# Application, Installation, & Service Manual

## ATF-Series
### Triple Function Central Air Source Heat Pump

**Two-stage R410a 60Hz**
**Model Sizes 45-75**


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**002000MAN-04**

## SAFETY PRECAUTIONS

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

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

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

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

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

# Model Nomenclature

**ATF—75—HACW—P—1T—C—SDELF—xx**

**Series:**
ATF = Air to Triple Function

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

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

**Refrigerant:**
P = R410a

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

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

**Hydronic Coil:**
C = Copper
Y = CuNi coil & piping
Z = CuNi coil only

**Air Coil:**
S = Standard
K = Coated

**Blower Type:**
D = Direct Drive

**Blower Motor:**
E = ECM (Variable Speed)

**Air Return Orientation:**
L = Left Return
R = Right Return

**Air Outlet Orientation:**
F = Field Configurable
(top or side)

**Revision:**
01, 02 etc.

**ACE—75—P—1/6—KDE—xx**

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

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

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

**Air Coil:**
S = Standard
K = Coated

**Blower Type:**
D = Direct Drive

**Blower Motor:**
E = ECM (Variable Speed)

**Revision:**
01, 02 etc.

| APPLICATION TABLE - INDOOR UNIT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MODEL | FUNCTION | REFRIGERANT | VOLTAGE | COMPRESSOR | HYDRONIC COIL | AIR COIL/ BLOWER/AIR RETURN | AIR RETURN | AIR OUTLET | REVISIONS | | | |
| ATF-45 | H A C W | P | 1<br>2<br>4 | T | C<br>Y<br>Z | S D E | L<br>R | F | 05 | | | |
| ATF-55 | H A C W | P | 1<br>2<br>4 | T | C<br>Y<br>Z | S D E | L<br>R | F | 05 | | | |
| ATF-65 | H A C W | P | 1<br>2<br>4 | T | C<br>Y<br>Z | S D E | L<br>R | F | 05 | | | |
| ATF-75 | H A C W | P | 1<br>2<br>4 | T | C<br>Y<br>Z | S D E | L<br>R | F | 05 | | | |
| This manual applies only to the models and revisions listed in this table. | | | | | | | | | | | | |

| APPLICATION TABLE - OUTDOOR UNIT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MODEL | REFRIGERANT | VOLTAGE | AIR COIL | BLOWER TYPE | BLOWER MOTOR | REVISIONS | | | |
| ACE-45 | P | 1/6 | K | D | E | 03 | 04 | | |
| ACE-55 | P | 1/6 | K | D | E | 03 | 04 | | |
| ACE-65 | P | 1/6 | K | D | E | 08 | | | |
| ACE-75 | P | 1/6 | K | D | E | 08 | | | |
| This manual applies only to the models and revisions listed in this table. | | | | | | | | | |

| APPLICATION TABLE - FIRMWARE AND PC APP | | | |
|---|---|---|---|
| Firmware | Version | Associated PC APP | Version |
| MGT GEN2 Bootload Firmware | V3.60+ | MGT GEN2 PC APP | V2.00+ |

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

# Table of Contents

# Tables & Documents

## Tables



## Documents

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

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

# 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

## 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
- ½" COPPER PIPE
- ½" 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 R410A 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)

## 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.

## Placement of Tanks

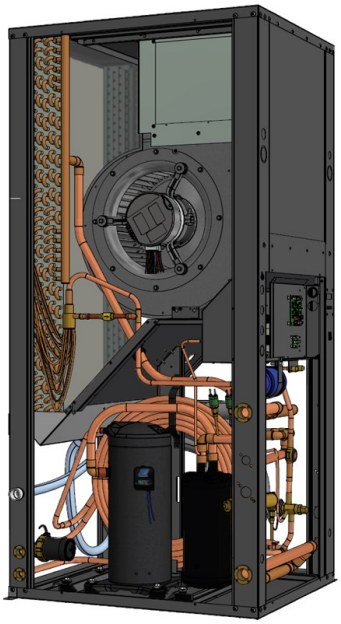
See **ATF System Description** and **Piping** chapters for example placements of the hydronic buffer tank and domestic hot water preheat and final tanks.

## Indoor Unit Air Outlet Orientation

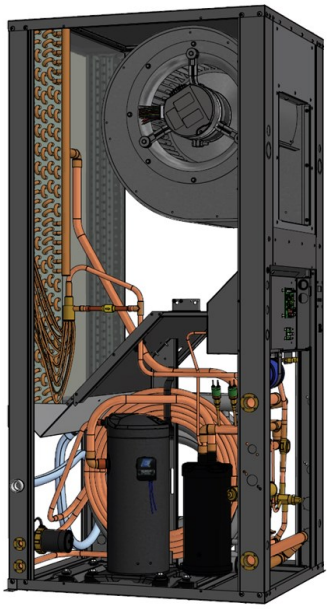
The indoor unit has a field configurable blower position, resulting in top or side air discharge. Its default location from the factory is in the top of the unit, providing a “ninety” in the airflow. It can easily be placed in the side of the unit for straight through airflow. Note that if this is done,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

To switch the location of the fan outlet:

1. Turn the power of 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*

## 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.

*LEFT RETURN* *RIGHT RETURN*

## 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.**

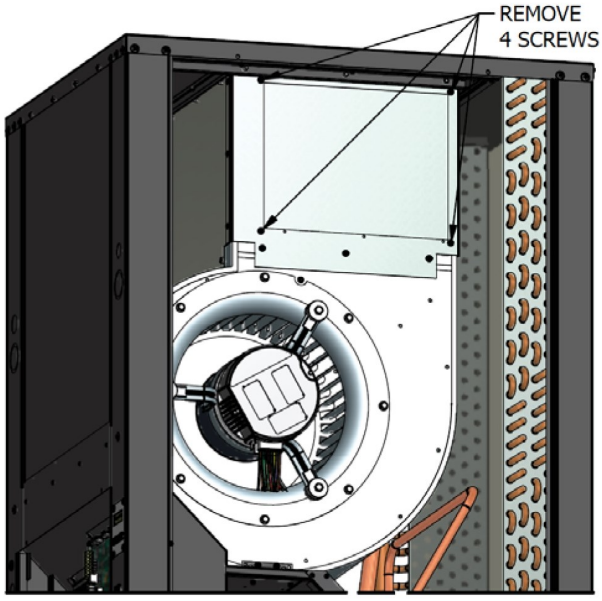
**1. Blower in top discharge position:** Plenum heater is mounted inside heat pump cabinet. See diagram on following page. Remove the screws from the cover plate, remove the cover plate, and place the plenum heater in the cutout. Slide it up and secure the bottom flange with three cover plate screws.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

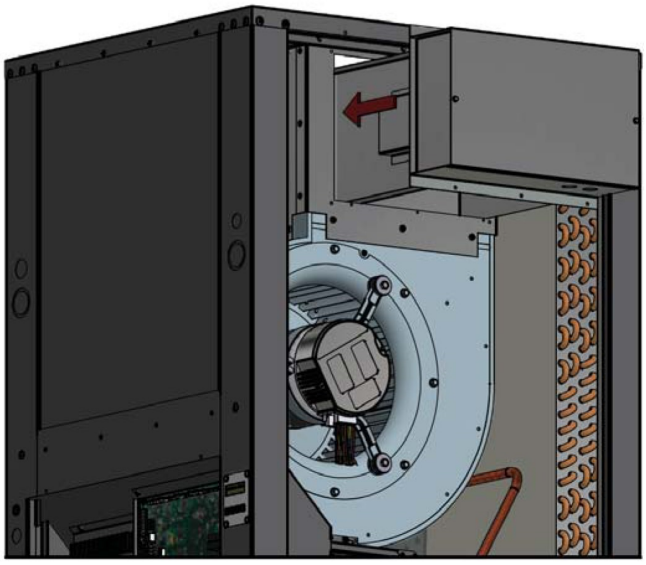
**2. Blower in side discharge position:** Plenum heater should be installed in the air discharge duct outside the heat pump cabinet in a manner that allows all of the airflow to pass through it to prevent any hot spots in the heater elements. Ensure that the plenum heater is mounted in an approved position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

# Internal Plenum Heater Installation
## R, TF, ATA, ATF, DX, DXTF Series

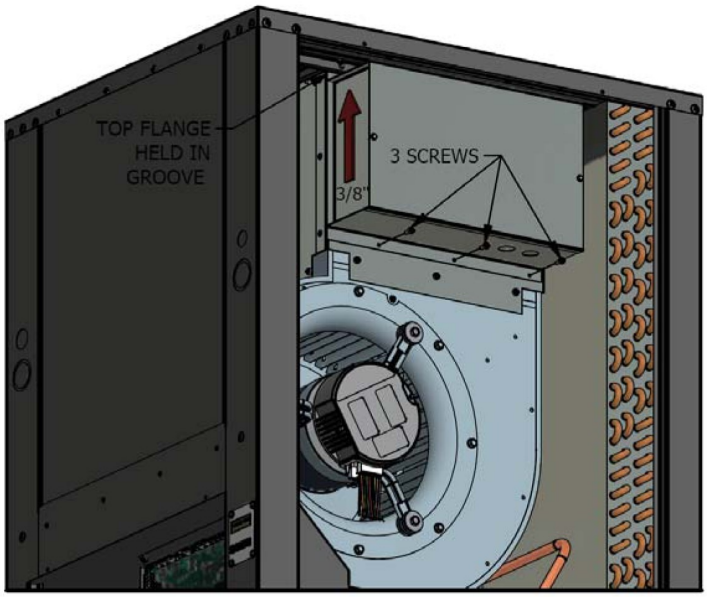
**1.** Remove four screws as shown, and remove blank panel.




**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.

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

| | | |
|---|---|---|
| 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 | Drawing Number | Revision | Sheet |
|---|---|---|---|
| LET | 001915INF | 01 | 1 / 1 |

## 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.

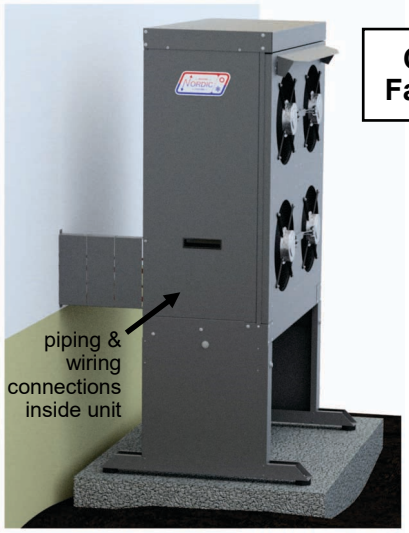
There should be little or no obstruction in the fan (front) direction for at least **10 ft (3 m)**, and preferably **16 ft (5 m)**, otherwise airflow and therefore overall performance will be reduced.

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**

## Outdoor Fan Speed Reduction

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

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

## 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.

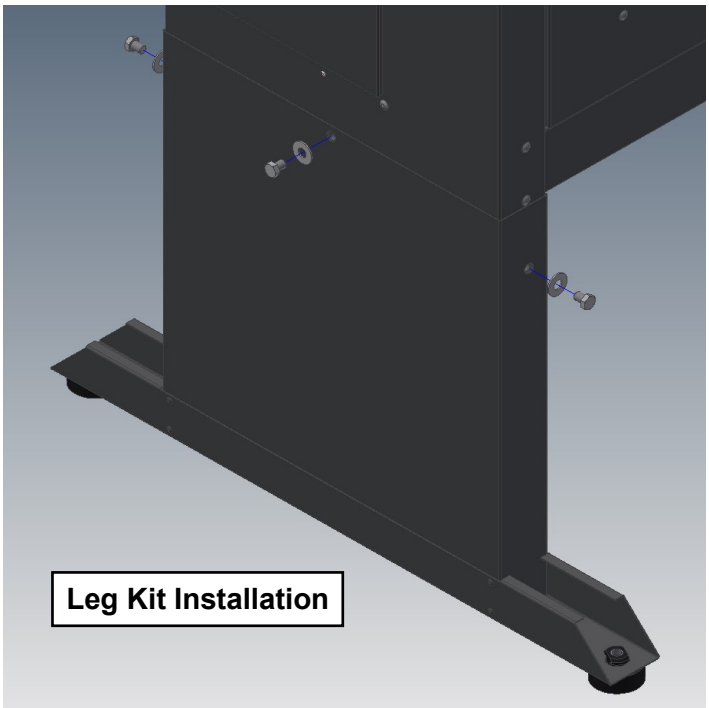
1. If there is less than ~4" (10 cm) of snow accumulation expected, the unit could be mounted directly on a concrete pad. This is **not recommended** in cold climates, since ongoing care would be required to ensure re-frozen condensate does not build up under unit.
2. The unit can be mounted on angle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

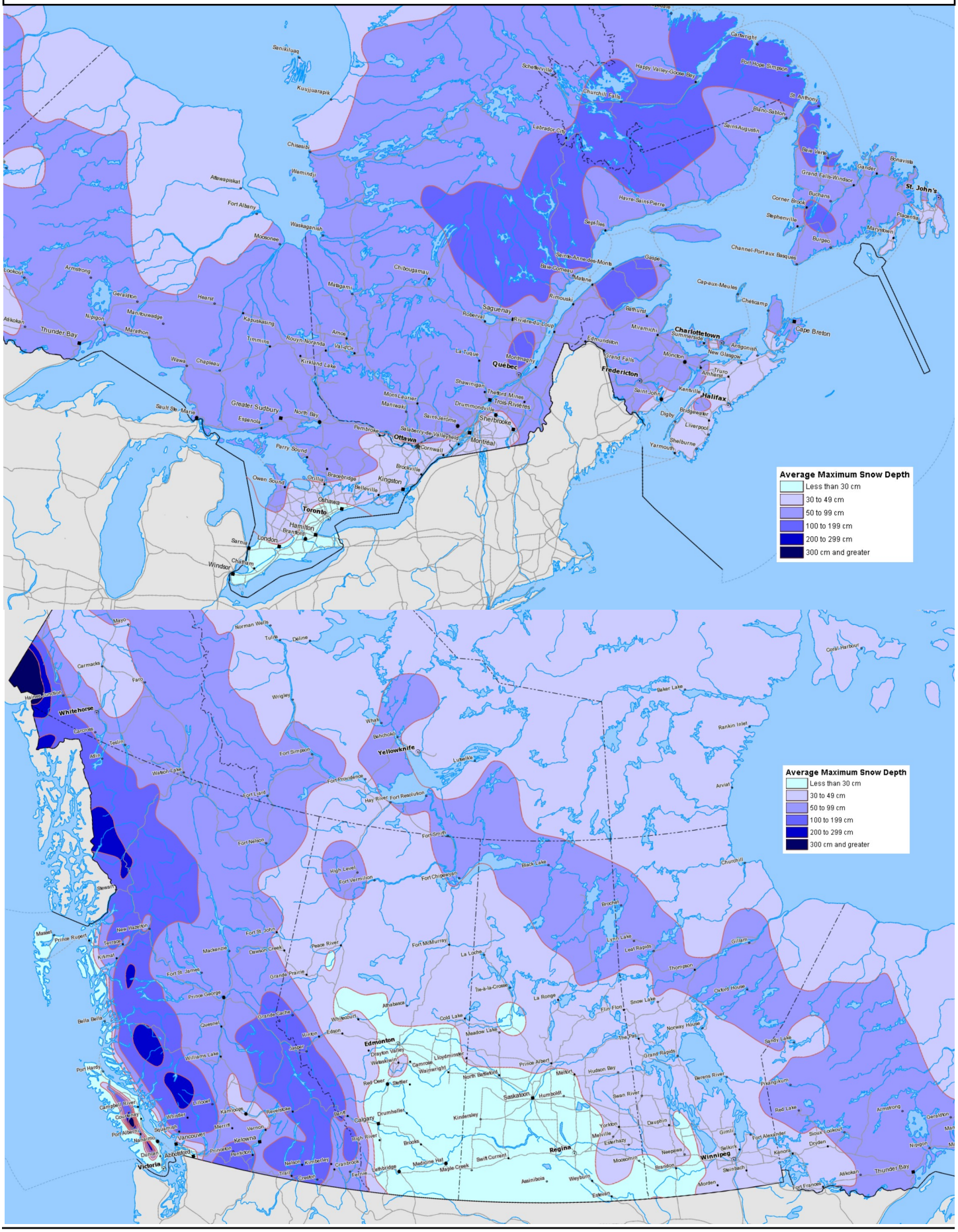
Whether or not a foot kit is used, be sure to mount the unit using the 4 rubber grommets included with the unit, to dampen any vibration. **The unit must be fastened to its mounting surface with four bolts through these grommets to prevent**



**Leg Kit Installation**

## 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** | **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** |
| **C<sub>P</sub>** | **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 5 - Control Transformer | |
|---|---|
| **Voltage** | **Low Voltage Circuit Protection** |
| **(1) 208/230-1-60** | **Resettable breaker on transformer** |
| **(2) 208-3-60** | |
| **(4) 460-3-60** | **Primary / Secondary fuses** |
| **(6) 220-1-50** | |
| **(7) 380-3-50** | |

## BACnet Connections

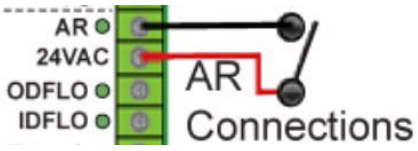
If using BACnet for external control of heating/cooling demand and/or monitoring of status, use a shielded twisted pair to the connector at the bottom left of control board. There is an optional termination jumper located above the connector.

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 if from terminal **L4** (NOT_HYD_AUX) to **DO_2** (HYD_AUX) on the control board.

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

| TABLE 9 - Setpoint Control: Aux. Connections | |
|---|---|
| **Signal** | **Description** |
| **D1** | **Hydronic Auxiliary dry contacts** |
| **D2** | |
| **R** | **Jumper R and D1** |
| **D1** | |
| **D2** | **24vac to actuate aux. heat contactor coil** |
| **CD** | **Contactor coil ground** |
| **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.**

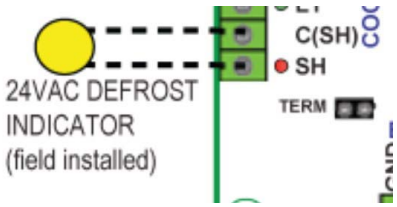
## Domestic Hot Water (Desuperheater)

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<br>24VAC | **Airflow reduction:** connect $AR_1$ to $AR_2$ with a dry contact to reduce the airflow for zoning. Connections located on control board. |

## 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 common or ground terminal for powering the external device.

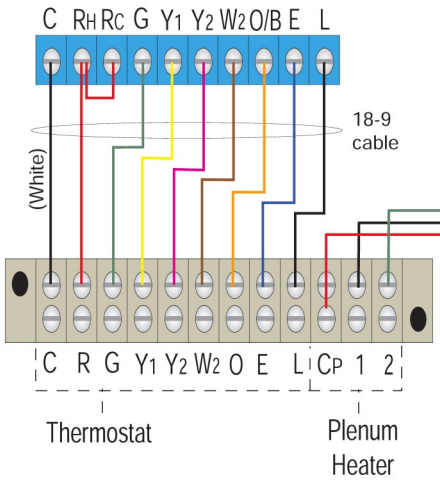
**TABLE 12 - Aquastat (Signals Control) Connections**

| 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) |

# Typical Thermostat Connections to GEN2 Control Board

## Two-Stage Models (Compressor Stages = T)

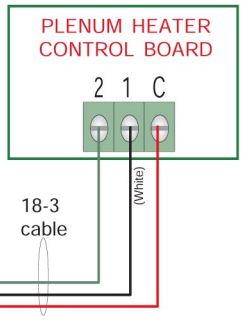
Typical 3 stage heat
2 stage cool
Heat Pump Thermostat



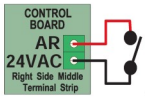

CONNECTION DESCRIPTION:

| | |
|---|---|
| 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.



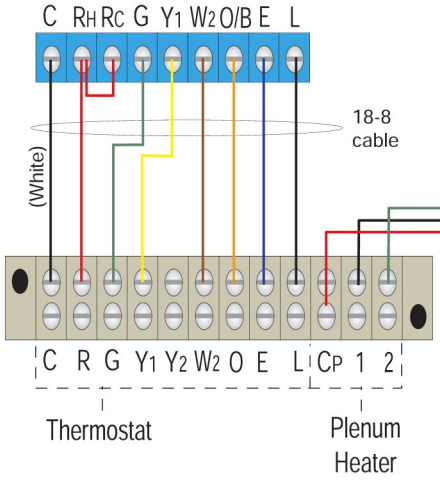

Note: If only using as single stage then only an 18-2 cable is required, place a jumper wire between 2 and 1 of the plenum heater terminals.




Note: Connect 24VAC amd 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)

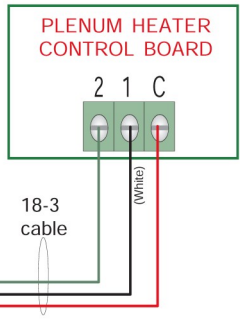
Typical 2 stage heat
1 stage cool
Heat Pump Thermostat



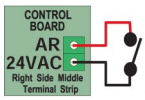

CONNECTION DESCRIPTION:

| | |
|---|---|
| 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 amd AR together with a dry contact to invoke the airflow reduction function. Refer to the manual for more information.

| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 01 | Initial Release | C. GEDDES | C. GEDDES | 21 APR 2016 |

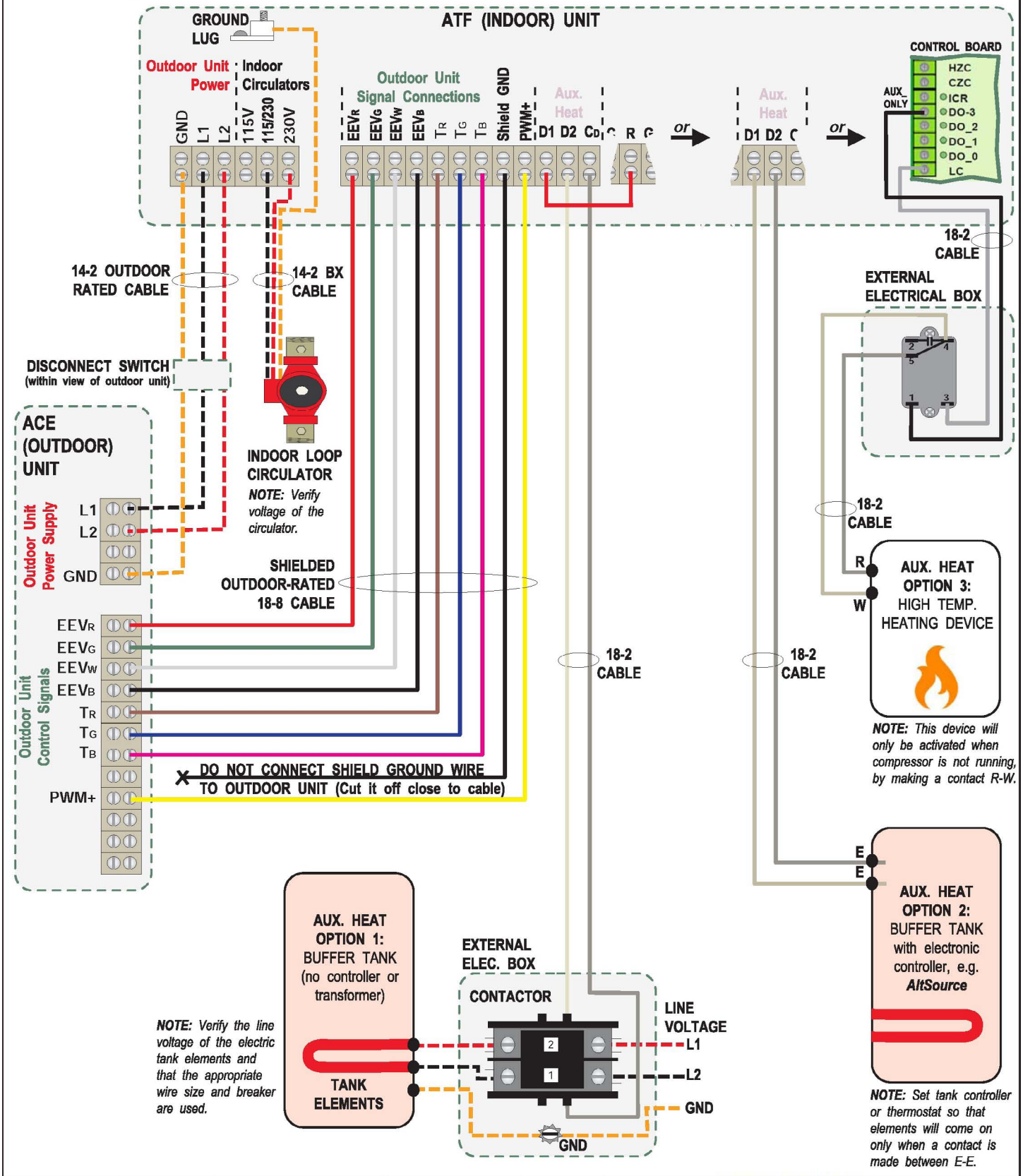
| | | |
|---|---|---|
| Drawn By: Chris Geddes | Date: 21 APR 2016 | |
| Checked By: Chris Geddes | Date: 21 APR 2016 | |
| Approved By (ENG): Chris Geddes | Date: 21 APR 2016 | |
| Approved By (MFG) | Date | |
| Approved By | Date | |

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

Drawing Name: Typical Thermostat Connections to GEN2 Control Board

| Size | Drawing Number | Drawing Rev | SHEET |
|---|---|---|---|
| A | 002071CDG | 01 | 1 of 1 |

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




| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| 02 | 000310 | Dan Rheault | Dan Rheault | 15-Feb-2023 |
| 01 | 000261 | Dan Rheault | Dan Rheault | 23-May-2018 |

| | | |
|---|---|---|
| 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 |
| Approved By (ENG) | Date | Size: A \| Drawing Number: 002304CDG \| Drawing Rev: 02 \| Sheet: 1 of 1 |
| Approved By (MFG) | Date | |
| Approved By | Date | |

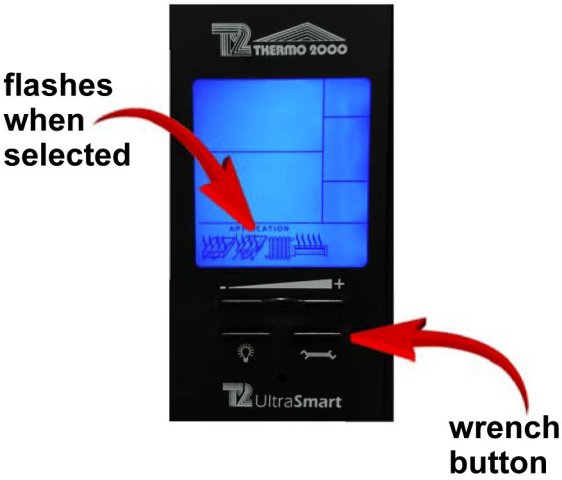
# AltSource Tanks: Getting Started

**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.)*

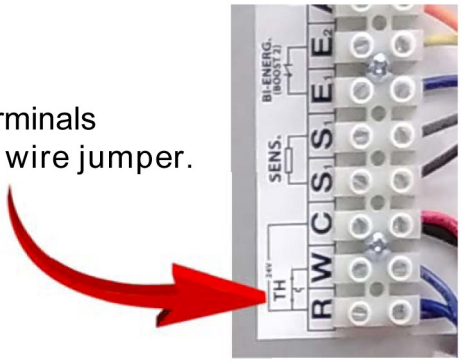
**1.** Put the tank in “Bi-Energy” rather than “Electric” mode, with switch on back of controller.

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

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




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



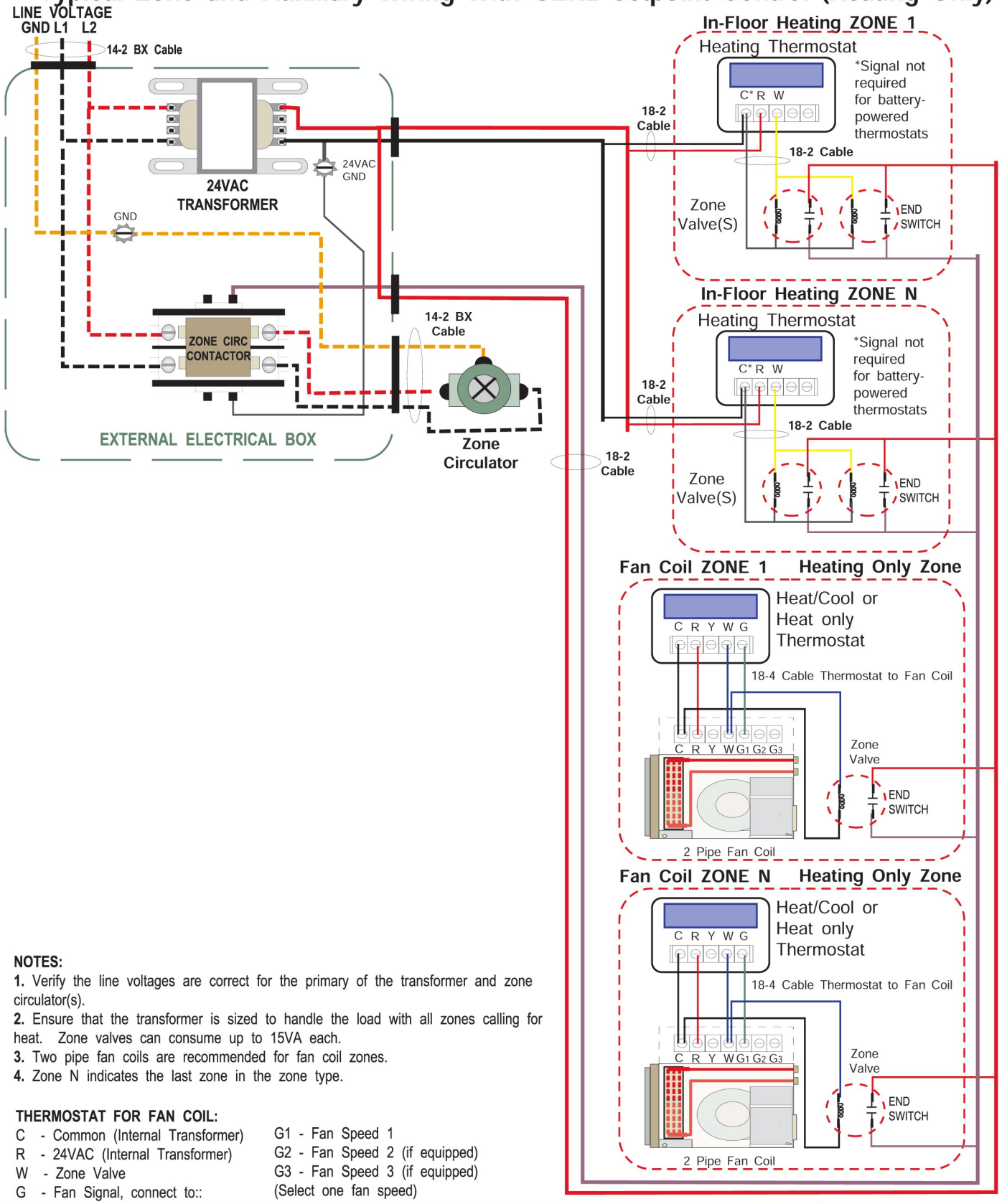

**4.** Now the tank elements will only be activated by a connection between the $E_1$-$E_2$ tank terminals, up to the 125°F maximum. This will be done by an 18-2 wire to the **D1-D2** terminals in the heat pump, activating the elements only when ***AUX*** heat is required.

See heat pump manual for further explanation.

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


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

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




**NOTES:**

**1.** Verify the line voltages are correct for the primary of the transformer and zone circulator(s).

**2.** Ensure that the transformer is sized to handle the load with all zones calling for heat. Zone valves can consume up to 15VA each.

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

**4.** Zone N indicates the last zone in the zone type.

**THERMOSTAT FOR FAN COIL:**

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

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

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

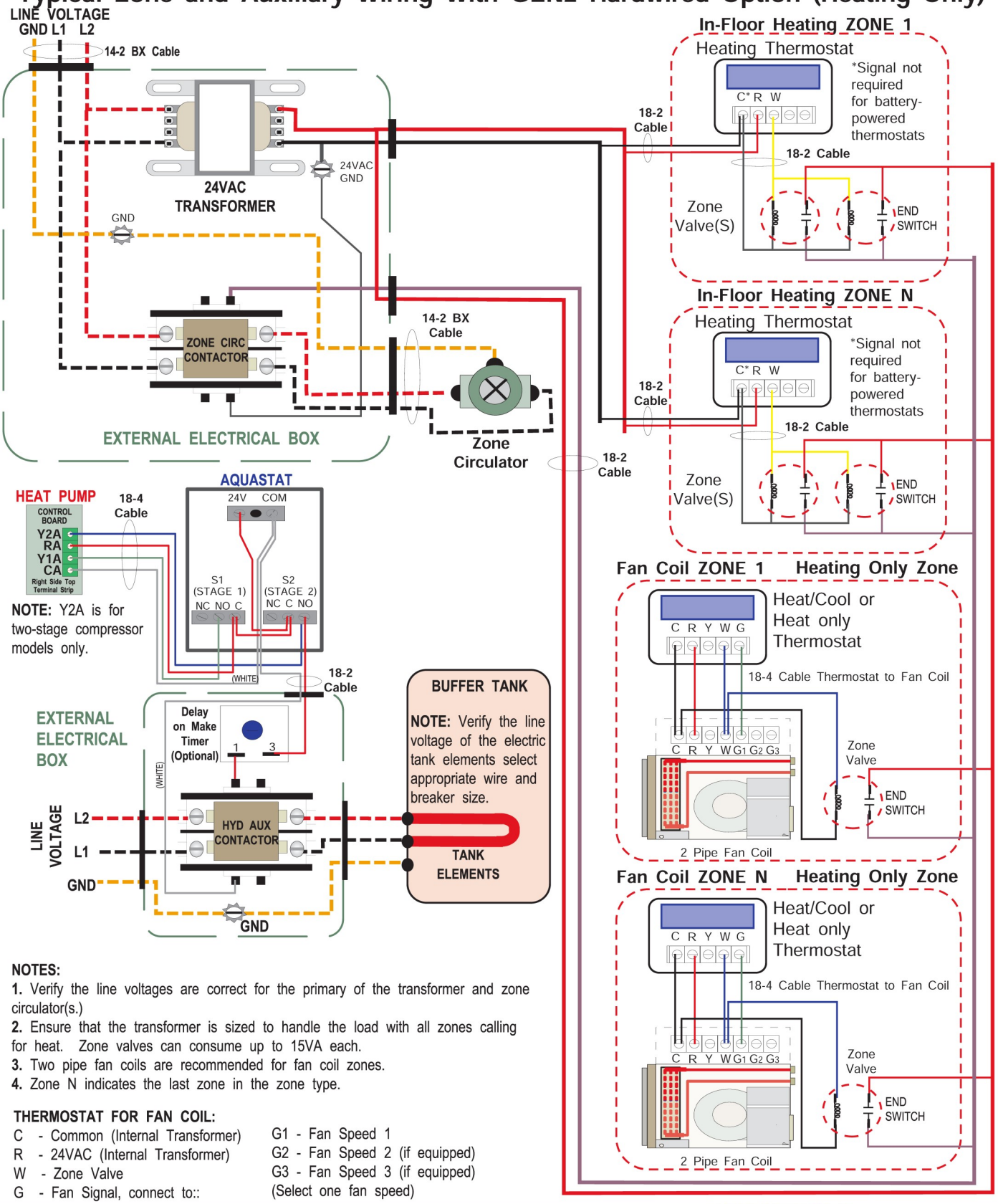
| | | |
|---|---|---|
| Drawn By C. Geddes | Date 04-APR-2016 | |
| Checked By C. Geddes | Date 04-APR-2016 | |
| Approved By (ENG) C. Geddes | Date 04-APR-2016 | |
| Approved By (MFG) | Date | |
| Approved By | Date | |

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

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

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

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




**NOTES:**

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

**THERMOSTAT FOR FAN COIL:**

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

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

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

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

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

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

# 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.

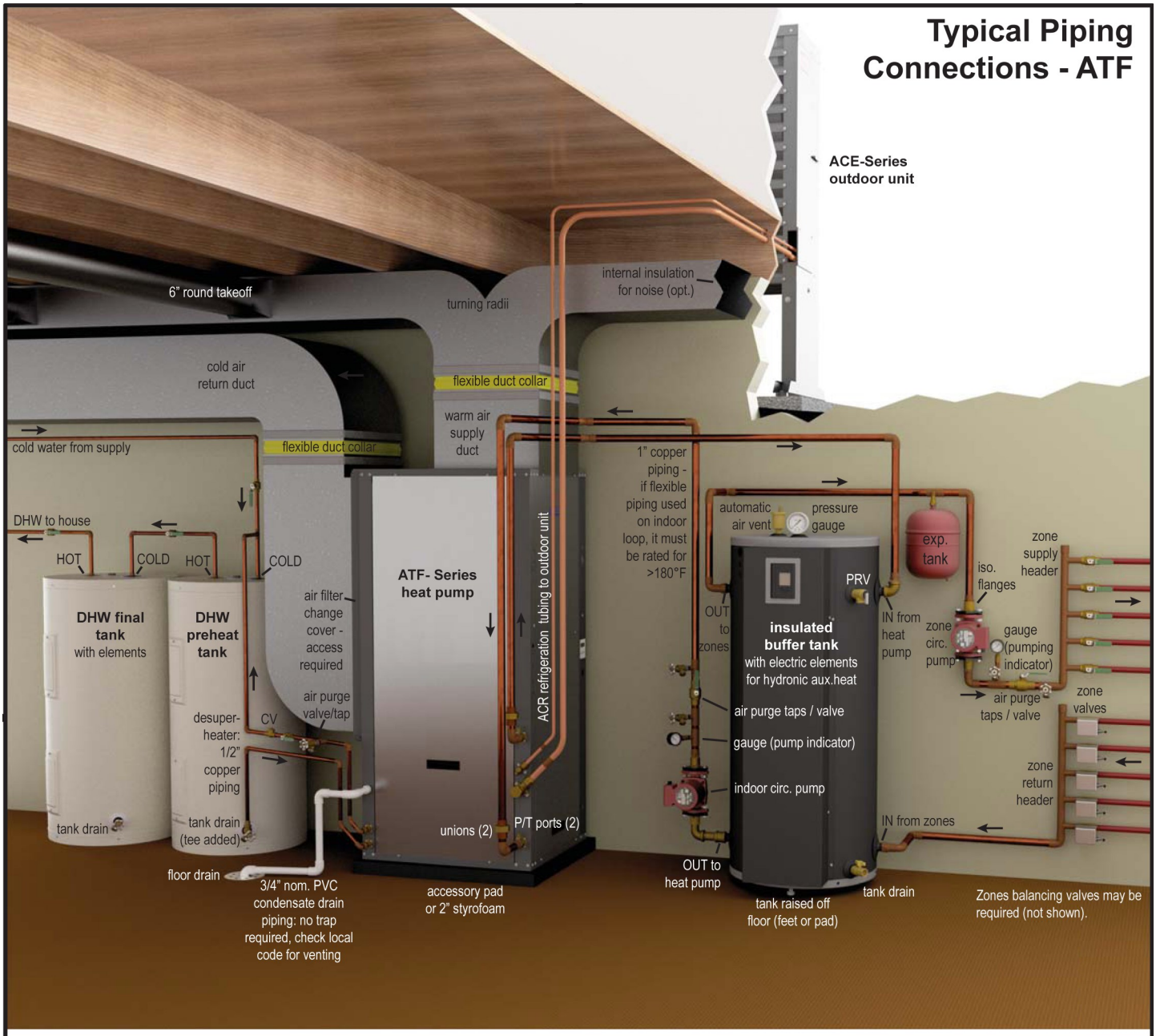
The DHW loop may have to be purged of air several times before good circulation is obtained. A temperature difference between the DHW In and DHW Out can be felt by hand when the circulator pump is operating properly.

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 ines as shown in the diagram, a pressure relief valve must be installed to prevent possible damage to the domestic hot water circulator pump should both valves be closed.**

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.

| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| 02 | 000266 | Dan Rheault | Dan Rheault | 1-Mar-2020 |
| 01 | Initial Rel. | Dan Rheault | Dan Rheault | 25-May-2018 |

| | | |
|---|---|---|
| Drawn By: Dan Rheault | Date: 25-May-2018 | |
| Checked By: Dan Rheault | Date: 25-May-2018 | |
| Eng. Approved By | Date | |
| Mfg. Approved By | Date | |
| Approved By | Date | |


MARITIME GEOTHERMAL LTD.
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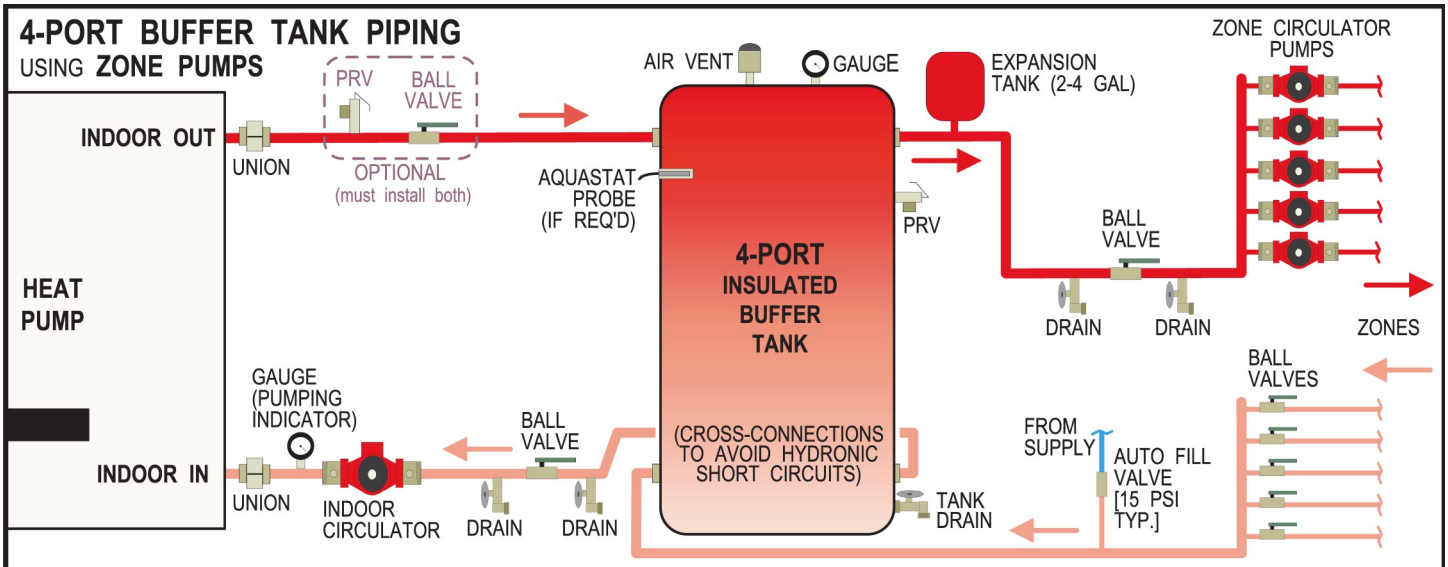
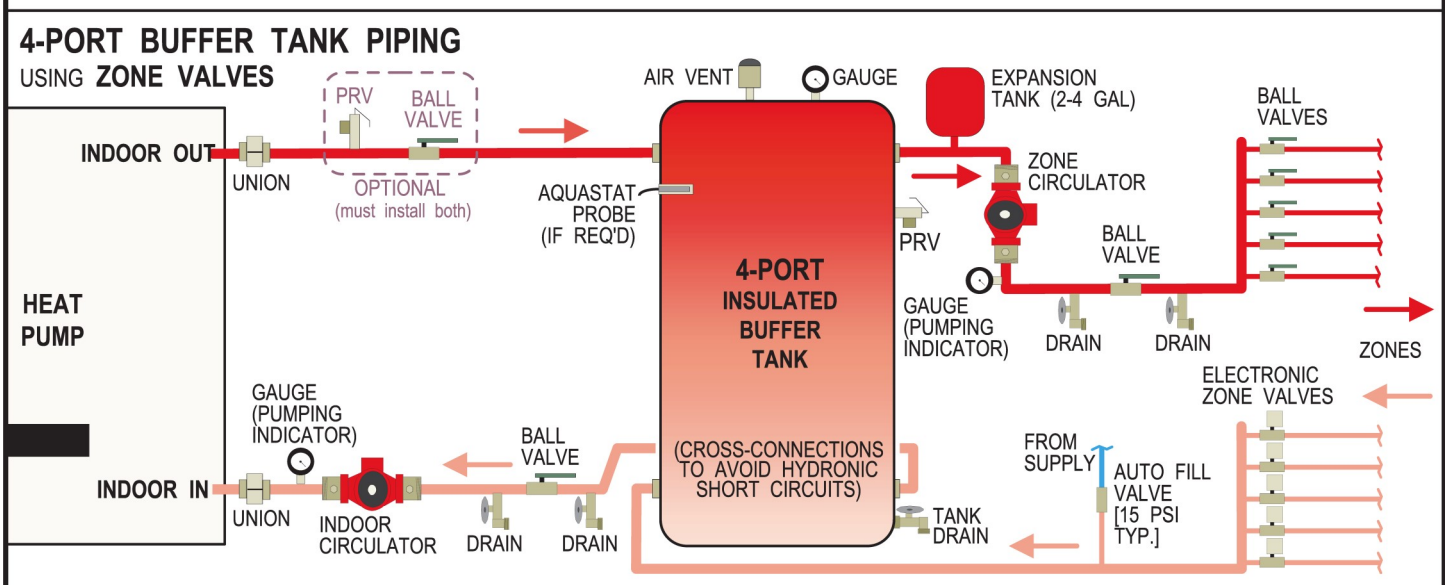
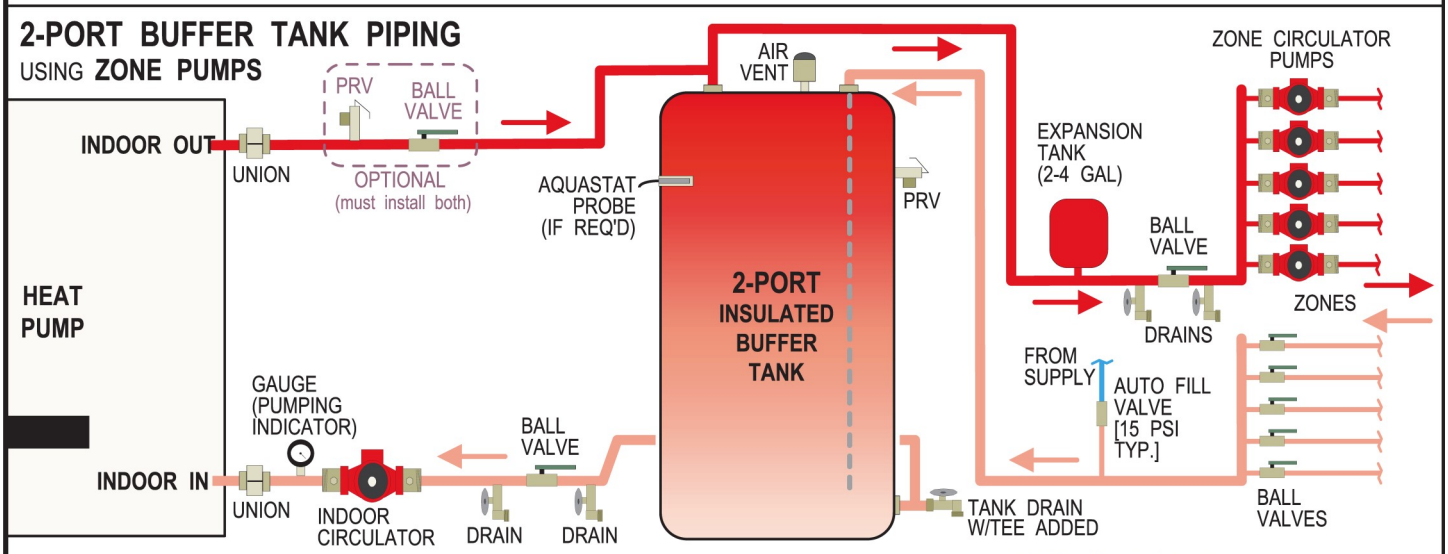
Drawing Name: **Typical Piping Connections - ATF**

| Size | Drawing Number | Revision | Sheet |
|---|---|---|---|
| LET | 002305PDG | 02 | 1 / 1 |



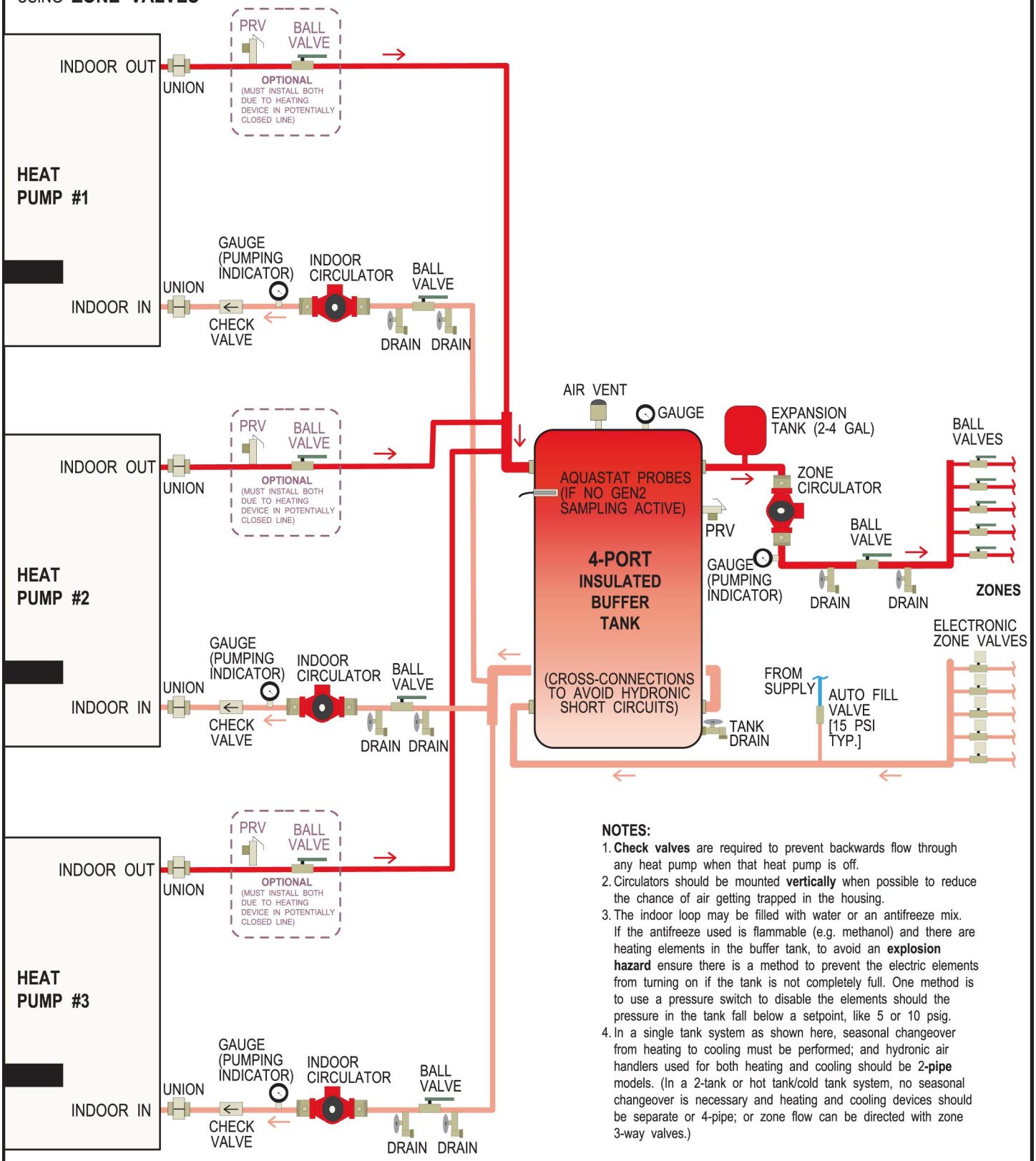




| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 02 | (add fill valve) | D. RHEAULT | D. RHEAULT | 1-Feb-2021 |
| 01 | Initial Release | D. RHEAULT | D. RHEAULT | 14-Dec-2018 |

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

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

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




**NOTES:**

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

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

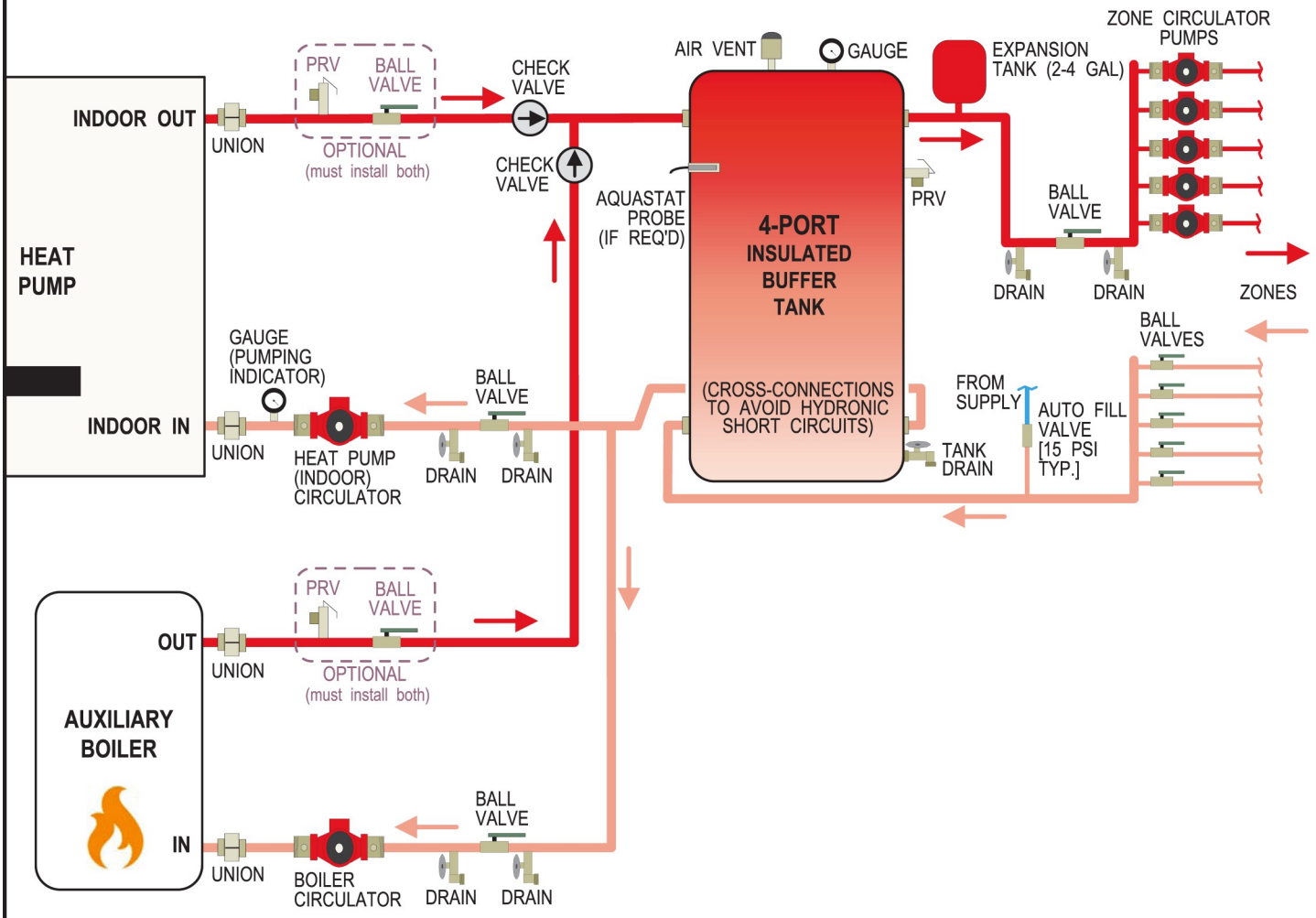
| | | | |
|---|---|---|---|
| Drawn By: Dan Rheault | Date: 9-Aug-2021 | MARITIME GEOTHERMAL LTD. | 170 Plantation Rd. Petitcodiac, NB E4Z 6H4 |
| Checked By: Dan Rheault | Date: 9-Aug-2021 | Drawing Name: **Buffer Tank Piping - Multiple Units** | |
| Approved By (ENG) | Date | | |
| Approved By (MFG)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

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

# Auxiliary Boiler Piping

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

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




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

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

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

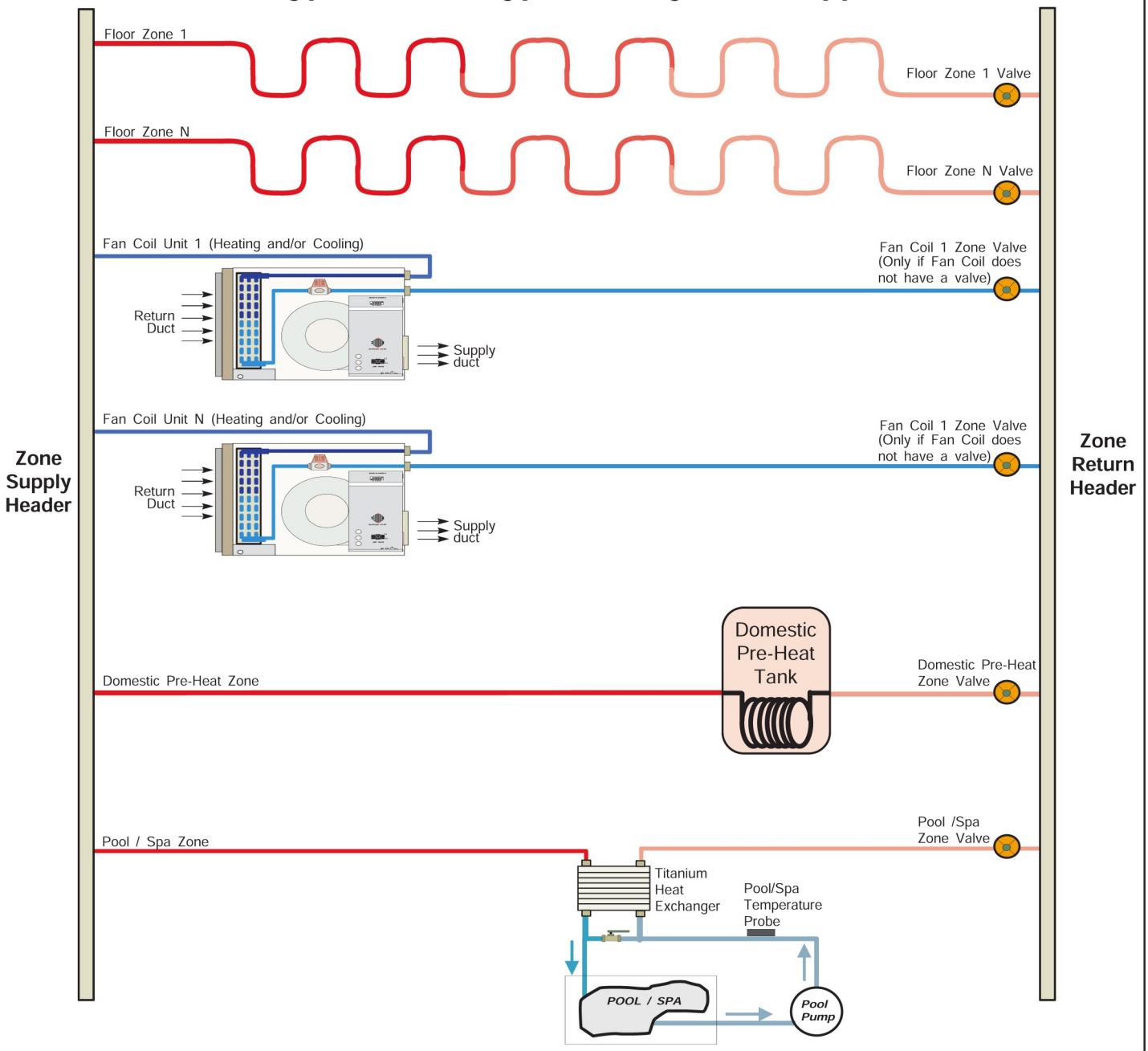
| | | |
|---|---|---|
| Drawn By: Dan Rheault | Date: 14-Dec-2018 | |
| Checked By: Dan Rheault | Date: 14-Dec-2018 | |
| Approved By (ENG) | Date | |
| Approved By (MFG) | Date | |
| Approved By | Date | |

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

Drawing Name: **Auxiliary Boiler Piping**

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

# Typical Zone Types for Hydronic Applications




**NOTES:**

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

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

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

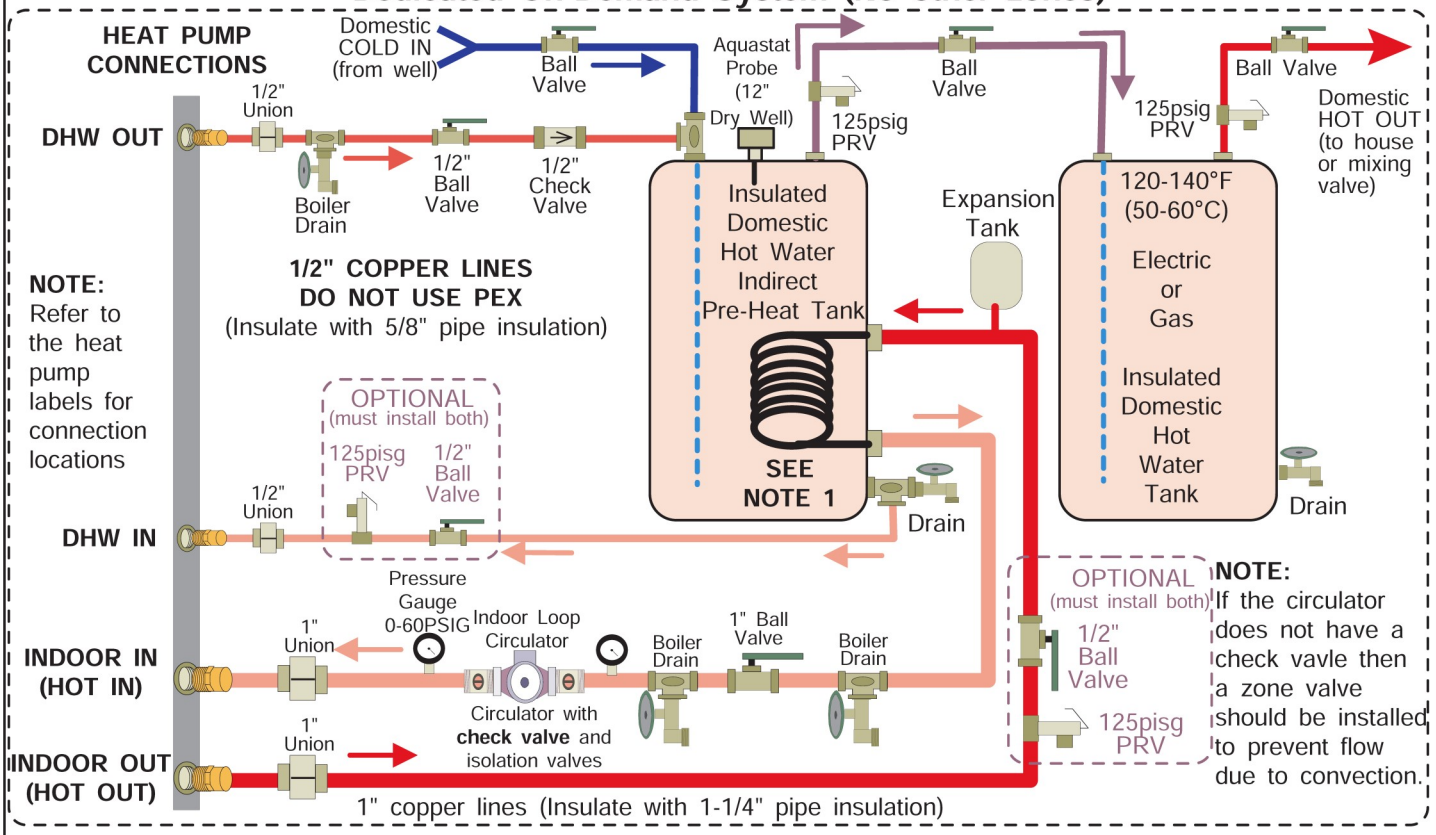
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Zone Types for Hydronic Applications

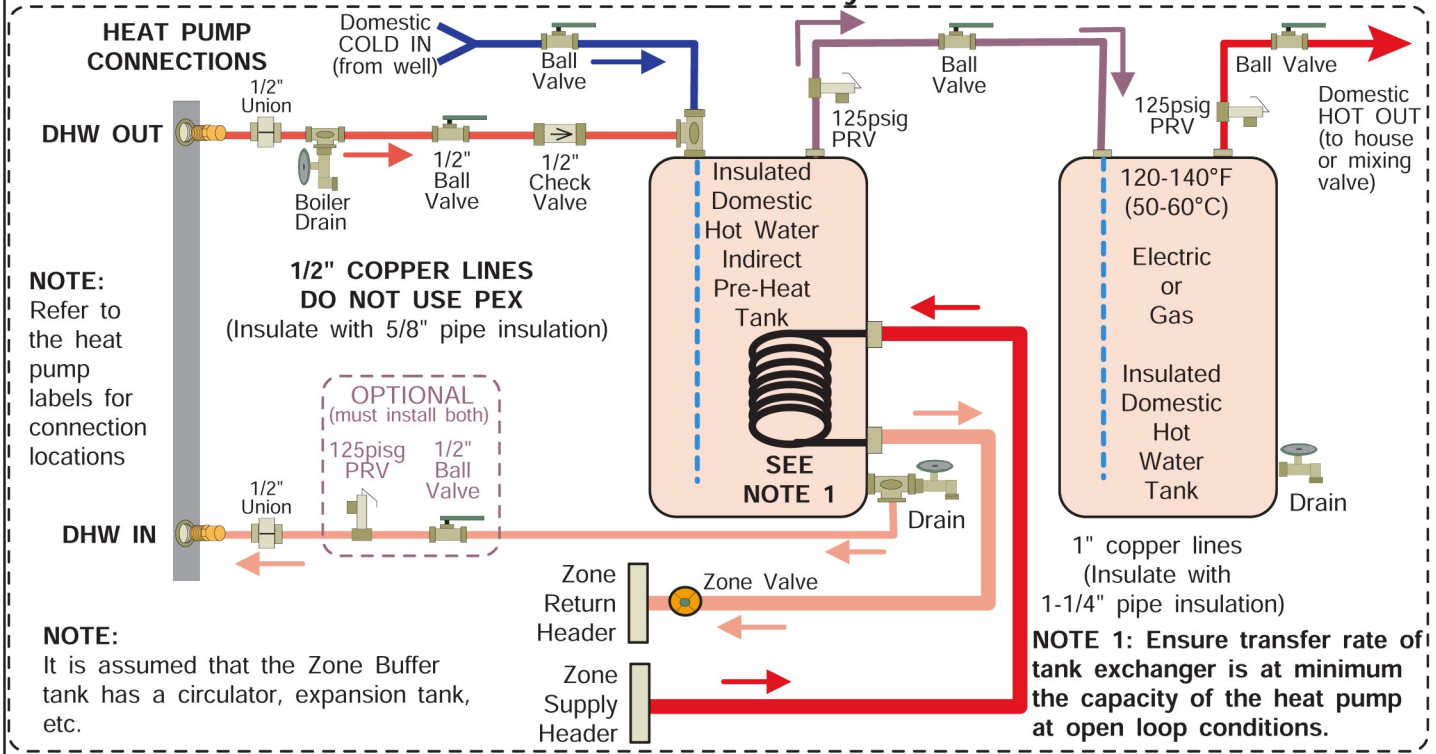
| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 000530PDG | 01 | 1 of 1 |

# Single Unit Connection to On-Demand Domestic Hot Water Pre-Heat Tank

## Dedicated On-Demand System (No other zones)




## Zoned On-Demand System




| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| 02 | 000161 | C. GEDDES | C. GEDDES | 05 FEB 10 |
| 01 | Initial Release | C. GEDDES | C. GEDDES | 29 JUN 09 |

| | | |
|---|---|---|
| Drawn By: Chris Geddes | Date: 29 JUN 09 | |
| Checked By: Chris Geddes | Date: 29 JUN 09 | |
| Approved By (ENG): Chris Geddes | Date: 29 JUN 00 | |
| Approved By (MFG): | Date: | |
| Approved By: | Date: | |

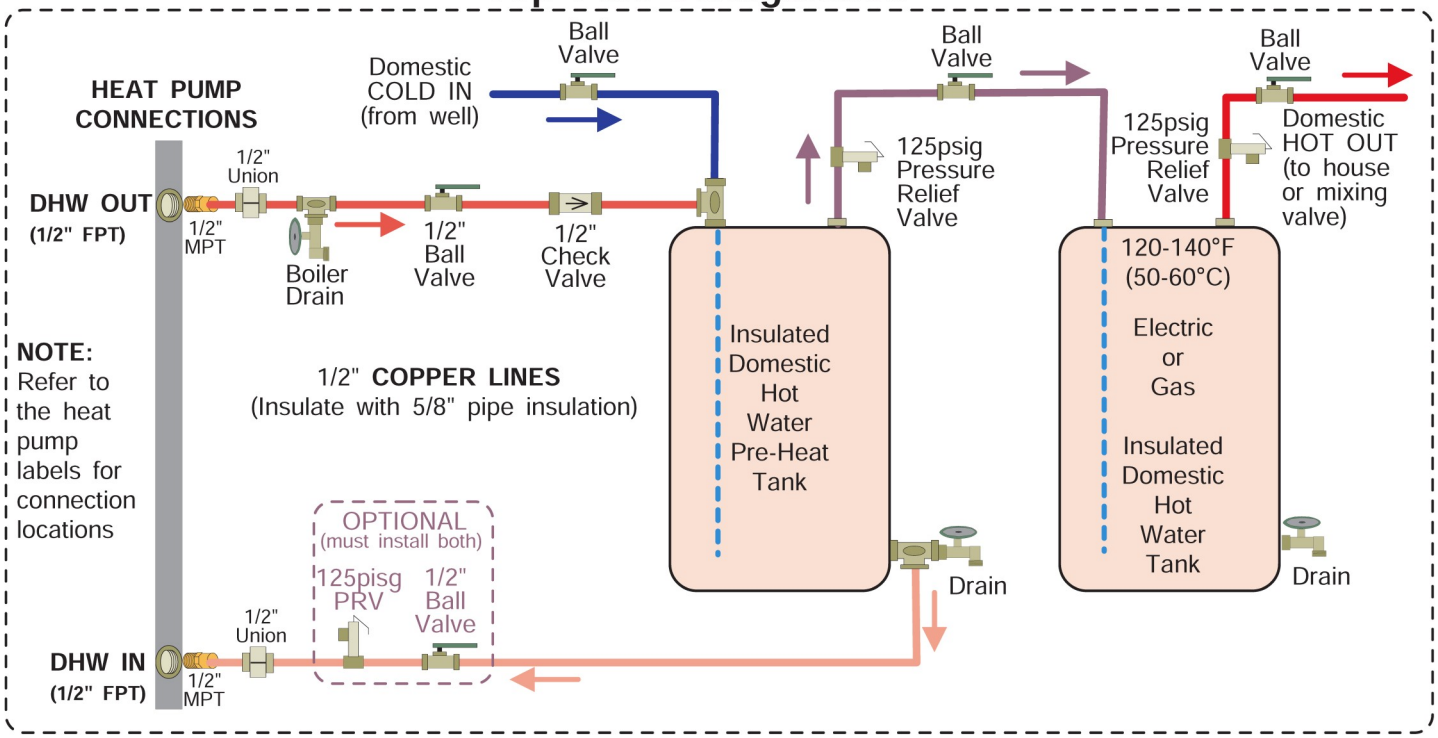
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

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

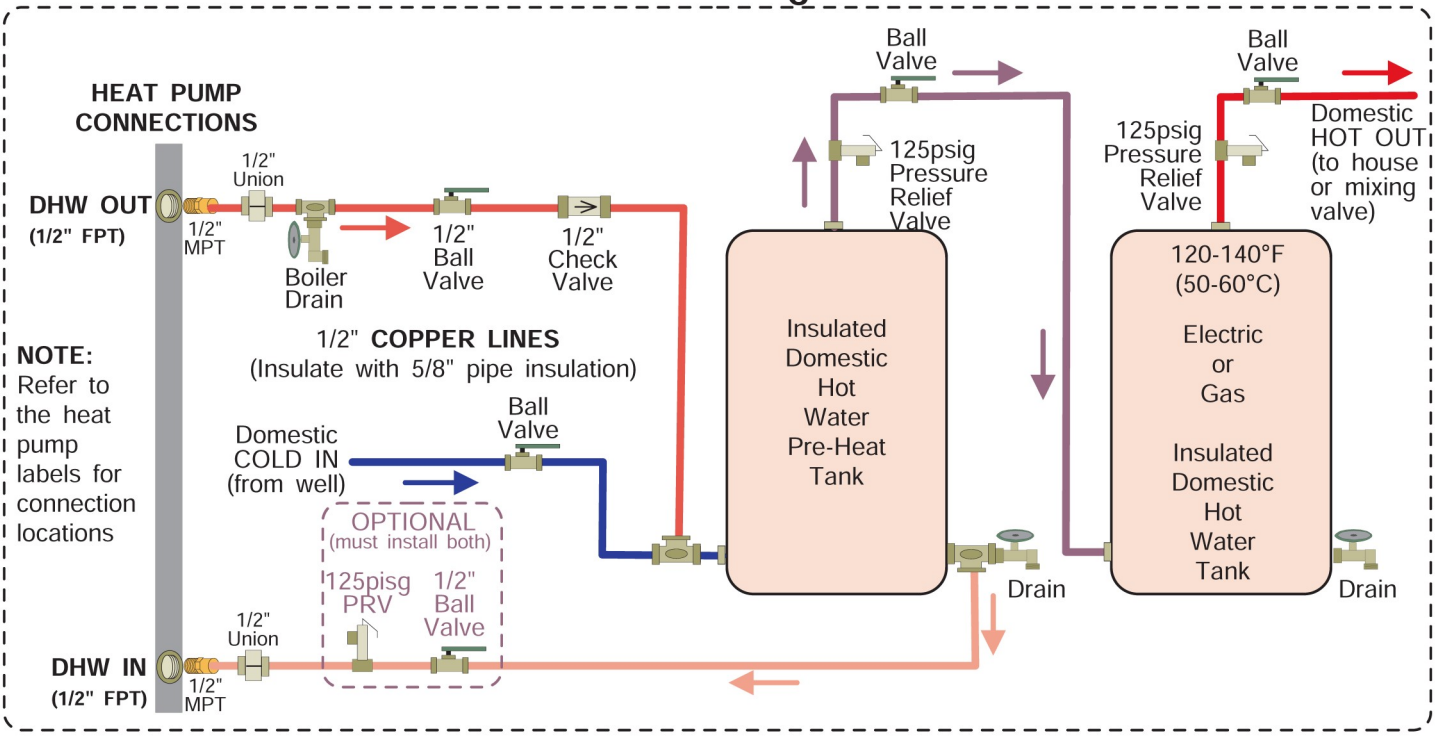
| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 001055PDG | 02 | 1 of 1 |

# Desuperheater Connection to DHW Pre-Heat Tank

## Top Port Configuration




## Side Port Configuration




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

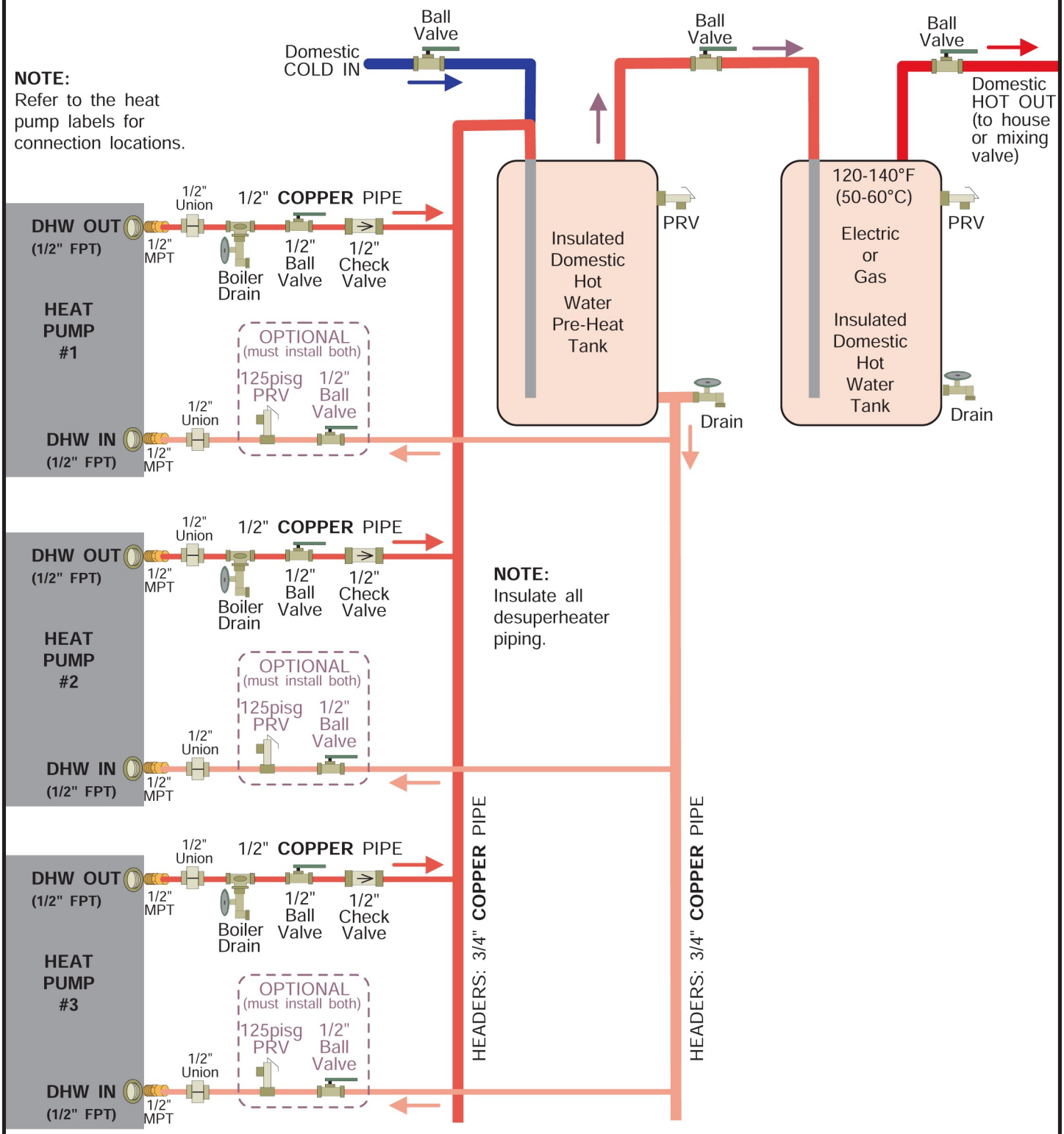
| | | |
|---|---|---|
| Drawn By: Chris Geddes | Date: 10 MAR 09 | |
| Checked By: Chris Geddes | Date: 10 MAR 09 | |
| Approved By (ENG): Chris Geddes | Date: 10 MAR 09 | |
| Approved By (MFG): | Date: | |
| Approved By: | Date: | |

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

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

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

# Desuperheater Connection to DHW Pre-Heat Tank - Multiple Units




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

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

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

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

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

# Outdoor Unit Line Set

## 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 | | |
|---|---|---|
| ATA-25/45 | Vapour line O.D. | 3/4” |
| | Liquid line O.D. | 3/8” |
| ATA-55/65/75 | Vapour line O.D. | 7/8” |
| | Liquid line O.D. | 1/2” |

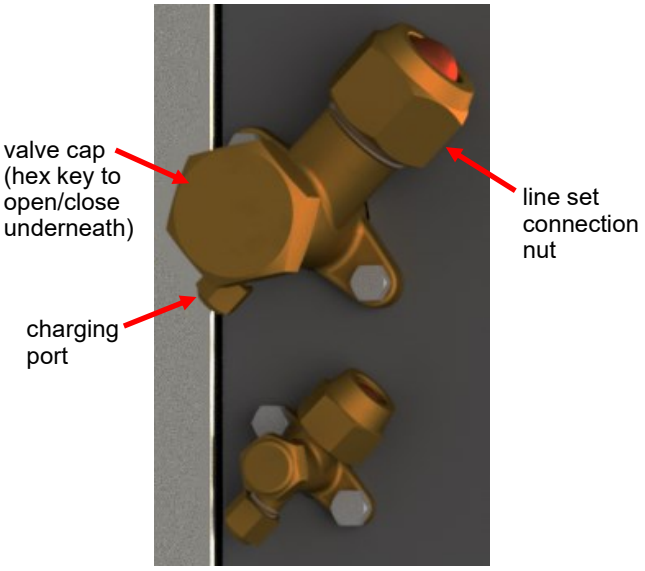
**IMPORTANT NOTE: The line set between the indoor and outdoor units must not exceed 70 ft. (21 m) in length.**

## 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.




| 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)* |

## 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.

## Oil Traps

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

## Filter-Dryer

Note that **no field installed filter-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 any joints in in the line sets are accessible for leak testing.

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

## Silver Soldering Line Sets

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

A wet rag may be wrapped around each of the outdoor unit ports to prevent melting the grommet when silver soldering; however this should 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 the system sealed.

## Charging the System

The indoor unit is pre-charged for line sets up to **20 ft** long. Once the system has been vacuumed, if 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) | (kg) |
| 22 | 2 | 0.1 | 0.06 |
| 24 | 4 | 0.3 | 0.12 |
| 26 | 7 | 0.4 | 0.19 |
| 28 | 9 | 0.6 | 0.25 |
| 30 | 11 | 0.7 | 0.31 |
| 32 | 13 | 0.8 | 0.37 |
| 34 | 15 | 1.0 | 0.44 |
| 36 | 18 | 1.1 | 0.50 |
| 38 | 20 | 1.2 | 0.56 |
| 40 | 22 | 1.4 | 0.62 |
| 42 | 24 | 1.5 | 0.69 |
| 44 | 26 | 1.7 | 0.75 |
| 46 | 29 | 1.8 | 0.81 |
| 48 | 31 | 1.9 | 0.87 |
| 50 | 33 | 2.1 | 0.94 |
| 52 | 35 | 2.2 | 1.00 |
| 54 | 37 | 2.3 | 1.06 |
| 56 | 40 | 2.5 | 1.12 |
| 58 | 42 | 2.6 | 1.19 |
| 60 | 44 | 2.8 | 1.25 |
| 62 | 46 | 2.9 | 1.31 |
| 64 | 48 | 3.0 | 1.37 |
| 66 | 51 | 3.2 | 1.43 |
| 68 | 53 | 3.3 | 1.50 |
| 70 | 55 | 3.4 | 1.56 |

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

# Typical ATA/ATF to Outdoor Unit Line Set Connections


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

| | | |
|---|---|---|
| Drawn By | Dan Rheault | Date 6-Oct-2017 |
| Checked By | Dan Rheault | Date 6-Oct-2017 |
| Eng. Approved By | | Date |
| Mfg. Approved By | | Date |
| Approved By | | Date |

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

Drawing Name
**Typical ATA/ATF to Outdoor Unit Line Set Connections**

| Size | Drawing Number | Revision | Sheet |
|---|---|---|---|
| LET | 002250CDG | 02 | 1 / 1 |

# 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 **95º-105ºF (35-40ºC)**, 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 travelling 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.

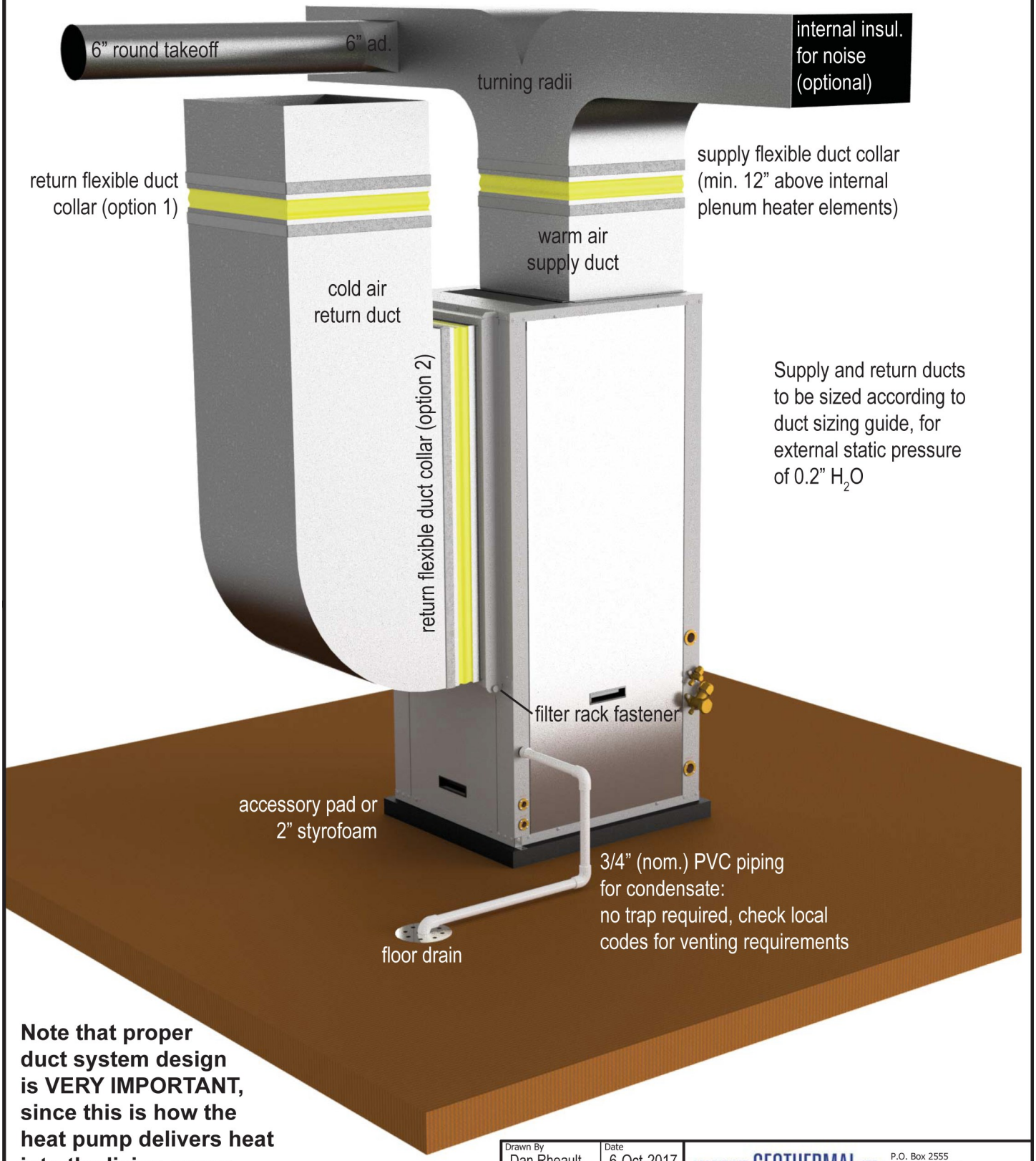
## Thermostat Location

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




**Note that proper duct system design is VERY IMPORTANT, since this is how the heat pump delivers heat into the living space.**

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

| | | |
|---|---|---|
| Drawn By: Dan Rheault | Date: 6-Oct-2017 | |
| Checked By: Dan Rheault | Date: 6-Oct-2017 | |
| Eng. Approved By | Date | |
| Mfg. Approved By | Date | |
| Approved By | Date | |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Drawing Name: **Typical Duct & Condensate Connections - ATA/ATF Series**

| Size | Drawing Number | Revision | Sheet |
|---|---|---|---|
| LET | 002249PDG | 02 | 1 / 1 |

## TABLE 19 - Duct Sizing Guide (external static of 0.20" $H_2O$)

| 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.

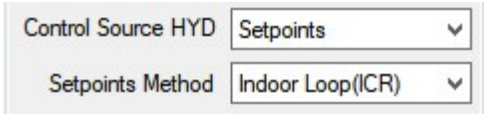
## 1. Hydronic Heating: Setpoint Control

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.

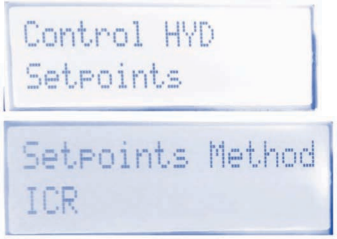
There are two options for Setpoint Control, Indoor Loop (ICR) method and HTS/CTS method.

### *Setpoint Control Method 1 - Indoor Loop (ICR)*

***PC APP: Tools-->Configuration***




***LCD Interface: Configuration***



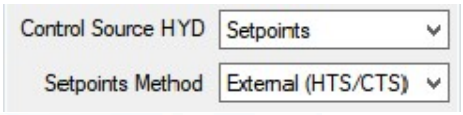

This is the default method and uses the Indoor OUT temperature probe inside the unit for temperature control. Its value is displayed in the **Hot Tank** box on the PC App's **View --> Setpoint Control** screen. If this temperature shows **NC**, then either the probe is not connected to the board or there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

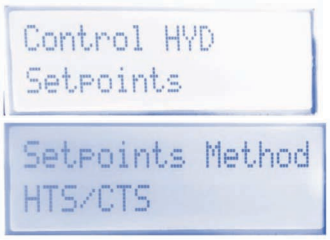
See below, and also the **PC Application (PC App)** section for full screenshots of the various windows.

### *Setpoint Control Method 2 - External HTS/CTS*

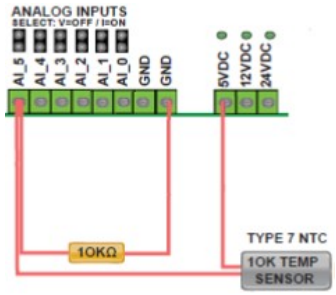
***PC APP: Tools-->Configuration***




***LCD Interface: Configuration***



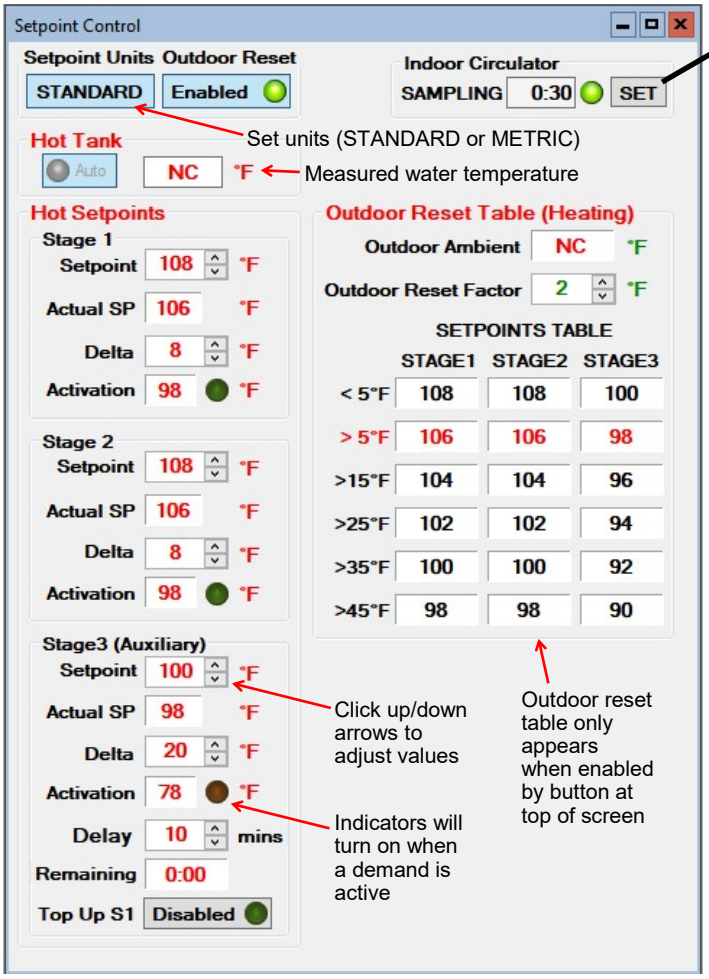

When this method is used, no indoor circulator control for temperature sampling will occur. It requires an external temperature sensor placed in a dry well in the top of the buffer tank. Its value is displayed in the **Hot Tank** box on the PC App's **View --> Setpoint Control** screen. If this temperature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

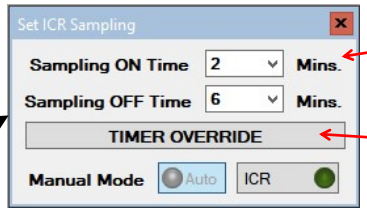



A 10K Type 7 (or Type 3) NTC thermistor along with a 10K 1% or better resistor must be connected to the control board in order to use the External HTS/CTS method. Connect the sensor to the AI_5 input as shown above and on the wiring diagram (SCH) in the **Model Specific Information** section. Remove 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 switching to Manual Override mode, the Activation no longer responds to the Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached . Go to the Control Panel to turn demand ON/OFF with the Stage buttons when in Manual Override Mode .**

**TABLE 20 - Typical Temperature Setpoints**

| | Stage 1 | | Stage 2 | | Stage 3 | |
|---|---|---|---|---|---|---|
| **Item** | **°F** | **°C** | **°F** | **°C** | **°F** | **°C** |
| **Setpoint** | **108** | **42** | **105** | **41** | **102** | **39** |
| **Delta** | **8** | **4** | **8** | **4** | **8** | **4** |
| **Activation *** | **100** | **38** | **97** | **37** | **94** | **35** |
| **Delay** | | | | | **10 minutes** | |
| *Activation is determined by the Setpoint and Delta values | | | | | | |

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

The maximum water temperature setpoint is **120°F / 49°C**. This is de-rated at cold outdoor temperatures according to the following table, to keep the compressor operating within its envelope. The de-rated setpoint will be shown as "**Actual SP**" in the **Setpoint Control** window. (**Actual SP** will also be reduced by the **Outdoor Reset** feature, described shortly.)

**TABLE 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 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.

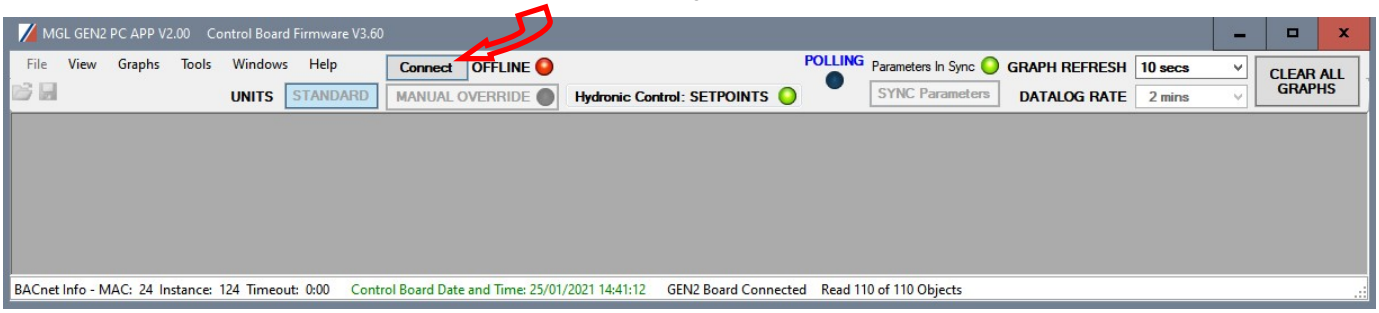
Most installations will instead use **Setpoint Control**; however, **Signals Control** provides control flexibility for certain situations, for example if two water loops with different setpoints are being heated. Temperature settings similar to those outlined in the previous **Setpoint Control** section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

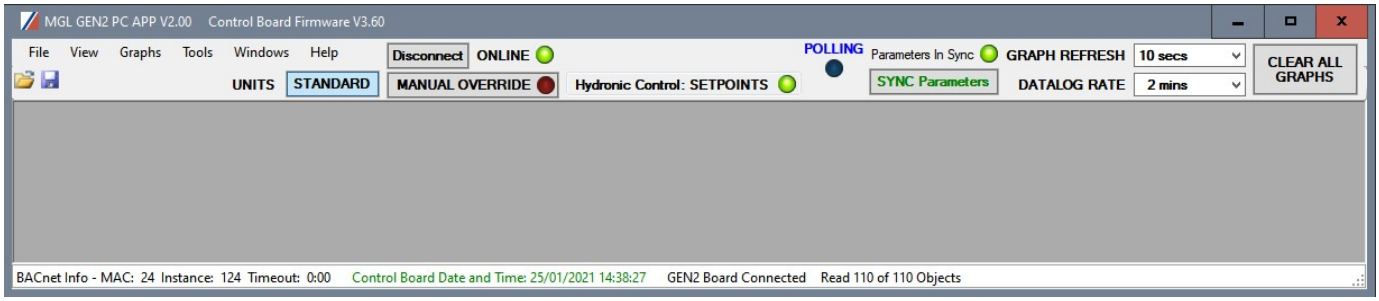
# PC Application (PC App)

**NOTE:** Before using the PC Application, refer to **Appendices B & C** for installation instructions for the PC Application and USB driver for the COM port. Both must be installed in order to run the PC App and communicate with the control board.

Connect a USB cable between the PC and the control board USB connector located at the bottom center of the board. Use the Windows Start menu to launch the PC App. You should see a screen similar to the one below. The revision of the PC APP is shown in the top left corner of the screen. Click the ***Connect*** button to begin communications with the control board.




Once connected, the menus and buttons will become accessible, the number of Objects available and Read should appear (they should be the same) and the Polling LED will begin to flash. The PC time and date will appear at the bottom left corner of the screen. Clicking on "Control Board Date and Time" will display the current control board date and time. If the date and time need to be adjusted, click on menu ***Tools—Set Date and Time***. The control board date and time will be set to that of the PC.




## PC Application Menus

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

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

***File-->Open***: Opens a saved page arrangement.
***File-->Save***: Saves the current page arrangement under the current name.
***File-->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.

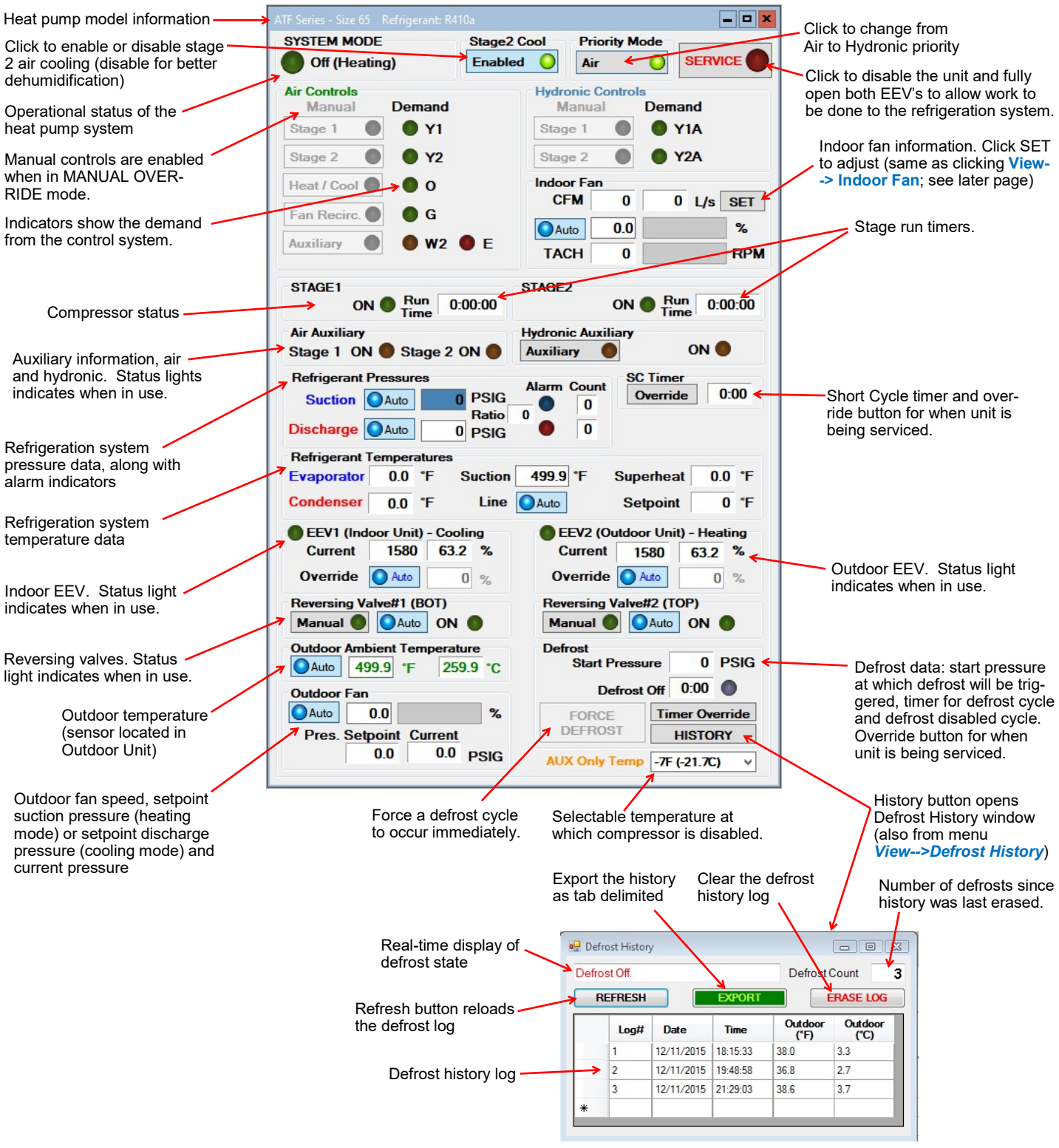
***Help Menu:*** This shows information about the PC Application.

***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 (this will be lost when the PC is disconnected from the control board.)
3. **LIMITS** - Limits in effect which prevent compressor operation but that do not cause an alarm.
4. **FAULTS** - List of board hardware faults.

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

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

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

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

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

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

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

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

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

***Low Charge:*** 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).

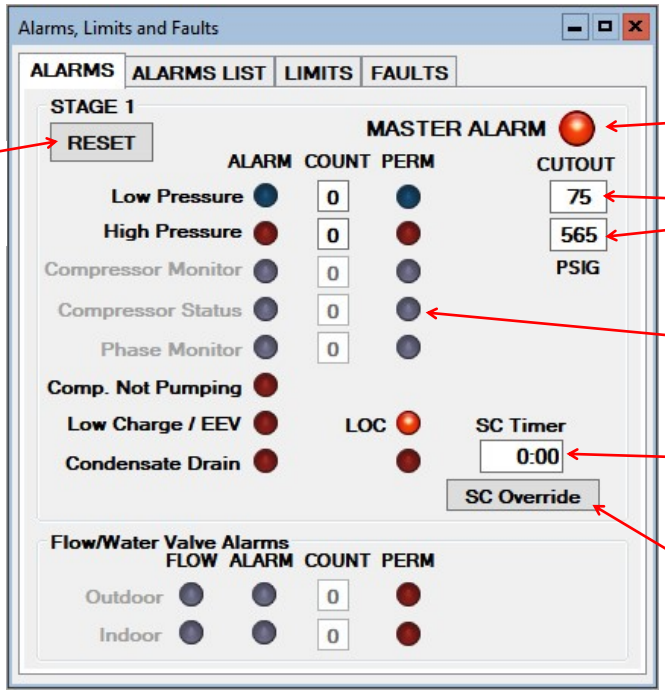
***Condensate Drain:*** This alarm occurs if fluid level in the condensate tray rises to the level of the sensor (if equipped).

***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.

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

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

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




***Master Alarm*** occurs when any alarm occurs.

Low Pressure cut out

High Pressure cut out

Greyed out alarms are not applicable to the system.

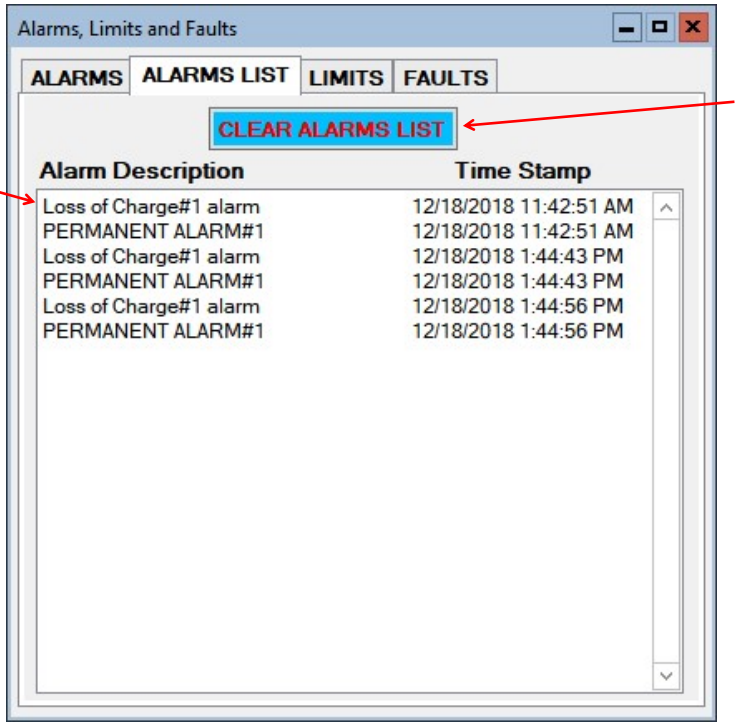
Short Cycle Timer counts down time until the next compressor start is allowed.

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

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

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

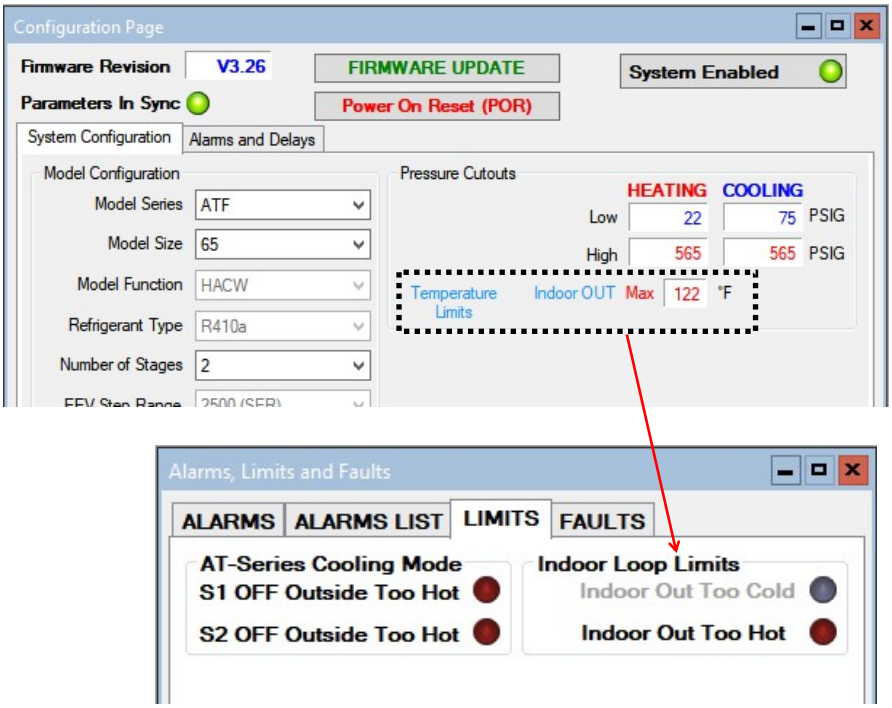
Each alarm that occurs while the PC APP is connected to the control board will appear here. The alarm type and a time stamp will be shown. The alarms list will be erased when the PC APP is disconnected from the control board.




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

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

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



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

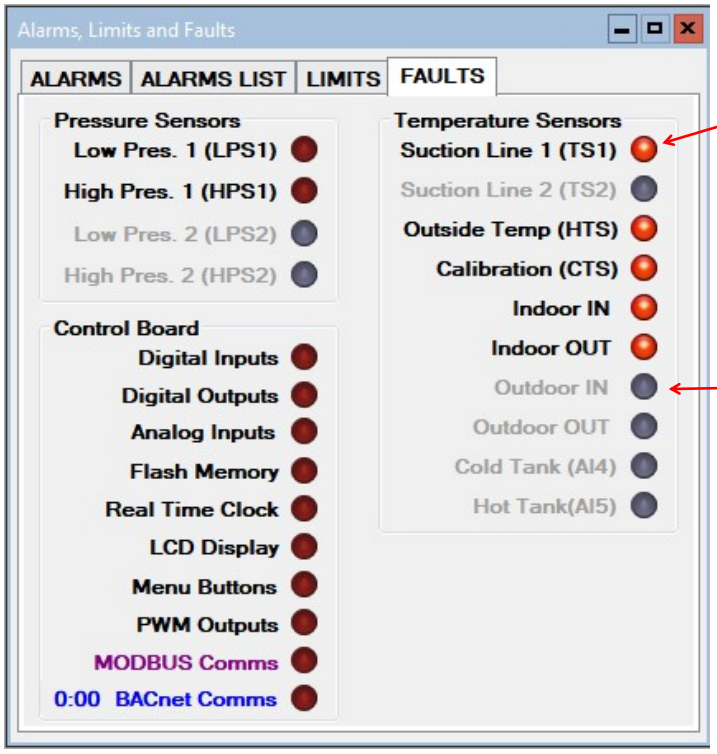
This tab shows hardware faults that could occur. If one of these faults occurs there may be a problem with the control board hardware, with LCD Display and buttons, or with a sensor.

**If a fault occurs, some things to try:**

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

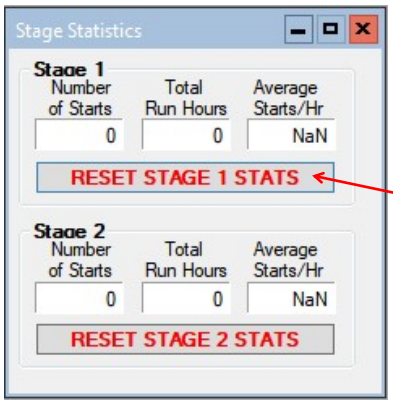



### *View-->Defrost History*:

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

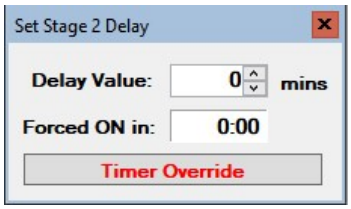
### *View-->Stage Stats*:

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




### *View-->Set Stage 2 Delay*:

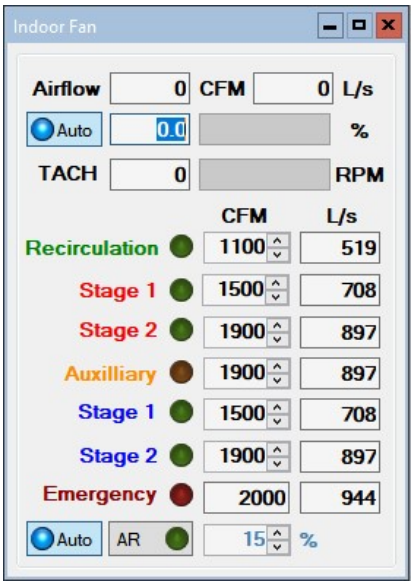
Sets the delay before stage 2 is engaged on a stage 1 demand. **Set to "0" for no stage 2 engaged on a stage-1-only demand from thermostat.**



### *View-->Indoor Fan*

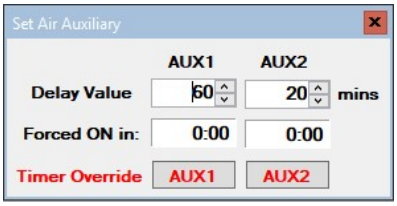
Shows the settings screen for the indoor fan/blower. Airflow may be adjusted up or down by the user within the allowed range. See **Indoor Airflow Data** section in the **Model Specific Information** chapter for airflow ranges.

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



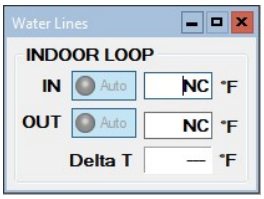

### *View-->Set Air Auxiliary Delays*

Sets 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.**



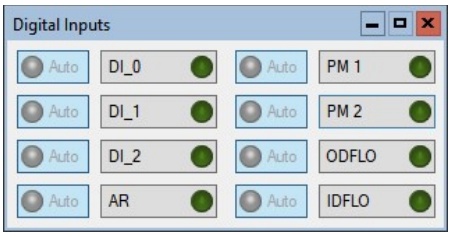

### *View-->Water Lines*

Shows the water line temperatures.



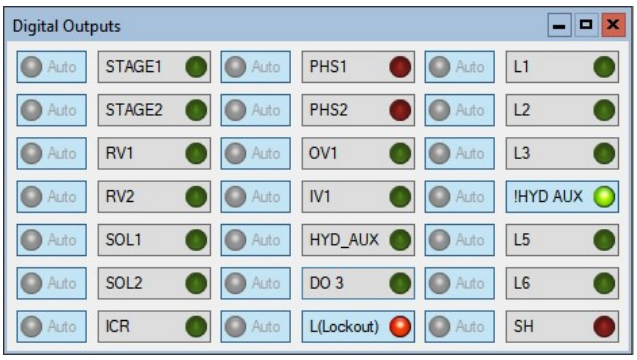

### *View-->Digital Inputs*

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




### *View-->Digital Outputs*

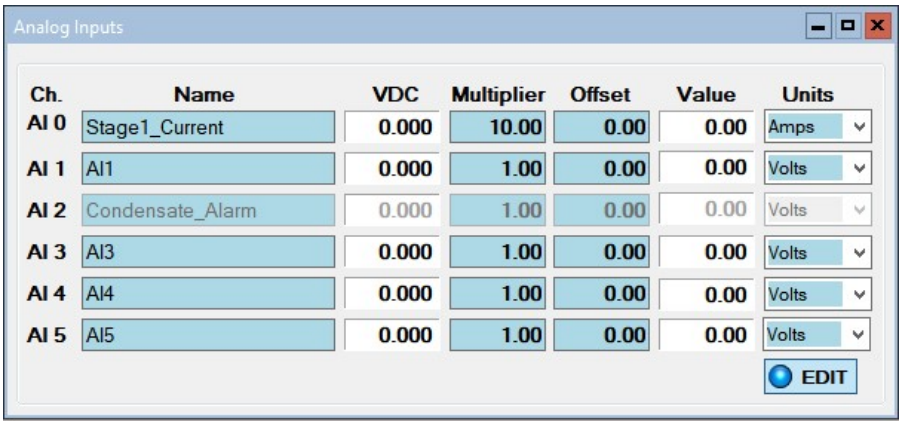
Shows the digital outputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.
.




### *View-->Analog Inputs*

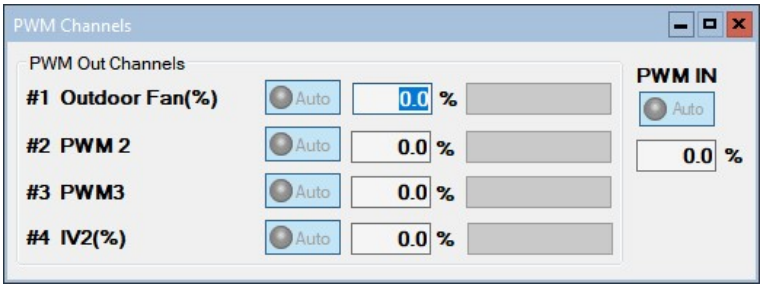
Shows the Analog inputs and their individual settings and values.

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



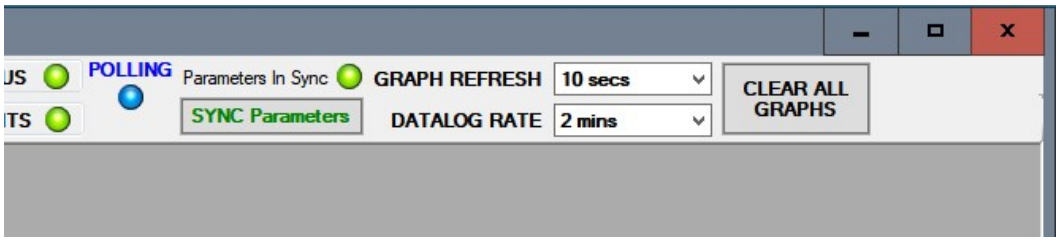

### *View-->PWM Channels*

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

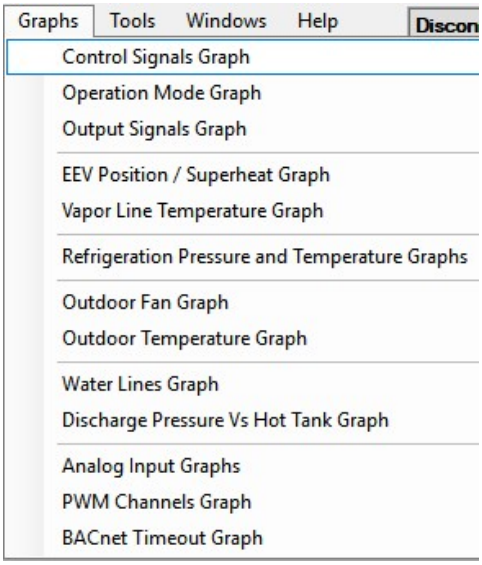


## *Graphs Menu:*

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




**TIP:** To screen print a graph and save it as a picture, hold down the Windows key and press Print Screen on the key-board. The image on the screen will be saved to the folder C:\Users\Username\Pictures\Screenshots.




ON/OFF status of the system control signals (demands)

ON/OFF status of air heating, water heating, and air cooling modes

ON/OFF status of digital outputs

EEV position and resulting superheat

Suction temperature

Suction and discharge pressures, evaporating and condensing temperatures

Suction (heating) or discharge (cooling/defrost) pressure vs. outdoor fan speed

Suction (heating) or discharge (cooling/defrost) pressure vs. outdoor temperature

Indoor IN/OUT temperatures and delta T

Discharge pressure vs tank temperature

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

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

For troubleshooting synchronization with 3rd party BACnet controllers.

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


Graph Name

CLEAR button erases all graph data

Check boxes to select which items are graphed

Current values

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

X axis = Number of samples.

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

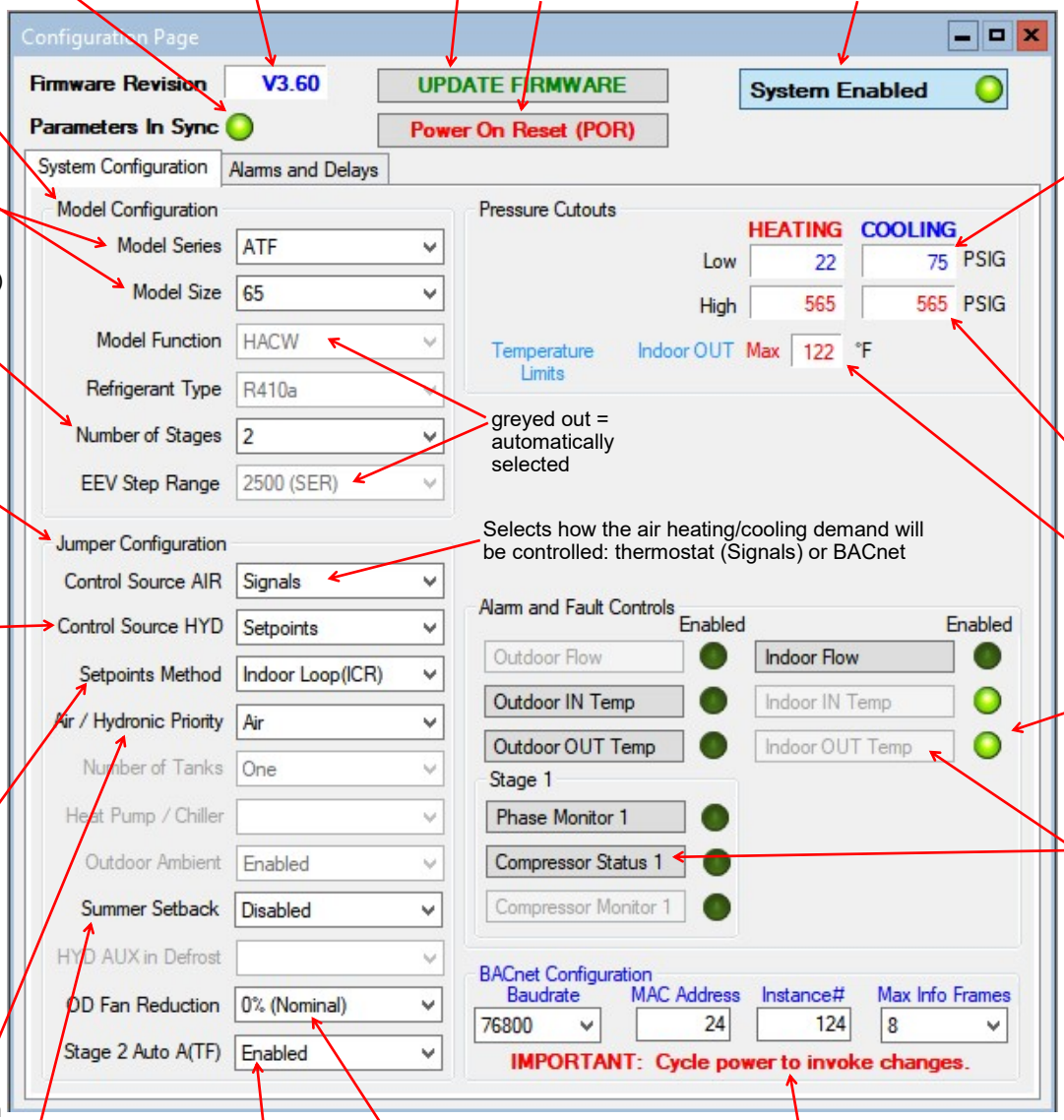
e.g. 20 samples **x** 1 second refresh = elapsed time of 20 seconds.

## *Tools Menu:*

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

### *Tools-->Configuration (System Configuration tab):*

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




Green when parameters have been updated, red during the update

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

Firmware update: see Appendix

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

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

Model Configuration section to select the system type

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

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

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

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

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

Air or Hydronic priority. Can also be set from button on Control Panel screen.

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

Selects whether or not compressor stage 2 is automatically activated whenever there is a simultaneous demand for air and water heat, so that the priority demand can be satisfied as soon as possible.

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

greyed out = automatically selected

Selects how the air heating/cooling demand will be controlled: thermostat (Signals) or BACnet

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

Fluid selection determines the low pressure cutout value. Outdoor is preset to air for this series. There is no selection for the Hydronic Indoor Loop since there is no cooling mode for it.

High pressure cutout determined by refrigerant type

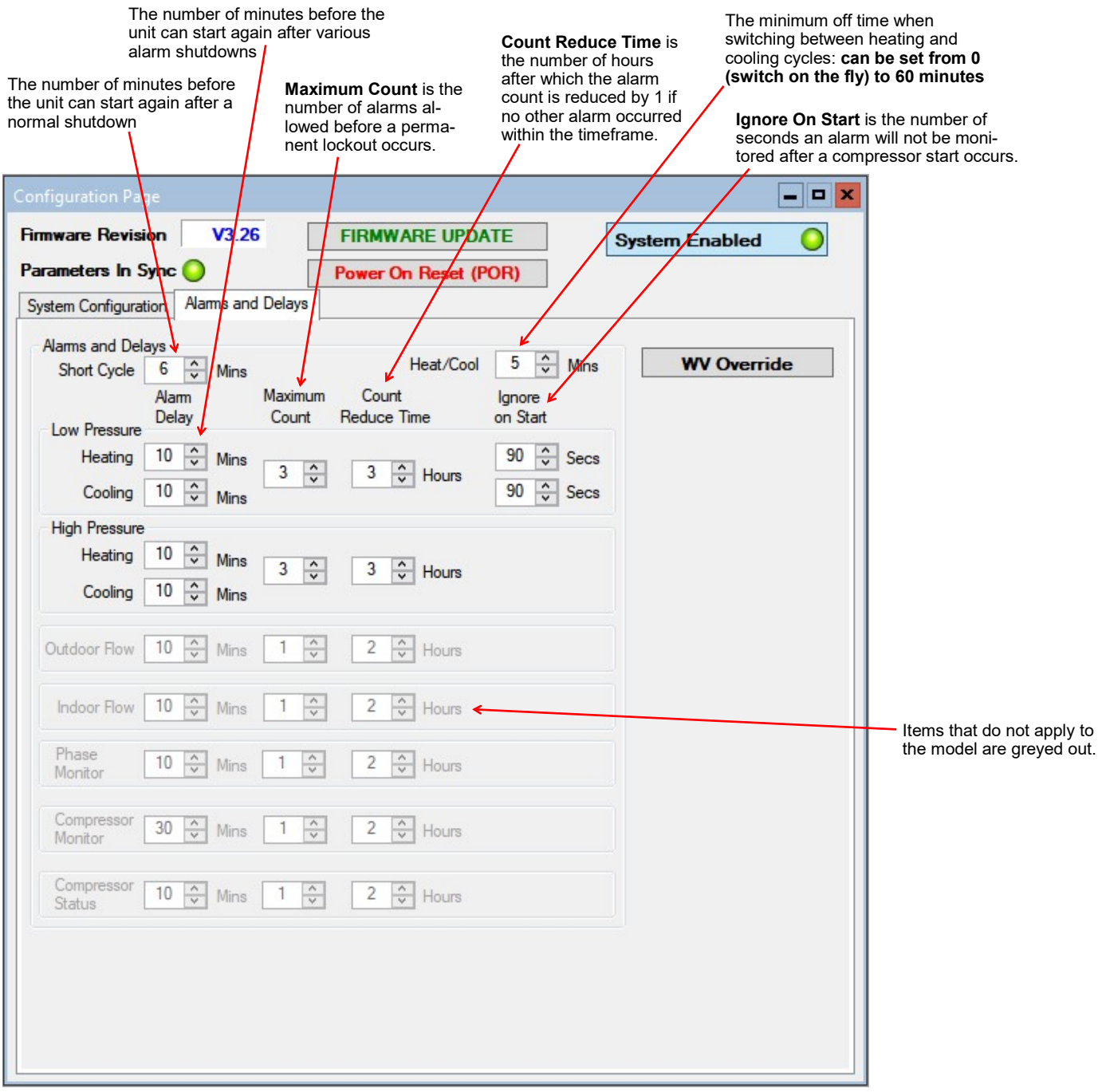
Temperature limits determined by Model Series and Fluid Type/Mixture

The Enabled indicators show which alarms are enabled

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

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

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

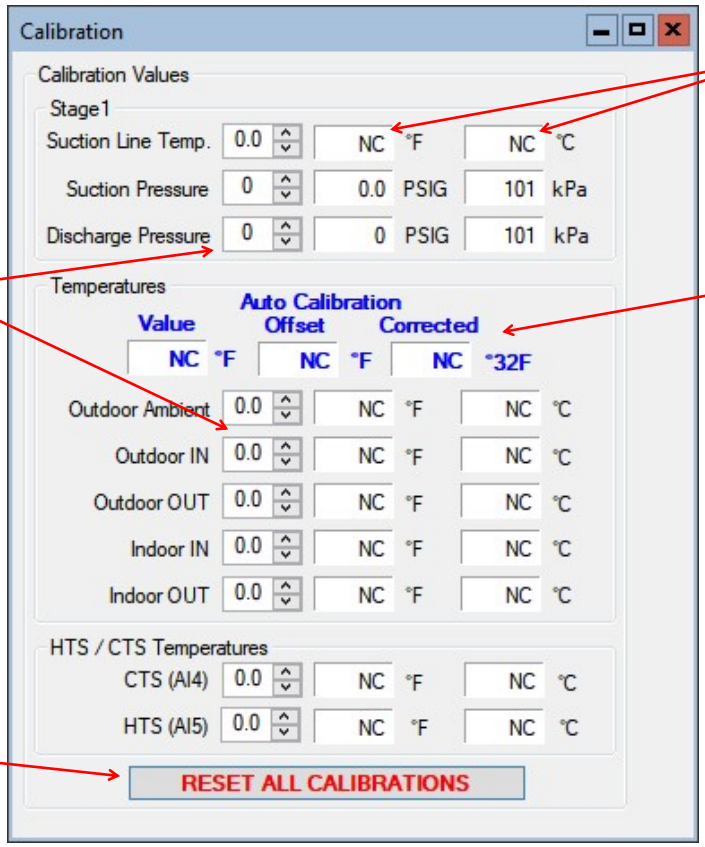


### *Tools-->Calibration:*

**Generally there is no need for calibration.**

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

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




Current values in standard and metric.

Calibration adjustments

Temperature Auto Calibration information. The offset is applied to all temperature sensors. Calibration adjustments made to each sensor are in addition to the Auto Calibration values.

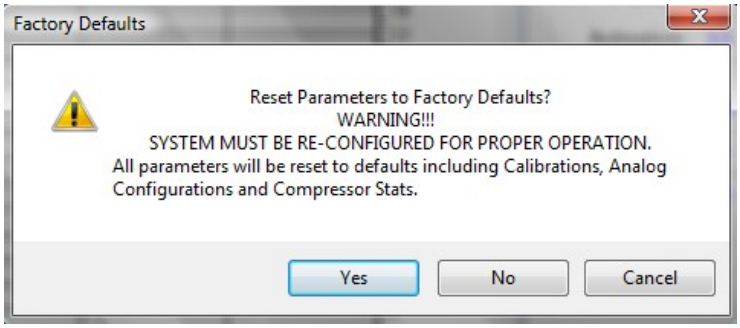
**Click on the RESET ALL CALIBRATIONS button to clear all calibration data. A popup window will appear for confirmation.**

### *Tools-->Reset to Factory Defaults:*

This will reset all parameters to default values.

**THE SYSTEM MUST BE RECONFIGURED AFTER A RESET IS PERFORMED.**

A reset will default the system to a two stage ATW Series Size 65 with Signals as the control source. Calibrations, alarm delays, analog configurations, compressor statistics, and Setpoint Control values will be returned to defaults as well.




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

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

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

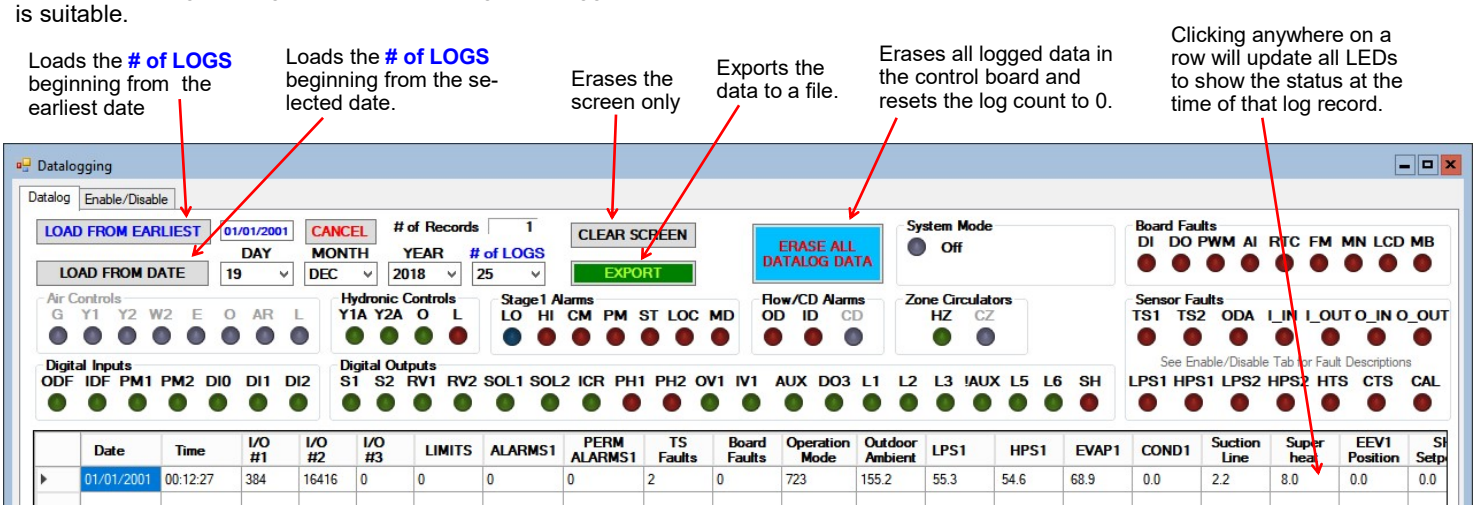
### *Tools-->Datalogging (Datalog tab):*

A log will be automatically recorded at the following rates:

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

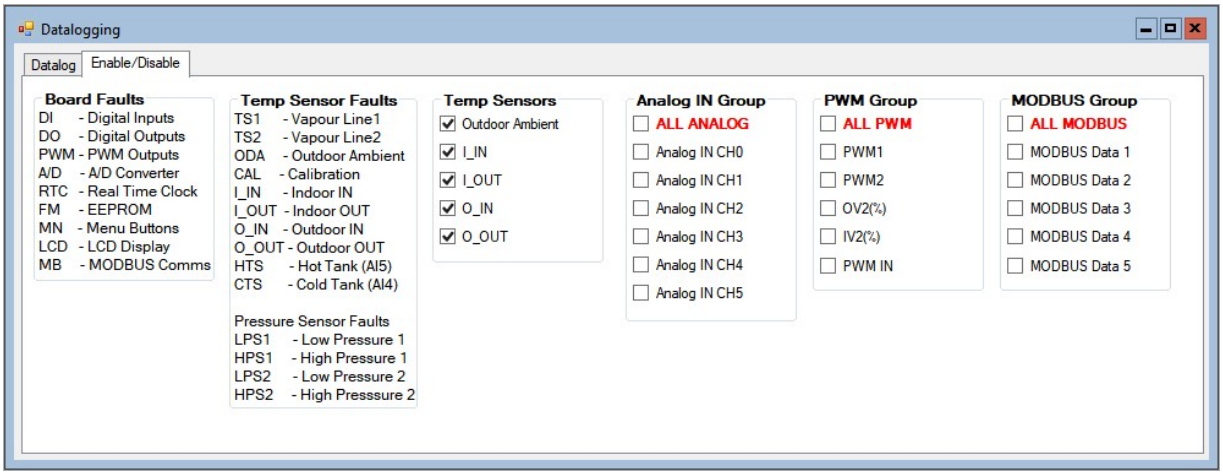
The maximum number of datalog records is 32,224, which will take 45 days to fill up at the default recording rate of 2 minutes.

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




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

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

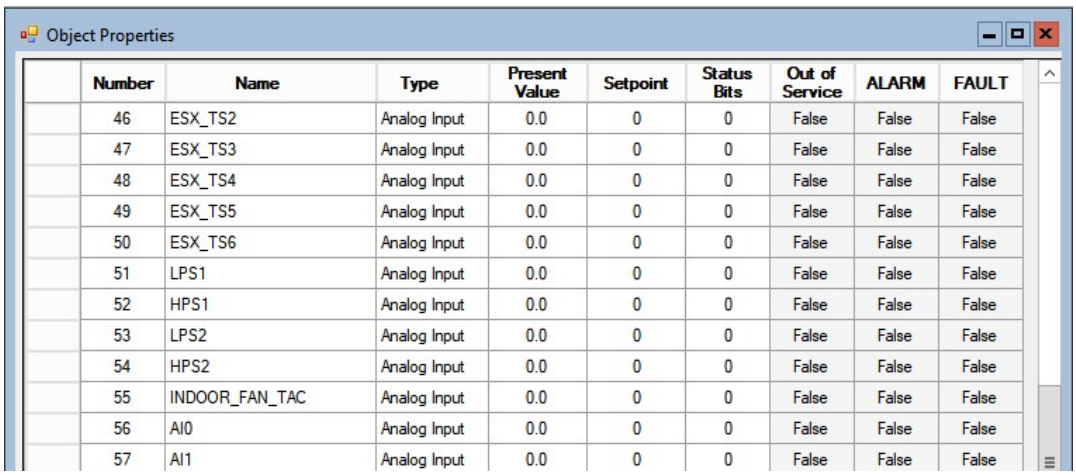



### *Tools-->MODBUS:*

For future use.

### *Tools-->Objects:*

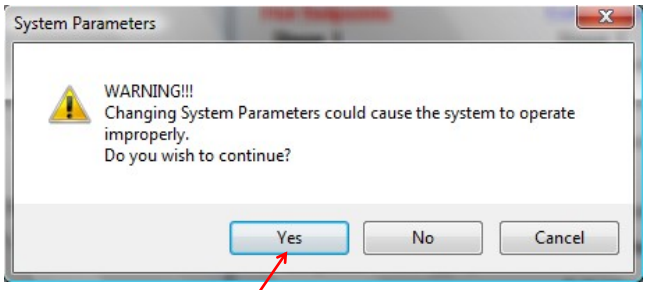
This is a window to display the runtime data, which is not stored when the power is turned off. No changes are possible.

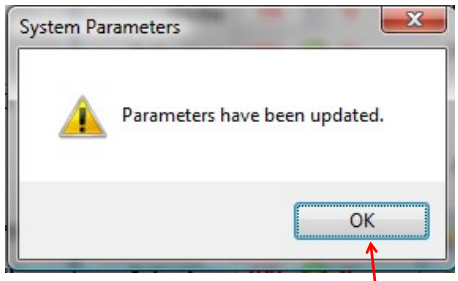


### *Tools-->Parameters:*

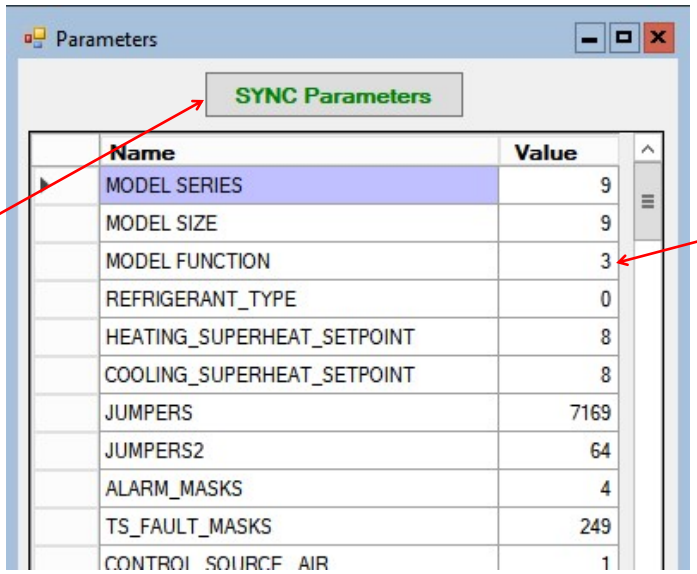
**WARNING! The Parameters page is for advanced use only.**
**Changing parameter values can cause the system to stop functioning properly.**

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




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

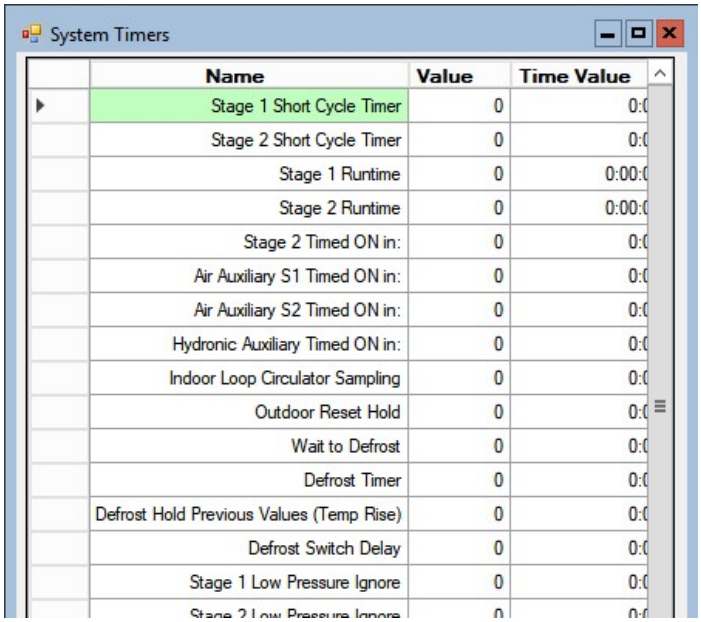



Click this button to reload the table with the values from the control board memory.

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

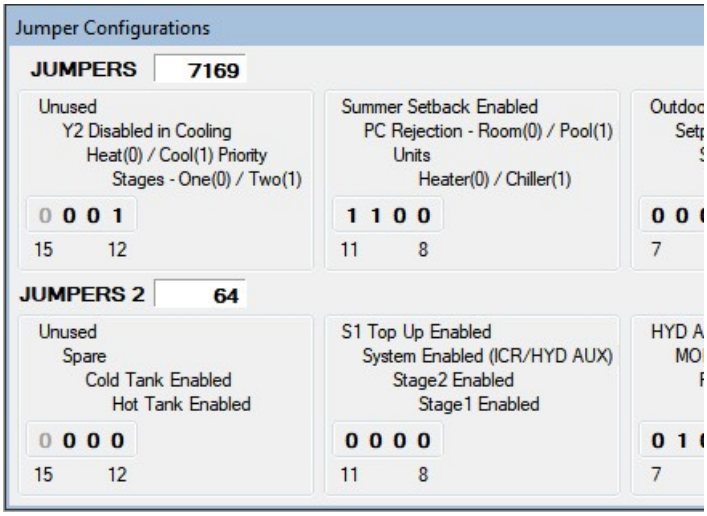
### *Tools-->SYSTEM TIMERS:*

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



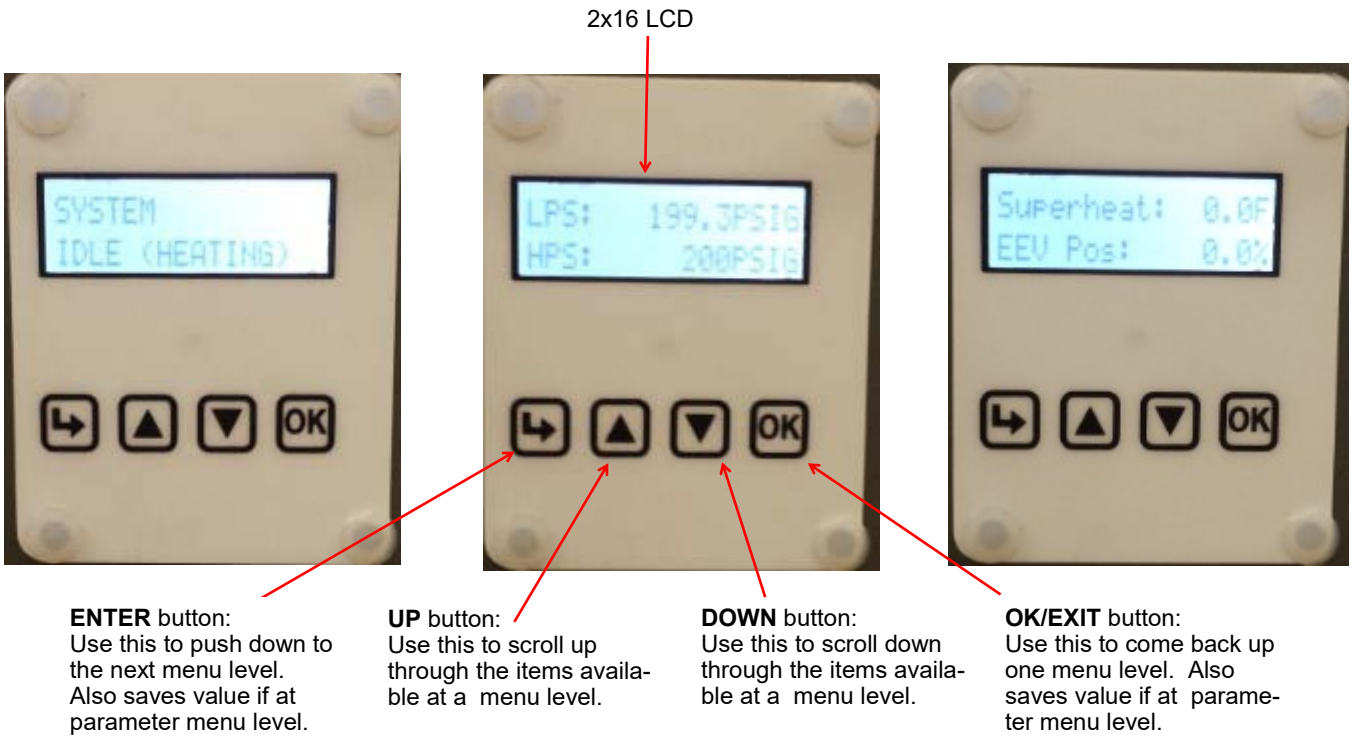

### *Tools-->Jumpers:*

This page shows internal jumper configurations, for developers.



# LCD 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.

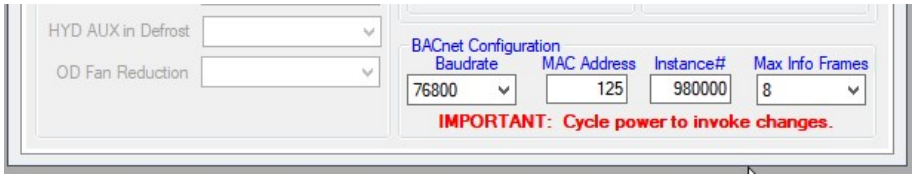
The connector on the control board is a three wire removable screw connector. The signals are as follows:
A: Communications line (+) (right pin)
B: Communications line (-) (middle pin)
C: Ground connection (left pin)

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.

**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 (AI0) - requires accessory |
| | AI1 (Comp2_Current) | AI1 | Present Value | User | User defined (0-5VDC or 4-20mA) |
| | AI2 | AI2 | Present Value | User | User defined (0-5VDC or 4-20mA) |
| | AI3 | AI3 | Present Value | User | User defined (0-5VDC or 4-20mA) |
| | AI4 (CTS) | AI4 | Present Value | degF (degC) | User defined (0-5VDC or 4-20mA) |
| | 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.<br>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) - requires accessory | |
| AI1 (Comp2 Current) | Analog Input | AI1 | N/A | |
| LPS1 | Analog Input | AI6 | Low pressure alarm | |
| HPS1 | Analog Input | AI7 | High pressure alarm | |
| LPS2 | Analog Input | AI13 | N/A | |
| HPS2 | Analog Input | AI14 | N/A | |
| Outdoor Flow | Binary Value | BV10 | 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 - N/A |
| | | 14 | 16,385 | N/A |
| | | 15* | 32,769 | N/A |
| Note: Permanent Alarm objects are type Analog Value but values are bit coded and may be decoded as such (integer value).<br>Note * : Value is for a single alarm and reference only. Value includes + 1 for Master Alarm | | | | |

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

| TABLE 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).<br>Note * : Value is for a single alarm and reference only. | | | | |

| TABLE 28 - BACnet OBJECTS - FAULT Descriptions (Read Only) | | | | |
|---|---|---|---|---|
| **Name** | **Data Type** | **ID** | **Description** | |
| AI4 (Cold Tank) | Analog Input | AI0 | N/A | |
| AI5 (Hot Tank) | Analog Input | AI1 | Hot tank temperature sensor faulty or disconnected - requires accessory | |
| LPS1 | Analog Input | AI6 | 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 1 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 | N/A |
| Note: Board and Sensor Fault objects are type Analog Value but values are bit coded and may be decoded as such (integer value).<br>Note * : Value is for a single fault and reference only. | | | | |

# Startup Procedure

The ATF-Series Two-Stage R410a Startup Record located in this manual is used in conjunction with this startup procedure to provide a detailed record of the installation. A completed copy should be left on site, a copy kept on file by the installer and a copy should be sent to Maritime Geothermal Ltd.

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

## Pre-Start Inspection

**Outdoor Unit:**

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

**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 Two-Stage R410a | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Installation Site** | | **Startup Date** | | **Installer** | | | | | | | | |
| **City** | | | | **Company** | | | | | | | | |
| **Province** | | **Check boxes unless asked to record data. Circle data units.** | | **Model** | | | | | | | | |
| **Country** | | | | **Serial #** | | | | | | | | |
| **Homeowner Name** | | **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 | | | |

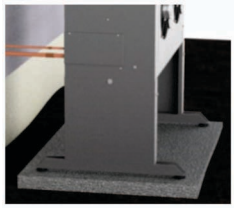
## STARTUP DATA

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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:** |
|---|---|---|---|

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. Note that some alarms require accessory components. | | |
| **Low Pressure** | A low pressure alarm occurs when the suction pressure drops to or below the ***Low Pressure Cutout*** value. The low pressure is checked just before a compressor start; if it is OK the compressor will start, otherwise an alarm will occur. When the compressor starts, the low pressure alarm will be ignored for the number of seconds that ***Low Pressure Ignore*** is set to, after which the low pressure alarm will be re-enabled. This allows a dip in suction pressure below the cutout point during startup without causing a nuisance alarm. | Go to the Low Pressure section of the mode the unit was operating in at the time of the alarm. (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 (accessory)** | This alarm occurs when there is a current draw on the compressor but no call for the compressor to be on (welded contactor) or when there is a call for the compressor to be on but there is no compressor current draw (manual high pressure control is open or contactor failure). Requires current sensor accessory. | Check contactor if compressor is staying on when it should be off. Go to Compressor section if compressor is not on when it should be. Also check for tripped manual high pressure control. |
| **Comp. Not Pumping** | Discharge pressure is less than 30 psi higher than suction pressure after 2 minutes run time. It indicates 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 (if present), indicating condensate drain is blocked. | Check condensate drain. |
| **Multiple Defrosts** | This alarm occurs if a second defrost occurs immediately after the defrost disabled timer expires from a previous defrost cycle. | Go to **Low suction pressure** or **Outdoor temperature reading incorrect** in the **Operation Troubleshooting - Heating Mode** section. |

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

| BACnet TROUBLESHOOTING | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **BACnet communications not working properly**<br><br>**Or**<br><br>**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.<br>**Cycle power to invoke any changes.** |
| | Selected MAC address and/or Instance # conflict with other devices on the network. | Check MAC address and Instance # in relation to other system devices. | |
| | BACnet wiring or termination problem. | Verify correct twisted pair wire and termination in the **BACnet Interface** chapter (earlier). | Correct wiring. |
| | Hardware problem on heat pump control board. | Remove BACnet connector from board as well as jumper from TERM (located just above the BACnet connector). Using a multimeter set to DC volts with negative probe on **B** and positive probe on **A**, confirm there is **+2.5VDC**. | Replace board if voltage not correct. |

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

| 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 in$H_2O$. 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<br><br>**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).<br>On the ECM Fan connector **on the left side of the control board:**<br>1) verify that there is 12 to 20VDC between pin G (grey wire) and pin C (white wire).<br>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.<br><br>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).<br>On the ECM Fan connector **at the fan motor:**<br>1) verify that there is 12 to 20VDC between pin G (grey wire) and pin C (white wire).<br>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 ductwork 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.

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

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

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

**Tests to determine if an EEV is working**

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

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

**The EEV can be checked electrically:**

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

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

**Check with a new EEV:**

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

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

# Repair Procedures

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

## *Pumpdown Procedure*

1. Place the unit in SERVICE mode via the PC App or LCD interface; this will open the EEVs and start the indoor circulator (as long that circulator is powered and controlled by the heat pump). **DO NOT** turn off electrical power at the breaker panel, since the 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.

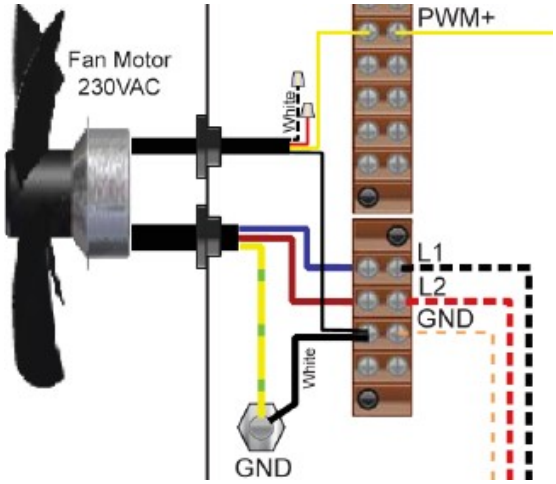
## *Compressor Replacement Procedure*

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 and acid test. If it fails, pump down the unit and replace the filter-dryer.
6. Charge the unit a final time. Unit should now be clean and repeated future burn-outs can be avoided.

## *Outdoor Fan Replacement Procedure*

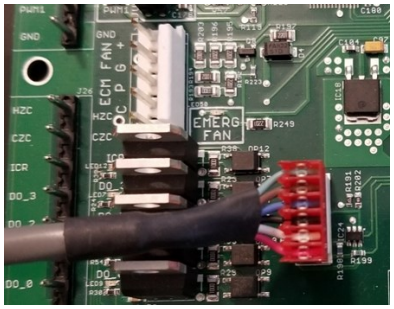
1. Turn of the power to the Indoor Unit. This will ensure that power and control signals are off in the outdoor unit.
2. Remove the two screws that hold the electrical box cover in place and remove the cover.
3. Remove the two bolts that secure the front cover in place.
4. Loosen the four bolts that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

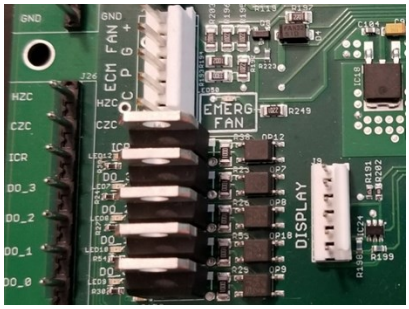
6. For the fan signal cable: remove the **YELLOW** wire from the **PWM** terminal and remove the **BLACK** wire from the **GND** terminal.
7. For the fan power cable: remove the **BLUE** wire from **L1**, the **RED** wire from **L2** and the **YELLOW/GREEN** wire from **GND**.
8. Pull the cables out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



## *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).



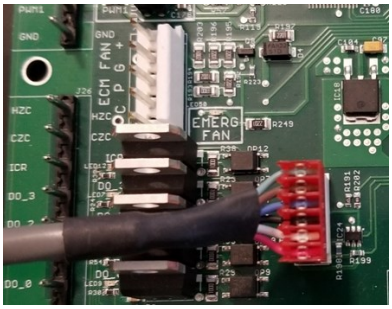

5. Remove all connectors from the top of the control board. Each connector (or wire) should be marked already from the factory, e.g. HPS1, LP1, TS1, etc.. This matches the marking on the control board.
6. The control board is held in place at its four corners. Squeeze each standoff by hand or with needle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

# Model Specific Information

**Table 29 - Shipping Information - Indoor Unit**

| MODEL | WEIGHT | DIMENSIONS in (cm) | | |
|---|---|---|---|---|
| | lb. (kg) | 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 30 - Shipping Information - Outdoor Unit**

| MODEL | WEIGHT | DIMENSIONS in (cm) | | |
|---|---|---|---|---|
| | lb. (kg) | 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 31 - Refrigerant Charge**

| MODEL | lb | *kg* | Refrigerant | Oil Type |
|---|---|---|---|---|
| **ATF-45** | 7.5 | *3.4* | R410a | POE |
| **ATF-55** | 11.0 | *5.0* | R410a | POE |
| **ATF-65** | 12.0 | *5.5* | R410a | POE |
| **ATF-75** | 13.0 | *5.9* | R410a | POE |

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

**Table 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* | |
| | AIR Cooling | Minimum EAT | 50 | *10* | |
| | AIR Cooling | Maximum EAT | 100 | *38* | |
| **OUTDOOR** | 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** | **2,290** | **30,100** | ***8.8*** | **3.85** | **2,240** | **25,500** | ***7.5*** | **3.34** | **2,100** | **19,600** | ***5.8*** | **2.74** |
| **55** | **1500** | ***708*** | **2** | **3,110** | **40,700** | ***11.9*** | **3.83** | **3,030** | **34,400** | ***10.1*** | **3.33** | **2,760** | **25,700** | ***7.5*** | **2.72** |
| **65** | **1900** | ***897*** | **2** | **3,955** | **51,800** | ***15.2*** | **3.84** | **3,810** | **43,200** | ***12.7*** | **3.32** | **3,560** | **32,800** | ***9.6*** | **2.70** |
| **75** | **2100** | ***991*** | **2** | **4,550** | **59,400** | ***17.4*** | **3.83** | **4,485** | **50,700** | ***14.9*** | **3.31** | **4,295** | **39,000** | ***11.4*** | **2.66** |

**Table 38 - Standard Capacity Ratings - Air Cooling** — **60 Hz**

| Indoor Air 80°F (26.7°C) DB / 67°F (19.°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** | **2,235** | **34,100** | ***10.0*** | **15.2** | **4.47** | **2,605** | **31,400** | ***9.2*** | **12.1** | **3.53** |
| **55** | **1500** | ***708*** | **2** | **2,925** | **44,000** | ***12.9*** | **15.0** | **4.41** | **3,410** | **40,600** | ***11.9*** | **11.9** | **3.49** |
| **65** | **1900** | ***897*** | **2** | **3,725** | **55,400** | ***16.2*** | **14.9** | **4.36** | **4,310** | **51,200** | ***15.0*** | **11.9** | **3.48** |
| **75** | **2100** | ***991*** | **2** | **4,385** | **64,600** | ***18.9*** | **14.7** | **4.31** | **5,010** | **59,200** | ***17.4*** | **11.8** | **3.46** |

**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* | psi | *kPa* | | 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** | **2518** | **33,600** | ***9.9*** | **3.91** | **2581** | **29,200** | ***8.6*** | **3.32** | **2742** | **22,000** | ***6.5*** | **2.35** |
| **55** | **12.0** | ***0.76*** | **4.1** | ***28*** | **2** | **3270** | **43,400** | ***12.7*** | **3.89** | **3320** | **37,400** | ***11.0*** | **3.30** | **3615** | **28,700** | ***8.4*** | **2.32** |
| **65** | **14.0** | ***0.88*** | **5.0** | ***34*** | **2** | **3866** | **51,000** | ***14.9*** | **3.86** | **3837** | **43,400** | ***12.7*** | **3.31** | **4272** | **33,900** | ***9.9*** | **2.33** |
| **75** | **16.0** | ***1.01*** | **4.0** | ***36*** | **2** | **4417** | **58,600** | ***17.2*** | **3.88** | **4527** | **50,200** | ***14.7*** | **3.25** | **4893** | **38,400** | ***11.2*** | **2.30** |

# Air Heating/Cooling Performance

< Preliminary >

## ATF-45-HACW-P-1T *R410a, 60 Hz, ZPS30K5E-PFV*

**HEATING**

| 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) | **$COP_H$** |
| **-5°F** | -16 | 6,563 | 8.3 | 175 | 2,109 | **70°F** | 92 | 1,200 | 82 | 12 | **13,763** | **1.91** |
| **5°F** | -8 | 9,208 | 8.7 | 175 | 2,073 | | 96 | 1,200 | 84 | 14 | **16,282** | **2.30** |
| **15°F** | 0 | 11,862 | 9.2 | 175 | 2,097 | | 100 | 1,200 | 86 | 16 | **19,018** | **2.66** |
| **25°F** | 8 | 14,780 | 9.7 | 175 | 2,164 | | 104 | 1,200 | 89 | 19 | **22,167** | **3.00** |
| **35°F** | 16 | 17,901 | 10.2 | 175 | 2,241 | | 108 | 1,200 | 91 | 21 | **25,548** | **3.34** |
| **45°F** | 25 | 21,314 | 10.7 | 175 | 2,293 | | 112 | 1,200 | 94 | 24 | **29,141** | **3.72** |
| **55°F** | 32 | 24,824 | 11.2 | 175 | 2,365 | | 116 | 1,200 | 97 | 27 | **32,894** | **4.08** |
| **65°F** | 40 | 28,562 | 11.7 | 175 | 2,454 | | 120 | 1,200 | 101 | 31 | **36,936** | **4.41** |

**COOLING**

| 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** |
| **50°F** | 61 | 47,054 | 6.4 | 170 | 1,739 | **80°F** | 46 | 1,200 | 56 | 24 | 12,370 | 28,455 | **40,825** | **23.5** |
| **60°F** | 71 | 45,268 | 6.8 | 170 | 1,852 | | 47 | 1,200 | 58 | 23 | 11,712 | 26,941 | **38,653** | **20.9** |
| **70°F** | 82 | 43,764 | 7.5 | 170 | 2,018 | | 47 | 1,200 | 59 | 21 | 11,085 | 25,499 | **36,583** | **18.1** |
| **80°F** | 92 | 42,248 | 8.3 | 170 | 2,191 | | 47 | 1,200 | 60 | 20 | 10,446 | 24,030 | **34,476** | **15.7** |
| **90°F** | 103 | 41,028 | 9.4 | 170 | 2,456 | | 48 | 1,200 | 61 | 19 | 9,679 | 22,691 | **32,370** | **13.2** |
| **100°F** | 113 | 39,667 | 10.6 | 170 | 2,703 | | 48 | 1,200 | 62 | 18 | 9,020 | 21,147 | **30,167** | **11.2** |
| **110°F** | 124 | 38,322 | 12.2 | 170 | 2,993 | | 49 | 1,200 | 64 | 16 | 8,322 | 19,510 | **27,832** | **9.3** |
| **120°F** | 135 | 36,960 | 14.1 | 170 | 3,319 | | 49 | 1,200 | 65 | 15 | 7,581 | 17,774 | **25,356** | **7.6** |

*METRIC*

**HEATING**

| OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | | INDOOR LOOP *(Air)* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outdoor Air Temperature** | Evaporating Temperature | Heat Absorbed (W) | Compressor Current (A) | Fan (W) | Input Power (W) | **EAT** | Cond. Temp. | Airflow (L/s) | LAT (°C) | Delta T (°C) | **Heating** (W) | **$COP_H$** |
| **-21°C** | -26.7 | 1,923 | 8.3 | 175 | 2,109 | **21°C** | 33.3 | 566 | 27.5 | 6.4 | **4,032** | **1.91** |
| **-15°C** | -22.2 | 2,698 | 8.7 | 175 | 2,073 | | 35.6 | 566 | 28.6 | 7.5 | **4,770** | **2.30** |
| **-9°C** | -17.8 | 3,475 | 9.2 | 175 | 2,097 | | 37.8 | 566 | 29.9 | 8.8 | **5,572** | **2.66** |
| **-4°C** | -13.4 | 4,331 | 9.7 | 175 | 2,164 | | 40.0 | 566 | 31.4 | 10.3 | **6,495** | **3.00** |
| **2°C** | -8.8 | 5,245 | 10.2 | 175 | 2,241 | | 42.2 | 566 | 32.9 | 11.8 | **7,486** | **3.34** |
| **7°C** | -3.9 | 6,245 | 10.7 | 175 | 2,293 | | 44.4 | 566 | 34.6 | 13.5 | **8,538** | **3.72** |
| **13°C** | 0.2 | 7,273 | 11.2 | 175 | 2,365 | | 46.7 | 566 | 36.3 | 15.2 | **9,638** | **4.08** |
| **18°C** | 4.6 | 8,368 | 11.7 | 175 | 2,454 | | 48.9 | 566 | 38.2 | 17.1 | **10,822** | **4.41** |

**COOLING**

| OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | | INDOOR LOOP *(Air @ 50% RH)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outdoor Air Temperature** | Condensing Temperature | Heat Rejected (W) | Compressor Current (A) | Fan (W) | Input Power (W) | **EAT** | Evap. Temp. | Airflow (L/s) | LAT (°C) | Delta T (°C) | Latent (W) | Sensible (W) | **Cooling** (W) | **$COP_C$** |
| **10°C** | 16.1 | 13,787 | 6.4 | 170 | 1,739 | **27°C** | 7.9 | 566 | 13.5 | 13.2 | 3,624 | 8,337 | **11,962** | **6.88** |
| **16°C** | 21.7 | 13,263 | 6.8 | 170 | 1,852 | | 8.1 | 566 | 14.2 | 12.5 | 3,432 | 7,894 | **11,325** | **6.11** |
| **21°C** | 27.8 | 12,823 | 7.5 | 170 | 2,018 | | 8.3 | 566 | 14.9 | 11.8 | 3,248 | 7,471 | **10,719** | **5.31** |
| **27°C** | 33.3 | 12,379 | 8.3 | 170 | 2,191 | | 8.6 | 566 | 15.5 | 11.1 | 3,061 | 7,041 | **10,101** | **4.61** |
| **32°C** | 39.4 | 12,021 | 9.4 | 170 | 2,456 | | 8.8 | 566 | 16.2 | 10.5 | 2,836 | 6,649 | **9,484** | **3.86** |
| **38°C** | 45.0 | 11,622 | 10.6 | 170 | 2,703 | | 9.0 | 566 | 16.9 | 9.8 | 2,643 | 6,196 | **8,839** | **3.27** |
| **43°C** | 51.1 | 11,228 | 12.2 | 170 | 2,993 | | 9.2 | 566 | 17.6 | 9.0 | 2,438 | 5,716 | **8,155** | **2.72** |
| **49°C** | 57.2 | 10,829 | 14.1 | 170 | 3,319 | | 9.4 | 566 | 18.4 | 8.2 | 2,221 | 5,208 | **7,429** | **2.24** |

# Hydronic Performance

## ATF-45-HACW-P-1T *R410a, 60 Hz, ZPS30K5E-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) | **$COP_H$** |
| HEATING | **-5°F** | -16°F | 5,530 | 13.5 | 3290 | 102°F | 110°F | 10 | **105°F** | 3°F | **16,600** | **1.48** |
| | **5°F** | -8°F | 9,490 | 11.5 | 2830 | 101°F | 110°F | | | 4°F | **19,000** | **1.96** |
| | **15°F** | 1°F | 12,600 | 10.5 | 2620 | 101°F | 109°F | | | 4°F | **21,400** | **2.39** |
| | **25°F** | 9°F | 17,100 | 10.1 | 2520 | 100°F | 109°F | | | 5°F | **25,500** | **2.97** |
| | **35°F** | 17°F | 21,400 | 9.7 | 2430 | 99°F | 109°F | | | 6°F | **29,500** | **3.56** |
| | **45°F** | 26°F | 25,200 | 9.4 | 2360 | 98°F | 109°F | | | 7°F | **33,100** | **4.12** |
| | **55°F** | 34°F | 28,800 | 9.1 | 2270 | 98°F | 109°F | | | 7°F | **36,400** | **4.70** |
| | **65°F** | 43°F | 32,700 | 8.8 | 2180 | 97°F | 108°F | | | 8°F | **39,900** | **5.38** |
| | **-5°F** | -16°F | - | - | - | - | - | 10 | **120°F** | *LLT is limited to 105°F at these outdoor temperatures* | | |
| | **5°F** | -8°F | - | - | - | - | - | | | | | |
| | **15°F** | 1°F | 10,900 | 13.0 | 3180 | 116°F | 124°F | | | 4°F | **21,300** | **1.98** |
| | **25°F** | 9°F | 14,900 | 12.3 | 3040 | 115°F | 124°F | | | 5°F | **25,100** | **2.42** |
| | **35°F** | 17°F | 18,900 | 11.8 | 2920 | 114°F | 124°F | | | 6°F | **28,600** | **2.88** |
| | **45°F** | 26°F | 22,400 | 11.4 | 2820 | 114°F | 124°F | | | 6°F | **31,800** | **3.30** |
| | **55°F** | 34°F | 25,700 | 11.0 | 2710 | 113°F | 123°F | | | 7°F | **34,800** | **3.76** |
| | **65°F** | 43°F | 29,300 | 10.6 | 2600 | 112°F | 123°F | | | 8°F | **38,000** | **4.28** |

*METRIC*

| | OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | INDOOR LOOP *(Water)* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Outdoor Air Temperature** | Evaporating Temperature | Heat Absorbed (W) | Compressor Current (A) | Input Power (W) | ELT | Condensing Temperature | Liquid Flow (L/s) | **LLT** | Delta T | **Heating** (W) | **$COP_H$** |
| HEATING | **-21°C** | -27°C | 1620 | 13.5 | 3290 | 39°C | 43°C | 0.63 | **40.5°C** | 1.8°C | **4,860** | **1.48** |
| | **-15°C** | -22°C | 2780 | 11.5 | 2830 | 38°C | 43°C | | | 2.1°C | **5,560** | **1.96** |
| | **-9°C** | -18°C | 3700 | 10.5 | 2620 | 38°C | 43°C | | | 2.4°C | **6,270** | **2.39** |
| | **-4°C** | -13°C | 5020 | 10.1 | 2520 | 38°C | 43°C | | | 2.8°C | **7,480** | **2.97** |
| | **2°C** | -8°C | 6280 | 9.7 | 2430 | 37°C | 43°C | | | 3.3°C | **8,660** | **3.56** |
| | **7°C** | -4°C | 7400 | 9.4 | 2360 | 37°C | 43°C | | | 3.7°C | **9,700** | **4.12** |
| | **13°C** | 1°C | 8440 | 9.1 | 2270 | 37°C | 43°C | | | 4.0°C | **10,700** | **4.70** |
| | **18°C** | 6°C | 9580 | 8.8 | 2180 | 36°C | 42°C | | | 4.4°C | **11,700** | **5.38** |
| | **-21°C** | -27°C | - | - | - | - | - | 0.63 | **49°C** | *LLT is limited to 40.5°C at these outdoor temperatures* | | |
| | **-15°C** | -22°C | - | - | - | - | - | | | | | |
| | **-9°C** | -18°C | 3180 | 13.0 | 3180 | 47°C | 51°C | | | 2.4°C | **6,240** | **1.98** |
| | **-4°C** | -13°C | 4370 | 12.3 | 3040 | 46°C | 51°C | | | 2.8°C | **7,350** | **2.42** |
| | **2°C** | -8°C | 5530 | 11.8 | 2920 | 46°C | 51°C | | | 3.2°C | **8,390** | **2.88** |
| | **7°C** | -4°C | 6560 | 11.4 | 2820 | 45°C | 51°C | | | 3.5°C | **9,320** | **3.30** |
| | **13°C** | 1°C | 7530 | 11.0 | 2710 | 45°C | 51°C | | | 3.9°C | **10,200** | **3.76** |
| | **18°C** | 6°C | 8590 | 10.6 | 2600 | 4°C | 51°C | | | 4.2°C | **11,100** | **4.28** |

# Air Heating/Cooling Performance

< Preliminary >

## ATF-55-HACW-P-1T *R410a, 60 Hz, ZPS40K5E-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** | -17 | 7,655 | 12.1 | 185 | 2,552 | **70°F** | 91 | 1,500 | 81 | 11 | **16,367** | **1.88** |
| | **5°F** | -8 | 11,495 | 12.6 | 185 | 2,651 | | 95 | 1,500 | 84 | 14 | **20,542** | **2.27** |
| | **15°F** | 0 | 15,352 | 13.1 | 185 | 2,765 | | 99 | 1,500 | 87 | 17 | **24,789** | **2.63** |
| | **25°F** | 8 | 19,493 | 13.7 | 185 | 2,891 | | 103 | 1,500 | 90 | 20 | **29,359** | **2.98** |
| | **35°F** | 17 | 23,987 | 14.3 | 185 | 3,028 | | 107 | 1,500 | 93 | 23 | **34,321** | **3.32** |
| | **45°F** | 25 | 29,148 | 14.9 | 185 | 3,114 | | 111 | 1,500 | 97 | 27 | **39,777** | **3.74** |
| | **55°F** | 33 | 34,697 | 15.5 | 185 | 3,241 | | 115 | 1,500 | 101 | 31 | **45,758** | **4.14** |
| | **65°F** | 41 | 40,532 | 16.1 | 185 | 3,368 | | 119 | 1,500 | 105 | 35 | **52,027** | **4.53** |

| | 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** | 62 | 58,709 | 8.7 | 195 | 2,164 | **80°F** | 46 | 1,500 | 56 | 24 | 15,432 | 35,499 | **50,931** | **23.5** |
| | **60°F** | 72 | 57,478 | 9.4 | 195 | 2,367 | | 46 | 1,500 | 57 | 23 | 14,849 | 34,157 | **49,006** | **20.7** |
| | **70°F** | 83 | 56,122 | 10.5 | 195 | 2,613 | | 46 | 1,500 | 58 | 22 | 14,184 | 32,627 | **46,811** | **17.9** |
| | **80°F** | 93 | 54,638 | 11.8 | 195 | 2,853 | | 47 | 1,500 | 59 | 21 | 13,486 | 31,022 | **44,508** | **15.6** |
| | **90°F** | 104 | 53,224 | 13.4 | 195 | 3,194 | | 47 | 1,500 | 60 | 20 | 12,535 | 29,388 | **41,923** | **13.1** |
| | **100°F** | 114 | 51,622 | 15.0 | 195 | 3,538 | | 48 | 1,500 | 62 | 18 | 11,705 | 27,442 | **39,146** | **11.1** |
| | **110°F** | 125 | 50,123 | 17.2 | 195 | 3,968 | | 48 | 1,500 | 63 | 17 | 10,818 | 25,362 | **36,180** | **9.1** |
| | **120°F** | 135 | 48,394 | 19.4 | 195 | 4,383 | | 48 | 1,500 | 65 | 15 | 9,878 | 23,159 | **33,037** | **7.5** |

*METRIC*

| | OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | | INDOOR LOOP *(Air)* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Outdoor Air Temperature | Evaporating Temperature | Heat Absorbed (W) | Compressor Current (A) | Fan (W) | Input Power (W) | EAT | Cond. Temp. | Airflow (L/s) | LAT (°C) | Delta T (°C) | Heating (W) | $COP_H$ |
| HEATING | **-21°C** | -26.9 | 2,243 | 12.1 | 185 | 2,552 | **21°C** | 32.8 | 708 | 27.2 | 6.1 | **4,795** | **1.88** |
| | **-15°C** | -22.3 | 3,368 | 12.6 | 185 | 2,651 | | 35.0 | 708 | 28.7 | 7.6 | **6,019** | **2.27** |
| | **-9°C** | -17.8 | 4,498 | 13.1 | 185 | 2,765 | | 37.2 | 708 | 30.3 | 9.2 | **7,263** | **2.63** |
| | **-4°C** | -13.3 | 5,711 | 13.7 | 185 | 2,891 | | 39.4 | 708 | 32.0 | 10.9 | **8,602** | **2.98** |
| | **2°C** | -8.6 | 7,028 | 14.3 | 185 | 3,028 | | 41.7 | 708 | 33.8 | 12.7 | **10,056** | **3.32** |
| | **7°C** | -3.9 | 8,540 | 14.9 | 185 | 3,114 | | 43.9 | 708 | 35.8 | 14.7 | **11,654** | **3.74** |
| | **13°C** | 0.7 | 10,166 | 15.5 | 185 | 3,241 | | 46.1 | 708 | 38.1 | 16.9 | **13,407** | **4.14** |
| | **18°C** | 4.9 | 11,876 | 16.1 | 185 | 3,368 | | 48.3 | 708 | 40.4 | 19.3 | **15,244** | **4.53** |

| | OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | | INDOOR LOOP *(Air @ 50% RH)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Outdoor Air Temperature | Condensing Temperature | Heat Rejected (W) | Compressor Current (A) | Fan (W) | Input Power (W) | EAT | Evap. Temp. | Airflow (L/s) | LAT (°C) | Delta T (°C) | Latent (W) | Sensible (W) | Cooling (W) | $COP_C$ |
| COOLING | **10°C** | 16.7 | 17,202 | 8.7 | 195 | 2,164 | **27°C** | 7.6 | 708 | 13.5 | 13.1 | 4,522 | 10,401 | **14,923** | **6.90** |
| | **16°C** | 22.2 | 16,841 | 9.4 | 195 | 2,367 | | 7.8 | 708 | 14.0 | 12.7 | 4,351 | 10,008 | **14,359** | **6.07** |
| | **21°C** | 28.3 | 16,444 | 10.5 | 195 | 2,613 | | 8.0 | 708 | 14.6 | 12.1 | 4,156 | 9,560 | **13,715** | **5.25** |
| | **27°C** | 33.9 | 16,009 | 11.8 | 195 | 2,853 | | 8.2 | 708 | 15.2 | 11.5 | 3,951 | 9,089 | **13,041** | **4.57** |
| | **32°C** | 40.0 | 15,594 | 13.4 | 195 | 3,194 | | 8.4 | 708 | 15.8 | 10.9 | 3,673 | 8,611 | **12,283** | **3.85** |
| | **38°C** | 45.6 | 15,125 | 15.0 | 195 | 3,538 | | 8.7 | 708 | 16.5 | 10.2 | 3,429 | 8,040 | **11,470** | **3.24** |
| | **43°C** | 51.7 | 14,686 | 17.2 | 195 | 3,968 | | 8.9 | 708 | 17.3 | 9.4 | 3,170 | 7,431 | **10,601** | **2.67** |
| | **49°C** | 57.2 | 14,179 | 19.4 | 195 | 4,383 | | 9.1 | 708 | 18.1 | 8.6 | 2,894 | 6,785 | **9,680** | **2.21** |

# Hydronic Performance

## ATF-55-HACW-P-1T *R410a, 60 Hz, ZPS40K5E-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) | **$COP_H$** |
| **HEATING** | **-5°F** | -16°F | 6,810 | 16.7 | 3870 | 102°F | 110°F | 12 | **105°F** | 3°F | **19,800** | **1.50** |
| | **5°F** | -8°F | 11,800 | 15.7 | 3670 | 101°F | 109°F | | | 4°F | **24,100** | **1.93** |
| | **15°F** | 1°F | 16,200 | 14.8 | 3470 | 100°F | 109°F | | | 5°F | **27,800** | **2.35** |
| | **25°F** | 9°F | 21,400 | 14.0 | 3290 | 100°F | 109°F | | | 5°F | **32,400** | **2.89** |
| | **35°F** | 17°F | 27,400 | 13.2 | 3120 | 99°F | 109°F | | | 6°F | **37,900** | **3.56** |
| | **45°F** | 26°F | 32,600 | 12.8 | 3050 | 98°F | 108°F | | | 7°F | **42,800** | **4.11** |
| | **55°F** | 34°F | 37,500 | 12.5 | 2960 | 97°F | 108°F | | | 8°F | **47,500** | **4.69** |
| | **65°F** | 43°F | 42,600 | 12.2 | 2870 | 96°F | 108°F | | | 9°F | **52,200** | **5.34** |
| | **-5°F** | -16°F | - | - | - | - | - | 12 | **120°F** | *LLT is limited to 105°F at these outdoor temperatures* | | |
| | **5°F** | -8°F | - | - | - | - | - | | | | | |
| | **15°F** | 1°F | 13,300 | 17.6 | 4120 | 115°F | 124°F | | | 5°F | **27,100** | **1.93** |
| | **25°F** | 9°F | 18,300 | 16.6 | 3920 | 115°F | 124°F | | | 5°F | **31,400** | **2.35** |
| | **35°F** | 17°F | 23,900 | 15.8 | 3730 | 114°F | 123°F | | | 6°F | **36,400** | **2.87** |
| | **45°F** | 26°F | 28,800 | 15.4 | 3640 | 113°F | 123°F | | | 7°F | **41,000** | **3.30** |
| | **55°F** | 34°F | 33,500 | 15.1 | 3550 | 112°F | 123°F | | | 8°F | **45,400** | **3.75** |
| | **65°F** | 43°F | 38,200 | 14.7 | 3440 | 111°F | 123°F | | | 9°F | **49,800** | **4.23** |

*METRIC*

| | OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | INDOOR LOOP *(Water)* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Outdoor Air Temperature** | Evaporating Temperature | Heat Absorbed (W) | Compressor Current (A) | Input Power (W) | ELT | Condensing Temperature | Liquid Flow (L/s) | **LLT** | Delta T | **Heating** (W) | **$COP_H$** |
| **HEATING (METRIC)** | **-21°C** | -27°C | 2,000 | 16.7 | 3870 | 39°C | 43°C | 0.76 | **40.5°C** | 1.8°C | **5,800** | **1.50** |
| | **-15°C** | -22°C | 3,460 | 15.7 | 3670 | 38°C | 43°C | | | 2.2°C | **7,070** | **1.93** |
| | **-9°C** | -18°C | 4,750 | 14.8 | 3470 | 38°C | 43°C | | | 2.6°C | **8,160** | **2.35** |
| | **-4°C** | -13°C | 6,270 | 14.0 | 3290 | 38°C | 43°C | | | 3.0°C | **9,510** | **2.89** |
| | **2°C** | -8°C | 8,040 | 13.2 | 3120 | 37°C | 43°C | | | 3.5°C | **11,100** | **3.56** |
| | **7°C** | -4°C | 9,540 | 12.8 | 3050 | 37°C | 42°C | | | 4.0°C | **12,500** | **4.11** |
| | **13°C** | 1°C | 11,000 | 12.5 | 2960 | 36°C | 42°C | | | 4.4°C | **13,900** | **4.69** |
| | **18°C** | 6°C | 12,500 | 12.2 | 2870 | 36°C | 42°C | | | 4.8°C | **15,300** | **5.34** |
| | **-21°C** | -27°C | - | - | - | - | - | 0.76 | **49°C** | *LLT is limited to 40.5°C at these outdoor temperatures* | | |
| | **-15°C** | -22°C | - | - | - | - | - | | | | | |
| | **-9°C** | -18°C | 3,900 | 17.6 | 4120 | 46°C | 51°C | | | 2.5°C | **7,950** | **1.93** |
| | **-4°C** | -13°C | 5,350 | 16.6 | 3920 | 46°C | 51°C | | | 2.9°C | **9,210** | **2.35** |
| | **2°C** | -8°C | 7,010 | 15.8 | 3730 | 46°C | 51°C | | | 3.4°C | **10,700** | **2.87** |
| | **7°C** | -4°C | 8,430 | 15.4 | 3640 | 45°C | 51°C | | | 3.8°C | **12,000** | **3.30** |
| | **13°C** | 1°C | 9,810 | 15.1 | 3550 | 45°C | 51°C | | | 4.2°C | **13,300** | **3.75** |
| | **18°C** | 6°C | 11,200 | 14.7 | 3440 | 44°C | 51°C | | | 4.6°C | **14,600** | **4.23** |

# Air Heating/Cooling Performance

< Preliminary >

## ATF-65-HACW-P-1T *R410a, 60 Hz, ZPS51K5E-PFV*

**HEATING**

| 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) | **$COP_H$** |
| **-5°F** | -17 | 10,119 | 15.3 | 300 | 3,456 | **70°F** | 91 | 1,900 | 82 | 12 | **21,916** | **1.86** |
| **5°F** | -8 | 14,899 | 15.6 | 300 | 3,467 | | 95 | 1,900 | 84 | 14 | **26,734** | **2.26** |
| **15°F** | 0 | 19,721 | 16.2 | 300 | 3,563 | | 99 | 1,900 | 87 | 17 | **31,882** | **2.62** |
| **25°F** | 8 | 24,813 | 16.8 | 300 | 3,681 | | 103 | 1,900 | 90 | 20 | **37,378** | **2.97** |
| **35°F** | 17 | 30,197 | 17.5 | 300 | 3,812 | | 107 | 1,900 | 93 | 23 | **43,209** | **3.32** |
| **45°F** | 25 | 36,696 | 18.3 | 300 | 3,953 | | 111 | 1,900 | 96 | 26 | **50,188** | **3.72** |
| **55°F** | 34 | 43,231 | 19.1 | 300 | 4,122 | | 115 | 1,900 | 100 | 30 | **57,299** | **4.07** |
| **65°F** | 42 | 49,827 | 20.0 | 300 | 4,300 | | 119 | 1,900 | 104 | 34 | **64,503** | **4.40** |

**COOLING**

| 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** |
| **50°F** | 62 | 75,605 | 11.5 | 325 | 2,827 | **80°F** | 46 | 1,900 | 56 | 24 | 19,831 | 45,618 | **65,449** | **23.2** |
| **60°F** | 72 | 73,150 | 12.3 | 325 | 3,038 | | 46 | 1,900 | 57 | 23 | 18,869 | 43,404 | **62,272** | **20.5** |
| **70°F** | 83 | 71,046 | 13.5 | 325 | 3,339 | | 46 | 1,900 | 58 | 22 | 17,920 | 41,222 | **59,142** | **17.7** |
| **80°F** | 93 | 68,938 | 14.9 | 325 | 3,640 | | 47 | 1,900 | 60 | 21 | 16,970 | 39,037 | **56,008** | **15.4** |
| **90°F** | 104 | 67,066 | 16.8 | 325 | 4,050 | | 47 | 1,900 | 61 | 20 | 15,773 | 36,980 | **52,753** | **13.0** |
| **100°F** | 114 | 65,053 | 18.8 | 325 | 4,469 | | 48 | 1,900 | 62 | 18 | 14,743 | 34,566 | **49,309** | **11.0** |
| **110°F** | 125 | 63,253 | 21.4 | 325 | 5,009 | | 48 | 1,900 | 63 | 17 | 13,654 | 32,011 | **45,664** | **9.1** |
| **120°F** | 135 | 61,121 | 24.1 | 325 | 5,549 | | 48 | 1,900 | 65 | 15 | 12,465 | 29,225 | **41,690** | **7.5** |

*METRIC*

**HEATING**

| OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | | INDOOR LOOP *(Air)* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outdoor Air Temperature** | Evaporating Temperature | Heat Absorbed (W) | Compressor Current (A) | Fan (W) | Input Power (W) | **EAT** | Cond. Temp. | Airflow (L/s) | LAT (°C) | Delta T (°C) | **Heating** (W) | **$COP_H$** |
| **-21°C** | -26.9 | 2,965 | 15.3 | 300 | 3,456 | **21°C** | 32.8 | 900 | 27.5 | 6.4 | **6,421** | **1.86** |
| **-15°C** | -22.3 | 4,365 | 15.6 | 300 | 3,467 | | 35.0 | 900 | 28.9 | 7.8 | **7,833** | **2.26** |
| **-9°C** | -17.8 | 5,778 | 16.2 | 300 | 3,563 | | 37.2 | 900 | 30.4 | 9.3 | **9,341** | **2.62** |
| **-4°C** | -13.3 | 7,270 | 16.8 | 300 | 3,681 | | 39.4 | 900 | 32.0 | 10.9 | **10,952** | **2.97** |
| **2°C** | -8.6 | 8,848 | 17.5 | 300 | 3,812 | | 41.7 | 900 | 33.7 | 12.6 | **12,660** | **3.32** |
| **7°C** | -3.9 | 10,752 | 18.3 | 300 | 3,953 | | 43.9 | 900 | 35.8 | 14.7 | **14,705** | **3.72** |
| **13°C** | 0.9 | 12,666 | 19.1 | 300 | 4,122 | | 46.1 | 900 | 37.9 | 16.8 | **16,788** | **4.07** |
| **18°C** | 5.3 | 14,599 | 20.0 | 300 | 4,300 | | 48.3 | 900 | 40.0 | 18.9 | **18,899** | **4.40** |

**COOLING**

| OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | | INDOOR LOOP *(Air @ 50% RH)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outdoor Air Temperature** | Condensing Temperature | Heat Rejected (W) | Compressor Current (A) | Fan (W) | Input Power (W) | **EAT** | Evap. Temp. | Airflow (L/s) | LAT (°C) | Delta T (°C) | Latent (W) | Sensible (W) | **Cooling** (W) | **$COP_C$** |
| **10°C** | 16.7 | 22,152 | 11.5 | 325 | 2,827 | **27°C** | 7.6 | 900 | 13.3 | 13.3 | 5,810 | 13,366 | **19,176** | **6.78** |
| **16°C** | 22.2 | 21,433 | 12.3 | 325 | 3,038 | | 7.8 | 900 | 14.0 | 12.7 | 5,528 | 12,717 | **18,246** | **6.01** |
| **21°C** | 28.3 | 20,816 | 13.5 | 325 | 3,339 | | 8.0 | 900 | 14.6 | 12.1 | 5,251 | 12,078 | **17,328** | **5.19** |
| **27°C** | 33.9 | 20,199 | 14.9 | 325 | 3,640 | | 8.2 | 900 | 15.3 | 11.4 | 4,972 | 11,438 | **16,410** | **4.51** |
| **32°C** | 40.0 | 19,650 | 16.8 | 325 | 4,050 | | 8.4 | 900 | 15.9 | 10.8 | 4,622 | 10,835 | **15,457** | **3.82** |
| **38°C** | 45.6 | 19,060 | 18.8 | 325 | 4,469 | | 8.7 | 900 | 16.6 | 10.1 | 4,320 | 10,128 | **14,447** | **3.23** |
| **43°C** | 51.7 | 18,533 | 21.4 | 325 | 5,009 | | 8.9 | 900 | 17.3 | 9.4 | 4,000 | 9,379 | **13,379** | **2.67** |
| **49°C** | 57.2 | 17,908 | 24.1 | 325 | 5,549 | | 9.1 | 900 | 18.1 | 8.5 | 3,652 | 8,563 | **12,215** | **2.20** |

# Hydronic Performance

## ATF-65-HACW-P-1T *R410a, 60 Hz, ZPS51K5E-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) | **$COP_H$** |
| **HEATING** | **-5°F** | -16°F | 7,600 | 20.7 | 4730 | 102°F | 110°F | 14 | **105°F** | 3°F | **23,400** | **1.45** |
| | **5°F** | -8°F | 13,600 | 19.3 | 4410 | 101°F | 109°F | | | 4°F | **28,300** | **1.88** |
| | **15°F** | 1°F | 19,200 | 17.8 | 4100 | 100°F | 109°F | | | 5°F | **32,900** | **2.35** |
| | **25°F** | 9°F | 24,800 | 17.1 | 3950 | 100°F | 109°F | | | 5°F | **37,900** | **2.81** |
| | **35°F** | 17°F | 31,700 | 15.5 | 3620 | 99°F | 109°F | | | 6°F | **43,700** | **3.55** |
| | **45°F** | 26°F | 38,100 | 15.5 | 3610 | 98°F | 108°F | | | 7°F | **50,100** | **4.07** |
| | **55°F** | 34°F | 45,100 | 15.4 | 3570 | 97°F | 108°F | | | 8°F | **56,900** | **4.68** |
| | **65°F** | 43°F | 52,300 | 15.2 | 3490 | 96°F | 108°F | | | 9°F | **63,900** | **5.37** |
| | **-5°F** | -16°F | - | - | - | - | - | 14 | **120°F** | *LLT is limited to 105°F at these outdoor temperatures* | | |
| | **5°F** | -8°F | - | - | - | - | - | | | | | |
| | **15°F** | 1°F | 17,500 | 20.8 | 4830 | 115°F | 124°F | | | 5°F | **32,800** | **2.05** |
| | **25°F** | 9°F | 22,400 | 20.0 | 4650 | 115°F | 124°F | | | 5°F | **37,600** | **2.39** |
| | **35°F** | 17°F | 28,600 | 18.2 | 4270 | 114°F | 123°F | | | 6°F | **42,800** | **2.94** |
| | **45°F** | 26°F | 34,200 | 18.2 | 4270 | 113°F | 123°F | | | 7°F | **48,500** | **3.33** |
| | **55°F** | 34°F | 40,500 | 18.2 | 4250 | 112°F | 123°F | | | 8°F | **54,700** | **3.77** |
| | **65°F** | 43°F | 47,100 | 18.1 | 4190 | 111°F | 123°F | | | 9°F | **61,000** | **4.27** |

*METRIC*

| | OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | INDOOR LOOP *(Water)* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Outdoor Air Temperature** | Evaporating Temperature | Heat Absorbed (W) | Compressor Current (A) | Input Power (W) | ELT | Condensing Temperature | Liquid Flow (L/s) | **LLT** | Delta T | **Heating** (W) | **$COP_H$** |
| **HEATING (METRIC)** | **-21°C** | -27°C | 2,230 | 20.7 | 4730 | 39°C | 43°C | 0.88 | **40.5°C** | 1.9°C | **6,870** | **1.45** |
| | **-15°C** | -22°C | 3,980 | 19.3 | 4410 | 38°C | 43°C | | | 2.2°C | **8,300** | **1.88** |
| | **-9°C** | -18°C | 5,630 | 17.8 | 4100 | 38°C | 43°C | | | 2.6°C | **9,640** | **2.35** |
| | **-4°C** | -13°C | 7,250 | 17.1 | 3950 | 38°C | 43°C | | | 3.0°C | **11,100** | **2.81** |
| | **2°C** | -8°C | 9,290 | 15.5 | 3620 | 37°C | 43°C | | | 3.5°C | **12,800** | **3.55** |
| | **7°C** | -4°C | 11,200 | 15.5 | 3610 | 37°C | 42°C | | | 4.0°C | **14,700** | **4.07** |
| | **13°C** | 1°C | 13,200 | 15.4 | 3570 | 36°C | 42°C | | | 4.5°C | **16,700** | **4.68** |
| | **18°C** | 6°C | 15,300 | 15.2 | 3490 | 36°C | 42°C | | | 5.1°C | **18,700** | **5.37** |
| | **-21°C** | -27°C | - | - | - | - | - | 0.88 | **49°C** | *LLT is limited to 40.5°C at these outdoor temperatures* | | |
| | **-15°C** | -22°C | - | - | - | - | - | | | | | |
| | **-9°C** | -18°C | 5,140 | 20.8 | 4830 | 46°C | 51°C | | | 2.7°C | **9,610** | **2.05** |
| | **-4°C** | -13°C | 6,560 | 20.0 | 4650 | 46°C | 51°C | | | 3.0°C | **11,000** | **2.39** |
| | **2°C** | -8°C | 8,370 | 18.2 | 4270 | 46°C | 51°C | | | 3.4°C | **12,500** | **2.94** |
| | **7°C** | -4°C | 10,000 | 18.2 | 4270 | 45°C | 51°C | | | 3.9°C | **14,200** | **3.33** |
| | **13°C** | 1°C | 11,900 | 18.2 | 4250 | 45°C | 51°C | | | 4.3°C | **16,000** | **3.77** |
| | **18°C** | 6°C | 13,800 | 18.1 | 4190 | 44°C | 50°C | | | 4.9°C | **17,900** | **4.27** |

# Air Heating/Cooling Performance

< Preliminary >

## ATF-75-HACW-P-1T *R410a, 60 Hz, ZPS60K5E-PFV*

**HEATING**

| 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) | **$COP_H$** |
| **-5°F** | -17 | 12,161 | 18.6 | 410 | 4,028 | **70°F** | 92 | 2,100 | 82 | 12 | **25,910** | **1.88** |
| **5°F** | -8 | 17,560 | 19.4 | 410 | 4,159 | | 96 | 2,100 | 85 | 15 | **31,754** | **2.24** |
| **15°F** | 0 | 23,143 | 20.2 | 410 | 4,293 | | 100 | 2,100 | 88 | 18 | **37,797** | **2.58** |
| **25°F** | 8 | 29,197 | 21.1 | 410 | 4,387 | | 104 | 2,100 | 91 | 21 | **44,171** | **2.95** |
| **35°F** | 17 | 35,401 | 21.9 | 410 | 4,486 | | 108 | 2,100 | 94 | 24 | **50,710** | **3.31** |
| **45°F** | 25 | 42,073 | 22.8 | 410 | 4,552 | | 112 | 2,100 | 97 | 27 | **57,608** | **3.71** |
| **55°F** | 34 | 48,649 | 23.7 | 410 | 4,657 | | 116 | 2,100 | 101 | 31 | **64,544** | **4.06** |
| **65°F** | 42 | 55,597 | 24.6 | 410 | 4,807 | | 120 | 2,100 | 104 | 34 | **72,005** | **4.39** |

**COOLING**

| 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** |
| **50°F** | 63 | 88,261 | 14.0 | 450 | 3,311 | **80°F** | 46 | 2,100 | 55 | 25 | 23,167 | 53,291 | **76,458** | **23.1** |
| **60°F** | 73 | 85,697 | 15.5 | 450 | 3,593 | | 46 | 2,100 | 56 | 24 | 22,098 | 50,834 | **72,932** | **20.3** |
| **70°F** | 83 | 83,316 | 17.0 | 450 | 3,984 | | 46 | 2,100 | 57 | 23 | 20,973 | 48,244 | **69,217** | **17.4** |
| **80°F** | 93 | 80,444 | 18.7 | 450 | 4,290 | | 47 | 2,100 | 58 | 22 | 19,786 | 45,514 | **65,300** | **15.2** |
| **90°F** | 104 | 77,778 | 20.8 | 450 | 4,733 | | 47 | 2,100 | 60 | 20 | 18,261 | 42,813 | **61,074** | **12.9** |
| **100°F** | 114 | 74,910 | 23.0 | 450 | 5,194 | | 47 | 2,100 | 61 | 19 | 16,933 | 39,699 | **56,632** | **10.9** |
| **110°F** | 124 | 72,324 | 25.6 | 450 | 5,801 | | 47 | 2,100 | 63 | 17 | 15,541 | 36,435 | **51,976** | **9.0** |
| **120°F** | 134 | 69,726 | 28.6 | 450 | 6,447 | | 47 | 2,100 | 64 | 16 | 14,105 | 33,068 | **47,173** | **7.3** |

*METRIC*

**HEATING**

| OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | | INDOOR LOOP *(Air)* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outdoor Air Temperature** | Evaporating Temperature | Heat Absorbed (W) | Compressor Current (A) | Fan (W) | Input Power (W) | **EAT** | Cond. Temp. | Airflow (L/s) | LAT (°C) | Delta T (°C) | **Heating** (W) | **$COP_H$** |
| **-21°C** | -27.1 | 3,563 | 18.6 | 410 | 4,028 | **21°C** | 33.3 | 990 | 28.0 | 6.9 | **7,592** | **1.88** |
| **-15°C** | -22.4 | 5,145 | 19.4 | 410 | 4,159 | | 35.6 | 990 | 29.5 | 8.4 | **9,304** | **2.24** |
| **-9°C** | -17.8 | 6,781 | 20.2 | 410 | 4,293 | | 37.8 | 990 | 31.1 | 10.0 | **11,074** | **2.58** |
| **-4°C** | -13.2 | 8,555 | 21.1 | 410 | 4,387 | | 40.0 | 990 | 32.8 | 11.7 | **12,942** | **2.95** |
| **2°C** | -8.6 | 10,372 | 21.9 | 410 | 4,486 | | 42.2 | 990 | 34.5 | 13.4 | **14,858** | **3.31** |
| **7°C** | -3.8 | 12,327 | 22.8 | 410 | 4,552 | | 44.4 | 990 | 36.4 | 15.2 | **16,879** | **3.71** |
| **13°C** | 0.9 | 14,254 | 23.7 | 410 | 4,657 | | 46.7 | 990 | 38.2 | 17.1 | **18,911** | **4.06** |
| **18°C** | 5.8 | 16,290 | 24.6 | 410 | 4,807 | | 48.9 | 990 | 40.2 | 19.0 | **21,097** | **4.39** |

**COOLING**

| OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | | INDOOR LOOP *(Air @ 50% RH)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outdoor Air Temperature** | Condensing Temperature | Heat Rejected (W) | Compressor Current (A) | Fan (W) | Input Power (W) | **EAT** | Evap. Temp. | Airflow (L/s) | LAT (°C) | Delta T (°C) | Latent (W) | Sensible (W) | **Cooling** (W) | **$COP_C$** |
| **10°C** | 17.2 | 25,860 | 14.0 | 450 | 3,311 | **27°C** | 7.8 | 990 | 12.6 | 14.1 | 6,788 | 15,614 | **22,402** | **6.77** |
| **16°C** | 22.8 | 25,109 | 15.5 | 450 | 3,593 | | 7.9 | 990 | 13.2 | 13.4 | 6,475 | 14,894 | **21,369** | **5.95** |
| **21°C** | 28.3 | 24,411 | 17.0 | 450 | 3,984 | | 8.0 | 990 | 13.9 | 12.8 | 6,145 | 14,135 | **20,280** | **5.09** |
| **27°C** | 33.9 | 23,570 | 18.7 | 450 | 4,290 | | 8.1 | 990 | 14.6 | 12.0 | 5,797 | 13,336 | **19,133** | **4.46** |
| **32°C** | 40.0 | 22,789 | 20.8 | 450 | 4,733 | | 8.2 | 990 | 15.3 | 11.3 | 5,350 | 12,544 | **17,895** | **3.78** |
| **38°C** | 45.6 | 21,948 | 23.0 | 450 | 5,194 | | 8.3 | 990 | 16.2 | 10.5 | 4,961 | 11,632 | **16,593** | **3.19** |
| **43°C** | 51.1 | 21,191 | 25.6 | 450 | 5,801 | | 8.4 | 990 | 17.0 | 9.6 | 4,553 | 10,675 | **15,229** | **2.63** |
| **49°C** | 56.7 | 20,430 | 28.6 | 450 | 6,447 | | 8.6 | 990 | 17.9 | 8.7 | 4,133 | 9,689 | **13,822** | **2.14** |

# Hydronic Performance

## ATF-75-HACW-P-1T *R410a, 60 Hz, ZPS60K5E-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) | **$COP_H$** |
| **HEATING** | **-5°F** | -16°F | 7,910 | 23.1 | 5140 | 102°F | 110°F | 16 | **105°F** | 3°F | **25,100** | **1.43** |
| | **5°F** | -8°F | 14,900 | 21.5 | 4820 | 101°F | 109°F | | | 4°F | **30,900** | **1.88** |
| | **15°F** | 1°F | 21,600 | 20.9 | 4690 | 100°F | 109°F | | | 5°F | **37,200** | **2.32** |
| | **25°F** | 9°F | 29,100 | 19.6 | 4440 | 100°F | 109°F | | | 5°F | **43,900** | **2.89** |
| | **35°F** | 17°F | 36,500 | 18.8 | 4270 | 99°F | 109°F | | | 6°F | **50,600** | **3.48** |
| | **45°F** | 26°F | 43,900 | 18.1 | 4120 | 98°F | 108°F | | | 7°F | **57,600** | **4.09** |
| | **55°F** | 34°F | 51,700 | 17.5 | 3980 | 97°F | 108°F | | | 8°F | **64,900** | **4.77** |
| | **65°F** | 43°F | 60,100 | 16.9 | 3820 | 96°F | 108°F | | | 9°F | **72,800** | **5.58** |
| | **-5°F** | -16°F | - | - | - | - | - | 16 | **120°F** | *LLT is limited to 105°F at these outdoor temperatures* | | |
| | **5°F** | -8°F | - | - | - | - | - | | | | | |
| | **15°F** | 1°F | 19,100 | 24.3 | 5540 | 115°F | 124°F | | | 5°F | **37,100** | **1.99** |
| | **25°F** | 9°F | 25,900 | 22.9 | 5250 | 115°F | 124°F | | | 5°F | **43,400** | **2.42** |
| | **35°F** | 17°F | 32,500 | 22.0 | 5050 | 114°F | 123°F | | | 6°F | **49,400** | **2.86** |
| | **45°F** | 26°F | 39,300 | 21.2 | 4890 | 113°F | 123°F | | | 7°F | **55,600** | **3.33** |
| | **55°F** | 34°F | 46,400 | 20.6 | 4730 | 112°F | 123°F | | | 8°F | **62,100** | **3.85** |
| | **65°F** | 43°F | 54,100 | 19.8 | 4540 | 111°F | 123°F | | | 9°F | **69,300** | **4.47** |

*METRIC*

| | OUTDOOR LOOP *(Air)* | | | ELECTRICAL | | INDOOR LOOP *(Water)* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Outdoor Air Temperature** | Evaporating Temperature | Heat Absorbed (W) | Compressor Current (A) | Input Power (W) | ELT | Condensing Temperature | Liquid Flow (L/s) | **LLT** | Delta T | **Heating** (W) | **$COP_H$** |
| **HEATING (METRIC)** | **-21°C** | -27°C | 2,320 | 23.1 | 5140 | 39°C | 43°C | 1.0 | **40.5°C** | 1.7°C | **7,350** | **1.43** |
| | **-15°C** | -22°C | 4,360 | 21.5 | 4820 | 38°C | 43°C | | | 2.2°C | **9,070** | **1.88** |
| | **-9°C** | -18°C | 6,320 | 20.9 | 4690 | 38°C | 43°C | | | 2.6°C | **10,900** | **2.32** |
| | **-4°C** | -13°C | 8,520 | 19.6 | 4440 | 38°C | 43°C | | | 3.0°C | **12,900** | **2.89** |
| | **2°C** | -8°C | 10,700 | 18.8 | 4270 | 37°C | 43°C | | | 3.5°C | **14,800** | **3.48** |
| | **7°C** | -4°C | 12,900 | 18.1 | 4120 | 37°C | 42°C | | | 4.0°C | **16,900** | **4.09** |
| | **13°C** | 1°C | 15,100 | 17.5 | 3980 | 36°C | 42°C | | | 4.5°C | **19,000** | **4.77** |
| | **18°C** | 6°C | 17,600 | 16.9 | 3820 | 36°C | 42°C | | | 5.1°C | **21,300** | **5.58** |
| | **-21°C** | -27°C | - | - | - | - | - | 1.0 | **49°C** | *LLT is limited to 40.5°C at these outdoor temperatures* | | |
| | **-15°C** | -22°C | - | - | - | - | - | | | | | |
| | **-9°C** | -18°C | 5,590 | 24.3 | 5540 | 46°C | 51°C | | | 2.6°C | **10,900** | **1.99** |
| | **-4°C** | -13°C | 7,580 | 22.9 | 5250 | 46°C | 51°C | | | 3.0°C | **12,700** | **2.42** |
| | **2°C** | -8°C | 9,530 | 22.0 | 5050 | 45°C | 51°C | | | 3.4°C | **14,500** | **2.86** |
| | **7°C** | -4°C | 11,500 | 21.2 | 4890 | 45°C | 51°C | | | 3.9°C | **16,300** | **3.33** |
| | **13°C** | 1°C | 13,600 | 20.6 | 4730 | 45°C | 51°C | | | 4.3°C | **18,200** | **3.85** |
| | **18°C** | 6°C | 15,900 | 19.8 | 4540 | 44°C | 50°C | | | 4.8°C | **20,300** | **4.47** |

# Electrical Specifications

**TABLE 40 - ATF-Series Electrical Specifications** ** equipped with K6E compressors where available*

| | 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 | **14.1** | **84** | 3.5 | 3.0 | 1.6 | **23.0** | **26.5** | **40** | **#8-2*** |
| | 2 | 208-3-60 | 187 | 229 | **9.6** | **74** | 3.5 | 3.0 | 1.6 | **18.5** | **20.9** | **30** | **#10-3*** |
| | 4 | 460-3-60 | 414 | 506 | **5.1** | **37** | 3.5 | 3.0 | 1.6 | **14.0** | **15.3** | **20** | **#12-4** |
| ATF-55 | 1 | 208/230-1-60 | 187 | 253 | **20.4** | **122** | 4.0 | 4.0 | 1.6 | **30.8** | **35.9** | **50** | **#8-2*** |
| | 2 | 208-3-60 | 187 | 229 | **14.0** | **83** | 4.0 | 4.0 | 1.6 | **24.4** | **27.9** | **40** | **#8-3*** |
| | 4 | 460-3-60 | 414 | 506 | **6.4** | **41** | 4.0 | 4.0 | 1.6 | **16.8** | **18.4** | **20** | **#12-4** |
| ATF-65 | 1 | 208/230-1-60 | 187 | 253 | **22.8** | **147** | 5.5 | 4.0 | 3.0 | **36.1** | **41.8** | **60** | **#6-2*** |
| | 2 | 208-3-60 | 187 | 229 | **16.5** | **110** | 5.5 | 4.0 | 3.0 | **29.8** | **33.9** | **50** | **#8-3*** |
| | 4 | 460-3-60 | 414 | 506 | **7.2** | **52** | 5.5 | 4.0 | 3.0 | **20.5** | **22.3** | **30** | **#10-4** |
| ATF-75 | 1 | 208/230-1-60 | 187 | 253 | **27.6** | **190** | 6.5 | 4.0 | 3.0 | **41.9** | **48.8** | **60** | **#6-2*** |
| | 2 | 208-3-60 | 187 | 229 | **18.6** | **149** | 6.5 | 4.0 | 3.0 | **32.9** | **37.6** | **50** | **#8-3*** |
| | 4 | 460-3-60 | 414 | 506 | **9.0** | **61** | 6.5 | 4.0 | 3.0 | **23.3** | **25.6** | **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*** |

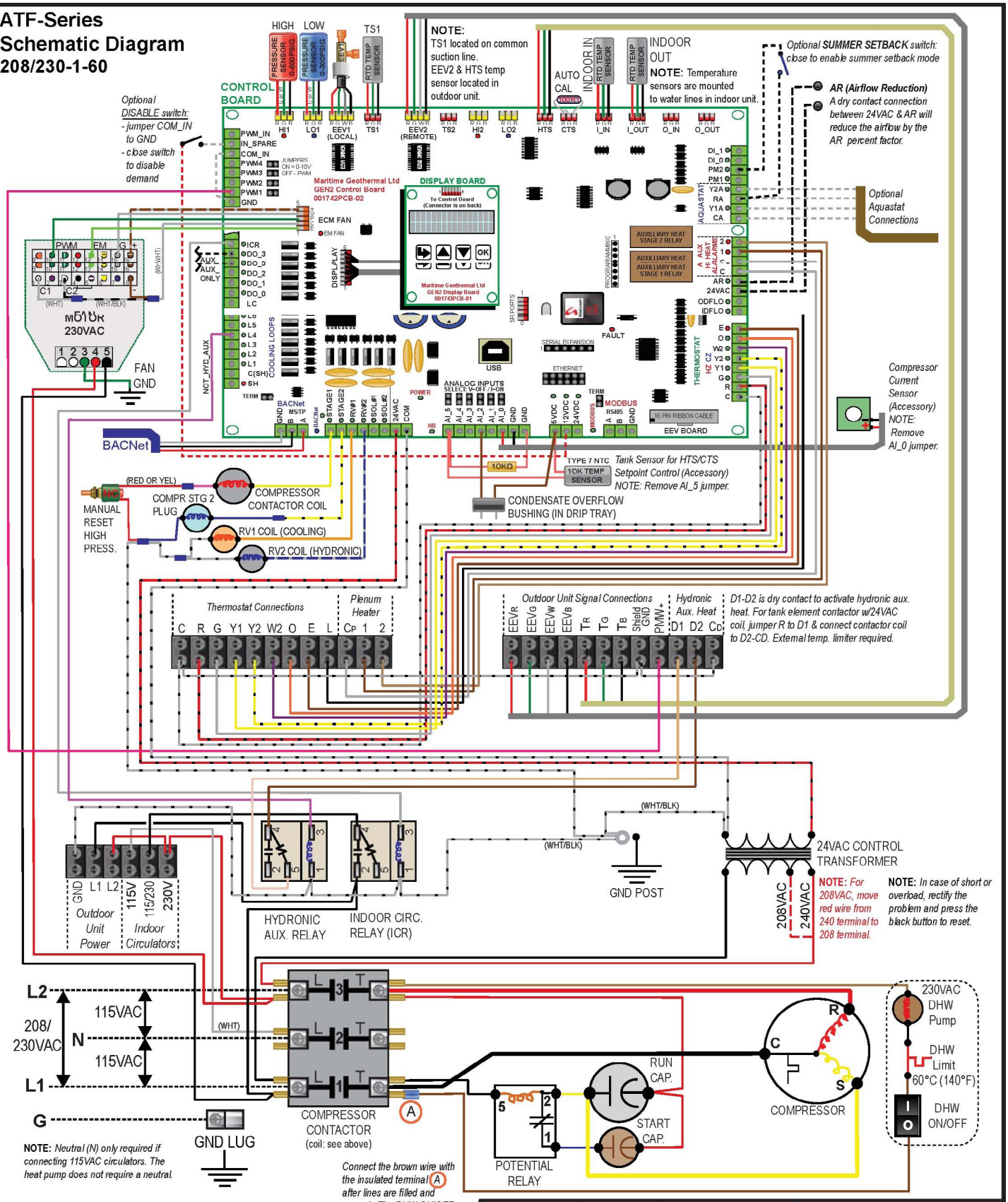
**Maximum external static pressure:**
**0.50in $H_2O$**

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** | ***> 7°C*** | **0%** | **100%** |
| **30 to 45°F** | ***-1 to 7°C*** | **-5%** | **95%** |
| **25 to 30°F** | ***-4 to -1°C*** | **-10%** | **90%** |
| **20 to 25°F** | ***-7 to -4°C*** | **-15%** | **85%** |
| **15 to 20°F** | ***-9 to -7°C*** | **-20%** | **80%** |
| **10 to 15°F** | ***-12 to -9°C*** | **-25%** | **75%** |
| **5 to 10°F** | ***-15 to -12°C*** | **-30%** | **70%** |
| **0 to 5°F** | ***-18 to -15°C*** | **-35%** | **65%** |
| **< 0°F** | ***< -18°C*** | **-40%** | **60%** |

# ATF-Series Schematic Diagram 208/230-1-60




| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 04 | 000310 | D. RHEAULT | D. RHEAULT | 15-FEB-2023 |
| 03 | 000274 | D. RHEAULT | D. RHEAULT | 01-MAR-2020 |
| 02 | 000261 | D. RHEAULT | D. RHEAULT | 01-JUN-2018 |
| 01 | Initial Release | C. GEDDES | C. GEDDES | 28-MAY-2015 |

| | | |
|---|---|---|
| Drawn By | C. GEDDES | Date 28-MAY-2015 |
| Checked By | C. GEDDES | Date 28-MAY-2015 |
| Eng. Approved By | C. GEDDES | Date 28-MAY-2015 |
| Mfg. Approved By | | Date |
| Approved By | | Date |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Drawing Name: ATF-**-HACW-P-1*-*-*DE*F Schematic Diagram

| Size | Drawing Number | Drawing Rev | Sheet |
|---|---|---|---|
| LET | 001956SCH | 04 | 1 / 1 |

# ATF-Series Electrical Box Diagram
## 208/230-1-60

### SYSTEM CONTROL DESCRIPTION

| Sytem Control by BACNet or External Control Signals | | |
|---|---|---|
| BACNet Object | External | Activation |
| SYSTEM_G | G | Fan Recirculation Mode |
| SYSTEM_Y1 | Y1 | Compressor Stage 1 (Air) |
| SYSTEM_Y2 | Y2 | Compressor Stage 2 (Air) |
| SYSTEM_W2 | W2 | Auxiliary Heat (Air) |
| SYSTEM_O | O | Air Heating (OFF) / Air Cooling (ON) |
| SYSTEM_Y1A | Y1A | Compressor Stage 1 (Hydronic) |
| SYSTEM_Y2A | Y2A | Compressor Stage 2 (Hydronic) |

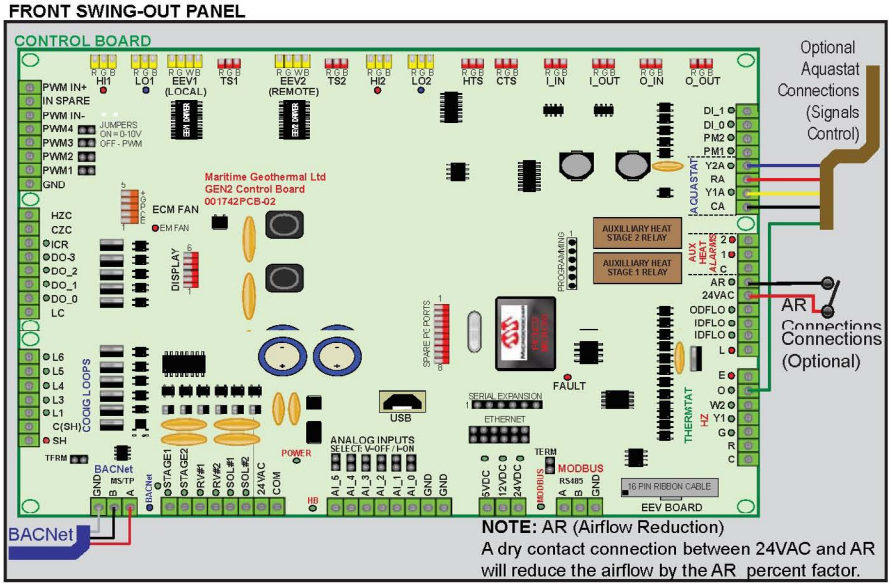
### OUTDOOR UNIT SIGNAL CONNECTIONS (24VAC)

Use an 18-8 **shielded outdoor rated** cable to connect the matching Outdoor Unit Signal Connections in the indoor and outdoor units. Connect the shield to the Shield GND terminal in indoor unit only.

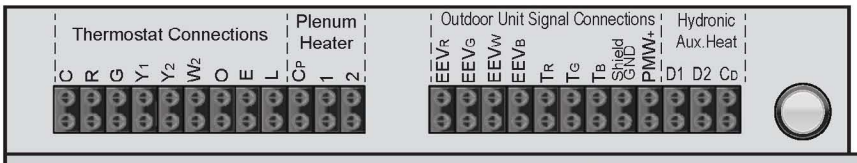
### OUTDOOR UNIT POWER CONNECTIONS (230VAC)

Use a 14-2 **outdoor rated** cable to connect the matching Outdoor Unit Power Supply connections in the indoor and outdoor units.

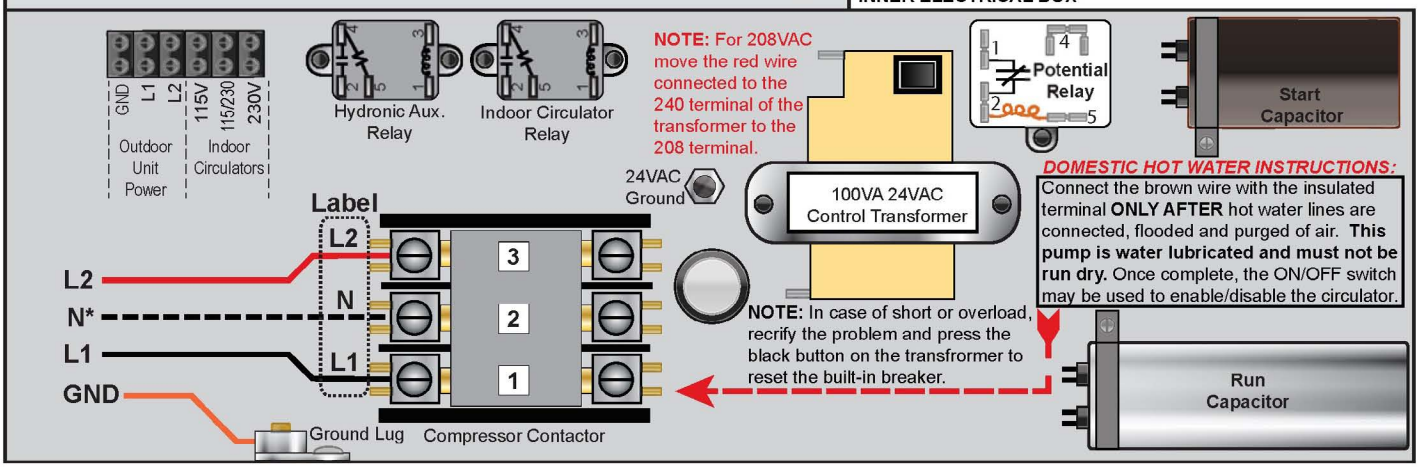
### FRONT SWING-OUT PANEL




**NOTE:** AR (Airflow Reduction)
A dry contact connection between 24VAC and AR will reduce the airflow by the AR percent factor.




### INNER ELECTRICAL BOX




### DOMESTIC HOT WATER INSTRUCTIONS:

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

### 208/230V POWER SUPPLY CONNECTIONS

*NOTE: Neutral (N) is only required if connecting 115VAC indoor circulators.

| Wire | Colour | Contactor (Label) |
|---|---|---|
| Line 2 | Red | L2 |
| Neutral* | White | N* |
| Line 1 | Black | L1 |
| Connect "GND" to Ground Lug. | | |

### INDOOR CIRCULATOR CONNECTIONS

**Refer to label in unit for Max. Amps.**
Connect 115VAC circulators to terminals **115V** and 115/230.
Connect 230VAC circulators to terminals **230V** and 115/230.

### HYDRONIC AUX. HEAT CONNECTIONS

Use an 18-2 conductor cable. Choose one of 2 types of auxiliary heat connections. Default is "ON".
*Tank temperature limiter must remain in place.*

D1, D2 — Dry contacts, closed when ATW calls for aux. heat

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

### EXT. AIR CONTROL CONNECTIONS (24VAC)

Use an 18-9 cable to connect the air thermostat to the Thermostat Connections terminal strip:

C - 24VAC Common
R - 24VAC Hot
G - Fan Recirculation Mode
Y1 - Compressor Stage1
Y2 - Compressor Stage2
W2 - Auxiliary Heat (Air)
E - Emergency Heat (Air)
O - Cooling Mode Active
L - Lockout indicator (24VAC if lockout)

A dry contact R to [G, Y1, Y2, W2, E, or O] will activate the input.

### EXT. HYDRONIC CONTROL CONNECTIONS (24V)

If using an external aquastat (*Signals* control method), use an 18-4 cable to connect the screw terminals on the right side of the control board to the aquastat:

CA - 24VAC Common
RA - 24VAC Hot
Y1A - Compressor Stage1
Y2A - Compressor Stage2

A dry contact RA to Y1A / Y2A will activate the input.

### PLENUM HEATER CONTROL CONNECTIONS

Use an 18-3 cable to connect plenum heater control board to the heat pump terminal strip:

CP - 24VAC common
1 - electric heat stage 1
2 - electric heat stage 2

| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 03 | 000310 | D. RHEAULT | D. RHEAULT | 15-FEB-2023 |
| 02 | 000261 | D. RHEAULT | D. RHEAULT | 01-JUN-2018 |

| | | |
|---|---|---|
| Drawn By C. GEDDES | Date 28-MAY-2015 | |
| Checked By C. GEDDES | Date 28-MAY-2015 | |
| Eng. Approved By C. GEDDES | Date 28-MAY-2015 | |
| Mfg. Approved By | Date | |
| Approved By | Date | |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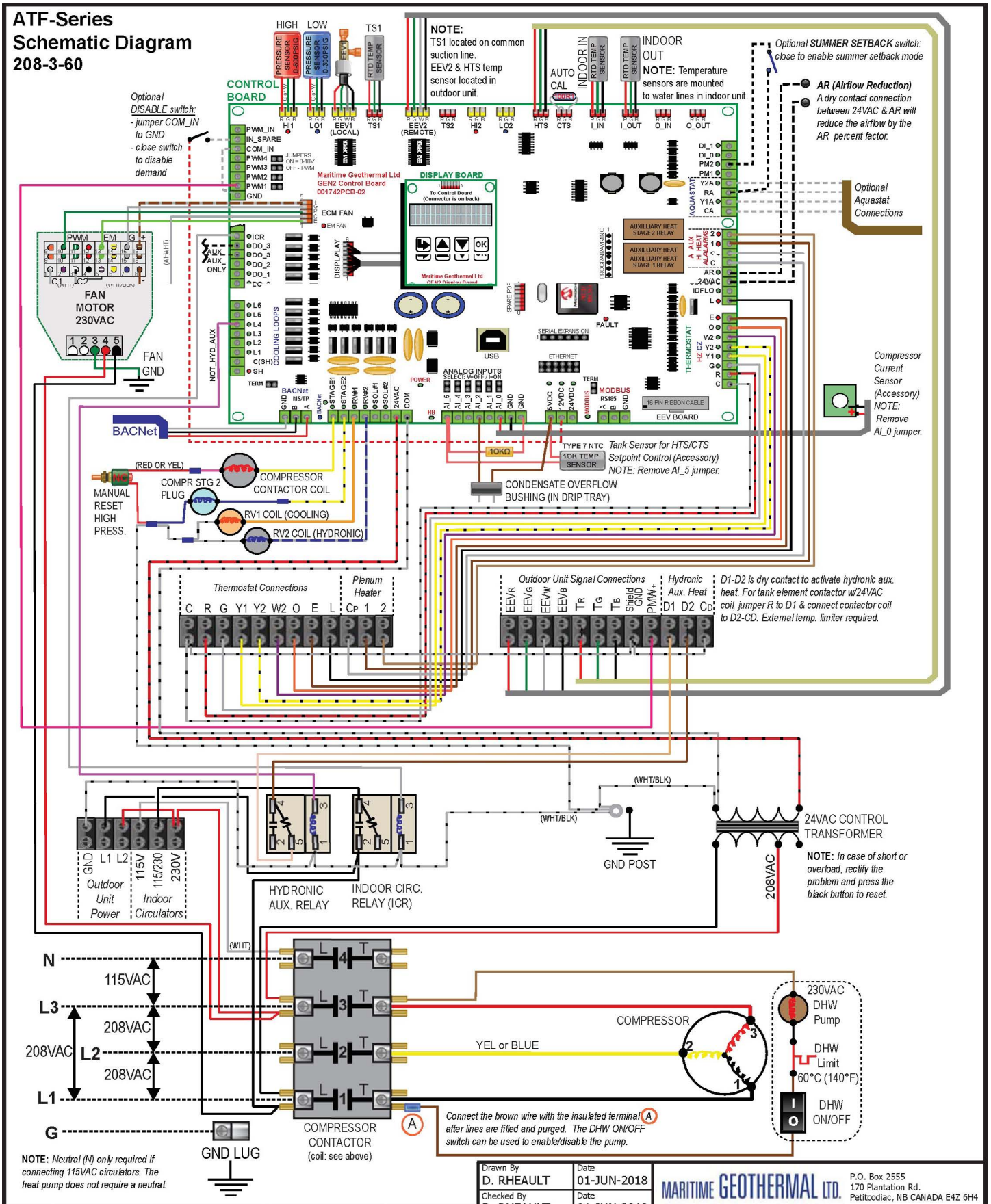
Drawing Name: ATF-**-HACW-P-1*-*-SDE*F Electrical Box Diagram

| Size | Drawing Number | Drawing Rev | Sheet |
|---|---|---|---|
| LET | 001957ELB | 03 | 1 / 1 |

# ATF-Series Schematic Diagram 208-3-60




| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 05 | 000310 | D. RHEAULT | D. RHEAULT | 15-FEB-2023 |
| 04 | 000296 | D. RHEAULT | D. RHEAULT | 1-JAN-2022 |
| 03 | 000274 | D. RHEAULT | D. RHEAULT | 01-MAR-2020 |
| 02 | 000261 | D. RHEAULT | D. RHEAULT | 01-JUN-2018 |

| | | |
|---|---|---|
| Drawn By: D. RHEAULT | Date: 01-JUN-2018 | |
| Checked By: D. RHEAULT | Date: 01-JUN-2018 | |
| Eng. Approved By: D. RHEAULT | Date: 01-JUN-2018 | |
| Mfg. Approved By: | Date: | |
| Approved By: | Date: | |

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Drawing Name: ATF-**-HACW-P-2*-*-*DE*F Schematic Diagram

| Size | Drawing Number | Drawing Rev | Sheet |
|---|---|---|---|
| LET | 001958SCH | 05 | 1 / 1 |

# ATF-Series Electrical Box Diagram
## 208-3-60

### SYSTEM CONTROL DESCRIPTION

| Sytem Control by BACNet or External Control Signals | | |
|---|---|---|
| BACNet Object | External | Activation |
| SYSTEM_G | G | Fan Recirculation Mode |
| SYSTEM_ Y1 | Y1 | Compressor Stage 1 (Air) |
| SYSTEM_Y2 | Y2 | Compressor Stage 2 (Air) |
| SYSTEM_W2 | W2 | Auxiliary Heat (Air) |
| SYSTEM_O | O | Air Heating (OFF) / Air Cooling (ON) |
| SYSTEM_Y1A | Y1A | Compressor Stage 1 (Hydronic) |
| SYSTEM_Y2A | Y2A | Compressor Stage 2 (Hydronic) |

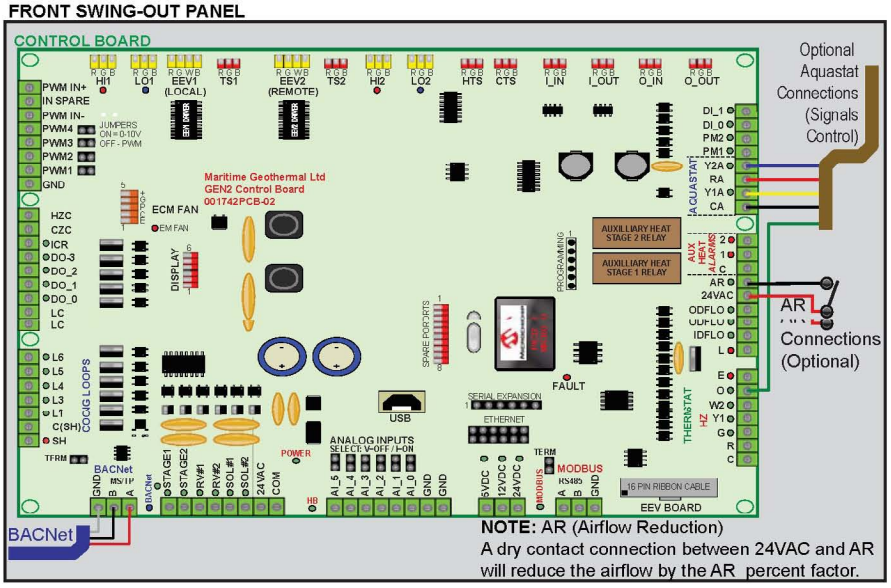
### OUTDOOR UNIT SIGNAL CONNECTIONS (24VAC)

Use an 18-8 **shielded outdoor rated** cable to connect the matching Outdoor Unit Signal Connections in the indoor and outdoor units. Connect the shield to the Shield GND terminal in indoor unit only.

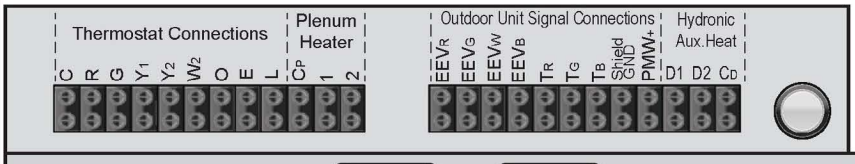
### OUTDOOR UNIT POWER CONNECTIONS (230VAC)

Use a 14-2 **outdoor rated** cable to connect the matching Outdoor Unit Power Supply connections in the indoor and outdoor units.

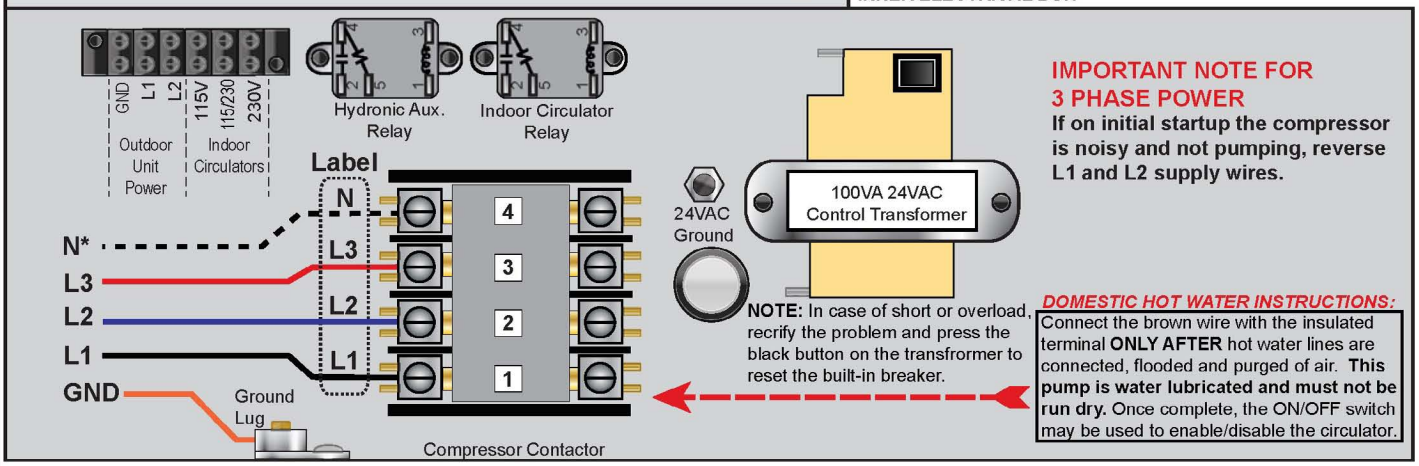
### FRONT SWING-OUT PANEL




**NOTE:** AR (Airflow Reduction)
A dry contact connection between 24VAC and AR will reduce the airflow by the AR percent factor.




### INNER ELECTRICAL BOX




**IMPORTANT NOTE FOR 3 PHASE POWER**
**If on initial startup the compressor is noisy and not pumping, reverse L1 and L2 supply wires.**

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

### DOMESTIC HOT WATER INSTRUCTIONS:

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

### 208V POWER SUPPLY CONNECTIONS

*NOTE: Neutral (N) is only required if connecting 115VAC indoor circulators.

| Wire | Colour | Contactor (Label) |
|---|---|---|
| Neutral* | White | N* |
| Line 3 | Red | L3 |
| Line 2 | Blue | L2 |
| Line 1 | Black | L1 |
| Connect "GND" to ground lug | | |

### INDOOR CIRCULATOR CONNECTIONS

**Refer to label in unit for Max. Amps.**
Connect 115VAC circulators to terminals **115V** and 115/230.
Connect 230VAC circulators to terminals **230V** and 115/230.

### EXT. AIR CONTROL CONNECTIONS (24VAC)

Use an 18-9 cable to connect the air thermostat to the Thermostat Connections terminal strip:

C - 24VAC Common
R - 24VAC Hot
G - Fan Recirculation Mode
Y1 - Compressor Stage1
Y2 - Compressor Stage2
W2 - Auxiliary Heat (Air)
E - Emergency Heat (Air)
O - Cooling Mode Active
L - Lockout indicator (24VAC if lockout)

A dry contact R to [G, Y1, Y2, W2, E, or O] will activate the input.

### EXT. HYDRONIC CONTROL CONNECTIONS (24V)

If using an external aquastat (*Signals* control method), use an 18-4 cable to connect the screw terminals on the right side of the control board to the aquastat:

CA - 24VAC Common
RA - 24VAC Hot
Y1A - Compressor Stage1
Y2A - Compressor Stage2

A dry contact RA to Y1A / Y2A will activate the input.

### HYDRONIC AUX. HEAT CONNECTIONS

Use an 18-2 conductor cable. Choose one of 2 types of auxiliary heat connections. Default is "ON".
*Tank temperature limiter must remain in place.*

D1, D2 — Dry contacts, closed when ATW calls for aux. heat

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

### PLENUM HEATER CONTROL CONNECTIONS

Use an 18-3 cable to connect plenum heater control board to the heat pump terminal strip:

CP - 24VAC common
1 - electric heat stage 1
2 - electric heat stage 2

| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 03 | 000310 | D. RHEAULT | D. RHEAULT | 15-FEB-2023 |
| 02 | 000261 | D. RHEAULT | D. RHEAULT | 01-JUN-2018 |

| | | |
|---|---|---|
| Drawn By | D.RHEAULT | Date 01-JUN-2018 |
| Checked By | D.RHEAULT | Date 01-JUN-2018 |
| Eng. Approved By | D.RHEAULT | Date 01-JUN-2018 |
| Mfg. Approved By | | Date |
| Approved By | | Date |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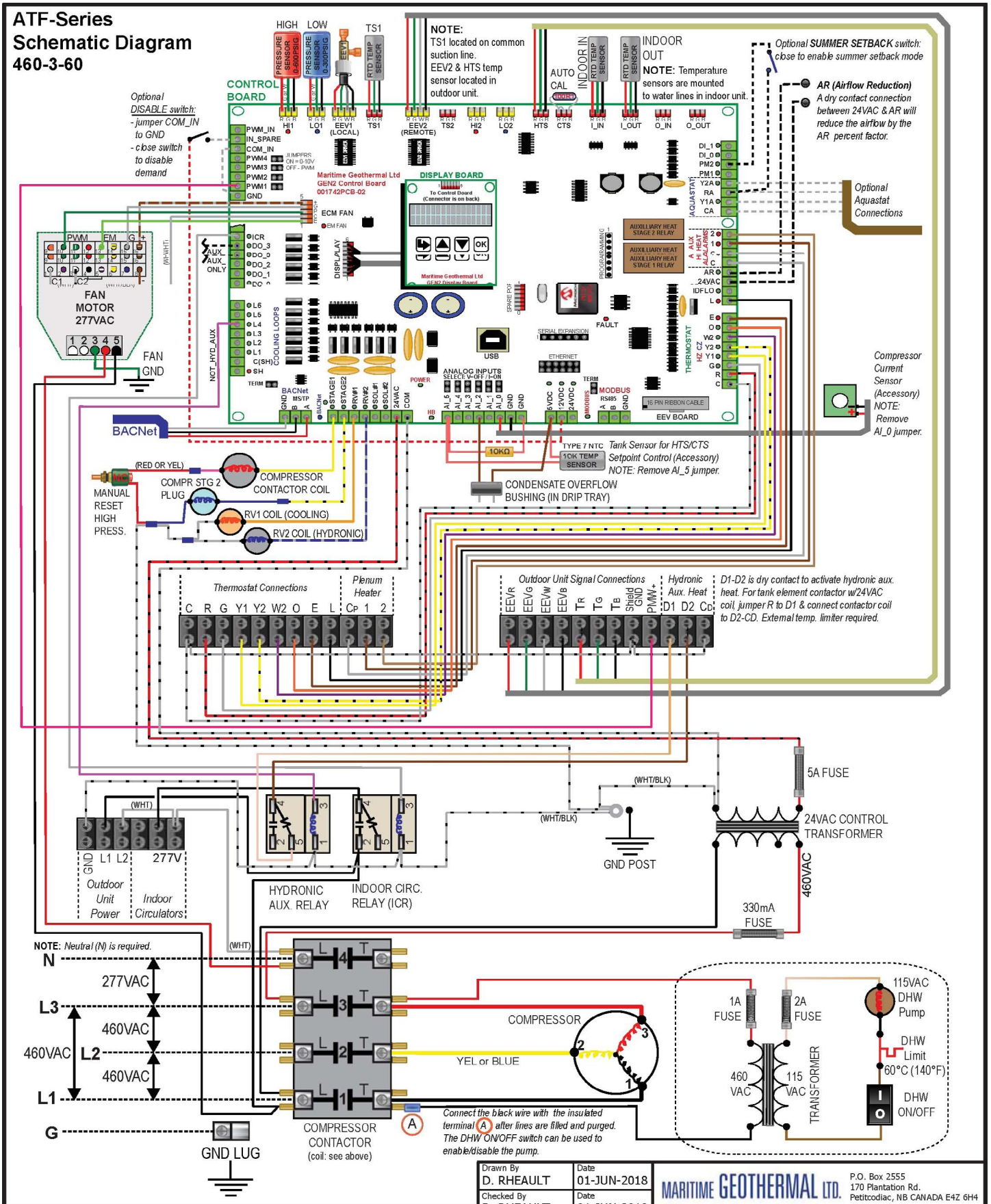
Drawing Name: ATF-**-HACW-P-2*-*-SDE*F Electrical Box Diagram

| Size | Drawing Number | Drawing Rev | Sheet |
|---|---|---|---|
| LET | 001959ELB | 03 | 1 / 1 |

# ATF-Series Schematic Diagram
## 460-3-60




| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 05 | 000310 | D. RHEAULT | D. RHEAULT | 15-FEB-2023 |
| 04 | 000296 | D. RHEAULT | D. RHEAULT | 1-JAN-2022 |
| 03 | 000274 | D. RHEAULT | D. RHEAULT | 01-MAR-2020 |
| 02 | 000261 | D. RHEAULT | D. RHEAULT | 01-JUN-2018 |

| | | |
|---|---|---|
| Drawn By | D. RHEAULT | Date 01-JUN-2018 |
| Checked By | D. RHEAULT | Date 01-JUN-2018 |
| Eng. Approved By | D. RHEAULT | Date 01-JUN-2018 |
| Mfg. Approved By | | Date |
| Approved By | | Date |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Drawing Name: ATF-**-HACW-P-4*-*-*DE*F Schematic Diagram

| Size | Drawing Number | Drawing Rev | Sheet |
|---|---|---|---|
| LET | 001960SCH | 05 | 1 / 1 |

# ATF-Series Electrical Box Diagram
## 460-3-60

### SYSTEM CONTROL DESCRIPTION

| Sytem Control by BACNet or External Control Signals | | |
|---|---|---|
| **BACNet Object** | **External** | **Activation** |
| SYSTEM G | G | Fan Recirculation Mode |
| SYSTEM_ Y1 | Y1 | Compressor Stage 1 (Air) |
| SYSTEM_Y2 | Y2 | Compressor Stage 2 (Air) |
| SYSTEM_W2 | W2 | Auxiliary Heat (Air) |
| SYSTEM_O | O | Air Heating (OFF) / Air Cooling (ON) |
| SYSTEM_Y1A | Y1A | Compressor Stage 1 (Hydronic) |
| SYSTEM_Y1A | Y1A | Compressor Stage 1 (Hydronic) |
| SYSTEM_Y2A | Y2A | Compressor Stage 2 (Hydronic) |

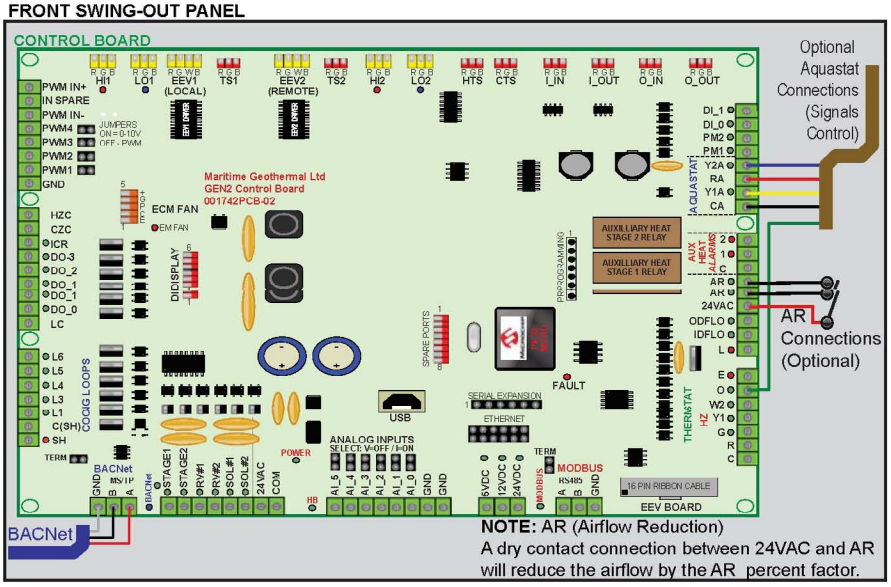
### OUTDOOR UNIT SIGNAL CONNECTIONS (24VAC)

Use an 18-8 **shielded outdoor rated** cable to connect the matching Outdoor Unit Signal Connections in the indoor and outdoor units. Connect the shield to the Shield GND terminal in indoor unit only.

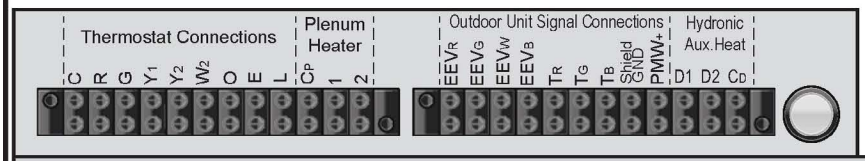
### OUTDOOR UNIT POWER CONNECTIONS (230VAC)

Use a 14-2 **outdoor rated** cable to connect the matching Outdoor Unit Power Supply connections in the indoor and outdoor units.

### FRONT SWING-OUT PANEL



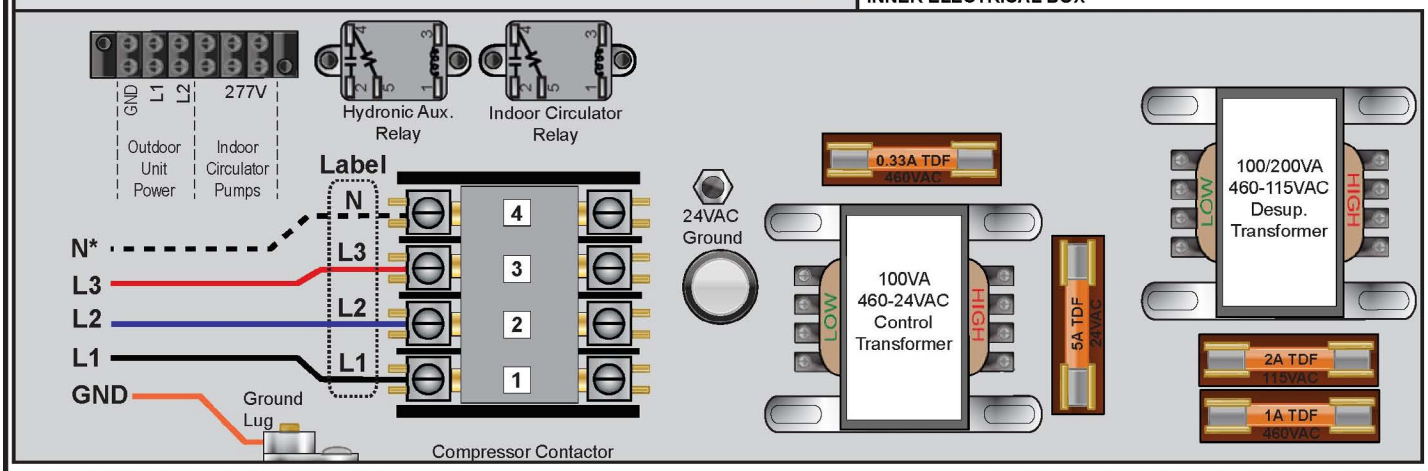

**NOTE:** AR (Airflow Reduction)
A dry contact connection between 24VAC and AR will reduce the airflow by the AR percent factor.




### IMPORTANT NOTE FOR 3 PHASE POWER

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

### INNER ELECTRICAL BOX




### 460V POWER SUPPLY CONNECTIONS

*NOTE: Neutral (N) is required.

| Wire | Colour | Contactor (Label) |
|---|---|---|
| Neutral* | White | N* |
| Line 3 | Red | L3 |
| Line 2 | Blue | L2 |
| Line 1 | Black | L1 |
| Connect "GND" to ground lug | | |

### INDOOR CIRCULATOR CONNECTIONS

**Refer to label in unit for Max. Amps.**
Connect 277VAC circulators to **277V** terminals.

### EXT. AIR CONTROL CONNECTIONS (24VAC)

Use an 18-9 cable to connect the air thermostat to the Thermostat Connections terminal strip:

C - 24VAC Common
R - 24VAC Hot
G - Fan Recirculation Mode
Y1 - Compressor Stage1
Y2 - Compressor Stage2
W2 - Auxiliary Heat (Air)
E - Emergency Heat (Air)
O - Cooling Mode Active
L - Lockout indicator (24VAC if lockout)

A dry contact R to [G, Y1, Y2, W2, E, or O] will activate the input.

### EXT. HYDRONIC CONTROL CONNECTIONS (24V)

If using an external aquastat (*Signals* control method), use an 18-4 cable to connect the screw terminals on the right side of the control board to the aquastat:

CA - 24VAC Common
RA - 24VAC Hot
Y1A - Compressor Stage1
Y2A - Compressor Stage2

A dry contact RA to Y1A / Y2A will activate the input.

### HYDRONIC AUX. HEAT CONNECTIONS

Use an 18-2 conductor cable. Choose one of 2 types of auxiliary heat connections. Default is "ON".

*Tank temperature limiter must remain in place.*

D1 / D2 — Dry contacts, closed when ATW calls for aux. heat

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

### PLENUM HEATER CONTROL CONNECTIONS

Use an 18-3 cable to connect plenum heater control board to the heat pump terminal strip:

CP - 24VAC common
1 - electric heat stage 1
2 - electric heat stage 2

| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 03 | 000310 | D. RHEAULT | D. RHEAULT | 15-FEB-2023 |
| 02 | 000261 | D. RHEAULT | D. RHEAULT | 01-JUN-2018 |

| | | |
|---|---|---|
| Drawn By | D.RHEAULT | Date 01-JUN-2018 |
| Checked By | D.RHEAULT | Date 01-JUN-2018 |
| Eng. Approved By | D.RHEAULT | Date 01-JUN-2018 |
| Mfg. Approved By | | Date |
| Approved By | | Date |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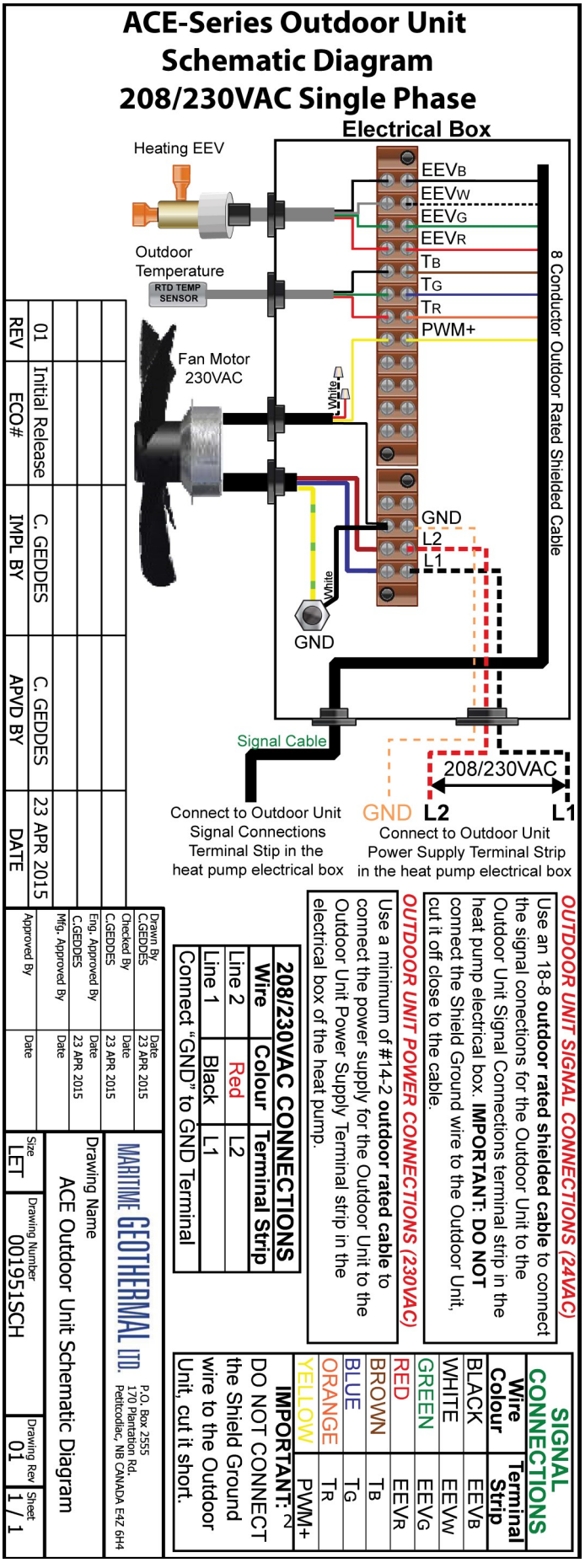
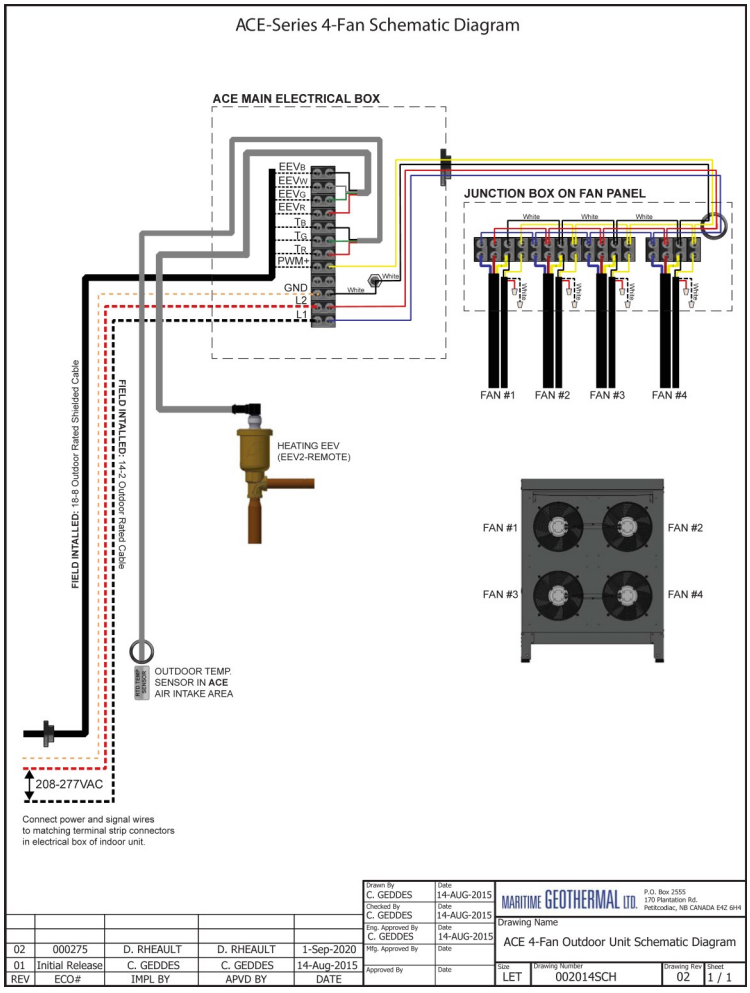
Drawing Name: ATF-**-HACW-P-4*-*-SDE*F Electrical Box Diagram

| Size | Drawing Number | Drawing Rev | Sheet |
|---|---|---|---|
| LET | 001961ELB | 03 | 1 / 1 |

# ACE-25/45/55 Wiring Diagram

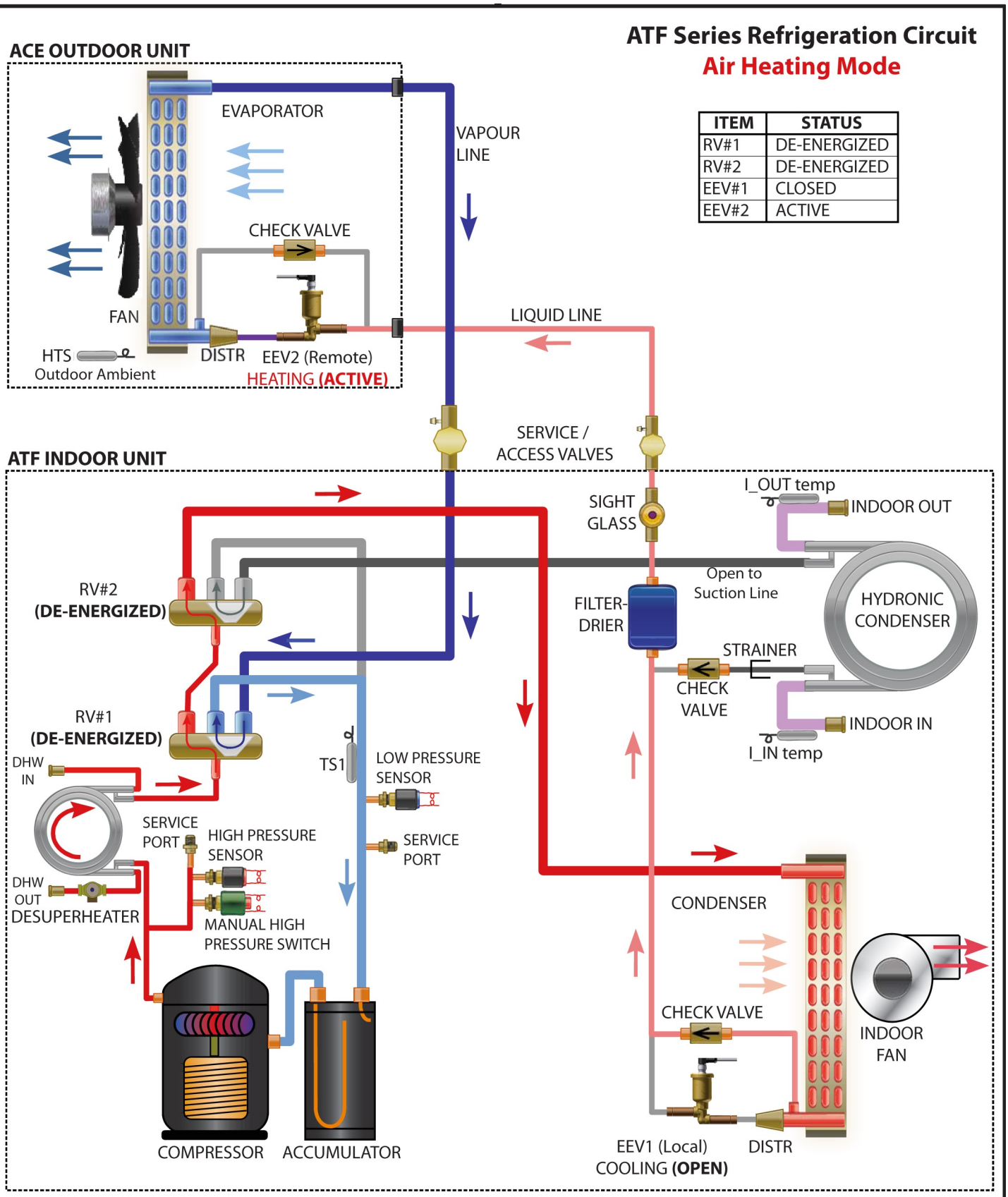



# ACE-65/75 Wiring Diagram



# ATF Series Refrigeration Circuit
## Air Heating Mode

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




| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| 01 | Initial Release | C. GEDDES | C. GEDDES | 16 JUL 2014 |

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

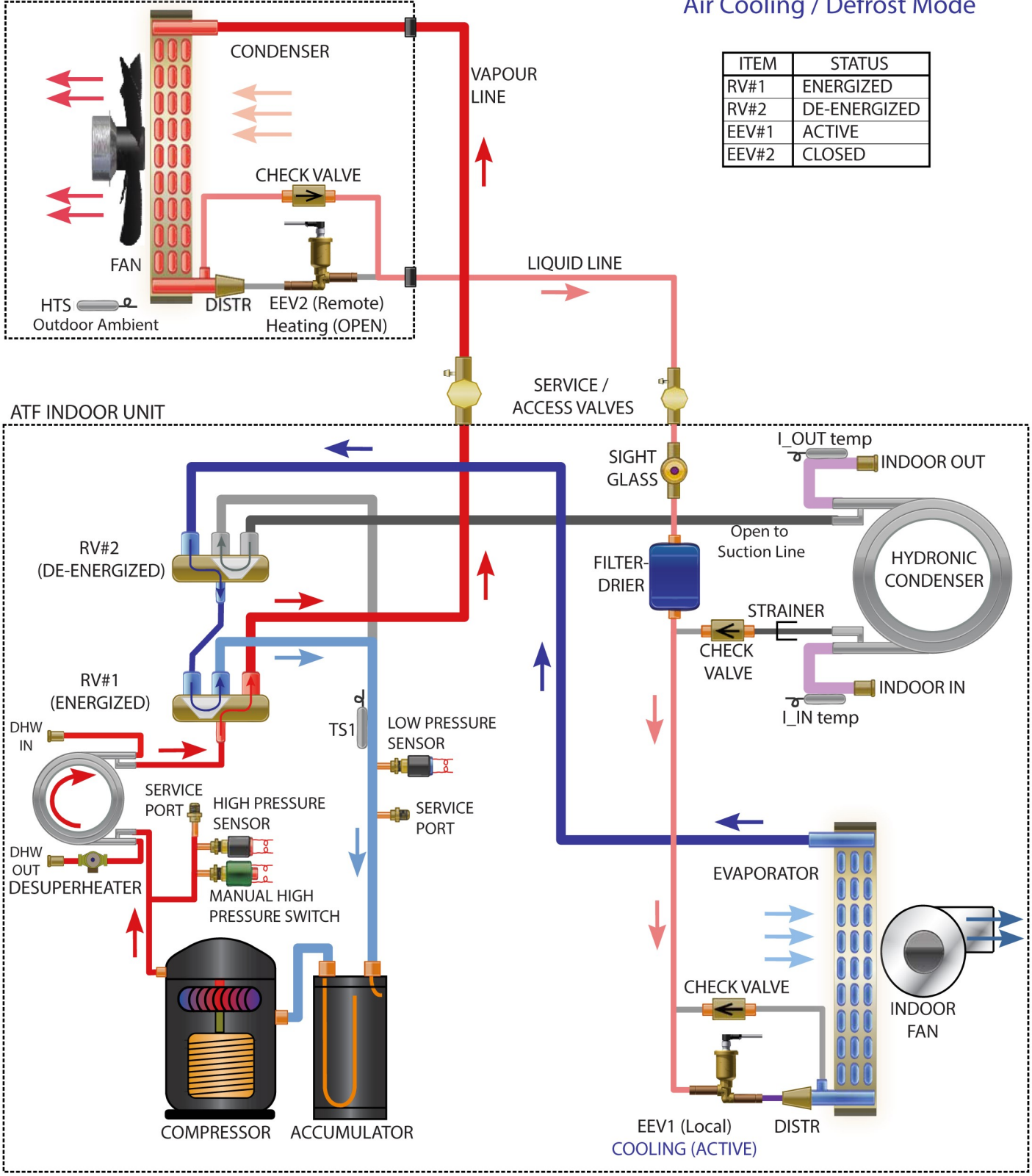

MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4


Drawing Name: ATF-Series Refrigeration Circuit Air Heating Mode

| Size | Drawing Number | Drawing Revision | Sheet |
|---|---|---|---|
| LET | 001844RCD | 01 | 1 / 1 |

# ATF Series Refrigeration Circuit
## Air Cooling / Defrost Mode

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




| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| 01 | Initial Release | C. GEDDES | C. GEDDES | 16 JUL 2014 |

| | | |
|---|---|---|
| Drawn By | C.GEDDES | Date 16 JUL 2014 |
| Checked By | C.GEDDES | Date 16 JUL 2014 |
| Eng. Approved By | C.GEDDES | Date 16 JUL 2014 |
| Mfg. Approved By | | Date |
| Approved By | | Date |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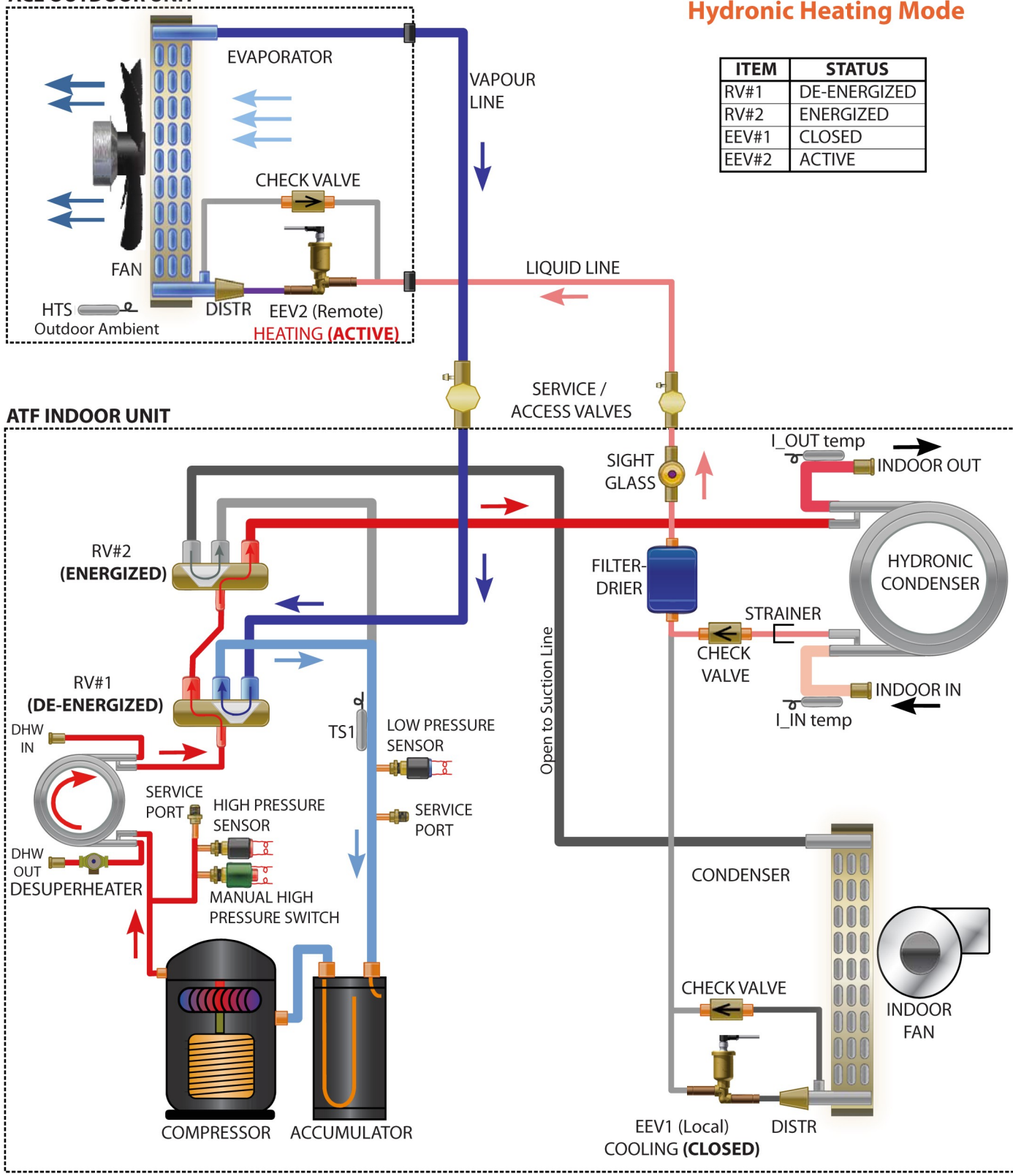
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4


Drawing Name: ATF-Series Refrigeration Circuit
Air Cooling / Defrost Mode

| Size | Drawing Number | Drawing Revision | Sheet |
|---|---|---|---|
| LET | 001845RCD | 01 | 1 / 1 |

# ATF Series Refrigeration Circuit
## Hydronic Heating Mode

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




| REV | ECO# | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 01 | Initial Release | C. GEDDES | C. GEDDES | 16 JUL 2014 |

| | | |
|---|---|---|
| Drawn By C.GEDDES | Date 16 JUL 2014 | |
| Checked By C.GEDDES | Date 16 JUL 2014 | |
| Eng. Approved By C.GEDDES | Date 16 JUL 2014 | |
| Mfg. Approved By | Date | |
| Approved By | Date | |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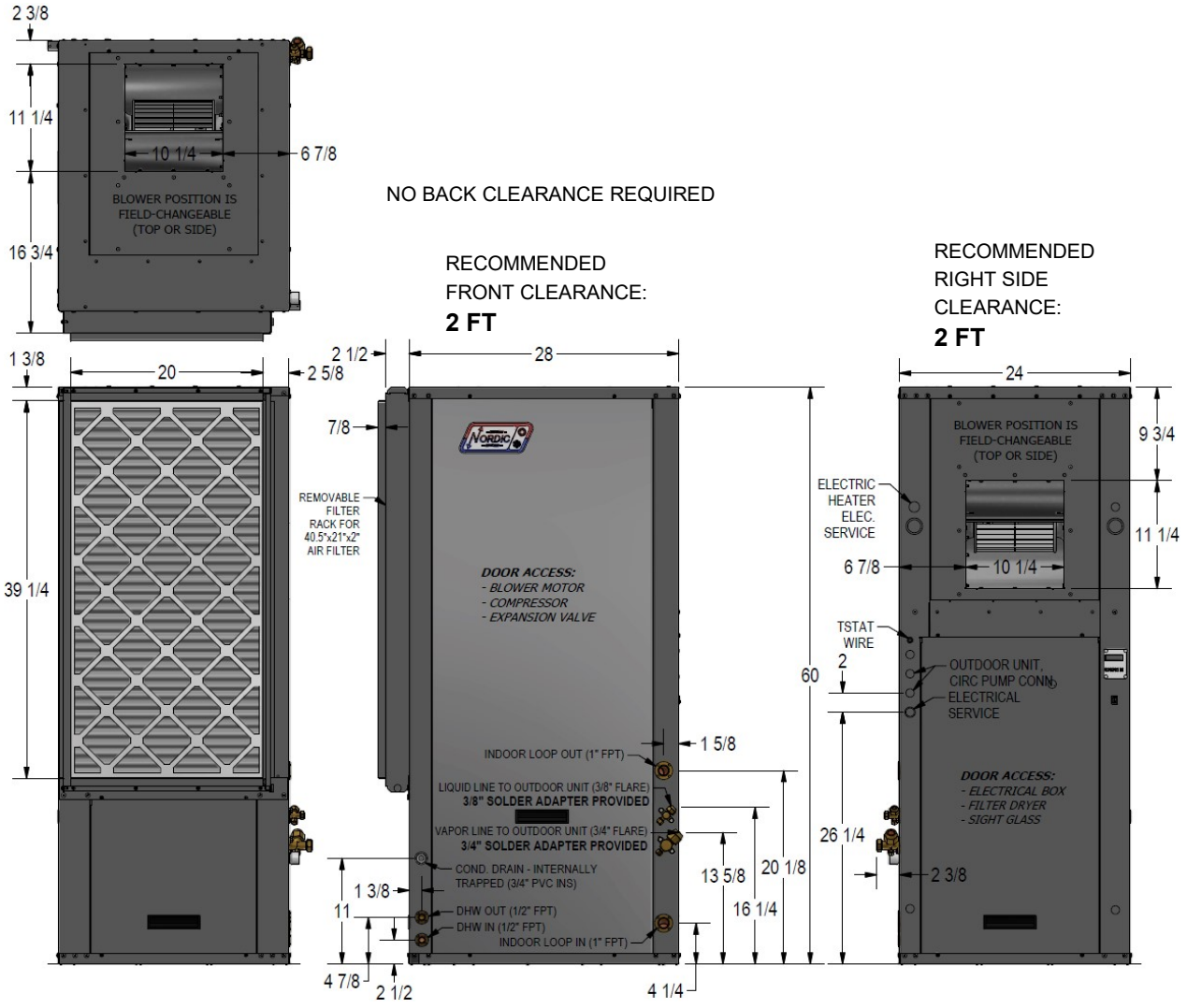
Drawing Name: ATF-Series Refrigeration Circuit Hydronic Heating Mode

| Size | Drawing Number | Drawing Revision | Sheet |
|---|---|---|---|
| LET | 001846RCD | 01 | 1 / 1 |

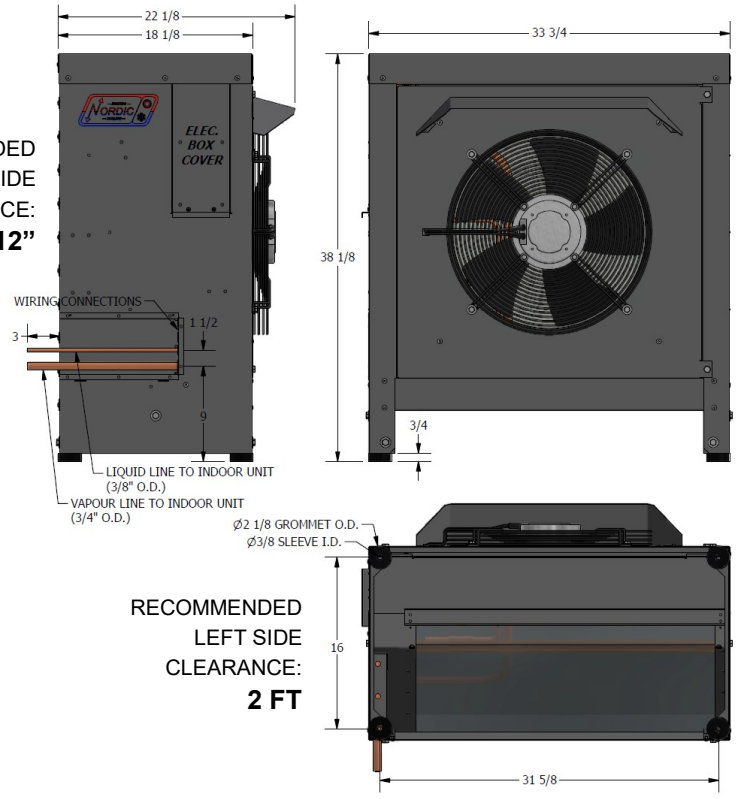
# Dimensions: ATF-45 (with Left Return Indoor Unit)

*All dimensions in inches*

***INDOOR UNIT***




***OUTDOOR UNIT***




RECOMMENDED BACK SIDE CLEARANCE: **12”**

RECOMMENDED FRONT SIDE CLEARANCE: **10-16 FT**

RECOMMENDED LEFT SIDE CLEARANCE: **2 FT**

NO RIGHT SIDE CLEARANCE REQUIRED

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

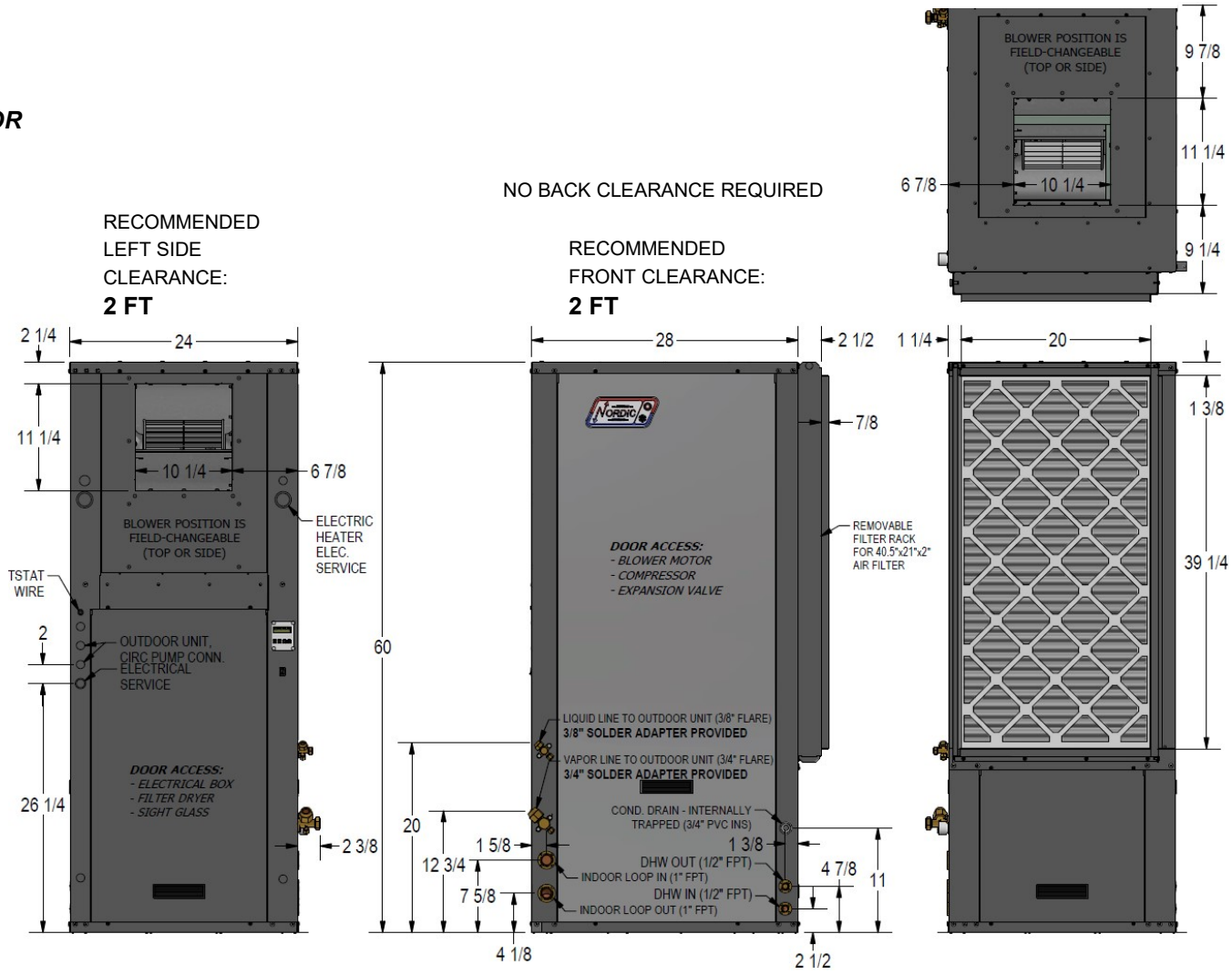
*All dimensions in inches*

***INDOOR UNIT***

NO BACK CLEARANCE REQUIRED

RECOMMENDED LEFT SIDE CLEARANCE: **2 FT**

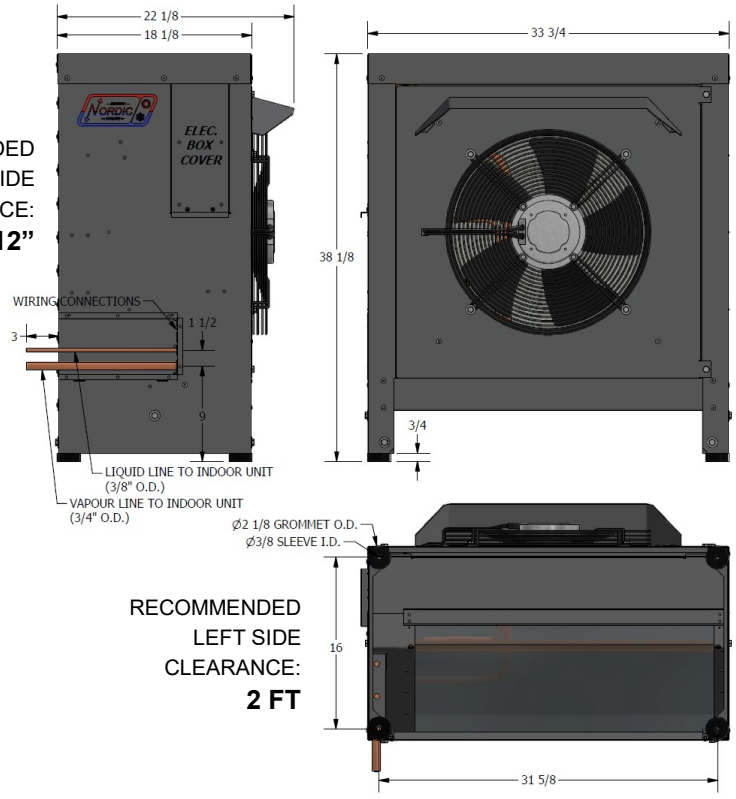
RECOMMENDED FRONT CLEARANCE: **2 FT**




***OUTDOOR UNIT***

RECOMMENDED BACK SIDE CLEARANCE: **12”**

RECOMMENDED FRONT SIDE CLEARANCE: **10-16 FT**



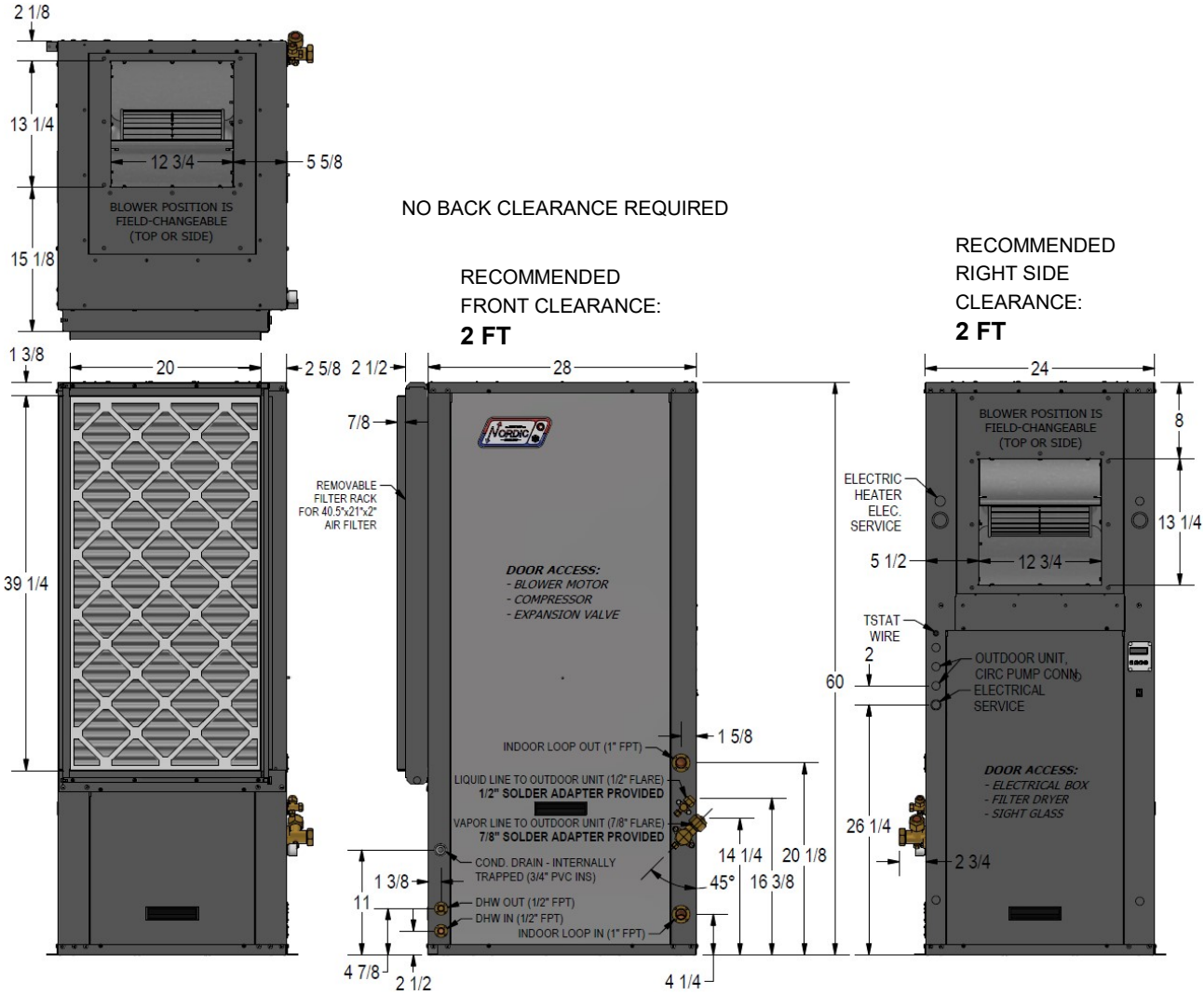

RECOMMENDED LEFT SIDE CLEARANCE: **2 FT**

NO RIGHT SIDE CLEARANCE REQUIRED

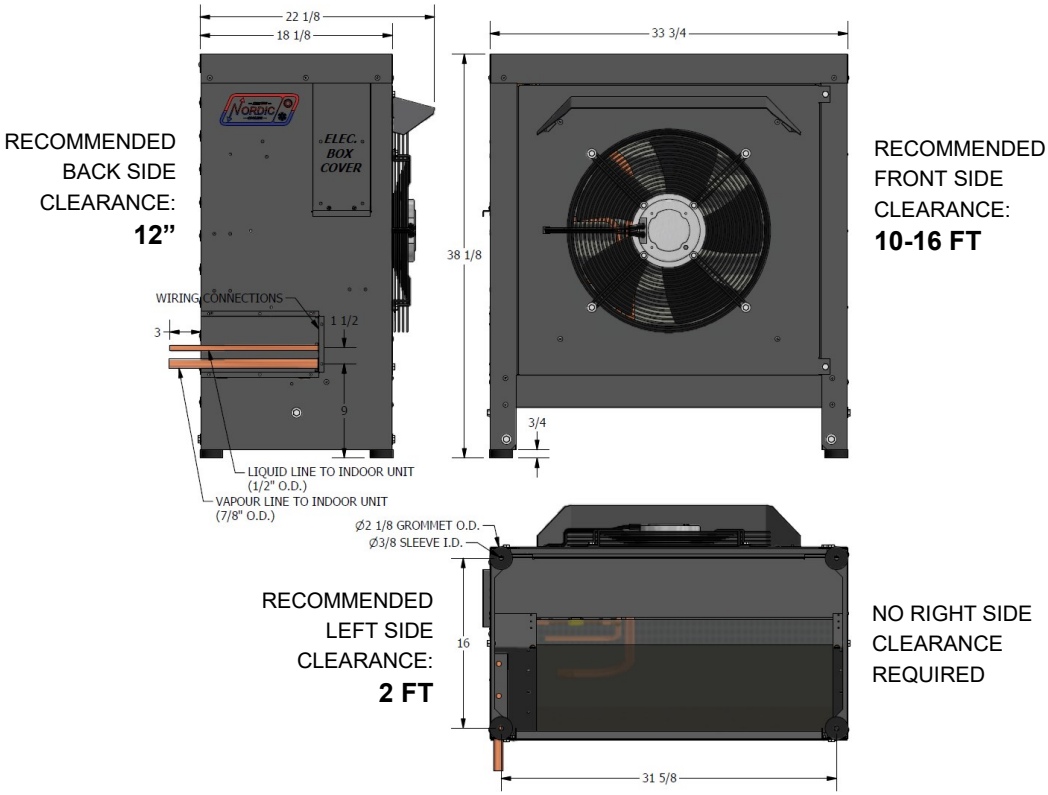
# Dimensions: ATF-55 (with Left Return Indoor Unit)

*All dimensions in inches*

***INDOOR UNIT***



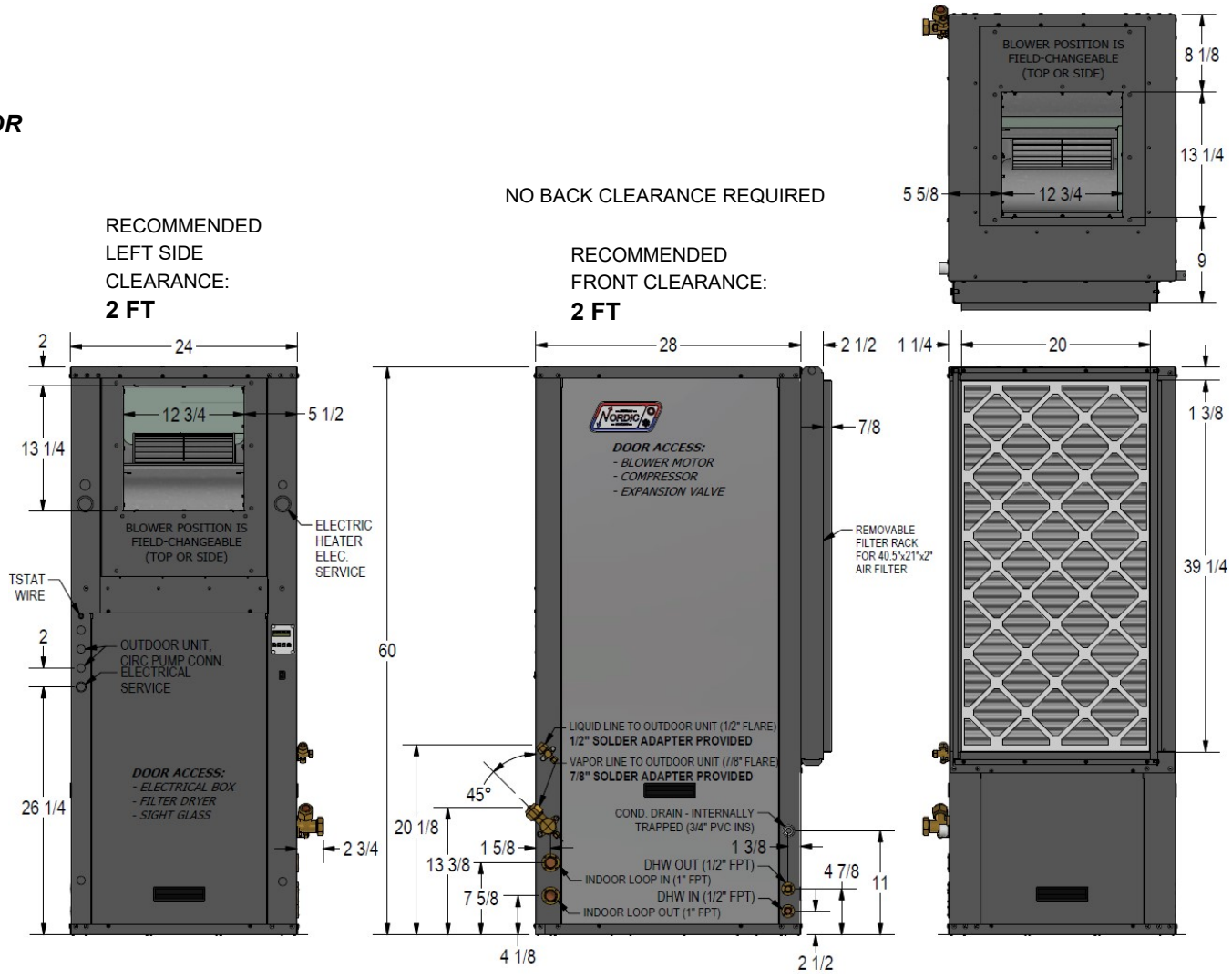

***OUTDOOR UNIT***



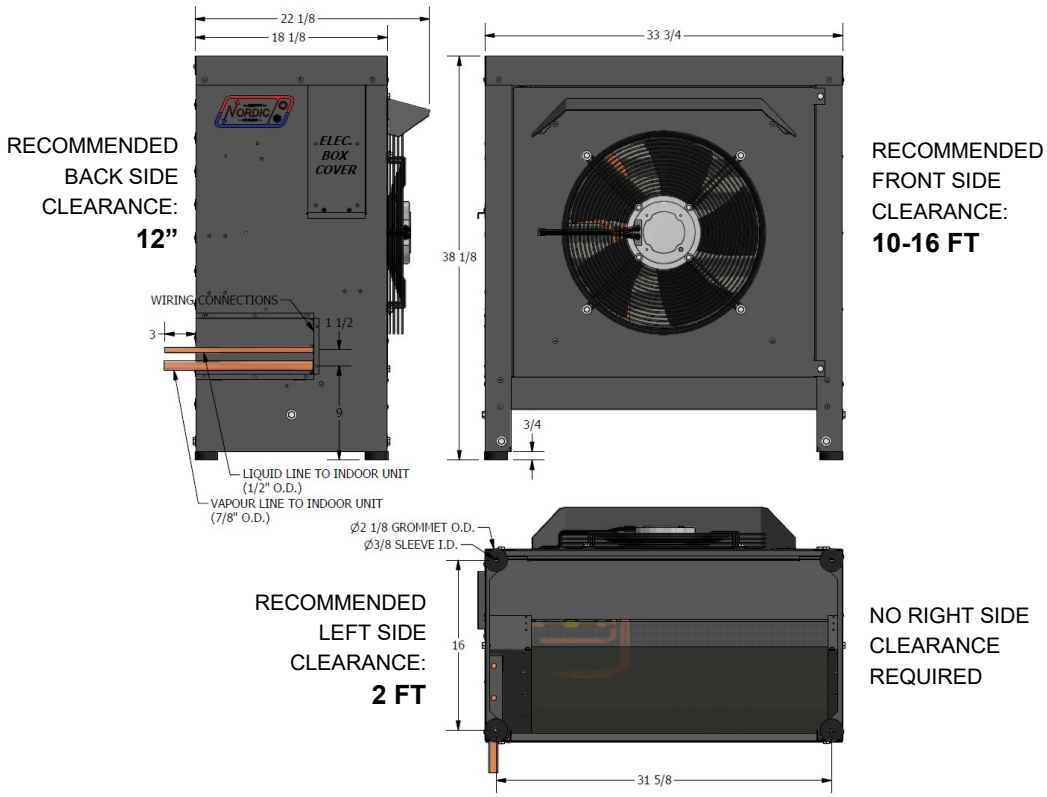
# Dimensions: ATF-55 (with Right Return Indoor Unit)

*All dimensions in inches*

***INDOOR UNIT***



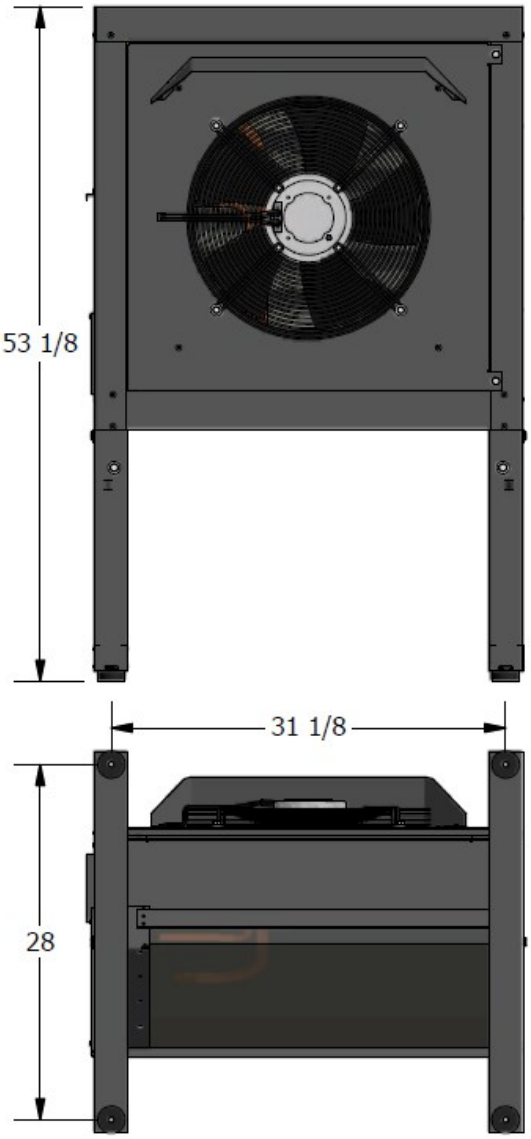

***OUTDOOR UNIT***



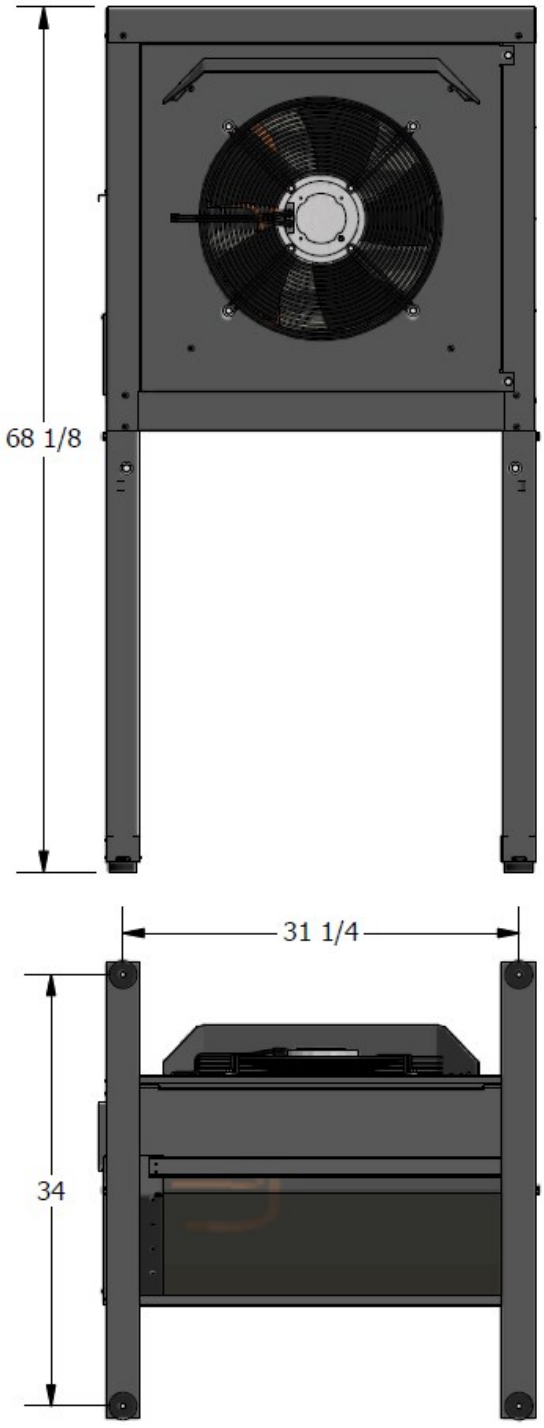
# Dimensions: ATF-45/55 (Leg Kit for Outdoor Unit)

*All dimensions in inches*

## WITH LEG KIT



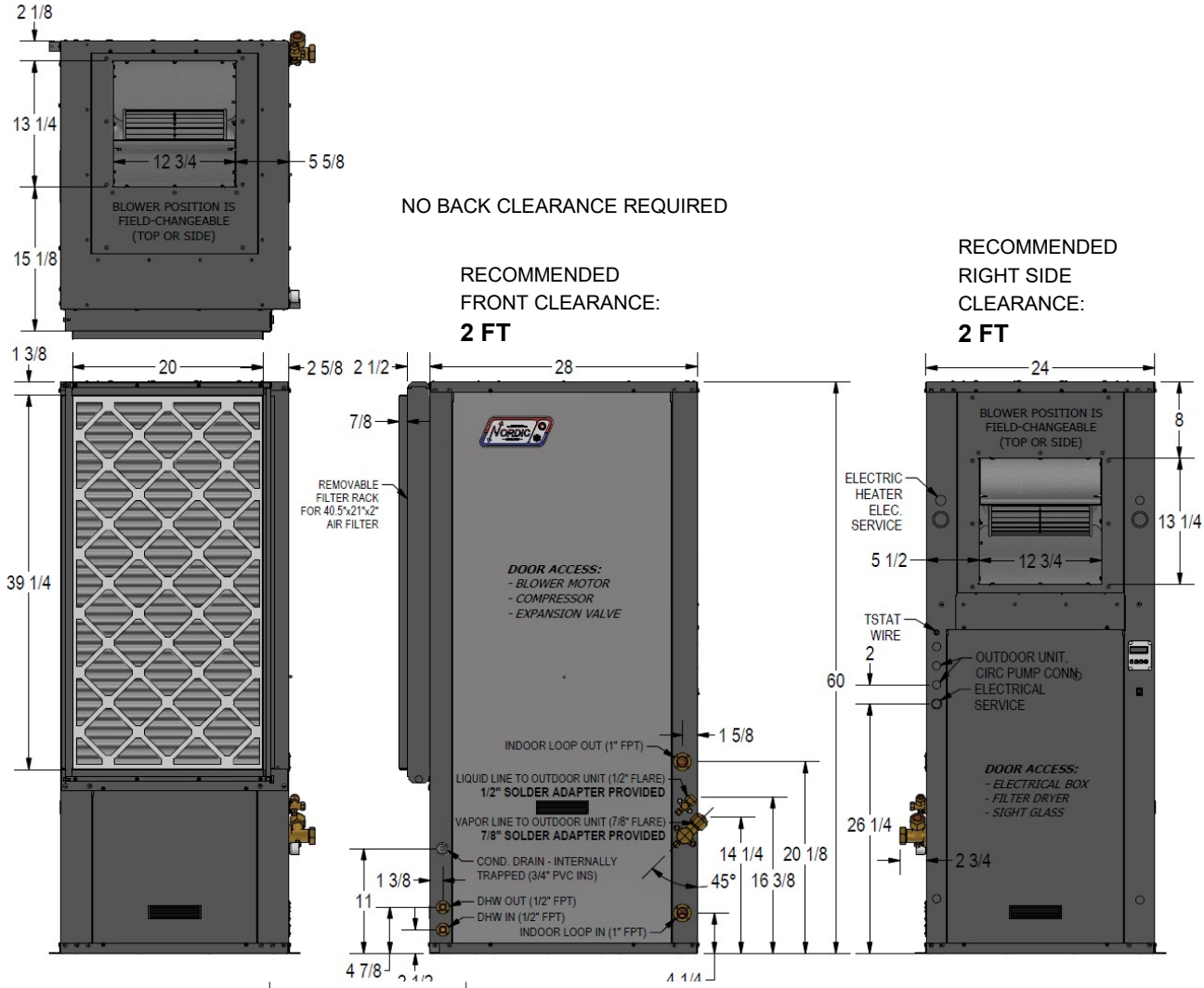

## WITH TALL LEG KIT



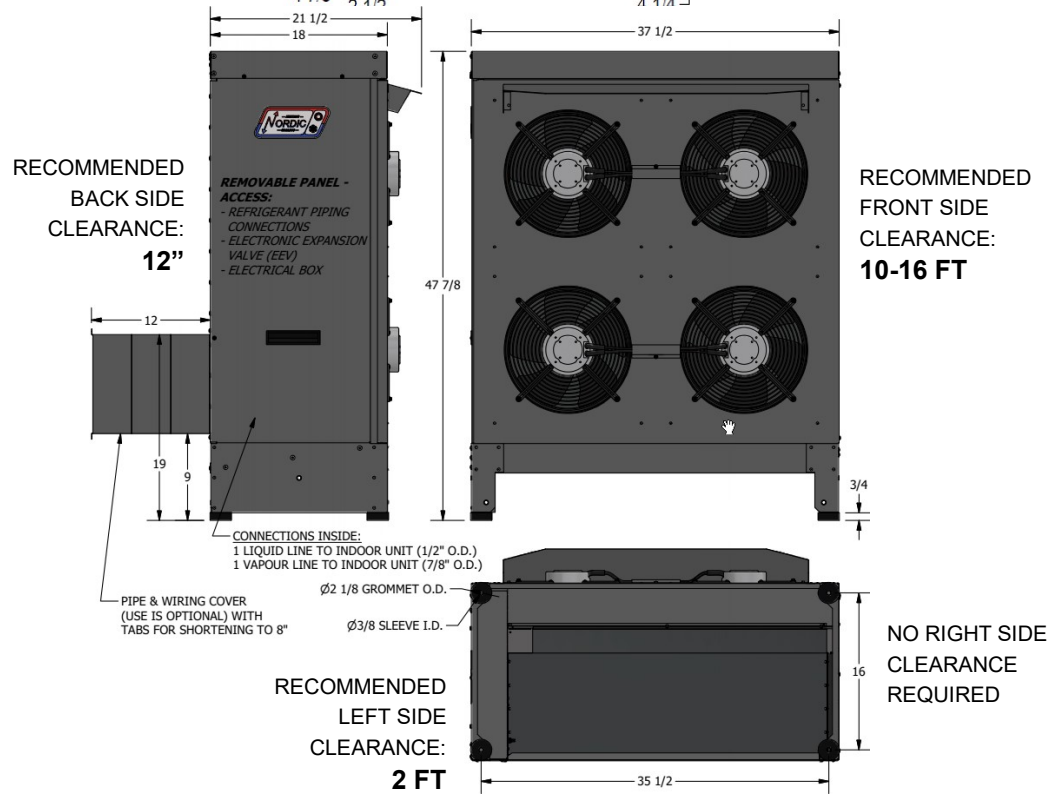
# Dimensions: ATF-65/75 (with Left Return Indoor Unit)

*All dimensions in inches*

***INDOOR UNIT***



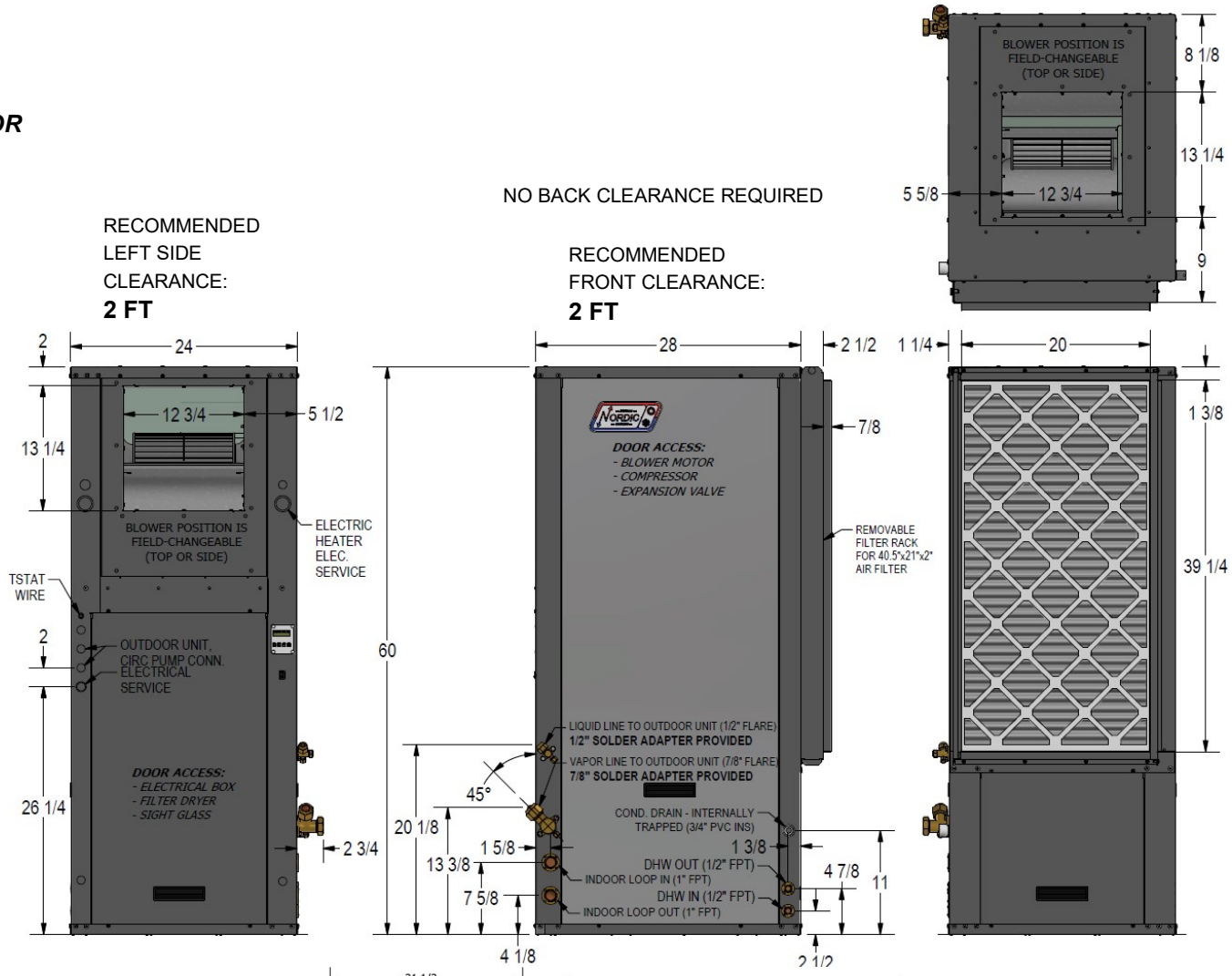

***OUTDOOR UNIT***



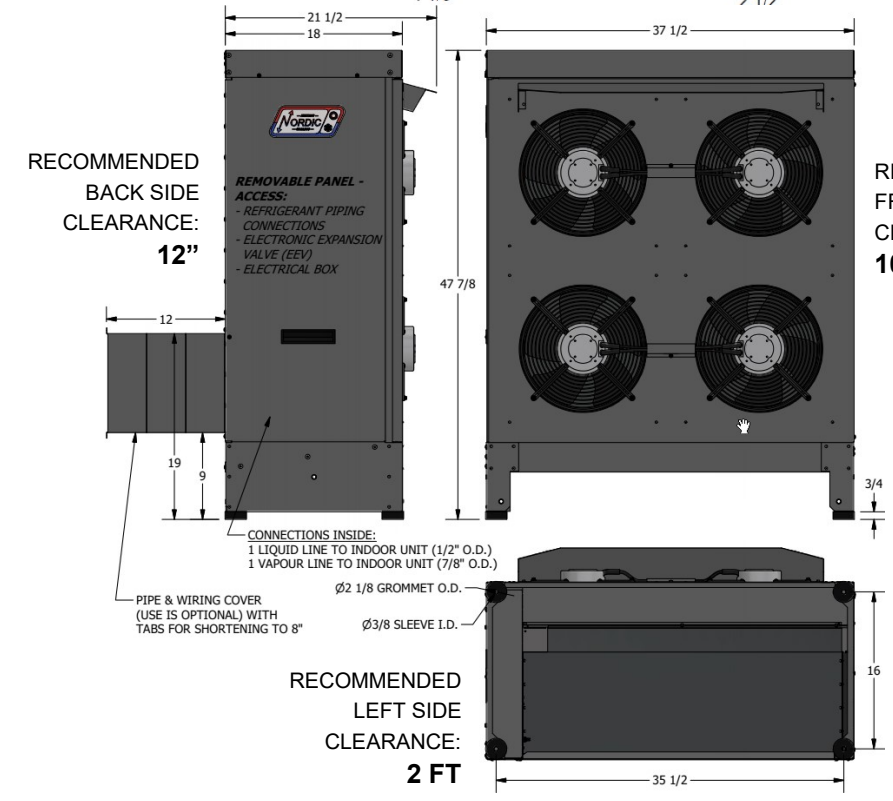
# Dimensions: ATF-65/75 (with Right Return Indoor Unit)

*All dimensions in inches*

***INDOOR UNIT***



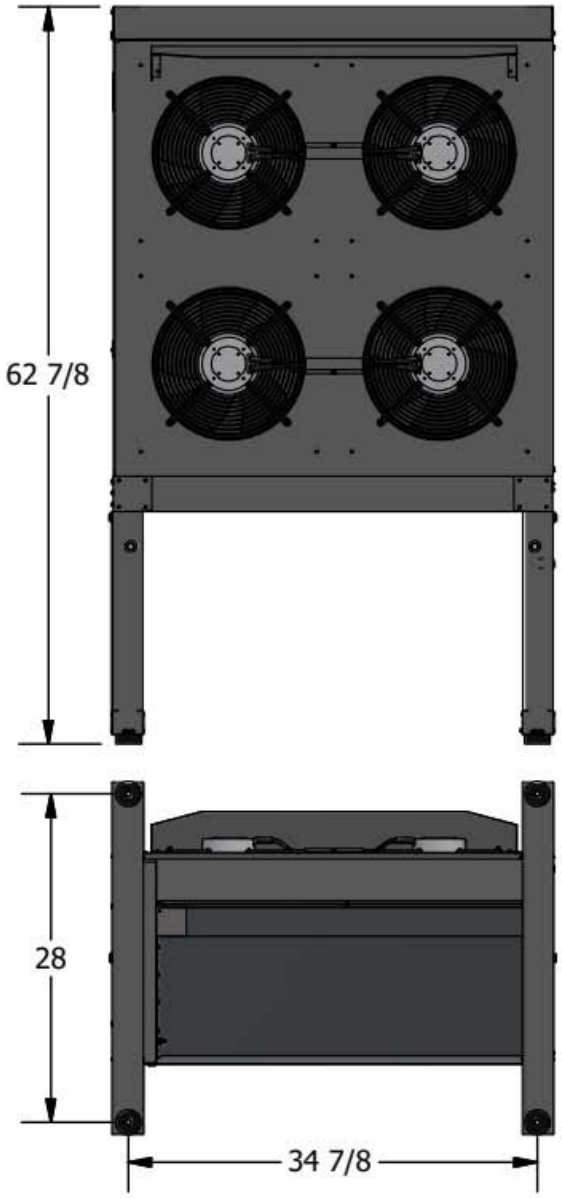

***OUTDOOR UNIT***



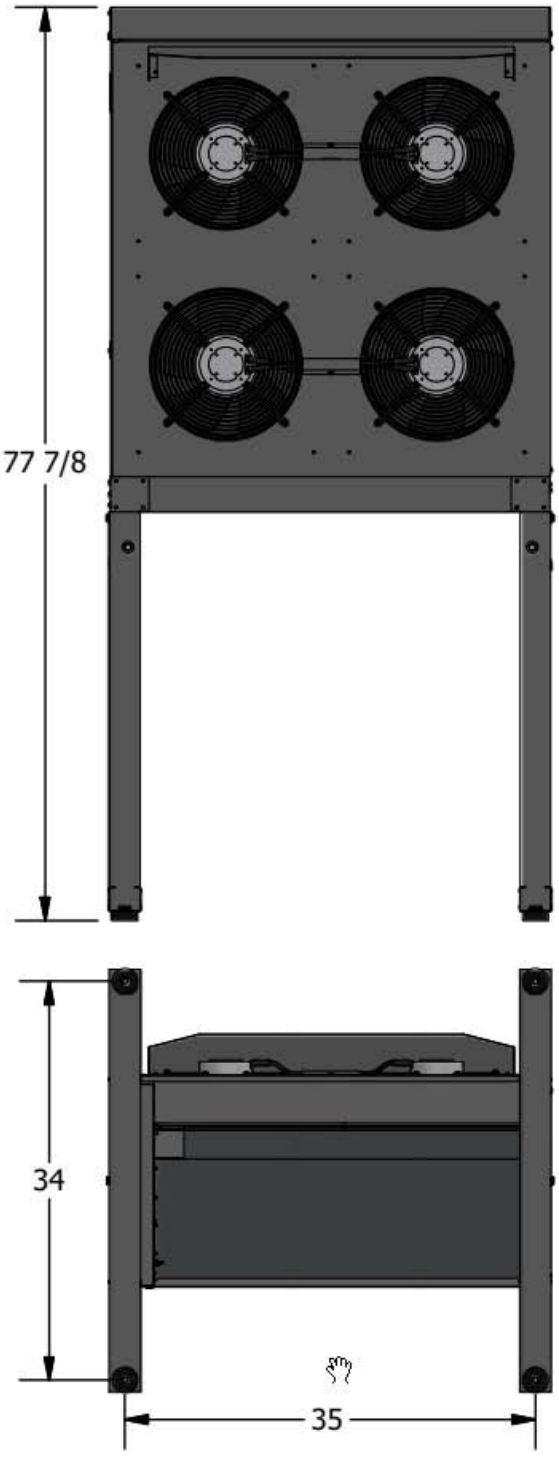
# Dimensions: ATF-65/75 (Leg Kit for Outdoor Unit)

*All dimensions in inches*

## WITH LEG KIT

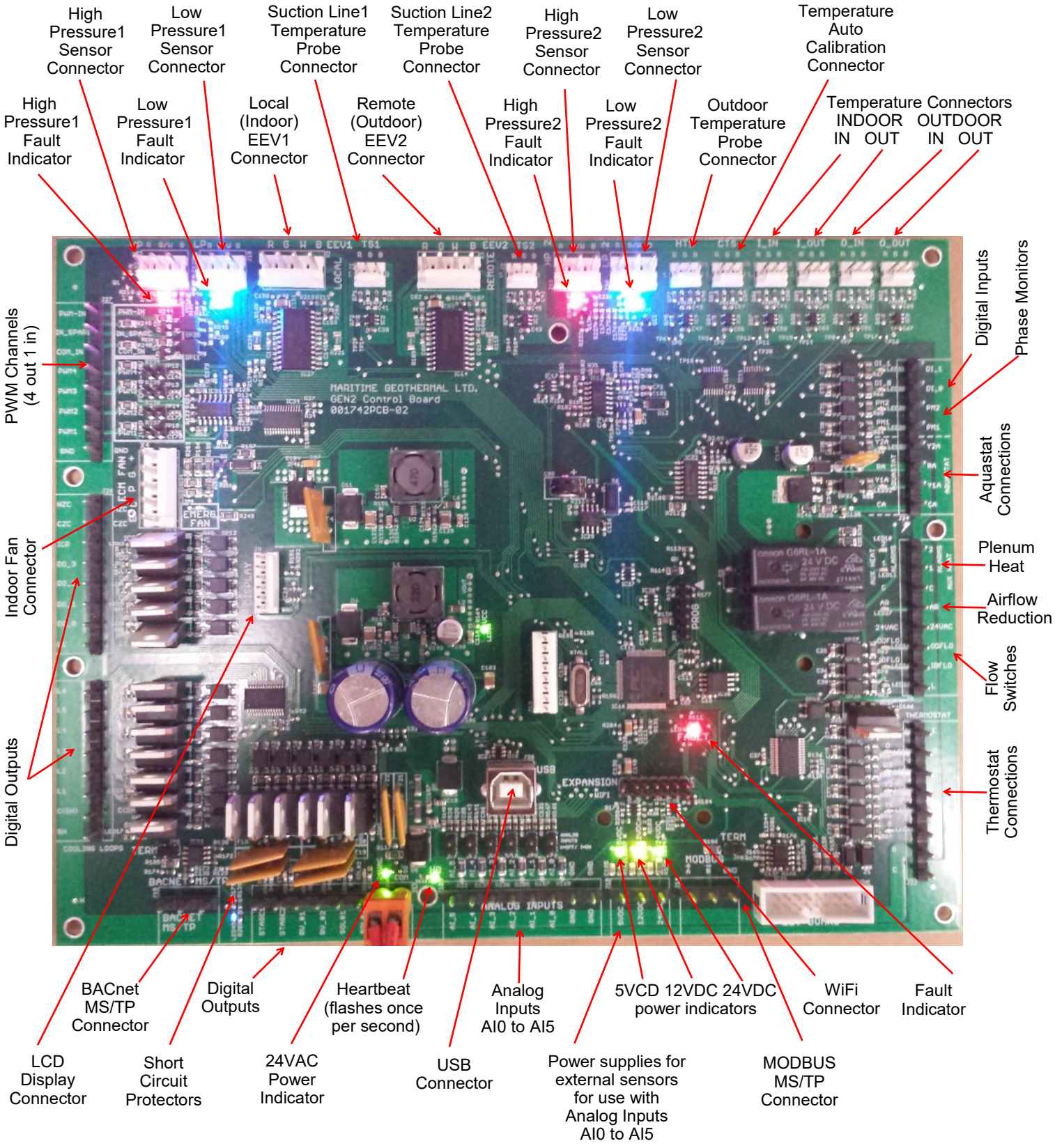



## WITH TALL LEG KIT



# 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 suction line inside unit. |
| EEV2 | Remote EEV | Mounted in Outdoor Unit, used in heating mode. |
| TS2 | Suction Line Temperature 2 | Unused. |
| HPS2/HI2 | High Pressure Sensor 2 | Unused. |
| LPS2/LO2 | Low Pressure Sensor 2 | Unused. |
| 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 | Unused. |
| O_OUT | Outdoor Loop OUT | Unused. |

| TABLE A2 - Control Board Connector Descriptions (Left Side) | | |
|---|---|---|
| **Name** | **Description** | |
| PWM_IN | Signal for PWM IN | Unused. |
| IN_SPARE | Spare digital input | Switch or dry contact from 12VDC to disable unit (also COM_IN to GND). |
| COM_IN | Common for PWM IN | Jumper to GND for disable functionality. |
| PWM4 | PWM / 0-10VDC output | Unused. |
| PWM3 | PWM / 0-10VDC output | Unused. |
| PWM2 | PWM / 0-10VDC output | Unused. |
| PWM1 | PWM / 0-10VDC output | Outdoor Fan PWM control signal. |
| GND | Ground | Ground for PWM channels. |
| | | |
| HZC | Hot Zone Circulator | Unused. |
| CZC | Cold Zone Circulator | Unused. |
| ICR | Internal Circulator Relay | Operates the Indoor Circulator. |
| DO_3 | Auxiliary Only | Output when hydronic auxiliary to be run without compressor. |
| DO_2 | Hydronic Auxiliary | Operates the hydronic auxiliary, pin 1A (Setpoint Control only). |
| DO_1 | Digital output | Unused. |
| DO_0 | Digital output | Unused. |
| LC | Loop common (ground) | Unused. |
| | | |
| L6 | Loop6 | Unused. |
| L5 | Loop5 | Unused. |
| L4 | NOT_HYD_AUX | Output OFF when auxiliary heat required; operates D1-D2 dry contacts. |
| L3 | Loop3 | Unused. |
| L2 | Loop2 | Unused. |
| L1 | Loop1 | ON when outdoor fan is operating. |
| C(SH) | Soaker Hose common | Ground for SH pin. |
| SH | Soaker Hose | Defrost indicator: ON when unit in defrost mode. |

| TABLE A3 - Control Board Connector Descriptions (Bottom) | | |
|---|---|---|
| **Name** | **Description** | |
| GND | BACnet MS/TP | Ground for shield if required. |
| B | BACnet MS/TP | RS-485. |
| A | BACnet MS/TP | RS-485. |
| | | |
| STAGE1 | Compressor Stage 1 | Starts / stops the 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 | Unused. |
| SOL#2 | Solenoid#2 | Unused. |
| 24VAC | Power supply for board | 24VAC power for control board. |
| COM | Power supply for board | GND for control board. |
| | | |
| AI_5 | Analog In Channel 5 | Optional type 3/7 10k hot tank temperature sensor for HTS/CTS Setpoint Control. |
| AI_4 | Analog In Channel 4 | 0 to 5VDC or 4-20mA user settable with board jumper. |
| AI_3 | Analog In Channel 3 | 0 to 5VDC or 4-20mA user settable with board jumper. |
| AI_2 | Analog In Channel 2 | Condensate sensor. |
| AI_1 | Analog In Channel 1 | 0 to 5VDC or 4-20mA user settable with board jumper. |
| AI_0 | Analog In Channel 0 | Optional compressor current sensor. |
| GND | Ground pin | Ground for analog sensors. |
| GND | Ground pin | Ground for analog sensors. |
| | | |
| 5VDC | Power for analog sensors | Provides 5VDC power supply for sensors. |
| 12VDC | Power for analog sensors | Provides 12VDC power supply for sensors. |
| 24VDC | Power for analog sensors | Provides 24VDC power supply for sensors. |
| | | |
| A | MODBUS | RS-485. |
| B | MODBUS | RS-485. |
| GND | MODBUS | Ground for shield if required. |

| TABLE A4 - Control Board Connector Descriptions (Right Side) | | |
|---|---|---|
| **Name** | **Description** | |
| DI_1 | Digital Input1 | Unused. |
| DI_0 | Digital Input0 | Unused. |
| 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 | Unused. |
| IDFLO | Indoor Flow Switch | Unused. |
| 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 Stage2 | 24VAC input from air thermostat. |
| Y1 | Thermostat 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. |

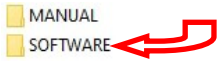
*NOTE: There is no need for an external aquastat for most systems, since the Setpoint Control Method provides built in aquastat functionality.

# 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:



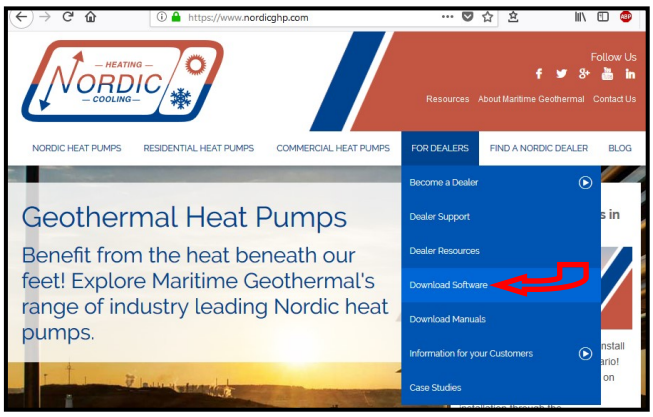

Double click on the SOFTWARE folder to show its contents:


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

---

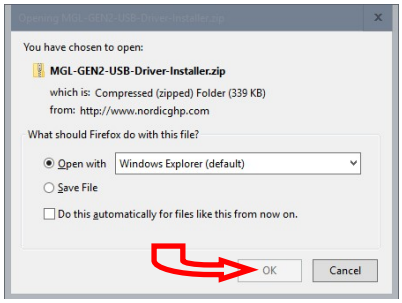
If the USB drive is not available, the same files can be **down-loaded from the web page**.

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

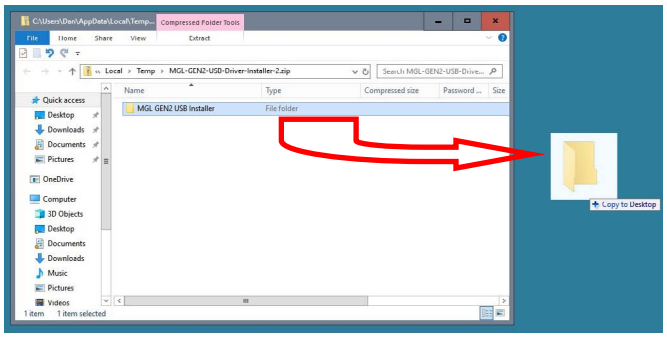



2. Click on **MGL GEN2 USB Driver Installer** to download it:

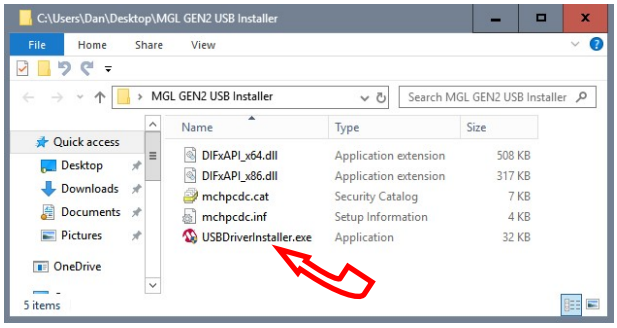

3. Choose "Open with Windows Explorer", and hit "OK". *(If the choice window doesn't pop up, find the downloaded file in your browser downloads and double click on it.)*



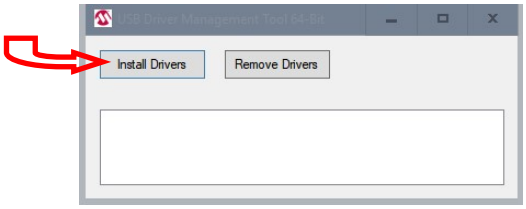

4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



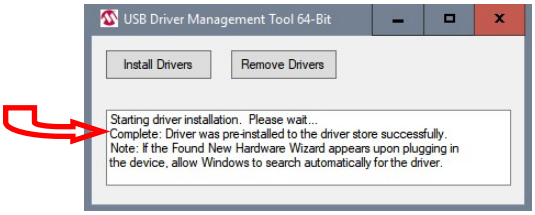

5. Double click on the folder you just dragged onto the desktop, then double click on the "USBDriverInstaller" file:




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



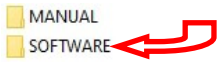

7. You will see a message indicating the driver was installed successfully. You are now ready to install the PC App.



# Appendix C - PC App Installation (Windows 11)

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

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



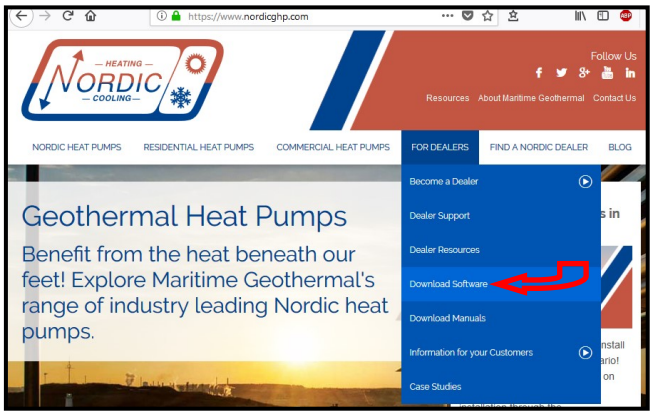

Double click on the SOFTWARE folder to show its contents:


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

---

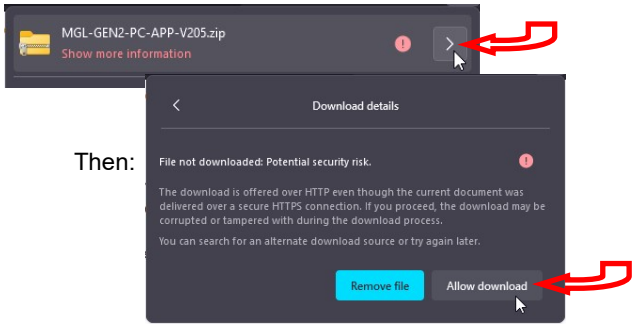
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

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

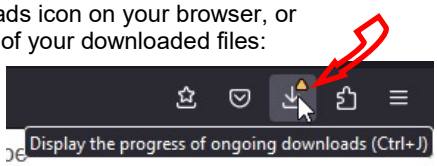



2. Click on **MGL GEN2 PC APP V2__** to download it:

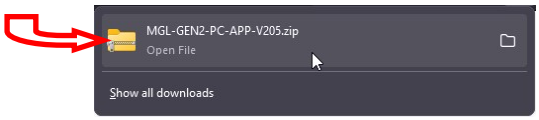

3. You may see a warning like this one. Click as shown:



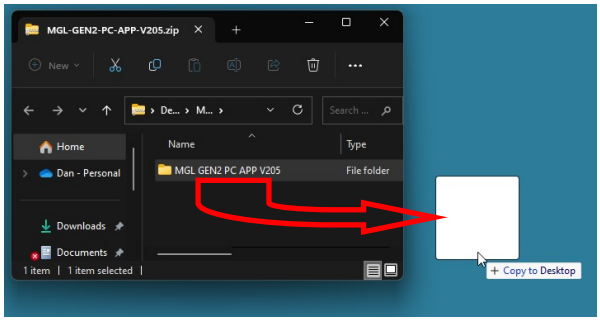

4. Click on the downloads icon on your browser, or otherwise view a list of your downloaded files:



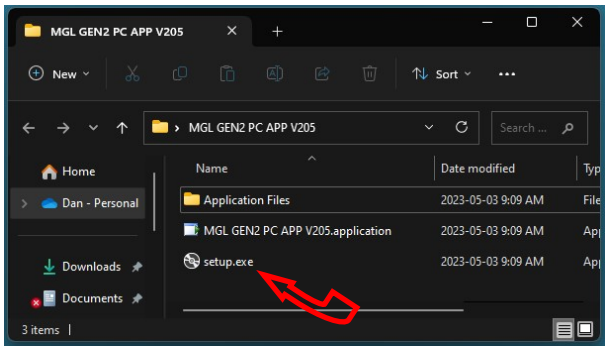

5. Then click on the .zip file to open it in a File Explorer window:



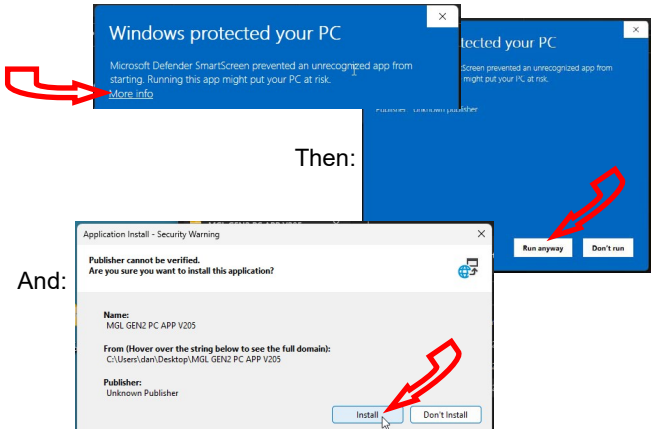

6. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:




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




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

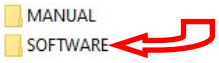



9. The PC App will open when it is finished installing. (In the future, it should be started from the start menu.) You are now ready to connect a USB cord between the laptop computer and GEN2 control board, and connect.

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

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

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



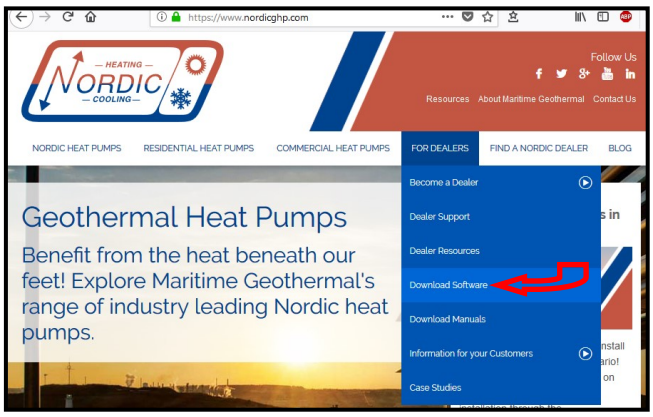

Double click on the SOFTWARE folder to show its contents:


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

---

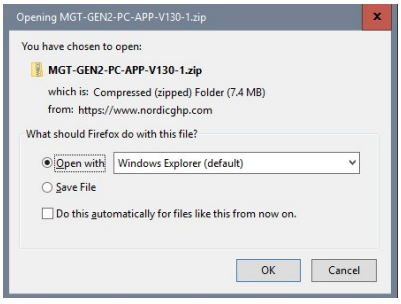
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

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

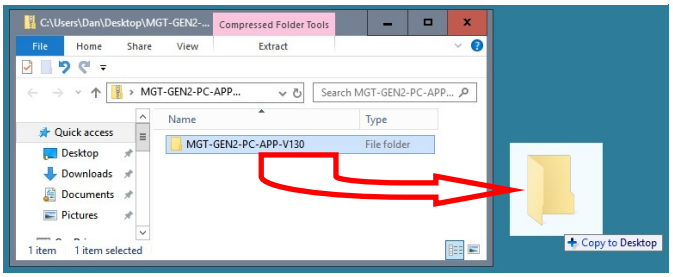



2. Click on **MGL GEN2 PC APP V2__** to download it:

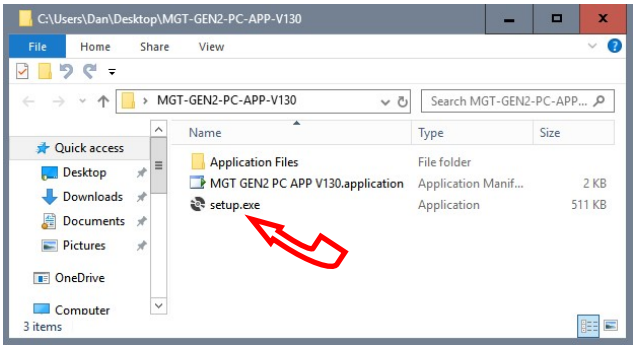

3. Choose "Open with Windows Explorer", and hit "OK":



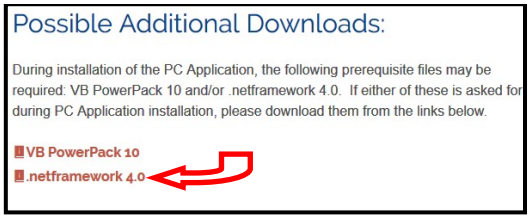

4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:




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




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




Then go back to step 5.

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

# Appendix E: Updating Firmware

## METHOD 1: Updating Firmware Using PC App

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

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

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

   ***\Desktop\MGL GEN2 Bootload Firmware V376***

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

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

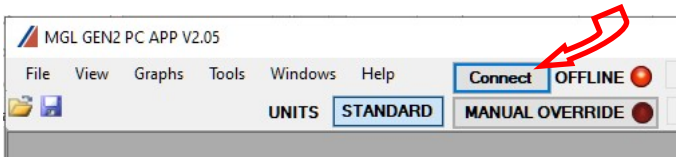
   | | |
   |---|---|
   | MGL_GEN2_V376.production.hex | (firmware file) |
   | PIC32UBL.exe | (the programmer) |
   | USB Bootloader Instructions.pdf | (these instructions) |

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

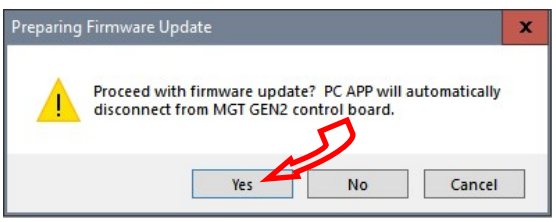
3. Connect a USB (printer) cable between computer and control board.

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

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

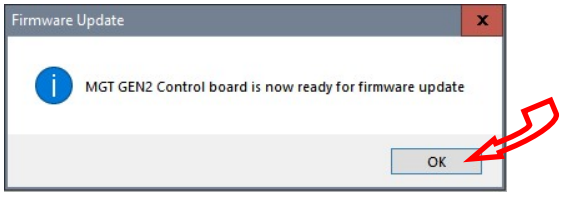



6. Go to menu **Tools --> Update Firmware**. The following message box will appear:



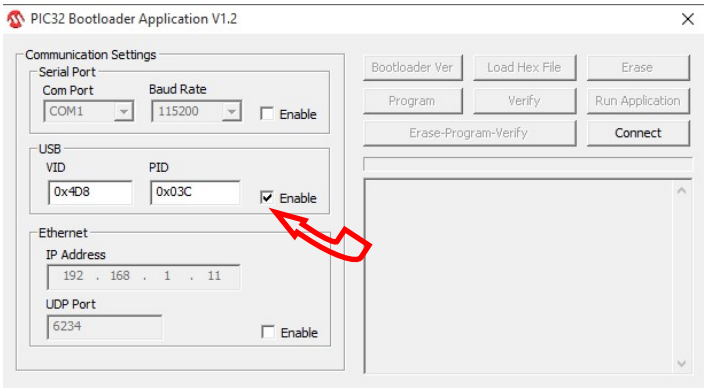

7. Click on **YES**. The following message box will appear:


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

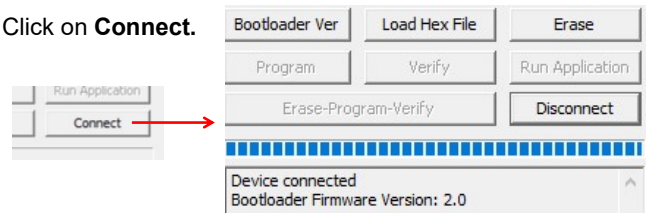



9. Click on **OK**. The control board is now in bootloader mode and is ready to be programmed.

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

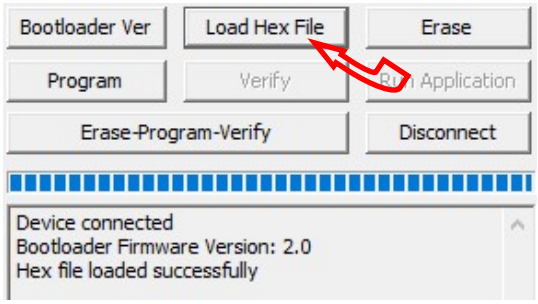



11. Click on **Connect.**

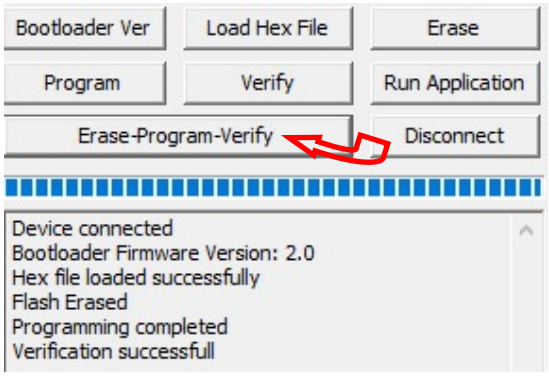



*If device fails to connect and an error message is displayed, the board's bootloader may be older than v2.0. It will be necessary to instead update the firmware via jumper pins (**METHOD 2**), as per the next section.*

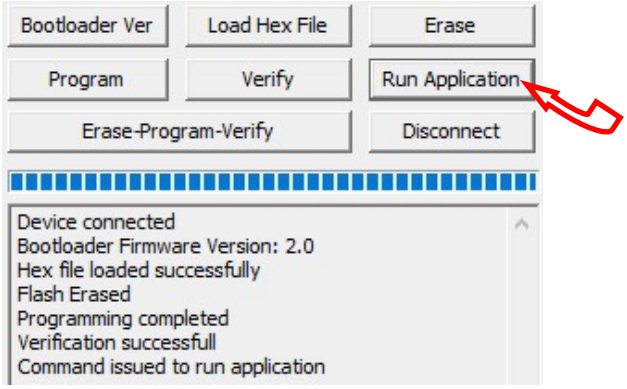
12. Click on **Load Hex File**. Select the M*GL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.



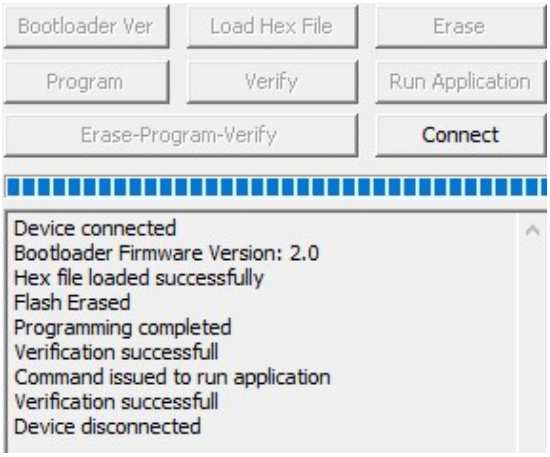

13. Click on **Erase—Program—Verify.** Programming…. Wait while status bar shows progress. The messages should read as below when finished:




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



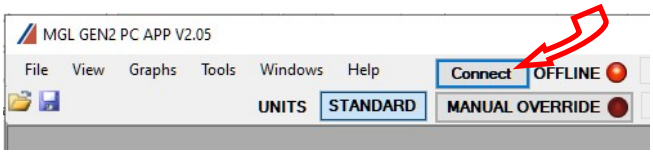

15. **Wait until the programmer disconnects itself.** The messages should read as follows:




16. Close the PIC32 program.

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

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



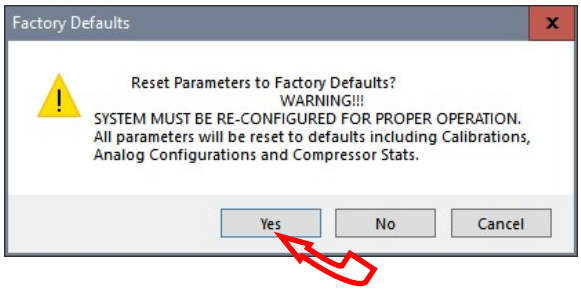

**NOTE: Updating the firmware does not affect the configuration settings.**

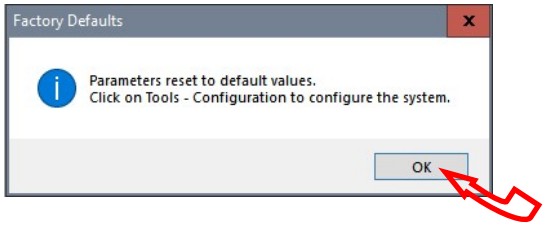
# Reset to Defaults?

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

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

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




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

# METHOD 2: Updating Firmware Using Jumper Pins

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

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

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

   ***\Desktop\MGL GEN2 Bootload Firmware V376***

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

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

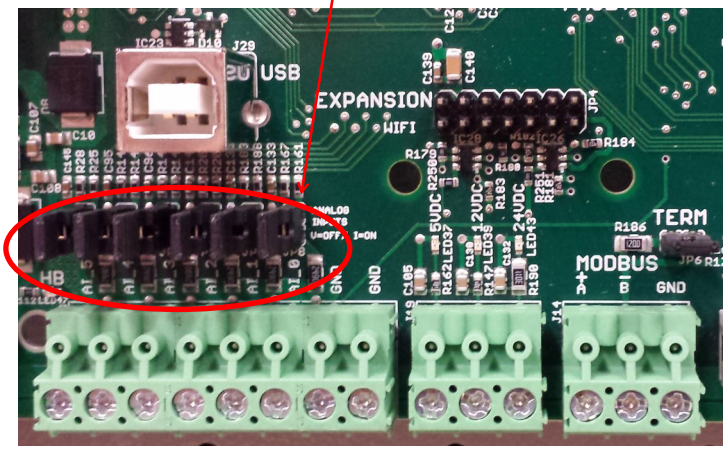
   Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

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

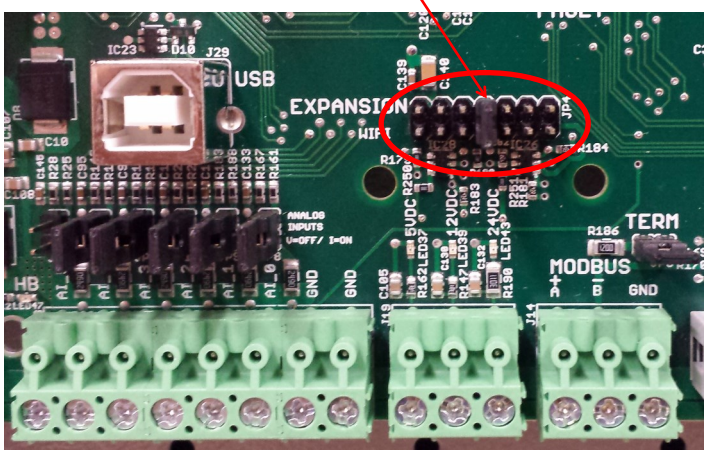
4. Turn power off to the heat pump.

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

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

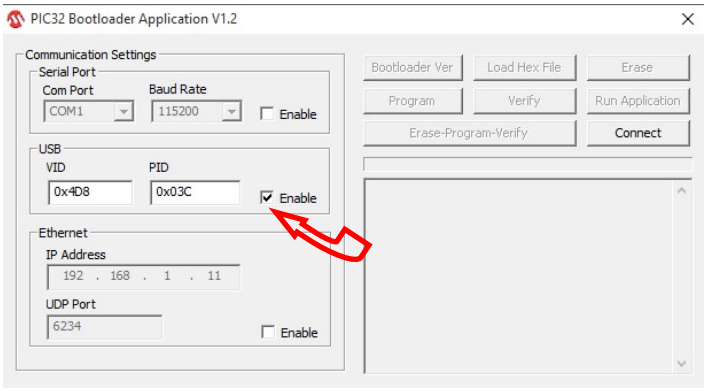



*Place jumper here*

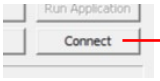


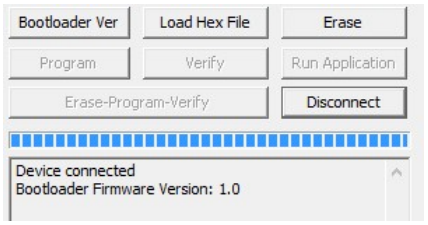

6. Turn the power back on. The control board is now in boot loader mode and is ready to be programmed.

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

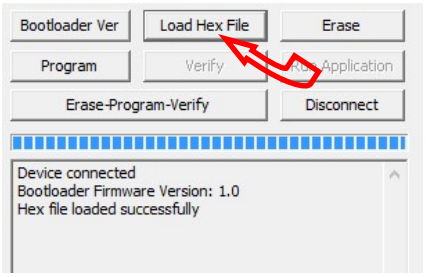



8. Click on **Connect.**



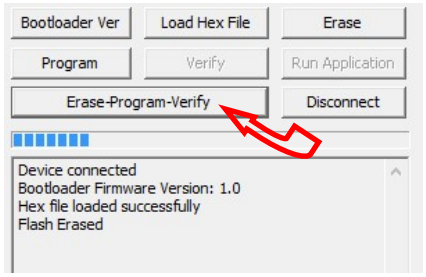




9. Click on **Load Hex File**. Select the *MGL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.




10. Click on **Erase—Program—Verify**

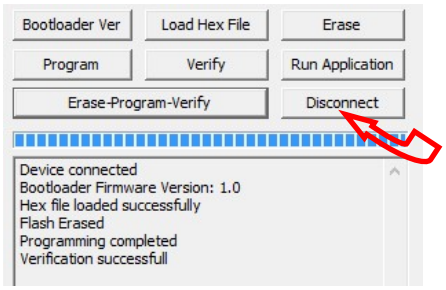
Programming…




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

12. Turn power off to the heat pump again.

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




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

# LIMITED 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.