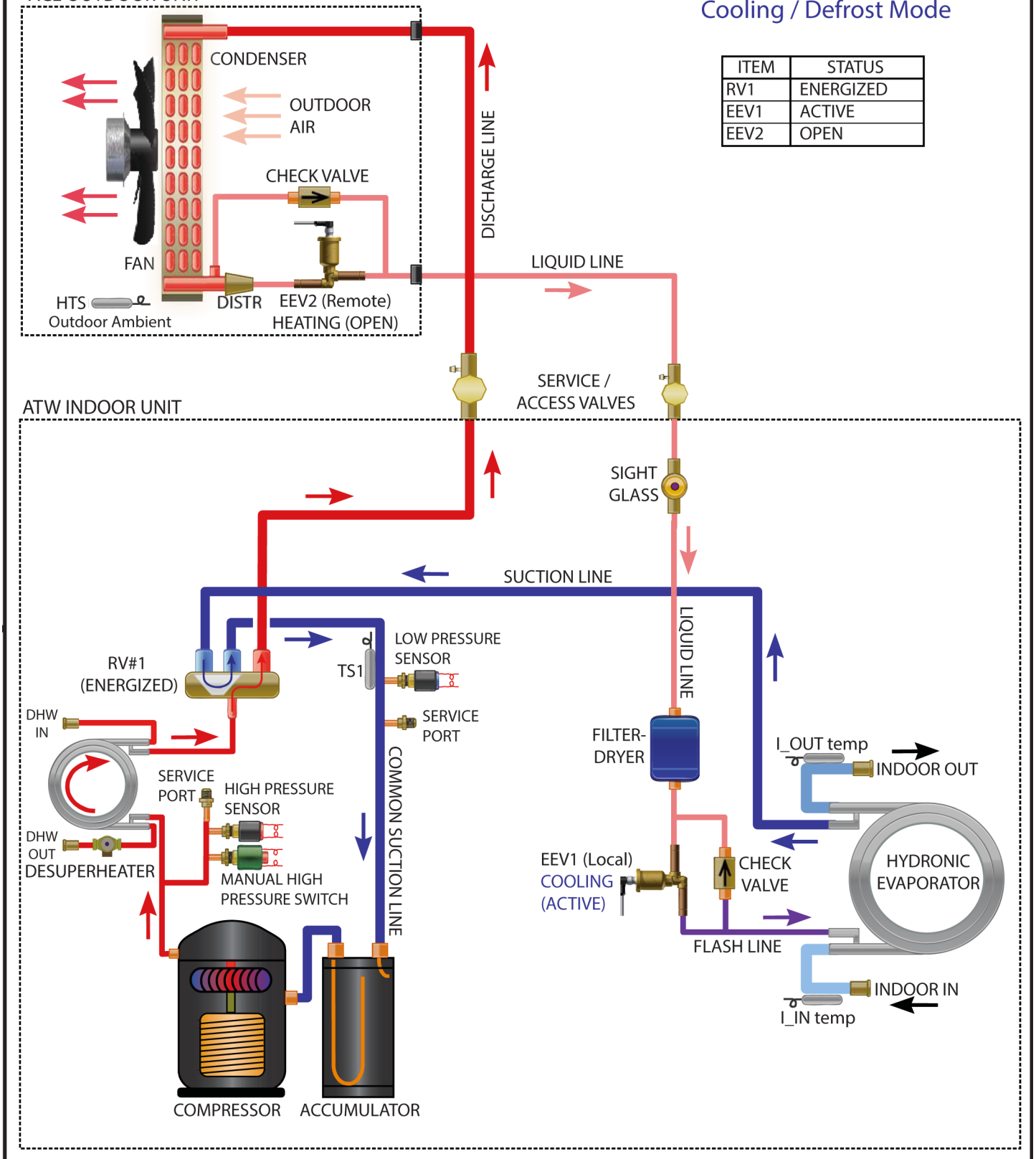
ATW Series Refrigeration Circuit
Cooling / Defrost Mode

ITEM	STATUS
RV1	ENERGIZED
EEV1	ACTIVE
EEV2	OPEN



REV	ECO#	IMPL BY	APVD BY	DATE
03	000270	D. RHEAULT	D. RHEAULT	12-FEB-2019
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	Initial Release	C. GEDDES	C. GEDDES	16-JUL-2014

Drawn By C.GEDDES	Date 16-JUL-2014	
Checked By C.GEDDES	Date 16-JUL-2014	
Eng. Approved By C.GEDDES	Date 16-JUL-2014	
Mfg. Approved By	Date	
Approved By	Date	

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

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

Size	Drawing Number	Drawing Revision	Sheet
LET	001841RCD	03	1 / 1

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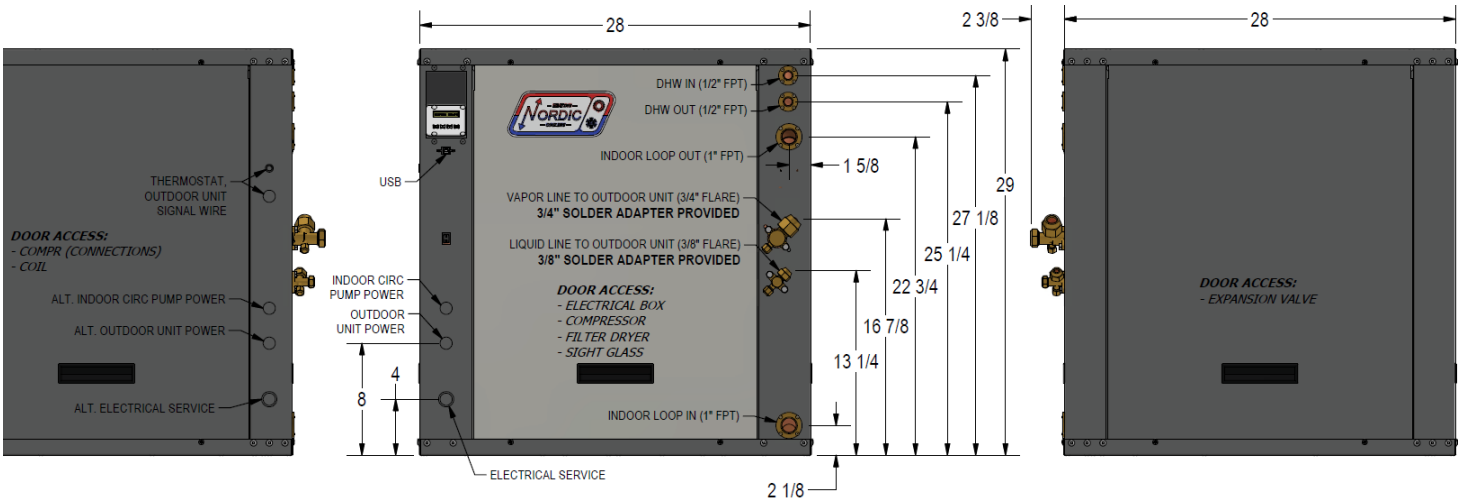
Dimensions: ATW-25/45

All dimensions in inches



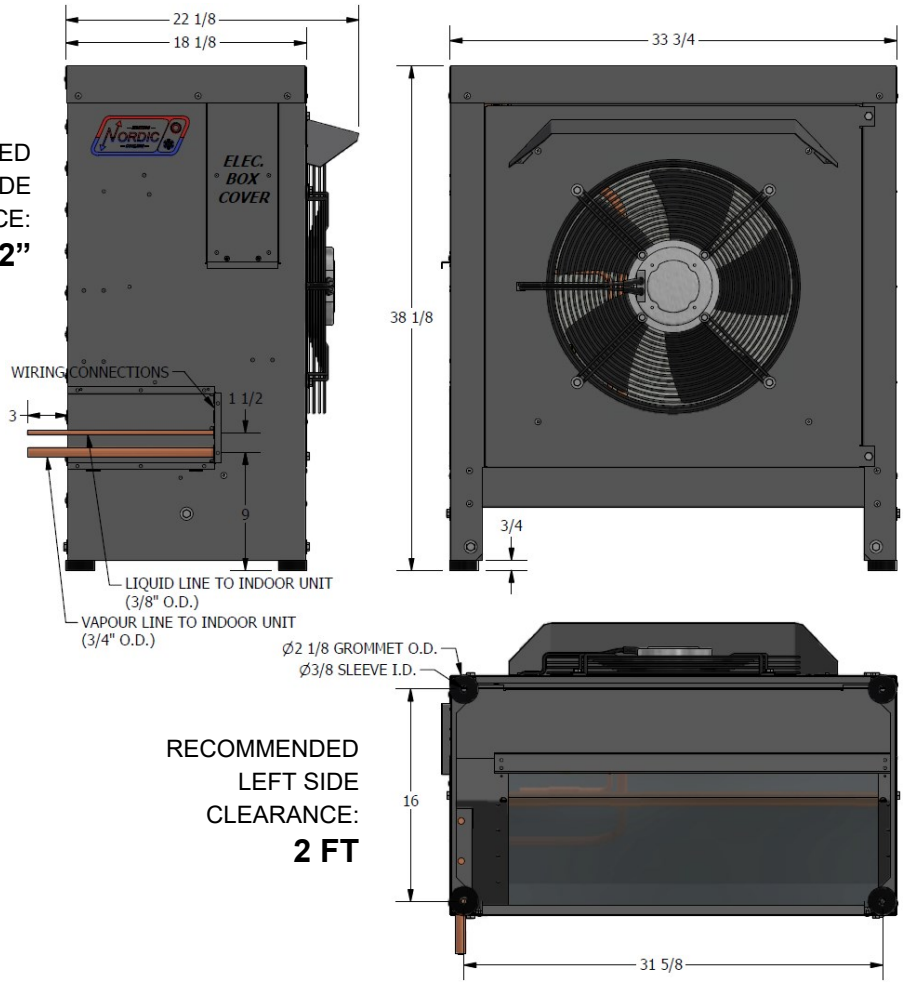
LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE:
3 FT

RECOMMENDED RIGHT SIDE CLEARANCE:
2 FT

NO BACK CLEARANCE REQUIRED

RECOMMENDED BACK SIDE CLEARANCE:
12”



RECOMMENDED FRONT SIDE CLEARANCE:
10-16 FT

RECOMMENDED LEFT SIDE CLEARANCE:
2 FT

NO RIGHT SIDE CLEARANCE REQUIRED

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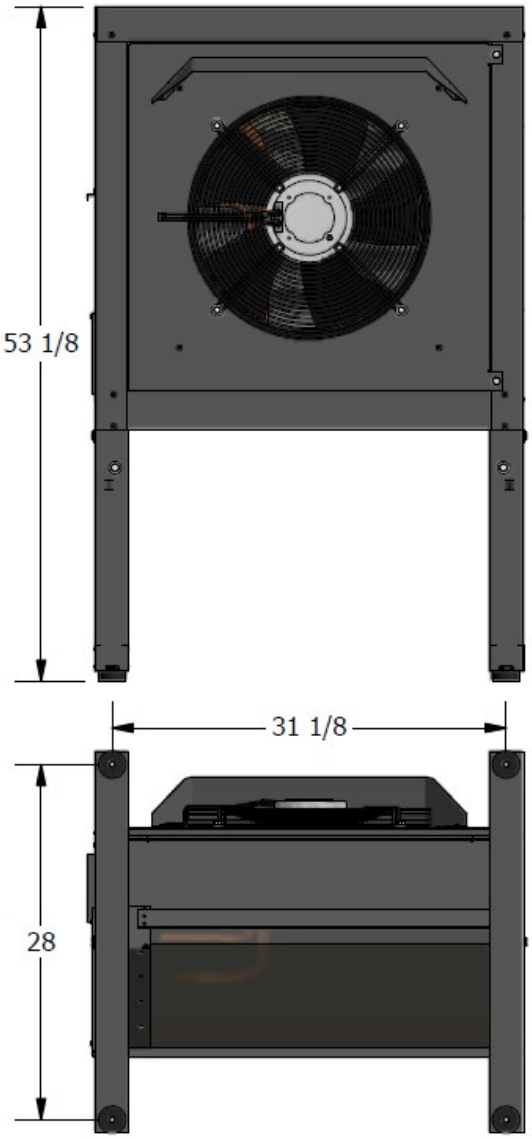
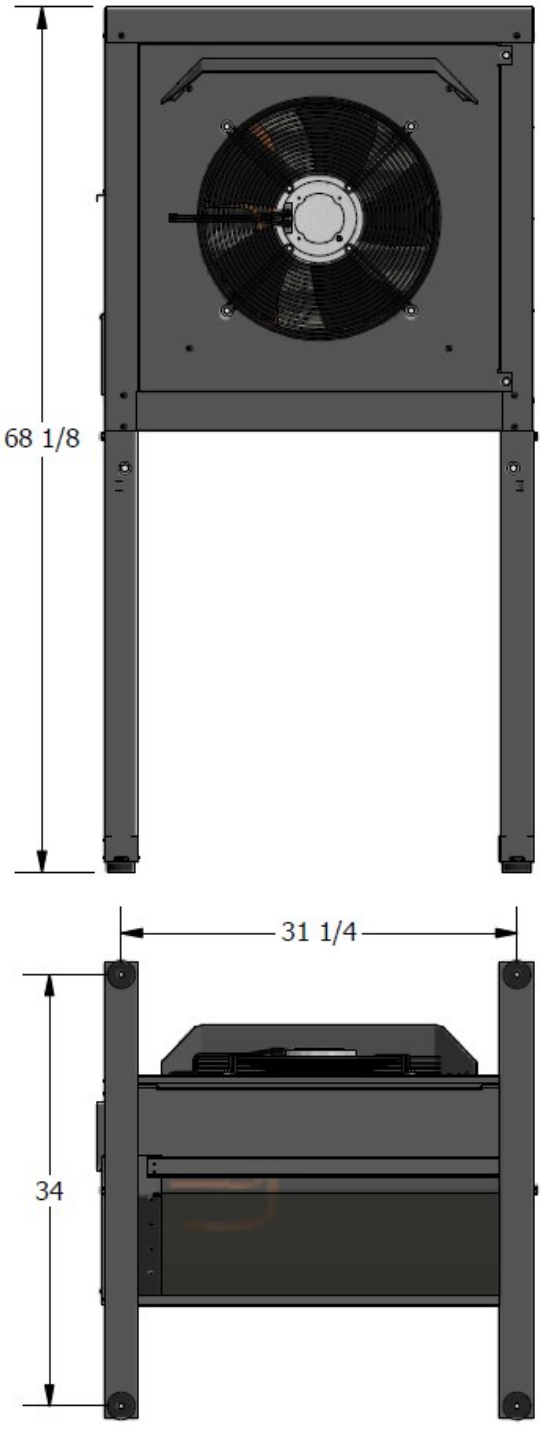
Dimensions: ATW-25/45

WITH LEG KIT



WITH TALL LEG KIT



All dimensions in inches

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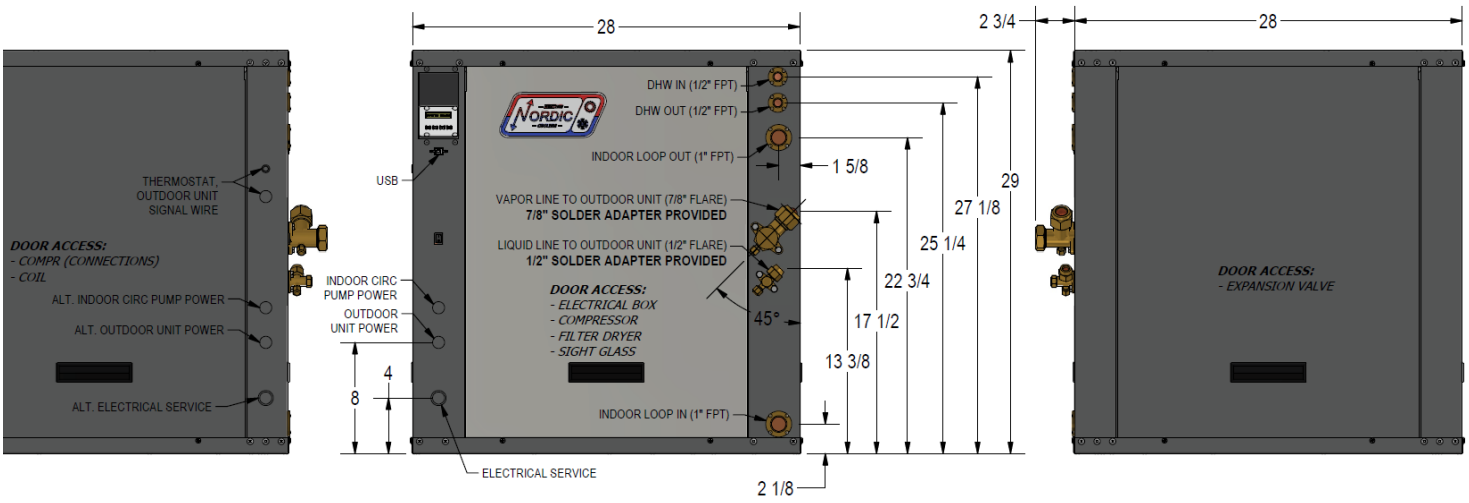
Dimensions: ATW-55

All dimensions in inches



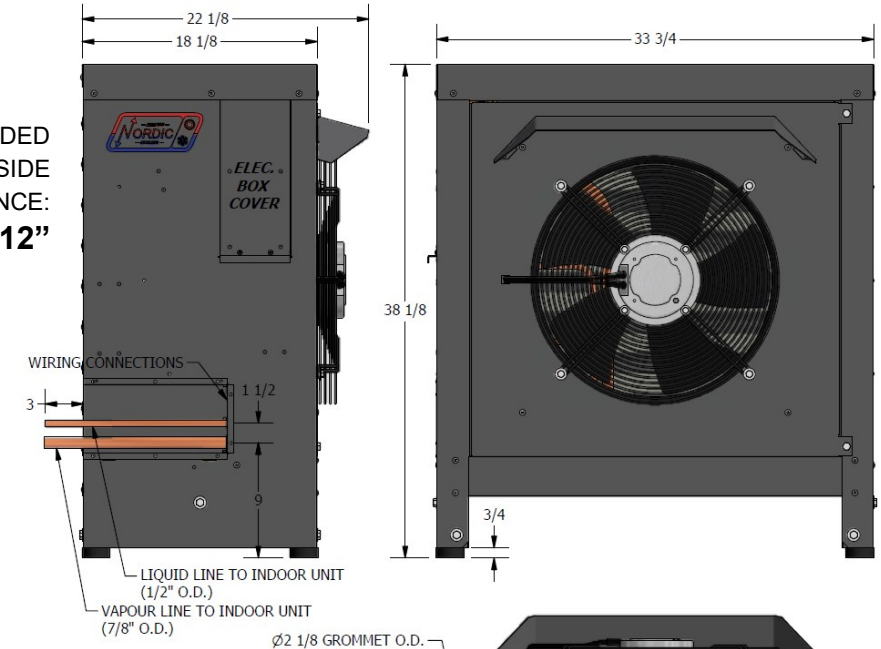
LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE:
3 FT

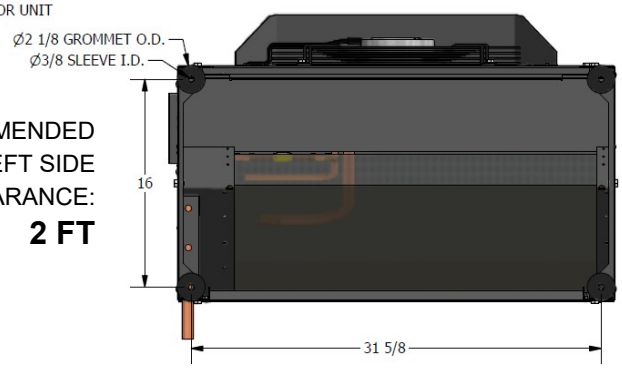
RECOMMENDED RIGHT SIDE CLEARANCE:
2 FT

NO BACK CLEARANCE REQUIRED

RECOMMENDED BACK SIDE CLEARANCE:
12”



RECOMMENDED FRONT SIDE CLEARANCE:
10-16 FT



RECOMMENDED LEFT SIDE CLEARANCE:
2 FT

NO RIGHT SIDE CLEARANCE REQUIRED

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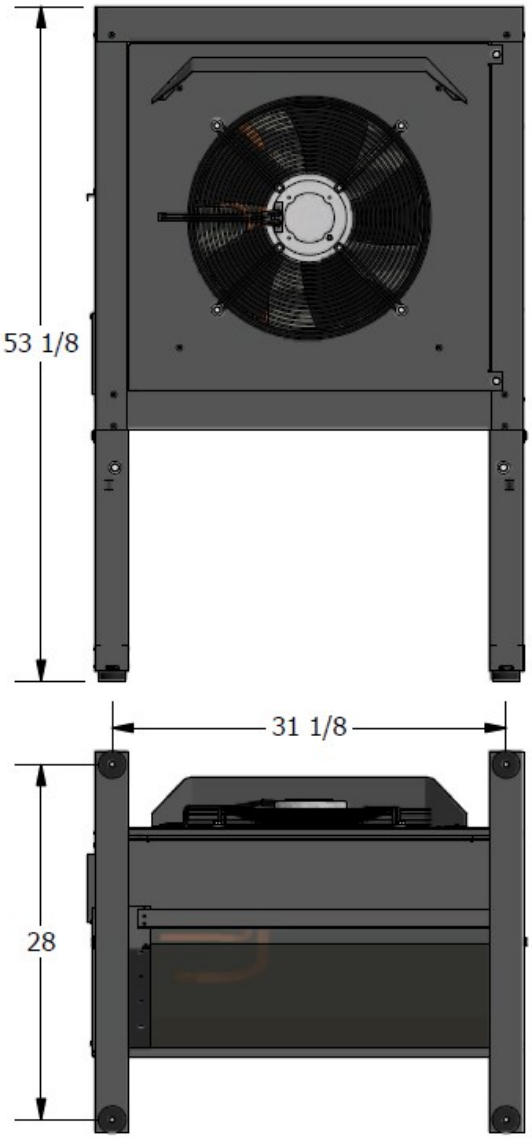
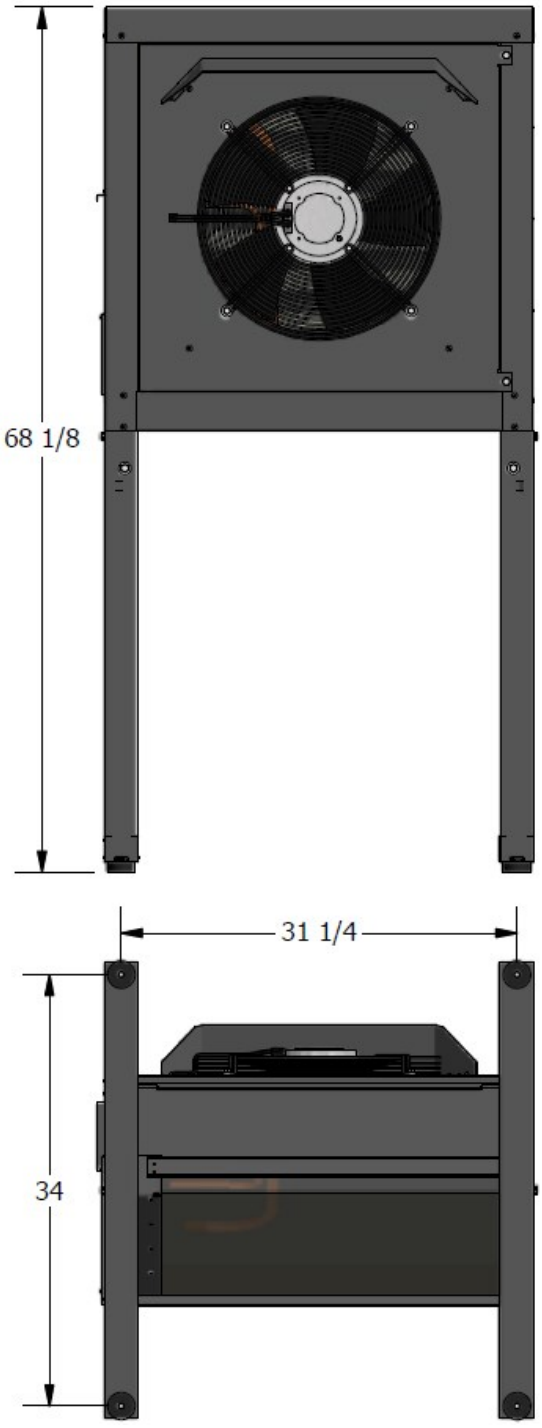
Dimensions: ATW-55

WITH LEG KIT



WITH TALL LEG KIT



All dimensions in inches

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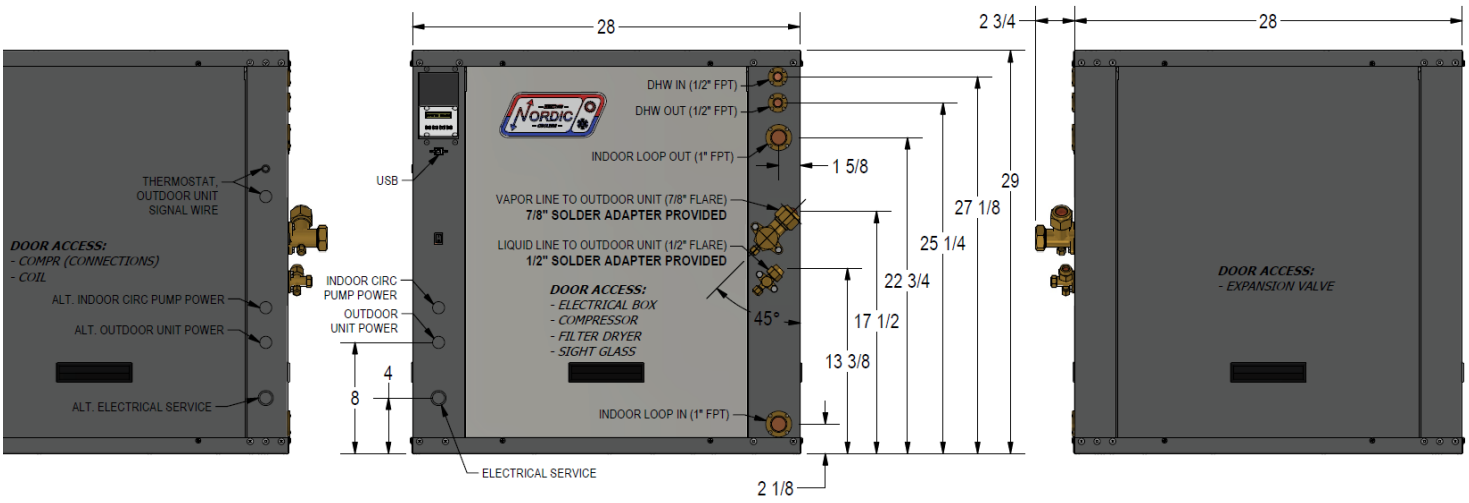
Dimensions: ATW-65/75

All dimensions in inches



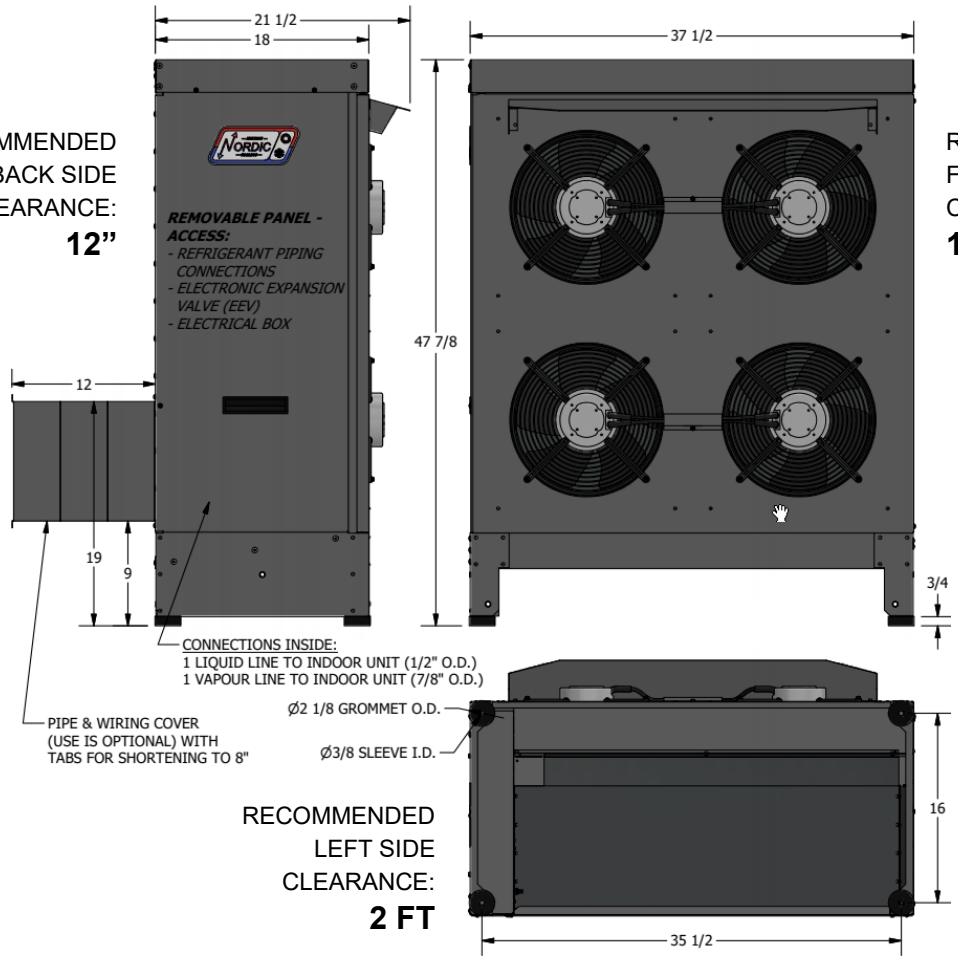
LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE:
3 FT

RECOMMENDED RIGHT SIDE CLEARANCE:
2 FT

NO BACK CLEARANCE REQUIRED

RECOMMENDED BACK SIDE CLEARANCE:
12”



RECOMMENDED FRONT SIDE CLEARANCE:
10-16 FT

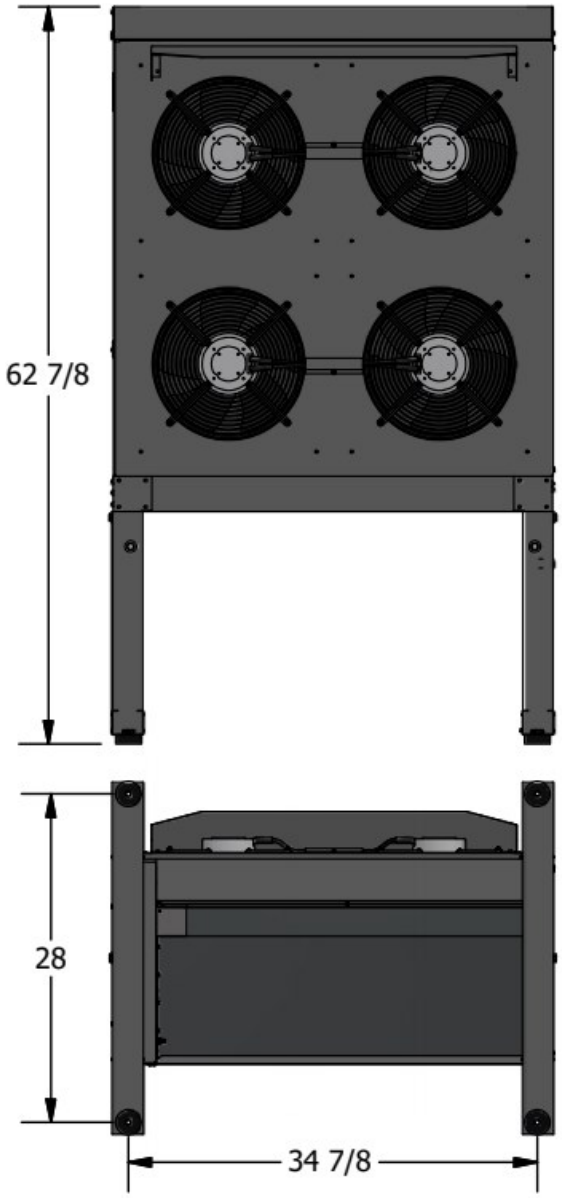
RECOMMENDED LEFT SIDE CLEARANCE:
2 FT

NO RIGHT SIDE CLEARANCE REQUIRED

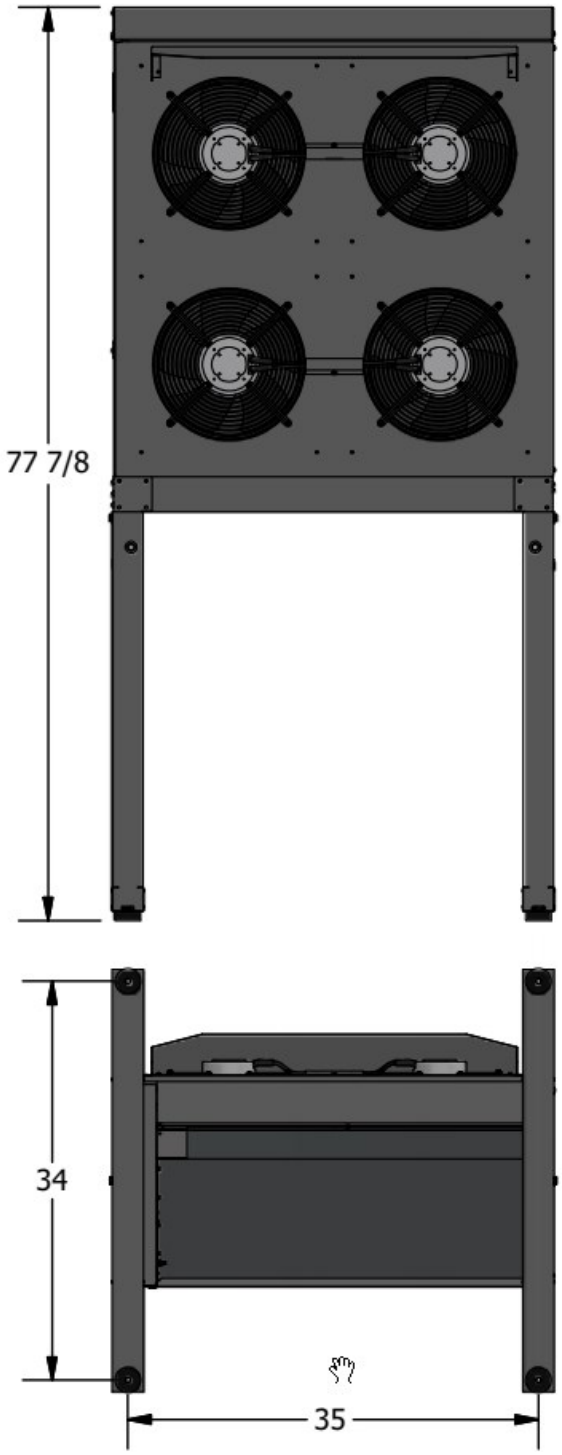
go to TABLE OF CONTENTS

Dimensions: ATW-65/75

WITH LEG KIT



WITH TALL LEG KIT



All dimensions in inches

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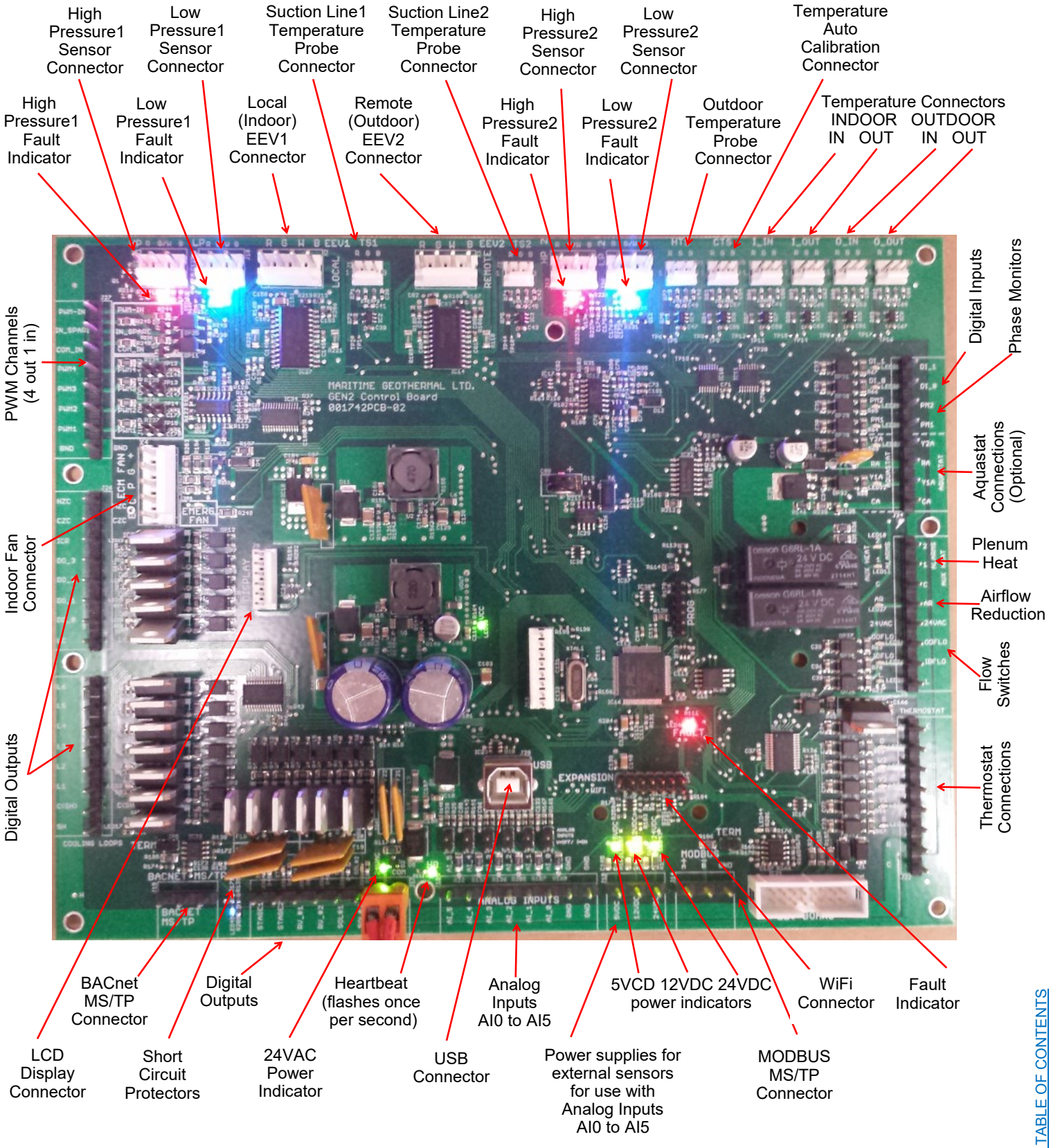
Appendix A: Gen2 Control Board Description

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.



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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 compressor discharge pressure.
LPS1/LO1	Low Pressure Sensor 1	Mounted in indoor unit, measures compressor suction pressure.
EEV1	Local EEV	Mounted in indoor unit, active in cooling mode.
TS1	Suction Line Temperature 1	Mounted to common suction line inside unit.
EEV2	Remote EEV	Mounted in outdoor unit, active in heating mode.
TS2	Suction Line Temperature 2	Not used.
HPS2/HI2	High Pressure Sensor 2	Not used.
LPS2/LO2	Low Pressure Sensor 2	Not used.
HTS/ODTS	Outdoor Temperature	Temperature sensor, mounted in outdoor unit.
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	Not used.
O_OUT	Outdoor Loop OUT	Not used.

TABLE A2 - Control Board Connector Descriptions (Left Side)		
Name	**Description**	
PWM_IN	Signal for PWM IN	Not used.
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	Not used.
PWM3	PWM / 0-10VDC output	Not used.
PWM2	PWM / 0-10VDC output	Not used.
PWM1	OUTDOOR_FAN	Outdoor fan PWM control signal.
GND	Ground	Jumper to COM_IN for disable functionality.
HZC	Hot Zone Circulator	Not used.
CZC	Cold Zone Circulator	Not used.
ICR	Internal Circulator Relay	Operates the indoor circulator.
DO_3	AUX_ONLY	Output OFF when auxiliary heat to be run without compressor; operates H1-H2.
DO_2	HYD_AUX	ON when hydronic auxiliary on (Setpoint Control only).
DO_1	Digital output	Not used.
DO_0	Digital output	Not used.
LC	Loop common (ground)	Not used.
L6	Loop6	Not used.
L5	Loop5	Not used.
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	Not used.
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.

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TABLE A3 - Control Board Connector Descriptions (Bottom)		
Name	**Description**	
GND	BACnet MS/TP	Ground for shield if required.
B	BACnet MS/TP	RS-485.
A	BACnet MS/TP	RS-485.
STAGE1	Compressor Stage 1	Starts / stops the compressor.
STAGE2	Compressor Stage 2	Turns the compressor stage 2 solenoid on/off.
RV#1	Reversing Valve#1	Off in heating mode, on in cooling mode.
RV#2	Reversing Valve#2	Not used.
SOL#1	Solenoid#1	Not used.
SOL#2	Solenoid#2	Accessory refrigerant vent fan relay/contactor.
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	Accessory type 3/7 10k hot tank temperature sensor for HTS/CTS Setpoint Control.
AI_4	Analog In Channel 4	Accessory type 3/7 10k cold tank temp. sensor for HTS/CTS Setpoint Control.
AI_3	Analog In Channel 3	Compressor discharge line temperature sensor.
AI_2	Analog In Channel 2	Not used.
AI_1	Analog In Channel 1	Not used.
AI_0	Analog In Channel 0	Compressor current sensor.
GND	Ground pin	Ground for analog sensors.
GND	Ground pin	Ground for analog sensors.
5VDC	Power for analog sensors	5VDC regulated power supply for sensors.
12VDC	Power for analog sensors	12VDC regulated power supply for sensors.
24VDC	Power for analog sensors	24VDC unregulated power supply for sensors.
A	MODBUS	RS485 communication for refrigerant leak detector.
B	MODBUS	RS485 communication for refrigerant leak detector.
GND	MODBUS	Ground for shield if required.

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TABLE A4 - Control Board Connector Descriptions (Right Side)		
Name	**Description**	
DI_1	Digital Input1	Not used.
DI_0	Digital Input0	Not used.
PM2	Phase Monitor2	Switch or dry contact from R to activate Summer Setback mode.
PM1	Phase Monitor1	Accessory for 3 phase models.
Y2A*	Aquastat Stage2	Optional stage 2 24VAC input for use with Signals/Hardwired control.
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	Plenum Heat Stage2	Not used.
1	Plenum Heat Stage1	Not used.
C	Plenum Heat Common	Not used.
AR	Airflow Reductions	Not used.
24VAC	Power	Accessory 24VAC power.
ODFLO	Outdoor Flow Switch	Not used.
IDFLO	Indoor Flow Switch	Not used.
L	Thermostat Lockout Indicator	Not used.
E	Thermostat Emergency Heat	Not used.
O	Thermostat Heat/Cool	24VAC input from external dry contact via terminal strip; activates cooling mode.
W2	Thermostat Auxiliary Heat	Not used.
Y2	Thermostat Stage2	Not used.
Y1	Thermostat Stage1	Not used.
G	Thermostat Fan Recirculation	Not used.
R	Thermostat Power (24VAC)	Not used.
C	Thermostat Power (Ground)	Not used.

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

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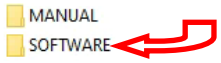
Appendix B - USB Driver Installation (Windows 10 & earlier)

NOTE: This step is ***not necessary*** for **Windows 11**.

The first step in connecting a **Windows 10 or earlier** laptop computer to the control board is to install the USB driver.

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

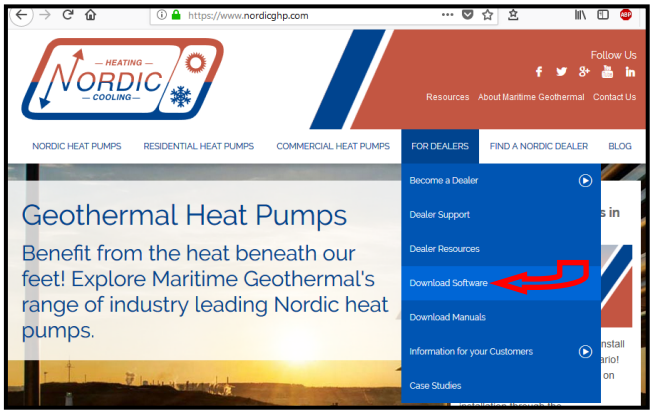


Double click on the SOFTWARE folder to show its contents:

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

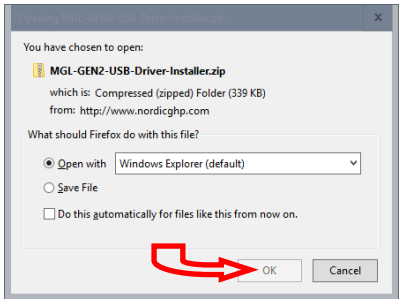
If the USB drive is not available, the same files can be **down-loaded from the web page**.

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

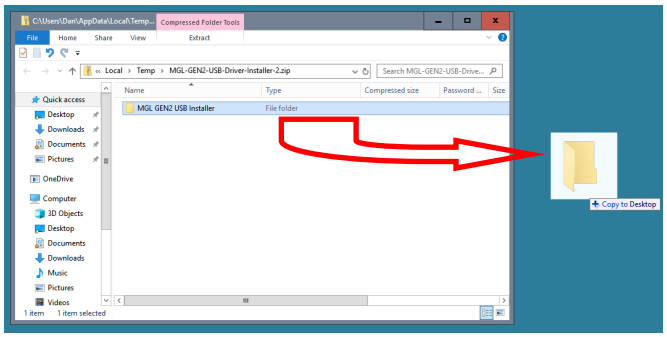


2. Click on **MGL GEN2 USB Driver Installer** to download it:

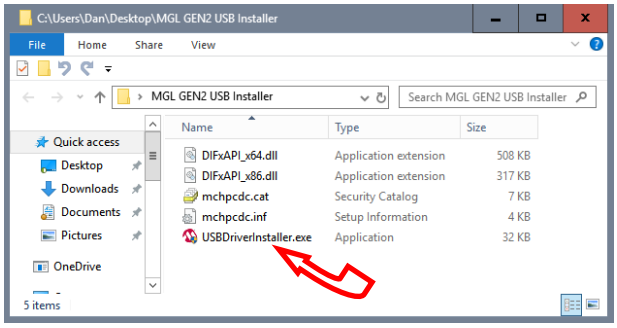
3. Choose "Open with Windows Explorer", and hit "OK". *(If the choice window doesn't pop up, find the downloaded file in your browser downloads and double click on it.)*



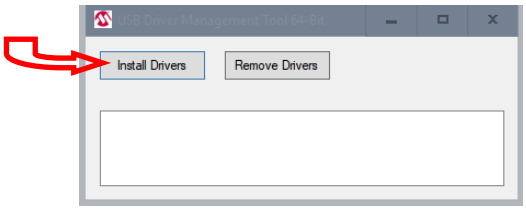
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



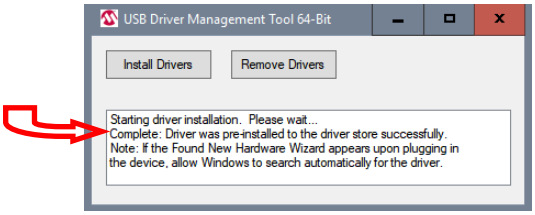
5. Double click on the folder you just dragged onto the desktop, then double click on the "USBDriverInstaller" file:



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



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



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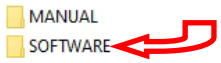
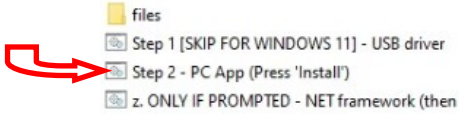
Appendix C - PC App Installation (Windows 11)

The PC App allows detailed interfacing with the control board using a Windows laptop computer. These instructions are for ***Windows 11***.

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



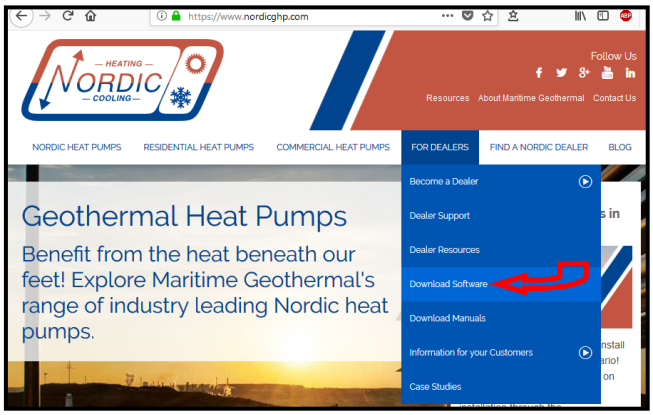
Double click on the SOFTWARE folder to show its contents:



Double click on **Step 2** and follow the prompts, clicking "More info", "Run anyway", "Install", or similar on any warning windows which pop up, perhaps more than once. Pictures of warning windows you might encounter are shown below in step **8**.

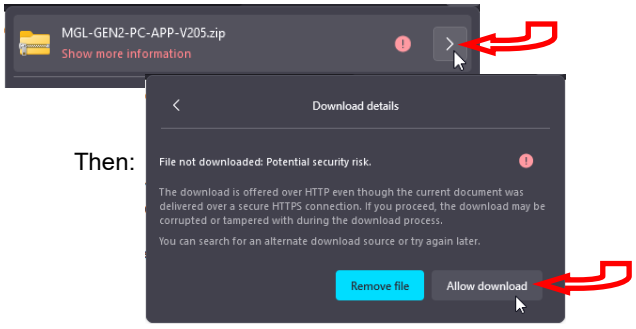
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

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

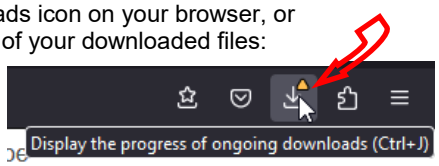


2. Click on **MGL GEN2 PC APP V2__** to download it:

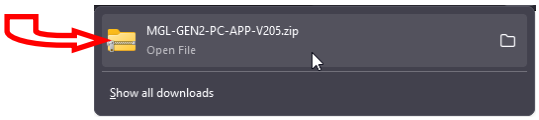
3. You may see a warning like this one. Click as shown:



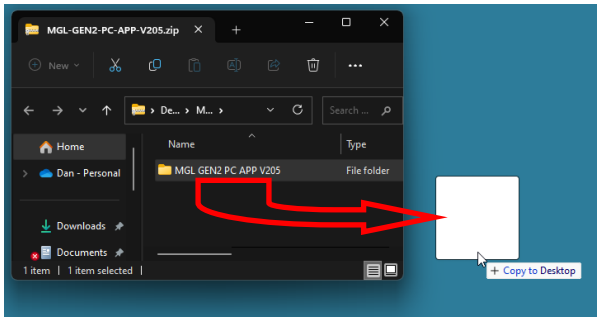
4. Click on the downloads icon on your browser, or otherwise view a list of your downloaded files:



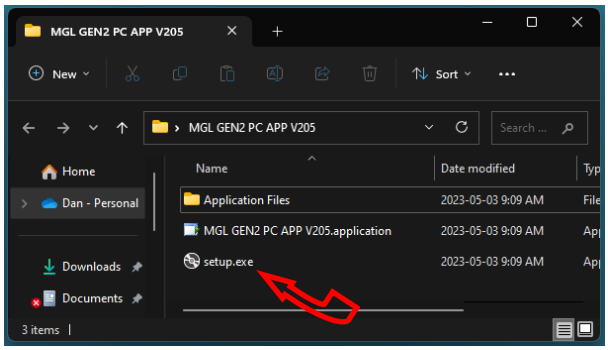
5. Then click on the .zip file to open it in a File Explorer window:



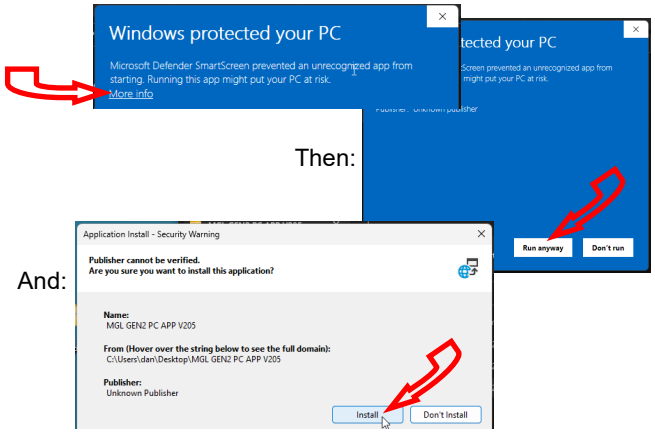
6. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



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



8. Click "More info", "Run anyway", "Install", or similar on any warning windows which pop up, perhaps more than once.



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

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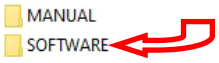
Appendix D - PC App Installation (Windows 10 & earlier)

The PC App allows detailed interfacing with the control board using a Windows laptop computer. These instructions are for ***Windows 10 or earlier***. First, install the USB driver as per the previous appendix.

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

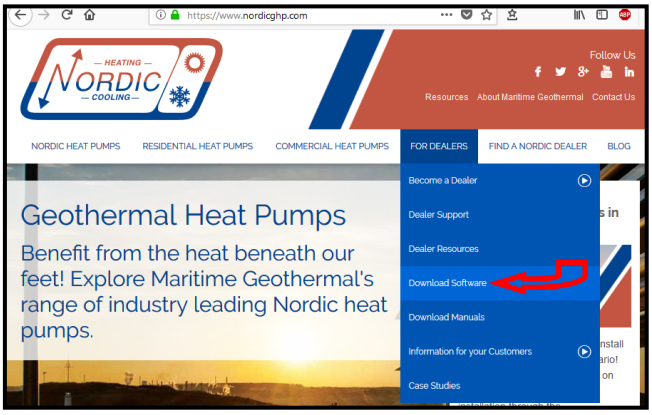


Double click on the SOFTWARE folder to show its contents:

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

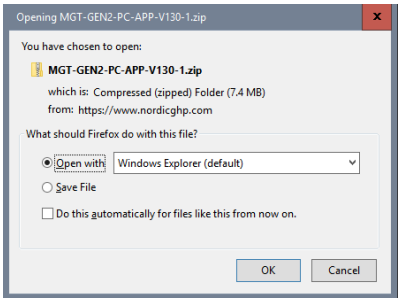
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

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

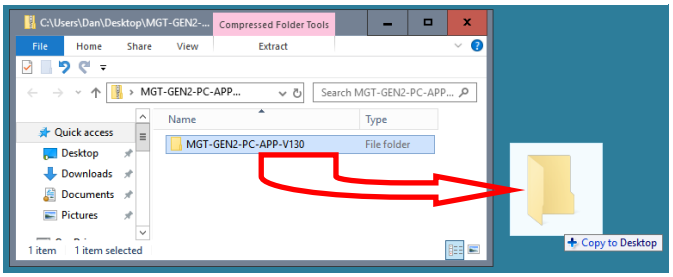


2. Click on **MGL GEN2 PC APP V2__** to download it:

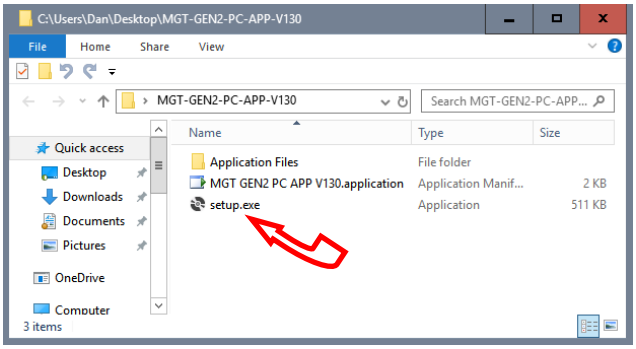
3. Choose "Open with Windows Explorer", and hit "OK":



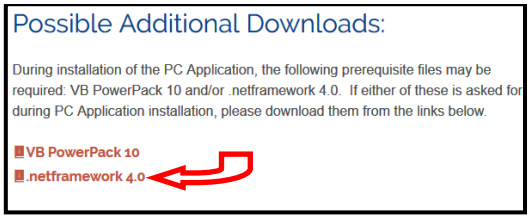
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



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



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



Then go back to step 5.

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

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Appendix E: Updating Firmware

METHOD 1: Updating Firmware Using PC App

This method can be used when updating newer control boards with bootloader version 2.0. This method will not work for older control boards with bootloader version 1.0 (approx. unit serial numbers -17 and lower); for those, see **METHOD 2**. Note that **METHOD 2** will work for all control boards.

The firmware comes as a .ZIP file named:
MGL GEN2 Bootload Firmware Vxxx.zip
where xxx is the version reference, e.g. 376 (version 3.76).
This file can be downloaded from **www.nordicghp.com**, menu *For Dealers --> Download Software*.

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

   \Desktop\MGL GEN2 Bootload Firmware V376

   Also be sure the latest PC App version (e.g. v2.05) is installed, which is listed alongside the firmware on the web page. If needed, install a new version as per those instructions, and uninstall older PC App versions to avoid their accidental use (which can corrupt control board parameters).

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

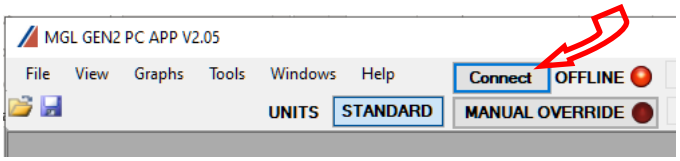
MGL_GEN2_V376.production.hex	(firmware file)
PIC32UBL.exe	(the programmer)
USB Bootloader Instructions.pdf	(these instructions)

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

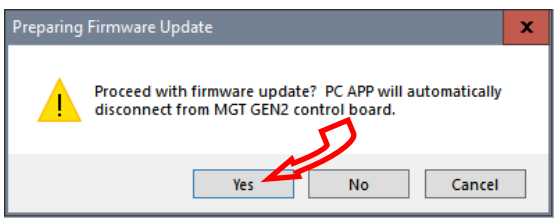
3. Connect a USB (printer) cable between computer and control board.

4. Launch the PC App version that matches the firmware (e.g. PC App 2.05 for firmware V3.76). After it is installed, the PC App can be started using the entry found under the "M" section in the Windows **START** menu, which is accessed using the 4-rectangles icon normally found at the bottom left corner of the computer screen.

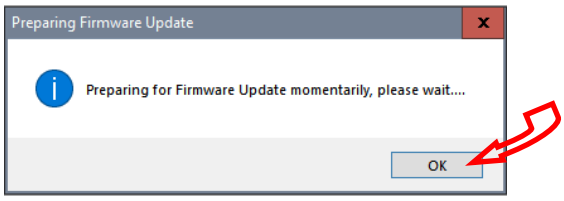
5. In the PC App, click on the **Connect** button to connect to the control board.



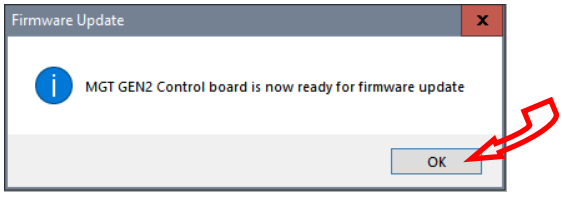
6. Go to menu **Tools --> Update Firmware**. The following message box will appear:



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

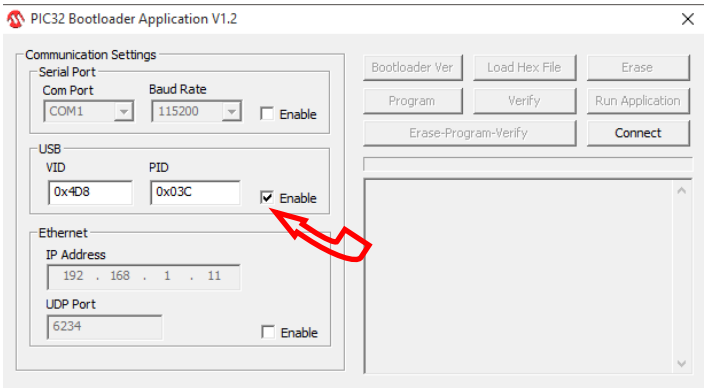


8. Click on **OK**. After a minute, the following message box will appear:

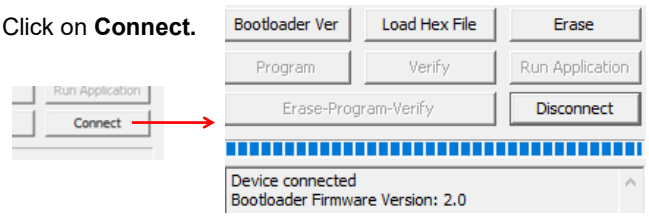


9. Click on **OK**. The control board is now in bootloader mode and is ready to be programmed.

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



11. Click on **Connect.**



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

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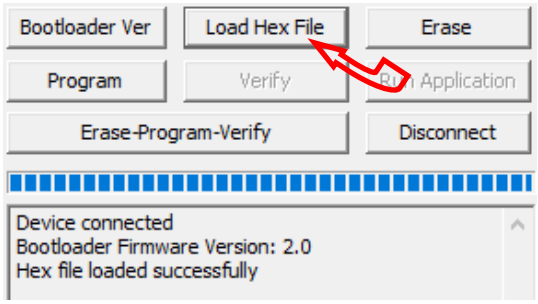
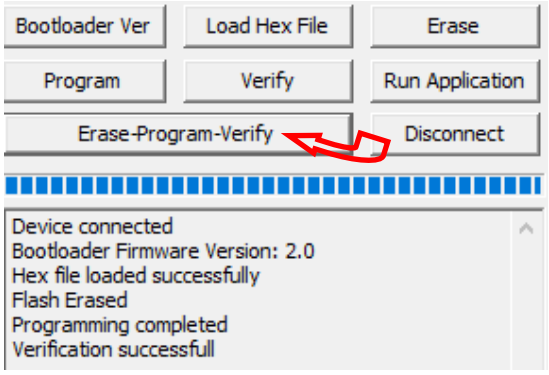
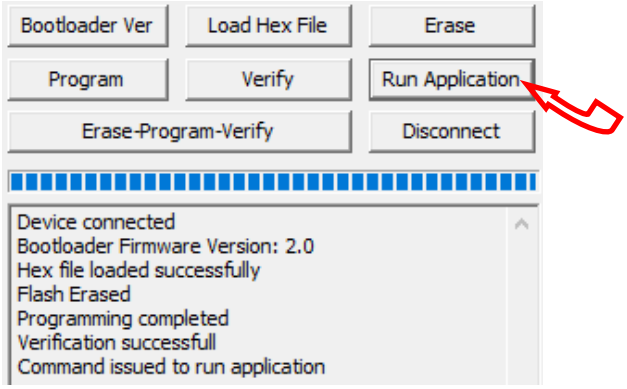
12. Click on **Load Hex File**. Select the M*GL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.



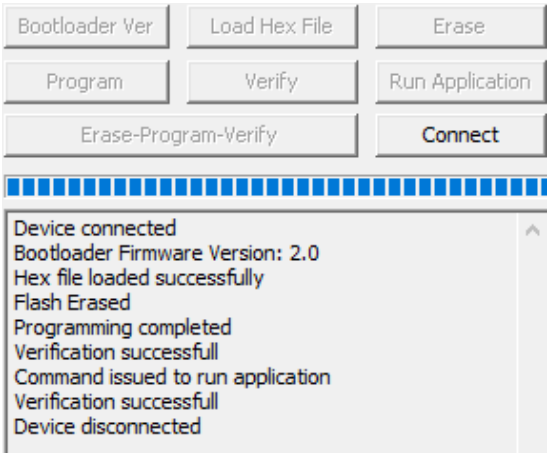
13. Click on **Erase—Program—Verify.** Programming…. Wait while status bar shows progress. The messages should read as below when finished:



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



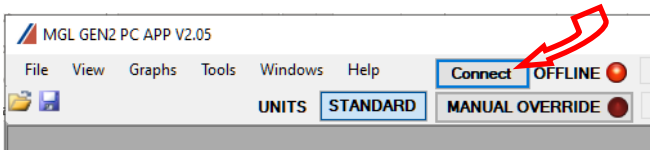
15. **Wait until the programmer disconnects itself.** The messages should read as follows:



16. Close the PIC32 program.

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

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



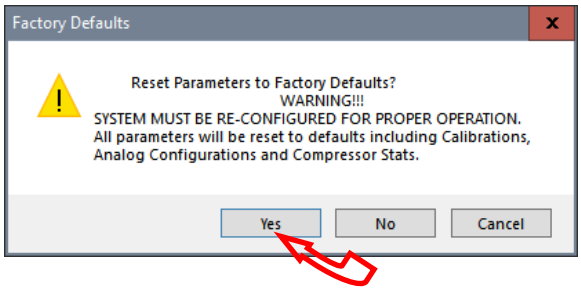
NOTE: Updating the firmware does not affect the configuration settings.

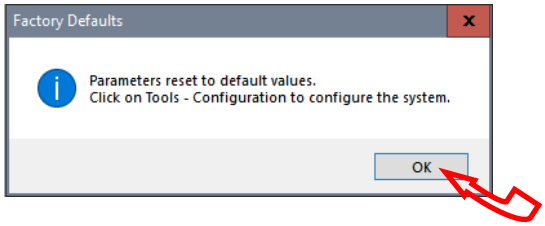
Reset to Defaults?

When updating from **firmware V3.75 or earlier**, the following steps must be taken after the update as there are significant differences in the internal parameters used to operate the system. These steps may also be performed for troubleshooting, when the control system is not acting as it should.

Note that if the firmware on a heat pumps is 2.45 or earlier, chances are that it will have an older bootloader version that requires the use of **METHOD 2** to update the firmware (see following page).

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





3. Go back to menu **Tools --> Configuration**. Re-select the Model Series 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.

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METHOD 2: Updating Firmware Using Jumper Pins

This method should be used when updating older control boards that have bootloader version 1.0, or where the PC App has trouble connecting to older firmware. This method will work for all control boards and can be used on all units.

The firmware comes as a .ZIP file named:
MGL GEN2 Bootload Firmware Vxxx.zip
where xxx is the version reference, e.g. 376 (version 3.76). This file can be downloaded from **www.nordicghp.com**, menu *For Dealers --> Download Software.*

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

   \Desktop\MGL GEN2 Bootload Firmware V376

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

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

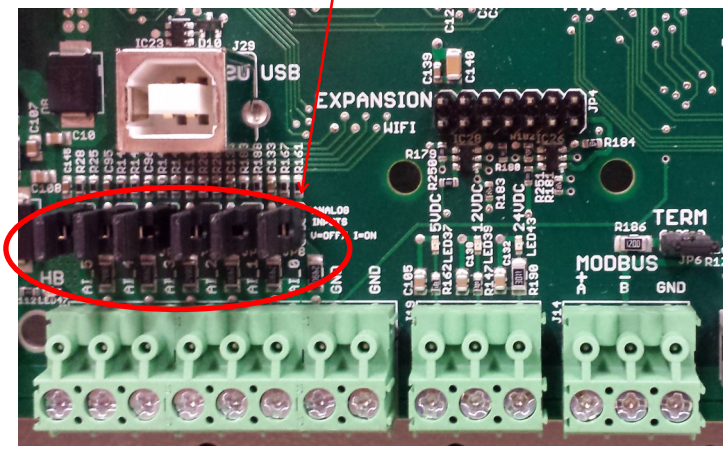
   Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

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

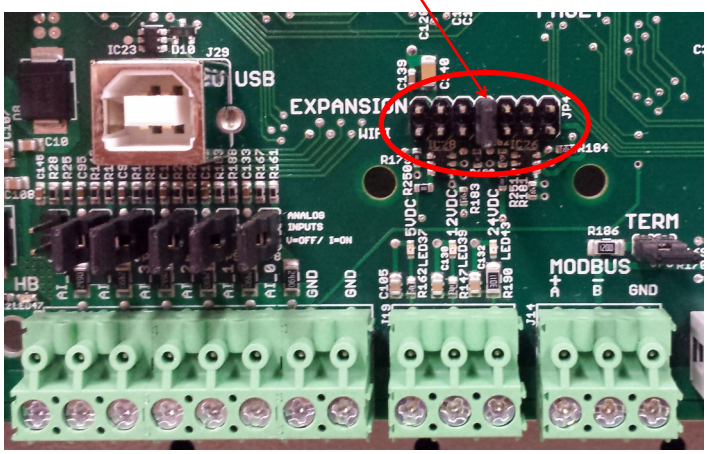
4. Turn power off to the heat pump.

5. Remove one of the black pin jumpers from just below the USB connector on the board and place in on the center pin pair of the EXPANSION header as shown below.

Borrow any one of these jumpers (however many are present)

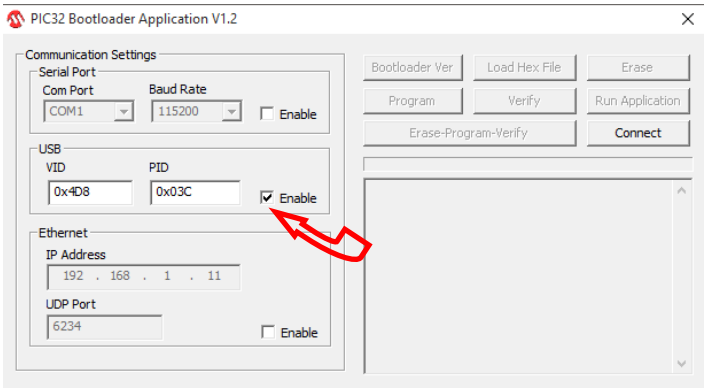


Place jumper here

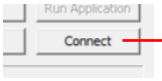


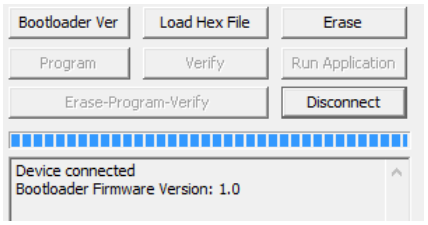
6. Turn the power back on. The control board is now in boot loader mode and is ready to be programmed.

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

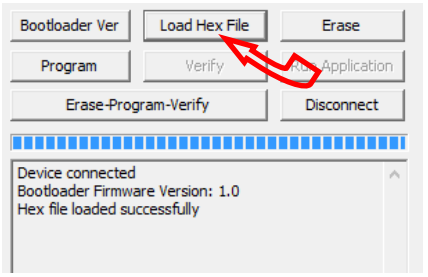


8. Click on **Connect.**



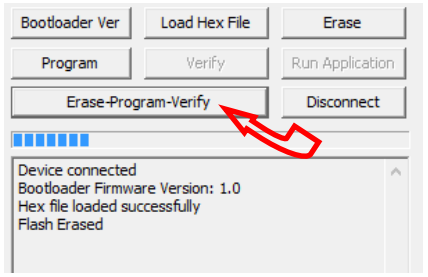


9. Click on **Load Hex File**. Select the *MGL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.



10. Click on **Erase—Program—Verify**

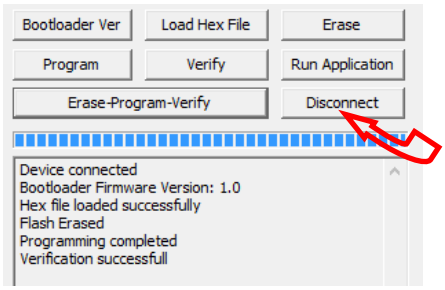
Programming…



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

12. Turn power off to the heat pump again.

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



14. Turn the power back on. Check that the LCD Display shows e.g. **MGL GEN2 V3.76** on the top line during power up.

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LIMITED RESIDENTIAL WARRANTY

MARITIME GEOTHERMAL LTD. warrants that the heat pumps manufactured by it shall be free from defects in materials and workmanship for a period of (5) FIVE YEARS after the date of installation or for a period of (5) FIVE YEARS AND (60) SIXTY DAYS after the date of shipment, whichever occurs first. In addition MARITIME GEOTHERMAL LTD. warrants that the compressor shall be free of defects in materials and workmanship for an additional period of (2) TWO YEARS from said date.

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

This warranty is subject to the following conditions:

1. The NORDIC® heat pump must be properly installed and maintained in accordance with MARITIME GEOTHERMAL LTD.'s installation and maintenance instructions.
2. The installer must complete the "**Installation Data Sheet**", have it endorsed by the owner and return it to Maritime Geothermal Ltd. within 21 days of installation of the unit.
3. It is the responsibility of the building or general contractor to supply temporary heat to the structure prior to occupancy. These heat pumps are designed to provide heat only to the completely finished and insulated structure. Start-up of the unit shall not be scheduled prior to completion of construction and final duct installation for validation of this warranty.
4. It is the customer's responsibility to supply the proper quantity and quality of water.

If the heat pump, manufactured by MARITIME GEOTHERMAL LTD., fails to conform to this warranty, MARITIME GEOTHERMAL LTD.'s sole and exclusive liability shall be, at its option, to repair or replace any part or component which is returned by the customer during the applicable warranty period set forth above, provided that (1) MARITIME GEOTHERMAL LTD. is promptly notified in writing upon discovery by the customer that such part or component fails to conform to this warranty. (2) The customer returns such part or component to MARITIME GEOTHERMAL LTD., transportation charges prepaid, within (30) thirty days of failure, and (3) MARITIME GEOTHERMAL LTD.'s examination of such component shall disclose to its satisfaction that such part or component fails to meet this warranty and the alleged defects were not caused by accident, misuse, neglect, alteration, improper installation, repair or improper testing.

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Maritime Geothermal Ltd.
PO Box 2555
170 Plantation Road
Petitcodiac, NB, E4Z 6H4

RESIDENTIAL WARRANTY REGISTRATION

(A PRINTED COPY OF THIS FORM IS SHIPPED WITH THE UNIT.)

Complete all fields to have your warranty effective as of the install date. Should this form not be completed or if it does not include sufficient detail, warranty will be effective as of the date your unit was shipped from Maritime Geothermal Ltd..

Model: _____

Serial Number: _____

Install Date: _____

Installed By: _____
(company name)

Loop Type: ☐ horizontal ☐ vertical ☐ open ☐ pond
(geothermal only)

Installation Type: ☐ new construction ☐ replacement/retrofit

Address of installation: _____

City: _____

Province / State: _____

Postal Code / Zip: _____

Where do I find my model and serial number?

There is a label on the outside of your unit like this one.