



Application, Installation, & Service Manual

ATF-Series Triple Function Central Air Source Heat Pump

Two-stage **R454b**
Model Sizes 45-75



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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.

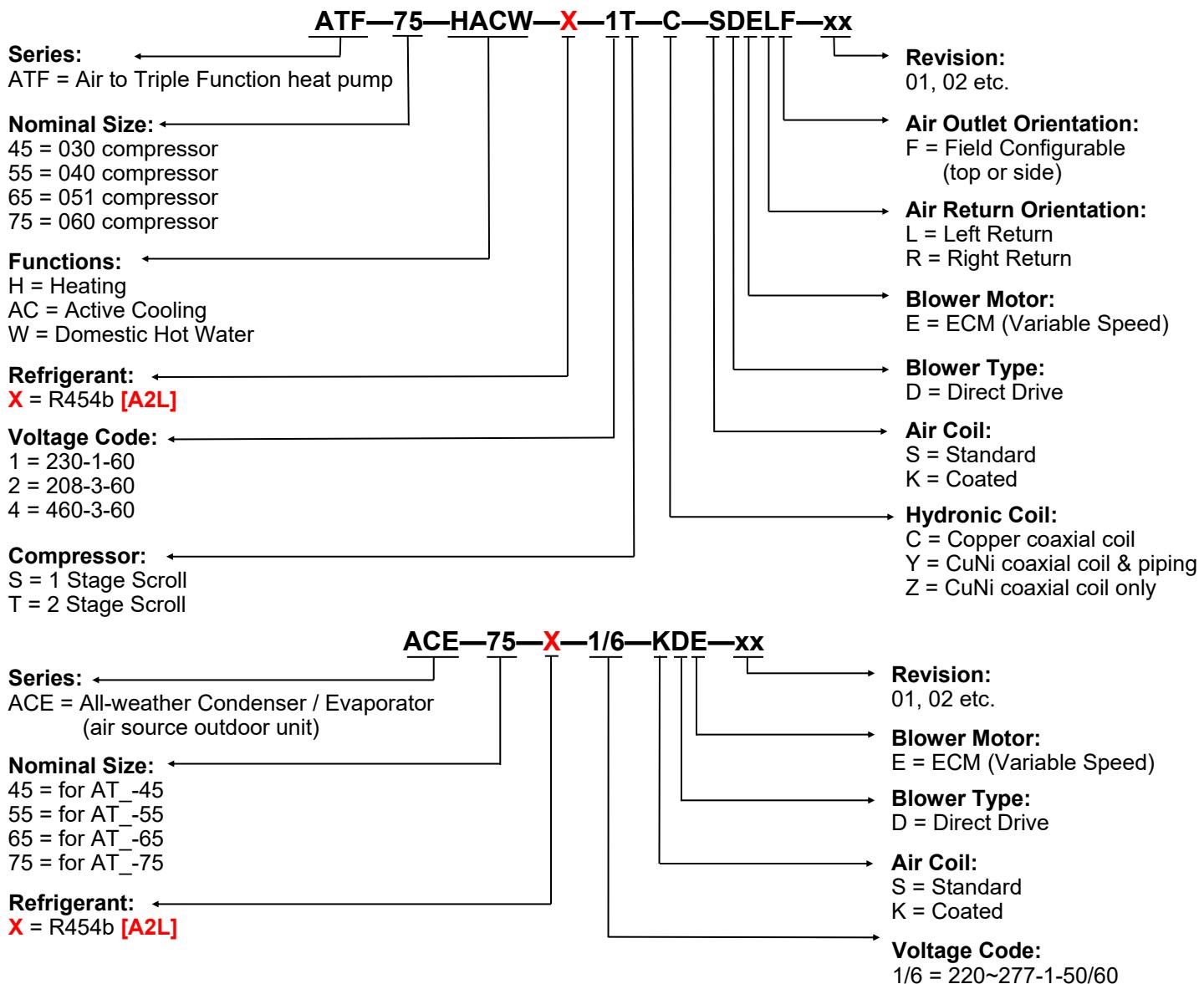


This appliance is not intended for intervention by persons with reduced physical, sensory, or mental capabilities or lack of experience and knowledge, unless suitably supervised. Children should be prevented from playing with appliance.



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.

Model Nomenclature



APPLICATION/AVAILABILITY TABLE - INDOOR UNIT											
MODEL SERIES	MODEL SIZE	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESSOR	HYDRONIC COIL	AIR COIL/BLOWER/AIR RETURN	AIR RETURN	AIR OUTLET	REVISIONS	
ATF	45 55 65 75	HACW	X	1 2 4	T	C Y Z	S D E	L R	F	01	

APPLICATION/AVAILABILITY TABLE - OUTDOOR UNIT							
MODEL SERIES	MODEL SIZE	REFRIGERANT	VOLTAGE	AIR COIL	BLOWER TYPE	BLOWER MOTOR	REVISIONS
ACE	45 55 65 75	X	1/6	K	D	E	01

This manual applies only to the models and revisions listed in these tables.

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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ATF System Description

General Overview

The **ATF-Series** heat pump is an air source heat pump that can heat or cool via a forced air duct system, as well as heat water for hydronic applications like in-floor heating.

Being an air source heat pump, it does not require a ground loop, instead using an outdoor fan unit to exchange heat with the outdoor air. Unlike most air source outdoor units on the market, this outdoor unit contains only an air coil, ECM hub motor fan, expansion valve (EEV), and outdoor temperature sensor. The remaining components, including the compressor and all electronics, are located 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 heating domestic hot water is possible (through a desuperheater circuit) since water lines are inside and will never freeze.

The air heating and cooling functions are controlled by a standard 3H/2C 24V room thermostat. The hydronic heating control is done by an internal routine that maintains the buffer tank temperature, without external sensors ('Setpoint Control'). BACnet or an external aquastat can also be used.

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

A two-stage scroll compressor is standard. 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. The cabinet is powder coated galvanized sheet metal. Control is overseen by the Nordic GEN2 programmable control board, which has many advanced features like laptop connectivity via the free PC App software, data logging & graphing, and real time readout from electronic temperature & pressure sensors. A premium electrically commutated (ECM) blower motor with adjustable airflow is standard.

1. Air Heating Mode

In air heating mode, heat is extracted from the outdoor air and transferred to the air duct system. 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 Air Heat

An electric resistance plenum heater, placed inside the heat pump but ordered separately, is **required**. This is because the capacity of air source heat pumps fall as the outdoor temperature drops and the heating load increases. This output reduction can be seen in the performance charts later in this manual, and is common to all air source heat pumps. The plenum heater will be sized to satisfy all of the heat load if the outdoor

temperature falls below the minimum for heat pump operation: -7°F (-22°C).

A second important function of the plenum heater is to provide heat to the indoor air stream during defrost mode (described below), to **avoid cold air blowing into the space**.

The room air thermostat controls when the plenum heater is activated, normally due to a drop in the room temperature. The heater is installed inside the indoor unit, unless the blower is installed in the side discharge position, in which case it is installed in the air discharge ductwork outside the heat pump.

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 is a common cause of air coil failure in air source heat pumps.

2. Hydronic (Water) Heating Mode

In hydronic heating mode, the heat pump heats hot water in the buffer tank. EEV, outdoor fan, and defrost operation are the same as in air heating mode.

Auxiliary Hydronic Heat

Optionally, hydronic auxiliary heat may be installed, to keep the floor warm no matter what the outdoor temperature. This can consist of electric elements in the buffer tank, or an existing boiler may be retained and piped in parallel with the heat pump.

Auxiliary hydronic heat will be controlled by the heat pump via dry contacts. Buffer tanks with elements rated for space heating duty are available as accessories.

3. Air Cooling Mode

In air cooling mode, heat is extracted from the air duct system 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 and will slowly ramp up to the required speed when the system starts. During operation, the fan speed will automatically adjust up or down to maintain the discharge pressure setpoint value. Two stage units will drop down to the first stage to reduce the discharge pressure at very high outdoor temperatures.

Factory Options

Looking at the main service panel, the indoor unit can be ordered as a left or right hand air return from the factory. This must be specified at time of order as the physical construction of the two configurations is different. See **Installation Basics** chapter.

Mode and Priority Selection

The heat pump can be set to **Air** or **Hydronic** priority. Units are shipped set up for air priority. This is often a good setting, since drops in the household air temperature normally occur sooner if there is a lag in the ducted air system than if there is a drop in the hydronic water temperature.

However, if there is only an auxiliary air plenum heater installed (no hydronic auxiliary heat), the heat pump can be set to **hydronic priority**, so that the heat pump will heat in-floor water first and any shortfall in heating capacity on cold days will be covered by the air plenum heater.

Whenever there is a stage 1 demand from both the air thermostat and aquastat, the unit steps up to stage 2 of the priority mode in order to satisfy the priority demand quickly and get to the non-priority mode. If this functionality was not present, the unit could run in stage 1 of the priority mode (67% compressor capacity) for a long time with a 'call waiting', allowing the overall supply of heat to the building to fall behind the load.

SINGLE MODE OPERATION:

If there is only one mode being called for, the unit operates in the mode and stage that is called for.

SIMULTANEOUS DEMANDS - AIR PRIORITY:

If there is a call for:

- both **stage 1 air** and **stage 1 hydronic**
- both **stage 2 air** and **stage 1 hydronic**
- both **stage 1 air** and **stage 2 hydronic**
- both **stage 2 air** and **stage 2 hydronic**

The unit operates in **air mode in stage 2**.

SIMULTANEOUS DEMANDS - HYDRONIC PRIORITY:

If there is a call for:

- both **stage 1 air** and **stage 1 hydronic**
- both **stage 2 air** and **stage 1 hydronic**
- both **stage 1 air** and **stage 2 hydronic**
- both **stage 2 air** and **stage 2 hydronic**

The unit operates in **hydronic mode in stage 2**.



ATF 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, and also poor dehumidification during cooling mode.

Therefore, it should be expected that **any air source heat pump will need auxiliary heat on the coldest days**. An air side plenum heater is **required**; see reasons in previous chapter. Hydronic side auxiliary can also be implemented (tank elements or auxiliary boiler).

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
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.

Plenum Heater Sizing

The required plenum heater is available as an accessory in 5, 7, 10, 15 and 20kW sizes. Choose a size that covers **100% of the coldest day heat load**, according to the heat loss analysis mentioned in the last section. If that is not available, use the following recommendation:

TABLE 2 - Plenum Heater Sizing

Model	Plenum Heater Size (kW)	
	Recommended	Internally Possible
45	10	5, 7, 10
55	10	5, 7, 10, 15, 20
65	15	5, 7, 10, 15, 20
75	20	5, 7, 10, 15, 20

Two styles of plenum heater are available; the first is for internal installation (inside the indoor unit). Note limit for size 45 in above table.

The second has a wider element profile for installation outside the unit, in the ductwork. If field-installing the fan in the convertible side discharge position, this type of plenum heater will need to be used.

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

Ducted or forced air heat pumps should be centrally located in the home with respect to the conditioned space. This provides the best in economy and comfort and usually can be accomplished in harmony with the design of the home. A heating system cannot be expected to produce an even temperature throughout the building when it is located at one end of the structure and the heated or cooled air is transmitted with uninsulated metal ductwork.

If possible the front access panel and side access panel opposite the air return should remain clear of obstruction for a distance of **2 ft (0.7 m)** to facilitate servicing and general maintenance. No access is required on the back side. Ensure the unit is level to eliminate any possible condensate draining issues.

The heat pump comes equipped with an air filter rack which can be installed with the removable end (where the filter is inserted) on either side to facilitate changing the filter. Be careful not to run piping in front of the filter rack access cover, since access is required in order to change the air filter.

Raising the indoor unit off the floor a few inches is generally a good practice since this will prevent rusting of the bottom panel of the unit and deaden vibrations. An anti-vibration pad, available as an accessory, or a piece of 2" styrofoam should be placed under the unit.

Sample Bill of Materials

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

FROM MARITIME GEOTHERMAL

- ATF SERIES HEAT PUMP (L OR R RETURN)
W/ACE OUTDOOR UNIT
- PLENUM HEATER __ kW
- AIR THERMOSTAT (WIFI OR STD)
- SHIELDED 18-8 WIRE FOR OUTDOOR UNIT
- BUFFER TANK W/ELEMENTS __ kW

OPTIONAL FROM MARITIME GEOTHERMAL

- ANTI-VIBRATION PAD FOR UNDER UNIT
- SOUND JACKET
- COMPRESSOR SECURE START
- ELECTROSTATIC (CLEANABLE) AIR FILTER

DUCTWORK

- OUTLET PLENUM ADAPTER W/ FLEXIBLE COLLAR
- RETURN AIR ADAPTER W/ FLEXIBLE COLLAR
- FIBREGLASS INSULATION (FOR NOISE, IF REQ'D)
- TRUNK DUCT W/ JOINERS (IF NOT EXISTING)
- 6" ROUND DUCT W/ADAPTERS (IF NOT EXISTING)
- ALUMINUM TAPE
- SHEET METAL SCREWS

DHW:

- PREHEAT TANK, 40 OR 60 GAL
- 1/2" COPPER PIPE
- 1/2" FITTINGS, BALL VALVES, BOILER DRAINS, CV

ELECTRICAL

- HEAT PUMP SERVICE WIRE: 6-2/3 OR 8-2/3
- PLENUM HEATER SERVICE WIRE
- 14-2 OUTDOOR RATED WIRE W/ DISCONNECT SWITCH FOR OUTDOOR UNIT
- HEAT PUMP BREAKER
- PLENUM HEATER BREAKER
- THERMOSTAT WIRE 18-8
- THERMOSTAT WIRE 18-3 (PLENUM HEATER)
- FORK TERMINALS FOR TSTAT WIRE (6)
- CONDENSATE PUMP & HOSE (IF REQUIRED)

REFRIGERATION

- 1/2" & 7/8" (OR 3/8" & 3/4") ACR TUBING
- PIPE ISULATION
- EXTRA R454B REFRIGERANT FOR LINESETS >25 FT

HYDRONIC ZONES

- CIRCULATOR: HEAT PUMP TO TANK
- 1" PIPE & FITTINGS: HEAT PUMP TO TANK
- ZONE CIRCULATOR(S)
- ZONE TRANSFORMER & CIRC CONTACTOR
- ZONE VALVES (IF NOT INDIVIDUAL PUMPS)
- IN-FLOOR PIPING
- 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)

Placement of Tanks

See [ATF System Description](#) and [Piping](#) chapters for example placements of the hydronic buffer tank and domestic hot water preheat and final tanks.

Indoor Unit Air Outlet Orientation

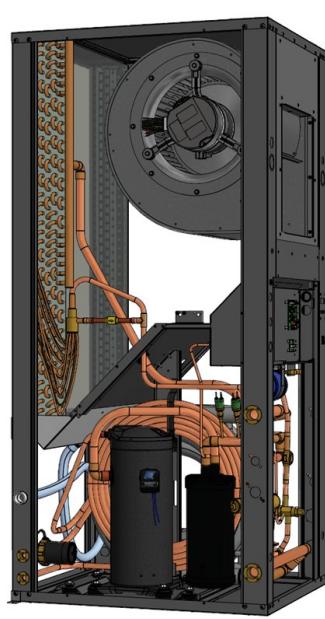
The indoor unit has a field configurable blower position, resulting in top or side air discharge. Its default location from the factory is in the top of the unit, providing a "ninety" in the airflow. It can easily be placed in the side of the unit for straight through airflow. Note that if this is done, plenum heater will need to be placed in ductwork outside unit.

To switch the location of the fan outlet:

1. Turn the power off to the unit.
2. Remove the screw that holds the side access panel in place and remove the access panel by pulling up on the handle and then outward from the bottom.
3. Disconnect the two wire harnesses and ground wire from the fan motor.
4. Repeat step 2 for the access panel with the fan mounted in it. Set the assembly on the floor.
5. Disconnect the plenum heater extension from the fan housing and from the access panel.
6. Mount the fan housing directly to the access panel.
7. Install the fan/panel in the new location and secure with the screw.
8. Reconnect both harnesses and ground wire.
9. Install the remaining access panel and secure with the remaining screw.



BLOWER IN
TOP DISCHARGE
POSITION (DEFAULT)



BLOWER IN
SIDE DISCHARGE
POSITION

Indoor Unit Air Return Orientation

The heat pump can be ordered as left or right air return from the factory. This must be specified at time of order as the physical construction of the two configurations is different. Refer to the [Dimensions](#) section toward the end of this manual for physical dimensions of the units.



Plenum Heater Installation

Be sure to specify the type of installation anticipated, since the plenum heater models are different for internal or external (duct) installation.

1. **Blower in top discharge position:** Plenum heater is mounted inside heat pump cabinet. See diagram on following page. Remove the screws from the cover plate, remove the cover plate, and place the plenum heater in the cutout. Slide it up and secure the bottom flange with three cover plate screws. Use the indicated knockouts on the heat pump cabinet for electrical connections.

When installation is complete, check the appropriate box of the label on the unit door to indicate which size heater was installed.

2. **Blower in side discharge position:** Plenum heater should be installed in the air discharge duct outside the heat pump cabinet in a manner that allows all of the airflow to pass through it to prevent any hot spots in the heater elements. Ensure that the plenum heater is mounted in an approved position as per its instructions.

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 for example. (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.

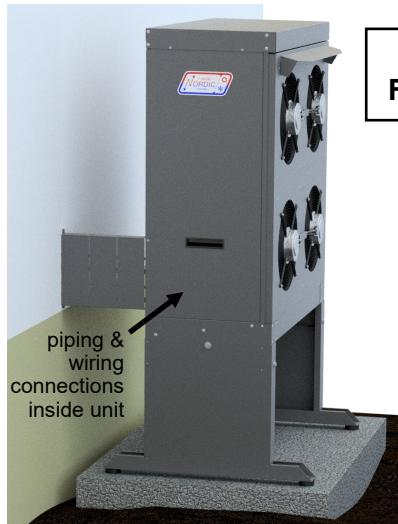
In addition, there should be at least **two feet (0.6 m)** of clearance on the electrical box and refrigeration piping side of the unit to facilitate servicing and general maintenance.

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** chapter) or PC App (see **PC Application** chapter).

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.

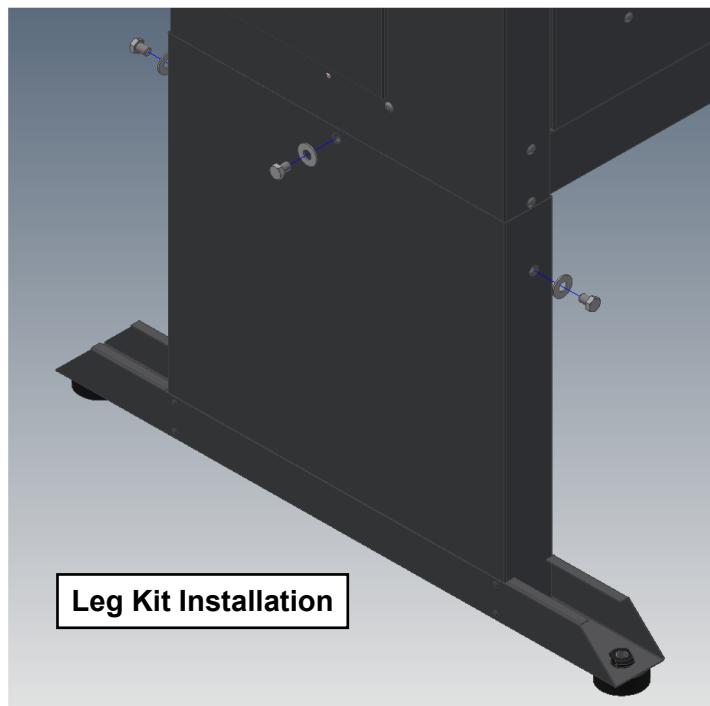
1. If there is less than ~4" (10 cm) of snow accumulation expected, the unit could be mounted directly on a concrete pad. This is **not recommended** in cold climates, since ongoing care would be required to ensure re-frozen condensate does not build up under unit.
2. The unit can be mounted on angle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

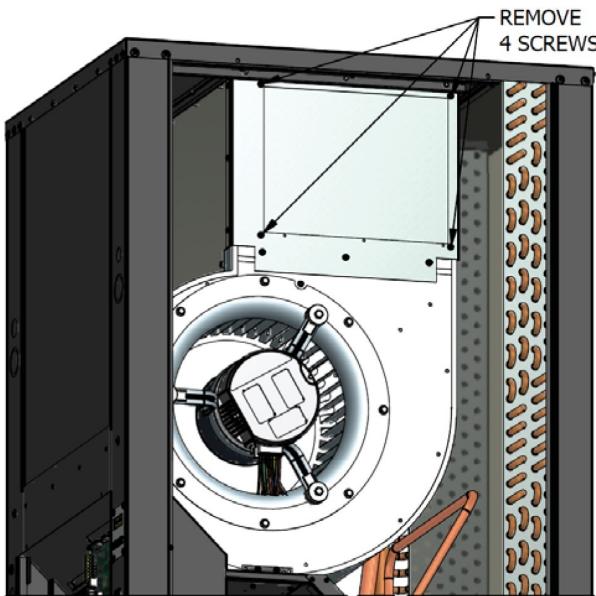


Leg Kit Installation

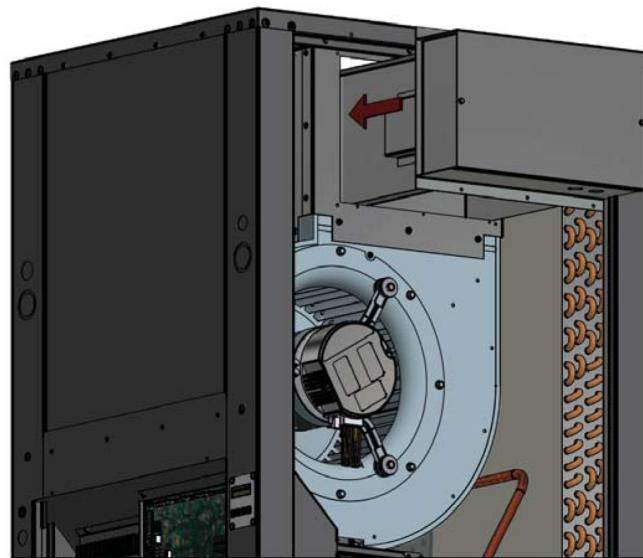
Internal Plenum Heater Installation

R, TF, ATA, ATF, DX, DXTF Series

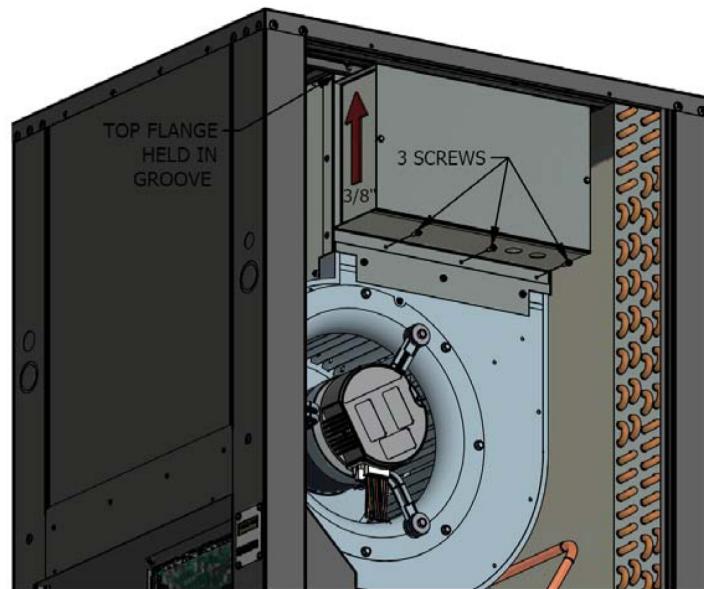
1. Remove four screws as shown, and remove blank panel.



2. Slide plenum heater into cutout until heater flange is flush with blower.



3. **Slide plenum heater UP** approximately 3/8". Top flange of heater is held in top groove of blower assembly and requires no fasteners. Install 3 screws through bottom flange of heater through pre-punched holes in heater and blower assembly.



Drawn By

Dan Rheault

Date

9-Jan-2015

Checked By

Dan Rheault

Date

9-Jan-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

Internal Plenum Heater Installation

Size

LET

Drawing Number

001915INF

Revision

01

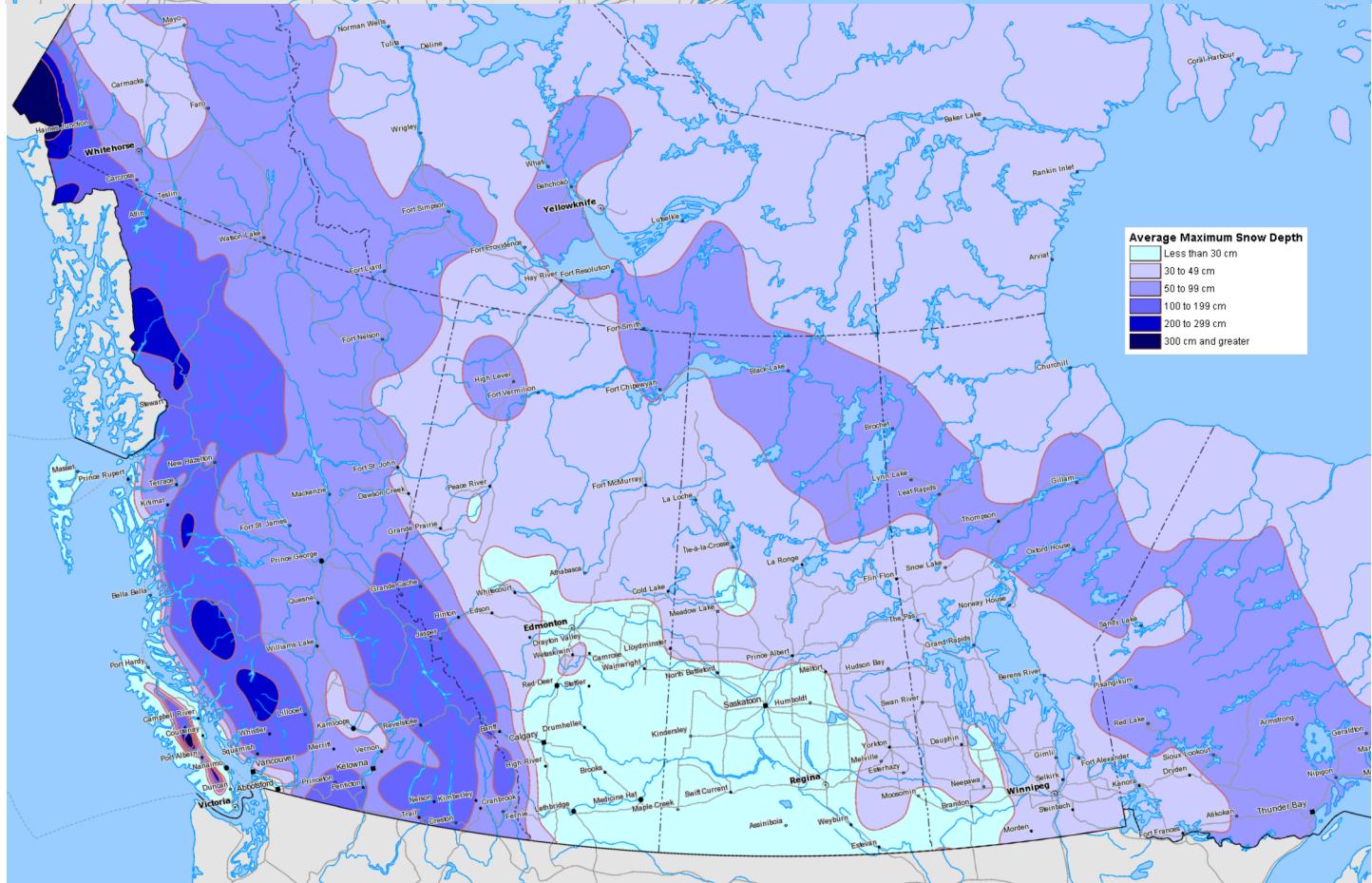
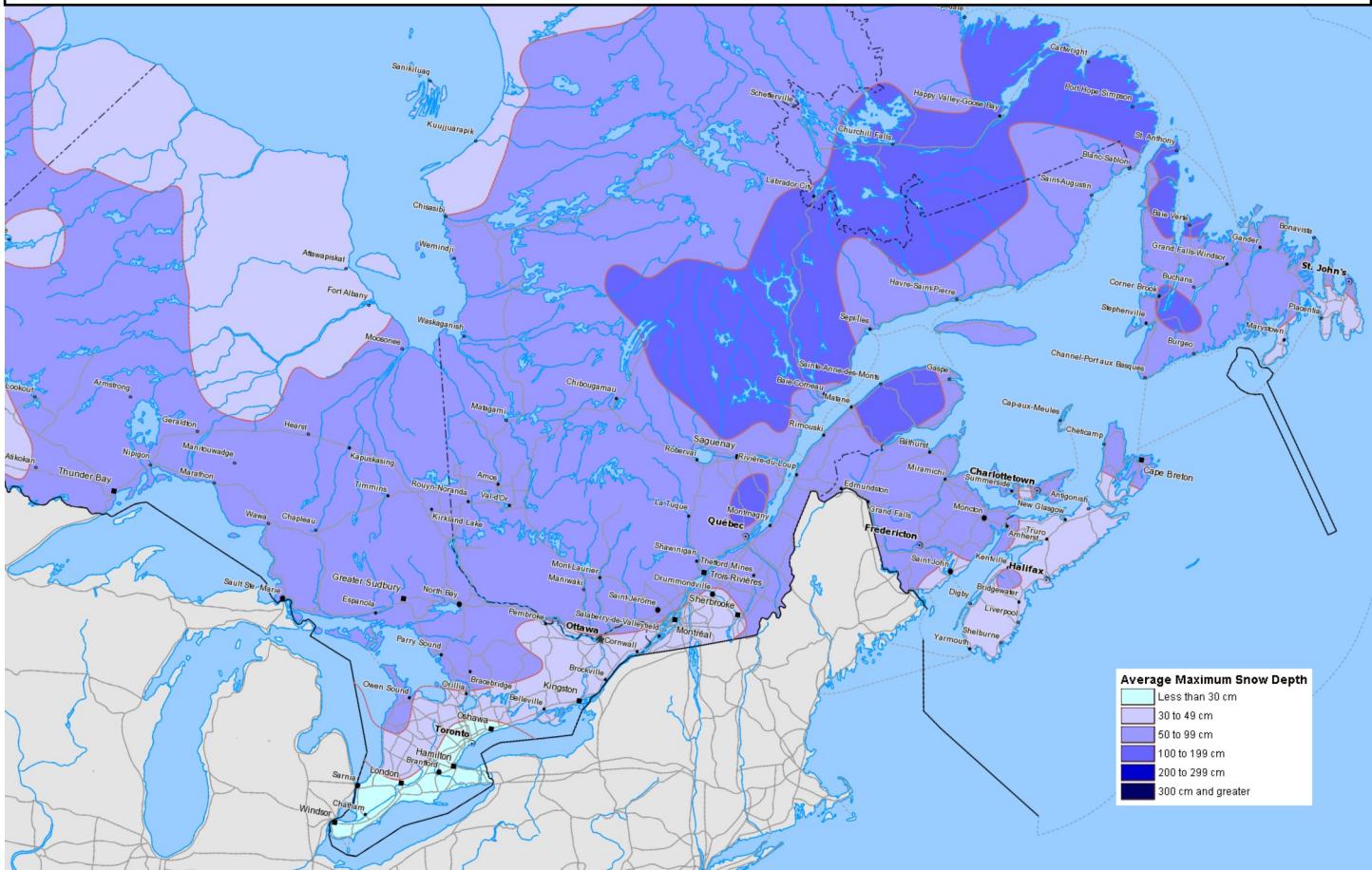
Sheet

1 / 1

01	Initial Release	Dan Rheault	Dan Rheault	9-Jan-2015
REV	ECO #	IMPL BY	APVD BY	DATE

Average Maximum Snow Depth - Canada (1979-1997)

Source: Natural Resources Canada



Wiring

Indoor Unit Power Supply Connections

Power supply for the heat pump from the breaker panel is supplied to the indoor unit. The unit has a concentric 1.093" / 0.875" knockout for main power supply connection to the electrical box. There are also two 7/8" knockouts and a 1/2" opening with plastic grommet (grommet hole is 3/8") for connections to the air thermostat, indoor loop circulator, 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



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	Required for 3-phase only
N	Neutral	208/230-1-60*, 208-3-60*, 460-3-60, 380-3-50
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 ATF 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: According to most codes, a disconnect switch visible and/or reachable from the outdoor unit must 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.

Plenum Heater: Power Connections

Auxiliary air heat will usually be provided by an electric duct heater (plenum heater). These are available as accessories in 5, 7, 10, 15, and 20 kW sizes, and are installed as previously noted in this manual. The plenum heater will have its own breaker and power supply wire. The Electrical Tables in the [Model Specific Information](#) section contain information about the size of wire for the connections, as well as the recommended breaker size.

Plenum Heater: Signal Connections

The ATF unit has two dry contacts to control the 2 stages of the plenum heater. These dry contacts can also be used to control other types of auxiliary air heat. Note that dry contacts are intended to activate equipment that has its own 24VAC transformer; if equipment does not have its own transformer, one will need to be installed in an external electrical box.

Connect the terminals on the ATF's terminal strip to the matching terminals on the plenum heater's control board using an 18-3 cable.

TABLE 5 - Plenum Heater Signal Connections

Signal	Description
CP	Common
1	Dry contact for auxiliary heat stage 1
2	Dry contact for auxiliary heat stage 2
Use a 3-conductor 18ga cable.	

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 two terminals (115V & 115/230 or 230V & 115/230) of the terminal strip marked **Indoor Circulator Pumps**. 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 6 - Indoor Loop Circulator Connections

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

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.

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. If the breaker trips, locate and correct the problem and then reset the breaker by pressing in on it.

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



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

TABLE 7 - Control Transformer

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

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.

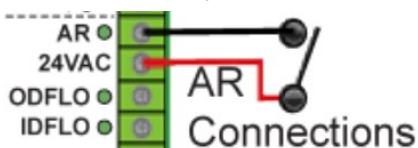
TABLE 8 - BACnet Connections

Line	Description
A	Communication +
B	Communication -
GND	Ground

Use a shielded twisted pair cable.

Airflow Reduction for Zoning

For air zoning, airflow may be reduced by a switch or dry contact using the connections on the right side of the control board. The dry contact may be from a relay and interconnected thermostats, or more commonly a zone controller.



The default reduction is 15%, but it may be adjusted from 5%-20% using the [View-->Indoor Fan](#) window in the PC App. See [PC Application](#) chapter. For airflow values including the reduction, see the [Indoor Airflow Data](#) table in the [Model Specific Information](#) chapter.

Setpoint Control (Hydronic 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.

Note that an external buffer tank temperature sensor may be used to replace the internal water OUT line temperature sensor for use with the Setpoint Control routine. This is called **External HTS/CTS Setpoint Control**. See [Operation](#) chapter.

Setpoint Control: Aux. Connections

When using Setpoint Control, there are **2 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.



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

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 it 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

Use a 2-conductor 18ga cable.

High Temperature Hydronic Auxiliary Heat

If using a high temperature hydronic auxiliary device that can only be activated when heat pump compressor is off (for example because the outdoor temperature is too cold), an SPDT relay may be connected to provide a dry contact for high temperature device activation by the heat pump's control board.

Refer to diagram [002304CDG](#) on a following page and schematic diagram in the [Model Specific Information](#) section. Connect the external relay's coil (normally relay pins 1 and 3) to **DO_3** (AUX ONLY) and **LC** at the left side of control board.

Then use the **COM** and **NC** relay contacts (normally pins 4 and 5) to enable the high temperature heating device when the **DO_3 (AUX_ONLY)** pin is off, meaning compressor is off and auxiliary heat is being called for.

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 indoor ATF 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*	Shielded cable ground wire

* Connect only to the indoor unit. In the outdoor unit, leave 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.

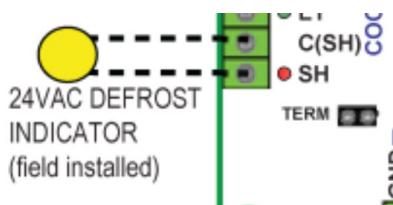
Domestic Hot Water (Desuperheater)

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

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

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.



Air Thermostat Connections

A three-stage heating and two stage cooling heat pump configurable thermostat is required. The stages are **S1** = stage 1 compressor, **S2** = stage 2 compressor and **S3** = electric auxiliary (in heating mode only). One can be ordered with the unit, or other heat pump thermostats with the same number of stages can be used. The air thermostat connections are located on a terminal strip in the indoor unit. Refer to diagram on a following page for connections between the thermostat and the heat pump.

The airflow can be reduced by an adjustable amount between 5 and 20% (value set in **PC App**) by making a dry contact across **24VAC** and **AR** on the right side middle terminal strip of the control board. This can be used for applications that have multiple air zones.

Care should be taken to ensure that the unit does not trip a safety control in heating or cooling mode if the AR reduction is used in conjunction with lower air flow settings.

TABLE 11 - Air Thermostat Connections

Signal	Description
C	24VAC common (ground)
R	24VAC hot
G	Fan low speed (for air recirculation)
Y1	Compressor ON (part load)
Y2	Compressor bump up to stage 2 (full load)
W2	Heating stage 3 (plenum heater)
O	Cooling mode (reversing valve)
E	Emergency heat (plenum heater)
L	Fault (24VAC when fault condition)
AR	Airflow reduction: connect AR ₁ to AR ₂ with a dry contact to reduce the airflow for zoning. Connections located on control board.
24VAC	

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 called **Signals Control**.

The wiring connections are at the top right of the ATF's control board, on the screw terminal connector section marked **AQUASTAT**. 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. **C** or **CA** is the ground terminal for powering the external device.

TABLE 12 - Aquastat (Signals Control) Connections

Signal	Description
C/CA	24VAC common (ground)
R/RA	24VAC hot
Y1A	Compressor ON (part load)
Y2A	Compressor bump up to stage 2 (full load)

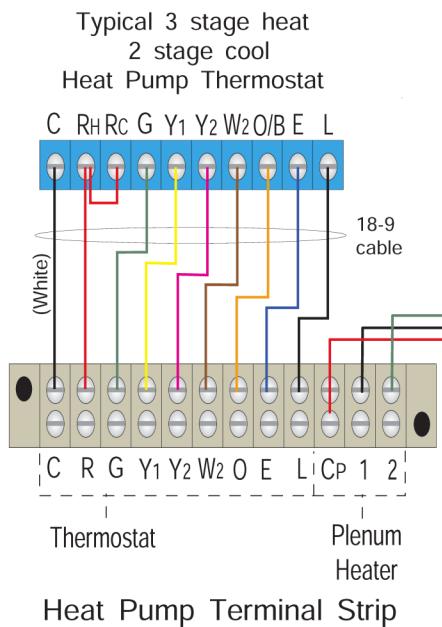
Refrigerant Vent Fan Connections

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.

Typical Thermostat Connections to GEN2 Control Board

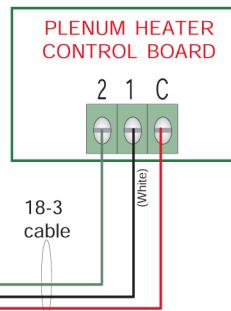
Two-Stage Models (Compressor Stages = T)



CONNECTION DESCRIPTION:

- C - 24VAC Common
- R - 24VAC Hot
- G - Fan
- Y1 - Stage 1 Heat/Cool (Compressor)
- Y2 - Stage 2 Heat/Cool (Compressor S2 solenoid coil)
- W2 - Stage 3 Heat (Plenum Heater)
- O - Reversing Valve (Cooling)
- E - Emergency Heat
- L - Compressor Lock-out Light

NOTE: Configure O/B for energized in cooling.

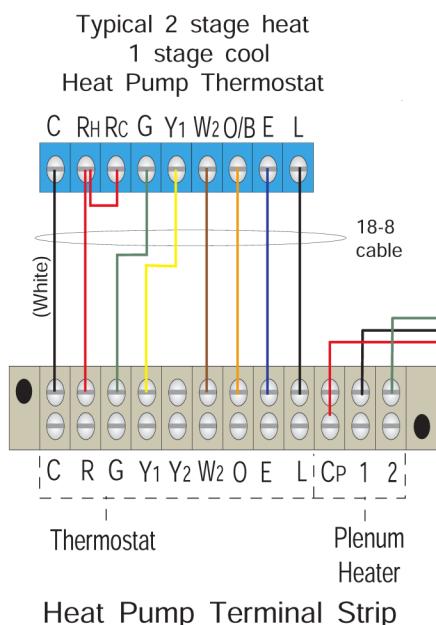


Note: If only using as single stage then only an 18-2 cable is required, place a jumper wire between 2 and 1 of the plenum heater terminals.



Note: Connect 24VAC and AR together with a dry contact to invoke the airflow reduction function. Refer to the manual for more information.

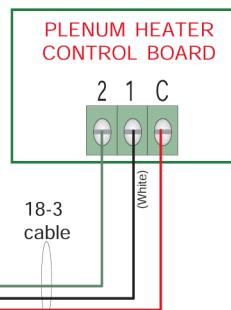
Single-Stage Models (Compressor Stages = S)



CONNECTION DESCRIPTION:

- C - 24VAC Common
- R - 24VAC Hot
- G - Fan
- Y1 - Stage 1 Heat/Cool (Compressor)
- W2 - Stage 3 Heat (Plenum Heater)
- O - Reversing Valve (Cooling)
- E - Emergency Heat
- L - Compressor Lock-out Light

NOTE: Configure O/B for energized in cooling.



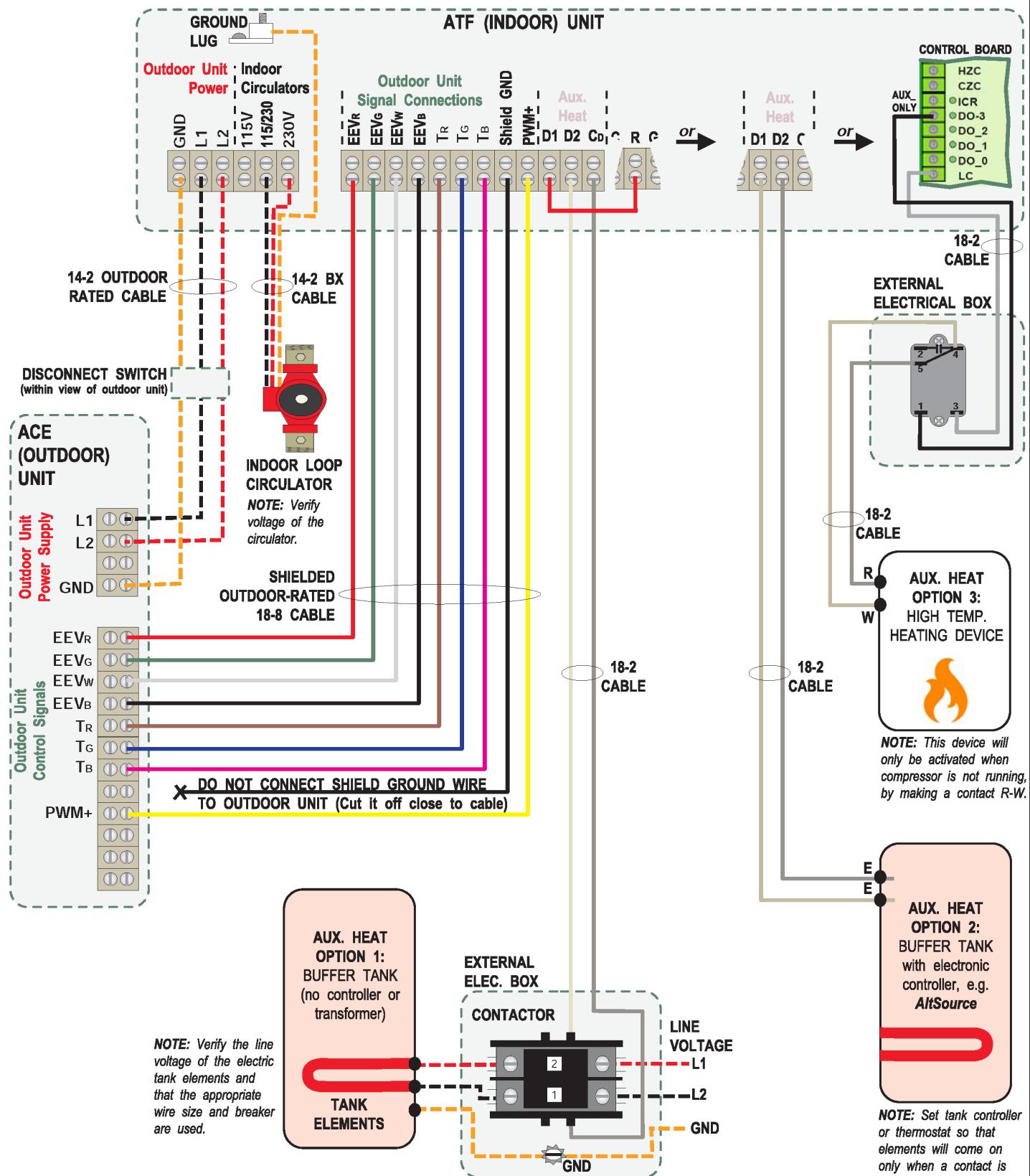
Note: If only using as single stage then only an 18-2 cable is required, place a jumper wire between 2 and 1 of the plenum heater terminals.



Note: Connect 24VAC and AR together with a dry contact to invoke the airflow reduction function. Refer to the manual for more information.

					Drawn By Chris Geddes	Date 21 APR 2016	Drawing Name Typical Thermostat Connections to GEN2 Control Board	170 Plantation Rd. Petitcodiac, NB E4Z 6H4
					Checked By Chris Geddes	Date 21 APR 2016		
					Approved By Chris Geddes	(ENG) Date 21 APR 2016		
					Approved By (MFG)	Date		
01	Initial Release	C. GEDDES	C. GEDDES	21 APR 2016	Approved By	Date	Size A	Drawing Rev 01
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date	Drawing Number 002071CDG	SHEET 1 of 1

Typical ATF Series Outdoor Unit, Auxiliary Heat, and Indoor Circulator Wiring



					Drawn By Dan Rheault	Date 23-May-2018	MARITIME GEOTHERMAL LTD.	170 Plantation Rd. Petitcodiac, NB E4Z 6H4
					Checked By Dan Rheault	Date 23-May-2018	Drawing Name	Typical ATF Outdoor Unit, Auxiliary Heat, and Indoor Circulator Wiring
02	000310	Dan Rheault	Dan Rheault	15-Feb-2023	Approved By (ENG)	Date	Size	Drawing Number 002304CDG
01	000261	Dan Rheault	Dan Rheault	23-May-2018	Approved By (MFG)	Date	Drawing Rev 02	Sheet 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date		



AltSource Tanks: Getting Started

A full product manual from Thermo2000 is included with the AltSource tank.

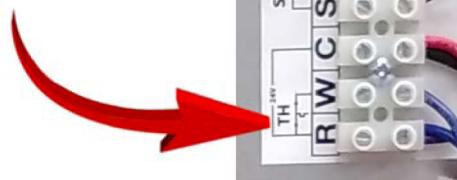
This sheet describes how to set the tank to work in conjunction with **NORDIC** heat pumps that are equipped with **D1-D2** terminals. (Some *W*-series models may not have D1-D2 terminals; in this case the tank can instead be set up run under its own control with a setpoint lower than that of the heat 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 $^{\circ}\text{F}/^{\circ}\text{C}$ 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 **E₁-E₂** 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.

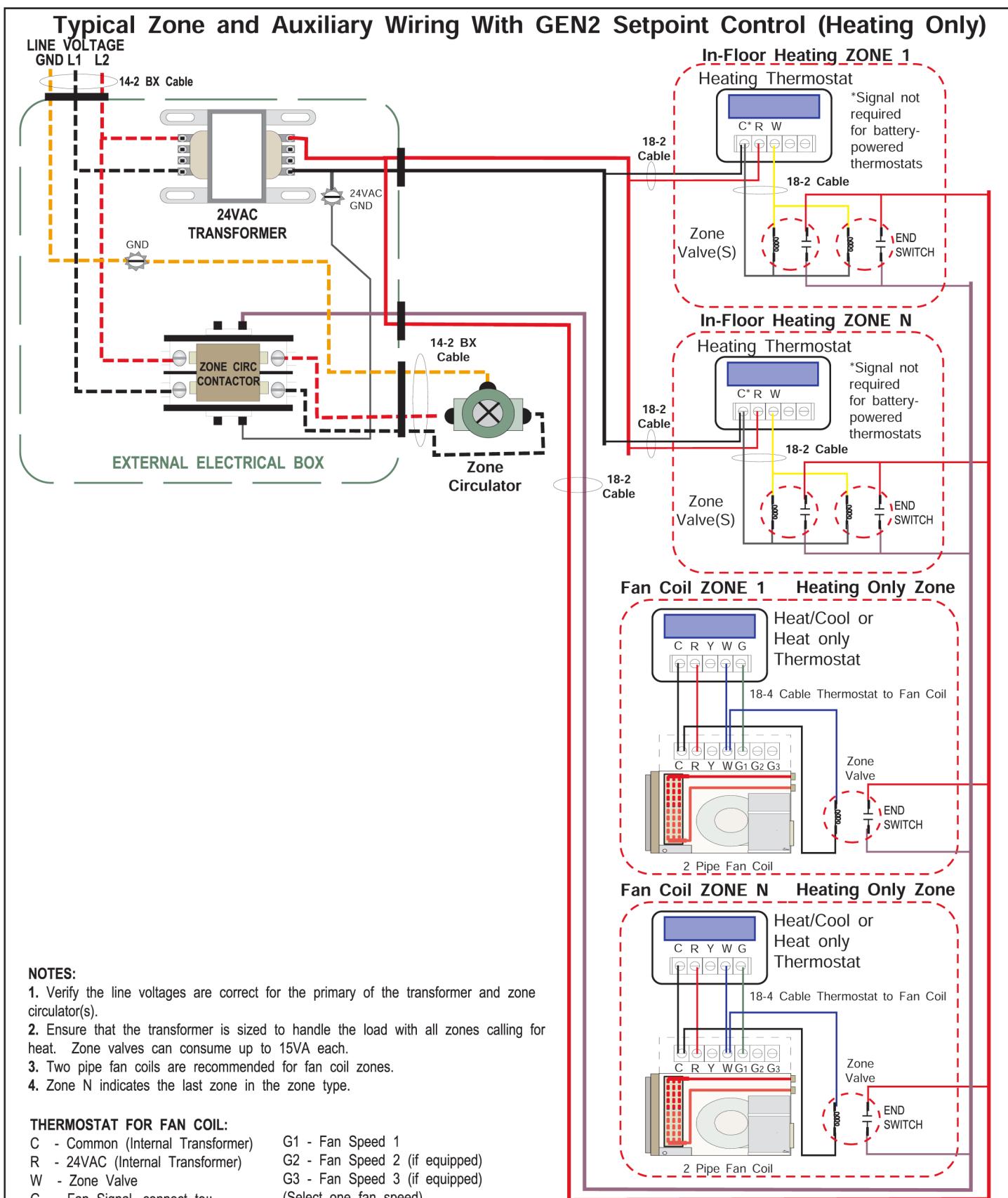
See heat pump manual for further explanation.

With **E₁** and **E₂** disconnected (not connected by the heat pump’s **D1-D2** terminals), the tank’s screen will look like this.



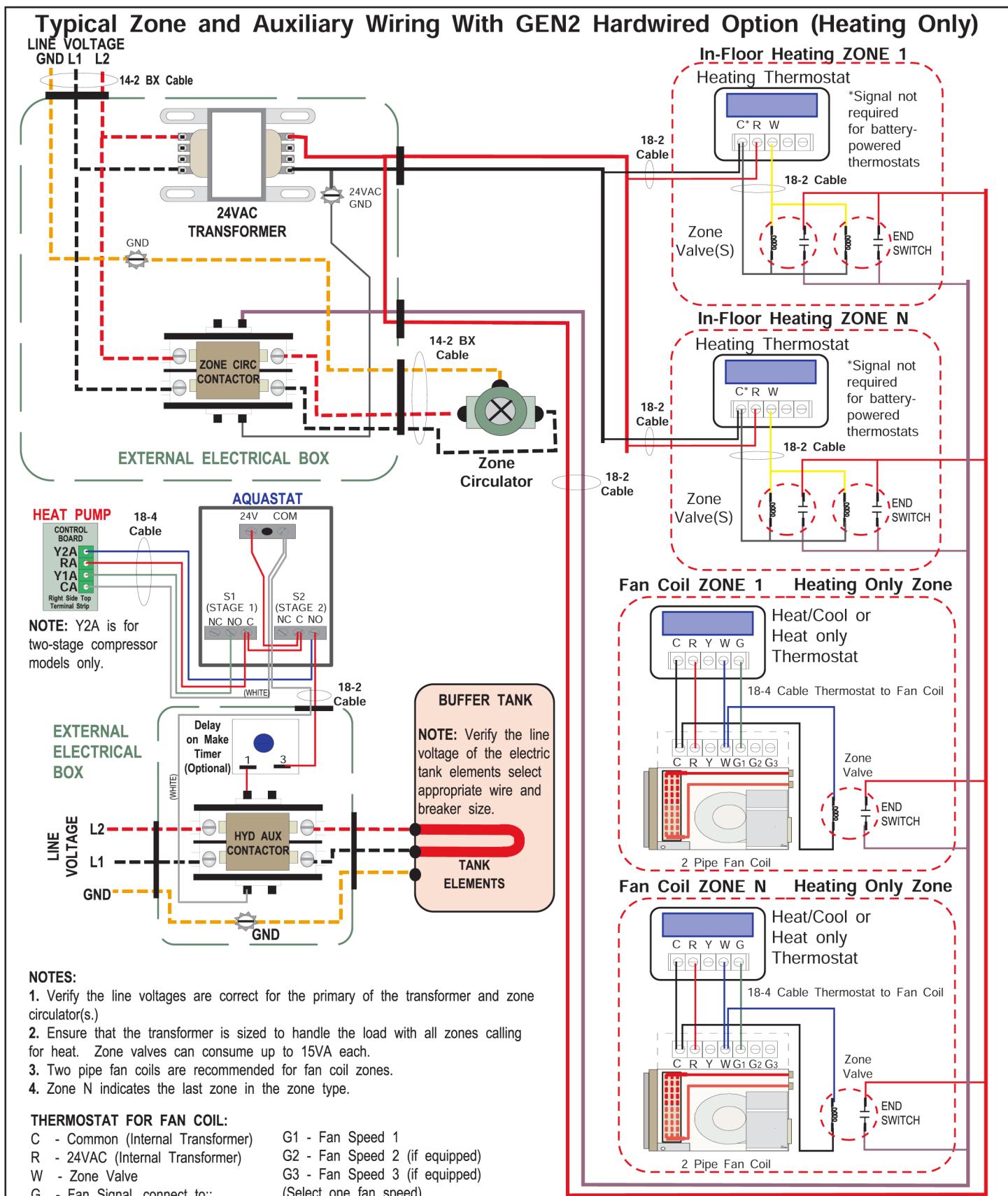
With **E₁** and **E₂** connected by the heat pump, a temperature setpoint of **125°F** corresponding to “joist heat” will appear. This is fine for a high limit.





				Drawn By C. Geddes	Date 04-APR-2016	170 Plantation Rd. Petitcodiac, NB E4Z 6H4
				Checked By C. Geddes	Date 04-APR-2016	
				Approved By (ENG) C. Geddes	Date 04-APR-2016	
				Approved By (MFG) C. Geddes	Date	
02	000253	D. RHEAULT	D. RHEAULT	Approved By Date		
01	Initial Release	C. GEDDES	C. GEDDES	04-APR-2017		
REV	ECO #	IMPL BY	APVD BY	DATE		

MARITIME GEOTHERMAL LTD.
Drawing Name **Typical Zone and Auxiliary Wiring
With GEN2 Setpoint Control (Heating Only)**
Size **A** Drawing Number **002067CDG** Drawing Rev **02** Sheet **1 of 1**



				Drawn By C. Geddes Checked By C. Geddes Approved By C. Geddes Approved By (MFG) Approved By	Date 04-APR-2016 Date 04-APR-2016 Date 04-APR-2016 Date Date
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017	
01	Initial Release	C. GEDDES	C. GEDDES	04-APR-2017	
REV	ECO #	IMPL BY	APVD 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 A Drawing Number 002069CDG Drawing Rev 02 Sheet 1 of 1

Piping

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 13 - Buffer Tank Size		
Heat Pump Size	Minimum Size gallons (Litres)	Recommended Size gallons (Litres)
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.

Condensate Drain

The unit comes equipped with one 3/4" female PVC socket drain connection. This drain allows the condensate which forms during the air conditioning cycle to be removed from the unit. The drain should be connected and vented as per local codes. During high humidity weather, there could be as much as 25 gallons of water formed per day.

The condensate drain is internally trapped and does not require an external trap. An external condensate pump may be installed if there is not sufficient slope to drain condensate under gravity to its destination.

To avoid overflow of the condensate pan, the drain line and trap should be inspected periodically to ensure they are not plugged with accumulated debris. There may be an alarm for condensate overflow, which will disable unit operation.

See also the [Ductwork](#) section for a diagram showing condensate drain connection.

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.

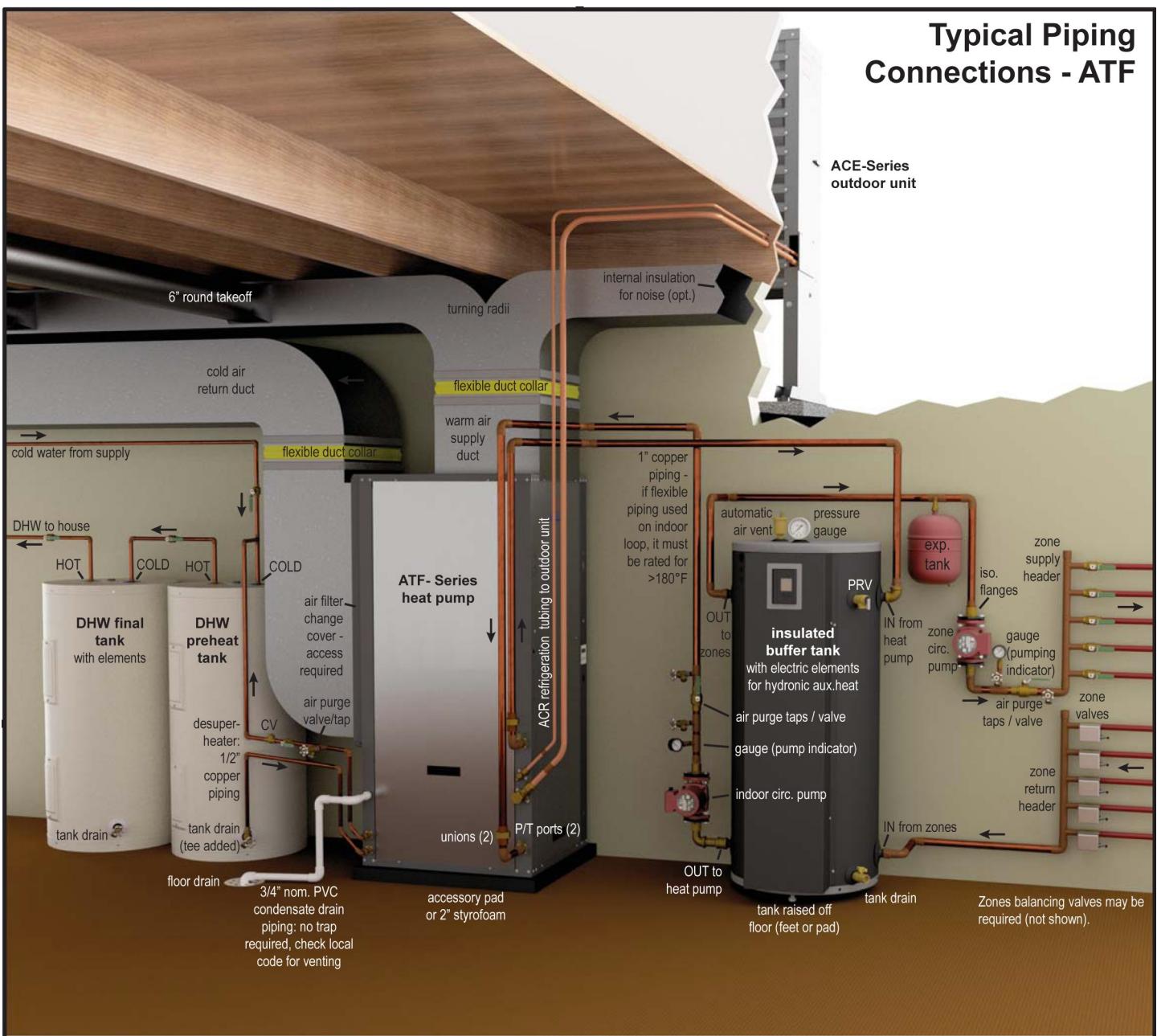
For the pre-heat tank setup, the final tank should be set to **140°F (60°C)**, which is required by most codes. The pre-heat tank does not require electric elements. This setup takes full advantage of the desuperheater as it is the sole heat provider to the pre-heat tank. The desuperheater remains active 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 lines 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.

Note that connection and use of the desuperheater is optional, and there is no problem for the heat pump if desuperheater is left unconnected.

Typical Piping Connections - ATF



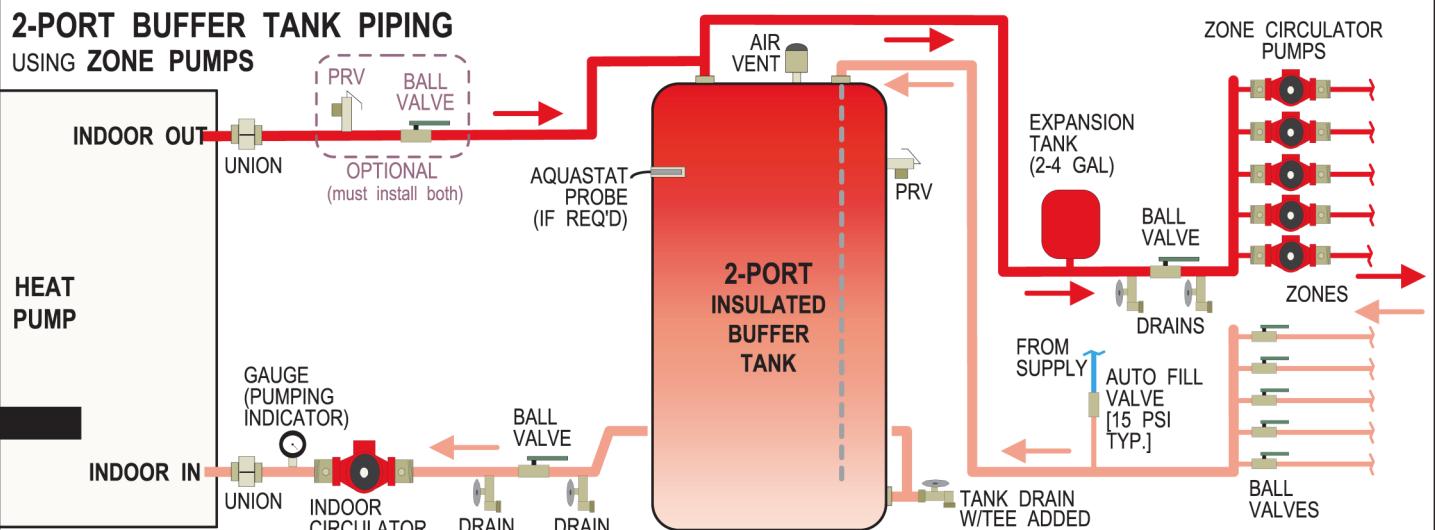
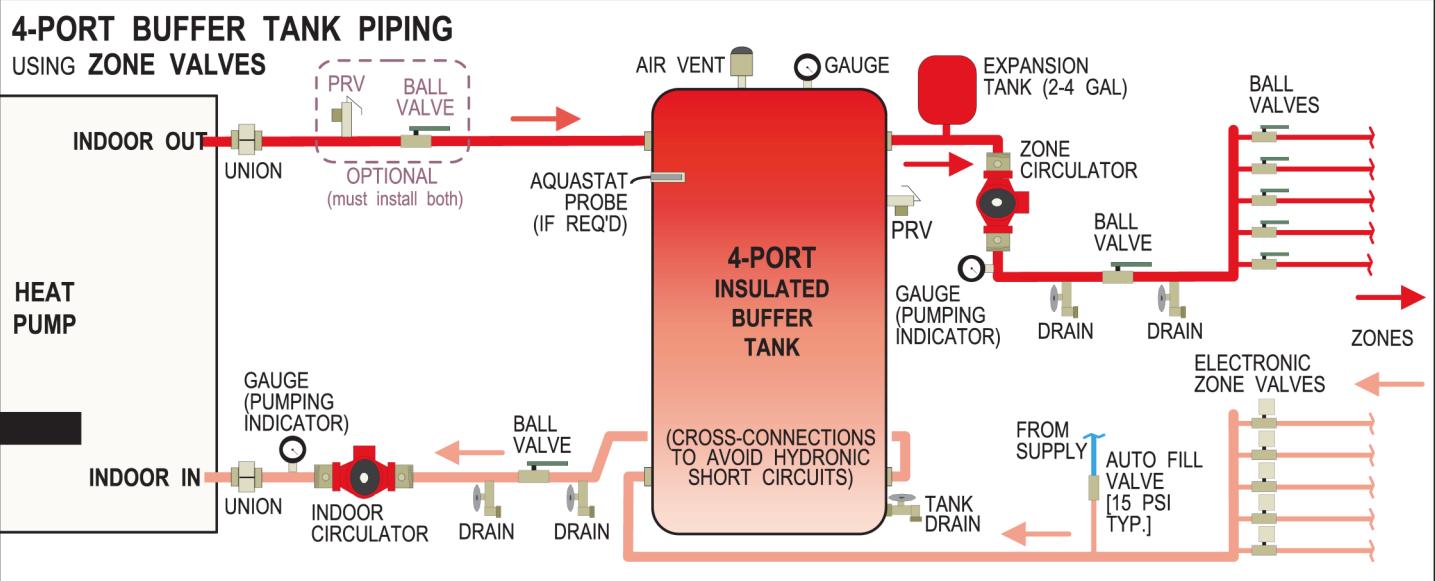
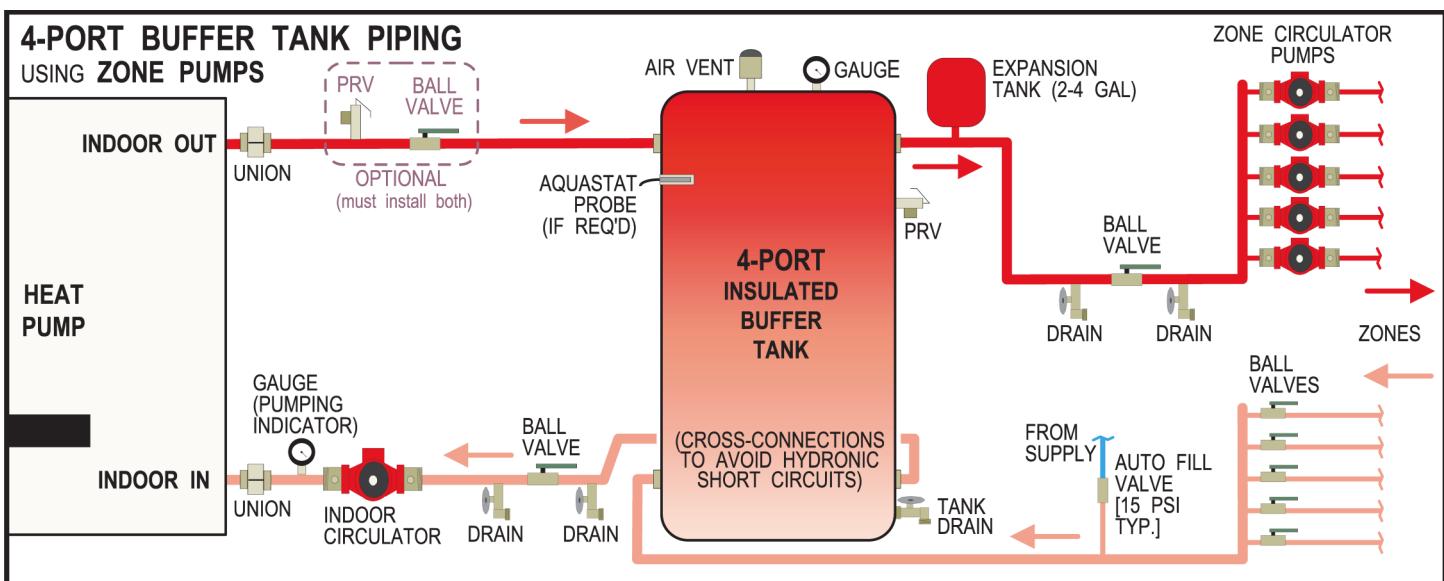
See other diagrams and instructions in the manual for sizing and selection of equipment, and system design.

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 some valid connection methods or details which differ from those shown, including:

- Hydronic heating zones that use one pump per zone instead of zone valves.
- Piping routed differently from that shown, or different piping & component types.

					Drawn By Dan Rheault	Date 25-May-2018	P.O. Box 2555 170 Plantation Rd. Petitcodiac, NB CANADA E4Z 6H4			
					Checked By Dan Rheault	Date 25-May-2018				
02	000266	Dan Rheault	Dan Rheault	1-Mar-2020	Eng. Approved By	Date	Drawing Name Typical Piping Connections - ATF			
01	Initial Rel.	Dan Rheault	Dan Rheault	25-May-2018	Mfg. Approved By	Date				
REV	ECO#	IMPL BY	APVD BY	DATE	Approved By	Date	Size LET	Drawing Number 002305PDG	Revision 02	Sheet 1 / 1



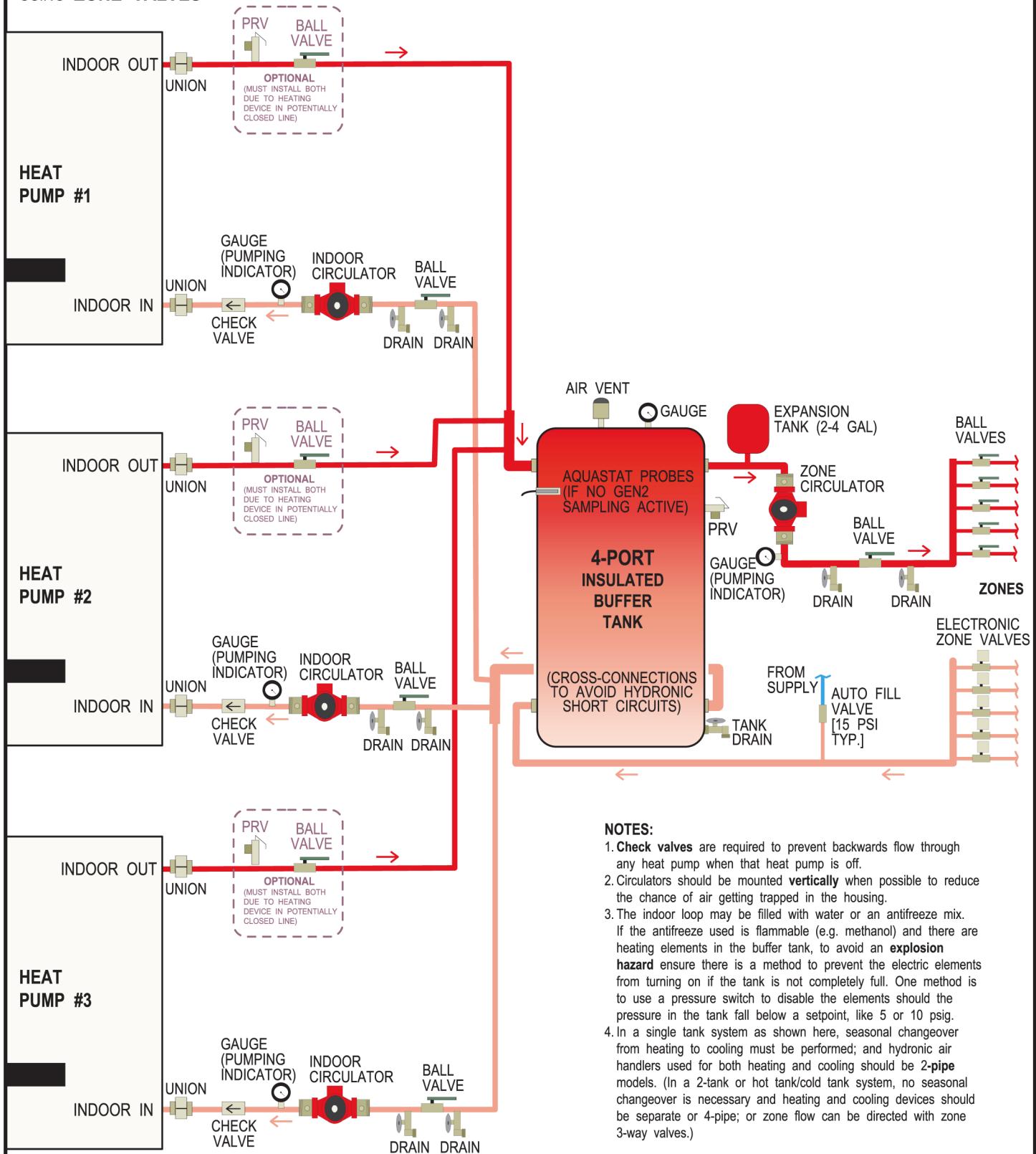
				Drawn By Dan Rheault	Date 14-Dec-2018
				Checked By Dan Rheault	Date 14-Dec-2018
02	(add fill valve)	D. RHEAULT	D. RHEAULT	Approved By (ENG)	Date
01	Initial Release	D. RHEAULT	D. RHEAULT	Approved By (MFG)	Date
REV	ECO #	IMPL BY	APVD BY	Approved By	Date

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

Recommended Hydronic Buffer Tank Piping

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

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



NOTES:

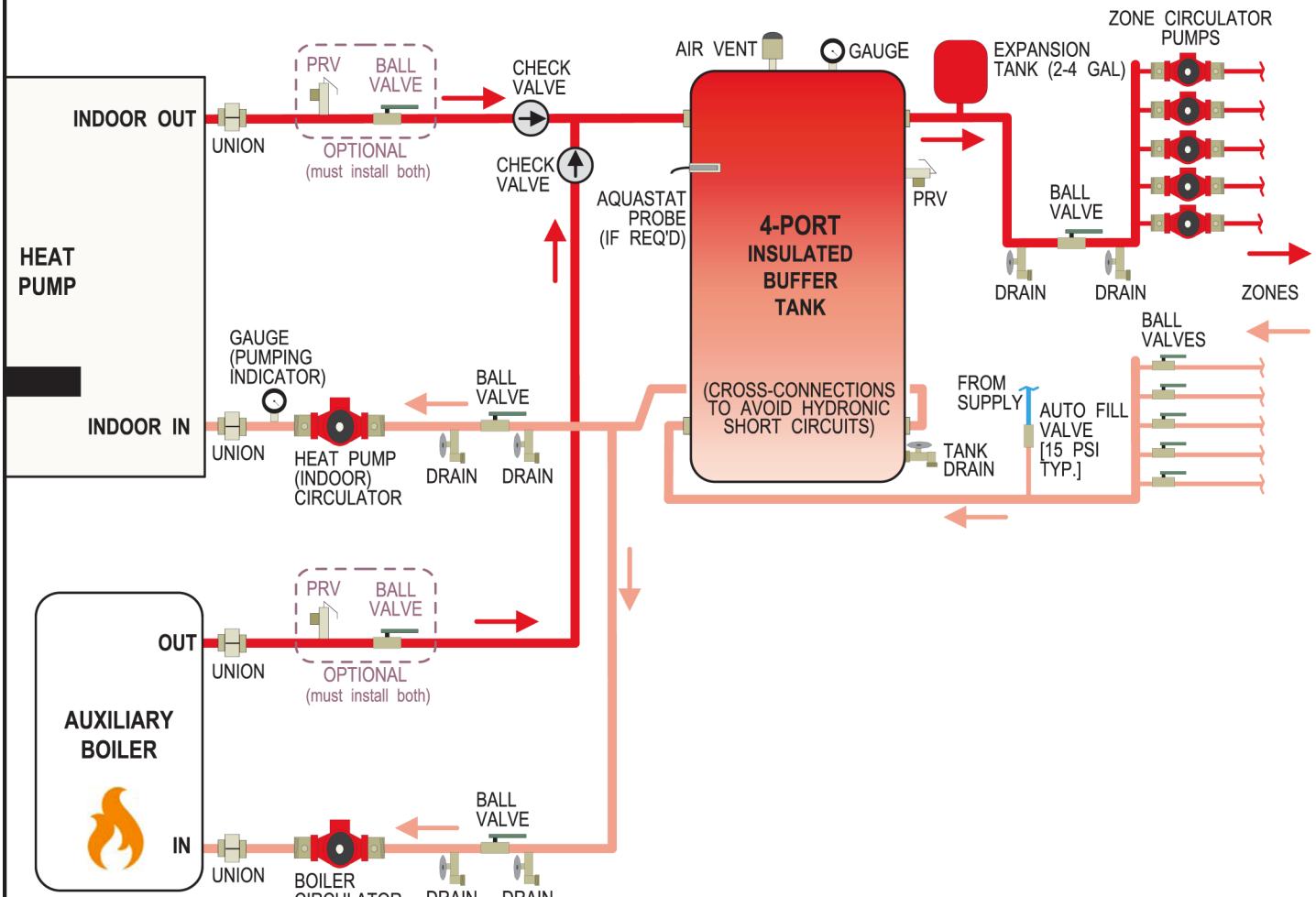
1. Check valves are required to prevent backwards flow through any heat pump when that heat pump is off.
2. Circulators should be mounted **vertically** when possible to reduce the chance of air getting trapped in the housing.
3. The indoor loop may be filled with water or an antifreeze mix. If the antifreeze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

					Drawn By Dan Rheault	Date 9-Aug-2021	MARITIME GEOTHERMAL LTD. Drawing Name Buffer Tank Piping - Multiple Units	170 Plantation Rd Petitcodiac, NB E4Z 6H4
					Checked By Dan Rheault	Date 9-Aug-2021		
					Approved By (ENG)	Date		
					Approved By (MFG)	Date		
01	Initial Release	D. RHEAULT	D. RHEAULT	9-Aug-2021	Approved By	Date	Size A	Drawing Number 002528PDG
REV	ECO #	IMPL BY	APVD BY	DATE			REV 01	SHEET 1 of 1

Auxiliary Boiler Piping

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

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

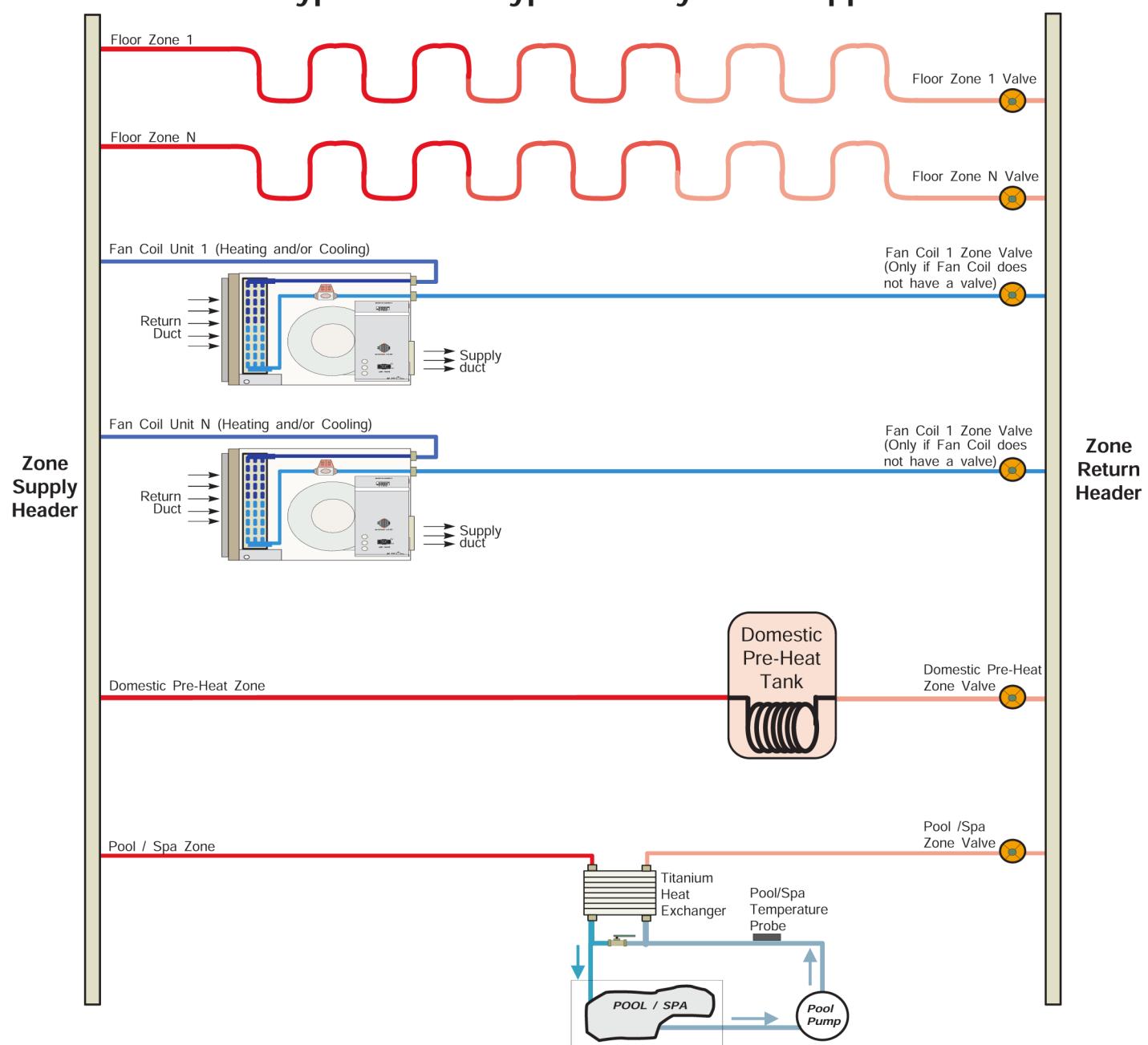


USING THIS PARALLEL ARRANGEMENT, BOILER MAY OPERATE ALONE (TO PROVIDE BACKUP HEAT) OR IN CONJUNCTION WITH HEAT PUMP (TO PROVIDE AUXILIARY HEAT).

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

				Drawn By Dan Rheaume	Date 14-Dec-2018	Drawing Name MARITIME GEOTHERMAL LTD. Auxiliary Boiler Piping	170 Plantation Rd Petitcodiac, NB E4Z 6H4
				Checked By Dan Rheaume	Date 14-Dec-2018		
02	(add fill valve)	D. RHEAUME	D. RHEAUME	Approved By (ENG)	Date		
01	Initial Release	D. RHEAUME	D. RHEAUME	Approved By (MFG)	Date		
REV	ECO #	IMPL BY	APVD BY	Approved By A	Date	Size A	Drawing Number 002367PDG
						REV 02	SHEET 1 of 1

Typical Zone Types for Hydronic Applications

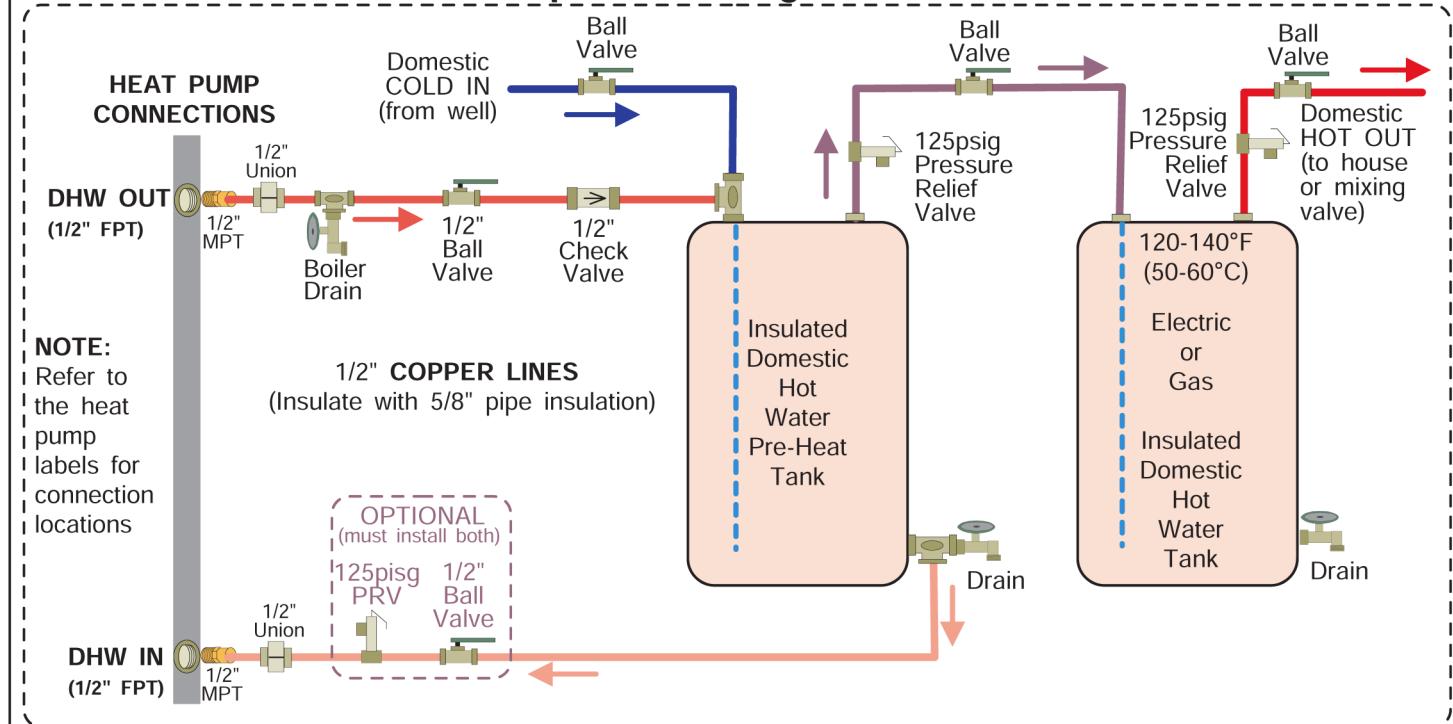

NOTES:

1. Floor zones are heating only. Cooling a floor zone will cause condensation in the floor. Floor zone valves should be wired through a relay that is controlled by the cooling signal (O) that breaks the signal when in cooling mode to ensure that they cannot accidentally be energized.
2. There may be multiple floor zones.
3. There may be multiple fan coil units, (heating and /or cooling). A zone valve is not required if the unit has a internal valve.
4. Domestic Pre-Heat Tank is for on-demand applications. 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.

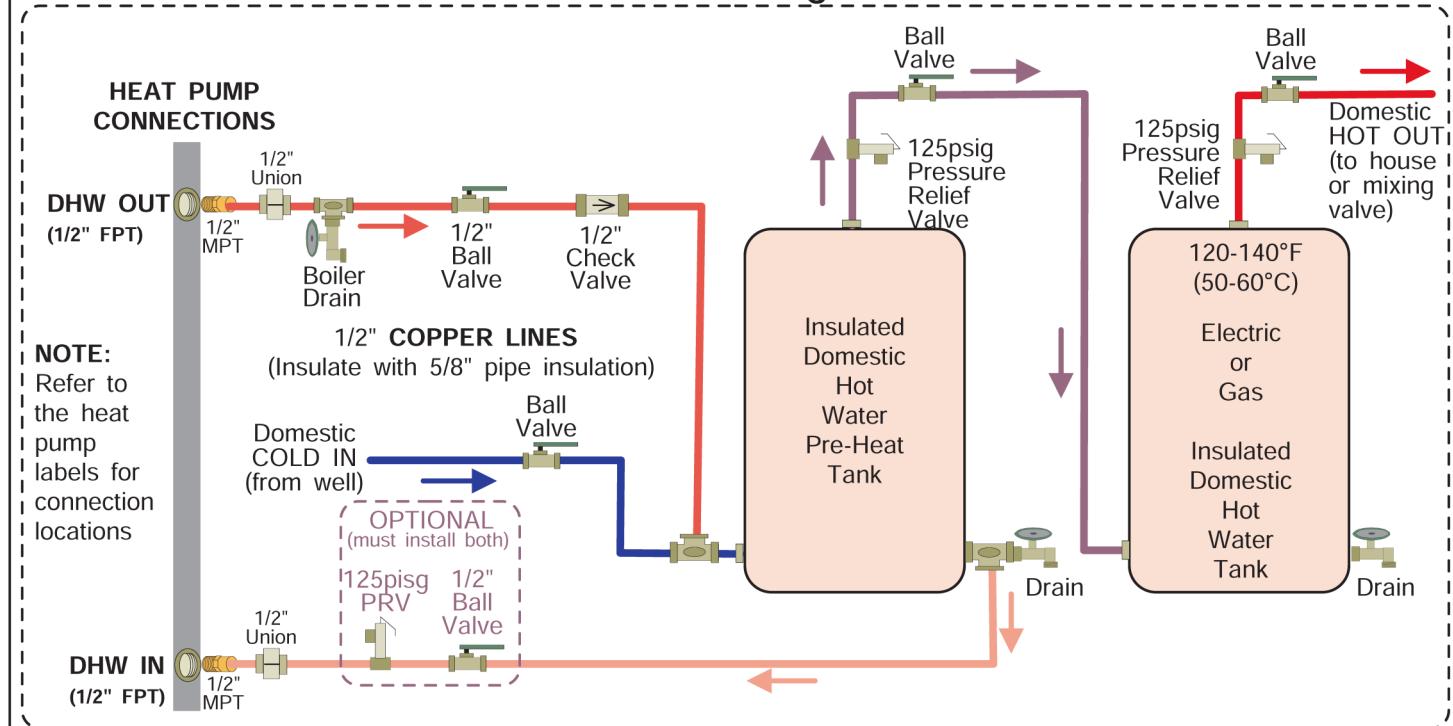
				Drawn By Chris Geddes	Date 06 SEP 07	Drawing Name MARITIME GEOTHERMAL LTD. Typical Zone Types for Hydronic Applications	170 Plantation Rd. Petitcodiac, NB E4Z 6H4
				Checked By Chris Geddes	Date 06 SEP 07		
				Approved By (ENG) Chris Geddes	Date 06 SEP 07		
				Approved By (MFG) Chris Geddes	Date		
01	Initial Release	C. GEDDES	C. GEDDES	06 SEP 07	Approved By Date	Size A	Drawing Number 000530PDG
REV	ECO #	IMPL BY	APVD BY	DATE		REV 01	SHEET 1 of 1

Desuperheater Connection to DHW Pre-Heat Tank

Top Port Configuration



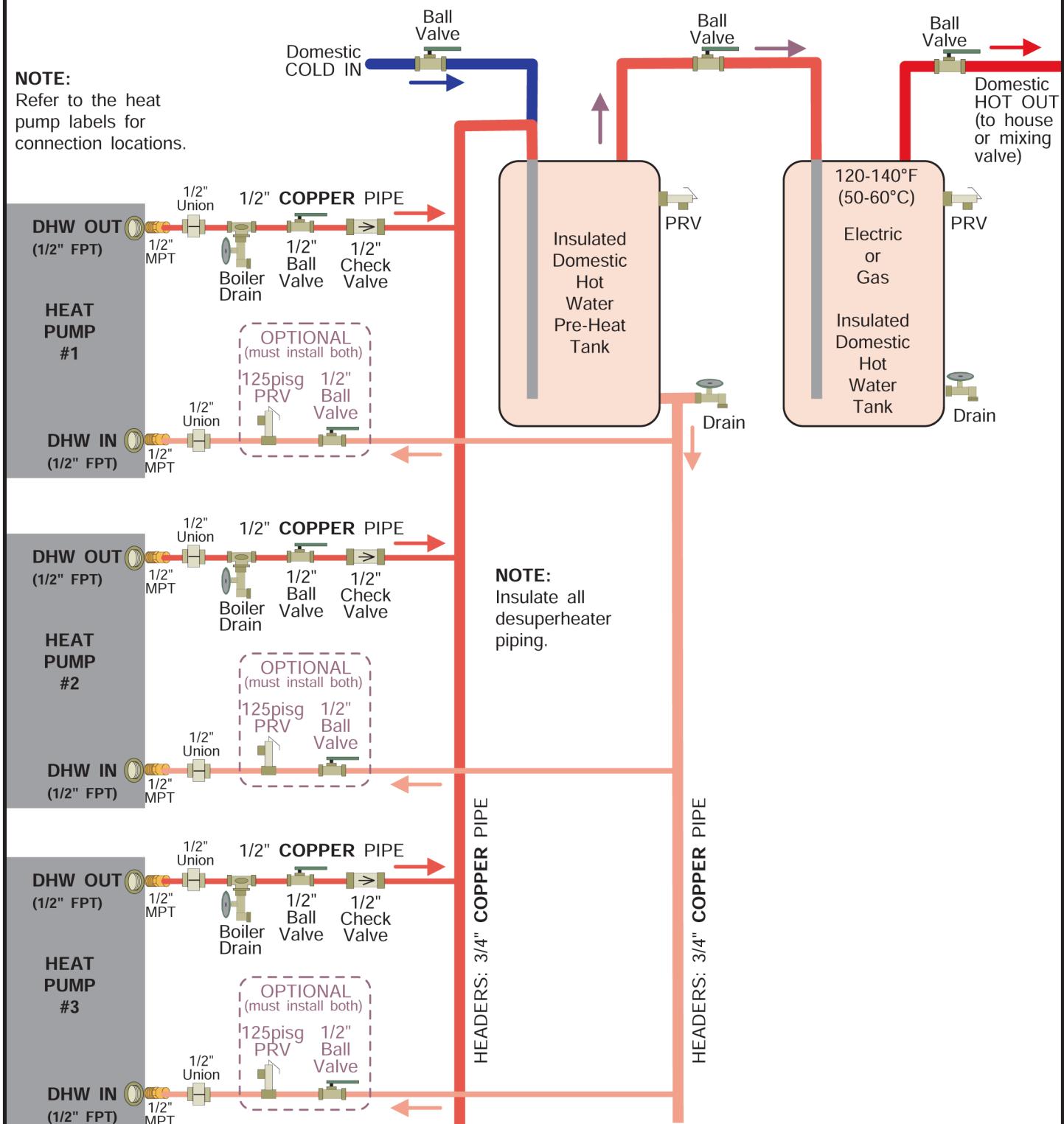
Side Port Configuration



					Drawn By Chris Geddes	Date 10 MAR 09	MARITIME GEOTHERMAL LTD.		170 Plantation Rd. Petitcodiac, NB E4Z 6H4
					Checked By Chris Geddes	Date 10 MAR 09			
					Approved By (ENG) Chris Geddes	Date 10 MAR 09	Drawing Name Single Unit Connection to DHW Pre-Heat Tank (Brass FPT)		
01a	Re-titled	D. RHEAULT	D. RHEAULT	15 JAN 19	Approved By (MFG) Chris Geddes	Date	Size A	Drawing Number 000970PDG	REV 01a
01	Initial Release	C. GEDDES	C. GEDDES	10 MAR 09	Approved By	Date			SHEET 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE					

Desuperheater Connection to DHW Pre-Heat Tank - Multiple Units

NOTE:
Refer to the heat pump labels for connection locations.



					Drawn By Dan Rheault	Date 24-Apr-2019	Drawing Name Multiple Unit Desuperheater Connection to DHW Pre-Heat Tank (Brass FPT)	170 Plantation Rd Pettingradiac, NB E4Z 6H4		
					Checked By Dan Rheault	Date 24-Apr-2019				
					Approved By Dan Rheault	(ENG) Date 24-Apr-2019				
					Approved By Dan Rheault	(MFG) Date				
01	Initial Release	D. RHEAULT	D. RHEAULT	24-Apr-2019	Approved By	Date	Size A	Drawing Number 002384PDG	REV 01	SHEET 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE						

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 14 - 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 15a - 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 15b - 3-way Service Valve Torques

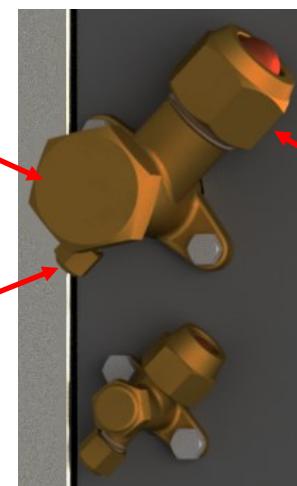
Nominal Size	Line set connection nut torque	Hex key torque	Valve cap torque	Charging port cap torque
3/8"	30-35 N.m (22-26 ft.lb)	5-7 N.m (4-5 ft.lb)	20-25 N.m (15-18 ft.lb)	10-12 N.m (7-9 ft.lb)
1/2"	40-45 N.m (30-33 ft.lb)	7-9 N.m (5-7 ft.lb)	25-30 N.m (18-22 ft.lb)	10-12 N.m (7-9 ft.lb)
3/4"	60-65 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.

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 through 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 16 - 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)
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 17 - 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)
22	4	0.3	0.12
24	8	0.5	0.24
26	13	0.8	0.36
28	17	1.1	0.48
30	21	1.3	0.60
32	25	1.6	0.71
34	29	1.8	0.83
36	34	2.1	0.95
38	38	2.4	1.07
40	42	2.6	1.19
42	46	2.9	1.31
44	50	3.2	1.43
46	55	3.4	1.55
48	59	3.7	1.67
50	63	3.9	1.79
52	67	4.2	1.91
54	71	4.5	2.02
56	76	4.7	2.14
58	80	5.0	2.26
60	84	5.3	2.38
62	88	5.5	2.50
64	92	5.8	2.62
66	97	6.0	2.74
68	101	6.3	2.86
70	105	6.6	2.98

Typical ATA/ATF to Outdoor Unit Line Set Connections



					Drawn By Dan Rheault	Date 6-Oct-2017	MARITIME GEOTHERMAL LTD. P.O. Box 2555 170 Plantation Rd. Petitcodiac, NB CANADA E4Z 6H4			
					Checked By Dan Rheault	Date 6-Oct-2017				
					Eng. Approved By	Date	Drawing Name Typical ATA/ATF to Outdoor Unit Line Set Connections			
02	000266	Dan Rheault	Dan Rheault	10-Feb-2020	Mfg. Approved By	Date				
01	Initial Rel.	Dan Rheault	Dan Rheault	6-Oct-2017	Approved By	Date	Size LET	Drawing Number 002250CDG	Revision 02	Sheet 1 / 1
REV	ECO#	IMPL BY	APVD BY	DATE						

Ductwork

Indoor Unit Blower Motor

The indoor unit is equipped with a direct drive ECM blower. The motor features a soft start function, and will maintain the programmed airflow up to the maximum external static value.

The airflow can be set in increments of 100cfm within an allowed range using the **Indoor Fan** page of the **PC App**. Airflow will be reduced with decreasing outdoor temperature, to avoid progressively cooler heated air being delivered as heat pump capacity decreases due to cold weather.

Air Duct Zoning

Air zoning can be done with heat pumps that have 2-stage compressors, but only to a limited extent. It is recommended that heating zoning be done with the hydronic side instead. With ducted air zoning, no zone should be less than 1/3 the total area, to avoid problems of high airflow and noise through one zone or safety control trips due to capacity mismatch between heat pump and zones.

The airflow can be reduced by an adjustable amount between 5 and 20% (value set in **PC App**) by making a dry contact across **24VAC** and **AR** on the right side middle terminal strip of the control board, as show in **Wiring** chapter.

When only one zone of 50% or less is calling for heating or cooling, the compressor should be limited to **stage 1** operation by the zone controller by sending only a **Y1** (without **Y2**) control signal. Stage 1 corresponds to ~67% compressor capacity and ~80% airflow.

Refer to **Indoor Airflow Data** in the **Model Specific Information** section for actual airflows with the various reductions.

Duct Systems - General

Ductwork layout for a heat pump will differ from traditional hot air furnace design in the number of leads and size of main trunks required. Air temperature leaving the heat pump is normally **95°-105°F (35-40°C)**, much cooler than that of a conventional fossil fuel furnace. To compensate for this, larger volumes of lower temperature air must be moved and consequently duct sizing must be able to accommodate the greater airflow without creating a high static pressure or high velocity at the floor diffusers.

A duct system capable of supplying the required airflow is of utmost importance. Maritime Geothermal Ltd. recommends that the external static pressure from the duct system be kept below 0.2 inches of water total. In some instances the number of floor diffusers will actually double when compared to the number that would be used for a hot air oil-fired furnace. Refer to following tables.

1. Generally allow **100 cfm** for each floor grill.
2. All leads to the grills should be 6" in diameter (28sq.in. each).
3. The main hot air trunks should be at least 75% of the cross sectional area of leads being fed at any given point.
4. Return air grills should have a minimum of the same total cross sectional area as the total of the supply grills.
5. The cross sectional area of the return trunks should equal the cross sectional area of the grills being handled at any given point along the trunk.

It is **VERY IMPORTANT** that all turns in both the supply trunks and the return trunks be made with **TURNING RADII**. Air act like a fluid and, just like water, pressure drop is increased when air is forced to change direction rapidly around a sharp or irregular corner.

Flexible collars should be used to connect the main trunks to the heat pump. This helps prevent any vibrations from travel-

ling down the ductwork. If a plenum heater is installed, the collar should be at least 12" away from the heater elements.

If desired, the first 5-10 feet of the main supply trunks can be insulated internally with acoustical duct insulation to further inhibit any noise from the unit from travelling down the ductwork. If a plenum heater is installed, insulation should not be placed within 12" of the heater elements.

Duct Systems - Grill Layout

Most forced air heating systems in homes have the floor grills placed around the perimeter of the room. Supply grills should be placed under a window when possible to help prevent condensation on the window. Supply grill leads should be 6" in diameter (28 square inches each) to allow **100 cfm** of airflow.

In a typical new construction, there should be one supply grill for every 100 square feet of area in the room. When rooms require more than one grill, they should be placed in a manner that promotes even heat distribution, such as one at each end of the room. It is a good idea to place a damper in each grill supply or place adjustable grills so that any imbalances in the heat distribution can be corrected.

The total number of supply grills is based on the heat pump's nominal airflow. The table shows the number of grills recommended per heat pump size.

TABLE 18 - Number of Air Grills

Model Size	# of Grills (@100 cfm)
45	12
55	15
65	19
75	21

Return grills should be mounted on the floor. At minimum they should be the same size as the supply grill, **it is highly recommended that they be 25% to 50% larger than the total supply**. They should be placed opposite the supply grills when possible to ensure distribution across the room. For rooms requiring more than one supply grill, it may be possible to use one larger return grill if it can be centrally positioned opposite of the supply grills, however it is preferred to have one return for each supply to optimize heat distribution across the room.

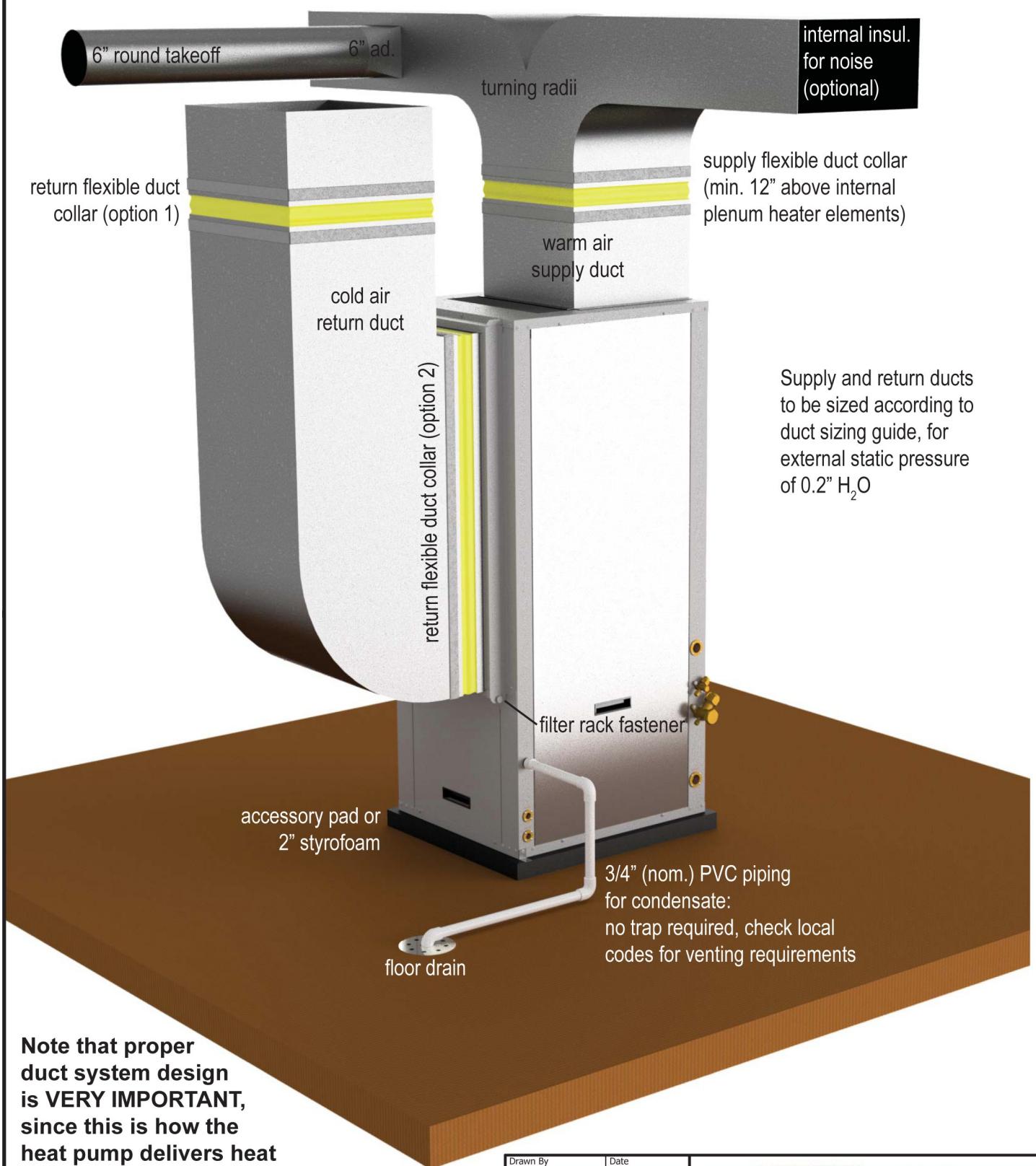
Thermostat Location

Most homes are a single ducted air zone with one thermostat. The thermostat should be centrally located within the home, typically on the main floor. It should be placed away from any supply grills, and should not be positioned directly above a return grill. Most installations have the thermostat located in a hallway, or on the inner wall of the living room. It should be noted that most homes do not have any supply ducts in the hallway. This can lead to a temperature lag at the thermostat if there is very little air movement in the hallway, causing the home to be warmer than indicated by the thermostat.

Plenum Heater

The plenum heater will be usually installed inside the heat pump, as described in the **Installation Basics** section. If the blower is installed in the side discharge position, the plenum heater will be installed in the discharge ductwork outside the unit, at least 12" away from any flexible duct collars. There is an accessory plenum heater with a wider cage profile available that is more suitable for duct installation.

Typical Duct & Condensate Connections - ATA/ATF Series



02	000266	Dan Rheault	Dan Rheault	10-Feb-2020
01	Initial Rel.	Dan Rheault	Dan Rheault	6-Oct-2017
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By Dan Rheault	Date 6-Oct-2017	MARITIME GEOTHERMAL LTD. P.O. Box 2555 170 Plantation Rd. Petitcodiac, NB CANADA E4Z 6H4	
Checked By Dan Rheault	Date 6-Oct-2017		
Eng. Approved By	Date		
Mfg. Approved By	Date		
Approved By	Date	Size LET	Drawing Number 002249PDG
		Revision 02	Sheet 1 / 1

TABLE 19 - Duct Sizing Guide (external static of 0.20" H₂O)

Airflow (cfm)	Minimum Duct Area (sq.in)	Diameter (in)	Rectangular Equivalents (in)								Return Air Diameter (in)	Airflow (L/s)
37	20	5	2.25 x 10	3 x 8	3.5 x 6	4 x 5.5	5 x 5			5	17	
63	20	5	2.25 x 10	3 x 8	3.5 x 6	4 x 5.5	5 x 5			6	30	
100	28	6	3.25 x 10	4 x 8	5 x 6	5.5 x 5.5	6 x 6			7	47	
152	38	7	3.25 x 14	4 x 11	5 x 8.5	6 x 7	6.5 x 6.5			8	72	
212	50	8	4 x 15	5 x 12	6 x 10	7 x 8	8 x 8			9	100	
226	50	8	4 x 15	5 x 12	6 x 10	7 x 8	8 x 8			10	107	
277	64	9	5 x 15	6 x 12	7 x 10	8 x 9	8.5 x 8.5			10	131	
304	64	9	5 x 15	6 x 12	7 x 10	8 x 9	8.5 x 8.5			12	143	
393	79	10	6 x 15	7 x 13	8 x 11	9 x 10	9.5 x 9.5			12	185	
411	113	12	7 x 18	8 x 16	9 x 14	10 x 12	11 x 11			12	194	
655	113	12	7 x 18	8 x 16	9 x 14	10 x 12	11 x 11			14	309	
680	154	14	8 x 22	9 x 19	10 x 17	11 x 15	12 x 14	13 x 13	14	321		
995	154	14	8 x 22	9 x 19	10 x 17	11 x 15	12 x 14	13 x 13	16	470		
1325	201	16	8 x 30	10 x 22	12 x 18	14 x 16	15 x 15			18	625	
1450	201	16	8 x 30	10 x 22	12 x 18	14 x 16	15 x 15			20	684	
1750	254	18	8 x 40	10 x 30	12 x 24	14 x 20	16 x 17	16.5 x 16.5	20	826		
2000	254	18	8 x 40	10 x 30	12 x 24	14 x 20	16 x 17	16.5 x 16.5	22	944		
2250	314	20	10 x 38	12 x 30	14 x 26	16 x 22	18 x 19	18.5 x 18.5	22	1062		
2600	314	20	10 x 38	12 x 30	14 x 26	16 x 22	18 x 19	18.5 x 18.5	24	1227		
2900	380	22	12 x 36	14 x 30	16 x 26	18 x 23	20 x 20		24	1369		
3400	380	22	12 x 36	14 x 30	16 x 26	18 x 23	20 x 20		26	1605		
3600	452	24	14 x 38	16 x 32	18 x 28	20 x 25	22 x 22		26	1699		
4300	452	24	14 x 38	16 x 32	18 x 28	20 x 25	22 x 22		28	2029		
5250	531	26	16 x 38	18 x 32	20 x 30	22 x 24	24 x 24		30	2478		
6125	616	28	18 x 38	20 x 34	22 x 30	24 x 28	26 x 26		32	2891		
6500	616	28	18 x 38	20 x 34	22 x 30	24 x 28	26 x 26		34	3068		
7250	707	30	20 x 40	22 x 38	24 x 32	26 x 30	28 x 28		34	3422		
7800	707	30	20 x 40	22 x 38	24 x 32	26 x 30	28 x 28		36	3681		
8500	804	32	22 x 40	24 x 38	26 x 34	28 x 32	30 x 30		36	4012		
9200	804	32	22 x 40	24 x 38	26 x 34	28 x 32	30 x 30		38	4342		
9800	908	34	24 x 42	25 x 40	26 x 38	28 x 34	30 x 32	31 x 31	38	4625		
10900	908	34	24 x 42	25 x 40	26 x 38	28 x 34	30 x 32	31 x 31	40	5144		
			28 x 40	30 x 36	32 x 34	33 x 33						
			30 x 42	32 x 38	34 x 36	35 x 35						
			30 x 45	34 x 40	36 x 38	37 x 37						

Operation

BACnet Control

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

Air Thermostat Operation

Demand for room heating or cooling through the ducted air system will come from a 24V 3H/2C room thermostat, described in the **Wiring** section. Refer to the thermostat's manual to set it up for 2-stage heat pump with electric backup, and for details on thermostat operation.

In heating dominant climates, better cooling mode dehumidification can be achieved by disabling compressor stage 2 in cooling. Then cooling mode will always operate at 67% compressor capacity, and longer run times will result. This setting must be made through the PC App's Control Panel; see **PC Application (PC App)** section.



Hydronic Temperature Control

One of the features of the ATF's GEN2 Control Board is built in aquastat functionality known as "Setpoint Control". This is an internal routine to sample the water OUT temperature to determine if hydronic heat is required; both water IN and OUT temperatures are measured using sensors on water lines inside the unit. The indoor circulator pump is turned on at regular intervals to refresh the water temperature. If sampling is not desired, there is the option to use an external accessory temperature sensor.

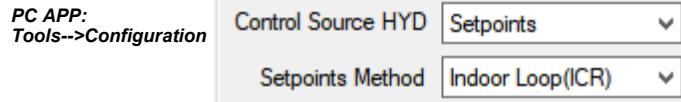
There is also provision to connect an external aquastat or controller instead of using this routine, for example if two water loops with different setpoints are being heated.

1. Hydronic Heating: Setpoint Control

It is recommended that this method be used to control the system's hydronic heat demand since it eliminates the need for an external temperature sensor or aquastat.

There are two options for Setpoint Control, Indoor Loop (ICR) method and HTS/CTS method.

Setpoint Control Method 1 - Indoor Loop (ICR)



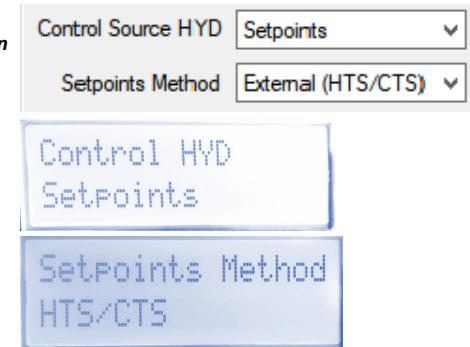
This is the default method and uses the Indoor OUT temperature probe inside the unit for temperature control. Its value

is displayed in the **Hot Tank** box on the PC App's **View --> Setpoint Control** screen. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

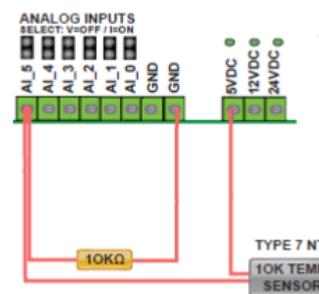
The heat pump will cycle the indoor circulator on and off when the unit is idle or in air heating/cooling mode, in order to sample the water temperature. When hydronic heating mode ends, the indoor circulator will continue to run for 30 seconds. It will then cycle with an OFF time and ON time as set by the **Set ICR Sampling** popup which appears when **SET** is clicked on the **View --> Setpoint Control** screen. The timer counts down the time remaining before the next switch between ON/OFF. The indoor circulator indicator will indicate when the circulator is ON, OFF or SAMPLING. The default sampling times are 2 minutes ON and 6 minutes OFF. The LCD interface will also indicate when the ICR is sampling (ON). The **Timer Override** button will reduce the countdown timer to 10 seconds. When sampling is done, stage 1/2/AUX water heating will be initiated if water temperature is below the corresponding activation point.

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

Setpoint Control Method 2 - External HTS/CTS



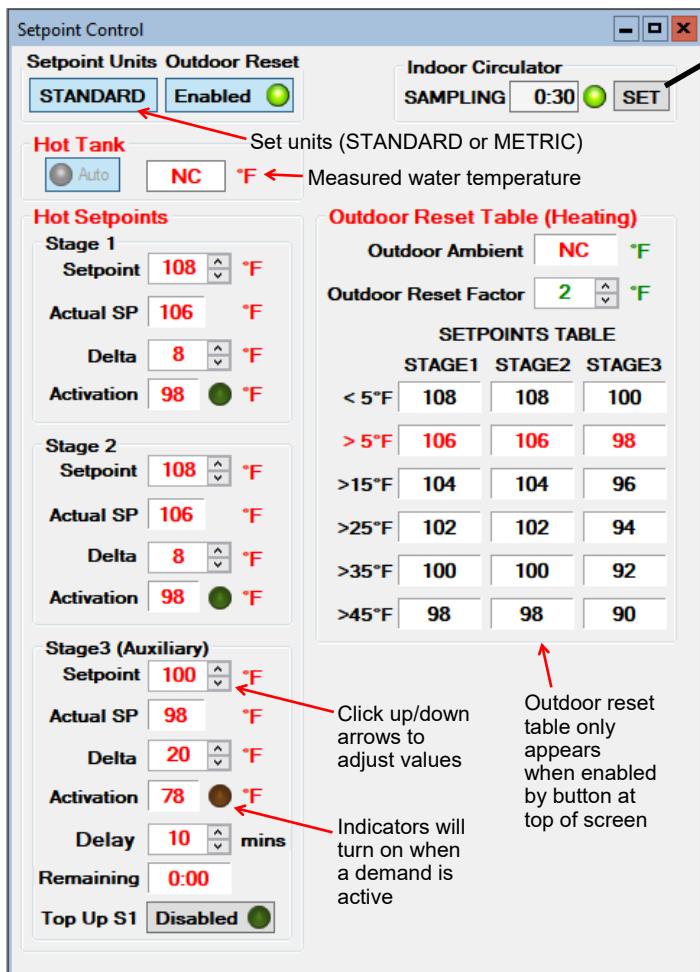
When this method is used, no indoor circulator control for temperature sampling will occur. It requires an external temperature sensor placed in a dry well in the top of the buffer tank. Its value is displayed in the **Hot Tank** box on the PC App's **View --> Setpoint Control** screen. If this temperature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



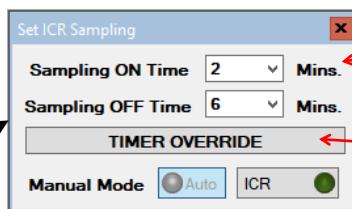
A 10K Type 7 (or Type 3) NTC thermistor along with a 10K 1% or better resistor must be connected to the control board in order to use the External HTS/CTS method. Connect the sensor to the AI_5 input as shown above and on the wiring diagram (SCH) in the **Model Specific Information** section. Remove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

For both setpoint control methods, hydronic temperature setpoints are controlled through the LCD interface or PC App (**View-->Setpoint Control**).

The **Setpoint Control** screen looks like this for both Method 1 (Indoor Loop) and Method 2 (HTS/CTS).



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



Set indoor circulator ON/OFF sampling intervals
Reduce countdown timer to 10s

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 21 - 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

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-enabled (as the setpoint will never be reached).

Summer Setback

The hydronic 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. It may also be activated by a field-installed switch; see **Wiring** chapter and the wiring (schematic) diagrams in the **Model Specific Information** chapter.

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.

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.

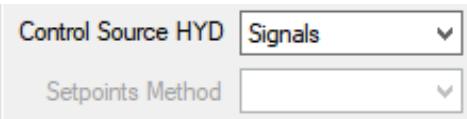
The table is created by subtracting the value of the Outdoor Reset Factor from the original setpoints once for each table row. The user-selected Hot Setpoints are located in the top row (<5°F), and the next row down equals the row above minus the Outdoor Reset Factor. The table row in use based on current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

See screenshot on previous page.

2. Hydronic Heating: Signals Control

PC APP:
Tools-->Configuration



LCD Interface:
Configuration



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.

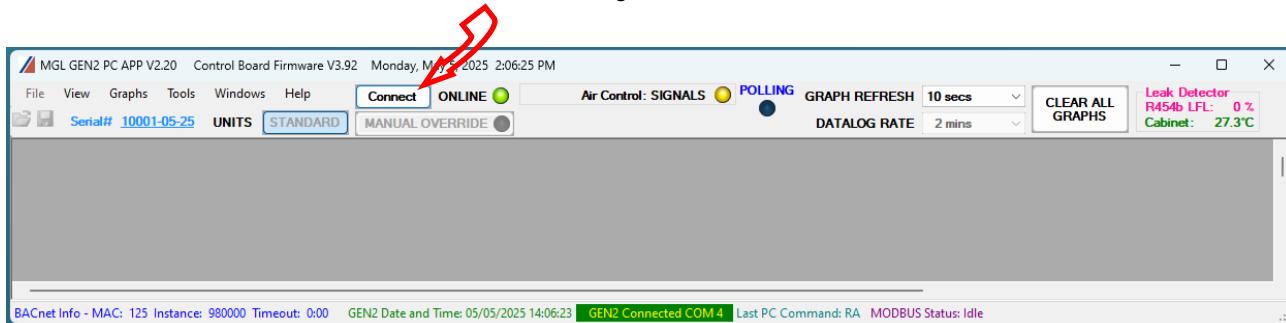
Most installations will instead use **Setpoint Control**; however, **Signals Control** provides control flexibility for certain situations, for example if two water loops with different setpoints are being heated. Temperature settings similar to those outlined in the previous **Setpoint Control** section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

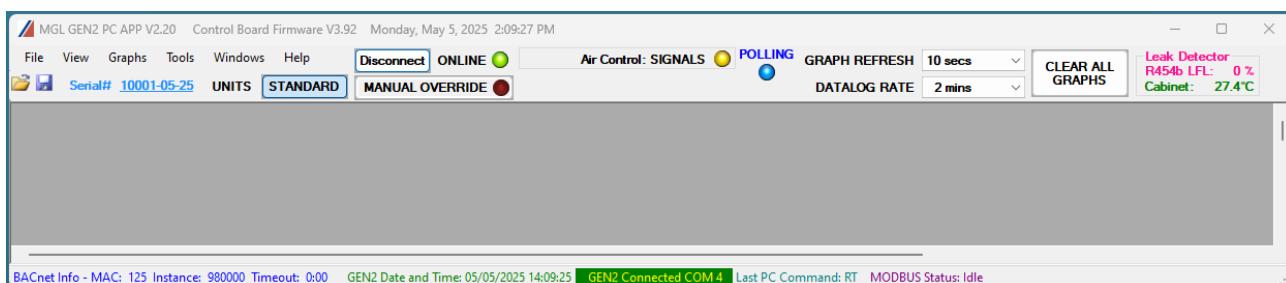
PC Application (PC App)

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 under the current name.
- File-->Save As:** Save the current page arrangement under a new name.
- File-->Exit:** Exits the PC Application.

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

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

Help Menu: This shows information about the PC Application.

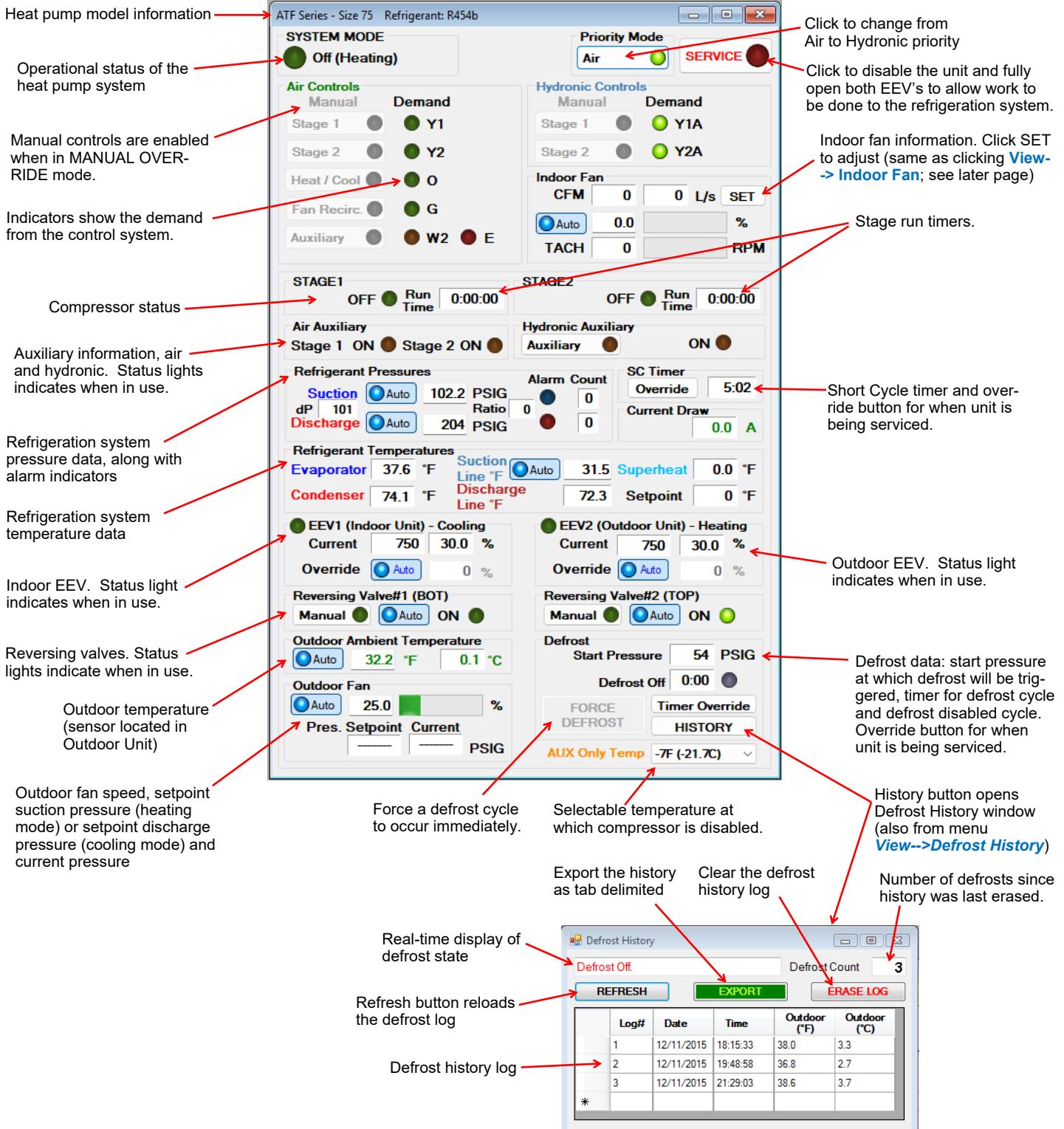
- Help-->About:** Displays the window shown to the right.



View Menu:

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

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



View-->Setpoint Control:

Shows the on-board temperature control screen. This screen is only available when **Control Source HYD** on the Configuration Page is set to **Setpoints** (not **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 (lost when PC is disconnected).
3. **LIMITS** - Limits in effect which prevent compressor operation but that do not cause an alarm.
4. **FAULTS** - List of board hardware faults.

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

NOTE: Greyed out Alarms in the PC APP are not applicable to the system setup and are not monitored by the control board.

NOTE: Refer to Alarms and Faults screenshot below to see which alarms have a count.

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

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

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

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

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

High Pressure: Occurs when the discharge pressure rises to or above the **High Pressure Cutout** value.

Compressor Status: 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).

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).

Condensate Drain: This alarm occurs if fluid level in the condensate tray rises to the level of the sensor (if equipped).

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.

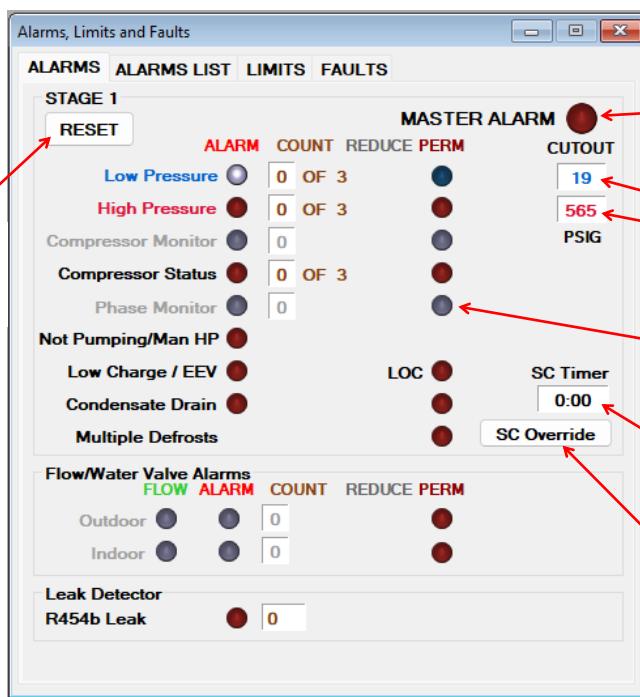
R454b Leak: The leak detector has detected the presence of A2L refrigerant inside cabinet.

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

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



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



Master Alarm occurs when any alarm occurs.

Low Pressure cut out
High Pressure cut out

Greyed out alarms are not applicable to the system.

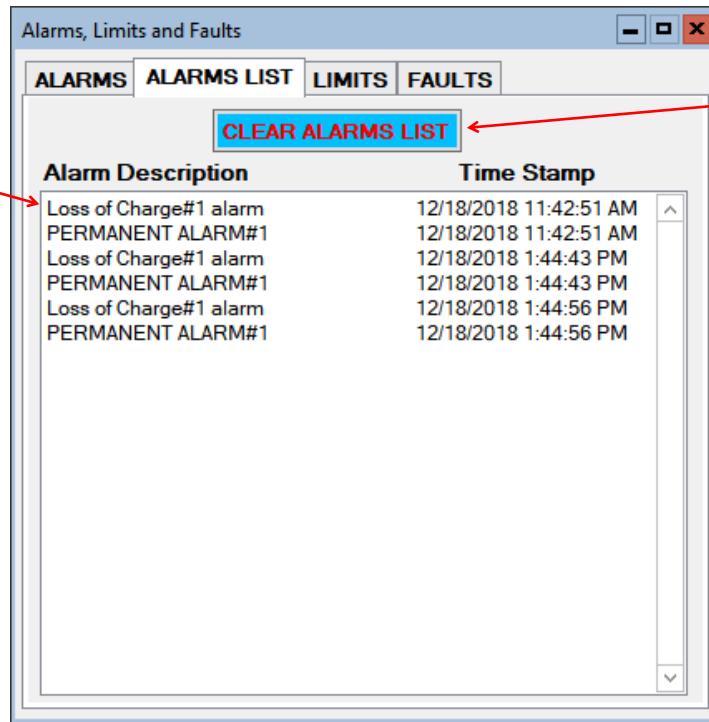
Short Cycle Timer counts down time until the next compressor start is allowed.

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

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

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

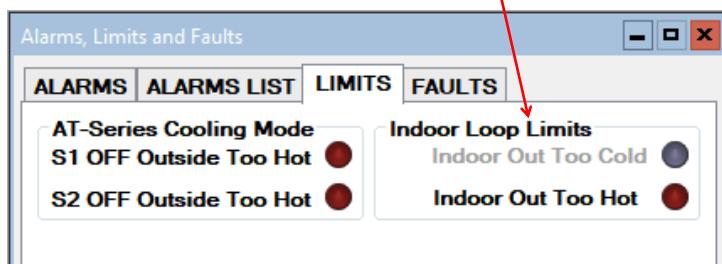
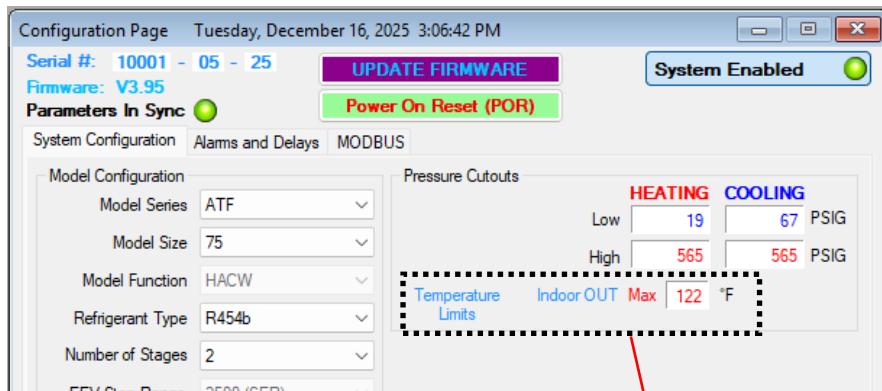
Each alarm that occurs while the PC APP is connected to the control board will appear here. The alarm type and a time stamp will be shown. The alarms list will be erased when the PC APP is disconnected from the control board.



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

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

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



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

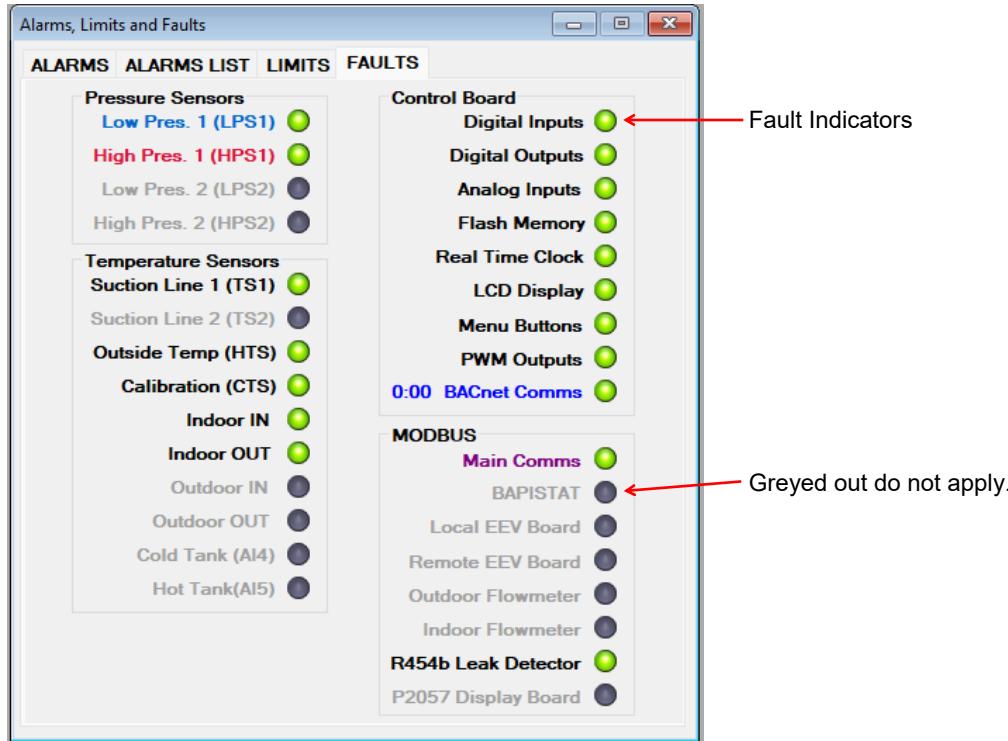
This tab shows hardware faults that could occur. If one of these faults occurs there may be a problem with the control board hardware, with LCD Display and buttons, or with a sensor.

If a fault occurs, some things to try:

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

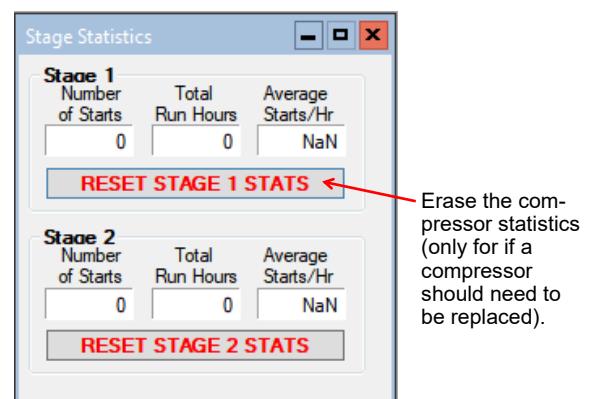
IMPORTANT NOTE: If the Indoor OUT (I_OUT) probe is faulty or disconnected, neither hydronic heating nor the auxiliary will operate if using Setpoint Control. They will continue to operate under Signals or BACnet control.

**View-->Defrost History:**

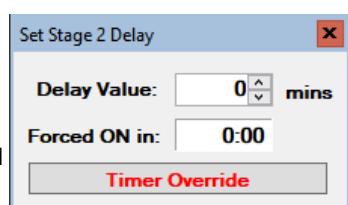
Same as clicking on HISTORY button in **Control Panel** window (see previous page).

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. **Set to "0" for no stage 2 engaged on a stage-1-only demand from thermostat.**



View-->Indoor Fan

Shows the settings screen for the indoor fan/blower. Airflow may be adjusted up or down by the user within the allowed range. See **Indoor Airflow Data** section in the **Model Specific Information** chapter for airflow ranges.

NOTE: This screen may also be accessed from the SET button of the Indoor Fan section of the Control Panel screen.

View-->Set Air Auxiliary Delays

Shows the delay before auxiliary air heat (plenum heater) is engaged on a stage 1 or stage 2 demand.

Set to "0" for no auxiliary heat engaged on a compressor-only demand from thermostat.

View-->Water Lines

Shows the water line temperatures.

Set Air Auxiliary window:

AUX1		AUX2	
Delay Value	60	20	mins
Forced ON in:	0:00	0:00	
Timer Override	AUX1	AUX2	

Water Lines window:

Indoor Loop - Water	
IN	Auto 32.0 °F
OUT	Auto 32.3 °F
ΔT	0.3 °F

Indoor Fan window:

Airflow	0 CFM	0 L/s
Auto	0.0	%
TACH	0	RPM
CFM	L/s	
Recirculation	1100	519
Stage 1	1500	708
Stage 2	1900	897
Auxiliary	1900	897
Stage 1	1500	708
Stage 2	1900	897
Emergency	2000	944
Auto	AR	%

View-->Digital Inputs

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

Digital Inputs window:

Air Thermostat	
Auto	G
Auto	Y1
Auto	Y2
Auto	O
Auto	W2
	E
Hydronic Thermostat	
Auto	Y1A
Auto	Y2A
Inputs	
Auto	DI_2
Auto	DI_1
Auto	DI_0
Auto	PM 2
Auto	PM 1
Auto	AR
Auto	ODFLO
Auto	IDFLO

View-->Digital Outputs

Shows the digital outputs and their individual status (ON/OFF).

Digital Outputs window:

Left Side	
Auto	ICR
Auto	DO_3 (AUX ONLY)
Auto	DO_2 (HYD AUX)
Auto	DO_1 (IV1)
Auto	DO_0
Auto	L1
Auto	L2
Auto	L3 (3-WAY COOL)
Auto	L4(NOT HYD AUX)
Auto	L5
Auto	L6
Auto	SH
Right Side	
Auto	PHS1
Auto	PHS2
Auto	L (Lockout)
Bottom	
Auto	STAGE1
Auto	STAGE2
Auto	RV1
Auto	RV2
Auto	SOL1
Auto	SOL2

View-->Analog Inputs

Shows the Analog inputs and their individual settings and values.

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

Analog Inputs window:

Ch.	Name	VDC	Multiplier	Offset	Value	Units
AI 0	Stage1_Current	0.000	10.00	0.00	0.00	Amps
AI 1	Stage2_Current	0.000	10.00	0.00	0.00	Amps
AI 2	Condensate_Alarm	0.000	1.00	0.00	0.00	Volts
AI 3	Discharge_Temp_1		1.00	0.00	74.7	°F
AI 4	Cold_Tank(CTS)		1.00	0.00	0.0	°F
AI 5	Hot_Tank(HTS)		1.00	0.00	0.0	°F

10K NTC Thermistor Type

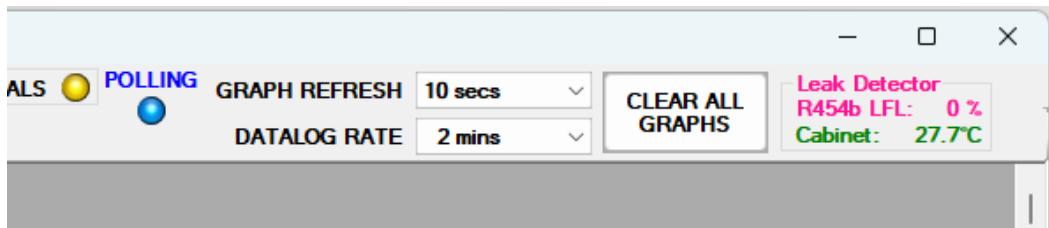
Click on EDIT to make changes. **EDIT**

PWM Channels window:

PWM Out Channels	
#1 Outdoor Fan(%)	25.0 %
#2 PWM 2	25.0 %
#3 OV2	0.0 %
#4 IV2	100.0 %
PWM IN	
Auto	0.0 %

Graphs Menu:

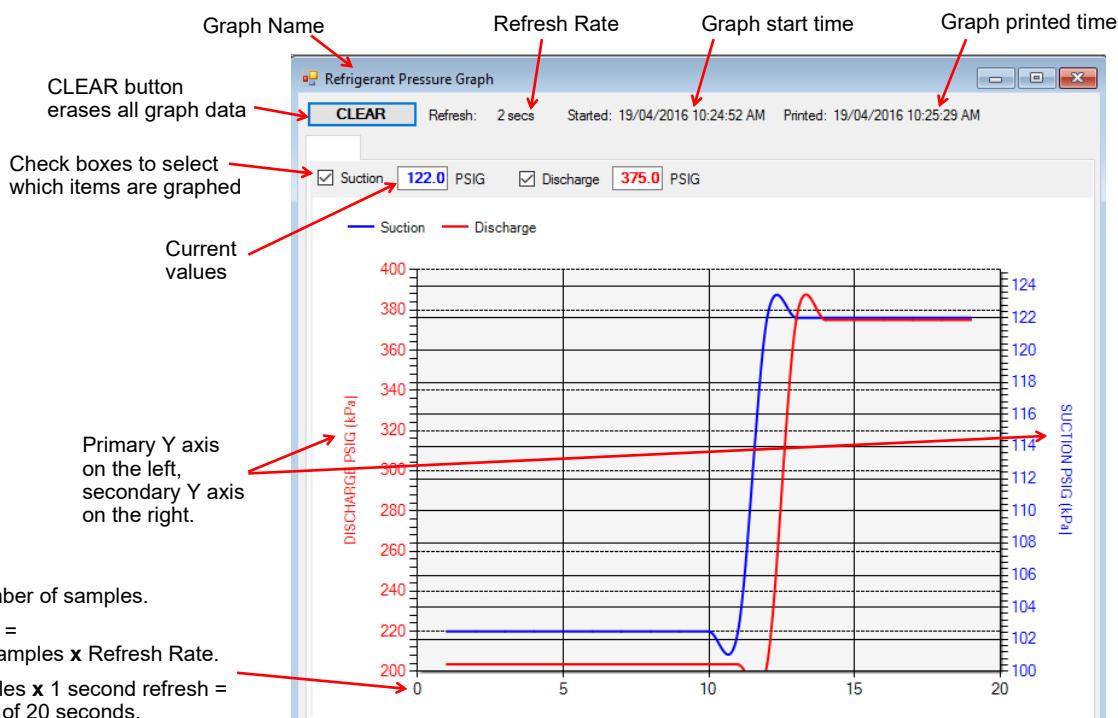
This menu is a list of the available graphs. Graphs are real-time and show a time stamp of when the recording started as well as a current time which will show up if the graph is screen captured. Each graph has a CLEAR button which will erase the stored data and restart the graph. There is also a master 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.

Graphs	Tools	Windows	Help	Discor
Control Signals Graph				ON/OFF status of the system control signals (demands)
Operation Mode Graph				ON/OFF status of heating and cooling modes
Input Signals Graph				ON/OFF status of digital inputs
Output Signals Graph				ON/OFF status of digital outputs
EEV Position / Superheat Graph				EEV position and resulting superheat
Vapor Line Temperature Graph				Suction temperature
Refrigeration Pressure and Temperature Graphs				Suction and discharge pressures, evaporating and condensing temperatures
Indoor Fan Graph				Indoor blower airflow demand % and speed feedback in rpm
Outdoor Fan Speed Graph				Outdoor fan demand % and suction pressure
Outdoor Temperature Graph				Outdoor temperature and suction pressure
Water Lines Graph				Indoor IN/OUT temperatures and delta T
Discharge Pressure Vs Hot Tank Graph				Discharge pressure vs tank temperature
Analog Input Graphs				All analog input channels (0-10VDC or 4-20mA).
PWM Channels Graph				All PWM / 0-10VDC output channels and one PWM / 0-10VDC input channel.
BACnet Timeout Graph				For troubleshooting synchronization with 3rd party BACnet controllers.
Leak Detector Graph				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.

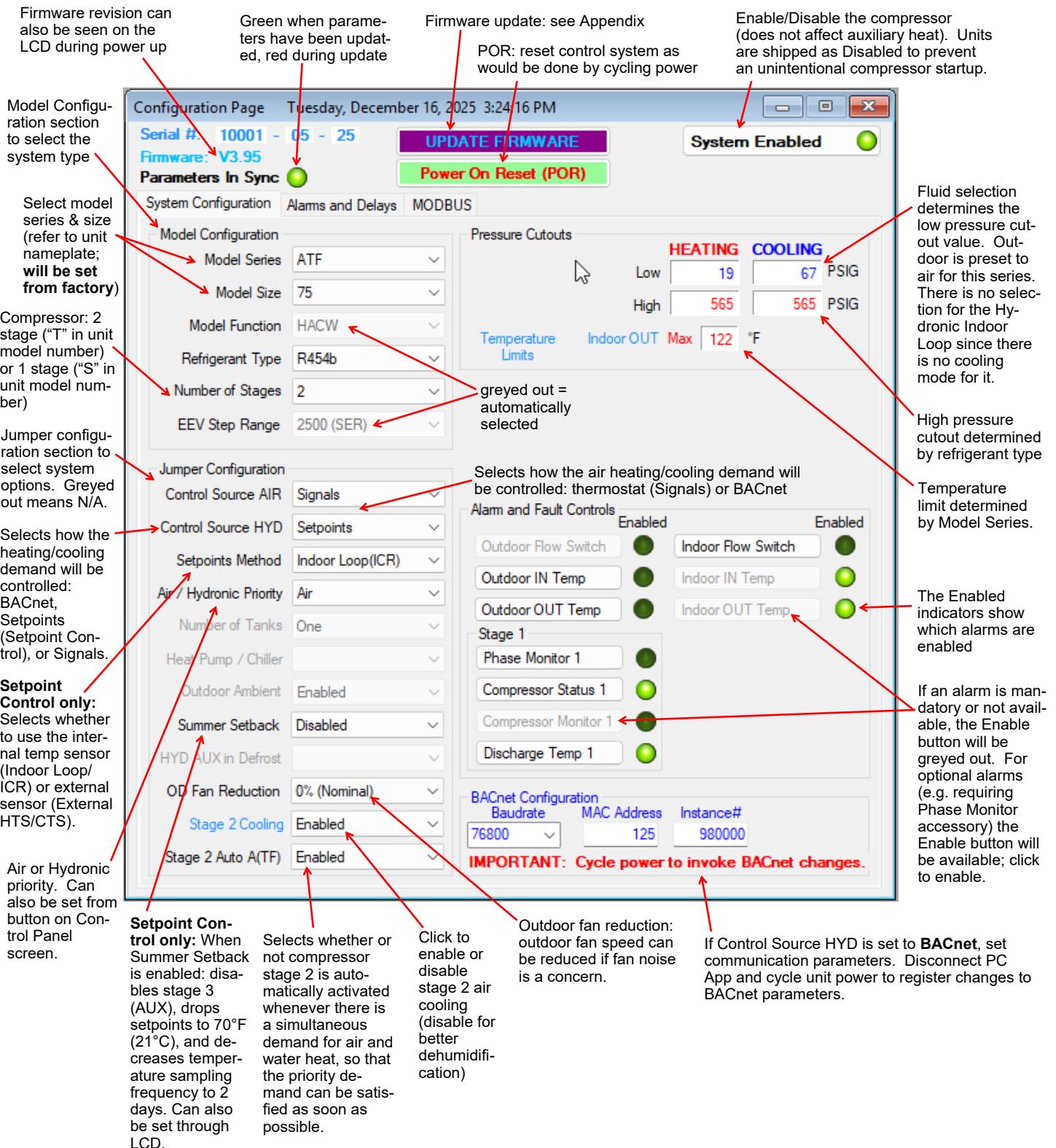


Tools Menu:

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

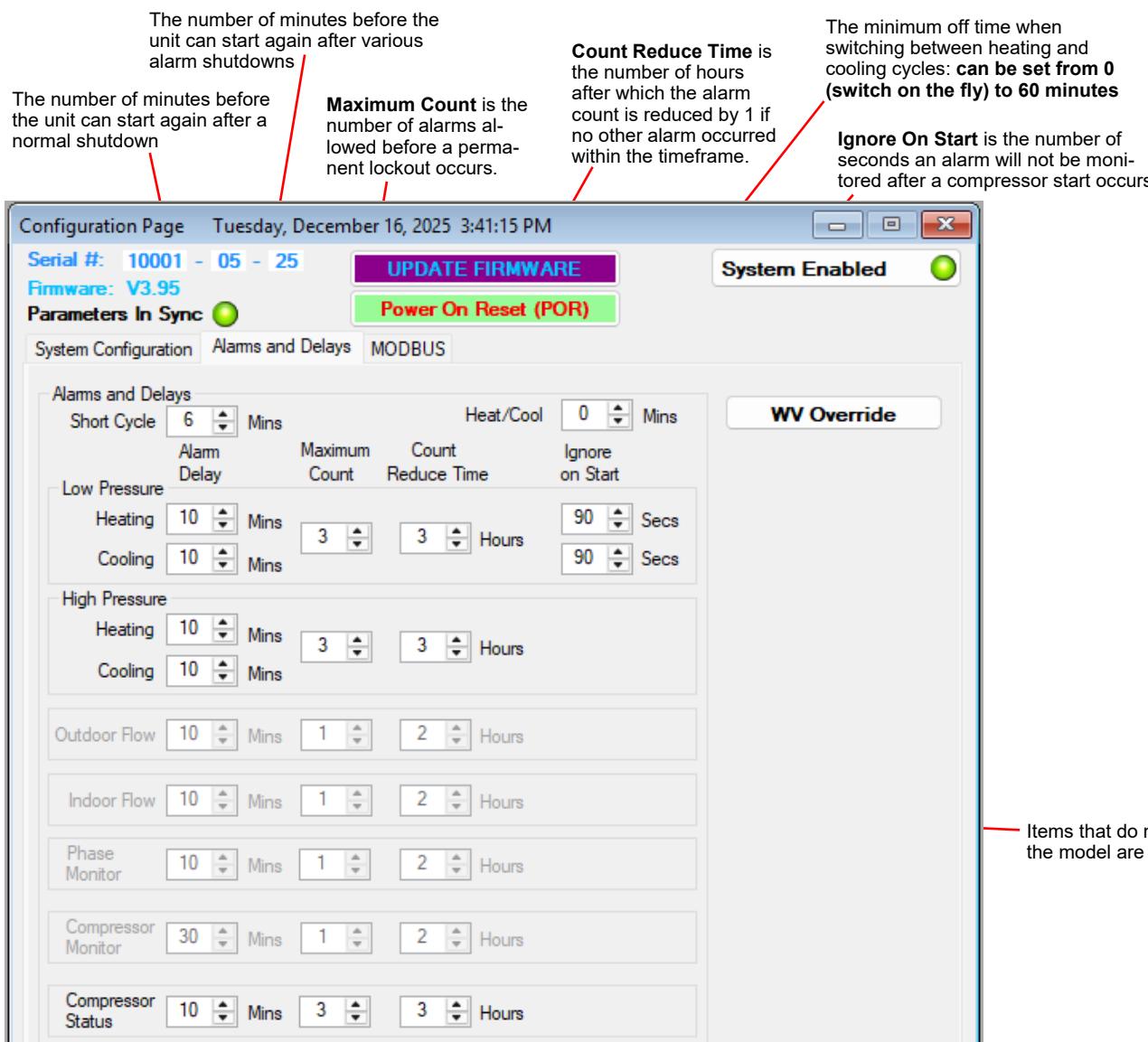
Tools-->Configuration (System Configuration tab):

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

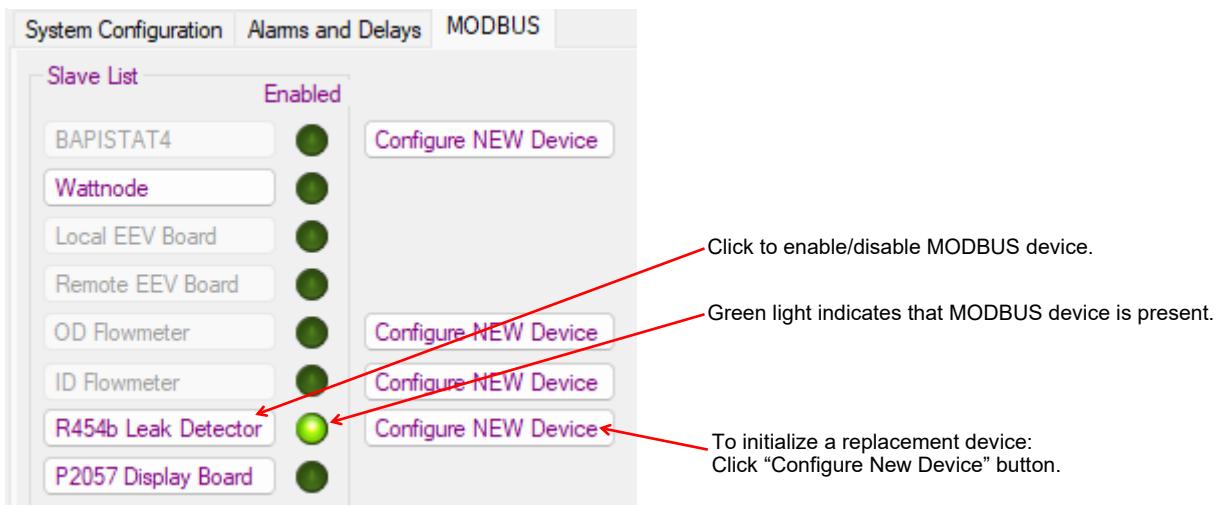


Tools-->Configuration (Alarms and Delays tab):

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

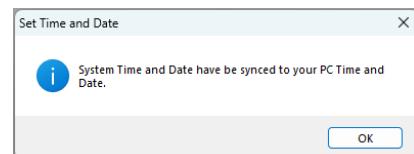
**Tools-->Configuration (MODBUS tab)**

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



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.

Loads the **QUANTITY** of logs beginning from earliest

Loads **QUANTITY** of logs beginning from selected date

Erases data from screen only

Exports the data to a file

Erases all logged data in the control board and resets the log count to zero (also available directly from **Tools** menu)

Load Rate: speed at which logs are retrieved from control board

Clicking anywhere on a row will update all LEDs to show the status at the time of that log record.

	HEX ADD#	Date DD/MM/YY	Time	I/O #1	I/O #2	I/O #3	LIMITS	ALARMS1	PERM ALARMS1	TS Faults	Board Faults	Operation Mode	LPS1	HPS1	EVAP1	COND1	Suction Line	Super heat	EEV1 Position	SH Setpoint	Or
1	10000	06/05/2025	08:40:36	2	1024	0	0	0	0	0	0	0	102.1	203.5	37.6	74.1	31.3	0.0	0.0	8.0	
2	10080	06/05/2025	08:40:41	2	1024	0	0	0	0	0	0	0	102.1	203.5	37.6	74.1	31.3	0.0	0.0	8.0	
3	101100	06/05/2025	08:40:46	2	1024	0	0	0	0	0	0	0	102.1	203.5	37.6	74.1	31.3	0.0	0.0	8.0	

Tools-->Datalogging (Enable/Disable tab)

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

Board Faults

Temp Sensor Faults

Temp Sensors

Analog IN Group

PWM Group

MODBUS Group

Datalog Rate Table

Pressure Sensor Faults

Start Block # of Blocks

LOAD BY BLOCK

SHOW LOG ADDRESS

TOTALS: Blocks 63, Sectors 1008, Logs 32,256

Timer Tick Count: 468 Log Rx Count: 2892 Timeout: 55

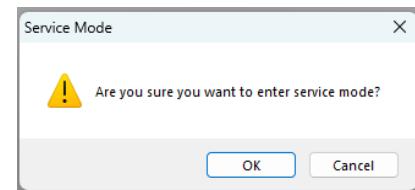
Datalog rate and capacity information

Load By Block: Developer use

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**

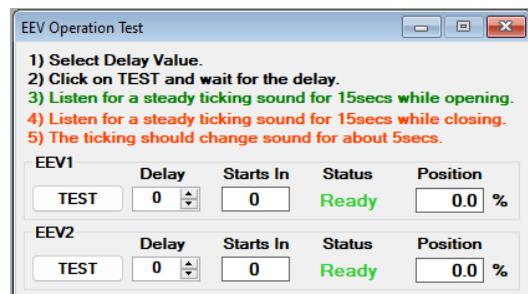
Allows individual control system demands or sensor values to be manually overridden for troubleshooting or service purposes. Also accessible via **MANUAL OVERRIDE** button in main window top bar—>

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

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

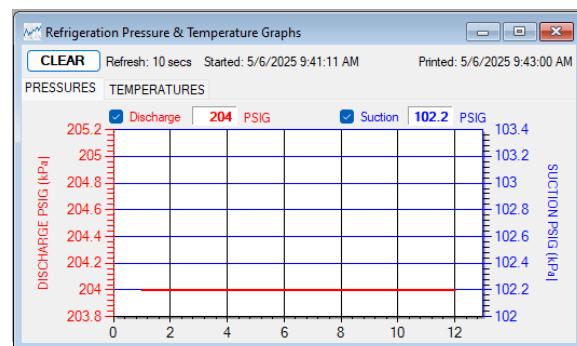
The EEV is operated through its range to OPEN and back to CLOSED, without an operator having to command it by using *Manual Override* mode.

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.

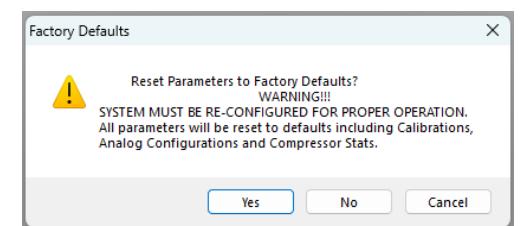
Enter the temperature of the probe, and the calculator will predict the resistance of the probe.

Tools-->Reset to Factory Defaults

This will reset all settings to default values.

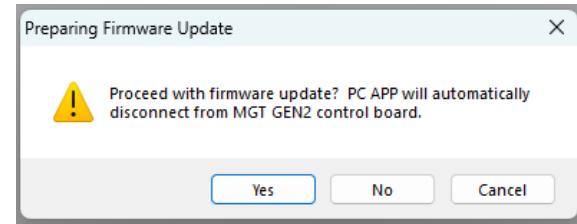
THE SYSTEM MUST BE RECONFIGURED AFTER A RESET IS PERFORMED.

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.

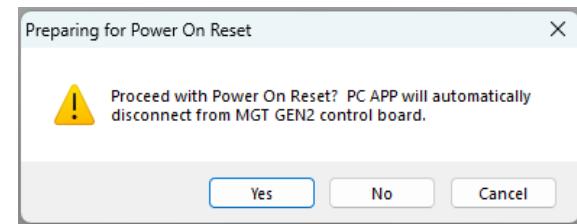
**Tools-->Update Firmware**

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)**

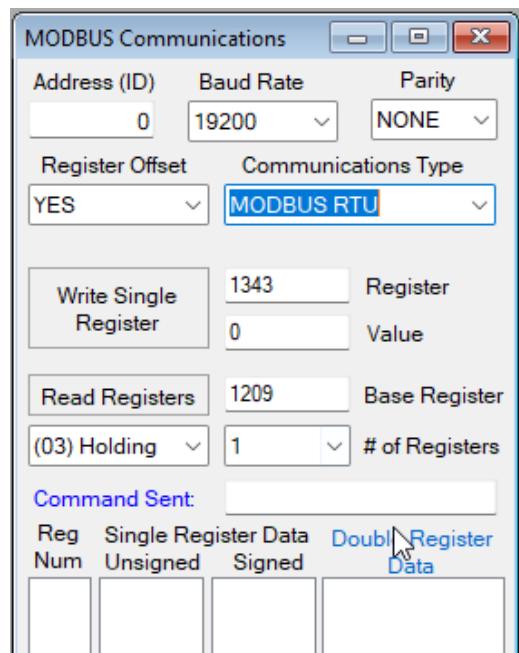
This function resets the control board as a power cycle off-on would.



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

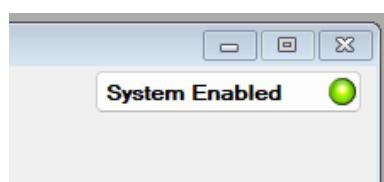
Tools-->Advanced-->SYSTEM TIMERS

Tools-->Advanced-->Performance

Tools-->System Enable/Disable

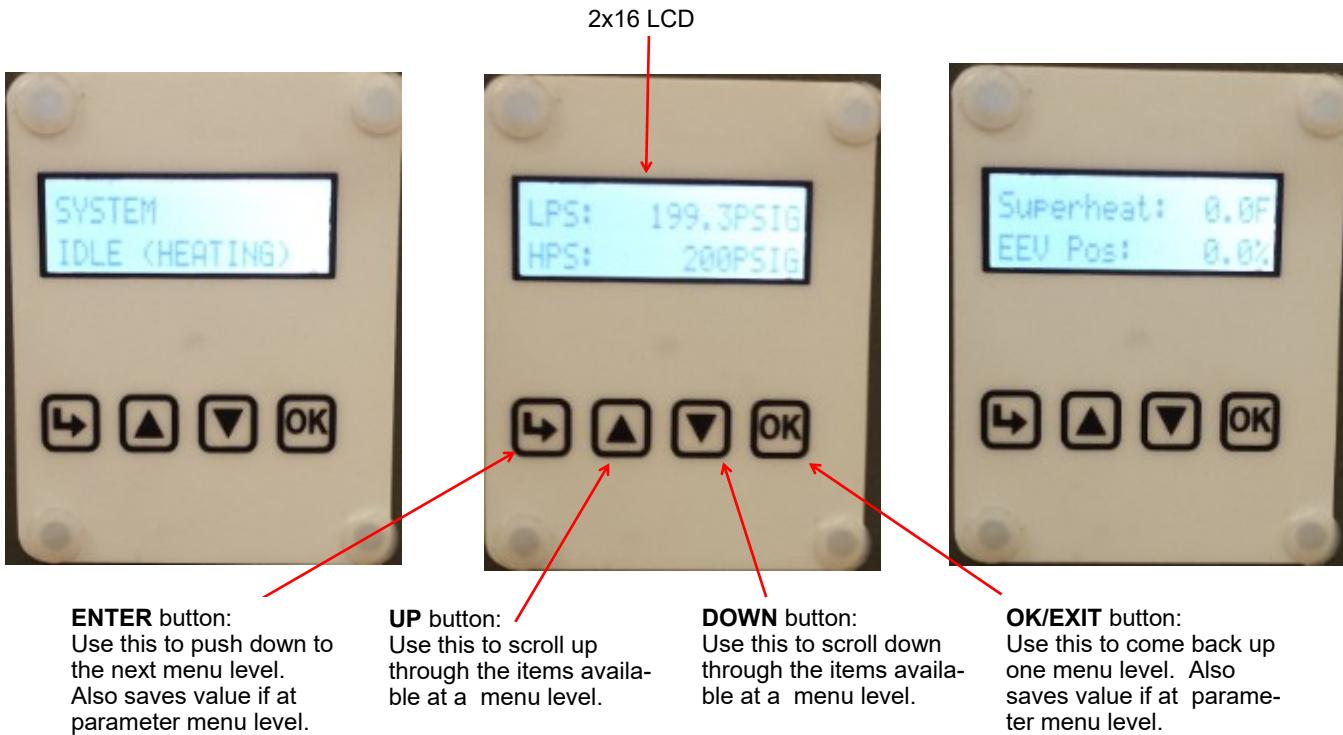
Enable/Disable the compressor (does not affect auxiliary heat). Units are shipped as Disabled to prevent an unintentional compressor startup.

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



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.

continued on next page...

...continued from previous page

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	— Priority	— Air		Sets the priority to air modes.
		— Hydronic		Sets the priority to hydronic mode.
	— Control AIR	— Signals		Hardwired air thermostat control.
		— BACnet		BACnet control - see BACnet section
	— Control HYD	— Setpoints		On-board water temperature control - see Setpoint Control section.
		— Signals		Hardwired / aquastat control.
		— BACnet		BACnet control - see BACnet 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 hot tank temperature sensor
	— OD Fan Reduction	— Reduction (%)		Outdoor fan speed reduction in %.
	— 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
	— Indoor IN Temp	— calibration adj.		Calibration in 0.1°F intervals
	— Indoor OUT Temp	— calibration adj.		Calibration in 0.1°F intervals
NOTE: Calibration is generally not required. Pressure sensors may be calibrated against a known source if needed. All temperature sensors have an Auto Calibration feature.				

BACnet Interface

The BACnet interface is an **MS/TP** connection via RS-485 twisted pair. 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

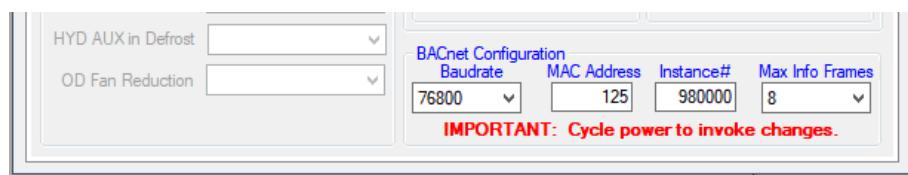
Model Name: MGT GEN2 Control Board

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

Name	Data Type	ID	Property	Description
SYSTEM_Y1A	Binary Value	BV0	Present Value	Demand for hydronic (water) heating (active is on)
SYSTEM_Y2A	Binary Value	BV1	Present Value	Demand for stage 2 hydronic (water) heating (active is on)
SYSTEM_O	Binary Value	BV2	Present Value	Switch to air cooling mode (RV#1). Inactive=HEATING, Active=COOLING
SYSTEM_Y1	Binary Value	BV3	Present Value	Demand for air heating or cooling (active is on)
SYSTEM_Y2	Binary Value	BV4	Present Value	Demand for stage 2 air heating or cooling (active is on)
SYSTEM_W2	Binary Value	BV5	Present Value	Demand for air auxiliary heat / plenum heater (active is on)
SYSTEM_G	Binary Value	BV6	Present Value	Demand for air recirculation (active is on)
SYSTEM_AR	Binary Value	BV7	Present Value	Demand for airflow reduction (active is on)
BACnet_Units	Binary Value	BV9	Present Value	Select the units to use for the BACnet objects

Note: object names may be subject to change without prior notice.

TABLE 23 - BACnet OBJECTS - OPERATION MODE Description (Read Only)

Name	Data Type	ID	Present Value	Description
Operation Mode	Analog Value	AV5	0	Air heating
			1	Air cooling
			2	Hydronic (water) heating
			9	Air heating off
			10	Air cooling off
			11	Hydronic (water) heating off

Note: Object is type Analog Value but value will always be an integer value.

TABLE 24 - 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 (used for condensate sensor, see Alarms table)
	AI3	AI3	Present Value	degF (degC)	Compressor discharge line temperature
	AI4 (CTS)	AI4	Present Value	degF (degC)	N/A
	AI5 (HTS)	AI5	Present Value	degF (degC)	Hot tank temperature from sensor - requires accessory
	LPS1	AI6	Present Value	PSIG (kPa)	Low pressure value (suction pressure)
	HPS1	AI7	Present Value	PSIG (kPa)	High pressure value (discharge pressure)
	EVAP1	AI8	Present Value	degF (degC)	Evaporating Temperature
	COND1	AI9	Present Value	degF (degC)	Condensing Temperature
	Suction Line 1	AI10	Present Value	degF (degC)	Suction line temperature
	Superheat 1	AI11	Setpoint Value	degF (degC)	Superheat
	EEV1 Position	AI12	Present Value	%	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	%	PWM input (from external source)
	PWM1 (OD Fan)	AV1	Present Value	%	Outdoor fan speed
	PWM2	AV2	Present Value	%	PWM output value (spare)
	PWM3 (OV2)	AV3	Present Value	%	PWM output value (spare)
	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	IV1 (to 24VAC Indoor Loop water valve)
	DO2 (HYD_AUX)	BO5	Present Value	N/A	Hydronic Auxiliary
	DO3 (AUX_ONLY)	BO6	Present Value	N/A	Hydronic Auxiliary Only (without compressor)
	PHS1	BO7	Present Value	N/A	Air plenum heater stage 1
	PHS2	BO8	Present Value	N/A	Air plenum heater stage 2
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	N/A
	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

TABLE 25 - 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 26 - BACnet OBJECTS - ALARM Descriptions (Read Only)**

Name	Data Type	ID	Description	
AI0 (Comp1 Current)	Analog Input	AI0	Stage 1 Status alarm (Start / Stop Failure)	
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	N/A	
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)
		9	513	Compressor not pumping / Manual high pressure switch alarm
		10	1024	Condensate overflow alarm
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

TABLE 27 - BACnet OBJECTS - LIMITS Description (Read Only)

Name	ID	BIT #	Decimal Value*	Bit Description
Limits (Present Value)	AV6	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.

TABLE 28 - 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	
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	
Outside 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
		5	32	Indoor OUT temperature
		6	64	N/A
		7	128	N/A
		8	256	N/A
		9	512	Hot tank temperature sensor on AI5 - accessory

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

Startup Procedure

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

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

Pre-Start Inspection

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 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.

Ductwork:

1. Verify that all ductwork has been completed and is firmly attached to the unit. Verify that any dampers or diverters are properly set for operation of the heat pump.
2. Verify that all registers are open and clear of any objects that would restrict the airflow.
3. Verify that a new air filter is installed and the cover is secured.
4. Verify the condensate drain is connected, properly vented, and free of debris.
5. If a plenum heater has been installed, verify that it is securely fastened.

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.

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 with the air thermostat OFF. 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 moving (a clicking sound).
2. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.
3. Connect a USB cable between the USB connector on the board and a laptop with the PC App installed (recommended but optional).
4. Select the desired Control Source HYD via the PC APP Configuration Page or via the LCD interface Configuration Menu. **Set the water setpoints to a low value (e.g. 50°F) to prevent the compressor from coming on on water heating mode.**
5. Enable the system either with the PC App's Configuration Page **System Enable/Disable** button or via the LCD interface.

Air Heating Mode:

1. Set the thermostat to heating mode and adjust the setpoint to activate stage 1 and stage 2. The fan should slowly ramp up to speed after the time delay of the thermostat expires (if applicable) and the compressor will start.
2. Check the PC App or LCD interface. The suction and discharge pressures will vary based on the outdoor temperature and indoor air temperature, but they should be **90-110PSIG** and **260-360PSIG** respectively for a typical start-up.
3. Monitor the unit via the PC APP or LCD while the unit runs, and record the following after 10 minutes of run time:
 1. Suction pressure
 2. Discharge pressure
 3. Duct Return temperature (poke a small hole in the flex collar and insert probe in airstream)
 4. Duct Supply temperature (poke a small hole in the flex collar and insert probe in airstream)
 5. Duct Delta T (should be between **22-32°F, 12-18°C**)
 6. Outdoor air temperature
 7. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
4. Adjust the thermostat setpoint to the desired room temperature and let the unit run through a cycle.
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 on.
6. 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.
7. Remove the electrical cover from the plenum heater. Place a current clamp meter around one of the supply wires. Turn on the power to the plenum heater. Adjust the thermostat setpoint to **85°F (29°C)**. Verify that the current draw increase as each electric heat stage is activated. (10kW has 2 stages, 15kW has 3 stages and 20kW has 4 stages).

Air Cooling Mode:

1. Set the thermostat to cooling mode and adjust the setpoint to activate stage 1 and stage 2.
2. Monitoring the unit via the PC APP or LCD Interface while the unit runs, record the following after 10 minutes of run time:
 1. Suction pressure
 2. Discharge pressure
 3. Duct Return temperature
 4. Duct Supply Out temperature
 5. Duct Delta T
 6. Outdoor air temperature
3. Adjust the thermostat setpoint to the desired room temperature if possible, otherwise set it just low enough to allow the unit to run (e.g. 1°F / 0.5°C less than room temperature) and let the unit run through a cycle.

Water Heating Mode:

1. Set air thermostat to "off". Adjust the Setpoint Control settings via the the PC App or LCD (or adjust aquastat if used) to 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 outdoor temperature and the indoor loop temperature, but they should be **90-110PSIG** and **260-360PSIG** respectively for a typical start-up.
3. Monitor the unit via the PC APP or LCD interface while the unit runs, and 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 (should be **8-12°F, 4-6°C**)
 6. Outdoor air temperature
 7. 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.

Final Inspection:

1. Turn the power off to the unit (and plenum heater if installed) 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. Install the electrical cover on the plenum heater if applicable.
3. Do a final check for leaks/spills and ensure the area is clean.
4. Turn the power on to the unit and the plenum heater if installed. Set the thermostat and water heat to the final settings.

Startup Record:

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

Startup Record Sheet - ATF-Series

Installation Site		Startup Date	Installer				
City			Company				
Province		Check boxes unless asked to record data. Circle data units.					
Country							
Homeowner Name		Customer 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						
Ductwork	Ductwork completed, dampers adjusted, registers open						
	Air filter and end cap are installed						
	Condensate drain is connected, properly vented, & free of debris						
	Plenum heater is securely fastened (if applicable)						
Indoor Loop (Hydronic)	All shut-off valves are open, loop is full and purged of air						
	Loop static pressure		psig	kPa			
Domestic Hot Water	All shut-off valves are open, lines are full and purged						
	Desuperheater pump wire is disconnected						
Electrical	High/low voltage connections are correct and securely fastened						
	Circuit breaker size and wire gauge for heat pump		A		Ga.		
	Circuit breaker size, wire gauge, and size for Plenum Heater		A		Ga.		kW

STARTUP DATA

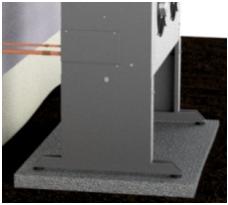
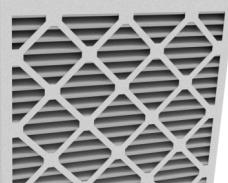
Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3						VAC
Air Heating Mode (10 minutes)	Suction Pressure / Discharge Pressure					psig	kPa
	Duct Return, Duct Supply, and Delta T		In		Out		°F °C
	Outdoor Air Temperature		°F	°C			
	Compressor L1 (black wire) current		A				
	Domestic Hot Water functioning						
Air Cooling Mode (10 minutes)	Suction Pressure / Discharge Pressure					psig	kPa
	Duct Return, Duct Supply, and Delta T		In		Out		°F °C
	Outdoor Air Temperature		°F	°C			
Water 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				

Date:		Startup Personnel Signature:	Witness/Site Signature:				
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A total of three copies are required, one for the site, one for the installer/startup and one to be sent to Maritime Geothermal Ltd.

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.
Indoor Air Filter		6 months Inspect for dirt. Replace if necessary.
Compressor Contactor		1 year Inspect for pitted or burned points. Replace if necessary.
Condensate Drain		1 year Inspect for clogs. Clean 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).

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 Interface 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 Interface 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 Interface, 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 air thermostat	No power from transformer.	See No Heartbeat on control board .	
	Faulty wiring between heat pump and thermostat.	24VAC is not present across R and C of the thermostat.	Correct the wiring.
	Faulty thermostat.	24VAC is present across R and C of the thermostat but thermostat has no display.	Replace thermostat .

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 that 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.
Condensate Drain	Water level in the condensate tray has risen to sensor level, indicating condensate drain is blocked.	Check condensate drain(s) for obstructions.
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.

FAULT TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
Pressure Sensor (e.g. LPS)	First, check for loose connection at LPS control board connector. If that looks ok: the sensor, sensor cable, or control board may be faulty.	1. Swap the high and low pressure sensor connectors LPS and HPS at control board.	If fault remains at LPS , replace control board. If fault changes to HPS , control board is OK; continue with step 2.
		2. Leaving control board connections as per step 1, swap connectors at high and low pressure sensors.	If fault remains at HPS , replace low pressure sensor (LPS). If fault changes to LPS , check continuity of and replace LPS cable.
Temperature Sensor (e.g. INDOOR IN)	First, check for loose connection at control board connector. If that looks ok: the sensor (with its cable) or control board may be faulty.	1. Swap the INDOOR IN and INDOOR OUT connectors at control board.	If fault remains at INDOOR IN , replace control board. If fault changes to INDOOR OUT , control board is OK; replace sensor with its built in cable.
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 and the Control Board, and then turning the power back on again. If this does not work then either the LCD Interface, 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 following page.
MODBUS: - Main Comms	Hardware problem on heat pump control board.	Check if 24-36VDC is present across 24VDC and GND at lower right of control board.	Replace control board if voltage not in range.
		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 control 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 following page.

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	5VDC 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.
	MODBUS termination problem	Verify MODBUS TERM jumper is in place on control board.	Install jumper if missing.
	Faulty refrigerant leak detector	5VDC is present on board as per above, termination is correct, but problem persists.	Replace leak detector.

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 <i>high suction pressure</i> and <i>high discharge pressure</i>) to determine the cause of the thermal overload trip.
	Burned out motor (open winding)	Remove wires from compressor. Ohmmeter shows infinite resistance between any two terminals. Note: Be sure compressor overload has had a chance to reset. If compressor is hot this may take several hours.	Replace the compressor.
	Burned out motor (shorted windings)	Remove wires from compressor. Resistance between any two terminals is below the specified value.	Replace the compressor.
	Motor shorted to ground.	Remove wires from compressor. Check for infinite resistance between each terminal and ground.	If any terminal to ground is not infinite replace the compressor.
	Seized compressor due to locked or damaged mechanism.	Compressor attempts to start but trips its internal overload after a few seconds. (Run capacitor already verified)	Attempt to "rock" compressor free. If normal operation cannot be established, replace compressor.
Compressor starts hard	Start capacitor faulty. (Single phase only)	Check with capacitance meter. Check for black residue around blowout hole on top of capacitor.	Replace if faulty. Remove black residue in electrical box if any.
	Potential relay faulty. (Single phase only)	Replace with new one and verify compressor starts properly.	Replace if faulty.
	Compressor is "tight" due to damaged mechanism	Compressor attempts to start but trips its internal overload after a few seconds. Run capacitor has been verified already.	Attempt to "rock" compressor free. If normal operation cannot be established, replace compressor.
Compressor stage 2 will not activate	Faulty stage 2 plug (solenoid coil is in plug).	Verify if 24VAC is present across Y2 and C of the terminal strip.	Replace module if signal is present. Check wiring if signal is not present.

OPERATION TROUBLESHOOTING - WATER 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 chapter.	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.

OPERATION TROUBLESHOOTING - WATER 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 - AIR 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 unit airflow	See Indoor Fan Troubleshooting section	Correct the problem.
	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	Entering indoor air temperature too cold (e.g. on startup, or if unit has been off for extended period)	Ensure entering air temperature is above the low limit indicated in the Model Specific Information section.	Reduce airflow temporarily until Indoor Out temperature has risen sufficiently. This can be done by partially blocking off the return duct.
	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.

OPERATION TROUBLESHOOTING - AIR 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 fan	Go to Indoor Fan troubleshooting section.	Go to Indoor Fan troubleshooting section.
Random manual high pressure trip (may not occur while on site)	Faulty compressor contactor	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it should be off.	Replace contactor.

OPERATION TROUBLESHOOTING - DEFROST & AIR 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.

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 unit airflow	See Indoor Fan Troubleshooting section. Note: low airflow will cause the air coil to ice up once the suction drops below 90PSIG .	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	Indoor airflow 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.
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.

INDOOR FAN/BLOWER TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
Low indoor unit airflow	Dirty air filter	Inspect.	Replace.
	Dirty air coil	Inspect.	Clean.
	Poor ductwork	Measure delta T between supply and return ducts at the unit. In heating mode, it should not be above 30°F(17°C).	The ECM fan will provide proper airflow up to an external static backpressure of 0.5 inH ₂ O. The ductwork is poorly designed or greatly undersized if the fan motor cannot provide the required airflow.
	Airflow selected is too low	Check airflow settings on Indoor Fan page of the PC APP.	Select a higher setting.
	Airflow reduction is enabled	AR1 and AR2 are connected with a dry contact or jumper.	Airflow reduction may not be feasible with lower airflow selections. Increase settings until unit operates properly.
Indoor fan not operating at correct speeds	Wrong model size selected	Verify that the model size is correct on the Configuration Page of the PC APP.	Select the correct model size.
Indoor fan not operating or operating intermittently	Fan control signal harness and/or fan power harness is loose	Verify that the connector is properly inserted into the fan motor. Gently tug on each wire to verify it is properly inserted into the connector.	Repair any loose connections.
	Control board not configured properly	Verify that the model series is correct on the Configuration Page of the PC APP.	Correct the configuration. If the wrong series is selected there may be not be any fan output.
	Faulty control board outputs Note: cycle the power once to see if the fan begins operating properly first	Create a call for the fan from the thermostat or use a jumper R-G (24VAC on G terminal in heat pump). On the ECM Fan connector on the left side of the control board : 1) verify that there is 12 to 20VDC between pin G (grey wire) and pin C (white wire). 2) Verify that there is 2 to 6VDC between pin P (dark green wire) and pin C (white wire)	If there is no voltage present on either of the pins (G and P) replace the control board. Ensure control board model series is correct, see above.
	Faulty control signal harness or faulty motor head	Create a call for the fan from the thermostat or use a jumper R-G (24VAC on G terminal in heat pump). On the ECM Fan connector at the fan motor : 1) verify that there is 12 to 20VDC between pin G (grey wire) and pin C (white wire). 2) Verify that there is 2 to 6VDC between pin P (dark green wire) and pin C (white wire)	If proper signal isn't present, replace the fan control signal harness. If proper signal is present, replace fan motor.
	Faulty fan power harness or faulty motor	Insert the tips of the voltmeter probes into the back of the connector at the fan to measure the voltage across the red and black wires. Value should be ~230VAC.	Replace power harness if 230VAC is not present, replace motor if 230VAC is present.

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, repair any loose connections.
	Faulty PWM output on GEN2 control board	Use manual mode of the PC APP to set the outdoor fan to 50%. Using a multimeter set to VDC, measure PWM1 to GND on 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 re-testing. 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 GND 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.

DOMESTIC HOT WATER (DESUPERHEATER) TROUBLE SHOOTING

Fault	Possible Cause	Verification	Recommended Action
Insufficient hot water (tank problem)	Thermostat on final hot water tank set too low. Should be set 120-140°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.

PLENUM HEATER TROUBLE SHOOTING

Fault	Possible Cause	Verification	Recommended Action
No 230VAC across plenum heater L1 and L2	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 plenum heater disconnect box (if installed), voltmeter shows voltage on the line side but not on the load side. Check if breaker is tripped.	Reset breaker or replace fuse at plenum heater disconnect box. Replace fuse with proper size and type. (Time-delay type "D")
	Same "Line" to L1 and L2	Measuring L1 to ground and L2 to ground both yield 115VAC, but L1 to L2 yields 0VAC.	Correct wiring.
No W2 signal at heat pump terminal strip	No call for auxiliary or emergency heat from thermostat	Verify that the thermostat is indicating that auxiliary or emergency heat should be on.	Set thermostat to engage auxiliary or emergency heat. (Note that some thermostats require a jumper between auxiliary and emergency. Check the tstat manual.)
	Faulty thermostat	Thermostat doesn't indicate a call for auxiliary or emergency when it should. Or indicates auxiliary or emergency but no 24VAC signal present across C and the auxiliary and/or emergency pin at the thermostat.	Replace thermostat.
	Faulty thermostat wiring	24VAC signal is present across C and the auxiliary and/or emergency pin at the thermostat but no 24VAC signal is present across W2 and C at the heat pump terminal strip.	Correct wiring.
No 24VAC signal from C to ground at the plenum heater control board	Plenum heater transformer is burned out	Voltmeter does not show 24VAC across transformer secondary.	Replace transformer.
	Plenum heater control board is faulty	Transformer tested OK in previous step.	Replace control board.
No 24VAC signal from 1 to ground at the plenum heater control board (when a plenum heater demand is present)	Faulty wiring	24VAC present across C and ground at the plenum heater, but not across ground of the plenum heater and C _P of the heat pump terminal strip	Correct the wire which should run from heat pump C _P to plenum heater C.
		If above tested OK, 24VAC is present across ground of plenum heater and 1 of the heat pump terminal strip, but not across ground of plenum heater and 1 of the plenum heater.	Correct the wire which should run from heat pump terminal "1" to plenum heater terminal "1".
Plenum heater thermal overload is tripped.	Indoor fan not operating	See Indoor Fan/Blower Troubleshooting section.	Correct problem. Reset thermal overload.
	Plenum heater is not positioned so that majority of airflow passes over elements (if installed in duct-work outside heat pump)	Plenum heater meant for internal heat pump installation is installed in a larger duct outside heat pump, or is positioned after duct elbow.	Reposition plenum heater, or obtain a plenum heater model with a wider element cage (contact Maritime Geothermal).
	Faulty overload	Reset thermal overload.	Replace if faulty.

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.

- 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.
- 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** 75-105ohms
- **WHITE** to **BLACK** 75-105ohms

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 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.

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.

**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.



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

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

General Repair Procedure

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

Vacuuming & Charging Procedure

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

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

Compressor Replacement Procedure

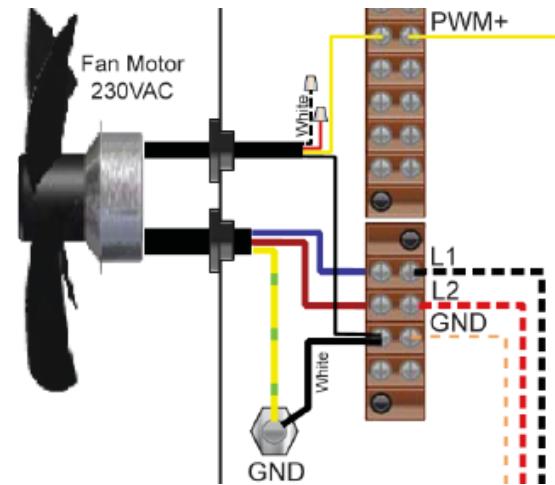
1. Pump down the unit as per the Pumpdown Procedure above. **If there was a compressor burn out (motor failure), the refrigerant cannot be reused and must be disposed of according to local codes.**
2. Disconnect piping.
3. Replace the compressor. Replace the liquid line filter-dryer. Always ensure nitrogen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

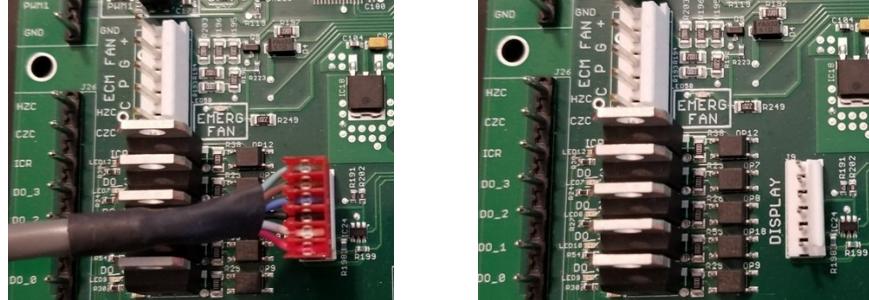


6. For the fan signal cable: remove the **YELLOW** wire from the **PWM** terminal and remove the **BLACK** wire from the **GND** terminal.
7. For the fan power cable: remove the **BLUE** wire from **L1**, the **RED** wire from **L2** and the **YELLOW/GREEN** wire from **GND**.
8. Pull the cables out 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.



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).

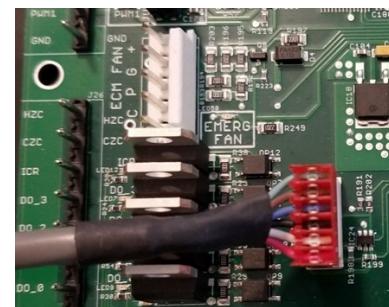


5. Remove all connectors from the top of the control board. Each connector (or wire) should be marked already from the factory, e.g. HPS1, LP1, TS1, etc.. This matches the marking on the control board.
6. The control board is held in place at its four corners. Squeeze each standoff by hand or with needle 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 Interface comes on. Note the firmware version. After EEV zeroing and Random Start countdown the display should begin alternating data.
14. If the replacement control board was pre-configured for this unit at the factory then the system is ready for operation. If it was not then use the PC App corresponding to the unit's firmware version to configure the unit. Refer to the **Tools -> Configuration** menu in the [PC APP](#) section.

LCD Interface (Display) Board Replacement Procedure

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



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



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

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.

Model Specific Information

**Table 29 - Refrigerant Charge**

MODEL	lb	kg	Refrigerant	Oil Type
ATF-45	7.5	3.4	R454b	POE
ATF-55	11.0	5.0	R454b	POE
ATF-65	12.0	5.5	R454b	POE
ATF-75	13.0	5.9	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 30 - Shipping Information - Indoor Unit

MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
ATF-45	450 (205)	44 (112)	36 (91)	66 (167)
ATF-55	490 (223)	44 (112)	36 (91)	66 (167)
ATF-65	505 (230)	44 (112)	36 (91)	66 (167)
ATF-75	530 (240)	44 (112)	36 (91)	66 (167)

Table 31 - Shipping Information - Outdoor Unit

MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
ACE-45	230 (104)	36 (91)	70 (178)	45 (114)
ACE-55	230 (104)	36 (91)	70 (178)	45 (114)
ACE-65	295 (134)	36 (91)	70 (178)	56 (142)
ACE-75	295 (134)	36 (91)	70 (178)	56 (142)

Table 32 - Indoor Loop Flow Rates

MODEL	gpm	L/s
ATF-45	10	0.63
ATF-55	12	0.76
ATF-65	14	0.88
ATF-75	16	1.0

Table 33 - Operating Temperature Limits

Loop	Mode	Parameter	(°F)	(°C)	Note
INDOOR	AIR Heating	Minimum EAT	60	15	
	AIR Heating	Maximum EAT	100	38	
	WATER Heating	Minimum ELT	60	15	
	WATER Heating	Maximum LLT	120	49	
OUTDOOR	AIR Cooling	Minimum EAT	50	10	
	AIR Cooling	Maximum EAT	100	38	
	Heating	Minimum EAT	-7	-22	Compressor automatically stops below this outdoor temperature.
	Cooling	Maximum EAT	120	49	Compressor automatically stops above this outdoor temperature.

Table 34 - 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
ACE-45	68.0	61.1	66.4	59.7	63.5	57.4	59.3	56.7
ACE-55	72.4	66.8	71.1	64.8	68.0	62.9	64.6	61.1
ACE-65	70.3	62.9	65.9	60.5	62.2	58.1	56.6	54.0
ACE-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 35 - Indoor Unit Sound (dBA)*

MODEL	1 ft distance	3 ft distance
ATF-45	58.4	56.6
ATF-55	60.7	59.8
ATF-65	61.4	59.7
ATF-75	65.5	64.8

* With all doors installed.

Pressure Drop Data

Table 36: Hydronic Loop Pressure Drop Data		Water 104°F							
		ATF-45		ATF-55		ATF-65		ATF-75	
gpm	L/s	psi	kPa	psi	kPa	psi	kPa	psi	kPa
5	0.32	1.1	7.6						
6	0.38	1.6	11	1.1	7.6	1.1	7.6	1.1	7.6
7	0.44	1.9	13	1.5	10	1.5	10	1.4	10
8	0.50	2.6	18	1.8	12	1.8	12	1.8	12
9	0.57	3.2	22	2.2	15	2.2	15	2.1	14
10	0.63	3.8	26	2.7	19	2.7	19	2.4	17
11	0.69	4.3	30	2.8	19	2.8	19	2.9	20
12	0.76	5.2	36	3.4	23	3.4	23	3.6	25
13	0.82	5.9	41	4	28	4	28	4.1	28
14	0.88	6.7	46	4.7	32	4.7	32	4.7	32
15	0.95	8.0	55	5.6	39	5.6	39	5.5	38
16	1.01			6.1	42	6.1	42	6.3	43

Standard Capacity Ratings

Standard CSA C656 (ARI 210-240).

< Preliminary >

Table 37 - Standard Capacity Ratings - Air Heating 60 Hz															
Indoor Air 70°F (21°C) db / 60°F (15.6°C) wb				H12 - Outdoor Air 47°F (8.3°C)			H22 - Outdoor Air 35°F (1.7°C)			H32 - Outdoor Air 17°F (-8.3°C)					
Model	Indoor Airflow		Stage	Input Energy	Capacity		COP _H	Input Energy	Capacity		COP _H	Input Energy	Capacity		COP _H
	cfm	L/s		Watts	Btu/hr	kW	W/W	Watts	Btu/hr	kW	W/W	Watts	Btu/hr	kW	W/W
45	1200	566	2	2,237	30,000	8.8	3.93	2,140	24,600	6.0	3.37	2,002	17,900	5.2	2.62
55	1500	708	2	3,013	40,200	11.8	3.91	2,868	32,600	8.0	3.33	2,649	23,500	6.9	2.60
65	1900	897	2	3,820	51,100	15.0	3.92	3,639	41,400	10.1	3.33	3,383	29,900	8.8	2.59
75	2100	991	2	4,392	58,600	17.2	3.91	4,269	48,200	12.0	3.31	4,092	35,600	10.4	2.55

Table 38 - Standard Capacity Ratings - Air Cooling 60 Hz															
Indoor Air 80°F (26.7°C) DB / 67°F (19.0°C) WB / 50% RH				B2 - Outdoor Air 82°F (27.8°C)				A2 - Outdoor Air 95°F (35°C)							
Model	Indoor Airflow		Stage	Input Energy	Capacity		EER	COP _C	Input Energy	Capacity		EER	COP _C		
	cfm	L/s		Watts	Btu/hr	kW	Btu/W-hr	W/W	Watts	Btu/hr	kW	Btu/W-hr	W/W		
45	1200	566	2	2,132	32,400	9.5	15.2	4.45	2,517	30,200	8.9	12.0	3.52		
55	1500	708	2	2,768	41,800	12.3	15.1	4.43	3,314	39,100	11.5	11.8	3.46		
65	1900	897	2	3,507	52,600	15.4	15.0	4.40	4,178	49,300	14.4	11.8	3.46		
75	2100	991	2	4,142	61,300	18.0	14.8	4.34	4,872	57,000	16.7	11.7	3.43		

Table 39 - Standard Capacity Ratings - Hydronic Heating 60 Hz																	
Indoor Loop ELT 104°F (40°C)				H12 - Outdoor Air 47°F (8.3°C)			H22 - Outdoor Air 35°F (1.7°C)			H32- Outdoor Air 17°F (-8.3°C)							
Model	Indoor Liquid Flow		Pressure Drop	Stage	Input Energy	Capacity		COP _H	Input Energy	Capacity		COP _H	Input Energy	Capacity		COP _H	
	gpm	L/s			Watts	Btu/hr	kW	W/W	Watts	Btu/hr	kW	W/W	Watts	Btu/hr	kW	W/W	
45	10.0	0.63	3.8	26	2	2,087	30,900	9.1	4.34	2,252	26,200	7.7	3.41	2,488	20,800	6.1	2.45
55	12.0	0.76	3.4	23	2	2,802	41,200	12.1	4.31	3,006	34,700	10.2	3.38	3,294	27,200	8.0	2.42
65	14.0	0.88	4.7	32	2	3,533	51,600	15.1	4.28	3,798	43,600	12.8	3.36	4,201	34,400	10.1	2.40
75	16.0	1.0	3.8	26	2	4,048	59,400	17.4	4.30	4,335	50,100	14.7	3.39	4,767	39,200	11.5	2.41

Air Heating/Cooling Performance

ATF-45-HACW-X-1T

R454b, 60 Hz, YAS30K1E-PFV

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air)								
HEATING	Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Cond. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	Heating (Btu/hr)	COP _H	
	-5°F	-16	6,400	6.7	180	1,847		88	1200	79	9	12,100	1.92	
	5°F	-8	8,500	6.9	180	1,916		92	1200	81	11	14,400	2.20	
	15°F	1	11,100	7.2	180	1,988		96	1200	83	13	17,200	2.54	
	25°F	9	14,200	7.5	180	2,062		100	1200	86	16	20,600	2.93	
	35°F	17	17,900	7.9	180	2,140		104	1200	89	19	24,600	3.37	
	45°F	26	22,100	8.3	180	2,221		108	1200	92	22	29,000	3.83	
	55°F	34	27,000	8.7	180	2,305		112	1200	96	26	34,200	4.35	
	65°F	42	32,600	9.1	180	2,392		116	1200	101	31	40,100	4.91	

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air @ 50% RH)									
COOLING	Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Evap. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	Latent (Btu/hr)	Sensible (Btu/hr)	Cooling (Btu/hr)	EER
	50°F	87	41,300	4.8	225	1,463		47	1200	61	-19	13,100	24,000	37,100	25.4
	60°F	96	40,500	5.6	225	1,637		49	1200	62	-18	12,100	23,600	35,700	21.8
	70°F	105	39,800	6.4	225	1,840		51	1200	62	-18	11,300	23,000	34,300	18.6
	80°F	115	39,000	7.5	225	2,080		52	1200	63	-17	10,400	22,300	32,700	15.7
	90°F	124	38,400	8.7	225	2,359		54	1200	63	-17	9,500	21,600	31,100	13.2
	100°F	133	37,700	10.2	225	2,687		55	1200	64	-16	8,600	20,700	29,300	10.9
	110°F	142	37,100	11.9	225	3,070		57	1200	65	-15	7,800	19,600	27,400	8.9
	120°F	151	36,500	13.9	225	3,521		58	1200	66	-14	6,900	18,400	25,300	7.2

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air)								
HEATING	Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (kW)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Cond. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	Heating (kW)	COP _H	
	-21°C	-26.7	1.9	6.7	180	1,847		30.9	566	26.3	5.2	3.6	1.92	
	-15°C	-22.1	2.5	6.9	180	1,916		33.2	566	27.3	6.2	4.2	2.20	
	-9°C	-17.4	3.3	7.2	180	1,988		35.4	566	28.5	7.4	5.0	2.54	
	-4°C	-12.8	4.2	7.5	180	2,062		37.6	566	29.9	8.8	6.0	2.93	
	2°C	-8.2	5.3	7.9	180	2,140		39.8	566	31.7	10.6	7.2	3.37	
	7°C	-3.6	6.5	8.3	180	2,221		42.1	566	33.5	12.4	8.5	3.83	
	13°C	1.1	7.9	8.7	180	2,305		44.3	566	35.8	14.7	10.0	4.35	
	18°C	5.7	9.6	9.1	180	2,392		46.5	566	38.3	17.2	11.8	4.91	

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air @ 50% RH)									
COOLING	Outdoor Air Temperature	Condensing Temperature	Heat Rejected (kW)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Evap. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	Latent (kW)	Sensible (kW)	Cooling (kW)	COP _C
	10°C	30.4	12.1	4.8	225	1,463		8.6	566	16.4	-10.3	3.8	7.0	10.9	7.44
	16°C	35.6	11.9	5.6	225	1,637		9.4	566	16.6	-10.1	3.6	6.9	10.5	6.39
	21°C	40.7	11.7	6.4	225	1,840		10.3	566	16.8	-9.9	3.3	6.7	10.1	5.45
	27°C	45.8	11.4	7.5	225	2,080		11.1	566	17.1	-9.6	3.1	6.5	9.6	4.60
	32°C	50.9	11.3	8.7	225	2,359		11.9	566	17.4	-9.3	2.8	6.3	9.1	3.87
	38°C	56.1	11.0	10.2	225	2,687		12.8	566	17.8	-8.9	2.5	6.1	8.6	3.19
	43°C	61.2	10.9	11.9	225	3,070		13.7	566	18.3	-8.4	2.3	5.7	8.0	2.61
	49°C	66.3	10.7	13.9	225	3,521		14.5	566	18.8	-7.9	2.0	5.4	7.4	2.11

Hydronic Performance

ATF-45-HACW-X-1T

R454b, 60 Hz, YAS30K1E-PFV

OUTDOOR LOOP (Air)			ELECTRICAL		INDOOR LOOP (Water)						
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP _H
-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	LLT is limited to 105°F at these outdoor temperatures		
5°F	-	-	-	-	-	-			4.1	20,200	1.97
15°F	2	10,600	12.6	3,003	116	124			4.6	22,700	2.33
25°F	11	13,600	11.9	2,859	115	123			5.2	25,600	2.77
35°F	19	17,000	11.2	2,706	115	123			5.9	29,100	3.34
45°F	28	21,000	10.5	2,550	114	123			6.7	33,100	4.06
55°F	36	25,600	9.8	2,388	113	122			7.6	37,800	4.98
65°F	45	30,900	9.1	2,226	112	122					

METRIC

OUTDOOR LOOP (Air)			ELECTRICAL		INDOOR LOOP (Water)						
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (kW)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	Heating (kW)	COP _H
-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	LLT is limited to 40.5°C at these outdoor temperatures		
-15°C	-	-	-	-	-	-			2.3	5.9	1.97
-9°C	-16.7	3.1	12.6	3,003	46.6	50.8			2.6	6.7	2.33
-4°C	-11.9	4.0	11.9	2,859	46.3	50.7			2.9	7.5	2.77
2°C	-7.2	5.0	11.2	2,706	46.0	50.5			3.3	8.5	3.34
7°C	-2.5	6.2	10.5	2,550	45.6	50.4			3.7	9.7	4.06
13°C	2.2	7.5	9.8	2,388	45.2	50.2			4.2	11.1	4.98
18°C	6.9	9.1	9.1	2,226	44.7	50.1					

Air Heating/Cooling Performance

ATF-55-HACW-X-1T

R454b, 60 Hz, YAS40K1E-PFV

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air)						
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Cond. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	Heating (Btu/hr)	COP _H
HEATING	-5°F	-16	8,700	8.5	210	70°F	88	1500	80	10	15,800	1.97
	5°F	-8	11,300	9.2	210		92	1500	82	12	18,900	2.22
	15°F	1	14,600	9.8	210		96	1500	84	14	22,700	2.54
	25°F	9	18,700	10.3	210		100	1500	87	17	27,200	2.90
	35°F	17	23,700	10.9	210		103	1500	90	20	32,600	3.33
	45°F	26	29,500	11.4	210		107	1500	94	24	38,800	3.80
	55°F	34	36,400	11.9	210		111	1500	99	29	46,100	4.34
	65°F	42	44,100	12.5	210		115	1500	104	34	54,300	4.92

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air @ 50% RH)								
Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Evap. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	Latent (Btu/hr)	Sensible (Btu/hr)	Cooling (Btu/hr)	EER
COOLING	50°F	87	52,700	6.3	265	80°F	48	1500	61	-19	16,500	30,800	47,300	25.5
	60°F	96	51,900	7.3	265		49	1500	61	-19	15,300	30,400	45,700	22.0
	70°F	105	51,200	8.5	265		51	1500	61	-19	14,000	30,100	44,100	18.7
	80°F	114	50,500	9.9	265		52	1500	62	-18	12,800	29,400	42,200	15.7
	90°F	124	49,700	11.5	265		54	1500	62	-18	11,500	28,600	40,100	13.0
	100°F	133	49,200	13.4	265		55	1500	63	-17	10,300	27,700	38,000	10.7
	110°F	142	48,700	15.8	265		57	1500	64	-16	9,200	26,500	35,700	8.8
	120°F	151	48,200	18.7	265		58	1500	65	-16	8,000	25,100	33,100	7.1

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air)						
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (kW)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Cond. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	Heating (kW)	COP _H
HEATING	-21°C	-26.7	2.6	8.5	210	21°C	30.9	708	26.5	5.4	4.6	1.97
	-15°C	-22.1	3.3	9.2	210		33.1	708	27.6	6.5	5.5	2.22
	-9°C	-17.5	4.3	9.8	210		35.3	708	28.9	7.8	6.7	2.54
	-4°C	-12.8	5.5	10.3	210		37.5	708	30.4	9.3	8.0	2.90
	2°C	-8.2	7.0	10.9	210		39.7	708	32.3	11.2	9.6	3.33
	7°C	-3.6	8.6	11.4	210		41.9	708	34.4	13.3	11.4	3.80
	13°C	1.1	10.7	11.9	210		44.1	708	36.9	15.8	13.5	4.34
	18°C	5.7	12.9	12.5	210		46.3	708	39.7	18.6	15.9	4.92

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air @ 50% RH)								
Outdoor Air Temperature	Condensing Temperature	Heat Rejected (kW)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Evap. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	Latent (kW)	Sensible (kW)	Cooling (kW)	COP _C
COOLING	10°C	30.3	15.4	6.3	265	27°C	8.7	708	16.1	-10.6	4.8	9.0	13.9	7.47
	16°C	35.4	15.2	7.3	265		9.5	708	16.3	-10.4	4.5	8.9	13.4	6.45
	21°C	40.6	15.0	8.5	265		10.4	708	16.4	-10.3	4.1	8.8	12.9	5.48
	27°C	45.7	14.8	9.9	265		11.2	708	16.6	-10.1	3.8	8.6	12.4	4.60
	32°C	50.8	14.6	11.5	265		12.1	708	16.9	-9.8	3.4	8.4	11.8	3.81
	38°C	55.9	14.4	13.4	265		12.9	708	17.2	-9.5	3.0	8.1	11.1	3.14
	43°C	61.1	14.3	15.8	265		13.8	708	17.6	-9.1	2.7	7.8	10.5	2.58
	49°C	66.2	14.1	18.7	265		14.6	708	18.1	-8.6	2.3	7.4	9.7	2.08

Hydronic Performance

ATF-55-HACW-X-1T

R454b, 60 Hz, YAS40K1E-PFV

OUTDOOR LOOP (Air)			ELECTRICAL		INDOOR LOOP (Water)						
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP _H
-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	-	-	-	-	-	-			4.4	26,200	1.97
15°F	2	13,800	16.9	3,899	116	124			5.0	29,500	2.31
25°F	10	17,600	15.8	3,748	115	123			5.6	33,500	2.75
35°F	19	22,200	14.8	3,575	114	123			6.5	38,500	3.32
45°F	27	27,800	13.9	3,394	114	123			7.5	44,400	4.06
55°F	36	34,400	13.1	3,204	113	123			8.7	51,400	4.99

HEATING

METRIC

OUTDOOR LOOP (Air)			ELECTRICAL		INDOOR LOOP (Water)						
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (kW)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	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	-	-	-	-	-	-			2.4	7.7	1.97
-9°C	-16.7	4.0	16.9	3,899	46.4	50.9			2.8	8.7	2.31
-4°C	-12.0	5.2	15.8	3,748	46.1	50.8			3.1	9.8	2.75
2°C	-7.3	6.5	14.8	3,575	45.8	50.6			3.6	11.3	3.32
7°C	-2.6	8.1	13.9	3,394	45.3	50.5			4.2	13.0	4.06
13°C	2.2	10.1	13.1	3,204	44.7	50.3			4.8	15.1	4.99
18°C	6.9	12.3	12.3	3,019	44.1	50.2					

Air Heating/Cooling Performance

ATF-65-HACW-X-1T

R454b, 60 Hz, YAS51K1E-PFV

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air)							
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Cond. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	Heating (Btu/hr)	COP _H	
HEATING	-5°F	-16	10,600	11.9	300	3,093	70°F	88	1900	80	10	20,100	1.90
	5°F	-8	14,100	12.5	300	3,220		91	1900	82	12	24,000	2.18
	15°F	1	18,400	13.1	300	3,356		95	1900	84	14	28,800	2.52
	25°F	9	23,800	13.7	300	3,497		99	1900	87	17	34,600	2.90
	35°F	17	30,100	14.4	300	3,639		103	1900	90	20	41,400	3.33
	45°F	26	37,500	15.1	300	3,790		107	1900	94	24	49,300	3.81
	55°F	34	46,200	15.8	300	3,945		111	1900	99	29	58,600	4.35
	65°F	42	56,000	16.5	300	4,100		115	1900	104	34	68,900	4.93

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air @ 50% RH)									
Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Evap. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	Latent (Btu/hr)	Sensible (Btu/hr)	Cooling (Btu/hr)	EER	
COOLING	50°F	87	66,000	7.9	375	2,331	80°F	47	1900	62	-19	21,300	38,000	59,300	25.4
	60°F	96	65,100	9.3	375	2,644		49	1900	62	-18	19,700	37,700	57,400	21.7
	70°F	105	64,400	11.0	375	3,001		51	1900	62	-18	18,200	37,200	55,400	18.5
	80°F	115	63,500	12.9	375	3,417		52	1900	62	-18	16,600	36,500	53,100	15.5
	90°F	124	62,600	15.1	375	3,903		54	1900	63	-17	15,100	35,500	50,600	13.0
	100°F	133	62,000	17.6	375	4,478		55	1900	63	-17	13,500	34,500	48,000	10.7
	110°F	142	61,400	20.5	375	5,161		57	1900	64	-16	12,000	33,100	45,100	8.7
	120°F	151	61,000	23.8	375	5,981		58	1900	65	-15	10,600	31,300	41,900	7.0

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air)							
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (kW)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Cond. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	Heating (kW)	COP _H	
HEATING	-21°C	-26.7	3.1	11.9	300	3,093	21°C	30.8	900	26.5	5.4	5.9	1.90
	-15°C	-22.1	4.1	12.5	300	3,220		33.0	900	27.6	6.5	7.0	2.18
	-9°C	-17.5	5.4	13.1	300	3,356		35.2	900	28.9	7.8	8.4	2.52
	-4°C	-12.8	7.0	13.7	300	3,497		37.4	900	30.5	9.4	10.1	2.90
	2°C	-8.2	8.8	14.4	300	3,639		39.6	900	32.3	11.2	12.1	3.33
	7°C	-3.6	11.0	15.1	300	3,790		41.8	900	34.4	13.3	14.4	3.81
	13°C	1.1	13.5	15.8	300	3,945		44.1	900	37.0	15.9	17.2	4.35
	18°C	5.7	16.4	16.5	300	4,100		46.2	900	39.8	18.7	20.2	4.93

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air @ 50% RH)									
Outdoor Air Temperature	Condensing Temperature	Heat Rejected (kW)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Evap. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	Latent (kW)	Sensible (kW)	Cooling (kW)	COP _C	
COOLING	10°C	30.4	19.3	7.9	375	2,331	27°C	8.6	900	16.4	-10.3	6.2	11.1	HAB	7.44
	16°C	35.6	19.1	9.3	375	2,644		9.4	900	16.5	-10.2	5.8	11.0	17.4	6.36
	21°C	40.7	18.9	11.0	375	3,001		10.3	900	16.6	-10.1	5.3	10.9	16.8	5.42
	27°C	45.8	18.6	12.9	375	3,417		11.1	900	16.8	-9.9	4.9	10.7	16.2	4.54
	32°C	50.9	18.3	15.1	375	3,903		11.9	900	17.1	-9.6	4.4	10.4	15.6	3.81
	38°C	56.1	18.2	17.6	375	4,478		12.8	900	17.4	-9.3	4.0	10.1	14.8	3.14
	43°C	61.2	18.0	20.5	375	5,161		13.7	900	17.8	-8.9	3.5	9.7	14.1	2.55
	49°C	66.3	17.9	23.8	375	5,981		14.5	900	18.2	-8.5	3.1	9.2	13.2	2.05

Hydronic Performance

ATF-65-HACW-X-1T

R454b, 60 Hz, YAS51K1E-PFV

HEATING	OUTDOOR LOOP (Air)			ELECTRICAL		INDOOR LOOP (Water)						
	Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP _H
	-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			-	-	-	-	-			4.8	33,100	1.95
15°F			2	17,200	21.9	4,979	115			5.4	37,100	2.29
25°F			11	22,000	20.8	4,742	115			6.1	42,100	2.73
35°F			19	27,800	19.7	4,513	114			7.0	48,400	3.30
45°F			28	34,800	18.7	4,293	113			8.0	55,700	4.01
55°F			36	42,900	17.7	4,071	112			9.3	64,400	4.90
65°F			45	52,400	16.6	3,849	111					

METRIC

HEATING (METRIC)	OUTDOOR LOOP (Air)			ELECTRICAL		INDOOR LOOP (Water)						
	Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (kW)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	Heating (kW)	COP _H
	-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			-	-	-	-	-			2.7	9.7	1.95
-9°C			-16.6	5.0	21.9	4,979	46.2			3.0	10.9	2.29
-4°C			-11.9	6.4	20.8	4,742	45.9			3.4	12.3	2.73
2°C			-7.2	8.1	19.7	4,513	45.5			3.9	14.2	3.30
7°C			-2.4	10.2	18.7	4,293	45.0			4.4	16.3	4.01
13°C			2.3	12.6	17.7	4,071	44.4			5.2	18.9	4.90
18°C			7.0	15.4	16.6	3,849	43.7					

Air Heating/Cooling Performance

ATF-75-HACW-X-1T

R454b, 60 Hz, YAS60K1E-PFV

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air)							
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Cond. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	Heating (Btu/hr)	COP _H	
HEATING	-5°F	-16	12,300	14.6	460	3,925	70°F	87	2100	81	11	24,400	1.82
	5°F	-8	16,700	14.9	460	3,991		91	2100	83	13	29,000	2.13
	15°F	0	21,800	15.3	460	4,073		95	2100	85	15	34,400	2.48
	25°F	9	27,900	15.7	460	4,168		99	2100	88	18	40,800	2.87
	35°F	17	34,900	16.1	460	4,269		103	2100	91	21	48,200	3.31
	45°F	25	43,100	16.5	460	4,372		107	2100	95	25	56,700	3.80
	55°F	34	52,600	17.0	460	4,472		111	2100	99	29	66,600	4.36
	65°F	42	63,300	17.3	460	4,565		115	2100	104	34	77,600	4.98

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air @ 50% RH)									
Outdoor Air Temperature	Condensing Temperature	Heat Rejected (Btu/hr)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Evap. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	Latent (Btu/hr)	Sensible (Btu/hr)	Cooling (Btu/hr)	EER	
COOLING	50°F	87	78,200	9.4	550	2,887	80°F	47	2100	60	-20	24,900	45,300	70,200	24.3
	60°F	96	76,800	10.7	550	3,210		49	2100	60	-20	23,000	44,700	67,700	21.1
	70°F	105	75,400	12.4	550	3,591		50	2100	61	-19	21,000	44,000	65,000	18.1
	80°F	115	73,800	14.5	550	4,044		52	2100	61	-19	19,100	42,800	61,900	15.3
	90°F	124	72,400	16.9	550	4,574		53	2100	62	-18	17,200	41,500	58,700	12.8
	100°F	133	71,100	19.6	550	5,194		55	2100	62	-18	15,300	40,000	55,300	10.6
	110°F	142	70,000	22.7	550	5,919		56	2100	63	-17	13,500	38,200	51,700	8.7
	120°F	152	69,200	26.1	550	6,769		58	2100	64	-16	11,900	36,100	48,000	7.1

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air)							
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (kW)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Cond. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	Heating (kW)	COP _H	
HEATING	-21°C	-26.8	3.6	14.6	460	3,925	21°C	30.7	990	27.1	6.0	7.2	1.82
	-15°C	-22.2	4.9	14.9	460	3,991		32.9	990	28.2	7.1	8.5	2.13
	-9°C	-17.6	6.4	15.3	460	4,073		35.1	990	29.5	8.4	10.1	2.48
	-4°C	-12.9	8.2	15.7	460	4,168		37.3	990	31.1	10.0	12.0	2.87
	2°C	-8.3	10.2	16.1	460	4,269		39.6	990	32.9	11.8	14.1	3.31
	7°C	-3.7	12.6	16.5	460	4,372		41.8	990	35.0	13.9	16.6	3.80
	13°C	1.0	15.4	17.0	460	4,472		44.0	990	37.4	16.3	19.5	4.36
	18°C	5.6	18.6	17.3	460	4,565		46.2	990	40.1	19.0	22.7	4.98

OUTDOOR LOOP (Air)			ELECTRICAL			INDOOR LOOP (Air @ 50% RH)									
Outdoor Air Temperature	Condensing Temperature	Heat Rejected (kW)	Compressor Current (A)	Fan (W)	Input Power (W)	EAT	Evap. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	Latent (kW)	Sensible (kW)	Cooling (kW)	COP _C	
COOLING	10°C	30.6	22.9	9.4	550	2,887	27°C	8.4	990	15.6	-11.1	7.3	13.3	20.6	7.12
	16°C	35.7	22.5	10.7	550	3,210		9.3	990	15.8	-10.9	6.7	13.1	19.8	6.18
	21°C	40.8	22.1	12.4	550	3,591		10.2	990	15.9	-10.8	6.2	12.9	19.0	5.30
	27°C	45.9	21.6	14.5	550	4,044		11.0	990	16.2	-10.5	5.6	12.5	18.1	4.48
	32°C	51.1	21.2	16.9	550	4,574		11.8	990	16.5	-10.2	5.0	12.2	17.2	3.75
	38°C	56.2	20.8	19.6	550	5,194		12.7	990	16.9	-9.8	4.5	11.7	16.2	3.11
	43°C	61.3	20.5	22.7	550	5,919		13.6	990	17.4	-9.3	4.0	11.2	15.2	2.55
	49°C	66.4	20.3	26.1	550	6,769		14.4	990	17.9	-8.8	3.5	10.6	14.1	2.08

Hydronic Performance

ATF-75-HACW-X-1T

R454b, 60 Hz, YAS60K1E-PFV

OUTDOOR LOOP (Air)			ELECTRICAL		INDOOR LOOP (Water)						
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (Btu/hr)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (gpm)	LLT	Delta T	Heating (Btu/hr)	COP _H
-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	-	-	-	-	-	-			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

METRIC

OUTDOOR LOOP (Air)			ELECTRICAL		INDOOR LOOP (Water)						
Outdoor Air Temperature	Evaporating Temperature	Heat Absorbed (kW)	Compressor Current (A)	Input Power (W)	ELT	Condensing Temperature	Liquid Flow (L/s)	LLT	Delta T	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	-	-	-	-	-	-			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

Electrical Specifications

TABLE 40 - ATF-Series (R454b) Electrical Specifications

	Code	Power Supply			Compressor		Indoor Fan	Circu-lators	Outdoor Unit	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	RLA	Max A	Max A	Amps	Amps	Amps	ga
ATF-45	1	208/230-1-60	187	253	14.6	90	3.5	3.0	1.6	23.8	27.5	40	#8-2*
	2	208-3-60	187	229	9.9	82	3.5	3.0	1.6	19.1	21.6	30	#10-3*
	4	460-3-60	414	506	4.8	44	3.5	3.0	1.6	13.7	14.9	20	#12-4
ATF-55	1	208/230-1-60	187	253	18.3	138	4.0	4.0	1.6	29.0	33.6	50	#8-2*
	2	208-3-60	187	229	11.9	112	4.0	4.0	1.6	22.6	25.6	40	#8-3*
	4	460-3-60	414	506	6.8	62	4.0	4.0	1.6	17.2	18.9	20	#12-4
ATF-65	1	208/230-1-60	187	253	25.2	147	5.5	4.0	3.0	38.8	45.1	60	#6-2*
	2	208-3-60	187	229	13.8	150	5.5	4.0	3.0	27.4	30.9	50	#8-3*
	4	460-3-60	414	506	6.9	58	5.5	4.0	3.0	20.2	21.9	30	#10-4
ATF-75	1	208/230-1-60	187	253	28.0	166	6.5	4.0	3.0	42.6	49.6	60	#6-2*
	2	208-3-60	187	229	19.2	162	6.5	4.0	3.0	33.8	38.6	50	#8-3*
	4	460-3-60	414	506	9.1	71	6.5	4.0	3.0	23.4	25.7	30	#10-4

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

TABLE 41 - Plenum Heater Electrical Specifications

Size (kW)	(230-1-60)					(208-1-60)					(208-3-60)				
	Actual (kW)	FLA (A)	MCA (A)	Breaker (A)	Wire Size	Actual (kW)	FLA (A)	MCA (A)	Breaker (A)	Wire Size	Actual (kW)	FLA (A)	MCA (A)	Breaker (A)	Wire Size
5	5	20.8	26.0	30	#10	3.8	18.1	22.6	30	#10	5	13.9	17.4	30	#10
7	7	29.2	36.5	40	#8	5.3	25.3	31.6	40	#8	7	19.5	24.3	30	#10
10	10	41.7	52.1	60	#6	7.5	36.1	45.1	50	#6	10	27.8	34.7	40	#8
15	15	62.5	78.1	80	#4	11.3	54.2	67.7	80	#4	15	41.7	52.1	60	#6
20	20	83.3	104.2	100	#3	15.0	72.2	90.3	100	#3	-	-	-	-	-

Indoor Airflow Data

TABLE 42 - Indoor Airflow Range for STAGE 2 (Full Load)

Model Size	Nominal		Range		Airflow Reduction - 20%		Airflow Reduction - 15%		Airflow Reduction - 10%		Airflow Reduction - 5%	
	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s
25	750	350	600-900	280-425	600	280	640	300	680	320	710	340
45	1150	540	900-1400	430-660	920	430	980	460	1040	490	1090	520
55	1500	710	1200-1800	570-850	1200	570	1280	600	1350	640	1430	670
65	1900	900	1500-2300	710-1090	1520	720	1620	760	1710	810	1810	850
75	2200	1040	1750-2500	830-1180	1760	830	1870	880	1980	940	2090	990

TABLE 43 - Indoor Airflow Range for STAGE 1 (Part Load)

Model Size	Nominal		Range		Airflow Reduction - 20%		Airflow Reduction - 15%		Airflow Reduction - 10%		Airflow Reduction - 5%	
	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s
25	600	280	500-700	240-330	480	230	510	240	540	250	570	270
45	900	430	700-1100	330-520	720	340	770	360	810	380	860	400
55	1200	570	950-1450	450-680	960	450	1020	480	1080	510	1140	540
65	1500	710	1200-1800	570-850	1200	570	1280	600	1350	640	1430	670
75	1750	830	1400-2100	660-990	1400	660	1490	700	1580	740	1660	790

TABLE 44 - Indoor Airflow Range for STAGE 3 (Auxiliary)

Model Size	Nominal		Range		Airflow Reduction - 20%		Airflow Reduction - 15%		Airflow Reduction - 10%		Airflow Reduction - 5%	
	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s
25	750	350	600-900	280-425	600	280	640	300	680	320	710	340
45	1150	540	900-1400	430-660	920	430	980	460	1040	490	1090	520
55	1500	710	1200-1800	570-850	1200	570	1280	600	1350	640	1430	670
65	1900	900	1700-2300	800-1090	1520	720	1620	760	1710	810	1810	850
75	2200	1040	2000-2500	940-1180	1760	830	1870	880	1980	940	2090	990

TABLE 45 - Indoor Airflow Range for Fan Recirculation

Model Size	Nominal		Range		Airflow Reduction - 20%		Airflow Reduction - 15%		Airflow Reduction - 10%		Airflow Reduction - 5%	
	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s
25	425	201	325-525	153-248	340	160	360	170	380	180	400	190
45	650	310	500-800	240-380	520	250	550	260	590	280	620	290
55	850	400	700-1000	330-470	680	320	720	340	770	360	810	380
65	1100	520	900-1300	430-610	880	420	940	440	990	470	1050	490
75	1250	590	1000-1500	470-710	1000	470	1060	500	1130	530	1190	560

TABLE 46 - Indoor Airflow Range for Emergency Heat

Model Size	cfm	L/s
25/45	1200	566
55/65/75	2000	940

Maximum external static pressure:
0.50in H₂O

To obtain the AR airflow values, use a dry contact to connect AR to 24VAC on the right side of control board.
Airflow reduction % is set through PC App.

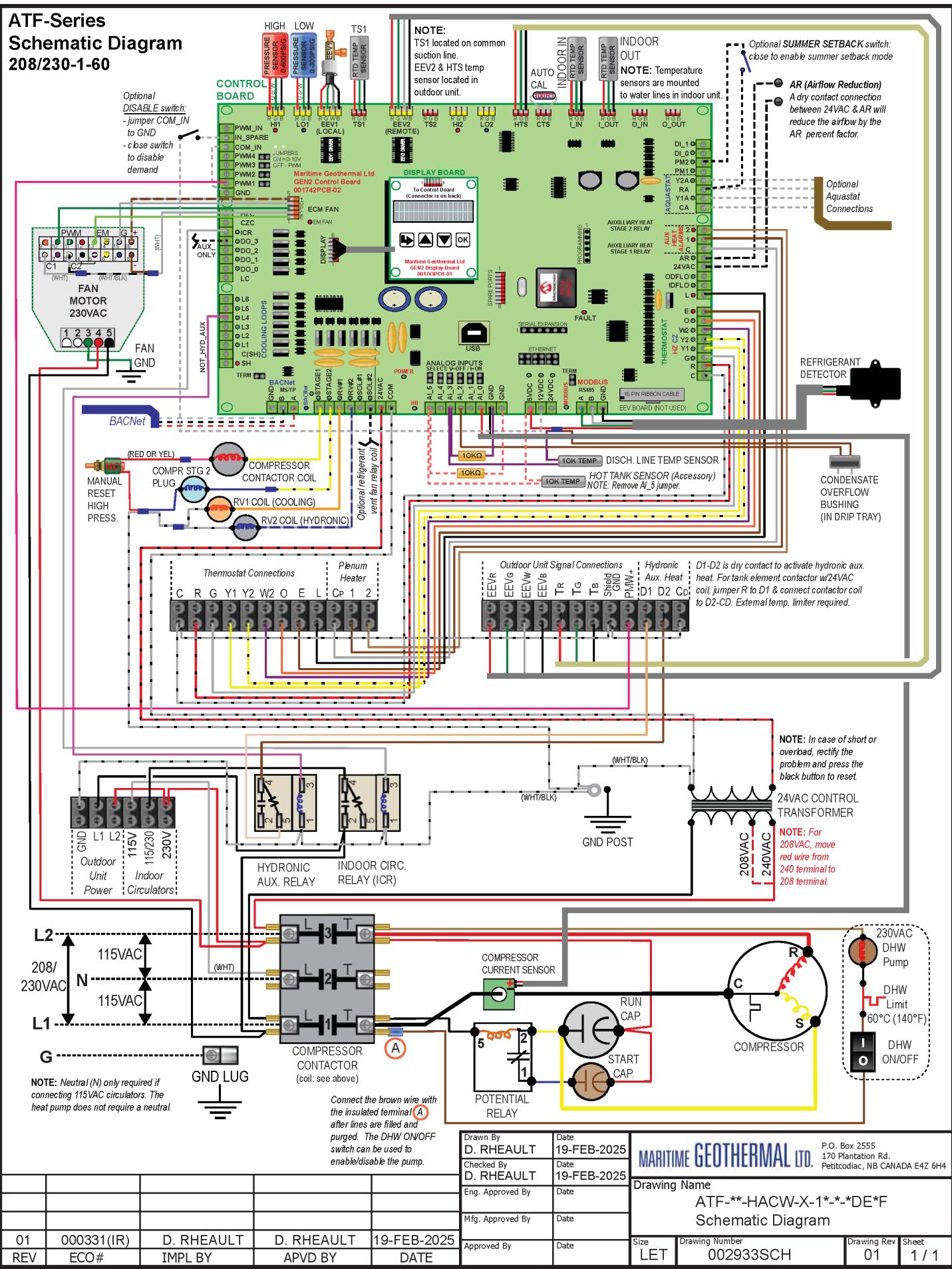
TABLE 47 - Indoor Airflow Reduction for Outdoor Temperature

Outdoor Temperature	Airflow Reduction	Airflow
> 45°F	0%	100%
30 to 45°F	-5%	95%
25 to 30°F	-10%	90%
20 to 25°F	-15%	85%
15 to 20°F	-20%	80%
10 to 15°F	-25%	75%
5 to 10°F	-30%	70%
0 to 5°F	-35%	65%
< 0°F	-40%	60%

ATF-Series

Schematic Diagram

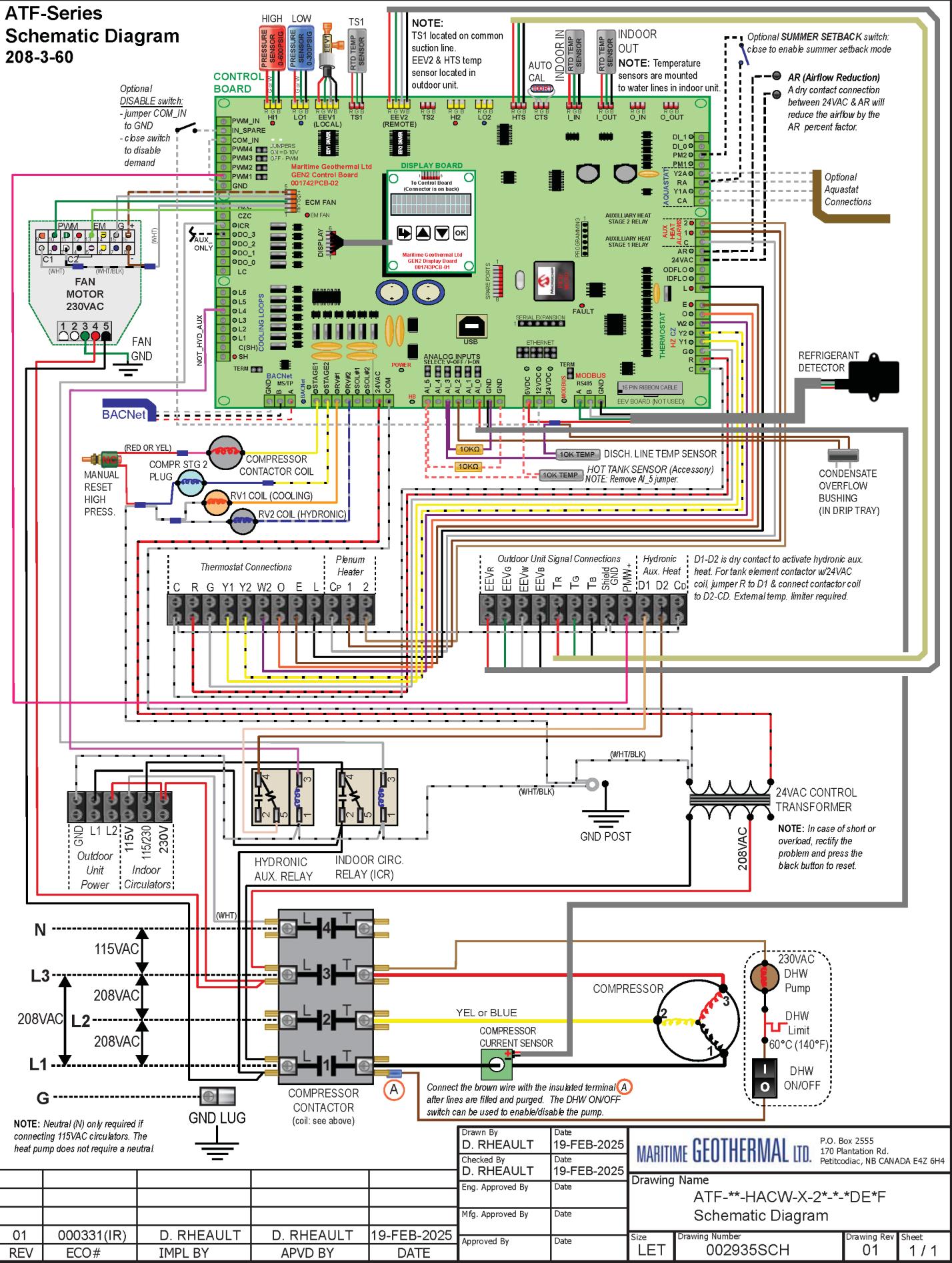
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ATF-Series

Schematic Diagram

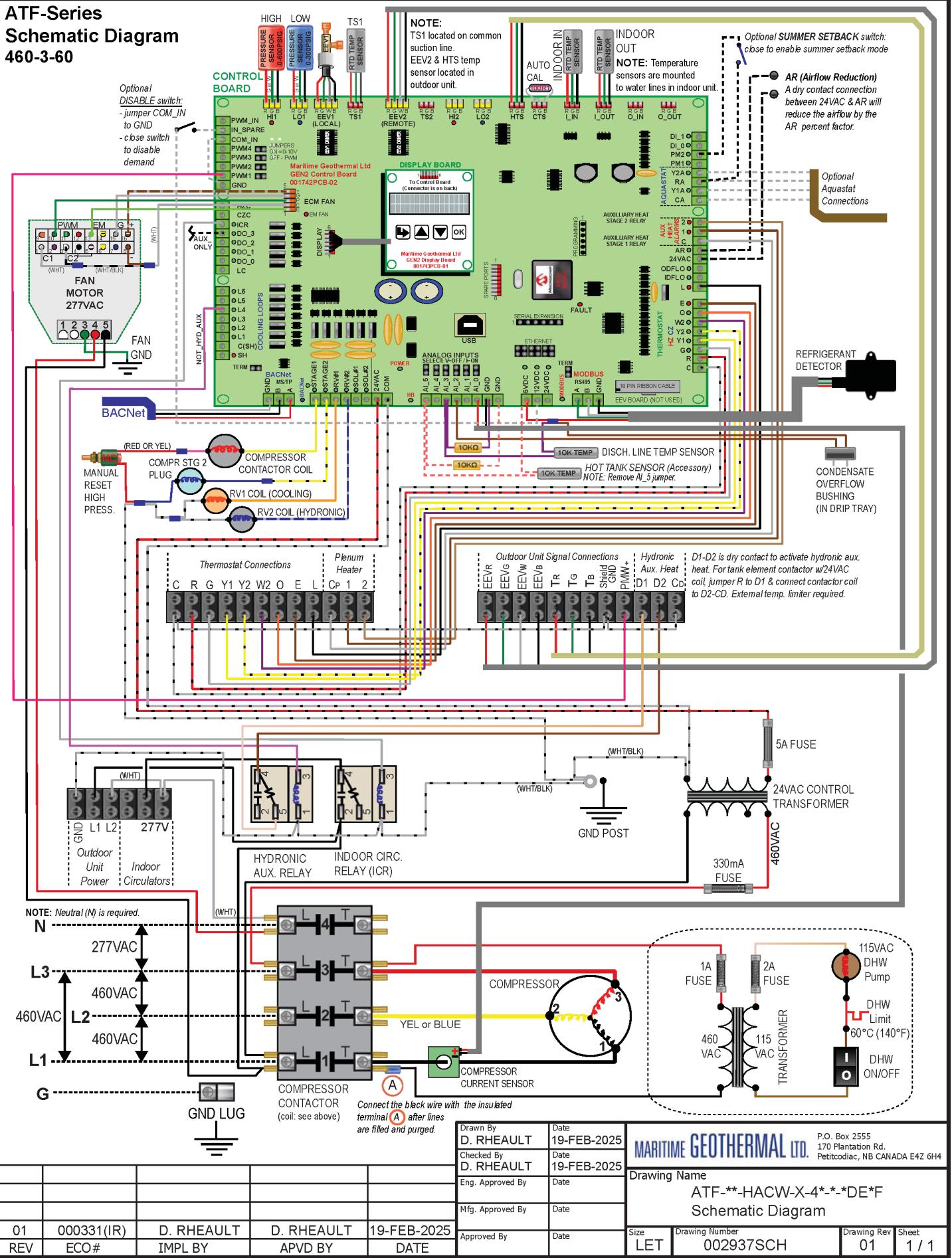
208-3-60



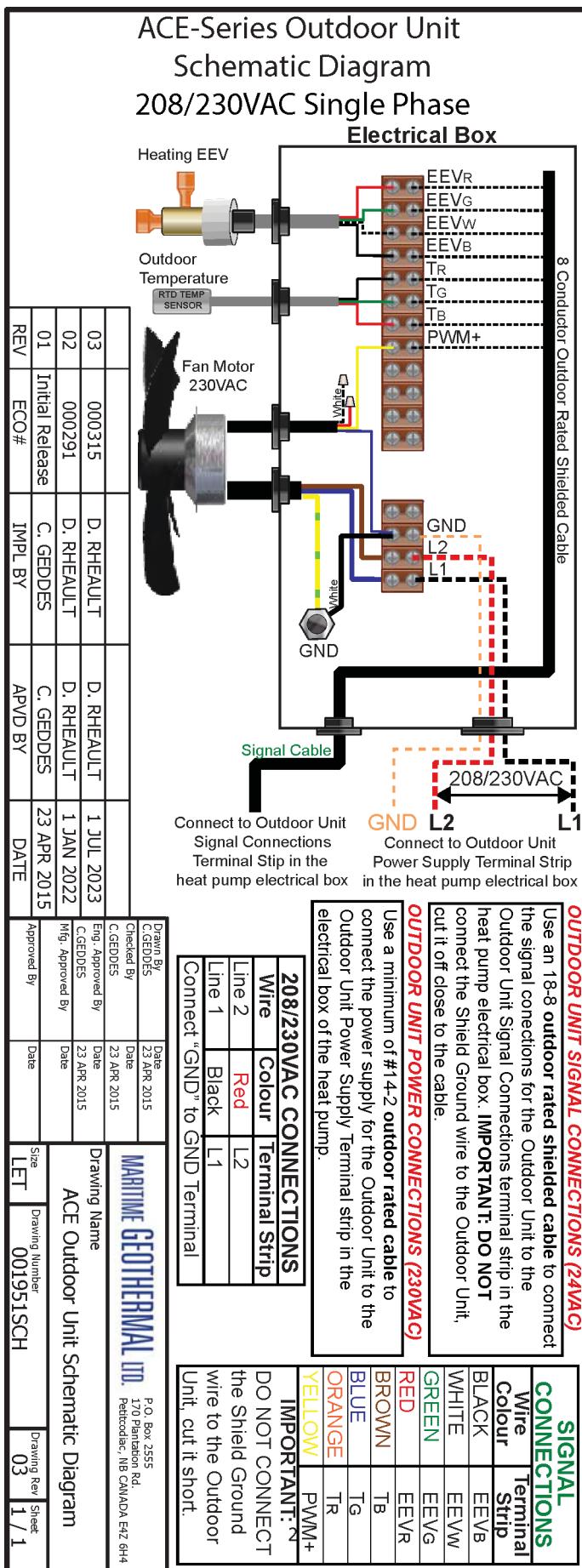
ATF-Series

Schematic Diagram

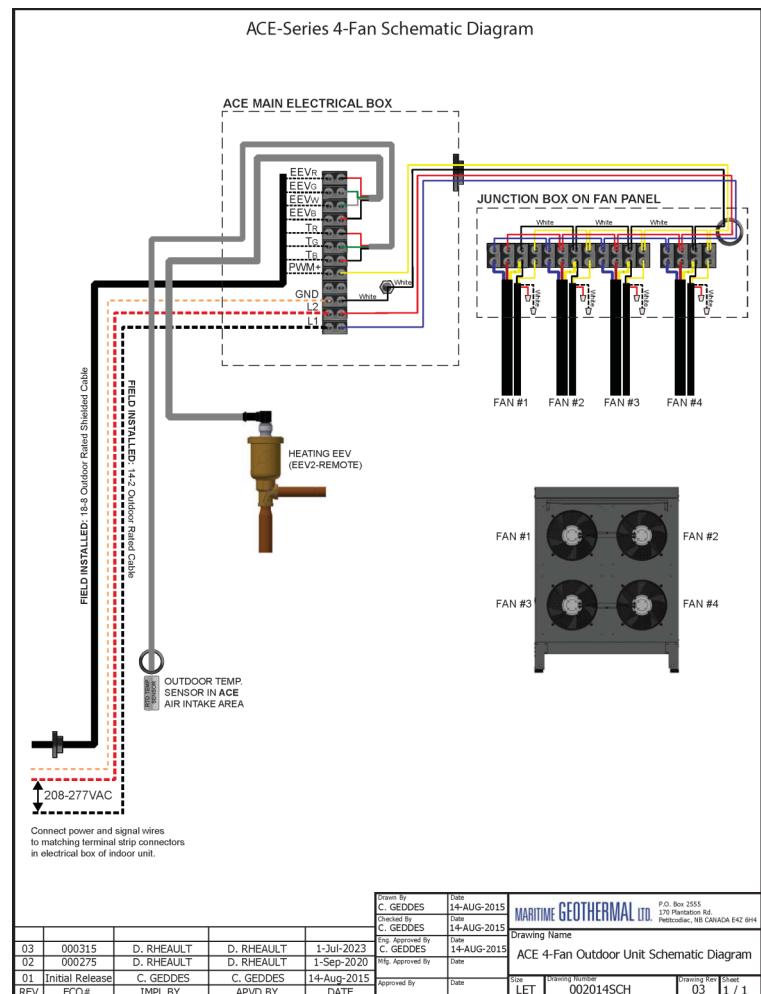
460-3-60



ACE-25/45/55 Wiring Diagram



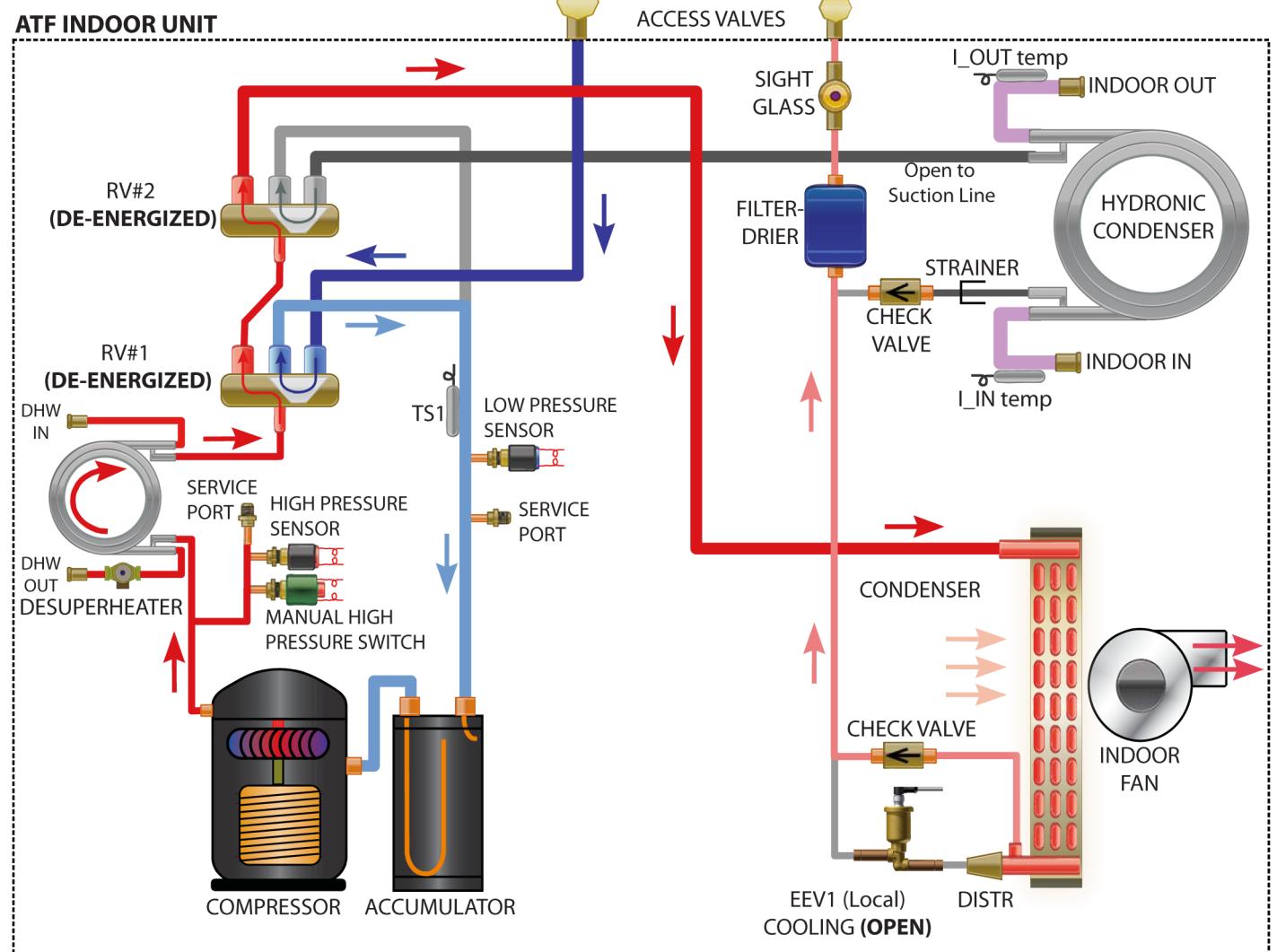
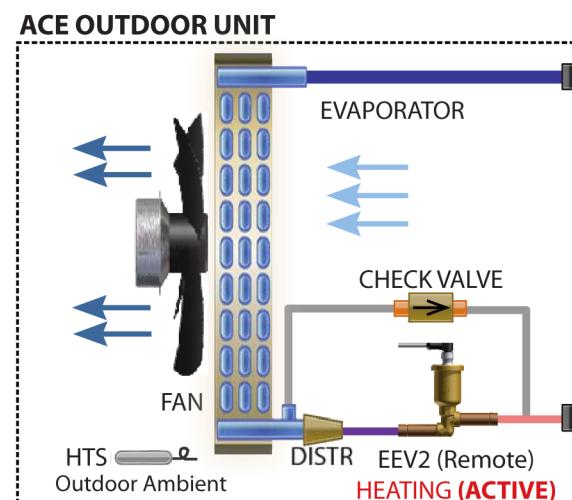
ACE-65/75 Wiring Diagram



ATF Series Refrigeration Circuit

Air Heating Mode

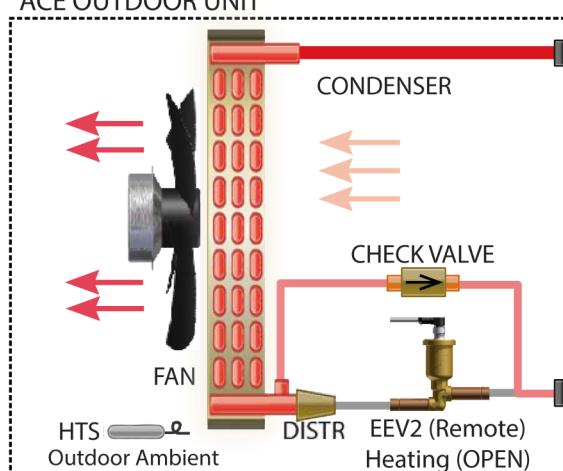
ITEM	STATUS
RV#1	DE-ENERGIZED
RV#2	DE-ENERGIZED
EEV#1	CLOSED
EEV#2	ACTIVE



Drawn By	Date	P.O. Box 2555 170 Plantation Rd. Petitcodiac, NB CANADA E4Z 6H4		
Checked By	Date			
Eng. Approved By	Date	Drawing Name ATF-Series Refrigeration Circuit Air Heating Mode		
Mfg. Approved By	Date			
Approved By	Date	Size	Drawing Number	Drawing Revision
REV	ECO#	LET	001844RCD	01
01	Initial Release	C. GEDDES	C. GEDDES	DATE
		IMPL BY	APVD BY	DATE

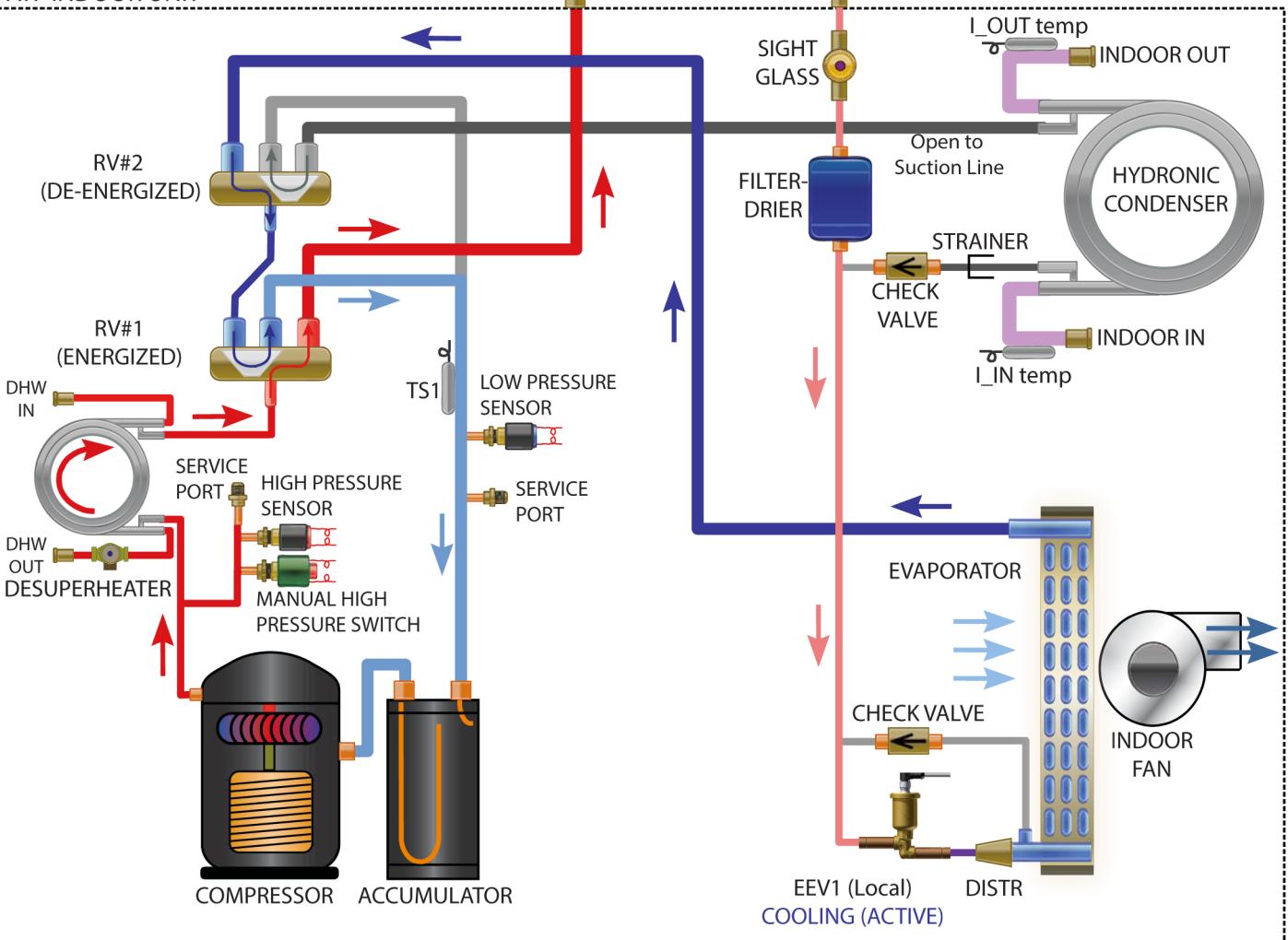
ATF Series Refrigeration Circuit

Air Cooling / Defrost Mode



ITEM	STATUS
RV#1	ENERGIZED
RV#2	DE-ENERGIZED
EEV#1	ACTIVE
EEV#2	CLOSED

ATF INDOOR UNIT

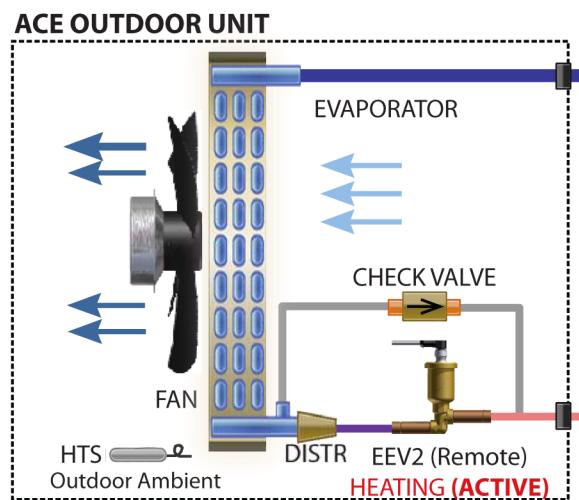


Drawn By C.GEDDES	Date 16 JUL 2014	P.O. Box 2555 170 Plantation Rd. Petitcodiac, NB CANADA E4Z 6H4	
Checked By C.GEDDES	Date 16 JUL 2014		
Eng. Approved By C.GEDDES	Date 16 JUL 2014		
Mfg. Approved By	Date		
Approved By	Date		
Size LET	Drawing Number 001845RCD	Drawing Revision 01	Sheet 1 / 1

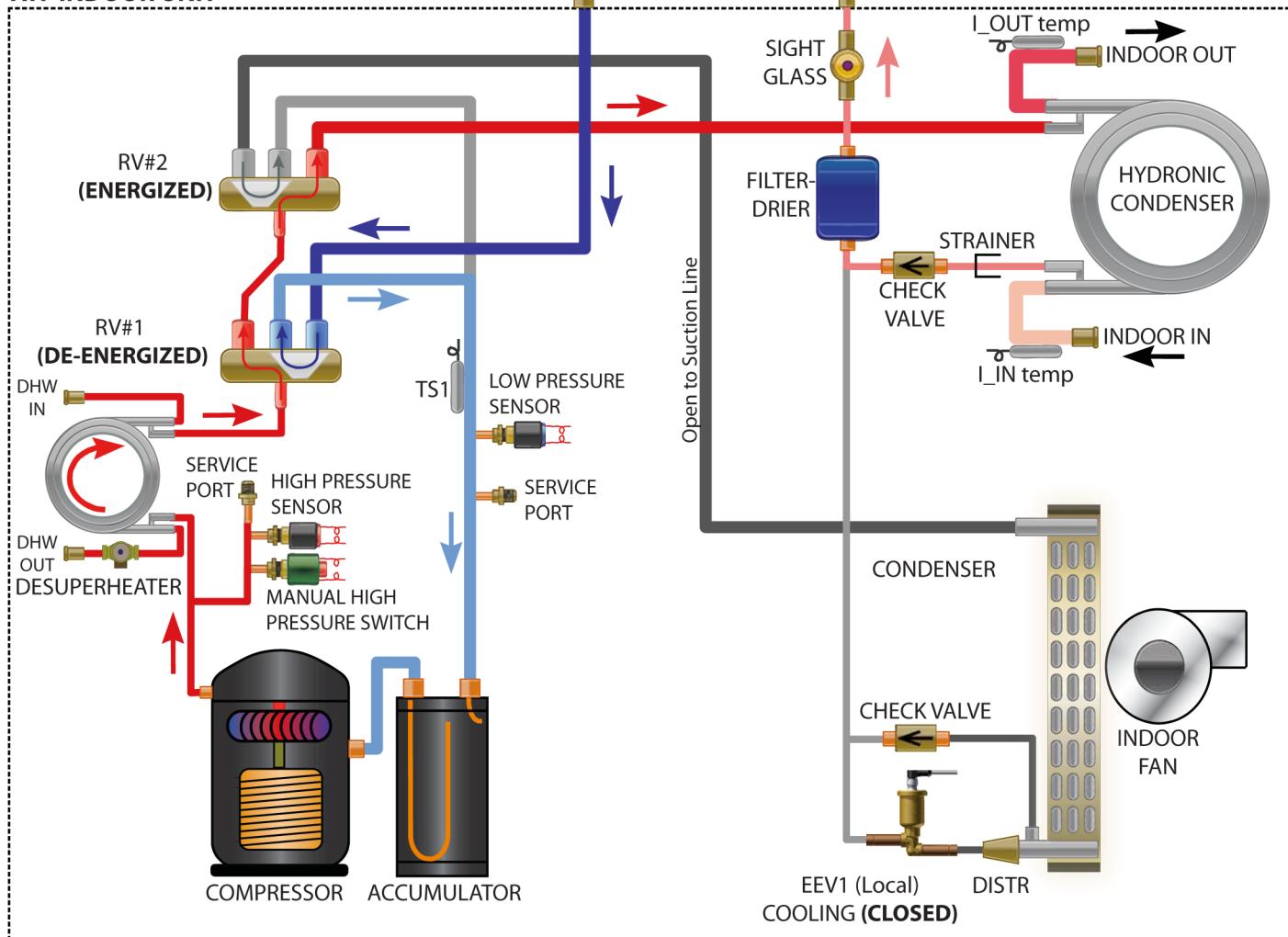
ATF Series Refrigeration Circuit

Hydronic Heating Mode

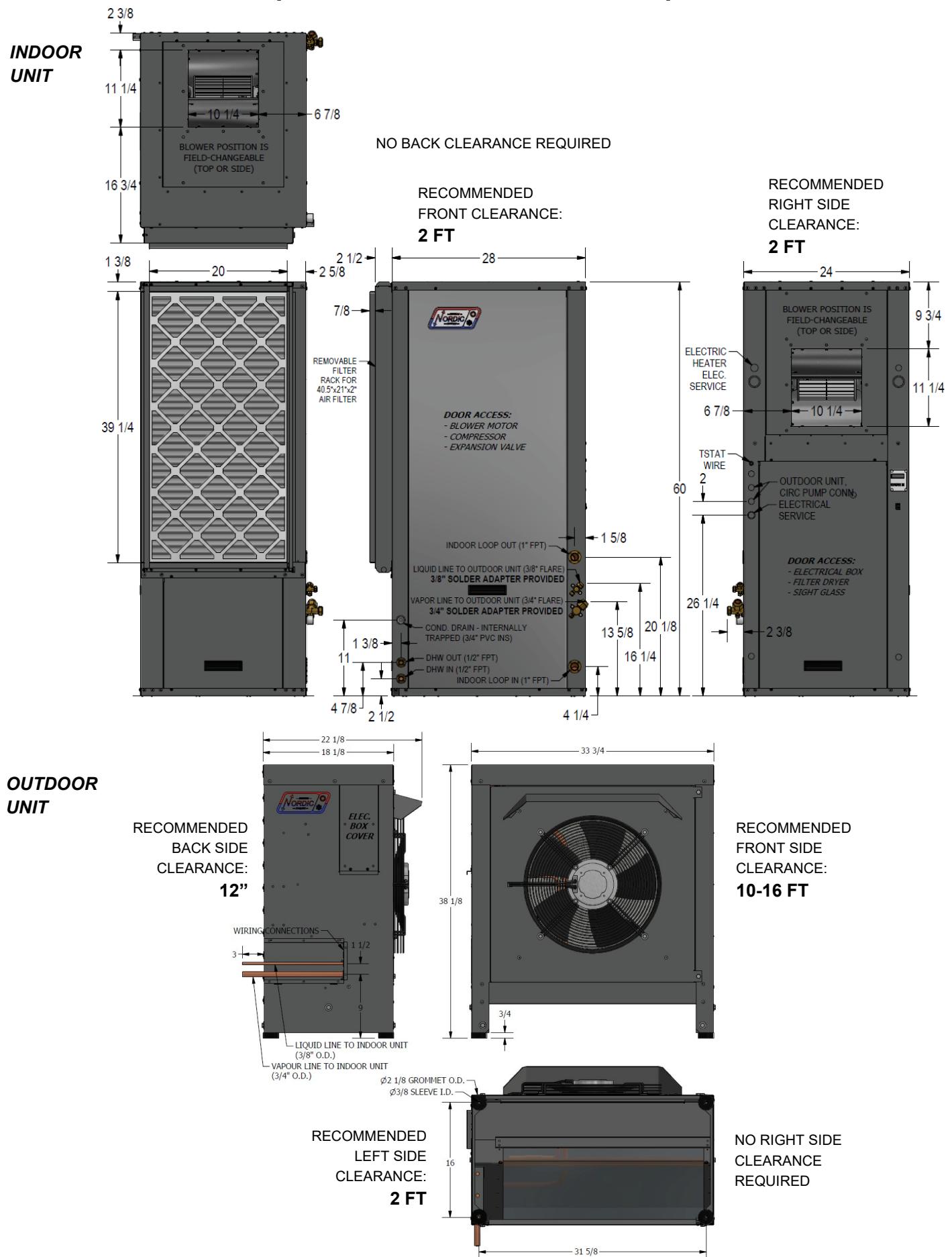
ITEM	STATUS
RV#1	DE-ENERGIZED
RV#2	ENERGIZED
EEV#1	CLOSED
EEV#2	ACTIVE



ATF INDOOR UNIT



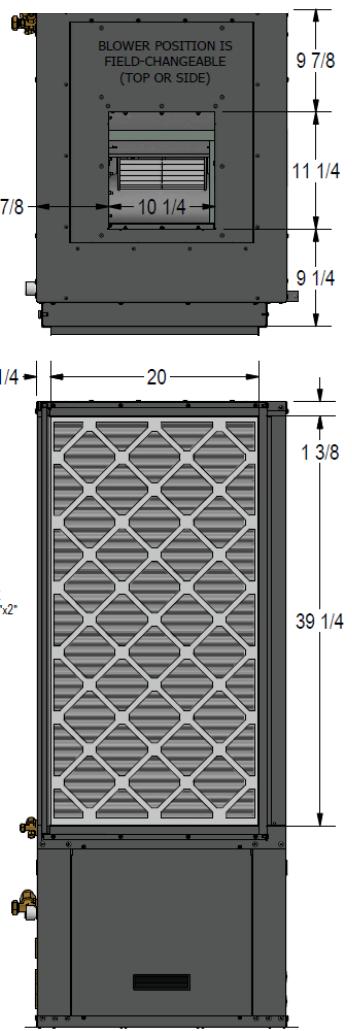
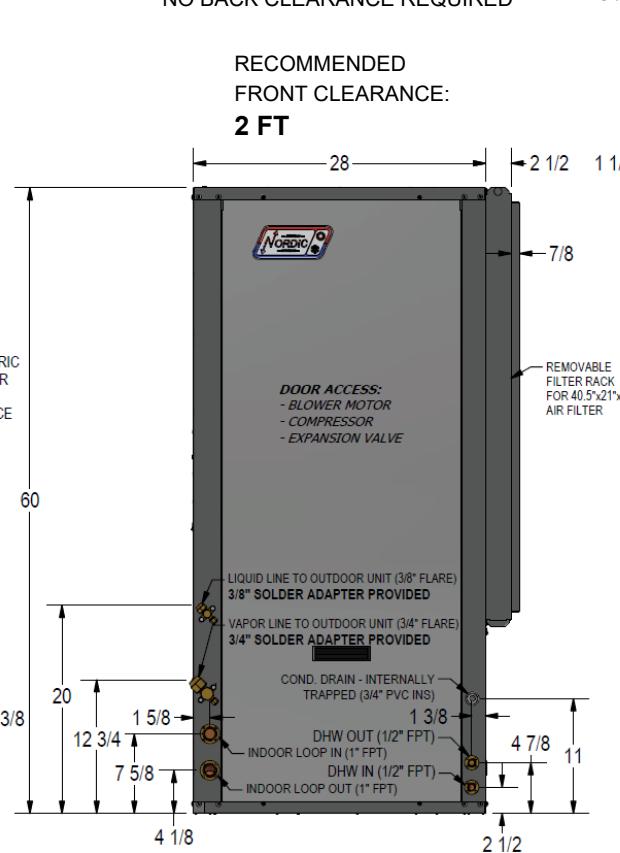
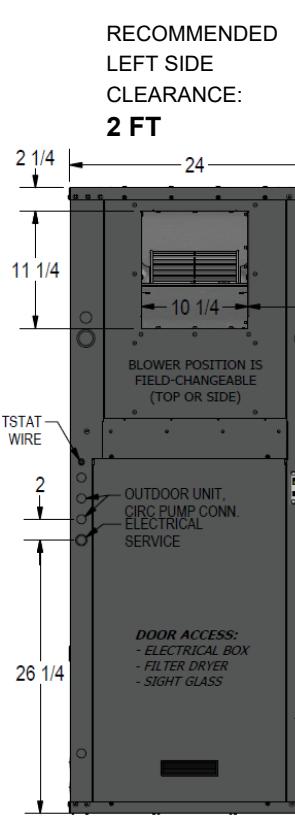
01	Initial Release	C. GEDDES	C. GEDDES	16 JUL 2014	Approved By	Date	MARITIME GEOTHERMAL LTD.	P.O. Box 2555 170 Plantation Rd. Petitcodiac, NB CANADA E4Z 6H4
REV	ECO#	IMPL BY	APVD BY	DATE	Size	Drawing Number	Drawing Revision	Sheet
					LET	001846RCD	01	1 / 1

Dimensions: ATF-45 (with Left Return Indoor Unit)*All dimensions in inches*

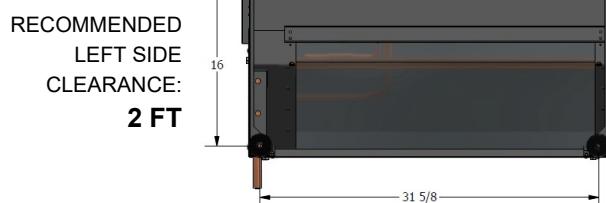
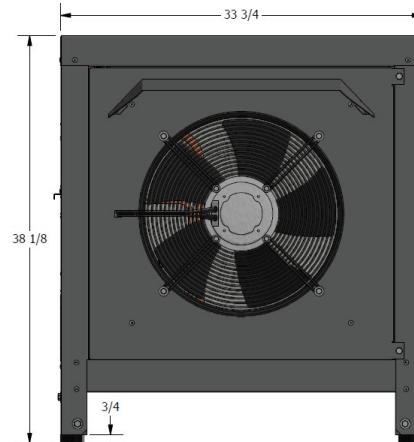
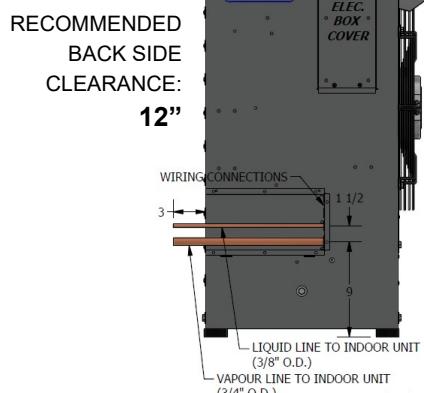
Dimensions: ATF-45 (with Right Return Indoor Unit)

All dimensions in inches

INDOOR UNIT

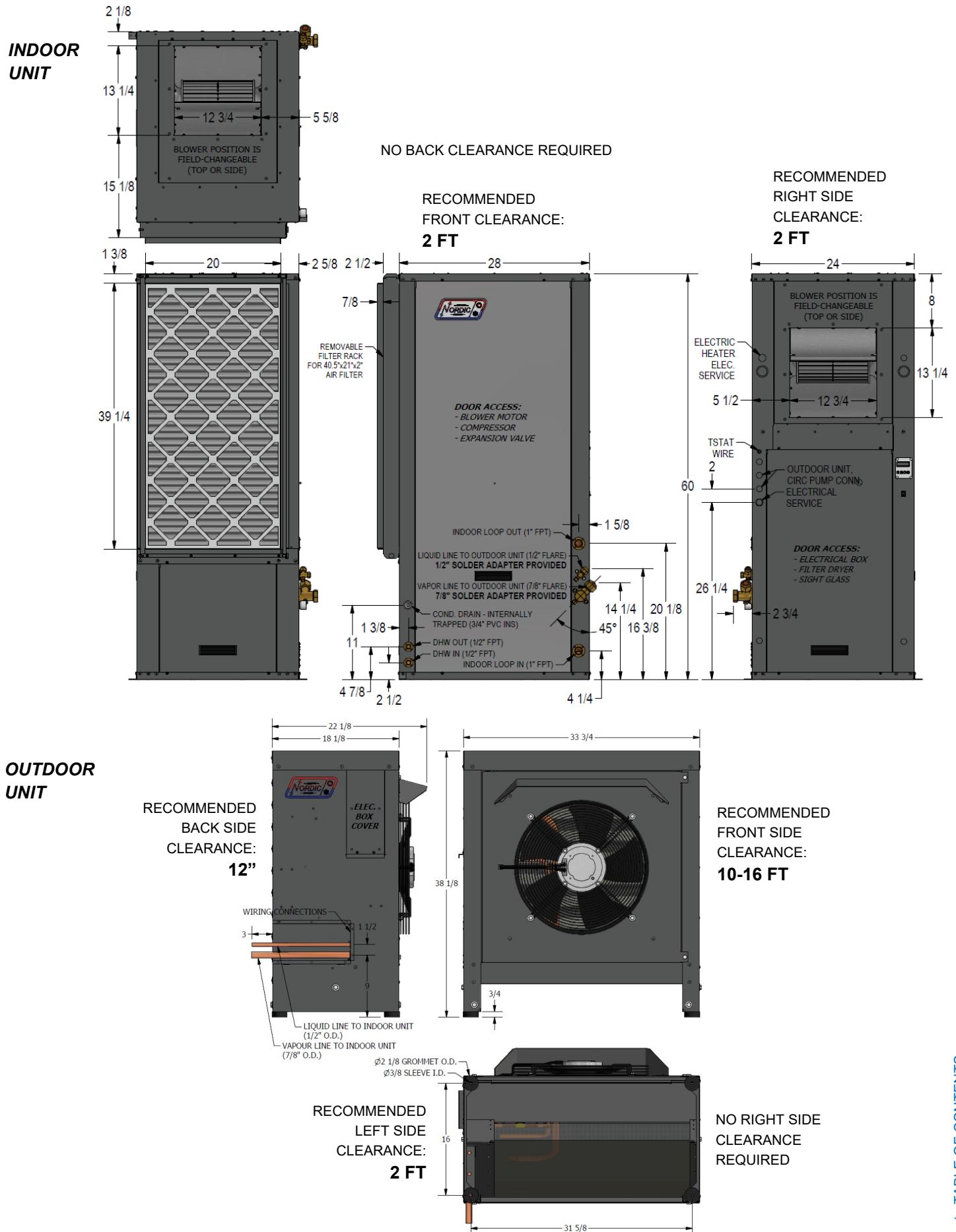


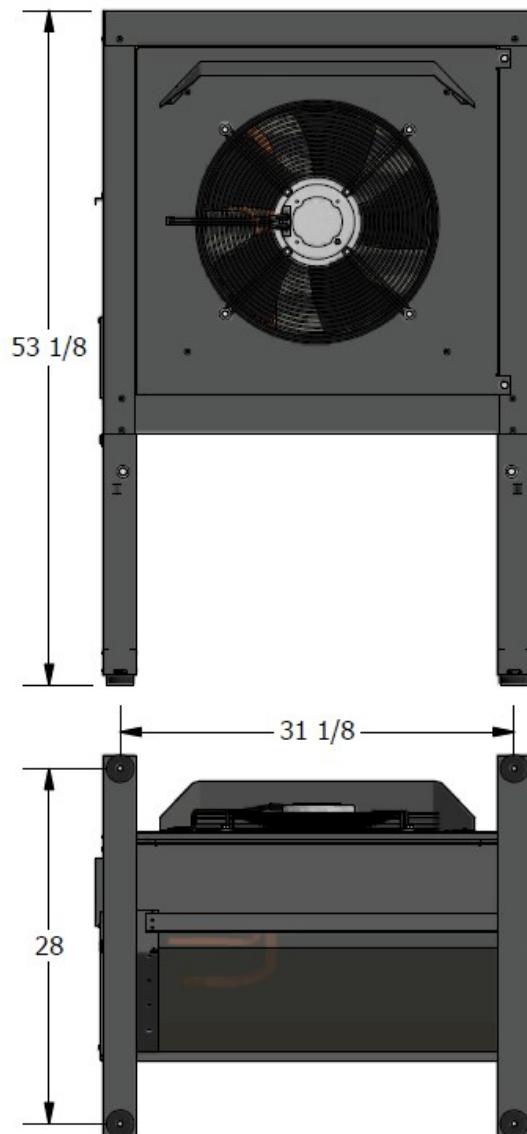
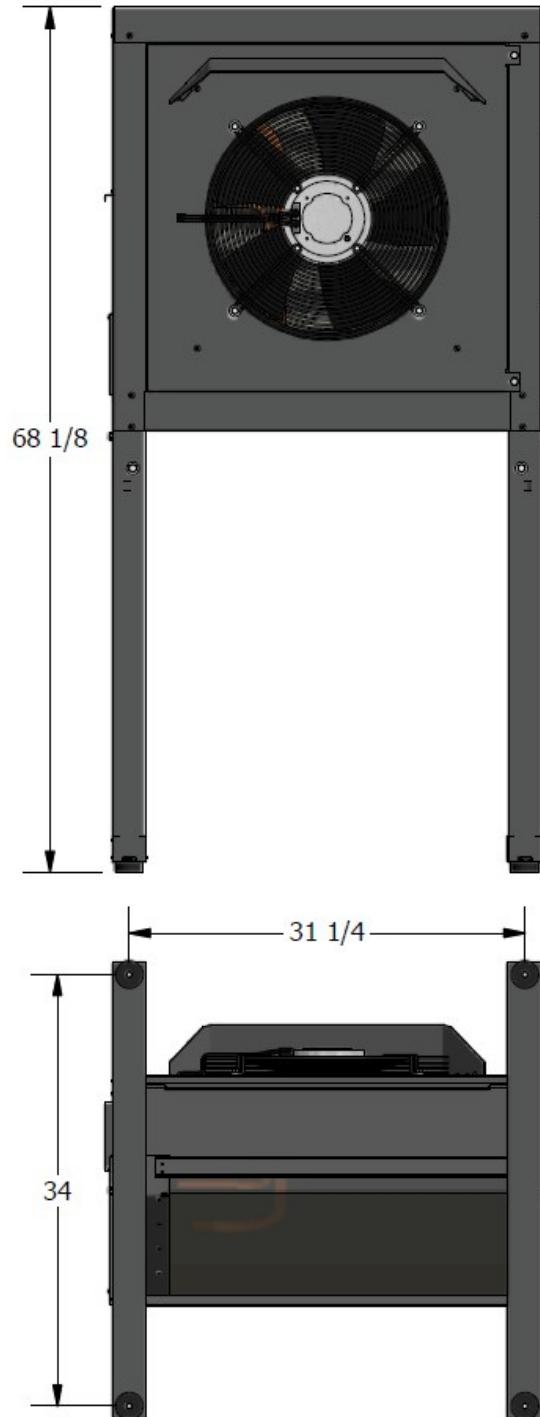
OUTDOOR UNIT



Dimensions: ATF-55 (with Left Return Indoor Unit)

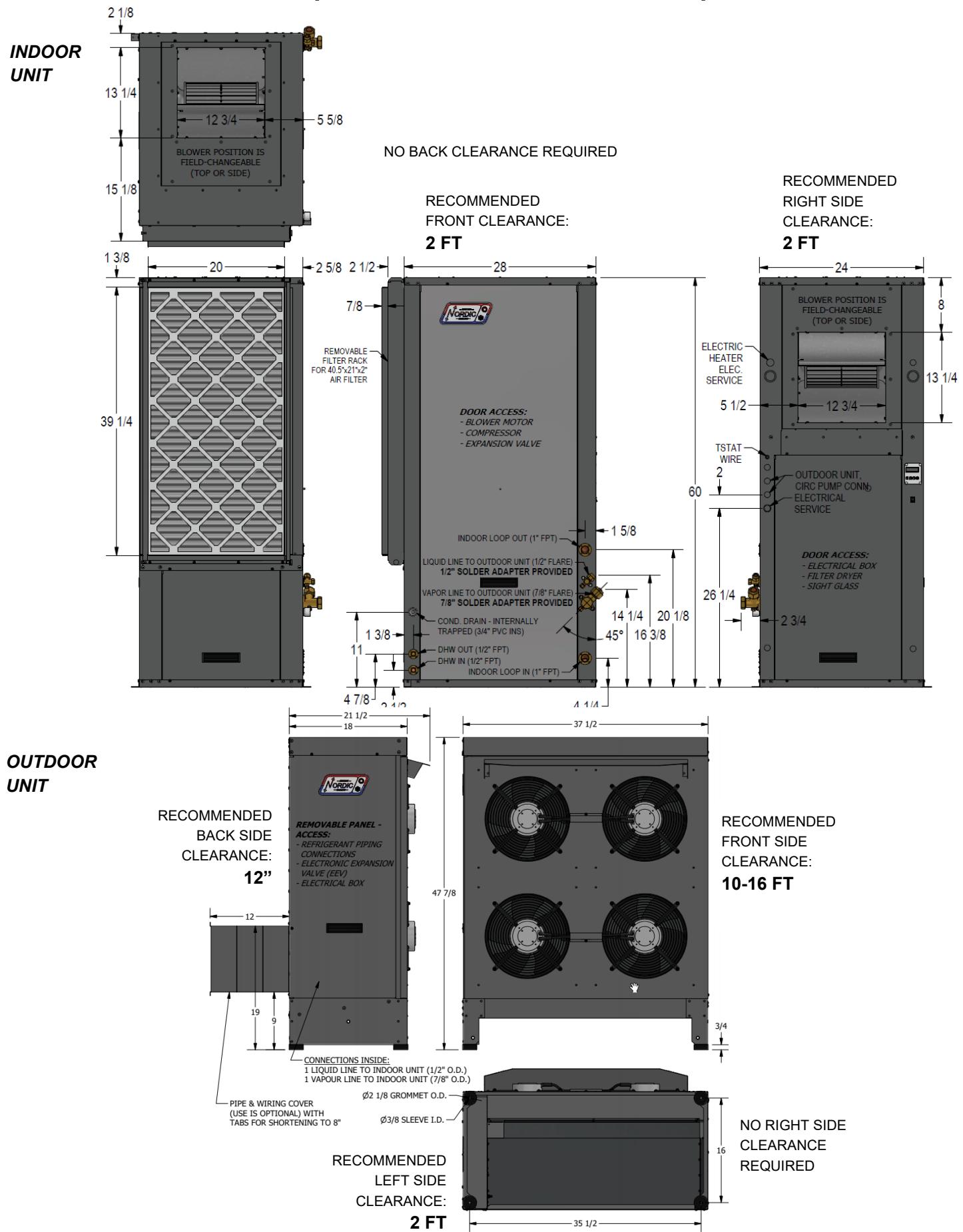
All dimensions in inches



Dimensions: ATF-45/55 (Leg Kit for Outdoor Unit)*All dimensions in inches***WITH LEG KIT****WITH TALL LEG KIT**

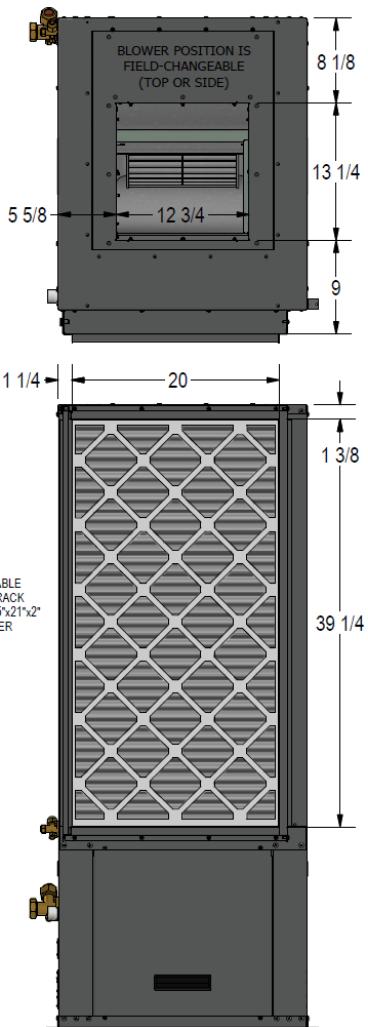
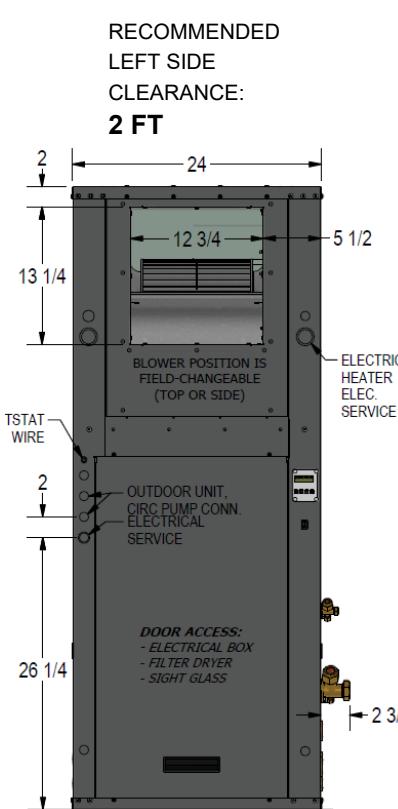
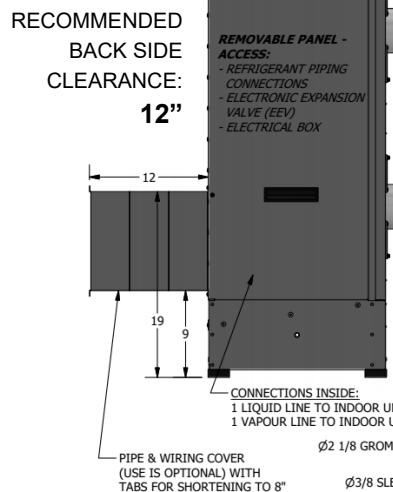
Dimensions: ATF-65/75 (with Left Return Indoor Unit)

All dimensions in inches

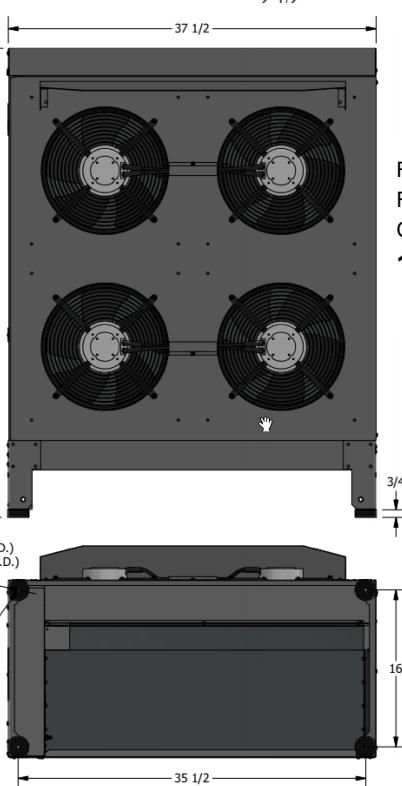


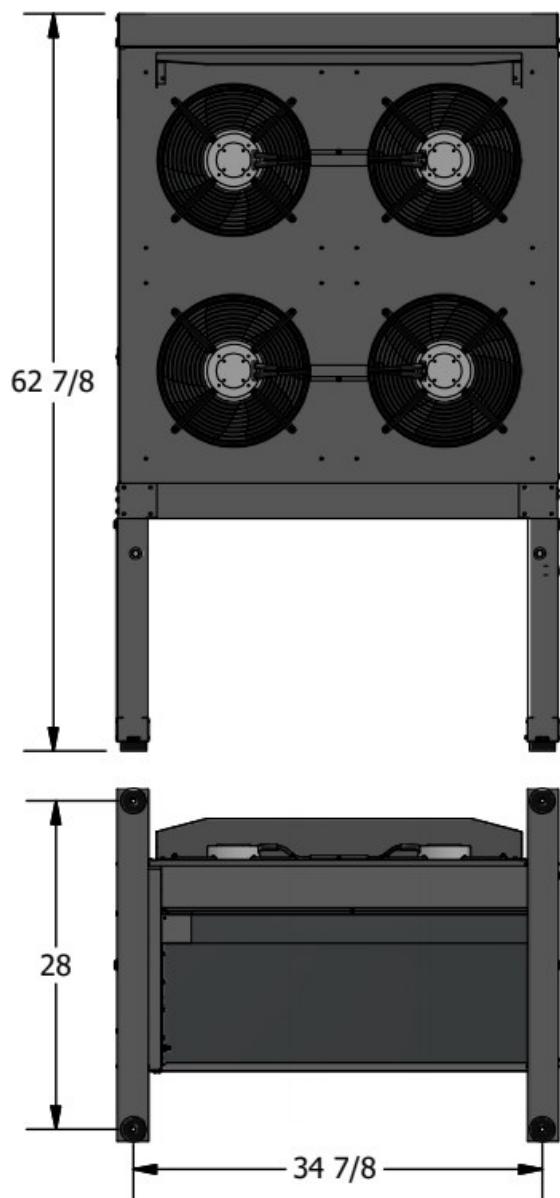
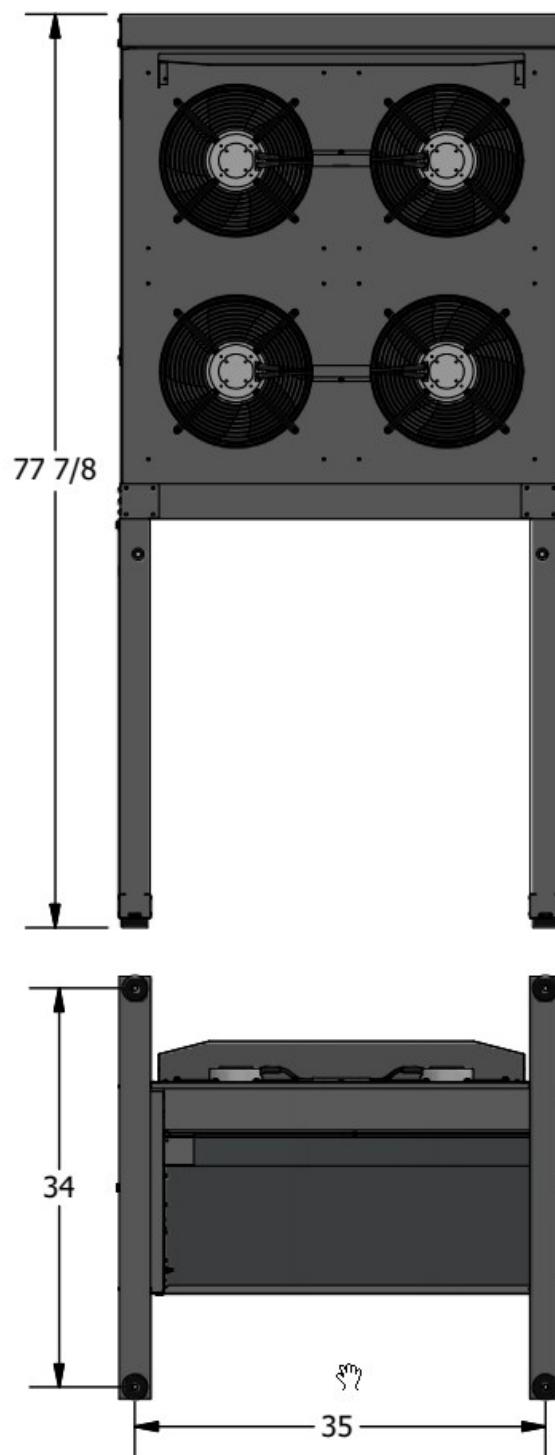
Dimensions: ATF-65/75 (with Right Return Indoor Unit)

All dimensions in inches

**INDOOR
UNIT****OUTDOOR
UNIT**

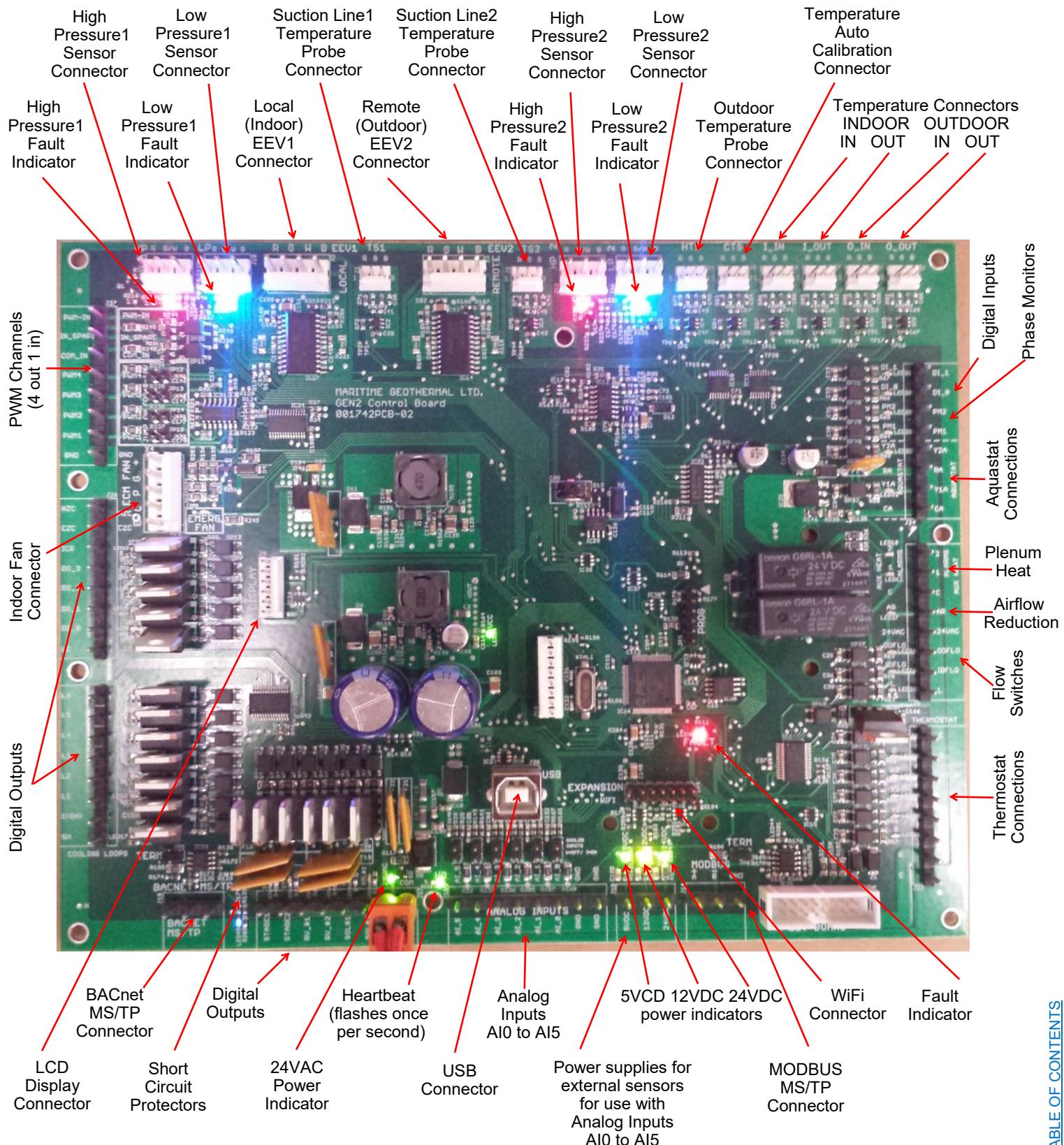
RECOMMENDED
LEFT SIDE
CLEARANCE:
2 FT



Dimensions: ATF-65/75 (Leg Kit for Outdoor Unit)*All dimensions in inches***WITH LEG KIT****WITH TALL LEG KIT**

Appendix A - GEN2 Control Board Description

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



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

TABLE A1 - Control Board Connector Descriptions (Top)

Name	Description	
HPS1/HI1	High Pressure Sensor 1	Mounted in indoor unit, measures discharge pressure.
LPS1/LO1	Low Pressure Sensor 1	Mounted in indoor unit, measures suction pressure.
EEV1	Local EEV	Mounted in indoor unit, used in cooling mode.
TS1	Suction Line Temperature 1	Mounted to common suction line inside unit.
EEV2	Remote EEV	Mounted in outdoor unit, used 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	Outdoor Temperature	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	PWM / 0-10VDC output	Outdoor fan PWM control signal.
GND	Ground	Ground for PWM channels.
HZC	Hot Zone Circulator	Not used.
CZC	Cold Zone Circulator	Not used.
ICR	Internal Circulator Relay	Operates the indoor circulator.
DO_3	AUX_ONLY	OFF when auxiliary heat to be run without compressor.
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	Loop3	Not used.
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.

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 modes, on in air cooling mode.
RV#2	Reversing Valve#2	Off in air heating or cooling modes, on in water heating mode.
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	Not used.
AI_3	Analog In Channel 3	Compressor discharge line temperature sensor.
AI_2	Analog In Channel 2	Condensate sensor.
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	RS-485.
B	MODBUS	RS-485.
GND	MODBUS	Ground for shield if required.

TABLE A4 - Control Board Connector Descriptions (Right Side)

Name	Description	
DI_1	Digital Input1	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 water heat stage 2 24VAC input for use with Signals/Hardwired control.
RA*	Aquastat Power (24VAC)	Optional 24VAC output for aquastat used with Signals/Hardwired control.
Y1A*	Aquastat Stage1	Optional water heat 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	Dry contact output to activate air plenum heater stage 2.
1	Plenum Heat Stage1	Dry contact output to activate air plenum heater stage 1.
C	Plenum Heat Common	Common terminal for air plenum heater dry contacts.
AR	Airflow Reductions	Digital input to reduce airflow for zoning applications.
24VAC	Power	Power to external dry contact for AR terminal.
ODFLO	Outdoor Flow Switch	Not used.
IDFLO	Indoor Flow Switch	Not used.
L	Thermostat Lockout Indicator	24VAC to external trouble indicator.
E	Thermostat Emergency Heat	24VAC input from air thermostat.
O	Thermostat Heat/Cool	24VAC input from air thermostat.
W2	Thermostat Auxiliary Heat	24VAC input from air thermostat.
Y2	Thermostat Compressor Stage2	24VAC input from air thermostat.
Y1	Thermostat Compressor Stage1	24VAC input from air thermostat.
G	Thermostat Fan Recirculation	24VAC input from air thermostat.
R	Thermostat Power (24VAC)	24VAC to air thermostat.
C	Thermostat Power (Ground)	24VAC ground for air thermostat.

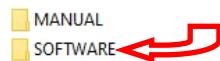
*NOTE: There is no need for an external aquastat for most systems, since the Setpoint Control Method provides built in aquastat functionality.

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

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

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

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



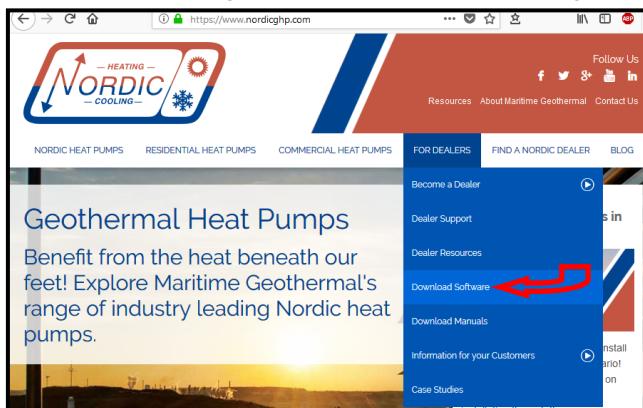
Double click on the SOFTWARE folder to show its contents:



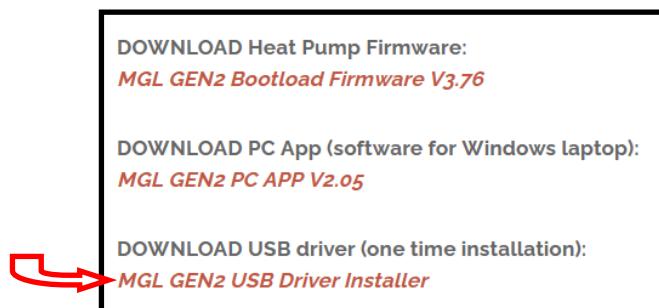
To install the USB driver, double click on **Step 1** and follow the prompts, clicking “allow” or “yes” as required.

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

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

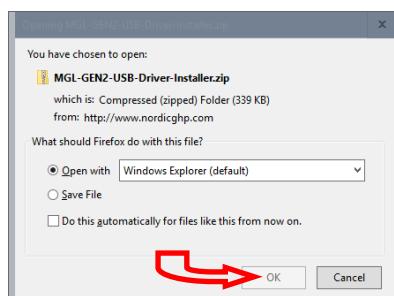


2. Click on **MGL GEN2 USB Driver Installer** to download it:

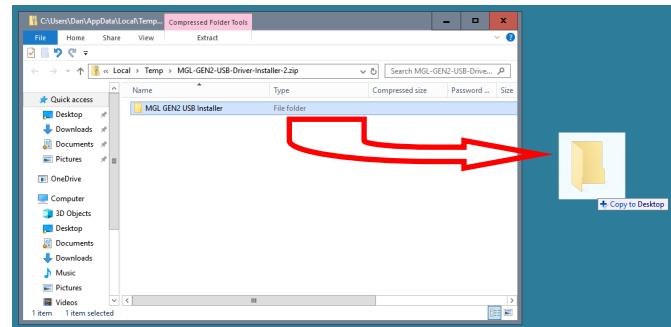


3. Choose “Open with Windows Explorer”, and hit “OK”.

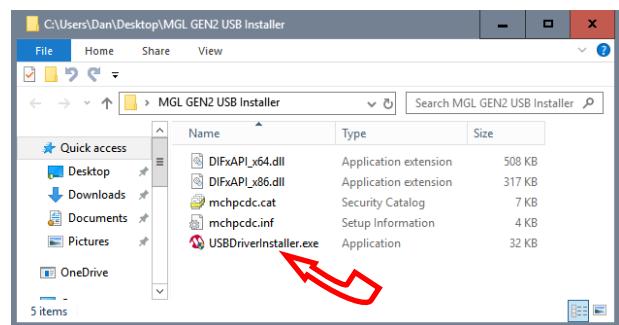
(If the choice window doesn't pop up, find the downloaded file in your browser downloads and double click on it.)



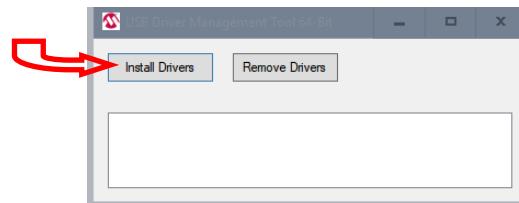
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



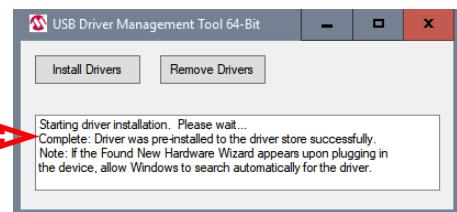
5. Double click on the folder you just dragged onto the desktop, then double click on the “USBDriverInstaller” file:



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



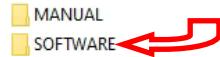
7. You will see a message indicating the driver was installed successfully. You are now ready to install the PC App.



Appendix C - PC App Installation (Windows 11)

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

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



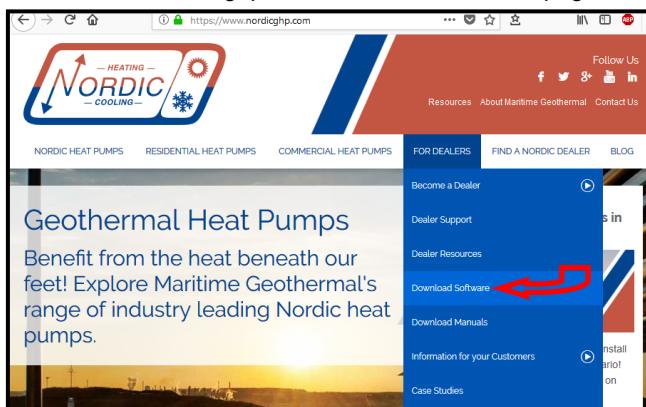
Double click on the SOFTWARE folder to show its contents:



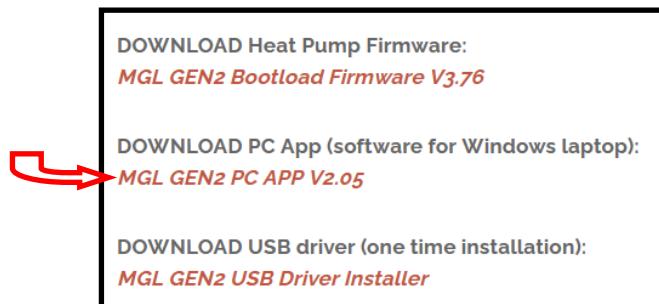
Double click on **Step 2** and follow the prompts, clicking “More info”, “Run anyway”, “Install”, or similar on any warning windows which pop up, perhaps more than once. Pictures of warning windows you might encounter are shown below in step 8.

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

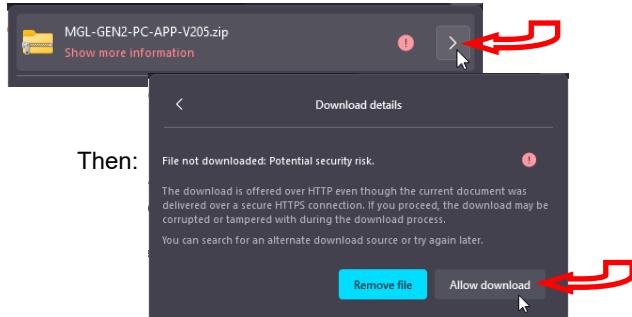
1. Go to www.nordicghp.com, Download Software page:



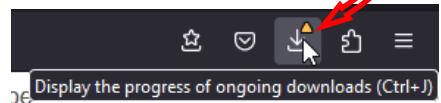
2. Click on **MGL GEN2 PC APP V2** to download it:



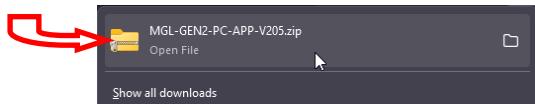
3. You may see a warning like this one. Click as shown:



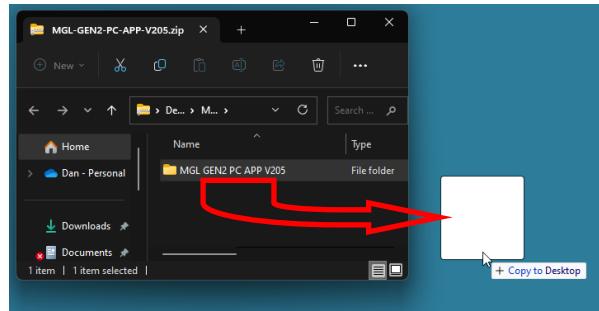
4. Click on the downloads icon on your browser, or otherwise view a list of your downloaded files:



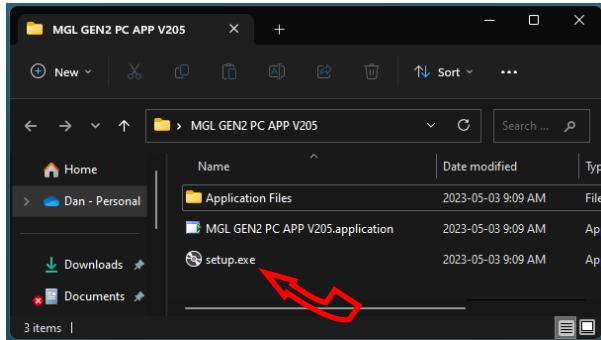
5. Then click on the .zip file to open it in a File Explorer window:



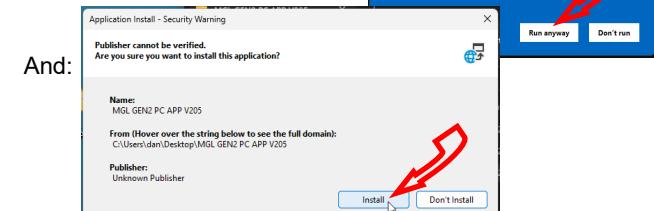
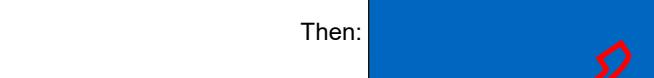
6. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



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



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

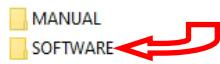


9. The PC App will open when it is finished installing. (In the future, it should be started from the start menu.) You are now ready to connect a USB cord between the laptop computer and GEN2 control board, and connect.

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

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

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



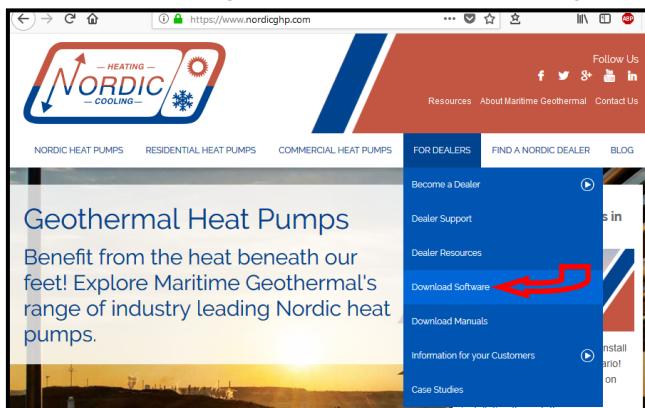
Double click on the SOFTWARE folder to show its contents:



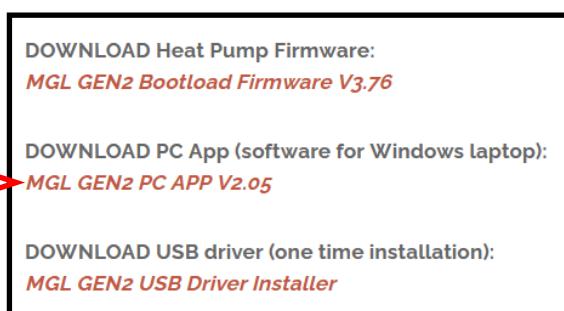
Double click on **Step 2** and follow the prompts, clicking “allow” or “yes” as required. If you get a warning that .NET framework is required, go back and double click on step **z**, then try **Step 2** again.

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

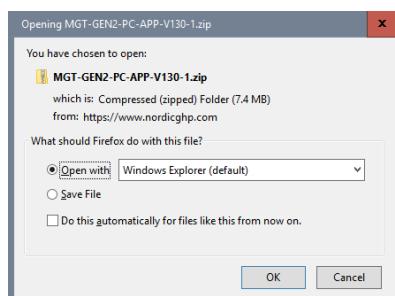
1. Go to www.nordicghp.com, Download Software page:



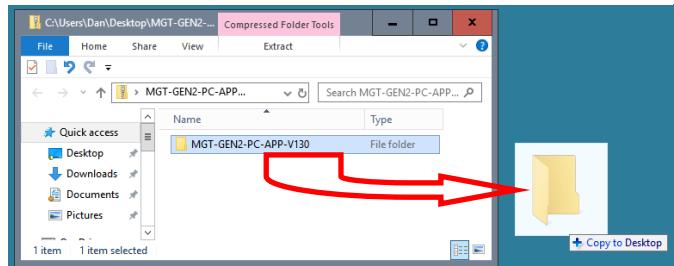
2. Click on **MGL GEN2 PC APP V2** to download it:



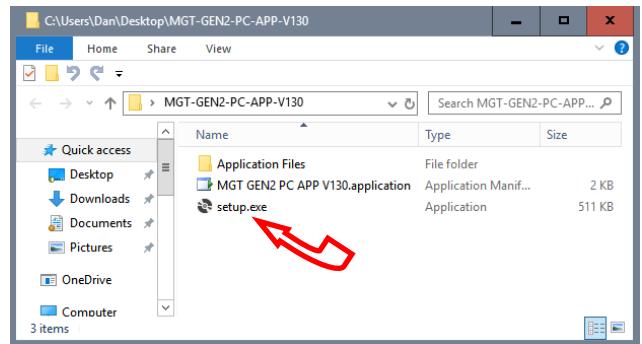
3. Choose “Open with Windows Explorer”, and hit “OK”:



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



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



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

Possible Additional Downloads:

During installation of the PC Application, the following prerequisite files may be required: VB PowerPack 10 and/or .netframework 4.0. If either of these is asked for during PC Application installation, please download them from the links below.



Then go back to step 5.

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

Appendix E: Updating Firmware

METHOD 1: Updating Firmware Using PC App

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

The firmware comes as a .ZIP file named:

MGL GEN2 Bootload Firmware Vxxx.zip

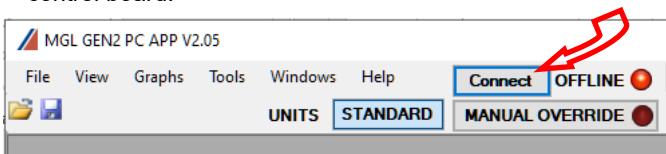
where xxx is the version reference, e.g. 376 (version 3.76). This file can be downloaded from www.nordicghp.com, menu *For Dealers --> Download Software*.

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

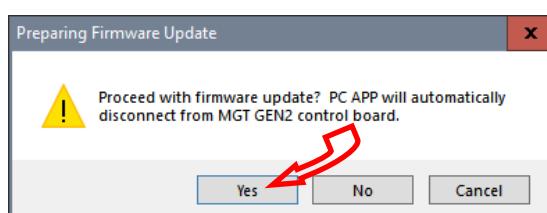
Desktop\ MGL GEN2 Bootload Firmware V376

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

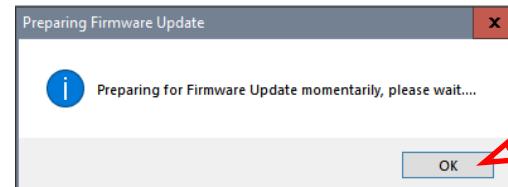
2. In that folder on the Desktop, there will be three files:
 - MGL_GEN2_V376.production.hex (firmware file)
 - PIC32UBL.exe (the programmer)
 - USB Bootloader Instructions.pdf (these instructions)
3. Note that on most computers, the file extensions (.exe, .pdf) will be hidden.
4. Connect a USB (printer) cable between computer and control board.
5. 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.
6. In the PC App, click on the **Connect** button to connect to the control board.



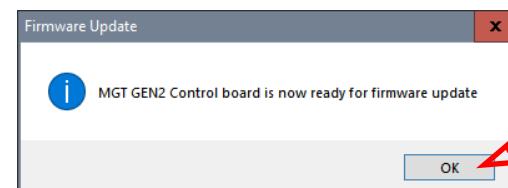
7. Go to menu **Tools --> Update Firmware**. The following message box will appear:



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

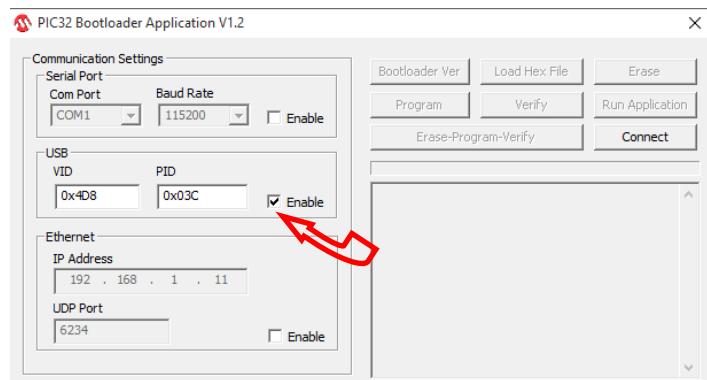


8. Click on **OK**. After a minute, the following message box will appear:

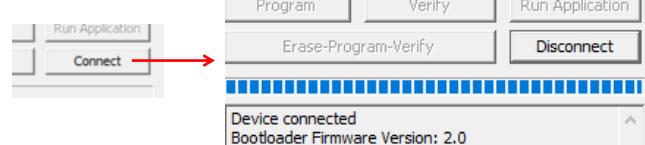


9. Click on **OK**. The control board is now in bootloader mode and is ready to be programmed.

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

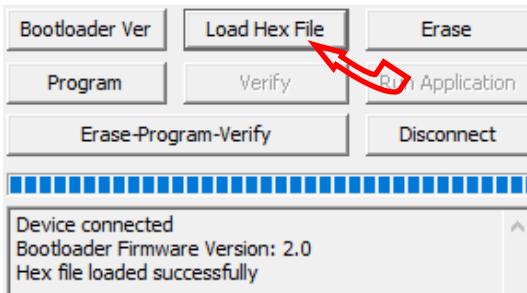


11. Click on **Connect**.

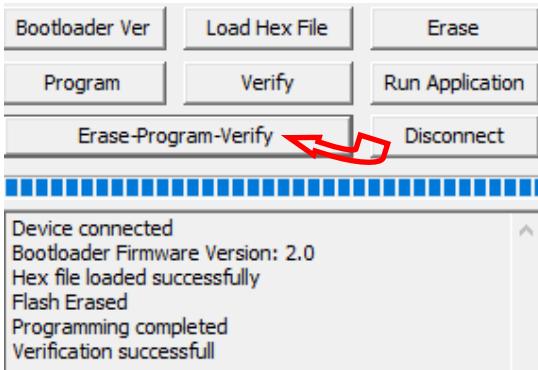


If device fails to connect and an error message is displayed, the board's bootloader may be older than v2.0. It will be necessary to instead update the firmware via jumper pins (**METHOD 2**), as per the next section.

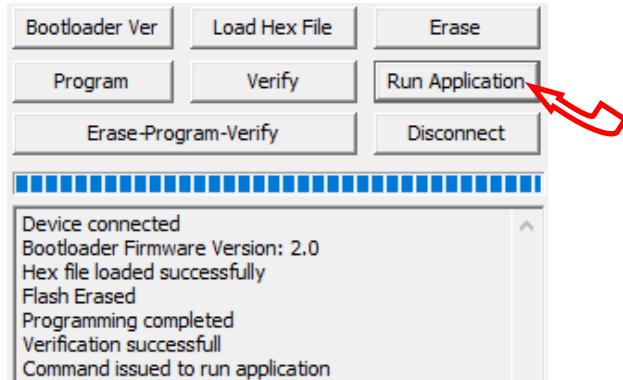
12. Click on **Load Hex File**. Select the **MGL_GEN2_V376.production.hex** (or higher version number) file, which is in the folder you created on the Desktop.



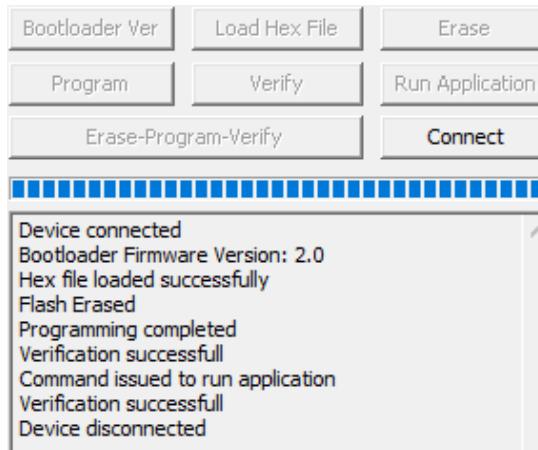
13. Click on **Erase—Program—Verify**. Programming.... Wait while status bar shows progress. The messages should read as below when finished:



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.



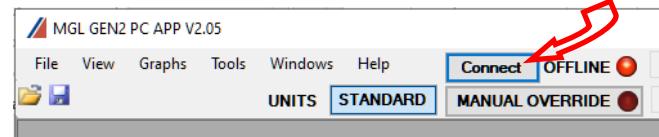
15. Wait until the programmer disconnects itself. The messages should read as follows:



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.



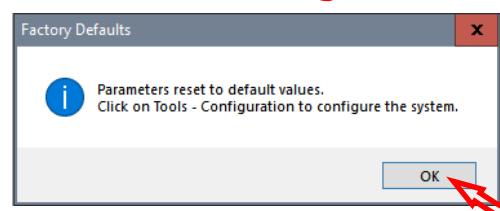
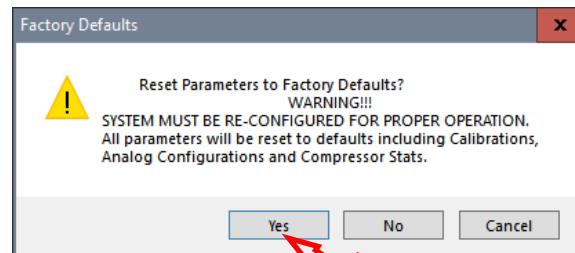
NOTE: Updating the firmware does not affect the configuration settings.

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.

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

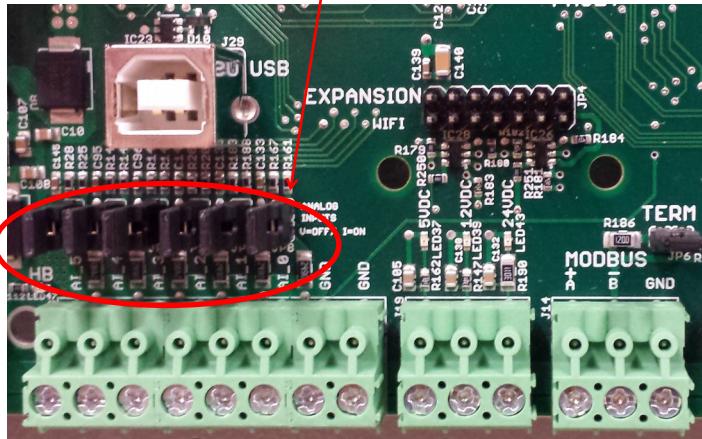
2. In that folder on the Desktop, there will be three files:

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

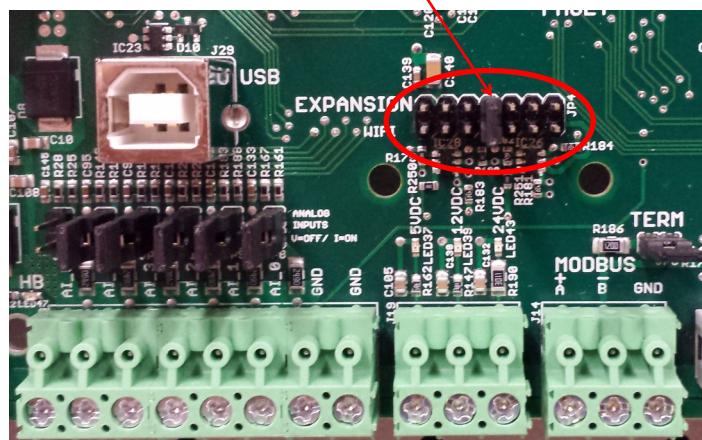
Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

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 it on the center pin pair of the EXPANSION header as shown below.

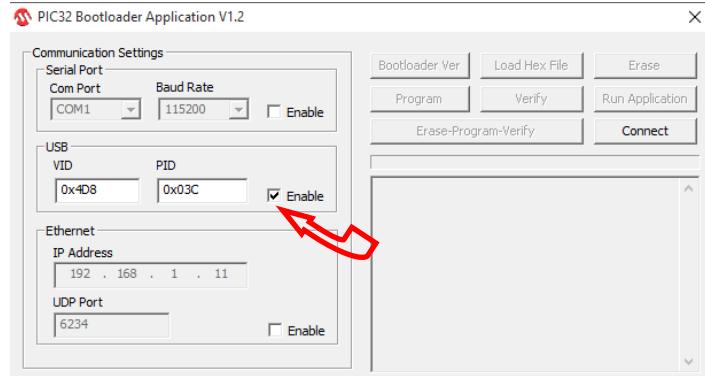
Borrow any one of these jumpers (however many are present)



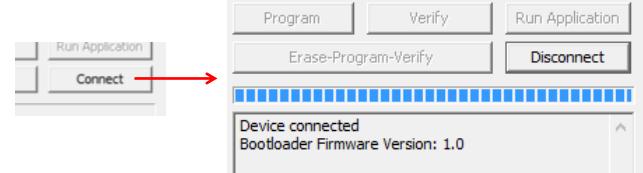
Place jumper here



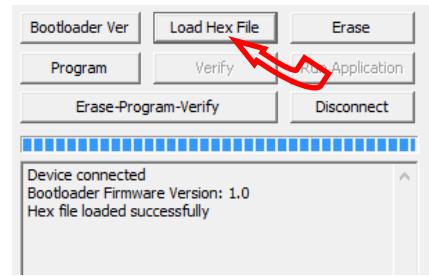
6. Turn the power back on. The control board is now in bootloader mode and is ready to be programmed.
7. Double click on the downloaded PIC32UBL.exe to run it. In the window that opens, click on the **USB Enable** check box.



8. Click on **Connect**.

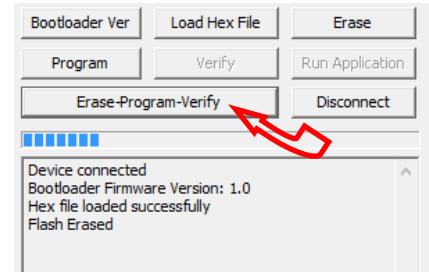


9. Click on **Load Hex File**. Select the **MGL_GEN2_V376.production.hex** (or higher version number) file, which is in the folder you created on the Desktop.

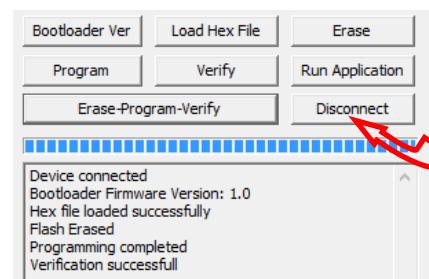


10. Click on **Erase—Program—Verify**

Programming...



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



12. Turn power off to the heat pump again.
13. Move the jumper back to where it was taken from.
14. Turn the power back on. Check that the LCD Display shows e.g. **MGL GEN2 V3.76** on the top line during power up.

LIMITED 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.