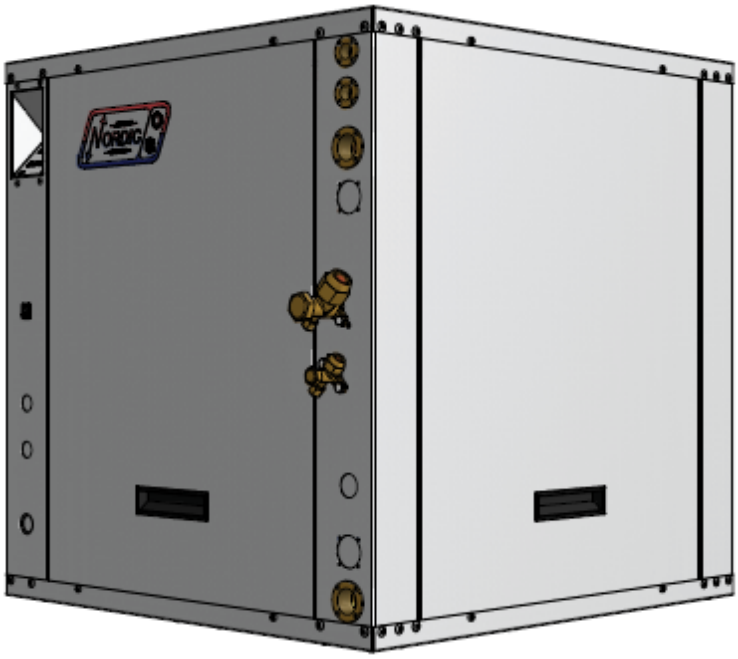
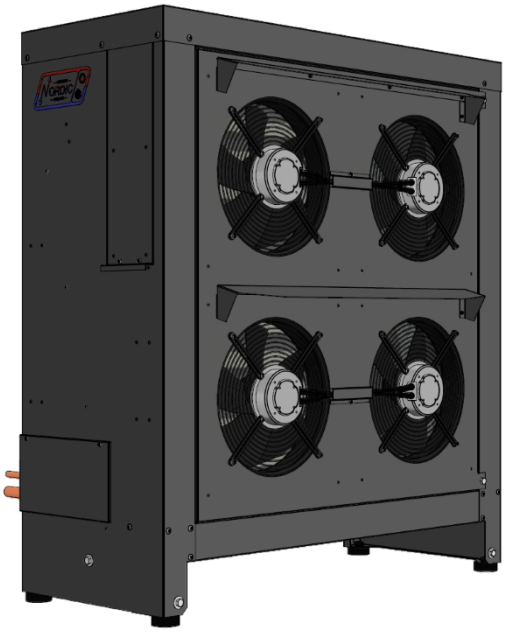
MARITIME GEOTHERMAL LTD.

Installation and Service Manual

ATW-Series
Reversing Air to Water Heat Pump

Two-Stage R410a
Model Sizes 25-75





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SAFETY PRECAUTIONS

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

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

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

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

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

Model Nomenclature

ATW—65—HACW—P—1T—C—xx

Series:
ATW = Active Cooling Air to Liquid

Nominal Size:
25 = 020 compressor
45 = 030 compressor
55 = 040 compressor
65 = 051 compressor
75 = 060 compressor
80 = 067/070 compressor

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

Refrigerant:
P = R410a

Revision:
01, 02 etc.

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

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

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

APPLICATION TABLE										
SIZE	**FUNCTION**	**REFRIGERANT**	**VOLTAGE**	**COMPRESSOR STAGES***	**INDOOR COIL**	**REVISIONS**				
25	HACW	P	1 2 4 6 7	T	C Y Z	02				
45	HACW	P	1 2 4 6 7	T	C Y Z	02				
55	HACW	P	1 2 4 6 7	T	C Y Z	02				
65	HACW	P	1 2 4 6 7	T	C Y Z	02				
75	HACW	P	1 2 4 7	T	C Y Z	02				
			6	S						
This manual applies only to the models and revisions listed in this table										

FIRMWARE AND PC APP APPLICATION TABLE			
Firmware	**Version***	**Associated PC APP**	**Version**
MGT GEN2 Bootload Firmware	V2.49Rx	MGT GEN2 PC APP	V1.19
MGT GEN2 Bootload Firmware	V2.48Rx	MGT GEN2 PC APP	V1.18
MGT GEN2 Bootload Firmware	V2.47Rx	MGT GEN2 PC APP	V1.17
* x may be any number from 1 to 9. There may not be an Rx, ie simply V2.49			

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

Table of Contents

Tables, Figures, & Documents

Tables

Figures

Documents

Installation Basics

Unit Description

The ATW-Series unit is a high efficiency two-stage air to water heat pump. When used in conjunction with a secondary source of heat, it may be used as the primary source of heating for whole home comfort down to a minimum outside temperature of -7°F (-21.7°C) at which point the unit will automatically shut down and the secondary source will provide the full heating capacity until the unit is re-enabled by warmer temperatures.

Unpacking the Unit

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

The heat pump is well constructed and every effort has been made to ensure that it will arrive intact, however it is in the customer's best interest to examine the unit thoroughly when it arrives.

Optimum Placement

For air to water models, the placement of the unit has negligible effect on the operation and efficiency of the system. It is recommended that the unit be placed near where the interconnect piping to the outdoor unit will be to keep the piping distance to a minimum.

If possible the access panels should remain clear of obstruction for a distance of **two feet** to facilitate servicing and general maintenance.

Raising the heat pump off the floor a few inches is generally a good practice since this will minimize noise and prevent rusting of the bottom panel of the unit. We recommend that the heat pump be placed on a pad, available from Maritime Geothermal as an accessory, or a piece of 2" thick styrofoam that will smooth out any irregularities in the cement floor and deaden any compressor noise emitted from the bottom of the cabinet.

Electrical Connections

The heat pump has several knockouts / holes for the electrical connections, shown in **DIAGRAM A**. Note that some connections are located on both the front and side of the unit for convenience. A schematic diagram (SCH) and electrical box layout diagram (ELB) can be found inside the electrical box cover of the unit as well as in the **Model Specific** section of this manual.

The Electrical Tables in the **Model Specific** section and the ELB diagram contain information about the size of wire for the connections, as well as the recommended breaker size. Power supply connections to the unit are made directly to the compressor contactor and are as per **TABLE 1.** Ground is to be connected to the GND lug inside the electrical box.

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

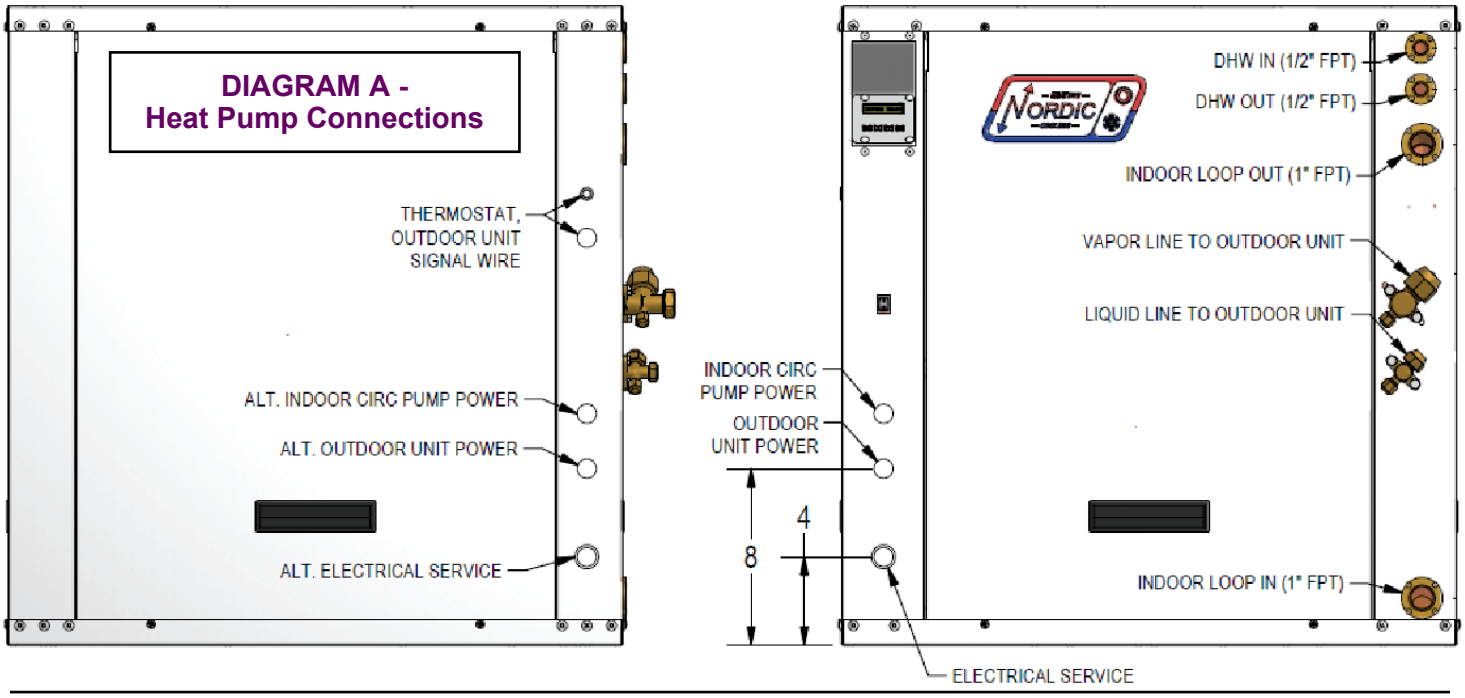


TABLE 1 - Power Supply Connections (Heat Pump)		
Line	**Description**	**Voltages**
L1	Line 1	All
L2	Line 2	All
L3	Line 3	208-3-60, 460-3-60, 380-3-50
N**	Neutral	208/230-1-60, 208-3-60, 380-3-50
GND	Ground	All (connect to ground lug)
** Only required if connecting 115VAC circulators to the heat pump for 208/230-1-60 and 208-3-60 models, the heat pump itself does not require a neutral. Required for 380-3-50 models.		

Control Transformer

The low voltage controls are powered by a 100VA class II transformer. Circuit protection is provided by either a resettable breaker on the secondary side of the transformer or primary and secondary fuses (refer to **TABLE 2**). Should the breaker trip (or fuse blow), locate and correct the problem and then reset the breaker by pressing in on it (or replace the blown fuse).

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

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

Indoor Loop Circulator Pump Wiring

The heat pump has provisions for connecting the circulator pump(s) so that they will be turned on whenever the compressor operates. Connect the circulator pump module to the appropriate two terminals (115VAC or 230VAC) of the terminal strip marked **INDOOR CIRCULATORS** in the heat pump, as per the voltage of the circulator pump module. 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, 24VAC and ground are provided on the terminal strip for use with external components to control the circulator(s). Refer to the electrical box drawing on the electrical box cover for more information.

Outdoor Unit Power Supply

The Outdoor Unit is powered from the ATW unit. The power supply for the Outdoor Unit is 208/230-1-60 or 220/1/50. The ATW and Outdoor Unit have matching terminal strips for these connections. Connect a two conductor (minimum 14ga) **outdoor rated cable** between the ATW and the Outdoor Unit. **TABLE 3** shows a description of the connections required. Refer to **drawing 002019CDG.**

IMPORTANT NOTE: A disconnect switch visible 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 MAX.

TABLE 3 - Power Supply Connections (Outdoor Unit)	
Line	**Description**
L1	Supply line
L2	Supply line
GND	Ground.
Use a two conductor outdoor rated 14ga minimum cable. A disconnect switch (10A MAX) visible from the Outdoor Unit must be installed in the power supply cable.	

Outdoor Unit Signal Connections

The ATW and Outdoor Unit have matching terminal strip signals for these connections. Connect an 8 conductor **shielded outdoor rated cable** between the terminal strip in the ATW and the terminal strip in the Outdoor Unit. The signals are marked as ***Outdoor Unit Signals Connections*** on the ATW terminal strip. **The shield ground wire is connected only to the ATW unit, do not connect the shield ground to the Outdoor Unit (there is no terminal for it).** Simply cut the shield ground wire short at the cable sheath in the Outdoor Unit. The signals are described **TABLE 4**. Refer to **drawing 002019CDG.**

TABLE 4 - 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 ATW. In the Outdoor Unit, leave this wire unconnected and cut it short at the cable sheath.**	

1. Setpoint Control

NOTE: If controlling the system via the BACnet interface, skip the next two sections, as no connections are required.

One of the features of the GEN2 Control Board is built in Aquastat functionality (with optional Outdoor Reset) known as "Setpoint Control". Refer to the Setpoint Control section of this manual for more information. It is recommended that this option be used to operate the heat pump system since it eliminates the need for an external aquastat and temperature probe in the tank (s) and provides a three stage system along with delay timer for the hydronic auxiliary heat. Only one external connection is required with this mode of operation, a dry contact from the R to O terminal to switch to cooling mode (see **TABLE 5**).

Note that in cooling mode, it is important to choose zone thermostats or other control devices that continuously send an "O" signal, even when there is no cooling demand. This is to avoid repeated heating and cooling of the buffer tank on demand cycling, causing temperature lags and high electricity consumption.

Drawings **002067CDG** and **002068CDG** show a typical wiring setup for zones, zone circulator and hydronic auxiliary for heating only and heating /cooling system.

TABLE 5 - Setpoint Control Connections	
Signal	**Description**
O	**Cooling Mode (Reversing Valve)**
R	**24VAC hot**

When using the Setpoint Control method to operate the unit, there are 3 methods for activating hydronic auxiliary heat. The connections are shown in **TABLE 6** and **drawing 002019CDG**.

First, a 24VAC control signal on terminal 1A (with CA as ground/common) is available to power the coil of an external contactor in order to operate hydronic auxiliary heat if installed. 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. **This signal can provide a maximum of 500mA at 24VAC.**

Second, a dry contact on terminals D1 and D2 is available, to actuate a heating device that has its own control transformer. In general, these types of devices will have their own electronic temperature controller. Therefore, it will be necessary to disable the on-board temperature control on the external heating device, and adjust its settings so it is only activated by the heat pump's controller. **This method should be used for the Thermo2000 EcoUltra tank that is available from Maritime Geothermal as an accessory.**

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

TABLE 6 - Setpoint Control: Hydronic Auxiliary Connections	
Signal	**Description**
CA	**24VAC common (ground)**
1A	**Hydronic Auxiliary (hot)**
D1	**Hydronic Auxiliary dry contacts**
D2	
H1	**Hydronic Auxiliary ONLY dry contacts (for high temperature auxiliary heat)**
H2	

2. Hardwired Control

In this mode of operation, the compressor stages are turned on and off according to an external device, e.g. a 2-stage aquastat. The electrical box diagram on the electrical box cover provides a description of the signal connections as does **TABLE 7**. The CA, RA, Y1A, and Y2A connections are located on the right side towards the top of the control board, on the screw terminal connector section marked **AQUASTAT**. The O terminal is found on the terminal strip (along with an alternate R and C connection).

TABLE 8 shows typical settings for the aquastat. With these settings, stage 1 will activate when the tank temperature reaches the activation point. If the load is too great, the tank temperature will continue to drop when heating until stage 2 is activated. As the tank temperature stops dropping and begins to increase when heating, stage 2 will turn off before stage 1,

TABLE 7 - Hardwired (Aquastat) Connections	
Signal	**Description**
O	**Cooling Mode (Reversing Valve)**
C	**24VAC common (ground)**
R	**24VAC hot**
Y1A	**Compressor ON (Part Load)**
Y2A	**Compressor bump up to Stage 2 (Full Load)**

rather than at the same time as stage 1. There are three main advantages to this:

- Less aquastat probe lag leading to reduced overshoot as the tank temperature rate of change is reduced when only stage 1 is active.
- Prolonged stage 1 run time leads to increased efficiency.
- Reduced number of compressor starts.

The settings may be changed as desired; however stage 1 setpoint for heating should not exceed **120°F (49°C)**; stage 1 cooling setpoint should not be set below **43°F (6°C).** Exceeding these setpoint limits will cause the heat pump operating pressures to approach the safety control settings, possibly causing nuisance shut downs.

If only floor zones are being heated, it is highly recommended to drop each of the heating setpoints by 10°F (5°C) for increased efficiency.

It is recommended that a buffer tank with electric elements be selected to provide auxiliary heat. When using Hardwired Control, the 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. The contactor can be connected to stage 2 of the heating aquastat via an optional 0-2hour timer. **Drawings 002069CDG and 002070CDG** show a typical wiring setup for zones, zone circulator and hydronic auxiliary for heating only and heating /cooling system.

Note that in cooling mode, it is important to choose zone thermostats or other control devices that continuously send an "O" signal, even when there is no cooling demand. This is to avoid repeated heating and cooling of the buffer tank on demand cycling, causing temperature lags and high electricity consumption.

TABLE 8 - Typical Aquastat Settings

HEATING

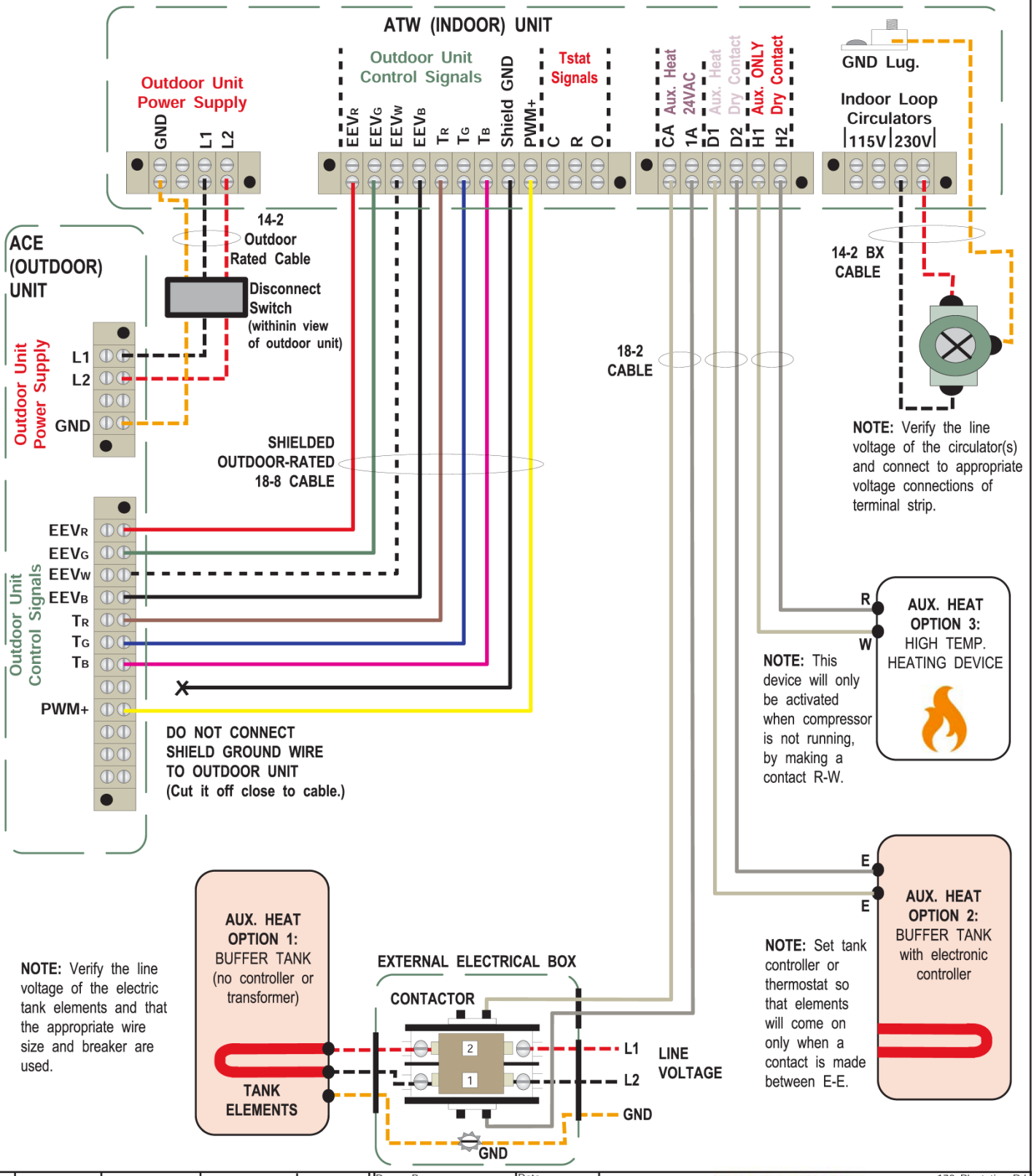
	Stage 1		Stage 2		Stage 3	
Item	**°F**	**°C**	**°F**	**°C**	**°F**	**°C**
Setpoint	**108**	**42**	**105**	**41**	**90**	**32**
Delta	**8**	**4**	**8**	**4**	**20**	**10**
Activation *	**100**	**38**	**97**	**37**	**70**	**22**
Delay					**10 minutes**	

COOLING

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

*Activation is determined by the Setpoint and Delta values

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



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

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

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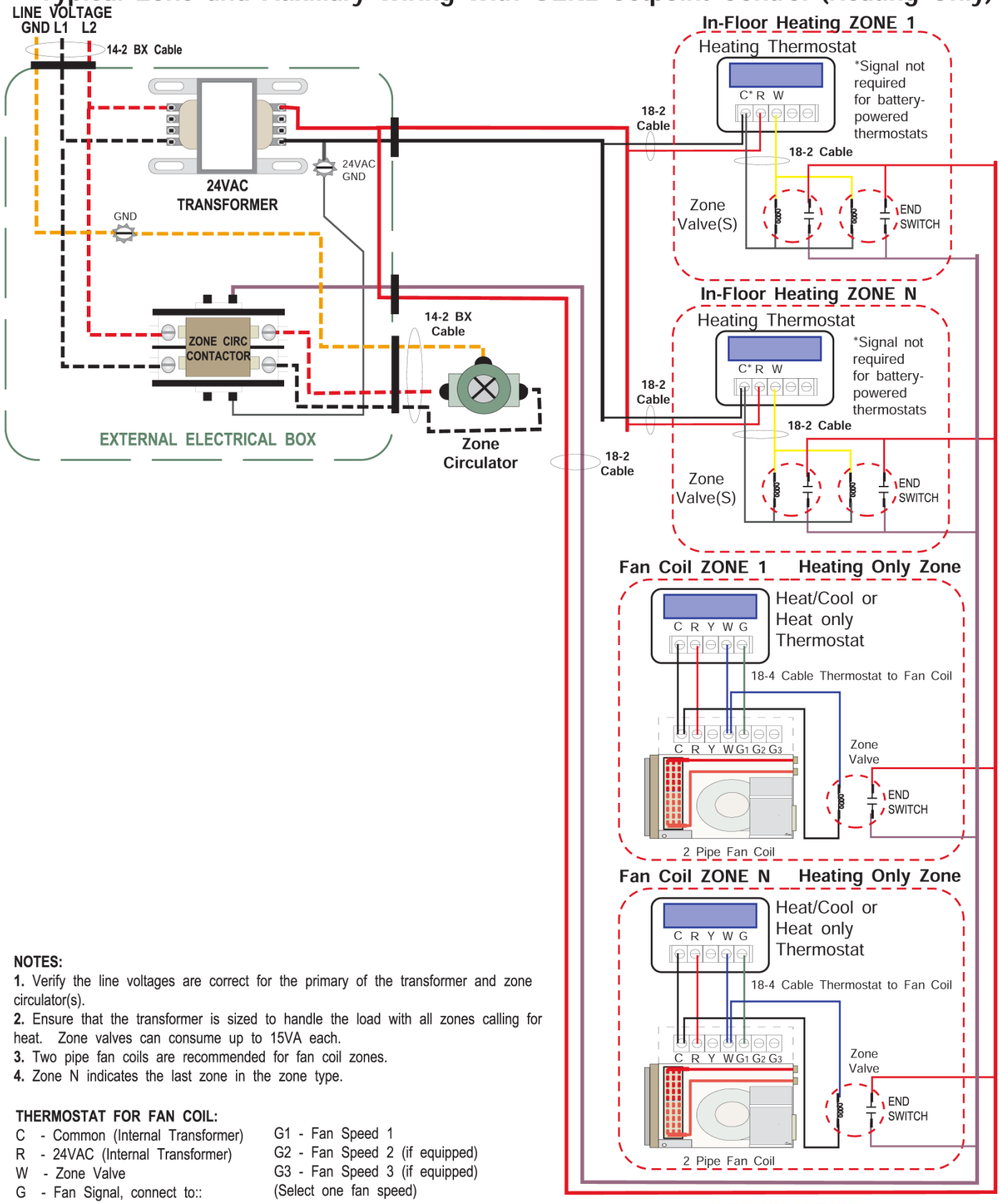
Drawing Name: Typical ATW Outdoor Unit, Auxiliary Heat and Indoor Circulator Wiring

Size	Drawing Number	Drawing Rev	Sheet
A	002019CDG	02	1 of 1

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

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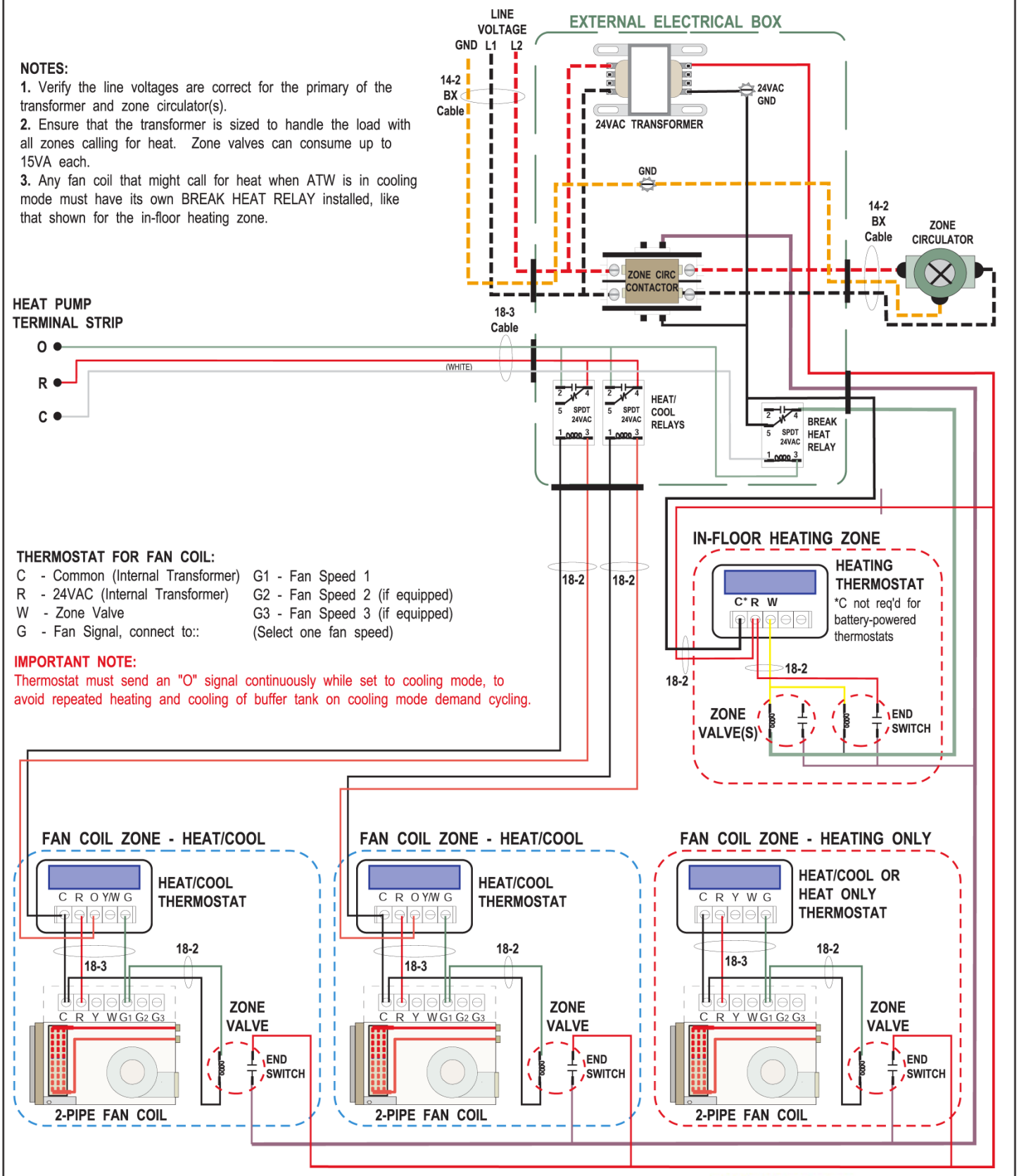
Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating Only)

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

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



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01	Initial Release	C. GEDDES	C. GEDDES	04-APR-2017

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

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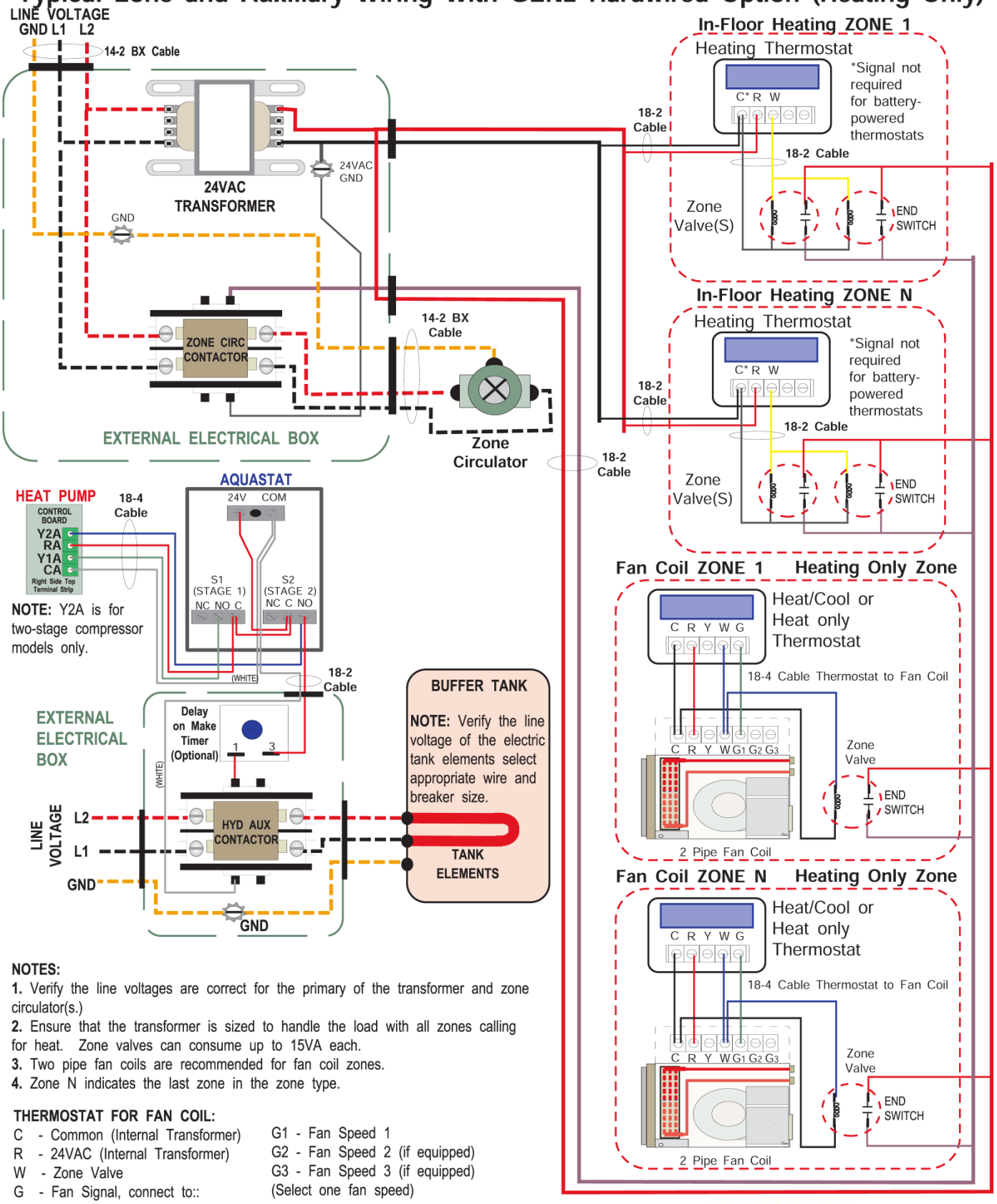
Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating & Cooling)

Size	Drawing Number	Drawing Rev	Sheet
A	002068CDG	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

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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

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

NOTES:

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

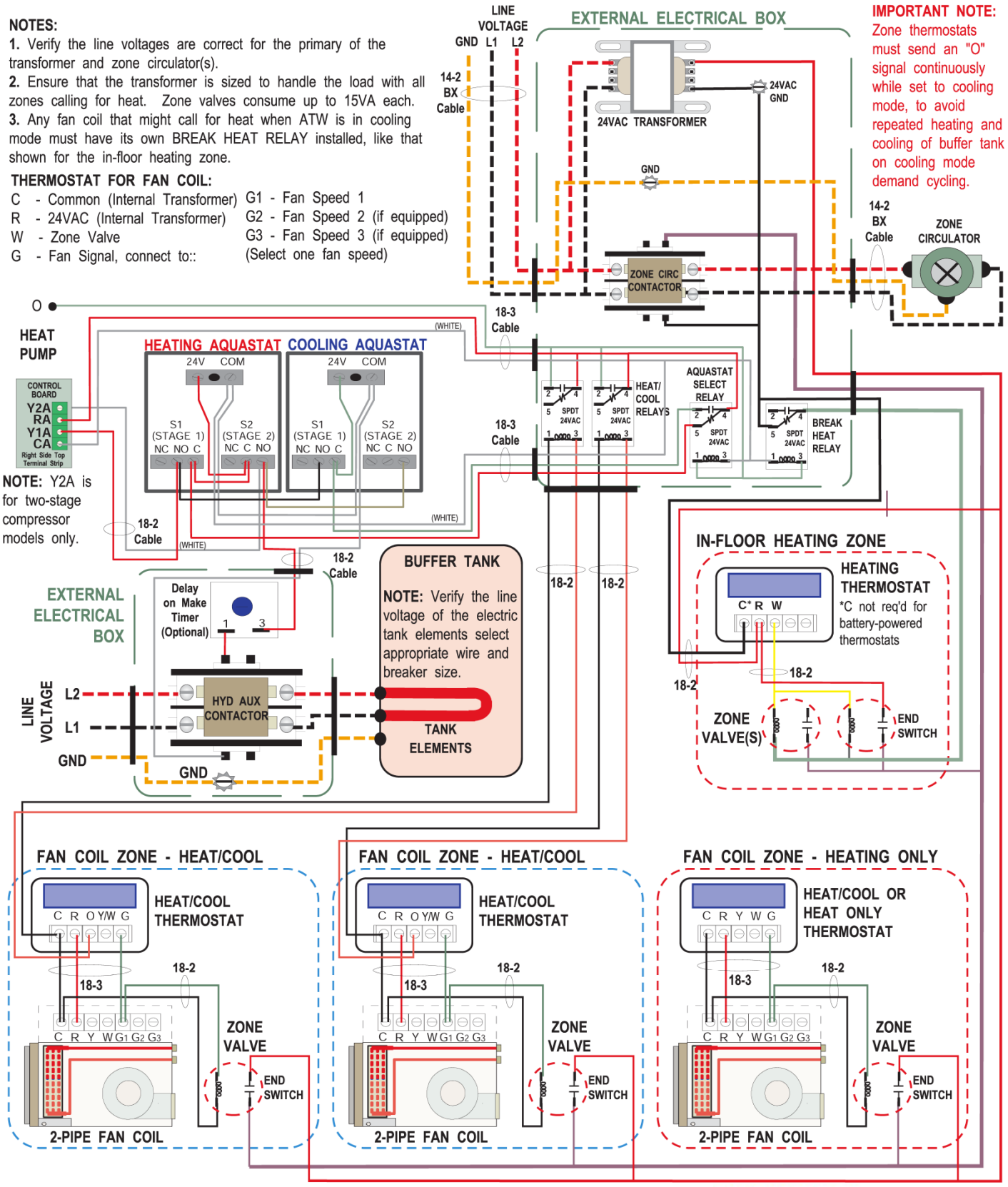
2. Ensure that the transformer is sized to handle the load with all zones calling for heat. Zone valves consume up to 15VA each.

3. Any fan coil that might call for heat when ATW is in cooling mode must have its own BREAK HEAT RELAY installed, like that shown for the in-floor heating zone.

THERMOSTAT FOR FAN COIL:

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

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



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

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

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

Indoor Loop Water Lines

The port connections for the Indoor Loop circuit are heavy duty 1" brass FPT fittings. They are labelled as INDOOR IN and INDOOR OUT. The ports are located on the front of the unit (refer to DIAGRAM A on page 7).

A typical 2 port buffer tank system is shown in **drawing 001981PDG** . This diagram shows all of the recommended components as well as where they should be placed. A typical 4 port buffer tank system is shown in **drawing 001046PDG** . Unions or some other form of disconnect should be used so that the coaxial heat exchanger may be accessed should it require cleaning.

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 8USGAL per ton of heat pump capacity. **TABLE 9** 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 9 - Buffer Tank Size

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

Domestic Hot Water (Desuperheater) Connections

The port connections for the DHW circuit are 1/2" brass FPT fittings. They are labelled as DHW IN and DHW OUT. The ports are located on the front of the unit (refer to DIAGRAM A).

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

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

Ensure the tank is filled with water and under pressure before activating the heat pump. Slightly loosen the boiler drain on the DHW Out pipe to allow air to escape from the system before the unit is started. This step will make certain that the domestic hot water circulator in the unit is flooded with water when it is started.

Connect 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.

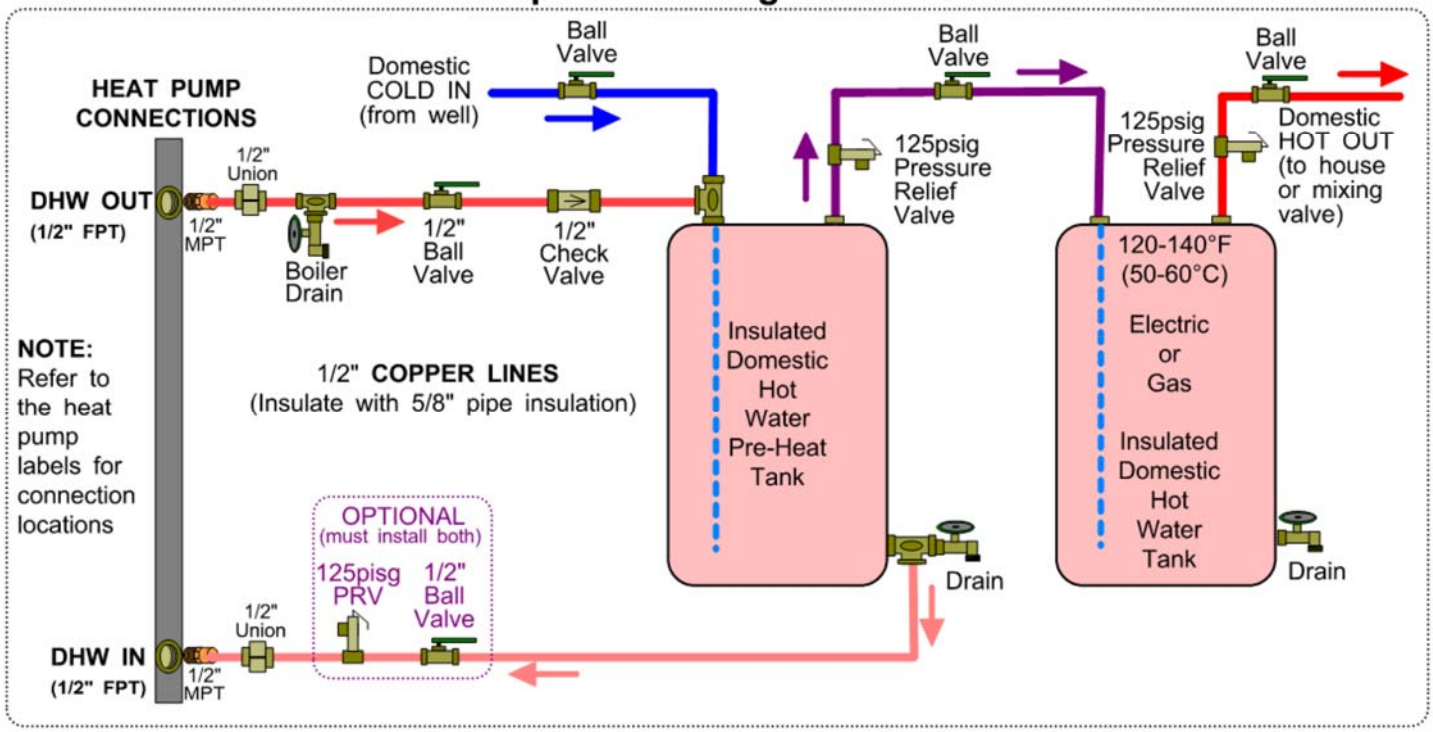
CAUTION: the domestic hot water pump is water lubricated; damage will occur to the pump if it is run dry for even a short period of time.

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

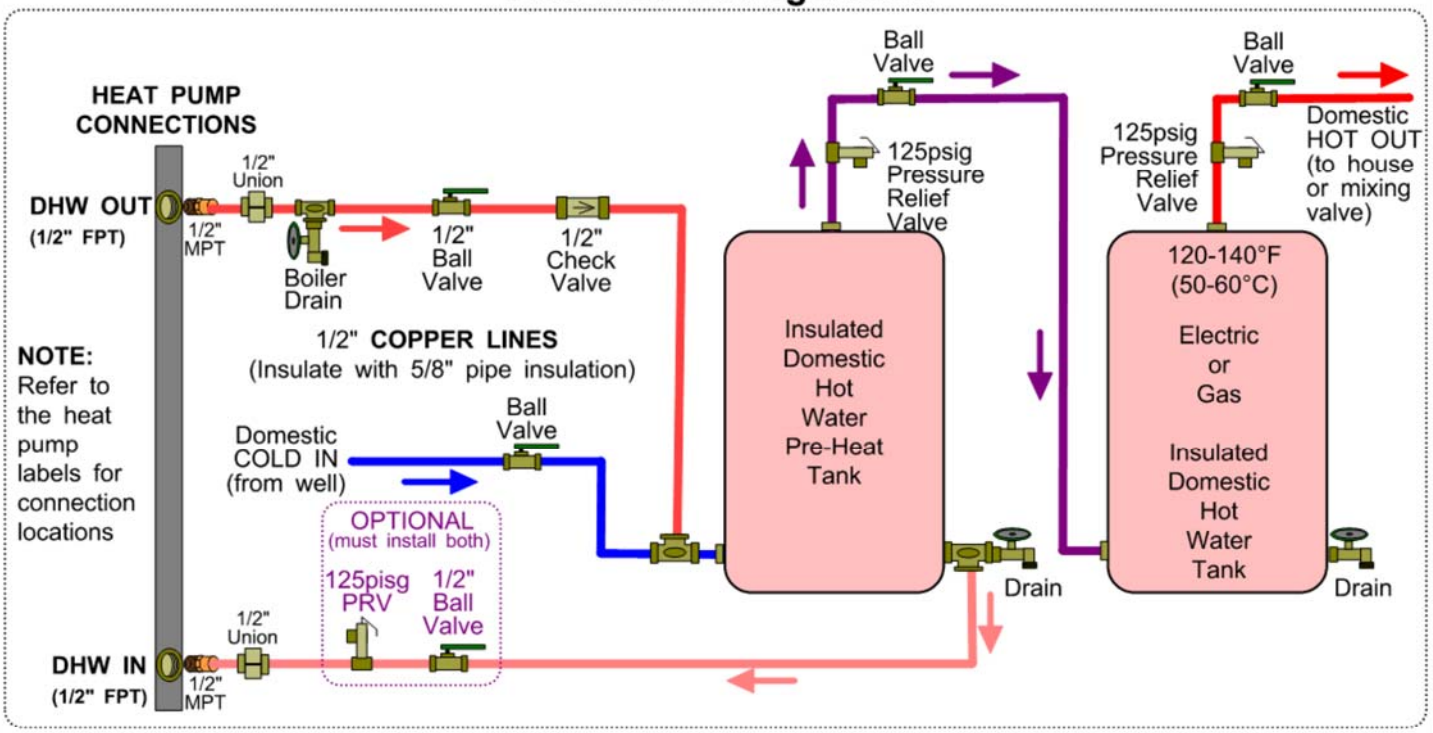
CAUTION: If two (2) shut-off valves are located on the domestic hot water ines as shown in the diagram, a pressure relief valve must be installed to prevent possible damage to the domestic hot water circulator pump should both valves be closed.

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

Top Port Configuration



Side Port Configuration



REV	ECO #	IMPL BY	APVD BY	DATE
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:	

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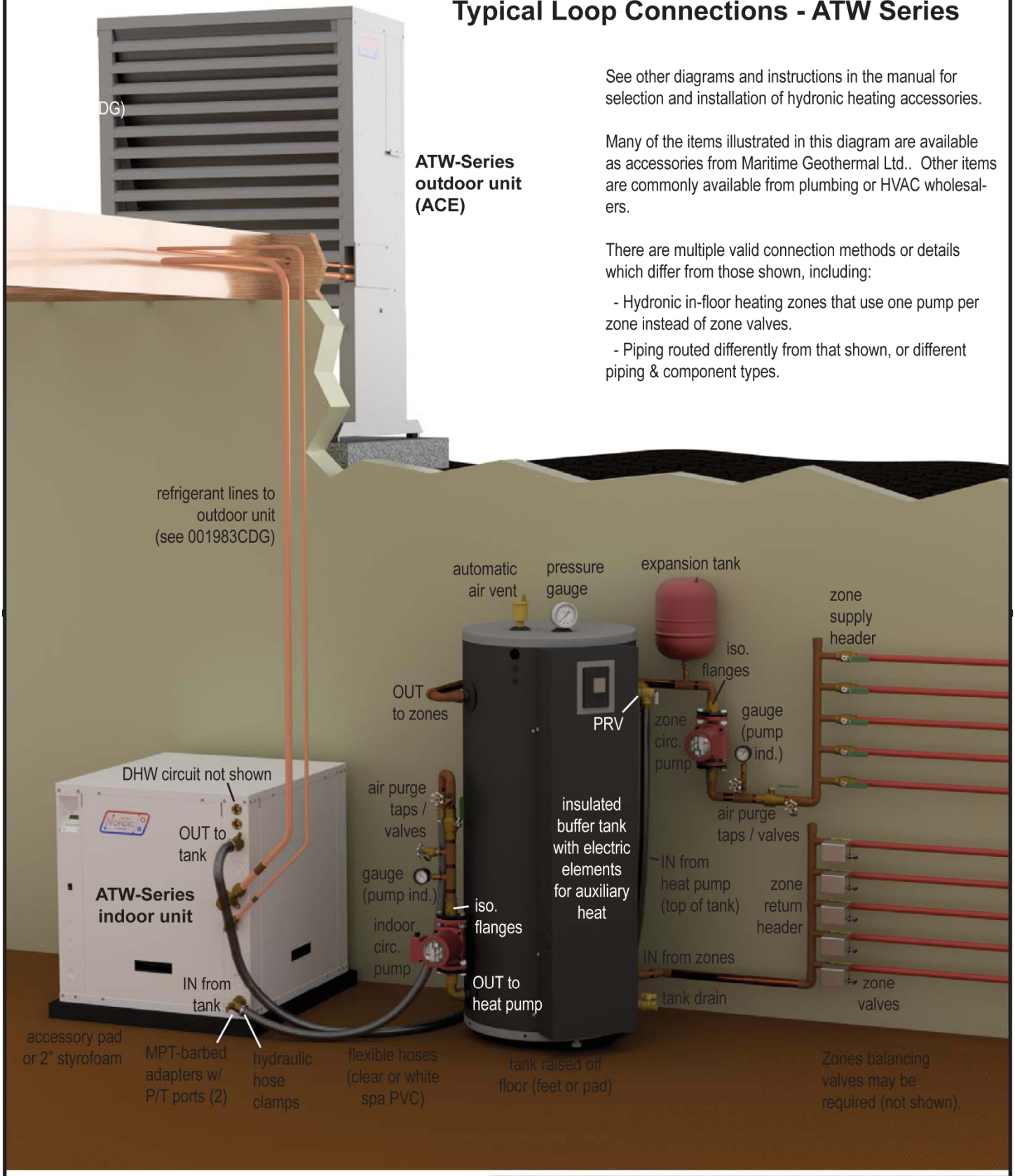
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

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

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

Typical Loop Connections - ATW Series



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

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

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

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

REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Rel.	Dan Rheault	Dan Rheault	23-Aug-2017

Drawn By: Dan Rheault	Date: 23-Aug-2017	
Checked By: Dan Rheault	Date: 23-Aug-2017	
Eng. Approved By	Date	
Mfg. Approved By	Date	
Approved By	Date	

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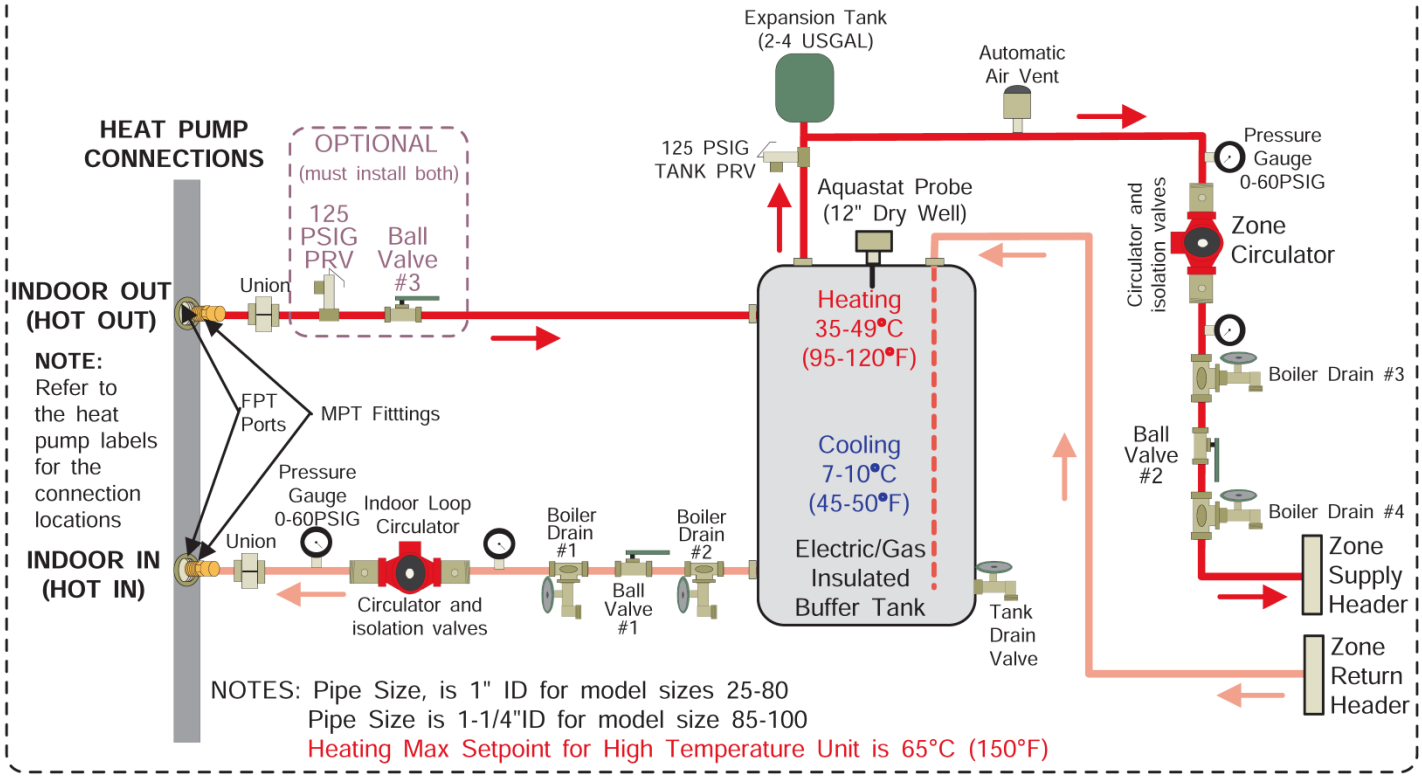
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: **Typical Loop Connections - ATW Series**

Size	Drawing Number	Revision	Sheet
LET	002239PDG	01	1 / 1

Typical Buffer Tank Configuration - Four Port Tank



NOTES:

1. Refer to diagram 000530PDG for the typical types of zones that may be connected to the supply and return headers.
2. Unions or another type of disconnect should be used to connect the heat pump to the loop.
3. Circulators should be mounted vertically when possible to reduce the chance of air getting caught in the housing.
4. The automatic air vent must be installed upright to function properly.
5. If the optional 1" ball valve is installed in the Indoor Out line, **the PRV must be installed as well,** to prevent pressure build up should both ball valves be closed.
6. Pressure gauges (0-60PSIG) are placed on both sides of the circulators for a quick check method to determine that the circulators are pumping.
7. Ensure the floor circulator is adequately sized to accomodate the type and number of zones connected to the system.
8. The aquastat probe should be placed all the way in the dry well, and the end of the well where the probe wire is should be well insulated.
9. The loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (ie methanol), and there are electric elements in the buffer tank, ensure there is a method to prevent the electric elements from turning on if the tank is not completely full. One method is to use a pressure switch to disable the elements should the pressure in the tank drop below a setpoint, such as 5 or 10PSIG. Allowing the elements to come on when they are not fully submerged will burn the element out and **could cause an explosion.**

PURGING PROCEDURE:

1. Ensure the power to the heat pump and any other power supplies connected to the system (floor circulator, etc) are turned off.
2. The system can be filled using Boiler Drain #1.. Connect the fill hose to the boiler drain and begin filling. Open the tank PRV to purge the air out as the system fills. Close the tank PRV when water begins to run out of it.
3. Open the automatic air vent.
4. Connect the purge hose to Boiler Drain #2. Close Ball Valve #1. Open Ball Valve #3 if installed. Open Boiler Drain #2. Purge until air is no longer heard leaving the system. Open the Tank PRV and let any air out. Close Boiler Drain#1, #2 and Ball Valve #1 and #3 if installed.
5. Zone can be purged by moving the fill hose (turn it off first) from Boiler Drain #1 to Boiler Drain #4. Connect the purge hose to Boiler Drain #3. Close Ball Valve #2. Open Boiler Drains #3 and #4. Purge each zone individually and then open them all at once. Zones can be opened using the individual thermostats or most can be opened manually. Open the Tank PRV intermittently to purge any air during this process.
6. When purging is complete, pressurize the system between 15 and 25PSIG.
7. Turn the fill hose off. Close Boiler Drains #3 and #4. Open Ball Valve #2. Remove the fill (turn the hose off first) and purge hoses.
8. Repeat steps 4 to 6 as necessary if air is still present in the system.

REV	ECO #	IMPL BY	APVD BY	DATE
02	000201	C. GEDDES	C. GEDDES	09 AUG 12
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	

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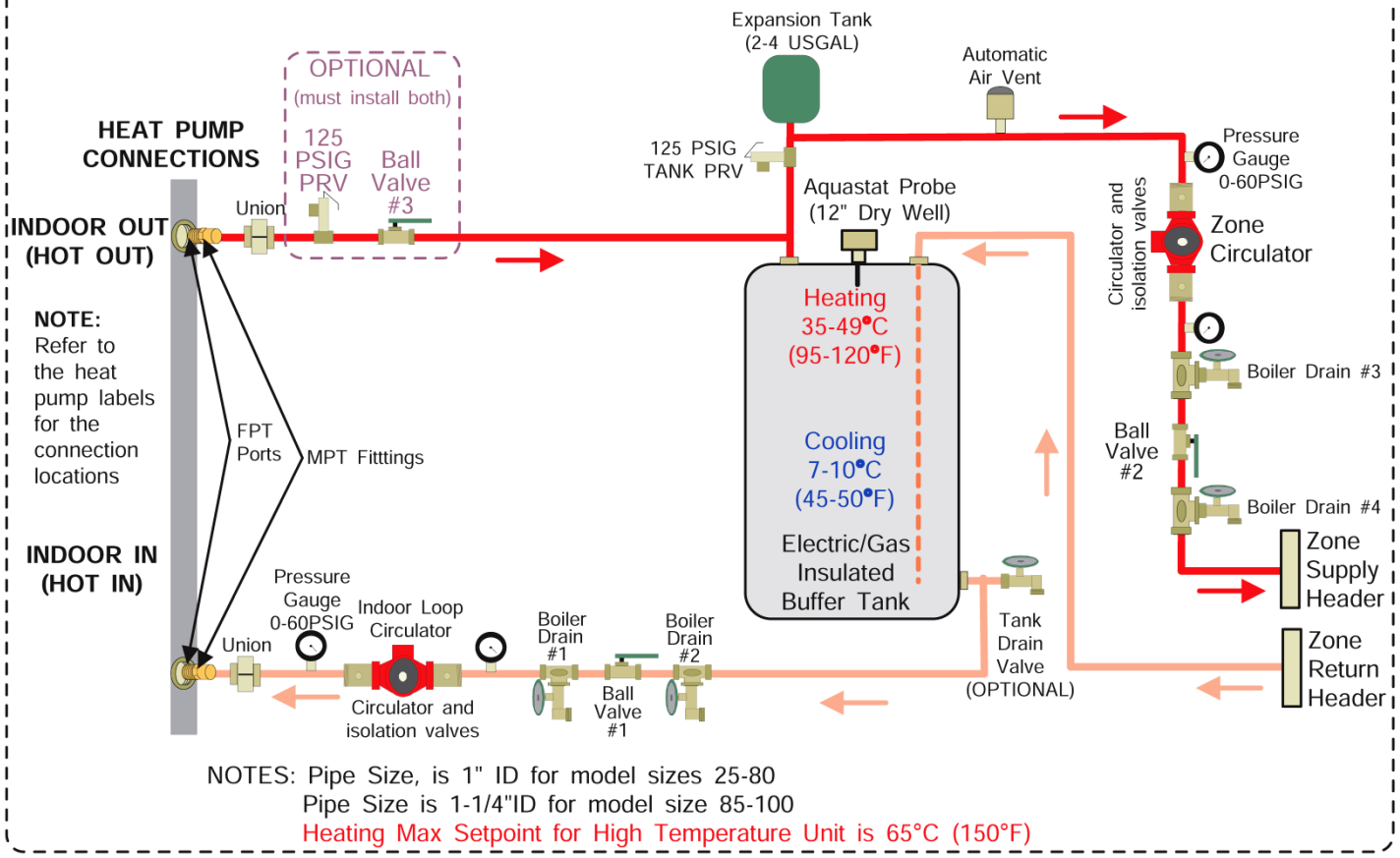
Drawing Name: Typical Buffer Tank Configuration - Four Port Tank (Brass FPT)

Size	Drawing Number	REV	SHEET
A	001046PDG	02	1 of 1

Typical Buffer Tank Configuration - Two Port Tank



NOTES: Pipe Size, is 1" ID for model sizes 25-80
Pipe Size is 1-1/4"ID for model size 85-100
Heating Max Setpoint for High Temperature Unit is 65°C (150°F)

NOTES:

1. Refer to diagram 000530PDG for the typical types of zones that may be connected to the supply and return headers.
2. Unions or another type of disconnect should be used to connect the heat pump to the loop.
3. Circulators should be mounted vertically and pointing UP when possible to reduce the chance of air getting caught in the housing.
4. The automatic air vent must be installed upright to function properly.
5. If the optional 1" ball valve is installed in the Indoor Out line, **the PRV must be installed as well,** to prevent pressure build up should both ball valves be closed.
6. Pressure gauges (0-60PSIG) are placed on both sides of the circulators for a quick check method to determine that the circulators are pumping.
7. Ensure the floor circulator is adequately sized to accomodate the type and number of zones connected to the system.
8. The aquastat probe should be placed all the way in the dry well, and the end of the well where the probe wire is should be well insulated.
9. The loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (ie methanol), and there are electric elements in the buffer tank, ensure there is a method to prevent the electric elements from turning on if the tank is not completely full. One method is to use a pressure switch to disable the elements should the pressure in the tank drop below a setpoint, such as 5 or 10PSIG. Allowing the elements to come on when they are not fully submerged will burn the element out and **could cause an explosion.**
10. Trank Drain Valve is optional, Boiler Drain #2 may be used as a tank drain if it is placed at or below the level of the tank drain port.

PURGING PROCEDURE:

1. Ensure the power to the heat pump and any other power supplies connected to the system (floor circulator, etc) are turned off.
2. The system can be filled using Boiler Drain #1.. Connect the fill hose to the boiler drain and begin filling. Open the tank PRV to purge the air out as the system fills. Close the tank PRV when water begins to run out of it.
3. Open the automatic air vent.
4. Connect the purge hose to Boiler Drain #2. Close Ball Valve #1. Open Ball Valve #3 if installed. Open Boiler Drain #2. Purge until air is no longer heard leaving the system. Open the Tank PRV and let any air out. Close Boiler Drain#1, #2 and Ball Valve #1 and #3 if installed.
5. Zone can be purged by moving the fill hose (turn it off first) from Boiler Drain #1 to Boiler Drain #4. Connect the purge hose to Boiler Drain #3. Close Ball Valve #2. Open Boiler Drains #3 and #4. Purge each zone individually and then open them all at once. Zones can be opened using the individual thermostats or most can be opened manually. Open the Tank PRV intermittently to purge any air during this process.
6. When purging is complete, pressurize the system between 15 and 25PSIG.
7. Turn the fill hose off. Close Boiler Drains #3 and #4. Open Ball Valve #2. Remove the fill (turn the hose off first) and purge hoses.
8. Repeat steps 4 to 6 as necessary if air is still present in the system.

01	Initial Release	C. GEDDES	C. GEDDES	08 JUN 2015
REV	ECO #	IMPL BY	APVD BY	DATE

Drawn By: Chris Geddes	Date: 08 JUN 2015	
Checked By: Chris Geddes	Date: 08 JUN 2015	
Approved By (ENG): Chris Geddes	Date: 08 JUN 2015	
Approved By (MFG):	Date:	
Approved By:	Date:	

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170 Plantation Rd.
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Drawing Name: Typical Buffer Tank Configuration - Two Port Tank (Brass FPT)

Size	Drawing Number	Drawing Rev	Sheet
A	001981PDG	01	1 of 1

Sample Bill of Materials - ATW Series

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

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

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

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

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

REFRIGERATION
- 1/2" & 7/8" (OR 3/8" & 3/4") ACR TUBING
- PIPE ISULATION
- EXTRA R410A REFRIGERANT FOR LINESETS >25 FT

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

- 2" STYROFOAM INSUL. (IF PAD NOT PURCHASED)

Outdoor Unit (ACE) Installation

Outdoor Unit Description

The ACE is the outdoor section to the 2-piece air source heat pump. The same outdoor unit is used with all air source series heat pumps.

There are two sizes of outdoor unit, one for unit sizes 25/45/55 and one for unit sizes 65/75/80. See the Model Specific Information section for more information.

The ACE contains only the outdoor refrigerant-to-air heat exchanger (air coil), an ECM hub motor axial fan, and the electronic expansion valve (EEV) that is used in heating mode. All other components are in the indoor unit, including the compressor, water coil, and electronics. Since the indoor unit is isolated from temperature extremes and moisture, unit servicing and component longevity are enhanced.

The hub motor fan is speed controlled by the GEN2 control board based on refrigerant suction pressure in heating mode, and refrigerant discharge pressure in cooling mode. This results in maximum airflow when needed, while allowing reduced airflow at other times for noise and power savings.

Because of humidity in the outdoor air and low coil temperature, periodic defrost cycles are necessary (as with any air source heat pump) in heating mode. When a defrost cycle occurs, the unit with switch from heating to cooling mode in order to melt any frost or ice that has built up on the outdoor air coil. Traditionally, defrost cycles were done based on a timer, or other simple means. With the GEN2 control system, a defrost cycle is only performed when determined by the controller, which compares outdoor air temperature and suction pressure. In addition, defrost is only terminated when ice is completely removed, as determined by a timer algorithm based on outdoor temperature. This results in power savings and prevention of ice damage to the coil.

The Outdoor Ice Channeling design utilized in the ACE also works to minimize or eliminate air coil fin and tubing damage caused by ice in traditional air source units. There is no drip tray under the air coils, so defrost condensate drips directly to the ground, and there is no surface on which it can re-freeze and cause damage. Also, the angled coil means that there is a single line for condensate to run off, so condensate cannot hold between horizontal fin bottoms and re-freeze there.

Outdoor Unit Location

The ACE unit must be placed outdoors, with the fan pointing away from the building. It should be at least **12 inches (30 cm)** away from the building or other obstructions on the back and sides for unimpeded return airflow. There should be little or no obstruction in the fan (front) direction for at least **30 feet (9 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.

IMPORTANT NOTE: The line set between the indoor and outdoor units must not exceed 75 ft (23 m) in length.

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 the snow.

To this end, several strategies may be employed. First, look up how much snowfall is expected in your area, either from local knowledge or weather data. The snowfall map included here **(DIAGRAM C)** can be used as a rough guide for Canada.

1. If the local climate has less than ~4" of snow accumulaton, the unit can be mounted directly on a concrete pad. In this case, care must be taken 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 **12" (30 cm),** and use brackets designed for twice the unit weight.
3. Two different leg kits which add either **15" (38 cm)** or **30" (76 cm)** of additional height are available as an accessory from Maritime Geothermal Ltd.

To attach the legs, 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.

DIAGRAM B: Leg Kit Installation

In all cases, 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 min. 5/16" bolts through these grommets to prevent a tipping hazard due to impact or high wind.**

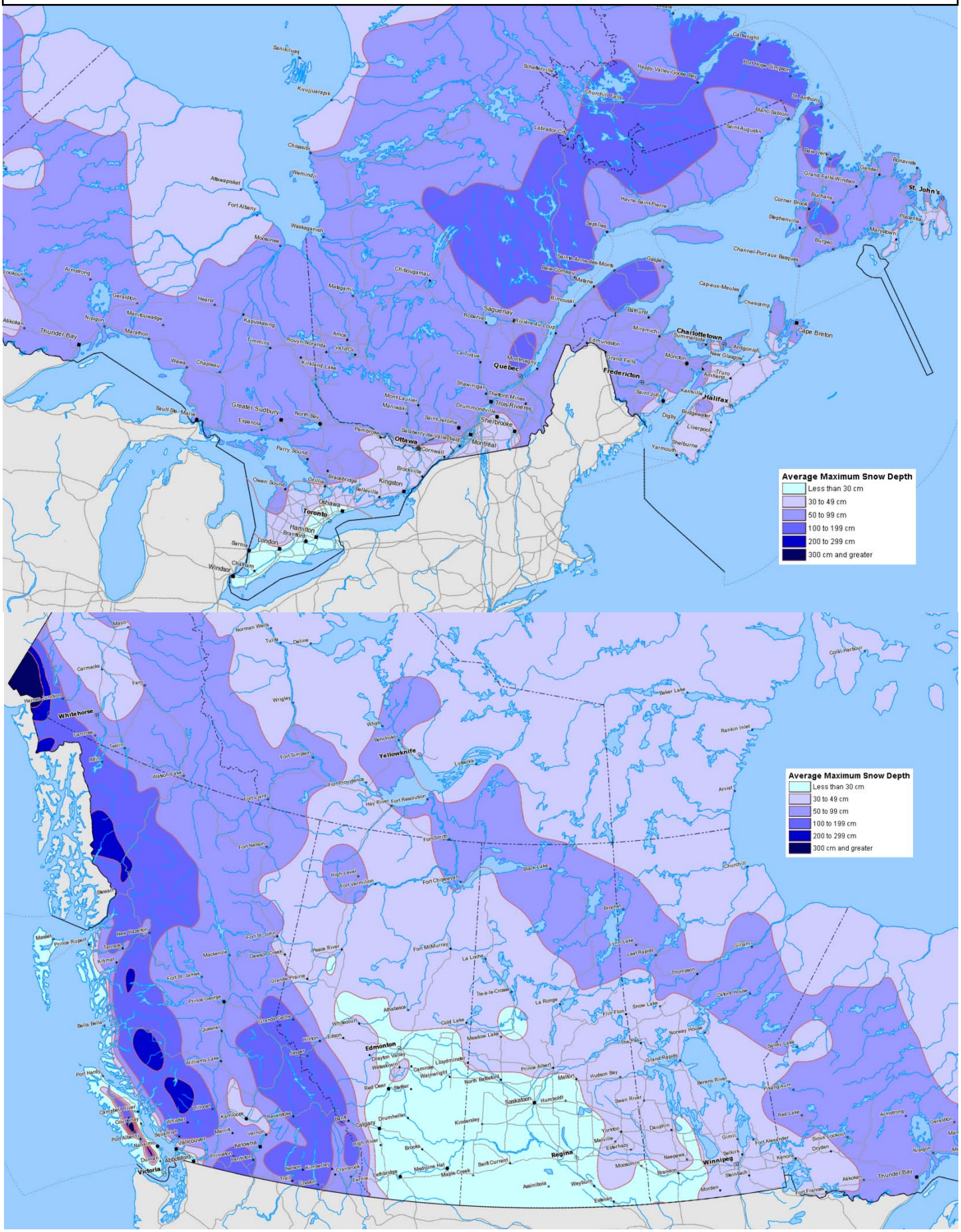
Outdoor Unit Wiring

Two cables need to be run from the indoor to outdoor unit: a signal cable and a power cable. See page 8 for details.

Note that the signal cable needs to be a **shielded** outdoor rated 8-conductor cable, of minimum 18 gauge (18-8). Since shielded thermostat/signal wire may not be a commonly stocked item at many wholesalers, rolls of this wire are available from Maritime Geothermal. If non-shielded wire is used, temperature readings and fan control may be compromised.

DIAGRAM C: Average Maximum Snow Depth - Canada (1979-1997)

Source: Natural Resources Canada



Outdoor Line Set Connection & Charging

Line Set Interconnect Tubing

The indoor unit connections for the interconnect line set are brass service valves with flared fittings.

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.

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

The outdoor unit has capped off (soldered) pipes from the factory and is charged with 15—25 psig of nitrogen. **The indoor unit comes pre-charged with enough refrigerant for a 20 ft (6.1 m) line set.** 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 line sizes are based on model size as per **TABLE 10**. The wrench size for access valve caps as well as the hex key size to open/ close the valves is indicated in the table as well.

TABLE 10 - Interconnect Line Set Sizing

	Liquid Line			Vapour Line		
Model Size	**Line Size**	**Hex Key**	**Cap Wrench**	**Line Size**	**Hex Key**	**Cap Wrench**
25/45	**3/8"**	**5mm (3/16")**	**19mm (3/4")**	**3/4"**	**5mm (3/16")**	**30mm (1-1/4")**
55/65/ 75	**1/2"**	**5mm (3/16")**	**19mm (3/4")**	**7/8"**	**8mm (5/16")**	**42mm (1-3/4")**
Valve service port caps wrench size is 14mm (9/16").						

Remove the side cover (if applicable) from the outdoor unit so that the piping is accessible. **001983CDG** is an illustration for a typical installation.

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. We recommend 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 will ensure minimum exposure to humidity in the atmosphere.

Oil Traps

If the lineset 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 **001983CDG.**

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 not be necessary 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 as per **TABLE 11**. 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 calculated amount of refrigerant from **TABLE 12 or TABLE 13.**

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, 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 11 - System Charge Chart

Model Size	lb	kg			
25	TBD	TBD	Extra length of line set (Models 25 and 45)	1.1oz per foot	0.10 kg per metre
45	7.5	3.4			
55	8.0	3.6			
65	10.0	4.5	Extra length of line set (Models 55, 65 and 75)	2.1oz per foot	0.18 kg per metre
75	11.0	5.0			

TABLE 12 - Extra Charge Chart (Sizes 25-45)

Total Lineset (ft)	Extra Charge (oz)	Extra Charge (lb)	Extra Charge (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
72	57	3.6	1.62
74	59	3.7	1.68

TABLE 13 - Extra Charge Chart (Sizes 55-75)

Total Lineset (ft)	Extra Charge (oz)	Extra Charge (lb)	Extra Charge (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
72	109	6.8	3.10
74	113	7.1	3.21

Typical ATW to Outdoor Unit Line Set Connections

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

Drawn By: Chris Geddes	Date: 9-Jun-2015	
Checked By: Chris Geddes	Date: 9-Jun-2015	
Eng. Approved By	Date	
Mfg. Approved By	Date	
Approved By	Date	

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Drawing Name: **Typical ATW to Outdoor Unit Line Set Connections**

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

Heat Pump Sizing

TABLE 14 contains a guideline to the size of home each air source heat pump size can handle.

TABLE 14 - Heat Pump Size vs. Heated Area

Model	sq.ft.	m^2
25	800	75
45	1,400	130
55	2,000	185
65	2,600	240
75	3,100	290

This is 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 PROPER HEAT LOSS/GAIN ANALYSIS BE PERFORMED BY A PROFESSIONAL WITH APPROVED CSA F-280 SOFTWARE BEFORE SELECTING THE SIZE OF UNIT REQUIRED FOR THE APPLICATION.

The analysis will result in a heat load for the coldest day, which is influenced by, for example, the number of levels, the size of the windows, the orientation of the home, attached garage, bonus rooms, walk-in basement, and coldest outdoor temperature for the region.

A heat pump model size can be selected by matching the calculated heat load to a heat pump's standard capacity rating at an outdoor temperature of 35°F (1.7°C), which is the AHRI $H2_2$ test condition. These are listed 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.

Hydronic Systems

Hydronic systems typically provide heat through two different types of media:

- radiant in-floor heating
- forced air heating via fan coil units

One of the benefits of hydronic systems is the flexibility in setting up the heating system. Whereas a typical forced air system has one central thermostat controlling the entire heating system, the home may be sectioned into several areas called zones with a hydronic system. Each zone has its own thermostat, allowing simple separate temperature control of the individual areas in the home.

There are other uses for hydronic systems, the two most common being on-demand domestic hot water and pool/spa heating. **Drawing 000530PDG** shows the most common types of zones. A typical system consists of the heat pump, the buffer tank and the zones. The heat pump's sole purpose is to maintain the buffer tank set point. Its operation is independent of the zone operation.

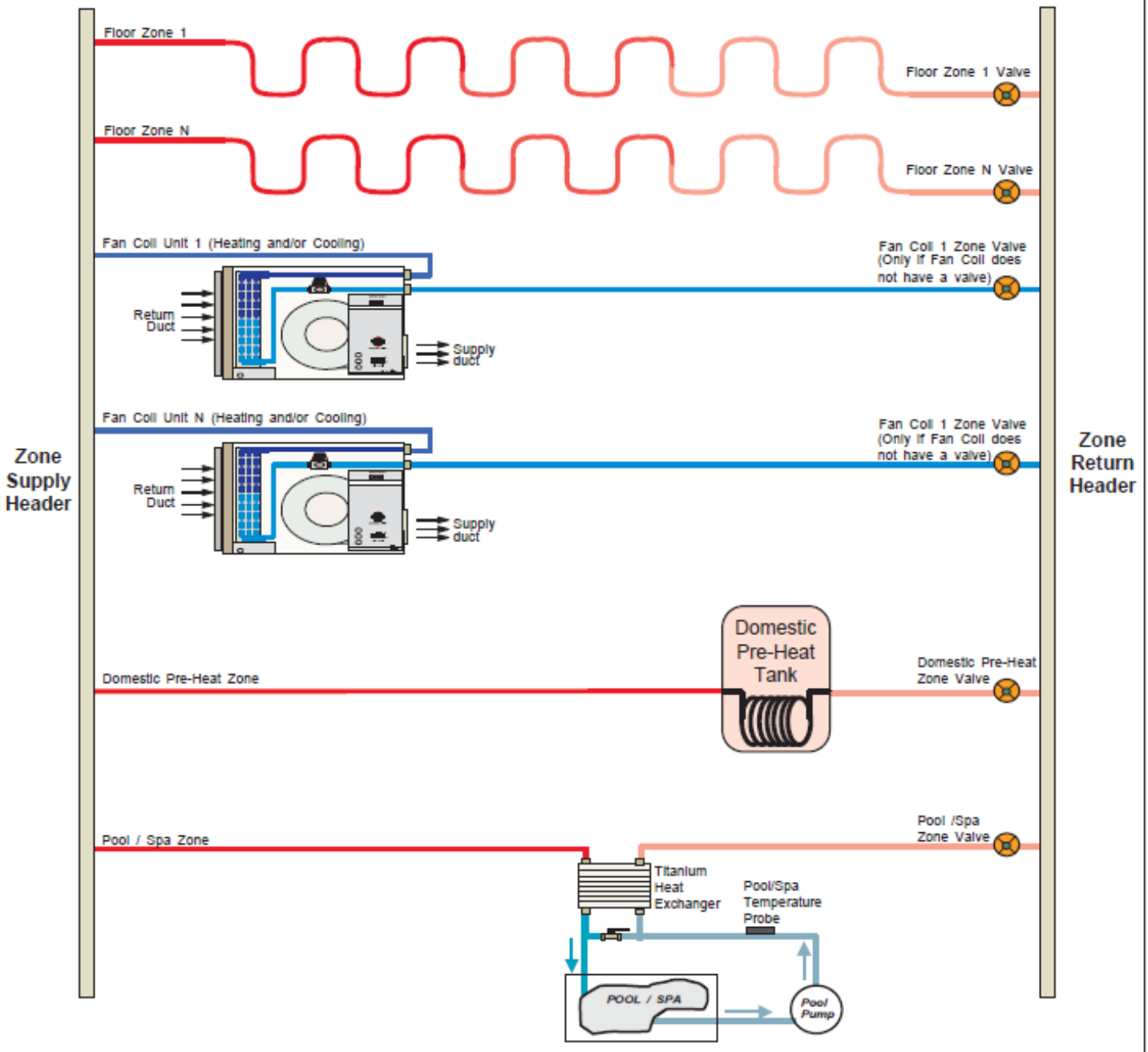
Drawings 001046PDG and 001981PDG earlier in this manual show typical piping configuration for a single unit with two port or four port buffer tank. This is a guideline for a simple installation. There are many other configurations, such as separate heating and cooling buffer tanks, multiple units connected to one buffer tank, etc. It is recommended that the hydronic system be designed by a qualified system designer to ensure proper functionality.

Fan coils can be used to provide heating and/or cooling for areas that do not have radiant in-floor heating. They provide a means of air heating/cooling with minimal or no ductwork. Note that the buffer tank temperature should be set for **115°F (46°C)** if there are fan coils in the system.

Two port fan coils are recommended for connection to the system if a single buffer tank is used for heating and cooling. For systems with separate hot and cold buffer tanks, **two port** fan coils are recommended for zones that provide only one function (heating or cooling), while **four port** fan coils are recommended for zones that heat and cool. These are simply suggestions, the fan coil selection will depend on the final system design.

It is recommended that all piping be insulated with 3/8" thick closed cell pipe insulation. This is a **MUST** for any piping that is used for cooling to prevent dripping onto floors and walls. Care should be taking when wiring the system to ensure that radiant in-floor heating zones are disabled whenever the heat pump is switched to cooling mode.

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.
Pettcodiac, NB
E4Z 6H4

Drawing Name: Typical Zone Types for Hydronic Applications

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

System Operation

General Overview

The ATW-Series heat pumps are reversing air to water heat pumps. The refrigeration circuit diagrams for the units can be found in the **Model Specific Information** section of the manual. The system consists of an indoor unit and an outdoor unit. The outdoor unit contains only an air coil and ECM fan, the heating mode EEV, along with the outdoor temperature sensor. The remaining components are found in the indoor unit, including the compressor (which is unlike most air-source systems). This has several advantages, for example minimal work must be done outside, important components are in the conditioned space for longevity, and domestic hot water (desuperheater circuit) is possible as the lines are inside and will not freeze. The system is controlled as selected by the Control Source parameter (BACnet, Setpoints or Signals).

Heating Operation

In heating mode the unit provides hot water to the buffer tank. Superheat is controlled by the heating EEV located in the outdoor unit while the EEV in the indoor unit is set to full open. As the unit operates, heat is extracted from the outdoor air, which causes the air coil to eventually frost up to the point that a defrost cycle is required. The time between defrost cycles varies depending on the outdoor conditions; refer to the **Defrost Operation** section below. If the outdoor temperature is above 34°F(1°C), the outdoor unit fan starts and stops when the heat pump starts and stops. If the temperature is below 34°F(1°C), the fan will remain on at a very slow speed when the heat pump is off in order minimize the chance of a fan freeze up as well as help prevent snow from entering the unit through the fan opening during a snow storm. The outdoor fan is controlled based on the suction pressure and will slowly ramp up to the required speed when the system starts. The heat pump will turn off and only the auxiliary heating system will operate if the outdoor temperature gets too cold. Refer to the **Model Specific Information** section for the limits of operation.

Cooling Operation

In cooling mode the unit provides chilled water to the buffer tank. Superheat is controlled by the cooling EEV located in the indoor unit while the EEV in the outdoor unit is set to full open. As the unit operates, heat is extracted from the buffer tank and rejected to the outdoor air. 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. The discharge pressure will begin to rise above the setpoint when the outdoor temperature exceeds the point at which the outdoor fan speed reaches its maximum value. Two stage units will drop down to the first stage to reduce the discharge pressure at elevated outdoor temperatures. Refer to the **Model Specific Information** section for the limits of operation. There is no defrost cycle when in cooling mode.

Defrost Operation

The ATW series heat pump has an advanced defrost control algorithm intended to provide a minimal number of defrosts and minimal defrost cycle time while achieving complete defrost The outdoor unit's unique design also has excellent resistance to coil freeze-ups and potential future coil damage as a result of repeated freeze ups.

The system uses the outdoor temperature and suction pressure to determine when a defrost cycle should occur as well as how long it should be. PID fan control allows the discharge pressure to rise quickly and then be maintained at a desired setpoint for quick defrosting. A "defrost disabled" period occurs after a defrost cycle which allows a potential problem with the unit to be identified as an alarm and prevents repetitive defrost cycles if this is in fact the case.

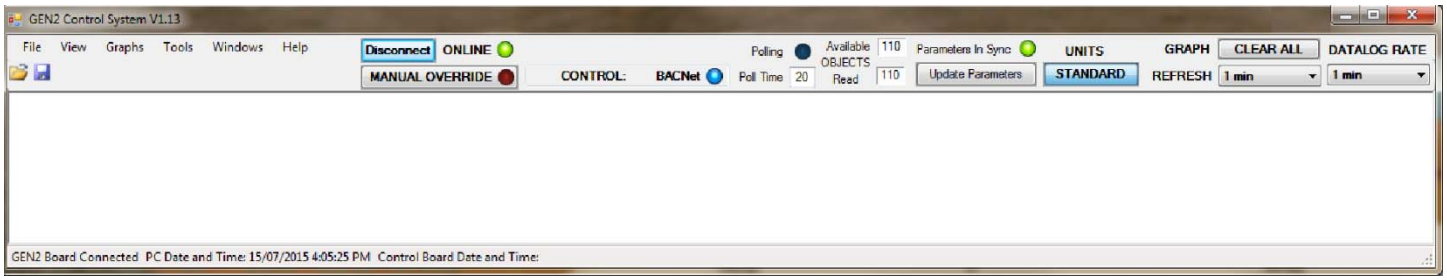
The outdoor unit has a unique design for combatting ice build up, a common problem with air source units. The coil sits on a 15° angle and the area below the coil is completely open. The angle causes the melting frost/snow to run down the back of the coil which creates a single line of run off along the back bottom edge of the coil rather than a runoff from the entire bottom of the coil. This concentrates the "weight" of the runoff over a much smaller area and thus run off occurs more quickly and at a higher velocity, minimizing the amount of runoff that remains trapped at the bottom of the coil due to surface tension between the coil fins. Any leftover runoff will freeze during the next heating cycle so it is extremely important to minimize this. Since the coil is on an angle, the comparatively small amount of runoff left versus a traditional flat coil is actually only around the back corner of the coil, making it virtually impossible for runoff to remain between coil two pipes and freezing between them, a common cause of eventual coil failure.

PC Application (PC App)

NOTE: Before using the PC Application refer to Appendices B and 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. Double click on the NordicGEN2Vx.xx application 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 five main menus: ***File, View, Graphs, Tools, 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.

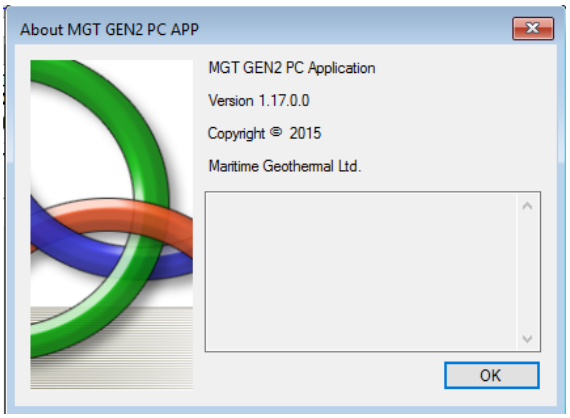
File—Open: Opens a saved page arrangement.
File—Save: Saves the current page arrangement under the current name.
File—Save As: Save the current page arrangement under a new name.
File—Exit: Exits the PC Application.

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.
Windows— Window Name: Brings the named open window to the front.

Help Menu: This simply 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 screen page will open, shown below.

View—Defrost History: The defrost history window will open, shown below. Same as clicking on History on main screen.

View—Stage Stats: The compressor information: number of starts, run hours and starts per hour, shown below.

Heat pump model information.

Operational status of the heat pump system.

Manual controls are enabled when in MANUAL OVERRIDE mode.

Indicators show the demand from the control system.

Compressor information, refer to ***Stage Statistics*** window shown below.

Auxiliary information. Status light indicates when in use.

Refrigeration system pressure data, along with alarm indicators.

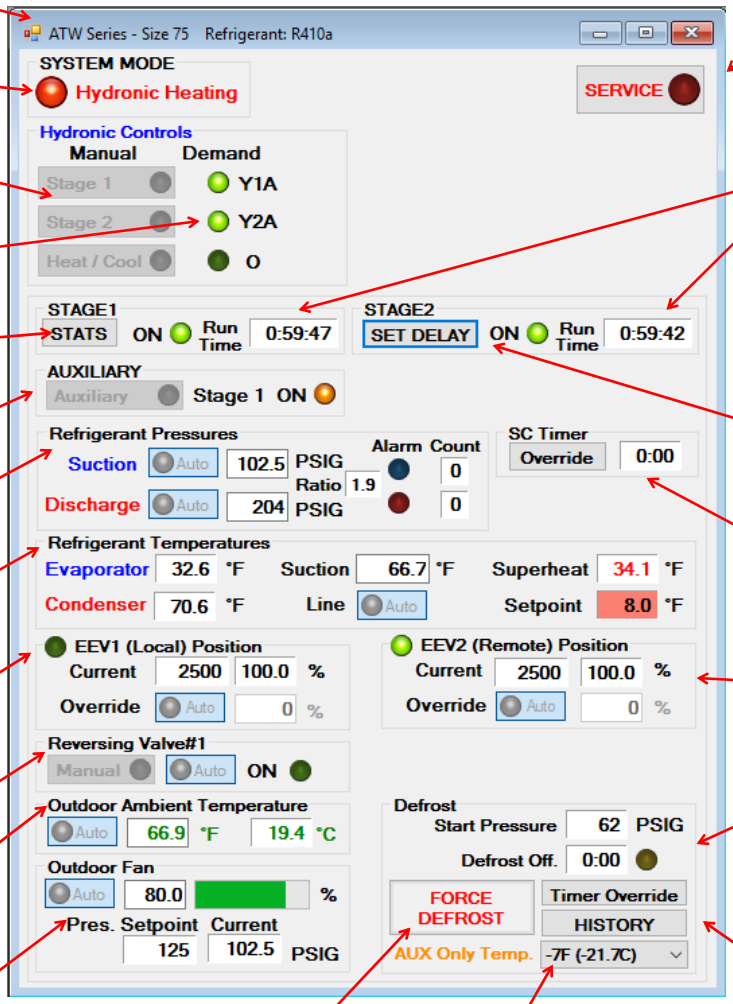
Refrigeration system temperature data.

Indoor EEV. Status light indicates when in use.

Reversing valves. Status light indicates when in use.

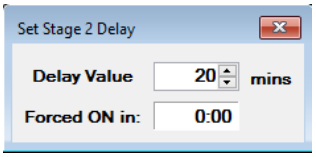
Outdoor temperature (sensor located in Outdoor Unit)

Outdoor fan speed, setpoint pressure and current pressure.



Clicking the SERVICE button will disable the unit and fully open both EEV's to allow repair work to be done to the refrigeration system.

Stage run timers.



Force Stage2 on after Stage1 has been operating for x minutes. Set to 0 to disable this functionality.

Short Cycle timer and override button for when unit is being serviced.

Outdoor EEV. Status light indicates when in use.

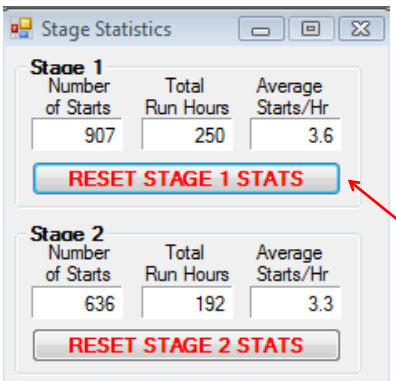
Defrost data: start pressure at which defrost will be triggered, timer for defrost cycle and defrost disabled cycle. Override button for when unit is being serviced.

History button opens Defrost History window.

Force a defrost cycle to occur immediately.

Selectable temperature at which compressor is disabled.

Click on **STATS** button or menu ***View-Stage Stats*** to open the window below.



Export the history as tab delimited.

Clear the defrost history log.

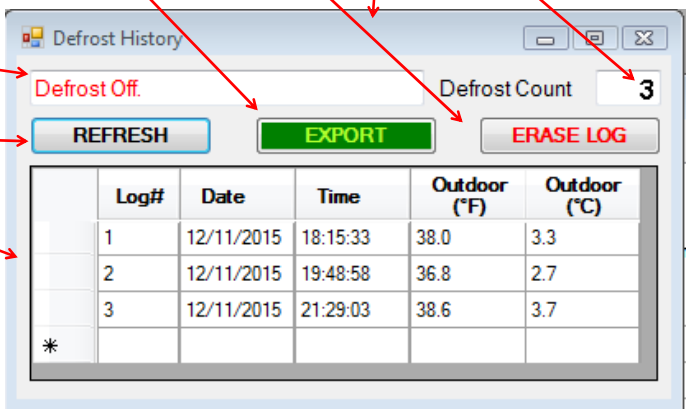
Number of defrosts since history was last erased.

Real-time display of defrost state.

Refresh button reloads the defrost log.

Defrost history log.

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



View—Alarms: The alarms page has three tabs, the first shows the current alarm status, number of alarms, high and low refrigeration alarm cutout values as well as the short cycle timer. The second tab shows a list of alarms that have occurred since the PC APP has been operating (this will be lost when the PC is disconnected from the controller board.) The third tab is a list of board hardware faults.

RESET button: This will reset all alarms and alarm counts, including a permanent alarm.

WARNING: Repeated resets can freeze and rupture the heat exchanger, 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.

ALARMS Tab (see screen shot on next page):
NOTE: Greyed out Alarms in the PC APP are not applicable to the system setup and are not monitored by the control board.
NOTE: Refer to Alarms and Faults screenshot below to see which alarms have a count.

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

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

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

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

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

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

Compressor Monitor: This alarm occurs when the compressor protection module sends a fault signal to the control board, generally due to the compressor windings overheating.

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

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

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

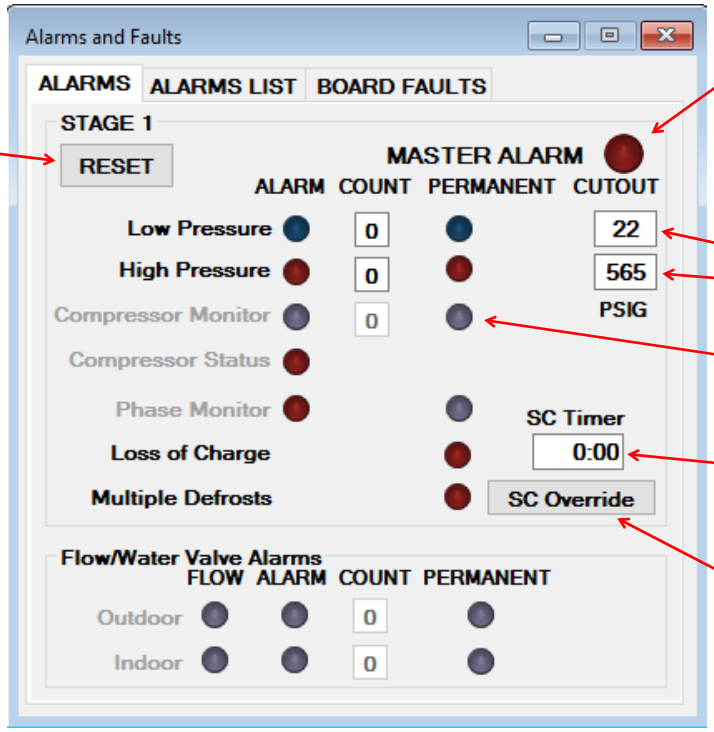
Multiple Defrosts: This alarm occurs if a second defrost occurs immediately after the defrost disabled timer elapses from a previous defrost cycle.

Outdoor Flow: This alarm is ignored on compressor start for the number of seconds the Outdoor Flow ***Ignore on Start*** is set to. Alarm monitoring will begin when the timer expires.

Indoor Flow: This alarm is ignored on compressor start for the number of seconds the Indoor Flow ***Ignore on Start*** is set to. Alarm monitoring will begin when the timer expires.

IMPORTANT NOTE: The datalogging 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.

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



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

Master Alarm occurs when any alarm occurs.

Low Pressure Cutout.
High Pressure Cutout.

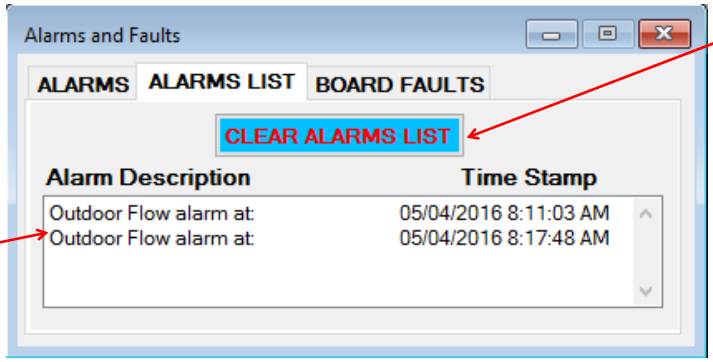
Greyed out alarms are not applicable to the system.

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.

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.

BOARD 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 or with the LCD Display and buttons.

NOTE: If a Board Fault occurs, try cycling the power to the heat pump. Turn the power off for 10 seconds and then back on again. If the fault persists then there is most likely a problem with the hardware and the board will need to be replaced.

Digital Inputs: A failure has occurred and the Control Board may no longer respond to the digital input signals.

Digital Outputs: A failure has occurred and the digital outputs may no longer work properly.

PWM Outputs: A failure has occurred and the PWM / 0-10VDC outputs may no longer work properly.

Analog to Digital: A failure has occurred and the data from the A/D converter may be corrupt resulting in erratic data values.

Real Time Clock: A failure has occurred, system time / date may no longer be valid, all time stamped data may be corrupt.

Flash Memory: A failure has occurred 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 setup again.

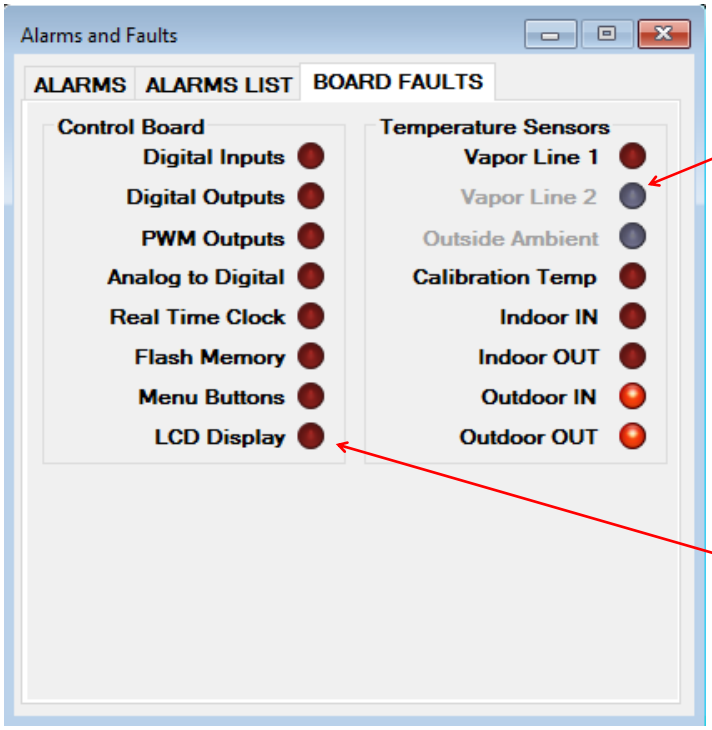
Menu Buttons: A failure has occurred and the Control board may no longer respond to menu button keypresses. Try turning off the power, disconnecting and reconnecting the cable between the LDC Display board and the Control Board and then turning the power back on again. If this does not work then either the LDC Display board, the cable or the driver section of the Control Board may be faulty.

LCD Display: A failure has occurred and display may show erratic data, no data or may not turn on at all. Try turning off the power, disconnecting and reconnecting the cable between the LDC Display board and the Control Board and then turning the power back on again. If this does not work then either the LDC Display board, the cable or the driver section of the Control Board may be faulty.

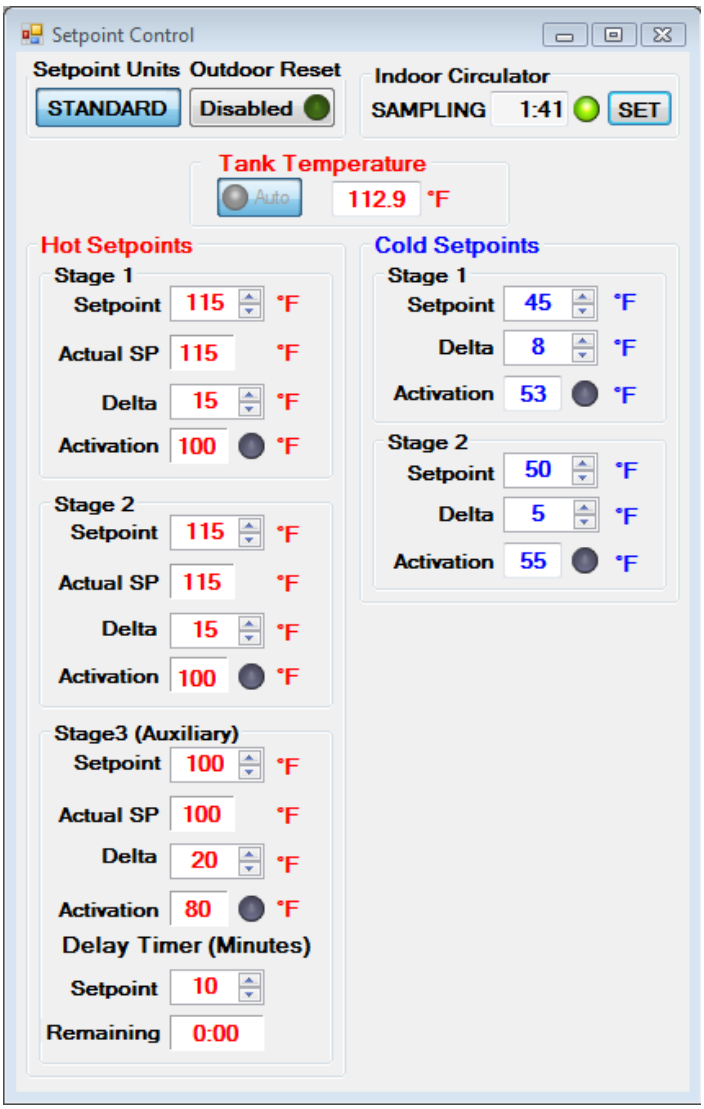
Temperature Sensors: A failure has occurred or the sensor is disconnected. Greyed out sensors do not to apply to the system as configured. Some sensors may be optional, go to the Configuration Page to enable/disable them.

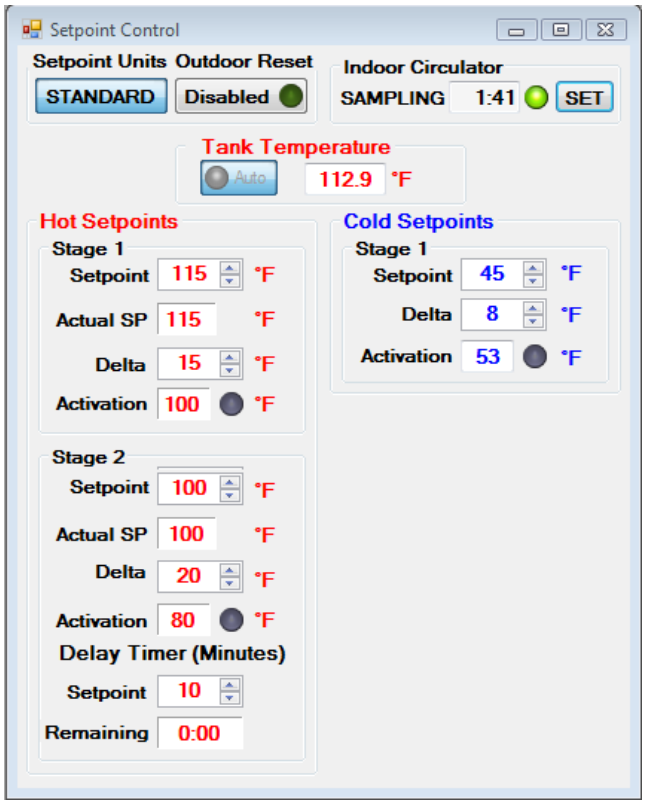
IMPORTANT NOTES: The heat pump will not operate if the Outdoor Ambient probe (HTS) is faulty or disconnected. The auxiliary will continue to operate but it's sepoint value may be reduced if using the Outdoor Reset function.

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

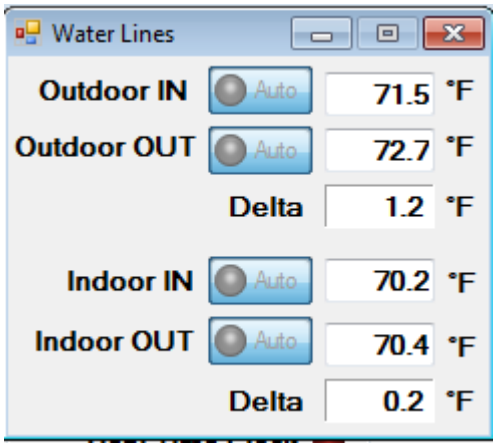


View—Setpoint Control : Shows the on-board aquastat control screen. This screen is only available when **Control Source HYD** on the Configuration Page is set to **Setpoints**. This screen is described in detail in the Setpoint Control section of the manual. The screens below show a two-stage model on the left and a single stage model on the right. Refer to the **SETPOINT CONTROL** section of the manual for a complete description of operation.

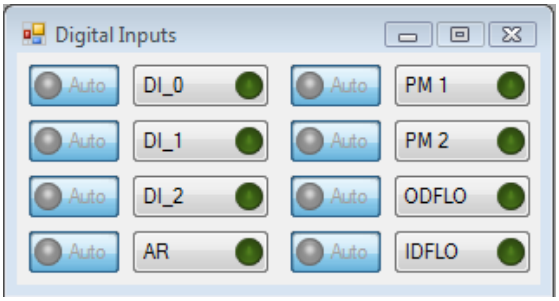




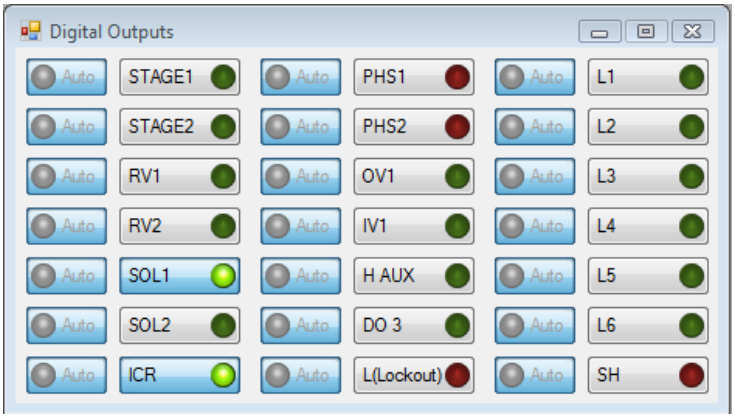
View—Water Lines: Shows the water line temperatures. For the ATW series, the Indoor IN and Indoor OUT are connected to the water lines inside the unit. The Outdoor lines are unused.



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 trouble shooting.

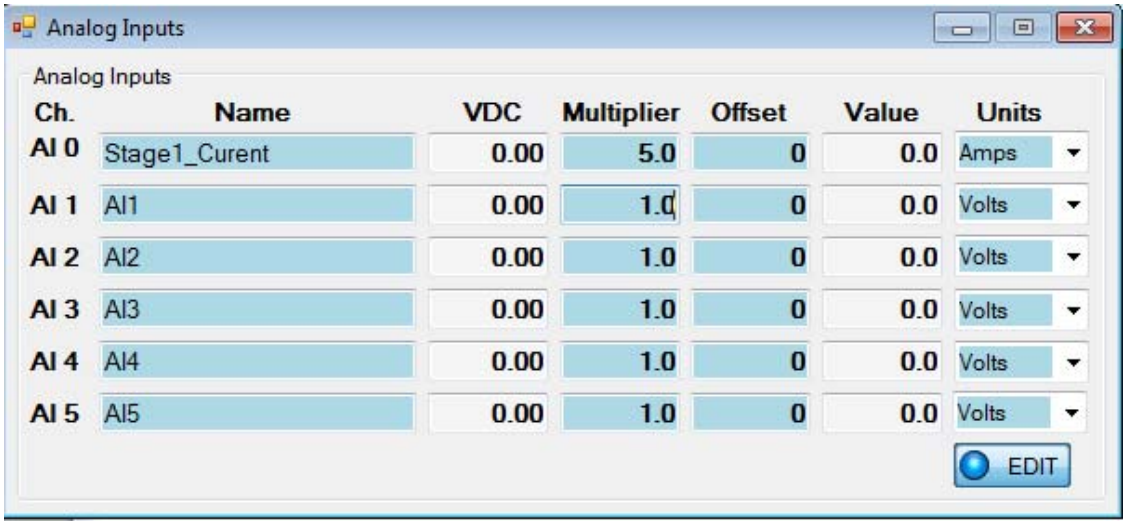


View—Digital Outputs: Shows the digital outputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate trouble shooting.

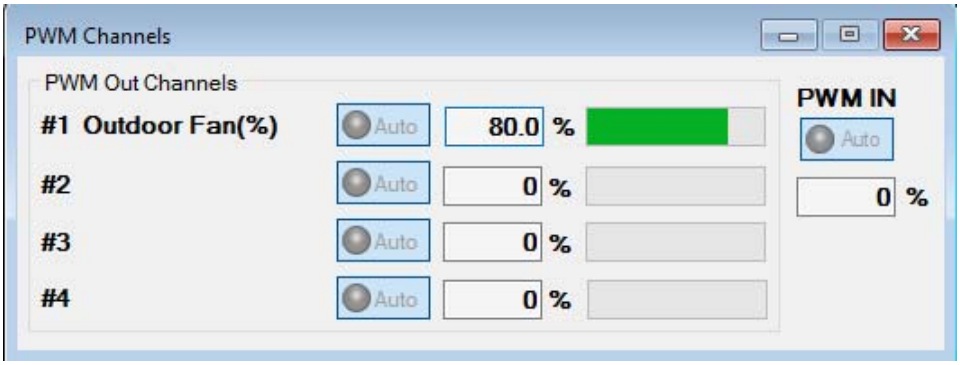


View—Analog Inputs: Shows the Analog inputs and their individual settings and values.

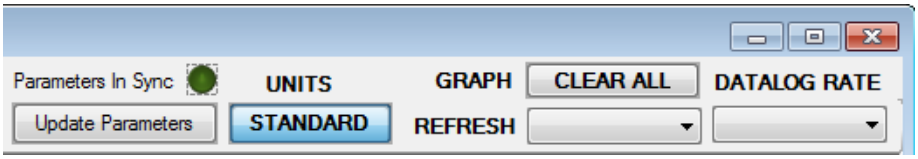
Click on the ***EDIT*** button to modify the blue boxes (button will now say ***SAVE***). For each channel a name may be selected (up to 16 characters), and the multiplier and Offset values may be set to accommodate the connected sensor scaling. Signals may be 4-20mA (channel jumper on board ON) or 0-10VDC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



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 when the graph was Screen Printed. Each graph has a CLEAR button which will erase the stored data and restart the graph. There is also a master CLEAR ALL button at the top right of the PC APP, this will clear all open graphs and re-start them all simultaneously to keep them in sync with each other. The refresh rate for the graphs is also located at the top right of the PC APP.



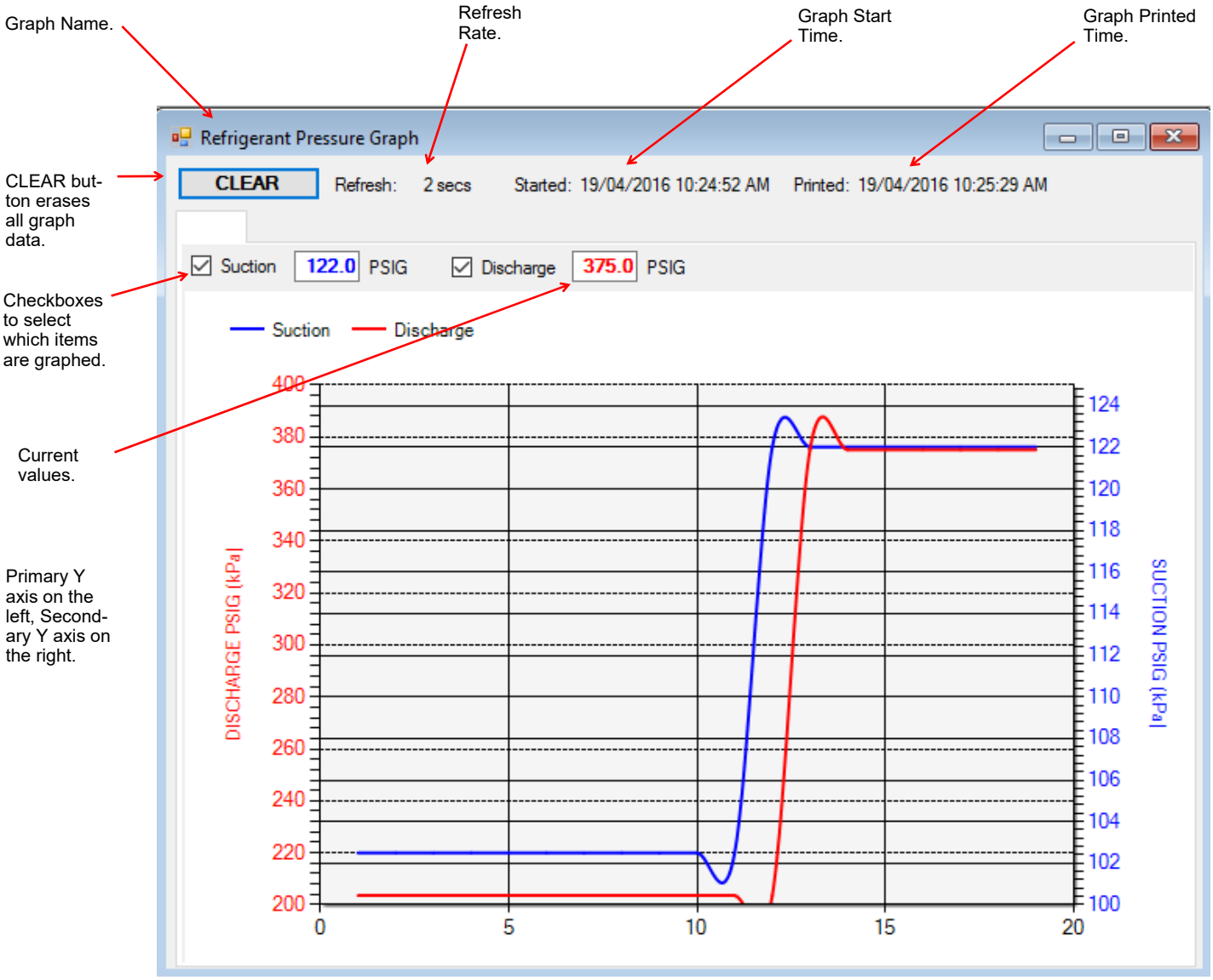
TIP: To screen print a graph and save it as a picture, press Print Screen and then paste the clipboard into MS Paint. Select the desired graph with the selection tool and copy it to a new MS Paint, then save the file as the desired name.

Here is the complete list of available graphs:

Graph—	
Control Signals Graph:	ON/OFF status of the system control signals.
EEV Graph:	EEV position, the suction line temperature and superheat.
Refrigeration Pressures Graph:	Suction and discharge pressures.
Refrigeration Temperatures Graph:	Evaporation and condensing temperatures.
Outdoor Fan Graph:	Suction (heating) or Discharge (Cooling and defrost) pressure vs outdoor fan speed.
Outdoor Temperature Graph:	Suction (heating) or Discharge (Cooling and defrost) pressure vs outdoor temperature.
Water Lines Graph:	Indoor IN, Indoor OUT and Indoor Delta T values.
Discharge vs Hot Tank Graph:	Discharge pressure vs tank temperature.
HTS CTS Graph:	For control systems using the HTS and/or CTS probe(s).
Analog Inputs Graph:	All six analog input channels (0-10VDC or 4-20mA).
PWM Channels Graph:	All four PWM / 0-10VDC output channels as well as one PWM / 0-10VDC input channel.
Input Power Graph *:	For future use.

An example of a graph is shown on the next page.

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



X axis = Number of samples.
Elapsed time = Number of Samples x Refresh rate.
ie 20 samples by 1second refresh = elapsed time of 20seconds.

Tools Menu: This is a list of the various tools are used for system setup and monitoring.

Tools—Configuration: This is where the system setup is done. **THIS SHOULD BE DONE ONLY BY A QUALIFIED INSTALLER**. Improper settings could cause the system to operate poorly or not at all.

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

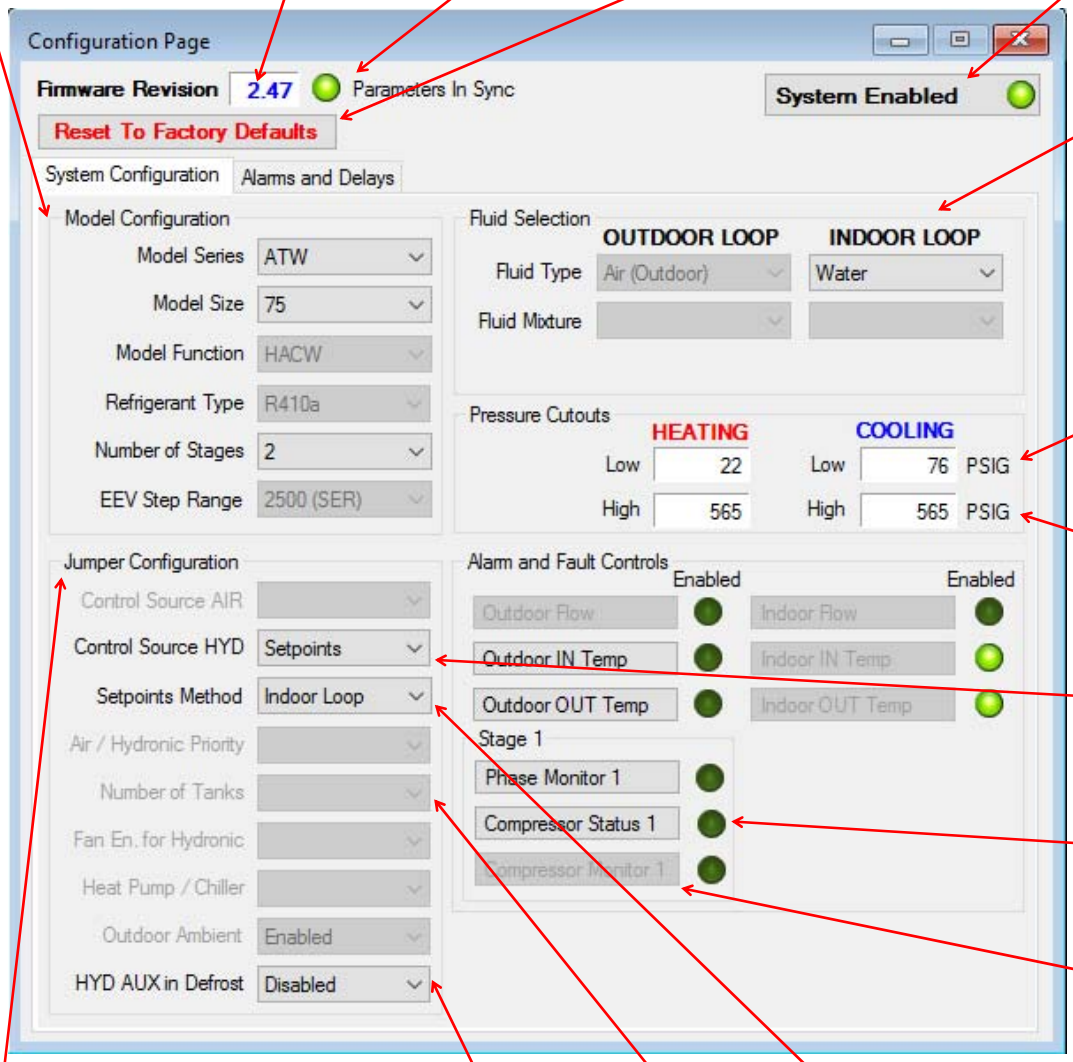
Model Configuration is used to select the system type.

Firmware Revision can also be seen on the LCD Display during power up.

Green when parameters have been updated, red during the update.

Clicking this will reset the saved parameters to the default values. The configuration will need to be completed afterwards.

Enable/Disable the compressor. Units are shipped as Disabled to prevent an unintentional compressor startup.



Fluid selection determines the low pressure cutout value. Select the appropriate Fluid Type and Fluid Mixture **by volume**.
SEE WARNING ABOVE.

Low pressure cutouts are determined by the combination of Refrigerant Type, Fluid Type and Fluid Mixture.

High pressure cutouts are determined by Refrigerant type.

Control Source HYD selects how the system will be controlled. The options are: BACnet, Setpoints and Signals.

The Enabled Indicators show which alarms are enabled and which are disabled .

If an alarm is standard or not available the Enable button will be greyed out. If an alarm is optional (may require accessory items) the Enable button will be accessible, click on it to enable the alarm.

Jumper configuration is used to select system options. Items that do not pertain to the type of system selected are greyed out.

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

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

Selects whether or not to use the internal temp sensor (default) or external sensor(s) **This is for Setpoint Control operation only.**

The following describes each item on the **Configuration Tab** of the **Configuration Page** .

IMPORTANT NOTE: System setup is done at the factory. Normally, only the control source, optional alarms and fluid type / fluid mix may need to be changed. Note that items that become unavailable or are automatically selected will be greyed out.

Model Configuration: These are used to select the type of heat pump the control board is installed in.

Model Series: Select the model series (refer to nameplate on unit) This will update remaining items to default values.

Model Size: Select the model size (refer to nameplate on unit).

Model Function: Select the model function (refer to the nameplate on the unit).

Refrigerant Type: Select the refrigerant type (refer to the nameplate on the unit).

Number of Stages: Select the number of stages (refer to the compressor model: ZP = 1 stage, ZPS = 2 stage).

EEV Step Range: Automatically selected.

Jumper Configuration: These are system level settings.

Control Source AIR: Not Applicable.

Control Source HYD: Select desired control source:

- ***BACnet:*** System is controlled via BACnet MS/TP RS-485 Interface. Refer to the **BACnet Interface** Section of the manual for more information.
- ***Signals:*** System is controlled via hardwired signals from an external source. Refer to the **Thermostat Requirements** section of the manual for more information.
- ***Setpoints:*** System is controlled via on-board aquastat functionality. Refer to the **Setpoint Control** section of the manual for more information.

Setpoints Method: Applicable only if ***Setpoints*** selected for ***Control Source HYD***. Select ***Indoor Loop*** (default) for the Indoor Circulator Sampling method or ***HTS / CTS*** to use external probes mounted in tanks.

Air/Hydronic Priority: Not Applicable.

Number of Tanks: Applicable only if ***Setpoints*** selected for ***Control Source HYD*** and ***HTS / CTS*** selected for ***Setpoints Method*** and a reversing model ***(HAC or HACW)***. Select ***One*** for single tank systems or ***Two*** for sys tems with a hot and cold tank.

Fan En. For Hydronic: Not Applicable.

Heat Pump / Chiller: Not Applicable.

HYD AUX in Defrost: Selects whether or not the hydronic auxiliary heat is activated during defrost mode (default is disabled).

Fluid Selection: Used to select the Indoor and Outdoor fluid types and volume mixture ratios.

Fluid Type (Outdoor): Automatically Selected.

Fluid Mix (Outdoor): Automatically Selected.

Fluid Type (Indoor): Select appropriate fluid type to match the antifreeze type (or water) in the loop.

Fluid Mix (Indoor): Select fluid mixture ratio (by volume). Greyed out if ***Fluid Type*** is water.

Pressure Cutouts: Automatically Selected based on ***Refrigerant Type***, ***Fluid Type*** and ***Fluid Mixture***.

Alarm Controls: These are optional or automatically selected alarms. If a button is greyed out and the Enabled Indicator is on the alarm is automatic, if the Enabled Indicator is off then the alarm is not available. Buttons that are not greyed out are optional alarms.

Outdoor Flow: Not Applicable.

Indoor Flow: Not Applicable.

Outdoor IN and OUT: Automatically selected.

Indoor IN and OUT: Automatically selected.

Phase Monitor1: Optional, for three-phase models only, requires Phase Monitor accessory.

Compressor Status1: Optional, requires current sensor accessory.

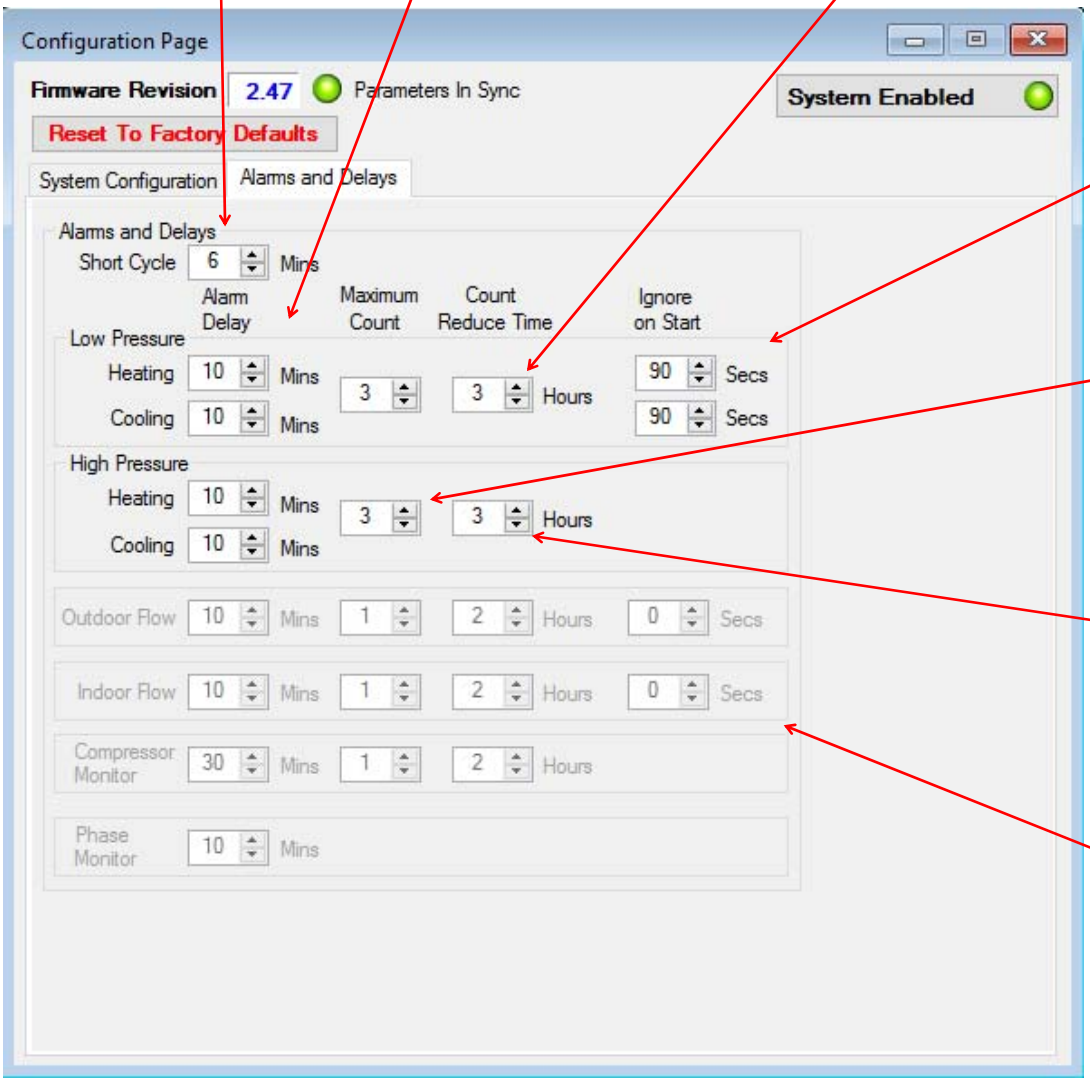
Compressor Monitor1: Not Applicable.

The screenshot below shows the Alarms and Delays tab of the Configuration Page. Click on the UP/DOWN arrows to change the value, note that values have both a low and high limit. Once values have been selected, click on APPLY to save the changes, a confirmation window will appear (see below), click on OK.

Short Cycle Delay is the number of minutes before the unit can start again after a normal shutdown.

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

Click on UP/DOWN arrows to adjust values within the range limits.



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

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

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

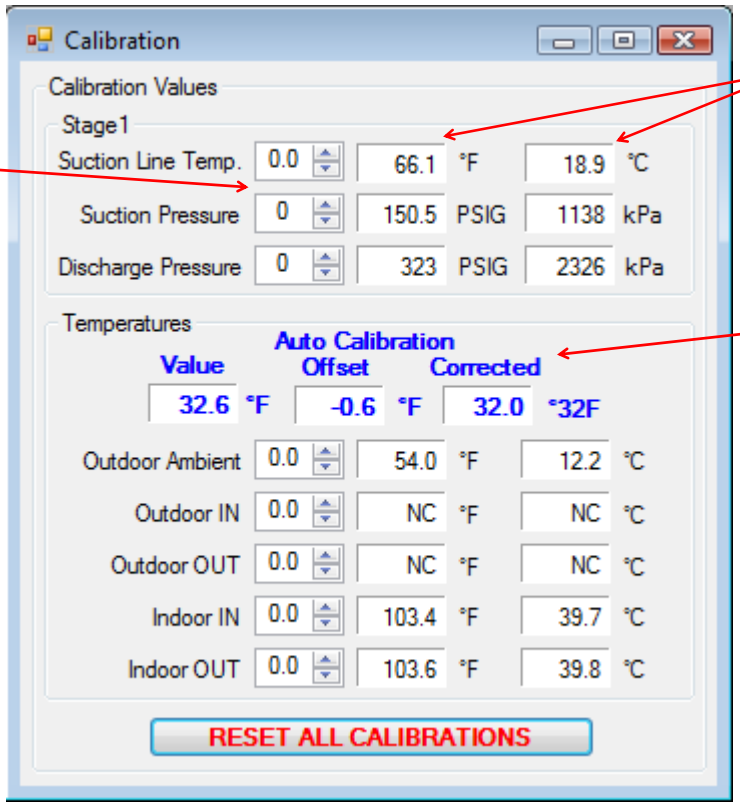
Items that do not apply to the model are greyed out.

Tools—Calibration: **NOTE: Generally there is no need for calibration.**
The suction and discharge pressures may be calibrated in increments/decrements of 1PSIG if there is a discrepancy in the readings when compared to a known good reference.

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

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

Calibration Adjustment. Pressures are +/-1PSIG, temperatures are +/- 0.1°F.

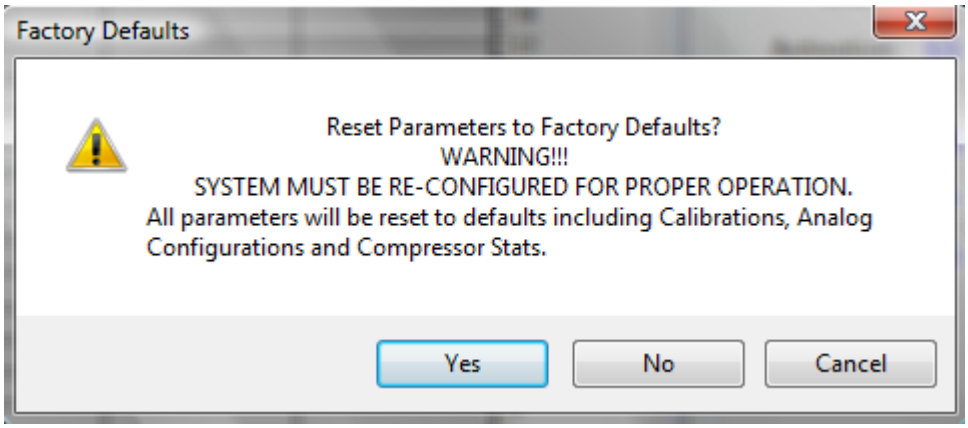


Current values in standard and metric.

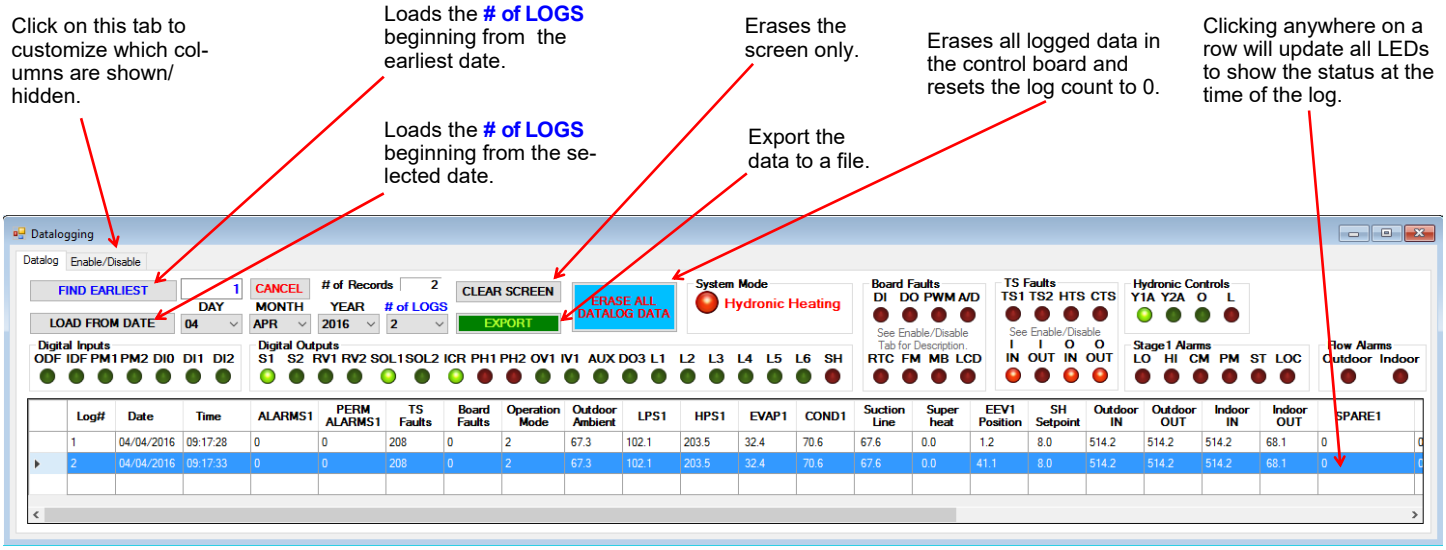
Temperature Auto Calibration information. The offset is applied to the temperature sensors. Calibration adjustments made here are in addition to the Auto Calibrated Values.

Tools—Set Date and Time: This will synchronize the date and time of the Control Board with the PC date and time. The Date and time of both the PC and the Control Board are shown in the status bar at the bottom of the APP. Click on the **Control Board Date and Time(Click):** button to show/refresh the control board date and time.

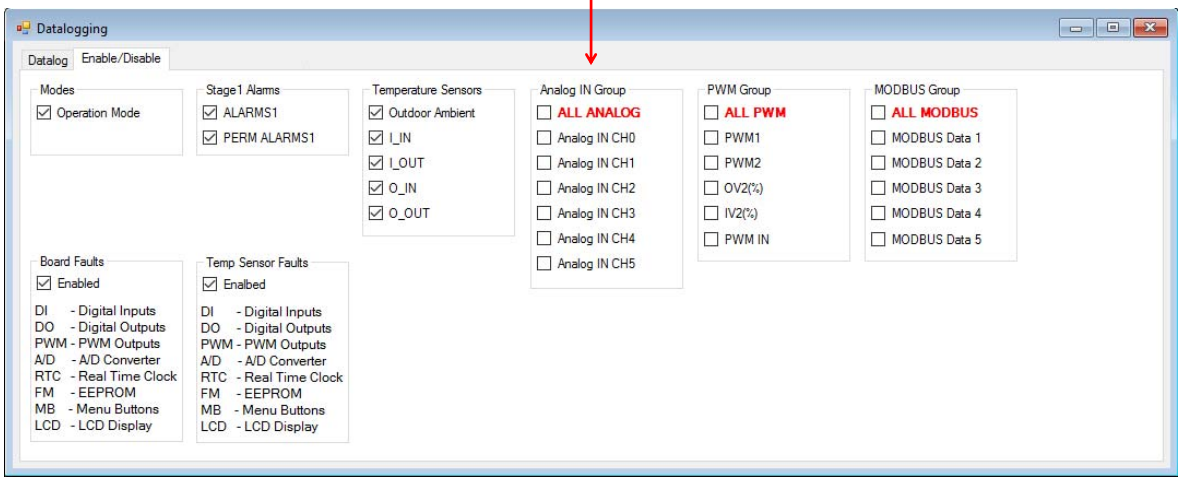
Tools—Reset to Factory Defaults: This will reset all parameters to default values. **THE SYSTEM MUST BE RECONFIGURED AFTER A RESET IS PERFORMED.** A reset will default the system to a two stage ATW Series Size 65 with Signals as the control source. Calibrations, alarm delays, analog configurations, compressor statistics and Setpoint Control values will be returned to defaults as well.



Tools—Datalogging: This will display the on-board datalogging screen. The datalog rate is set via the dropdown box at the top right of the APP. A log will be taken at the datalog rate whenever the system is operating or the system is off and the SC Timer is counting down. It will stop taking logs after the SC Timer expires until the system restarts again. It will stop taking logs when a permanent alarm occurs. The functionality of the screen is described below. Click on the Enable/Disable tab to customize which columns are shown/hidden.



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

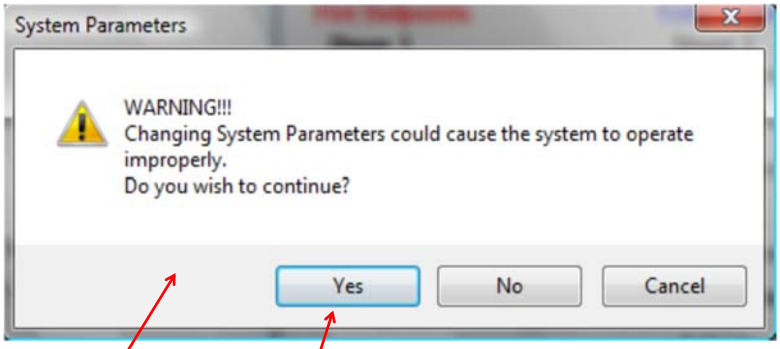


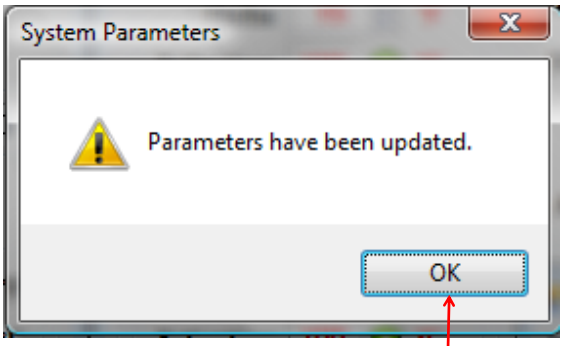
Tools—Set Date and Time: This will synchronize the date and time of the Control Board with the PC date and time. The Date and time of both the PC and the Control Board are shown in the status bar at the bottom of the APP. Click on the **Control Board Date and Time(Click):** button to show/refresh the control board date and time.

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 ATA 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—MODBUS: For Future Use.

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.



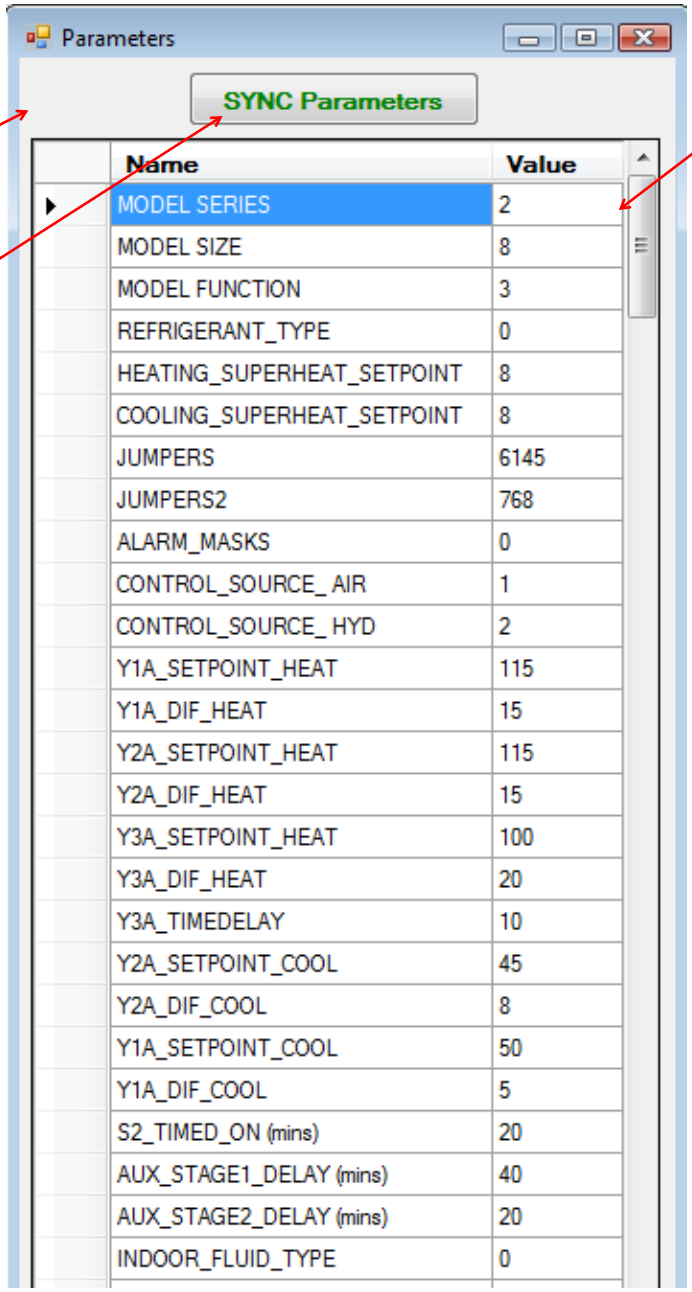


Clicking on menu item ***Tools—Parameters*** will display this warning.

Click on YES to open the parameters page.

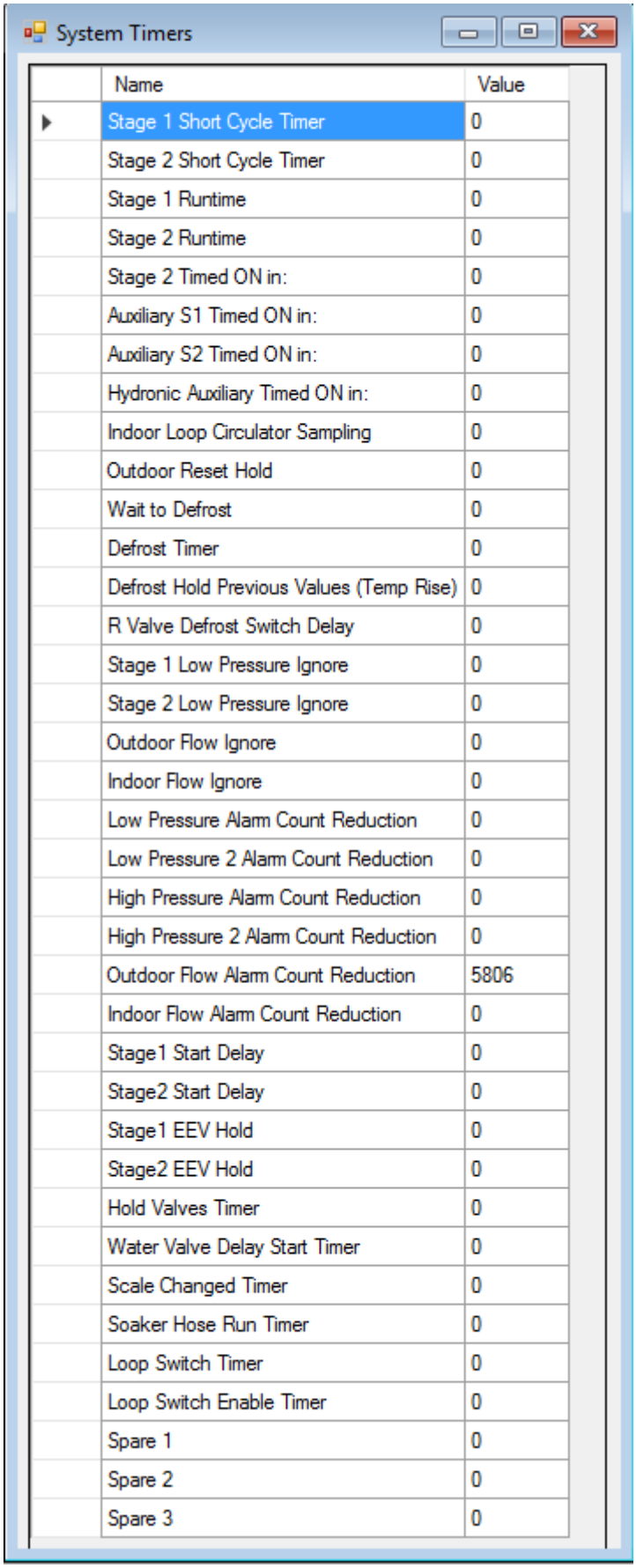
Click this button to reload the table with the values from the control board memory.

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



Name	Value
MODEL SERIES	2
MODEL SIZE	8
MODEL FUNCTION	3
REFRIGERANT_TYPE	0
HEATING_SUPERHEAT_SETPOINT	8
COOLING_SUPERHEAT_SETPOINT	8
JUMPERS	6145
JUMPERS2	768
ALARM_MASKS	0
CONTROL_SOURCE_ AIR	1
CONTROL_SOURCE_ HYD	2
Y1A_SETPOINT_HEAT	115
Y1A_DIF_HEAT	15
Y2A_SETPOINT_HEAT	115
Y2A_DIF_HEAT	15
Y3A_SETPOINT_HEAT	100
Y3A_DIF_HEAT	20
Y3A_TIMEDELAY	10
Y2A_SETPOINT_COOL	45
Y2A_DIF_COOL	8
Y1A_SETPOINT_COOL	50
Y1A_DIF_COOL	5
S2_TIMED_ON (mins)	20
AUX_STAGE1_DELAY (mins)	40
AUX_STAGE2_DELAY (mins)	20
INDOOR_FLUID_TYPE	0

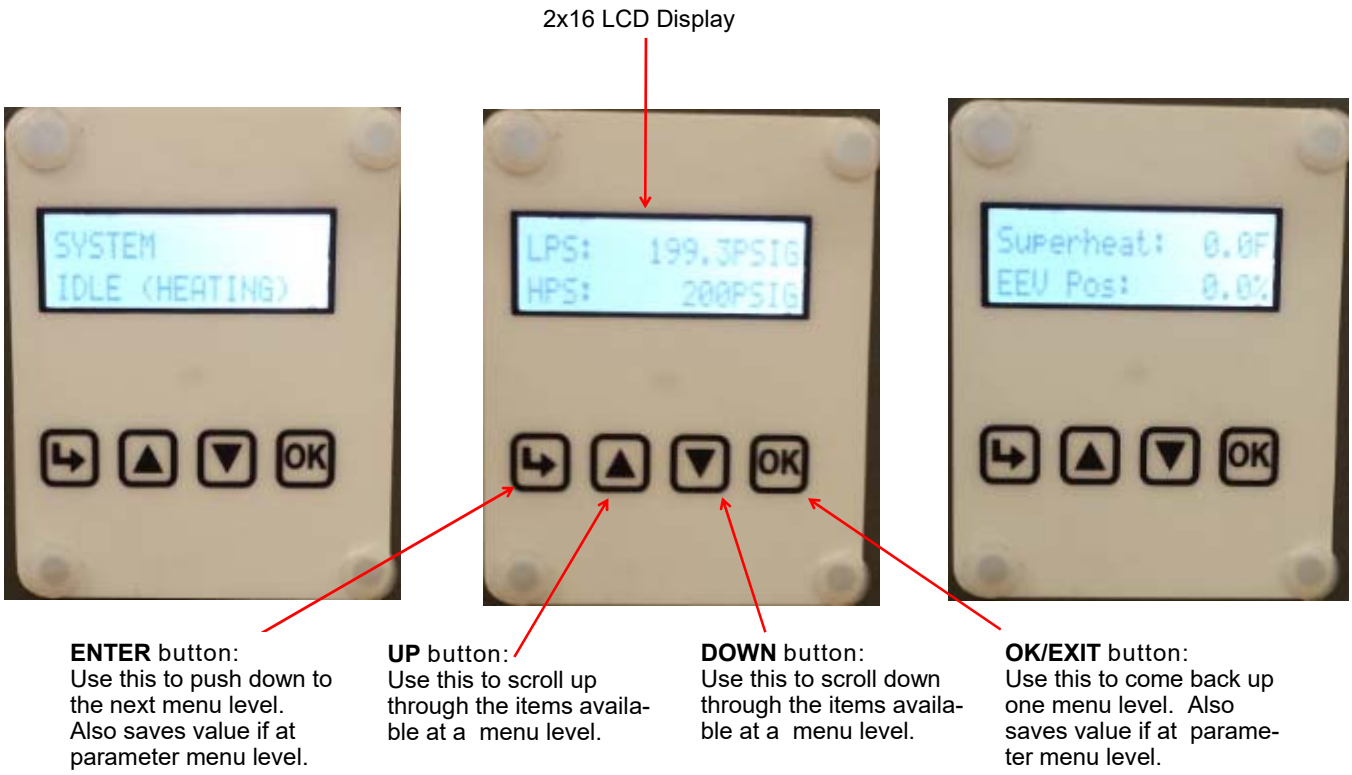
Tools—SYSTEM TIMERS: This page shows all timers by name along with their current values.



Name	Value
Stage 1 Short Cycle Timer	0
Stage 2 Short Cycle Timer	0
Stage 1 Runtime	0
Stage 2 Runtime	0
Stage 2 Timed ON in:	0
Auxiliary S1 Timed ON in:	0
Auxiliary S2 Timed ON in:	0
Hydronic Auxiliary Timed ON in:	0
Indoor Loop Circulator Sampling	0
Outdoor Reset Hold	0
Wait to Defrost	0
Defrost Timer	0
Defrost Hold Previous Values (Temp Rise)	0
R Valve Defrost Switch Delay	0
Stage 1 Low Pressure Ignore	0
Stage 2 Low Pressure Ignore	0
Outdoor Flow Ignore	0
Indoor Flow Ignore	0
Low Pressure Alarm Count Reduction	0
Low Pressure 2 Alarm Count Reduction	0
High Pressure Alarm Count Reduction	0
High Pressure 2 Alarm Count Reduction	0
Outdoor Flow Alarm Count Reduction	5806
Indoor Flow Alarm Count Reduction	0
Stage1 Start Delay	0
Stage2 Start Delay	0
Stage1 EEV Hold	0
Stage2 EEV Hold	0
Hold Valves Timer	0
Water Valve Delay Start Timer	0
Scale Changed Timer	0
Soaker Hose Run Timer	0
Loop Switch Timer	0
Loop Switch Enable Timer	0
Spare 1	0
Spare 2	0
Spare 3	0

LCD Display & Menus

Below are three pictures of the LCD Display and menu buttons. They are examples of the unit status and operating data displayed when at the message display level (top level). Pressing ENTER will enter into the menu levels beginning with the Main Menu. Pressing OK will toggle between message auto scroll and manual scroll modes. UP and DOWN do not do anything if in auto scroll mode; they cycle through the messages if in manual scroll mode.



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

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

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

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

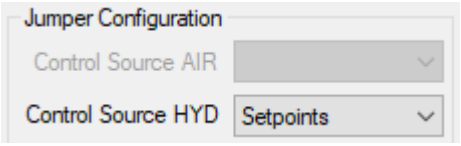
Main Menu: This is a list of the various tools are used for system setup and monitoring. They are each described below. The table shows what is displayed based on each press of the ENTER button starting at the Main Menu level.

ENTER (From Main)	ENTER (First Press)	ENTER (Second Press)	ENTER (Third Press)	Description
Setpoint Control	***— Setpoints***	***— Heating***	***— Stage 1 Setpoint***	Stage 1 stops when water temperature rises to this point.
(only if using Setpoint control)			***— 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	Temperature factor to use in the outdoor reset table.
		— Cooling	***— Stage 1 Setpoint***	Stage 1 stops when water temperature drops to this point.
			— Stage 1 Delta	Stage 1 starts when water temperature rises above setpoint by this amount.
			— Stage 2 Setpoint	Stage 2 stops when water temperature drops to this point.
			— Stage 2 Delta	Stage 2 starts when water temperature rises above setpoint by this amount.
System Enable	***System***	***— Disabled***		Disable compressor, auxiliary and ICR.
		— Enabled		Enable compressor, auxiliary and ICR.
Service Mode	***— Service Mode?***	***— No***		Do not enter Service Mode.
		— Yes		Enter into Service Mode.
EEV Control	***— EEV1 (Local)***	***— Auto/Manual***	***— Auto***	Puts EEV in Auto mode
			— Manual	Puts EEV in Manual mode
		— Manual Position	***— EEV Position (%)***	Sets EEV to manual position
	— EEV2 (Remote)	***— Auto/Manual***	***— Auto***	Puts EEV in Auto mode
			— Manual	Puts EEV in Manual mode
		— Manual Position	***— EEV Position (%)***	Sets EEV to manual position
Configuration	***— Control HYD***	***— BACnet***		BACnet control—see BACnet section
		— Signals		Hardwired Signal control
		— Setpoints		On-board aquastat control—see SETPOINT CONTROL section.
	— Outdoor Reset	***— Disable***		Disables Outdoor Reset functionality
		— Enable		Enables Outdoor Reset functionality
	— Setpoints Method	***— ICR***		Use Indoor Circulator Relay sampling
		— HTS/CTS		Use external temperature sensors
	— Time Delays	***— Short Cycle***		Short-cycle timer delay in minutes
	— Units	***— Standard***		Standard units
		— Metric		Metric units (does not affect calibration units)

Main Menu Continued				
ENTER (From Main)	**ENTER (First Press)**	**ENTER (Second Press)**	**ENTER (Third Press)**	**Description**
Configuration	***— Set Time***	***— Hours***		Set the system hours.
(continued)		***— Minutes***		Set the system minutes.
	— Set Date	***— Day***		Set the system day.
		— Month		Set the system month.
		— Year		Set the system year.
Calibration	***— Suction 1***		Suction Pressure.	Calibration in 1PSI intervals.
	— Discharge 1		Discharge Pressure	Calibration in 1PSI intervals.
	— Vapour Line 1		Suction line temperature	Calibration in 0.1°F intervals
	— Outdoor Ambient		Outside air temperature	Calibration in 0.1°F intervals
	— Outdoor IN Temp			Calibration in 0.1°F intervals
	— Outdoor OUT Temp			Calibration in 0.1°F intervals
	— Indoor IN Temp			Calibration in 0.1°F intervals
	— Indoor OUT Temp			Calibration in 0.1°F intervals
NOTE: Calibration is generally not required. Pressure sensors may be calibrated against a known source if needed. All temperature sensors have an Auto Calibration feature.				

Setpoint Control

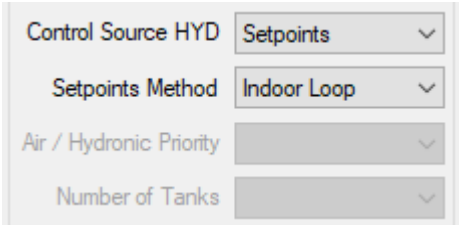
Units are shipped with the Control Source set to ***Setpoints*** as shown in the screenshot of the **Configuration Page** below. In order to prevent the compressor from starting when the power is first turned on, the system is **DISABLED** after factory testing is completed. The LCD display will show "**SYSTEM DISABLED**" when the system status display is shown. To enable the system, use either the ***System Enable/Disable*** button on the **configuration page** (top right corner) or used the LCD menus and select ***SYSTEM ENABLE***.



There are two control methods for Setpoint Control, Indoor Loop (ICR) method and HTS/CTS method. If using HTS/CTS method then the number of tanks must be selected as well, either one or two. Each control scenario is described below.

Setpoint Control Method 1 - Indoor Loop

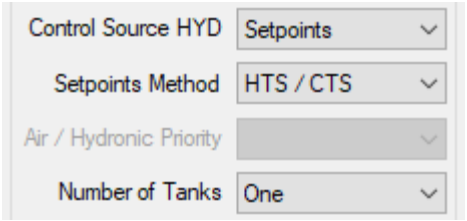
This is the default method and uses the **Indoor OUT** temperature probe inside the unit for temperature control, its value is displayed in the **Tank Temperature** box on the **Setpoint Control** screen. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it. The Indoor Circulator is used to sample the water temperature as described in the **INDOOR CIRCULATOR OPERATION** section. Cooling mode is selected by making a dry contact connection between the R and O terminals on the terminal strip in the electrical box.

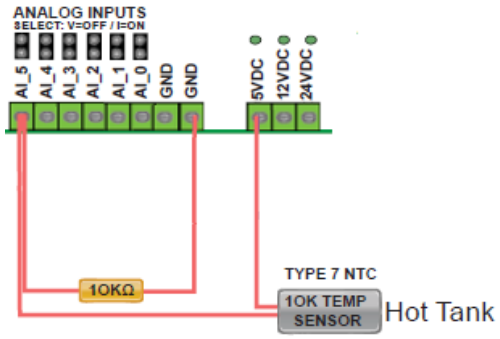


Setpoint Control Method 2 - HTS/CTS With One Tank

This method requires an external temperature sensor placed in a dry well in the system buffer tank, as would be the case for a traditional aquastat control system. Its value is displayed in the **Hot Tank** box on the **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 HTS/CTS method. Connect the Hot Tank sensor to the AI_5 input as shown below. Remove the AI_5 jumper on the control board. This sensor will be used for both heating and cooling. Cooling mode is selected by making a dry contact connection between the R and O terminals on the terminal strip in the electrical box.

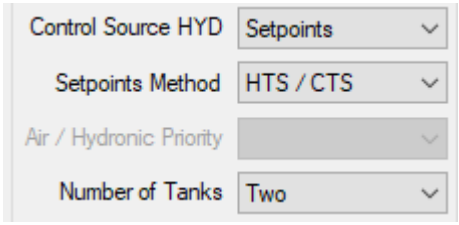


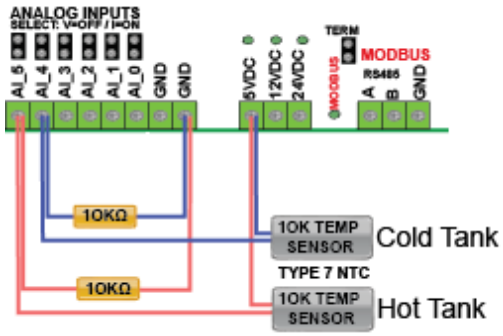


Setpoint Control Method 3 - HTS/CTS With Two Tanks

This method requires an external temperature sensor placed in a dry well in the system hot buffer tank as well as one placed in the system cold buffer tank., The values are displayed in the **Hot Tank** box and **Cold Tank** box on the **Setpoint Control** screen. If a 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 HTS/CTS method. Connect the Hot Tank sensor to the AI_5 input and the Cold Tank sensor to the AI_4 input as shown below. Remove the AI_5 and AI_4 jumpers on the control board. Cooling mode is selected by making a dry contact connection between the R and O terminals on the terminal strip in the electrical box.



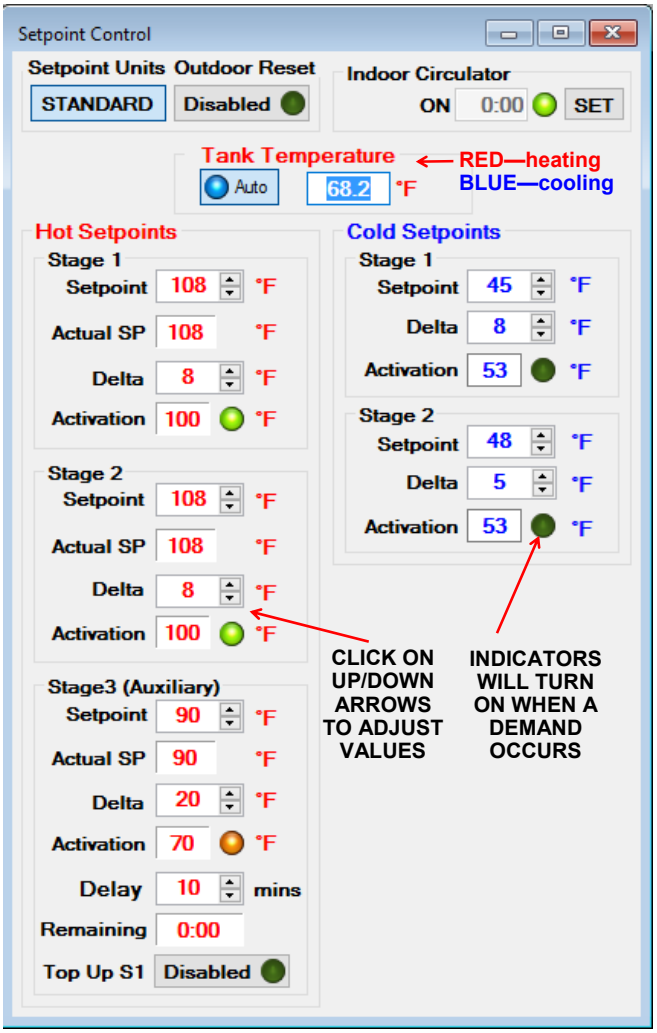


Click on menu ***View—Setpoint Control*** to open the **Setpoint Control** screen (see next page).

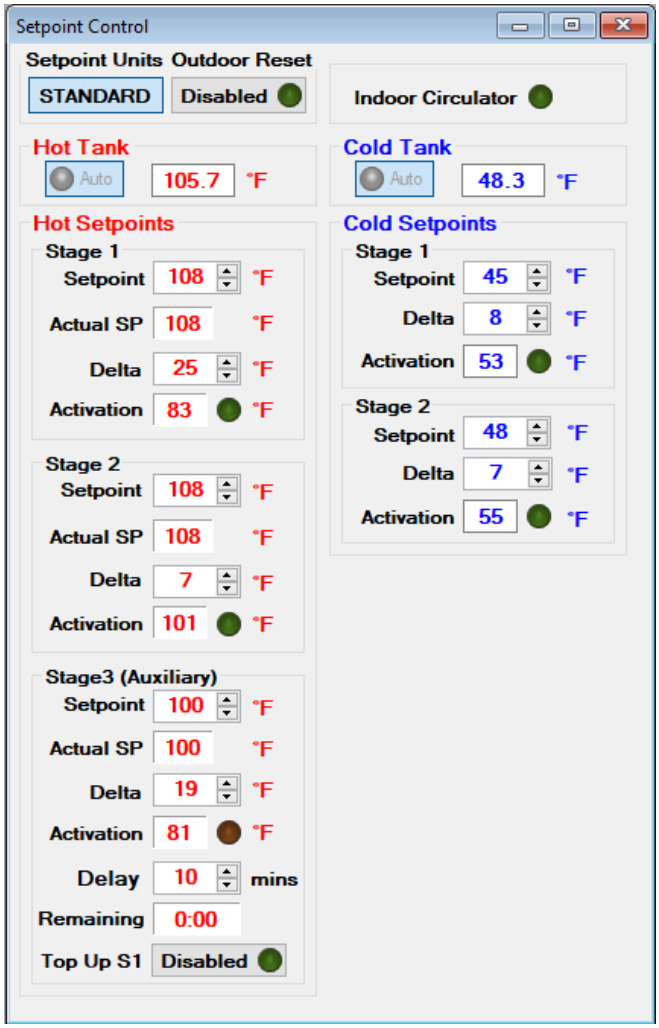
To adjust the setpoints and deltas, simply click on the up/down arrows. **TABLE 16** shows the default / recommended settings for both heating and cooling modes. If fan coils are used the heating setpoints may have to be set higher; the maximum value is **120°F (48°C)**. **This maximum is limited by the Outdoor Temperature as shown in TABLE 15 .**

The minimum value for cooling with water as the Indoor Loop fluid is **45°F (7°C)**.

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



The **Setpoint Control** screen looks like this for Method 3 (HTS/CTS - Two Tanks)



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 .

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

TABLE 15 - Maximum Output Temperature

Outdoor Temp. °F	Max output Temp. °F	Outdoor Temp, °°C	Max output Temp.°C
Above 15	120	Above -5	49
11 to 15	115	-9 to -5	46
6 to 10	110	-14 to -10	43
Below 6	105	Below -14	40

TABLE 16 - Typical Temperature Settings

HEATING						
	Stage 1		Stage 2		Stage 3	
Item	°F	°C	°F	°C	°F	°C
Setpoint	108	42	105	41	90	32
Delta	8	4	8	4	20	11
Activation *	100	38	97	37	70	21
Delay					10 minutes	
COOLING						
	Stage 1		Stage 2			
Item	°F	°C	°F	°C		
Setpoint	45	7	48	9		
Delta	8	4	8	4		
Activation *	53	11	56	13		

*Activation is determined by the Setpoint and Delta values

Indoor Circulator Operation

The Indoor Circulator will operate anytime the compressor is on. When ***Setpoints Method*** is set to ***Indoor Loop*** (default), the circulator will also cycle on and off when the compressor is not operating in order to sample the water temperature of the tank. When the compressor stops, the 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 **Setpoint Control Page**. The timer counts downs the time remaining before the next switch between ON/OFF. The Indoor Circulator indicator will indicate when the circulator is ON, OFF or SAMPLING. The default sampling times are 2 minutes ON and 6 minutes OFF. The LCD Display will indicate when the ICR is sampling (ON) as well. The ***Override Timer*** button will reduce the countdown timer to 10 seconds.

Top Up S1 Function

Enabling this allows the base stage1 setpoint to reached when the actual septoint is derated due to the outdoor temperature being too cold (refer to **TABLE 13**). When disabled, the heat pump and auxiliary operate normally and shut off at their actual setpoints. When enabled, the heat pump will shut off at its actual setpoint as usual. The auxiliary will now turn on if it was not already on and continue up to the stage1 setpoint. This creates a hybrid system that can maintain the stage1 setpoint even when the heat pump is in derated mode for systems that need hotter water than **105°F (41°C)** at all times.

IMPORTANT NOTE: Do not enable unless auxiliary is operational as the heat pump will not restart as the setpoint will not be reached.

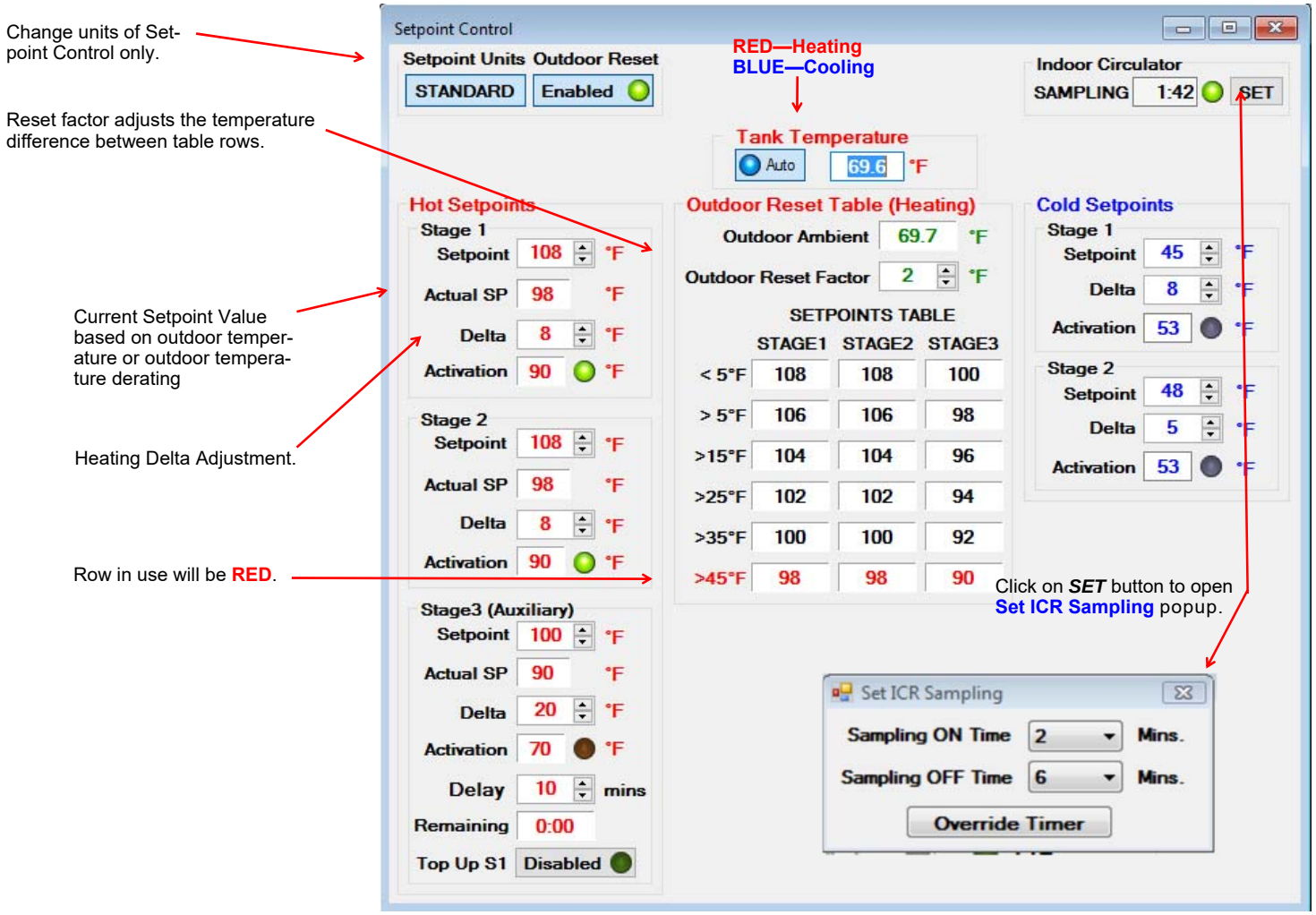
Outdoor Reset

When **Control Source HYD** is set to ***Setpoints***, an optional Outdoor Reset control algorithm is available for heating mode. This refers to built-in functionality which reduces the heating temperature setpoints at warmer outdoor temperatures, as measured by the outdoor unit. To enable it simply click on the Outdoor Reset button at the bottom of the screen. The button will change to say Enabled, the indicator will come on and the Outdoor Reset table will appear.

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

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

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



BACnet Interface

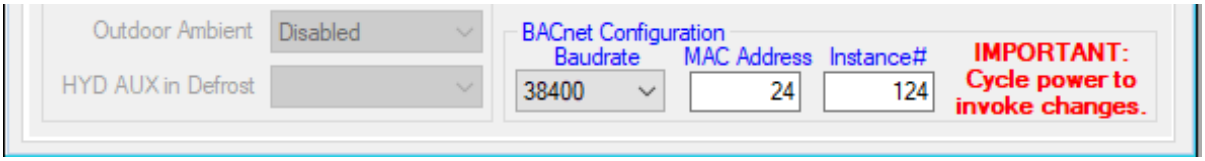
The BACnet interface is an MS/TP connection via RS-485 twisted pair. There is a termination jumper if required to terminate the connection. It is located just above the BACnet connector, marked as TERM on the control board.

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

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

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

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



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

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

TABLE 17 - BACnet OBJECTS - CONTROL SIGNALS (READ/WRITE)

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

TABLE 18 - BACnet OBJECTS - DATA (READ ONLY)					
Name	**Data Type**	**ID**	**Property**	**Units**	**Description**
LPS1	Analog Input	AI6	Present Value	PSIG (kPa)	Low pressure value (suction pressure)
HPS1	Analog Input	AI7	Present Value	PSIG (kPa)	High pressure value (discharge pressure)
EVAP1	Analog Input	AI8	Present Value	degF (degC)	Evaporating Temperature
COND1	Analog Input	AI9	Setpoint Value	degF (degC)	Condensing Temperature
Suction_Line1	Analog Input	AI10	Present Value	degF (degC)	Suction line temperature
Superheat1	Analog Input	AI11	Setpoint Value	degF (degC)	Superheat
EEV1_POS	Analog Input	AI12	Present Value	%	EEV1 position (% open)
EEV2_POS	Analog Input	AI19	Present Value	%	EEV2 position (% open)
Outside_Temp	Analog Input	AI20	Present Value	degF (degC)	Outdoor Ambient temperature
I_IN	Analog Input	AI23	Present Value	degF (degC)	Indoor IN temperature
I_OUT	Analog Input	AI24	Present Value	degF (degC)	Indoor OUT temperature
Comp1_Current	Analog Input	AI0	Present Value	A	compressor current draw (ACCESSORY)
AI_2	Analog Input	AI2	Present Value	User Selectable	User defined (0-5VDC or 4-20mA)
AI_3	Analog Input	AI3	Present Value	User Selectable	User defined (0-5VDC or 4-20mA)
AI_4	Analog Input	AI4	Present Value	User Selectable	User defined (0-5VDC or 4-20mA)
AI_5	Analog Input	AI5	Present Value	User Selectable	User defined (0-5VDC or 4-20mA)
PWM_IN	Analog Value	AV0	Present Value	%	PWM input (from external source)
PWM1	Analog Value	AV1	Present Value	%	PWM output value (spare)
PWM2	Analog Value	AV2	Present Value	%	PWM output value (spare)
PWM4	Analog Value	AV4	Present Value	%	IV2 - PWM or 0-10VDC for Indoor Loop water valve
STAGE1	Binary Output	BO0	Present Value	N/A	Compressor contactor (stage 1)
STAGE2	Binary Output	BO1	Present Value	N/A	Compressor stage 2 solenoid
ICR	Binary Output	BO2	Present Value	N/A	Indoor circulator control
DO_1	Binary Output	BO4	Present Value	N/A	IV1 (for 24VAC Indoor Loop water valve)
DO_2	Binary Output	BO5	Present Value	N/A	Hydronic Auxiliary
DO_3	Binary Output	BO6	Present Value	N/A	Hydronic Auxiliary Only (without compressor)
PHS_1	Binary Output	BO7	Present Value	N/A	Dry contact lockout pin for Stage 1
PHS_2	Binary Output	BO8	Present Value	N/A	Dry contact lockout pin for Stage 2
Indoor_Flow	Binary Value	BV11	Present Value	N/A	Indoor Loop flow switch (ACCESSORY)
Phase_Monitor1	Binary Value	BV12	Present Value	N/A	Phase Monitor (ACCESSORY)
Note: available objects may be subject to change without prior notice.					

TABLE 19 - BACnet OBJECTS - ALARMS AND FAULTS (READ ONLY)				
Name	**Data Type**	**ID**	**Alarm / Fault**	**Description**
LPS1	Analog Value	AI6	Alarm	Low pressure alarm
HPS1	Analog Value	AI7	Alarm	High pressure alarm
Indoor_Flow	Binary Value	BV11	Alarm	Indoor Loop flow alarm
Phase_Monitor1	Binary Value	BV12	Alarm	Phase Monitor alarm
PERM_ALARMS1	Binary Value	BV16	Alarm	Indicates a permanent alarm
LPS1	Analog Value	AI6	Fault	Low pressure sensor faulty or disconnected
HPS1	Analog Value	AI7	Fault	High pressure sensor faulty or disconnected
Suction_Line1	Analog Value	AI10	Fault	Suction line 1 temperature sensor faulty or disconnected.
Outside_Temp	Analog Value	AI20	Fault	Outside temperature sensor faulty or disconnected.
I_IN	Analog Value	AI23	Fault	Indoor IN temperature sensor faulty or disconnected.
I_OUT	Analog Value	AI24	Fault	Indoor OUT temperature sensor faulty or disconnected.
Note: objects may be subject to change without prior notice.				

Startup Procedure

The ATW-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. Fill in the top section of all three copies, or one copy if photocopies can be made after the startup has been completed.

Pre-Start Inspection

Outdoor Unit:

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

Indoor Loop (Hydronic Loop):

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

Domestic Hot Water:

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

Electrical:

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

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 display will show the outdoor temperature, low (suction) pressure, high (discharge) pressure, superheat, EEV position and water in/out temperatures.

Preparation:

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

Heating Mode:

1. Activate Stage 1 and Stage 2. The EEV will begin to open and the compressor will start, as will the circulator pumps.
2. Check the PC APP or LCD Display. The suction and discharge pressures will vary based on the outside temperature and the indoor loop temperature, but they should be about **90-110PSIG** and **260-360PSIG** respectively for a typical start-up.
3. Monitor the unit via the PC APP or LCD Display while the unit runs, record the following after 10 minutes of run time:
    1. Suction pressure
    2. Discharge pressure
    3. Indoor Loop In (Hot In) temperature
    4. Indoor Loop Out (Hot Out) temperature
    5. Indoor Delta T (should be between **8-12°F, 4-6°C**)
    6. Indoor flow (if available)
    7. Outdoor air temperature
    8. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
4. Adjust the control setpoints to the desired buffer tank temperature and let the unit run through a cycle. Record the setpoint and the discharge pressure just before the unit shuts off.
5. For units with a desuperheater, turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown in the electrical box diagram. Turn the power to the unit back on.
6. Open a zone (or zones) and let the tank cool down until Stage 2 is activated. Close the zone(s) again.
7. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand **(caution: pipes get hot).** If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.

Cooling Mode:

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

Final Inspection:

1. Turn the power off to the unit and remove all test equipment.
2. Install the electrical box cover and the access panel on the heat pump. Install the service port caps securely to prevent refrigerant loss.
3. Do a final check for leaks in the indoor loop piping and ensure the area is clean.
4. Turn the power on to the unit. Set the Setpoints Control (or aquastat) to the final settings and record the values.

Startup Record:

1. The startup personnel shall sign and date the Startup Record and have the startup witness or appropriate site personnel sign as well. The startup personnel shall 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—ATW-Series Two-Stage R410a

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

PRE-START INSPECTION

Outdoor Unit	System is pressure tested, vacuumed and extra charge added		(extra charge only if needed)
	Access valves are open and caps securely fastened		
	Unit is securely mounted at least 12” from building		
	All inter-connect piping is insulated and properly supported		
	Wiring is neat and securely fastened		
	Fan outlet is clear of obstructions		
Indoor Loop (Hydronic)	All shut-off valves are open (full flow available)		
	Loop is full and purged of air		
	Antifreeze type		
	Antifreeze concentration		% Volume % Weight
	Loop static pressure		PSI kPa
Domestic Hot Water	All shut-off valves are open		
	Lines are full and purged		
	Desuperheater pump wire is disconnected		
Electrical	High voltage connections are correct and securely fastened		
	Circuit breaker (or fuse) size and wire gauge for heat pump		A Ga.
	Circulator pump voltages (Indoor 1, Indoor 2)		V V V
	Low voltage connections are correct and securely fastened		

STARTUP DATA

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

Date:		**Startup Personnel Signature:**		**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.

General Maintenance

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

COAXIAL HEAT EXCHANGER FLUSHING PROCEDURE - INDOOR LOOP	
STEP 1	Isolate the heat exchanger by closing off Indoor IN and Indoor OUT in-line ball valves.
STEP 2	Connect a compressed air and a drain pipe to the Indoor IN and Indoor OUT hose bibs and blow the water or anti-freeze solution into a clean 5 gallon bucket.
STEP 3	Connect a purge cart to the pump module purge ports.
STEP 4	Place 2 gallons of RYDLYME in the purge cart. Circulate the fluid through the heat exchanger for at least 2 hours (3 recommended).
STEP 5	Disconnect the purge cart and dispose of the solution. RYDLYME is non-toxic and biodegradable and as such can be poured down a drain. Clean the purge cart thoroughly.
STEP 6	Connect fresh water and a drain to the pump module purge ports and flush the exchanger for several minutes.
STEP 7	Blow the heat exchanger out with compressed air as per STEP 2 and dump the water down a drain.
STEP 8	Connect the purge cart to the pump module purge ports. Re-fill and purge the heat exchanger with as per standard procedures (the anti-freeze from STEP 2 can be re-used).
STEP 9	Disconnect the purge cart and set the pump module valves back to the original positions.
STEP 10	Operate the system and check for improved performance.
*Depending on the plumbing, there should be either unions or boiler drains for to access the heat exchanger.	

Troubleshooting Guide

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

STEP 1: Verify that the LCD Display is functioning . If it is not, proceed to POWER SUPPLY TROUBLE SHOOTING, otherwise proceed to STEP 2.

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

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

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

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

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

ALARMS AND FAULTS TROUBLESHOOTING

Alarm/Fault	Description	Recommended Action
The following is a description of the alarms along with what to do when they occur. The datalogging 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. This section lists all alarms and faults. Alarms and faults that are not applicable to the unit will be greyed out on the Alarms page of the PC APP. Note that some alarms require accessory components. The LCD display will also indicate alarms and faults. Look up the alarm/fault in the table below and proceed to the appropriate section of the troubleshooting guide.		
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.
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 Monitor	This alarm occurs when the compressor protection module sends a fault signal to the control board, generally due to the compressor windings overheating.	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.
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.
Phase Monitor (accessory)	This alarm occurs when the Phase Monitor detects a fault condition and sends a fault signal to the control board. For three phase units only and requires Phase Monitor accessory.	Verify power supply for under/over voltages as well as phase balance. Check compressor contactors for pits or burns.
Loss of Charge	This alarm occurs if both the low pressure and high pressure sensors are below 30 psig (207 kPa).	Check system for refrigerant leak.
Indoor Flow	This alarm is ignored on compressor start for the number of seconds the Indoor Flow ***Ignore on Start*** is set to. Alarm monitoring will begin when the timer expires. Requires flow switch accessory.	Check Indoor flow switch. Check Indoor Loop flow.
Multiple Defrosts	This alarm occurs if a second defrost occurs immediately after the defrost disabled timer expires from a previous defrost cycle.	Go to the Low Pressure section of the mode the unit was operating in at the time of the alarm.

ALARMS AND FAULTS TROUBLESHOOTING

Alarm/Fault	Description	Recommended Action
The following are the control board hardware faults (Board Faults)		
Digital Inputs	A failure has occurred and the Control Board may no longer respond to the digital input signals.	Cycle the power a few times; if the fault persists replace the control board.
Digital Outputs	A failure has occurred and the digital outputs may no longer work properly.	Cycle the power a few times; if the fault persists replace the control board.
PWM Outputs	A failure has occurred and the PWM / 0-10VDC outputs may no longer work properly.	Cycle the power a few times; if the fault persists replace the control board.
Analog to Digital	A failure has occurred and the data from the A/D converter may be corrupt resulting in erratic data values.	Cycle the power a few times; if the fault persists replace the control board.
Real Time Clock	A failure has occurred, system time / date may no longer be valid, all time stamped data may be corrupt.	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 LDC Display board and the Control Board, and then turning the power back on again. If this does not work then either the LDC Display board, the cable, or the driver section of the Control Board may be faulty.
LCD Display	A failure has occurred and display may show erratic data, no data or may not turn on at all.	Try turning off the power, disconnecting and reconnecting the cable between the LDC Display board and the Control Board and then turning the power back on again. If this does not work then either the LDC Display board, the cable, or the driver section of the Control Board may be faulty.
Temperature Sensors	The sensor is reading outside of the acceptable range. Check to ensure connector is on securely.	Replace the temperature sensor. If this does not rectify the problem replace the control board.

COMPRESSOR TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Compressor will not start	Faulty control board.	No 24vac output on STAGE1 when compressor should be operating.	Replace control board.
	Faulty run capacitor. (Single phase only)	Check value with capacitance meter. Should match label on capacitor. Compressor will hum while trying to start and then trip its overload.	Replace if faulty.
	Loose or faulty wiring.	Check all compressor wiring, including inside compressor electrical box.	Fix any loose connections. Replace any damaged wires.
	Faulty compressor contactor.	Voltage on line side with contactor held closed, but no voltage on one or both terminals on the load side. Points pitted or burned. Or, 24VAC across coil but contactor will not engage.	Replace contactor.
	Thermal overload on compressor tripped.	Ohmmeter shows reading when placed across R and S terminals and infinity between C & R or C & S. A valid resistance reading is present again after the compressor has cooled down.	Proceed to Operation Troubleshooting to determine the cause of the thermal overload trip.
	Burned out motor (open winding)	Remove wires from compressor. Ohmmeter shows infinite resistance between any two terminals. Note: Be sure compressor overload has had a chance to reset. If compressor is hot this may take several hours.	Replace the compressor.
	Burned out motor (shorted windings)	Remove wires from compressor. Resistance between any two terminals is below the specified value.	Replace the compressor.
	Motor shorted to ground.	Remove wires from compressor. Check for infinite resistance between each terminal and ground.	If any terminal to ground is not infinite replace the compressor.
	Seized compressor due to locked or damaged mechanism.	Compressor attempts to start but trips its internal overload after a few seconds. (Run capacitor already verified)	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.
Compressor starts hard	Start capacitor faulty. (Single phase only)	Check with capacitance meter. Check for black residue around blowout hole on top of capacitor.	Replace if faulty. Remove black residue in electrical box if any.
	Potential relay faulty. (Single phase only)	Replace with new one and verify compressor starts properly.	Replace if faulty.
	Compressor is “tight” due to damaged mechanism	Compressor attempts to start but trips its internal overload after a few seconds. Run capacitor has been verified already.	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.
Compressor stage 2 will not activate	Faulty stage 2 module	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 - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High or low suction or discharge pressure	Faulty sensor	Compare pressure sensor reading against a known reference such as a new refrigeration manifold set.	Check wiring, replace sensor. If problem persists, replace control board.
High discharge pressure	Low 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 aquastat or BACnet control)	Use PC APP to verify that Indoor OUT does not exceed 120°F (49°C)	Reduce setpoint(s).
	EEV stuck almost closed or partially blocked by foreign object.	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Unit is overcharged.	High subcooling, low Indoor Loop delta T.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces.
Low suction pressure	Indoor OUT temperature too cold (on startup or if unit has been off for extended period)	Ensure Indoor OUT temperature is above the low limit indicated in the **Model Specific Information** section.	Reduce flow temporarily until Indoor Out temperature has risen sufficiently.
	Low or no outdoor unit airflow	Visually check 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 low suction pressure.	Replace filter-dryer.
	EEV stuck almost closed or partially blocked by foreign object.	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
	Low refrigerant charge.	Superheat is high, EEV position is high.	Locate the leak and repair it. Spray Nine, a sniffer, and/or dye are common methods of locating a leak.

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High suction pressure (may appear to not be pumping)	EEV stuck open.	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low super heat and discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Compressor frosting up	See Low Suction Pressure in this section.		
EEV frosting up	EEV stuck almost closed or partially blocked by foreign object.	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
Random high pressure trip (may not occur while on site)	Faulty indoor circulator relay	Using the PC APP, manually turn the ICR on/off several times and ensure the circulator(s) start and stop.	Replace relay.
Random manual high pressure trip (may not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it should be off.	Replace contactor.

OPERATION TROUBLESHOOTING - COOLING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Heating instead of cooling	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.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces.

OPERATION TROUBLESHOOTING - COOLING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High suction pressure (may appear to not be pumping)	EEV stuck open.	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Low suction pressure	Low indoor loop liquid flow.	Check for high delta T with the PC APP. The EEV will be at a lower position than normal as well.	Correct the problem.
	EEV stuck almost closed or partially blocked by foreign object.	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
	TS1 temperature sensor not reading properly.	If the sensor is reading low it will cause the superheat to appear high, which causes the EEV to continually close.	Verify EEV position is low compared to normal. Check temperature sensor, replace if necessary.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Low refrigerant charge.	Entering air temperature and airflow are good but suction is low. Check static refrigeration pressure of unit for a low value.	Locate the leak and repair it. Spray Nine, a sniffer, and dye are common methods of locating a leak.
Compressor frosting up	See Low Suction Pressure in this section.		
EEV frosting up	EEV stuck almost closed or partially blocked by foreign object.	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
Random manual high pressure trip (may not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it should be off.	Replace contactor.

OUTDOOR FAN TROUBLESHOOTING

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

EEV TROUBLESHOOTING

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

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

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

To determine if an EEV is working, use the PC APP and put the system in manual override mode. Manually adjust the EEV position by at least 25% either up or down and check to see that the suction pressure, discharge pressure and superheat react to the change. If there is no reaction, then it is likely that the EEV is not working or is stuck. There are 3 possibilities: the control board is not working properly, the cable is faulty, or the EEV is faulty.

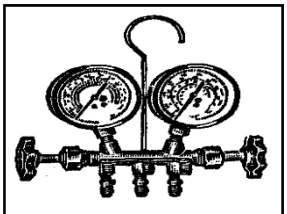
Set the EEV back to AUTO and then turn the heating or cooling demand off (but leave power on). Once the demand is off, if the EEV is working then the discharge pressure should remain significantly higher than the suction pressure, i.e. the system will not equalize (since EEV's are closed when there is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

If there is no clicking sound then either the control board is faulty, or the cable is faulty. The simplest method to check this is to connect a new EEV and cable to the control board and visually check the EEV so see if it opens and closes by setting the position o 0 and 100% If the new EEV works then the EEV in the unit needs to be replaced.

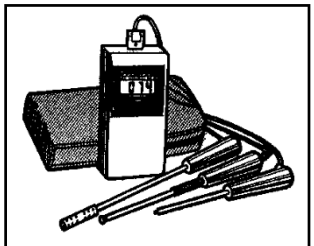
1) Connect a test EEV and test cable to the control board.
2) Set the EEV position to 0%.
3) Set the EEV position to 100% and then listen for clicking and watch to see if the pintle in the EEV moves open.
4) Set the EEV position to 0% and then listen for clicking and watch to see if the pintle in the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

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

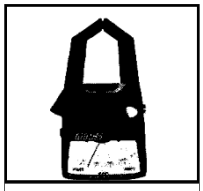
Troubleshooting Tools



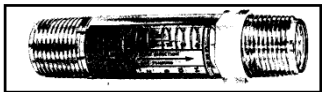
Refrigeration Gauges



Digital Thermometer



Multimeter - Voltmeter / Amprobe



In-line Flowmeter

PUMP DOWN PROCEDURE	
STEP 1	Connect the refrigerant recovery unit to the heat pump service ports via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. **If there was a compressor burn out, the refrigerant cannot be reused and must be disposed of according to local codes.**
STEP 2	All water coil heat exchangers must either have full flow or be completely drained of fluid before recovery begins. Failure to do so can freeze and rupture the heat exchanger, voiding its warranty. (Note that this does not apply to double wall domestic hot water exchangers (desuperheater coils)
STEP 3	Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual.
STEP 4	Allow the recovery unit suction pressure to reach a vacuum. Once achieved, close the charging manifold valves. Shut down, purge and disconnect the recovery unit as per the instructions in its manual. Ensure the recovery tank valve is closed before disconnecting the hose to it.
STEP 5	Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive pressure of 5-10PSIG is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected.
STEP 6	The heat pump is now ready for repairs. Always ensure nitrogen is flowing through the system during any soldering procedures to prevent soot buildup inside the pipes. Maritime Geothermal Ltd. recommends replacing the liquid line filter-drier anytime the refrigeration system has been exposed to the atmosphere.

VACUUM AND CHARGING PROCEDURE	
STEP 1	After completion of repairs and nitrogen pressure testing, the refrigeration circuit is ready for vacuuming.
STEP 2	Release the refrigerant circuit pressure and connect the vacuum pump to the charging manifold. Start the vacuum pump and open the charging manifold valves. Vacuum until the vacuum gauge remains at less than 500 microns for at least 1 minute with the vacuum pump valve closed.
STEP 3	Close the charging manifold valves then shut off and disconnect the vacuum pump. Place a refrigerant tank with the proper refrigerant on a scale and connect it to the charging manifold. Purge the hose to the tank.
STEP 4	Weigh in the appropriate amount of refrigerant through the low pressure (suction) service port. Refer to the label on the unit or the **Refrigerant Charge Chart** in the **MODEL SPECIFIC INFORMATION** section for the proper charge amount.
STEP 5	If the unit will not accept the entire charge, the remainder can be added through the low pressure service port after the unit has been restarted.

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

Model Specific Information

Table 20 - Shipping Information - Indoor Unit

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

Table 21 - Shipping Information - Outdoor Unit

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

Table 22 - Refrigerant Charge

MODEL	lb.	kg
ATW-25	5.5	2.5
ATW-45	7.5	3.4
ATW-55	8.0	3.6
ATW-65	10.0	4.5
ATW-75	11.0	5.0

Nominal charge value, refer to **Charging the System** section of the manual. System contains POE oil. Oil capacity is marked on the compressor label.

Table 23 - Indoor Loop Flow Rates

SIZE	gpm	L/s
ATW-25	8	0.50
ATW-45	10	0.63
ATW-55	12	0.76
ATW-65	14	0.88
ATW-75	16	1.01

Table 24 - Operating Temperature Limits

Loop	Mode	Parameter	(°F)	(°C)	Note
Indoor	Heating	Minimum ELT	60	15	
	Heating	Maximum LLT	120	49	
	Cooling	Minimum LLT	41	5	Water system (no antifreeze).
	Cooling	Minimum LLT	32	0	Antifreeze system. Adequate freeze protection required.
	Cooling	Maximum ELT	80	27	
Outdoor	Heating	Minimum EAT	-7	-22	ACE Outdoor Unit automatically stops compressor below this temp.
	Cooling	Maximum EAT	120	49	ACE Outdoor Unit automatically stops compressor above this temp.

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

Table 25 - Outdoor Unit Sound Levels (dBA)*

MODEL	1 ft distance		3 ft distance		5 ft distance		10 ft distance	
	Front	Side	Front	Sides	Front	Sides	Front	Sides
ATW-25	68.0	61.1	66.4	59.7	63.5	57.4	59.3	56.7
ATW-45	68.0	61.1	66.4	59.7	63.5	57.4	59.3	56.7
ATW-55	72.4	66.8	71.1	64.8	68.0	62.9	64.6	61.1
ATW-65	70.3	62.9	65.9	60.5	62.2	58.1	56.6	54.0
ATW-75	71.7	66.8	68.7	63.7	65.7	61.2	60.0	57.1

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

Table 26 - Indoor Unit Sound Levels (dBA)*

MODEL	1 ft distance	3 ft distance
ATW-25	57.1	55.8
ATW-45	57.2	56.0
ATW-55	56.4	54.9
ATW-65	56.4	55.4
ATW-75	55.7	53.0

* With all doors installed.

Table 27 - Indoor Loop Pressure Drop Data (Water)					
FLOW (gpm)	ATW-25 ΔP (psi)	ATW-45 ΔP (psi)	ATW-55 ΔP (psi)	ATW-65 ΔP (psi)	ATW-75 ΔP (psi)
4.0	0.9	0.9	-	-	-
5.0	1.4	1.2	-	-	-
6.0	1.7	1.7	1.2	1.2	0.7
7.0	2.3	2.1	1.6	1.5	0.9
8.0	**3.2**	2.8	1.9	1.9	1.3
9.0	3.4	3.5	2.4	2.3	1.6
10.0	4.4	**4.0**	2.9	2.6	1.9
11.0	5.1	4.6	3.1	3.2	2.3
12.0	6.0	5.5	**3.7**	3.9	2.6
13.0	6.9	6.2	4.3	4.4	3.0
14.0	-	7.0	5.0	**5.0**	3.2
15.0	-	8.2	5.8	5.7	3.5
16.0	-	-	6.3	6.5	**4.0**
17.0	-	-	-	-	4.4

Standard Capacity Ratings

The tables below depict the results of standard capacity rating tests according to CSA C656 (ARI 210-240) for the outside air temperatures. An Entering Liquid temperature of 104°F (50°C) is used, since this is the value in the geothermal C13256-2 standard. There is currently no official test standard for air to water heat pumps.

Table 28 - Standard Capacity Ratings - 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
25	8.0	0.50	3.2	22	2	1737	22,600	6.6	3.70	1768	19,600	5.7	3.15	1877	14,700	4.3	2.23
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

Table 29 - Standard Capacity Ratings - Cooling															60 Hz
Indoor Loop ELT 53.6°F (12°C)						B2 - Outdoor Air 82°F (27.8°C)					A2 - Outdoor Air 95°F (35°C)				
Model	Indoor Liquid Flow		Pressure Drop		Stage	Input Energy	Capacity		EER	COP_C	Input Energy	Capacity		EER	COP_C
	gpm	L/s	psi	kPa		Watts	Btu/hr	kW	Btu/W-hr	W/W	Watts	Btu/hr	kW	Btu/W-hr	W/W
25	8.0	0.50	3.2	22	2	1640	19,200	5.6	11.3	3.32	1856	17,300	5.1	9.0	2.64
45	10.0	0.63	3.8	26	2	2247	29,300	8.6	13.0	3.82	2591	26,300	7.7	10.2	2.98
55	12.0	0.76	4.1	28	2	2846	36,900	10.8	13.0	3.80	3320	33,100	9.7	10.0	2.92
65	14.0	0.88	5.0	34	2	3523	45,500	13.3	12.9	3.78	4087	41,300	12.1	10.1	2.96
75	16.0	1.01	4.0	28	2	4119	52,900	15.5	12.9	3.77	4775	47,700	14.0	10.0	2.93

Heating Mode

ATW-25-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			Electrical		Heating Data (Indoor Unit)						
Air Temp	Evaporating Temp	HAB	Compressor Current	Input Power	ELT	Condensing Temp	Liquid Flow	LLT	Delta T	Heating Capacity	COPh
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	Btu/hr	W/W
°C	°C	Watts			°C	°C	L/s	°C	°C	Watts	
-5.0	-16.2	3,239	9.8	2,396	104	112	8.0	106.9	2.9	**11,418**	**1.36**
-20.6	-26.8	949			40.0	44.4	0.505	41.6	1.6	**3,345**	
5.0	-7.8	5,756	8.2	2,036	104	112.5	8.0	107.2	3.2	**12,705**	**1.78**
-15.0	-22.1	1,687			40.0	44.7	0.505	41.8	1.8	**3,723**	
17.0	2.5	8,287	7.5	1,877	104	113	8.0	107.7	3.7	**14,692**	**2.23**
-8.3	-16.4	2,428			40.0	45.0	0.505	42.0	2.0	**4,305**	
25.0	8.8	10,774	7.2	1,815	104	113.5	8.0	108.2	4.2	**16,968**	**2.66**
-3.9	-12.9	3,157			40.0	45.3	0.505	42.4	2.4	**4,972**	
35.0	17.2	13,573	7.0	1,768	104	114	8.0	108.9	4.9	**19,608**	**3.15**
1.7	-8.2	3,977			40.0	45.6	0.505	42.7	2.7	**5,745**	
47.0	27.7	16,718	6.8	1,737	104	114.5	8.0	109.7	5.7	**22,648**	**3.70**
8.3	-2.4	4,898			40.0	45.8	0.505	43.1	3.1	**6,636**	
55.0	34.2	18,222	6.7	1,694	104	115	8.0	110.0	6.0	**24,002**	**4.02**
12.8	1.2	5,339			40.0	46.1	0.505	43.3	3.3	**7,033**	
65.0	42.9	20,561	6.6	1,638	104	115.5	8.0	110.5	6.5	**26,150**	**4.53**
18.3	6.1	6,024			40.0	46.4	0.505	43.6	3.6	**7,662**	
Compressor: ZPS20K5E-PFV											

Cooling Mode

ATW-25-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			Electrical		Cooling Data (Indoor Loop)						
Air Temp	Condensing Temp	Rejection	Compressor Current	Input Power	ELT	Evaporating Temp	Liquid Flow	LLT	Delta T	Cooling Capacity	EER (COPc)
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	Btu/hr	Btu/W-hr
°C	°C	Watts			°C	°C	L/s	°C	°C	Watts	W/W
50	62	27,286	3.7	1,118	53.6	38.8	8.0	47.7	5.9	**23,471**	**19.8**
10.0	16.7	7,995			12.0	3.8	0.505	8.7	3.3	**6,877**	**5.79**
60	72	26,752	4.4	1,304	53.6	39.0	8.0	48.0	5.6	**22,300**	**16.2**
15.6	22.2	7,838			12.0	3.9	0.505	8.9	3.1	**6,534**	**4.75**
70	83	25,993	5.1	1,473	53.6	39.2	8.0	48.4	5.2	**20,967**	**13.6**
21.1	28.3	7,616			12.0	4.0	0.505	9.1	2.9	**6,143**	**3.98**
80	93	25,035	5.7	1,607	53.6	39.4	8.0	48.7	4.9	**19,549**	**11.7**
26.7	33.9	7,335			12.0	4.1	0.505	9.3	2.7	**5,728**	**3.41**
90	104	24,058	6.5	1,770	53.6	39.6	8.0	49.1	4.5	**18,017**	**9.8**
32.2	40.0	7,049			12.0	4.2	0.505	9.5	2.5	**5,279**	**2.87**
100	114	23,131	7.4	1,942	53.6	39.8	8.0	49.5	4.1	**16,503**	**8.2**
37.8	45.6	6,777			12.0	4.3	0.505	9.7	2.3	**4,835**	**2.40**
110	125	22,299	8.5	2,173	53.6	40.0	8.0	49.9	3.7	**14,884**	**6.6**
43.3	51.7	6,534			12.0	4.4	0.505	9.9	2.1	**4,361**	**1.94**
120	135	21,531	9.7	2,429	53.6	40.2	8.0	50.3	3.3	**13,239**	**5.3**
48.9	57.2	6,309			12.0	4.6	0.505	10.2	1.8	**3,879**	**1.55**
Compressor: ZPS20K5E-PFV											

Heating Mode

ATW-45-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			Electrical		Heating Data (Indoor Unit)						
Air Temp	Evaporating Temp	HAB	Compressor Current	Input Power	ELT	Condensing Temp	Liquid Flow	LLT	Delta T	Heating Capacity	COPh
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	Btu/hr	W/W
°C	°C	Watts			°C	°C	L/s	°C	°C	Watts	
-5.0	-16.2	5,390	14.0	3,394	104	112	10.0	107.4	3.4	**16,787**	**1.45**
-20.6	-26.8	1,579			40.0	44.4	0.631	41.9	1.9	**4,919**	
5.0	-7.8	9,211	12.0	2,942	104	112.5	10.0	107.8	3.8	**19,065**	**1.90**
-15.0	-22.1	2,699			40.0	44.7	0.631	42.1	2.1	**5,586**	
19.5	5	12,856	11.1	2,742	104	113	10.0	108.4	4.4	**22,026**	**2.35**
-6.9	-15.0	3,767			40.0	45.0	0.631	42.4	2.4	**6,454**	
25.0	8.8	16,517	10.7	2,655	104	113.5	10.0	109.1	5.1	**25,392**	**2.80**
-3.9	-12.9	4,839			40.0	45.3	0.631	42.8	2.8	**7,440**	
35.0	17.2	20,597	10.4	2,581	104	114	10.0	109.8	5.8	**29,218**	**3.32**
1.7	-8.2	6,035			40.0	45.6	0.631	43.2	3.2	**8,561**	
45.0	25.7	25,228	10.1	2,518	104	114.5	10.0	110.7	6.7	**33,634**	**3.91**
7.2	-3.5	7,392			40.0	45.8	0.631	43.7	3.7	**9,855**	
55.0	34.2	27,481	9.8	2,450	104	115	10.0	111.1	7.1	**35,655**	**4.26**
12.8	1.2	8,052			40.0	46.1	0.631	44.0	4.0	**10,447**	
65.0	42.9	31,062	9.6	2,369	104	115.5	10.0	111.8	7.8	**38,961**	**4.82**
18.3	6.1	9,101			40.0	46.4	0.631	44.3	4.3	**11,415**	
Compressor: ZPS30K5E-PFV											

Cooling Mode

ATW-45-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			Electrical		Cooling Data (Indoor Loop)						
Air Temp	Condensing Temp	Rejection	Compressor Current	Input Power	ELT	Evaporating Temp	Liquid Flow	LLT	Delta T	Cooling Capacity	EER (COPc)
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	Btu/hr	Btu/W-hr
°C	°C	Watts			°C	°C	L/s	°C	°C	Watts	W/W
50	62	5,390	5.2	1,489	53.6	38.8	10.0	46.3	7.3	**36,226**	**24.3**
10.0	16.7	1,579			12.0	3.8	0.631	8.0	4.0	**10,614**	**7.13**
60	72	9,211	6.2	1,742	53.6	39.0	10.0	46.8	6.8	**34,145**	**19.6**
15.6	22.2	2,699			12.0	3.9	0.631	8.2	3.8	**10,004**	**5.74**
70	83	12,856	7.2	1,989	53.6	39.2	10.0	47.2	6.4	**31,898**	**16.0**
21.1	28.3	3,767			12.0	4.0	0.631	8.5	3.5	**9,346**	**4.70**
80	93	16,517	8.2	2,201	53.6	39.4	10.0	47.7	5.9	**29,621**	**13.5**
26.7	33.9	4,839			12.0	4.1	0.631	8.7	3.3	**8,679**	**3.94**
90	104	20,597	9.5	2,458	53.6	39.6	10.0	48.2	5.4	**27,226**	**11.1**
32.2	40.0	6,035			12.0	4.2	0.631	9.0	3.0	**7,977**	**3.25**
100	114	25,228	10.7	2,724	53.6	39.8	10.0	48.6	5.0	**24,911**	**9.1**
37.8	45.6	7,392			12.0	4.3	0.631	9.2	2.8	**7,299**	**2.68**
110	125	27,481	12.4	3,070	53.6	40.0	10.0	49.1	4.5	**22,465**	**7.3**
43.3	51.7	8,052			12.0	4.4	0.631	9.5	2.5	**6,582**	**2.14**
120	135	31,062	14.2	3,443	53.6	40.2	10.0	49.6	4.0	**19,992**	**5.8**
48.9	57.2	9,101			12.0	4.6	0.631	9.8	2.2	**5,858**	**1.70**
Compressor: ZPS30K5E-PFV											

Heating Mode

ATW-55-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			Electrical		Heating Data (Indoor Unit)						
Air Temp	Evaporating Temp	HAB	Compressor Current	Input Power	ELT	Condensing Temp	Liquid Flow	LLT	Delta T	Heating Capacity	COPh
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	Btu/hr	W/W
°C	°C	Watts			°C	°C	L/s	°C	°C	Watts	
-5.0	-16.2	6,440	17.1	3,967	104	112	12.0	107.3	3.3	**19,776**	**1.46**
-20.6	-26.8	1,887			40.0	44.4	0.757	41.8	1.8	**5,794**	
5.0	-7.8	11,273	16.3	3,795	104	112.5	12.0	108.0	4.0	**24,020**	**1.85**
-15.0	-22.1	3,303			40.0	44.7	0.757	42.2	2.2	**7,038**	
19.5	5	15,529	15.4	3,616	104	113	12.0	108.6	4.6	**27,667**	**2.24**
-6.9	-15.0	4,550			40.0	45.0	0.757	42.6	2.6	**8,106**	
25.0	8.8	20,528	14.7	3,465	104	113.5	12.0	109.4	5.4	**32,148**	**2.72**
-3.9	-12.9	6,015			40.0	45.3	0.757	43.0	3.0	**9,419**	
35.0	17.2	26,270	14.0	3,320	104	114	12.0	110.2	6.2	**37,398**	**3.30**
1.7	-8.2	7,697			40.0	45.6	0.757	43.5	3.5	**10,957**	
45.0	25.7	31,079	13.8	3,275	104	114.5	12.0	111.0	7.0	**42,053**	**3.76**
7.2	-3.5	9,106			40.0	45.8	0.757	43.9	3.9	**12,322**	
55.0	34.2	35,725	13.6	3,217	104	115	12.0	111.8	7.8	**46,500**	**4.24**
12.8	1.2	10,467			40.0	46.1	0.757	44.3	4.3	**13,624**	
65.0	42.9	40,421	13.4	3,145	104	115.5	12.0	112.5	8.5	**50,951**	**4.75**
18.3	6.1	11,843			40.0	46.4	0.757	44.7	4.7	**14,928**	
Compressor: ZPS40K5E-PFV											

Cooling Mode

ATW-55-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			Electrical		Cooling Data (Indoor Loop)						
Air Temp	Condensing Temp	Rejection	Compressor Current	Input Power	ELT	Evaporating Temp	Liquid Flow	LLT	Delta T	Cooling Capacity	EER (COPc)
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	Btu/hr	Btu/W-hr
°C	°C	Watts			°C	°C	L/s	°C	°C	Watts	W/W
50	62	55,747	8.6	2,030	53.6	38.8	12.0	45.4	8.2	**49,077**	**24.2**
10.0	16.7	16,334			12.0	3.8	0.757	7.5	4.5	**14,379**	**7.09**
60	72	51,325	9.5	2,247	53.6	39.0	12.0	46.3	7.3	**43,913**	**19.5**
15.6	22.2	15,038			12.0	3.9	0.757	7.9	4.1	**12,866**	**5.73**
70	83	48,221	10.6	2,513	53.6	39.2	12.0	46.9	6.7	**39,898**	**15.9**
21.1	28.3	14,129			12.0	4.0	0.757	8.3	3.7	**11,690**	**4.65**
80	93	46,531	11.9	2,784	53.6	39.4	12.0	47.4	6.2	**37,286**	**13.4**
26.7	33.9	13,634			12.0	4.1	0.757	8.5	3.5	**10,925**	**3.92**
90	104	44,608	13.5	3,135	53.6	39.6	12.0	47.9	5.7	**34,163**	**10.9**
32.2	40.0	13,070			12.0	4.2	0.757	8.8	3.2	**10,010**	**3.19**
100	114	43,337	15.2	3,503	53.6	39.8	12.0	48.3	5.3	**31,637**	**9.0**
37.8	45.6	12,698			12.0	4.3	0.757	9.1	2.9	**9,270**	**2.65**
110	125	41,884	17.4	3,964	53.6	40.0	12.0	48.8	4.8	**28,611**	**7.2**
43.3	51.7	12,272			12.0	4.4	0.757	9.3	2.7	**8,383**	**2.11**
120	135	40,302	19.6	4,432	53.6	40.2	12.0	49.4	4.2	**25,431**	**5.7**
48.9	57.2	11,808			12.0	4.6	0.757	9.6	2.4	**7,451**	**1.68**
Compressor: ZPS40K5E-PFV											

Heating Mode

ATW-65-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			Electrical		Heating Data (Indoor Unit)						
Air Temp	Evaporating Temp	HAB	Compressor Current	Input Power	ELT	Condensing Temp	Liquid Flow	LLT	Delta T	Heating Capacity	COPh
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	Btu/hr	W/W
°C	°C	Watts			°C	°C	L/s	°C	°C	Watts	
-5.0	-16.2	7,536	21.2	4,850	104	112	14.0	107.4	3.4	**23,783**	**1.44**
-20.6	-26.8	2,208			40.0	44.4	0.883	41.9	1.9	**6,968**	
5.0	-7.8	13,351	19.9	4,567	104	112.5	14.0	108.1	4.1	**28,630**	**1.84**
-15.0	-22.1	3,912			40.0	44.7	0.883	42.3	2.3	**8,389**	
19.5	5	18,780	18.5	4,277	104	113	14.0	108.7	4.7	**33,069**	**2.27**
-6.9	-15.0	5,502			40.0	45.0	0.883	42.6	2.6	**9,689**	
25.0	8.8	24,038	17.9	4,150	104	113.5	14.0	109.4	5.4	**37,897**	**2.68**
-3.9	-12.9	7,043			40.0	45.3	0.883	43.0	3.0	**11,104**	
35.0	17.2	30,593	16.4	3,837	104	114	14.0	110.2	6.2	**43,381**	**3.31**
1.7	-8.2	8,964			40.0	45.6	0.883	43.4	3.4	**12,710**	
45.0	25.7	36,544	16.6	3,865	104	114.5	14.0	111.1	7.1	**49,428**	**3.75**
7.2	-3.5	10,707			40.0	45.8	0.883	43.9	3.9	**14,482**	
55.0	34.2	42,976	16.6	3,868	104	115	14.0	112.0	8.0	**55,871**	**4.23**
12.8	1.2	12,592			40.0	46.1	0.883	44.4	4.4	**16,370**	
65.0	42.9	49,659	16.6	3,831	104	115.5	14.0	112.9	8.9	**62,428**	**4.77**
18.3	6.1	14,550			40.0	46.4	0.883	45.0	5.0	**18,291**	
Compressor: ZPS51K5E-PFV											

Cooling Mode

ATW-65-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			Electrical		Cooling Data (Indoor Loop)						
Air Temp	Condensing Temp	Rejection	Compressor Current	Input Power	ELT	Evaporating Temp	Liquid Flow	LLT	Delta T	Cooling Capacity	EER (COPc)
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	Btu/hr	Btu/W-hr
°C	°C	Watts			°C	°C	L/s	°C	°C	Watts	W/W
50	62	70,445	11.5	2,576	53.6	38.8	14.0	44.7	8.9	**62,011**	**24.1**
10.0	16.7	20,640			12.0	3.8	0.883	7.1	4.9	**18,169**	**7.05**
60	72	64,100	12.4	2,828	53.6	39.0	14.0	45.8	7.8	**54,808**	**19.4**
15.6	22.2	18,781			12.0	3.9	0.883	7.6	4.4	**16,058**	**5.68**
70	83	60,207	13.6	3,135	53.6	39.2	14.0	46.5	7.1	**49,865**	**15.9**
21.1	28.3	17,640			12.0	4.0	0.883	8.0	4.0	**14,610**	**4.66**
80	93	57,405	15.0	3,450	53.6	39.4	14.0	47.0	6.6	**45,989**	**13.3**
26.7	33.9	16,820			12.0	4.1	0.883	8.3	3.7	**13,475**	**3.91**
90	104	55,444	16.9	3,864	53.6	39.6	14.0	47.5	6.1	**42,613**	**11.0**
32.2	40.0	16,245			12.0	4.2	0.883	8.6	3.4	**12,486**	**3.23**
100	114	53,118	18.9	4,306	53.6	39.8	14.0	48.1	5.5	**38,780**	**9.0**
37.8	45.6	15,563			12.0	4.3	0.883	8.9	3.1	**11,363**	**2.64**
110	125	51,106	21.4	4,872	53.6	40.0	14.0	48.6	5.0	**34,835**	**7.1**
43.3	51.7	14,974			12.0	4.4	0.883	9.2	2.8	**10,206**	**2.09**
120	135	49,135	24.1	5,462	53.6	40.2	14.0	49.2	4.4	**30,850**	**5.6**
48.9	57.2	14,396			12.0	4.6	0.883	9.5	2.5	**9,039**	**1.65**
Compressor: ZPS51K5E-PFV											

Heating Mode

ATW-75-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			**Electrical**		**Heating Data (Indoor Unit)**						
Air Temp	Evaporating Temp	HAB	Compressor Current	Input Power	ELT	Condensing Temp	Liquid Flow	LLT	Delta T	**Heating Capacity**	**COPh**
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	**Btu/hr**	**W/W**
°C	°C	Watts			°C	°C	L/s	°C	°C	**Watts**	
-5.0	-16.2	7,762	23.6	5,257	104	112	16.0	107.2	3.2	**25,328**	**1.41**
-20.6	-26.8	2,274			40.0	44.4	1.009	41.8	1.8	**7,421**	
5.0	-7.8	14,532	22.1	4,971	104	112.5	16.0	107.9	3.9	**31,123**	**1.83**
-15.0	-22.1	4,258			40.0	44.7	1.009	42.2	2.2	**9,119**	
19.5	5	20,957	21.7	4,888	104	113	16.0	108.7	4.7	**37,265**	**2.23**
-6.9	-15.0	6,140			40.0	45.0	1.009	42.6	2.6	**10,919**	
25.0	8.8	28,124	20.5	4,668	104	113.5	16.0	109.5	5.5	**43,682**	**2.74**
-3.9	-12.9	8,240			40.0	45.3	1.009	43.0	3.0	**12,799**	
35.0	17.2	35,100	19.8	4,527	104	114	16.0	110.3	6.3	**50,174**	**3.25**
1.7	-8.2	10,284			40.0	45.6	1.009	43.5	3.5	**14,701**	
45.0	25.7	42,049	19.3	4,421	104	114.5	16.0	111.1	7.1	**56,763**	**3.76**
7.2	-3.5	12,320			40.0	45.8	1.009	43.9	3.9	**16,631**	
55.0	34.2	49,223	18.9	4,312	104	115	16.0	112.0	8.0	**63,565**	**4.32**
12.8	1.2	14,422			40.0	46.1	1.009	44.4	4.4	**18,624**	
65.0	42.9	56,992	18.4	4,183	104	115.5	16.0	112.9	8.9	**70,892**	**4.97**
18.3	6.1	16,698			40.0	46.4	1.009	44.9	4.9	**20,771**	
Compressor: ZPS60K5E-PFV											

Cooling Mode

ATW-75-HACW-P-1T										R410a 60 Hz	
Outdoor Unit			**Electrical**		**Cooling Data (Indoor Loop)**						
Air Temp	Condensing Temp	Rejection	Compressor Current	Input Power	ELT	Evaporating Temp	Liquid Flow	LLT	Delta T	**Cooling Capacity**	**EER (COPc)**
°F	°F	Btu/hr	Amps	Watts	°F	°F	gpm	°F	°F	**Btu/hr**	**Btu/W-hr**
°C	°C	Watts			°C	°C	L/s	°C	°C	**Watts**	**W/W**
50	62	77,181	13.7	2,838	53.6	38.8	16.0	45.1	8.5	**67,886**	**23.9**
10.0	16.7	22,614			12.0	3.8	1.009	7.3	4.7	**19,890**	**7.01**
60	72	72,429	15.3	3,216	53.6	39.0	16.0	45.9	7.7	**61,845**	**19.2**
15.6	22.2	21,222			12.0	3.9	1.009	7.7	4.3	**18,120**	**5.63**
70	83	69,770	17.0	3,640	53.6	39.2	16.0	46.4	7.2	**57,741**	**15.9**
21.1	28.3	20,442			12.0	4.0	1.009	8.0	4.0	**16,918**	**4.65**
80	93	66,919	18.7	4,032	53.6	39.4	16.0	46.9	6.7	**53,549**	**13.3**
26.7	33.9	19,607			12.0	4.1	1.009	8.3	3.7	**15,690**	**3.89**
90	104	64,259	20.9	4,519	53.6	39.6	16.0	47.4	6.2	**49,230**	**10.9**
32.2	40.0	18,828			12.0	4.2	1.009	8.6	3.4	**14,424**	**3.19**
100	114	61,724	23.1	5,026	53.6	39.8	16.0	48.0	5.6	**44,962**	**8.9**
37.8	45.6	18,085			12.0	4.3	1.009	8.9	3.1	**13,174**	**2.62**
110	125	59,615	26.0	5,682	53.6	40.0	16.0	48.5	5.1	**40,617**	**7.1**
43.3	51.7	17,467			12.0	4.4	1.009	9.2	2.8	**11,901**	**2.09**
120	135	57,708	29.1	6,380	53.6	40.2	16.0	49.1	4.5	**36,327**	**5.7**
48.9	57.2	16,908			12.0	4.6	1.009	9.5	2.5	**10,644**	**1.67**
Compressor: ZPS60K5E-PFV											

Electrical Tables

Table 30 - Voltage Code 1 (208/230-1-60)

Model	Compressor		Indoor Circulators	Outdoor Unit	FLA	MCA	Max Fuse/ Breaker	Wire Size**
	RLA	LRA	Max A	Max A	Amps	Amps	Amps	ga
25	11.7	58	3.0	1.6	17.1	20.0	30	#10-2
45	15.3	83	3.0	1.6	20.7	24.5	40	#8-2
55	21.2	104	4.0	1.6	27.6	32.9	50	#8-2
65	27.1	153	4.0	3.0	34.9	41.7	60	#6-2
75	29.7	179	4.0	3.0	37.5	44.9	60	#6-2

** Three (3) wire required if connecting 115VAC circulators to the unit.

Table 31 - Voltage Code 2 (208-3-60)

Model	Compressor		Indoor Circulators	Outdoor Unit	FLA	MCA	Max Fuse/ Breaker	Wire Size**
	RLA	LRA	Max A	Max A	Amps	Amps	Amps	ga
25	6.5	55	3.0	1.6	11.9	13.5	20	#12-3
45	11.6	73	3.0	1.6	17.0	19.9	30	#10-3
55	14.0	83	4.0	1.6	20.4	23.9	30	#10-3
65	16.5	110	4.0	3.0	24.3	28.4	40	#8-3
75	17.6	136	4.0	3.0	25.4	29.8	40	#8-3

** Four (4) wire required if connecting 115VAC circulators to the unit.

Table 32 - Voltage Code 4 (460-3-60)

Model	Compressor		Indoor Circulators	Outdoor Unit	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	Max A	Max A	Amps	Amps	Amps	ga
25	3.5	28	-	1.6	5.9	6.8	10	#14-3
45	5.7	38	-	1.6	8.1	9.5	15	#14-3
55	6.4	41	-	1.6	8.8	10.4	15	#14-3
65	7.2	52	-	3.0	9.6	11.4	15	#14-3
75	9.4	66	-	3.0	11.8	14.2	20	#12-3

Table 33 - Voltage Code 6 (220-1-50)

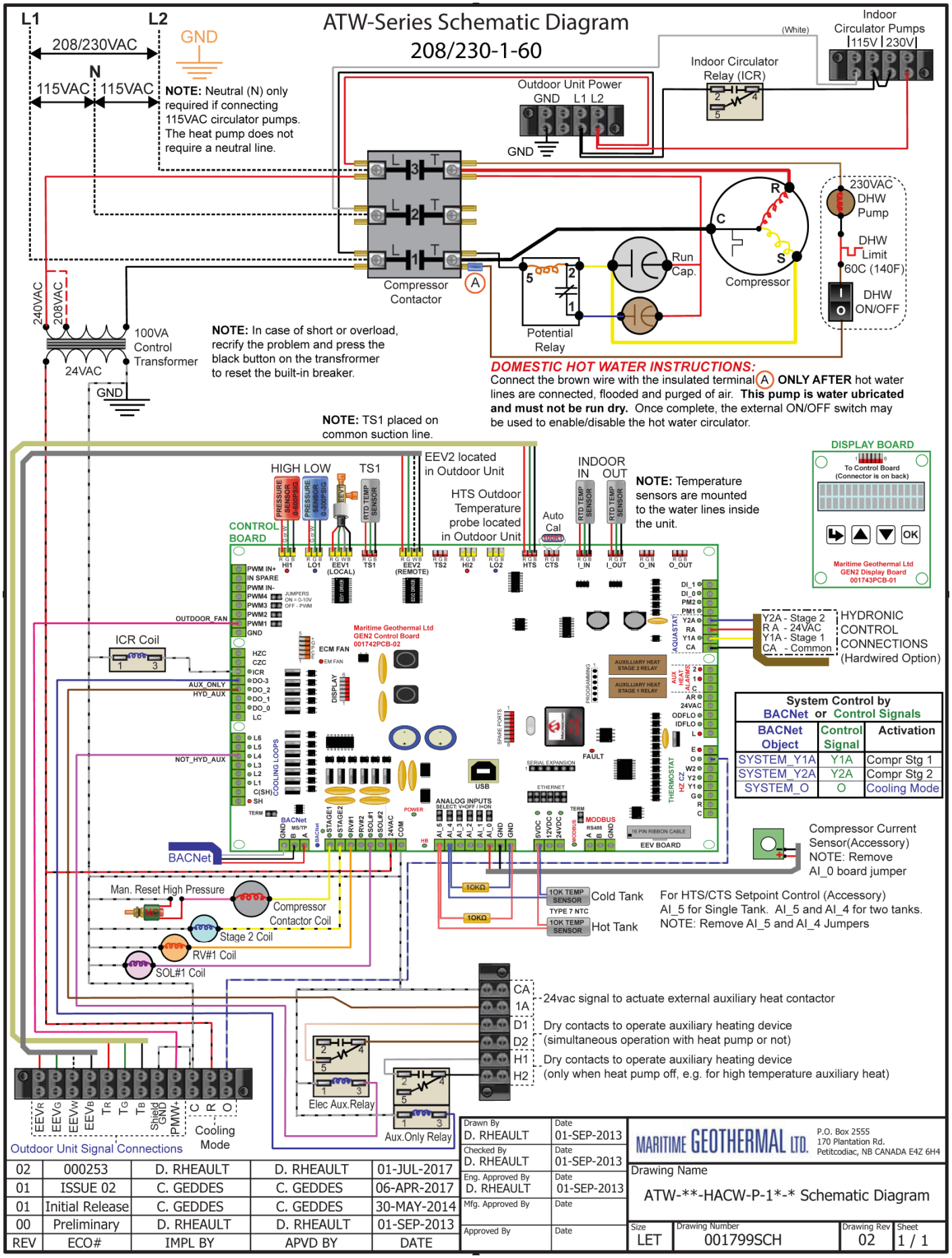
Model	Compressor		Indoor Circulators	Outdoor Unit	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	Max A	Max A	Amps	Amps	Amps	ga
25	9.2	52	3.0	1.6	14.6	16.9	25	#12-2
45	12.4	67	3.0	1.6	17.8	20.9	30	#10-2
55	15.5	100	3.0	1.6	21.9	25.8	40	#8-2
65	21.5	126	4.0	1.6	29.3	34.7	50	#8-2
75*	29.5	176	4.0	3.0	37.3	44.7	60	#6-2

* Models are single stage

Table 34 - Voltage Code 7 (380-3-50)

Model	Compressor		Indoor Circulators	Outdoor Unit	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	Max A	Max A	Amps	Amps	Amps	ga
25	3.2	27	3.0	1.6	8.6	9.4	10	#14-4
45	5.1	38	3.0	1.6	10.5	11.8	15	#14-4
55	6.1	43	4.0	1.6	12.5	14.0	20	#14-4
65	6.9	52	4.0	3.0	14.7	16.4	20	#14-4
75	8.5	66	4.0	3.0	16.3	18.4	25	#12-4

Wiring Diagram (208/230-1-60)



REV	ECO#	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	ISSUE 02	C. GEDDES	C. GEDDES	06-APR-2017
01	Initial Release	C. GEDDES	C. GEDDES	30-MAY-2014
00	Preliminary	D. RHEAULT	D. RHEAULT	01-SEP-2013

Drawn By	D. RHEAULT	Date	01-SEP-2013
Checked By	D. RHEAULT	Date	01-SEP-2013
Eng. Approved By	D. RHEAULT	Date	01-SEP-2013
Mfg. Approved By		Date	
Approved By		Date	

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

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

Size	Drawing Number	Drawing Rev	Sheet
LET	001799SCH	02	1 / 1

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

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	External	Activation
SYSTEM_Y1A	Y1A	Compressor Stage 1
SYSTEM_Y2A	Y2A	Compressor Stage 2
SYSTEM_O	O	Heating (OFF) / Cooling (ON)

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

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

EXTERNAL CONTROL CONNECTIONS (24VAC)

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

If using an external aquastat ("Signals" control method), use these connections in addition:
C - 24VAC Common (terminal strip)
Y1A - Compressor Stage1 (right board connector)
Y2A - Compressor Stage2 (right board connector)

A dry contact connection between R and any external control connection (Y1A, Y2A or O) will activate the external control signal input to the control board.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of 3 types of auxiliary heat connections:

CA / 1A — 24VAC signal to operate external auxiliary heat contactor (**Max load 500mA**.)

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

H1 / H2 — Dry contacts, closed when ATW calls for aux. heat (only when compressor OFF; use for high temperature backup heating devices)

OUTDOOR UNIT SIGNAL CONNECTIONS (24VAC)

Use an 18-8 **shielded** cable to connect the Outdoor Unit Signal Connections to the matching Outdoor Unit Signal Connections in the heat pump electrical box. Connect the shield ground to the Shield Ground terminal.

OUTDOOR UNIT POWER CONNECTIONS (230VAC)

Use a minimum of #14-2 outdoor rated cabling to connect the power supply of the outdoor unit to the matching terminals of the Outdoor Power Supply terminal strip in the electrical box of the heat pump.

CIRCULATOR CONNECTIONS (230/115VAC)

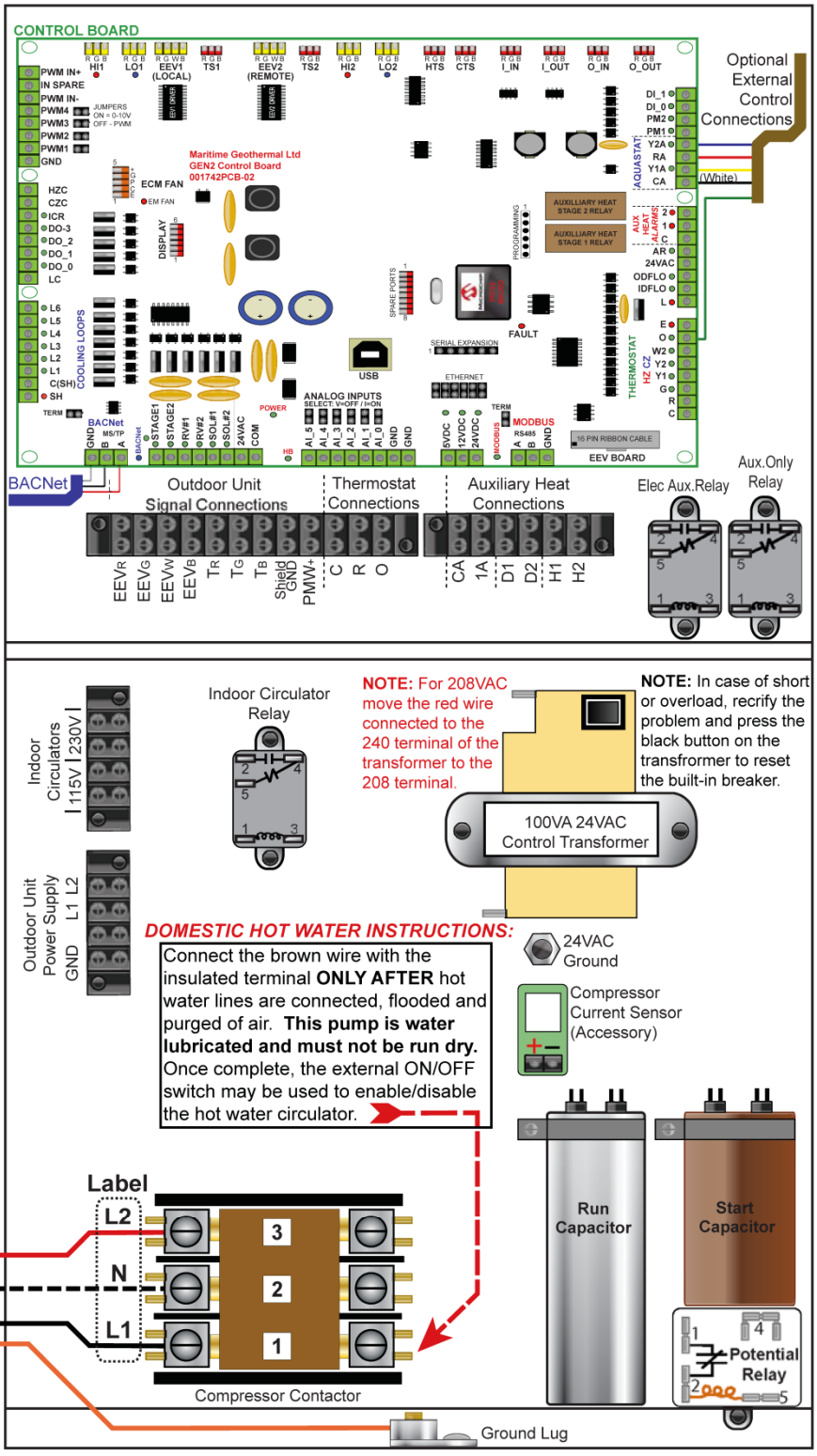
REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 115VAC circulators to 115V
Connect 230VAC circulators to 230V

POWER SUPPLY CONNECTIONS

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

208/230/115VAC CONNECTIONS		
Wire	Colour	Contactor (Label)
Line 2	Red	L2
Neutral*	White	N*
Line 1	Black	L1
Connect "GND" to Gnd.Lug		

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



REV	ECO#	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	Initial Release	C. GEDDES	C. GEDDES	30-MAY-2014

Drawn By	D. RHEAULT	Date	01-SEP-2013
Checked By	D. RHEAULT	Date	01-SEP-2013
Eng. Approved By	D. RHEAULT	Date	01-SEP-2013
Mfg. Approved By		Date	
Approved By		Date	

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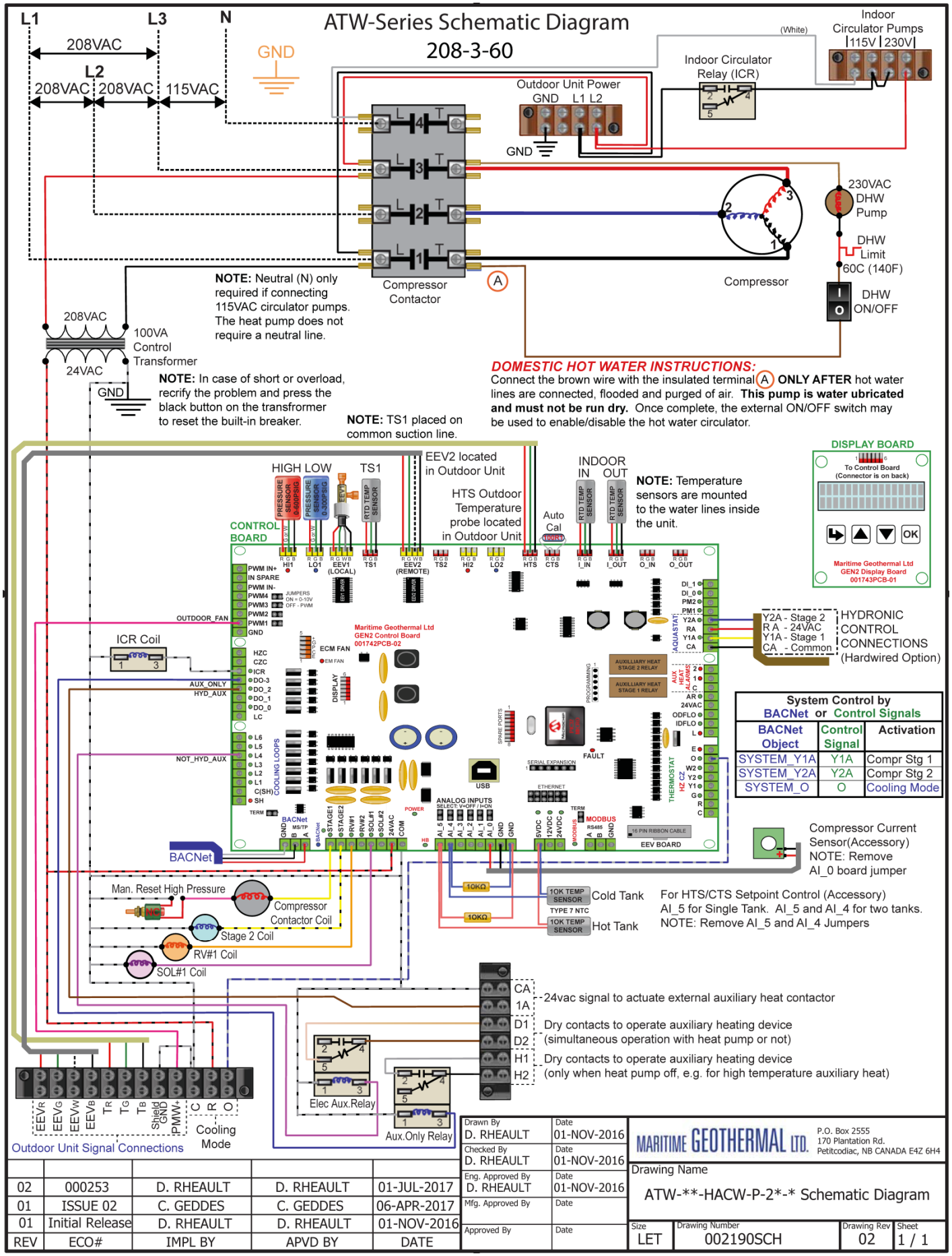
Drawing Name: ATW-**-HACW-P-1*-* Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	001800ELB	02	1 / 1

Wiring Diagram (208-3-60)



REV	ECO#	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	ISSUE 02	C. GEDDES	C. GEDDES	06-APR-2017
01	Initial Release	D. RHEAULT	D. RHEAULT	01-NOV-2016

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Approved By		Date

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

Size	Drawing Number	Drawing Rev	Sheet
LET	002190SCH	02	1 / 1

Electrical Box Layout (208-3-60)

ATW-Series Electrical Box Diagram
208-3-60

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	**External**	**Activation**
SYSTEM_Y1A	Y1A	Compressor Stage 1
SYSTEM_Y2A	Y2A	Compressor Stage 2
SYSTEM_O	O	Heating (OFF) / Cooling (ON)

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

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

EXTERNAL CONTROL CONNECTIONS (24VAC)

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

If using an external aquastat ("Signals" control method), use these connections in addition:
C - 24VAC Common (terminal strip)
Y1A - Compressor Stage1 (right board connector)
Y2A - Compressor Stage2 (right board connector)

A dry contact connection between R and any external control connection (Y1A, Y2A or O) will activate the external control signal input to the control board.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of 3 types of auxiliary heat connections:

CA / 1A — 24VAC signal to operate external auxiliary heat contactor (**Max load 500mA**.)

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

H1 / H2 — Dry contacts, closed when ATW calls for aux. heat (only when compressor OFF; use for high temperature backup heating devices)

OUTDOOR UNIT SIGNAL CONNECTIONS (24VAC)

Use an 18-8 shielded cable to connect the Outdoor Unit Signal Connections to the matching Outdoor Unit Signal Connections in the heat pump electrical box. Connect the shield ground to the Shield Ground terminal.

OUTDOOR UNIT POWER CONNECTIONS (208VAC)

Use a minimum of #14-2 outdoor rated cabling to connect the power supply of the outdoor unit to the matching terminals of the Outdoor Power Supply terminal strip in the electrical box of the heat pump.

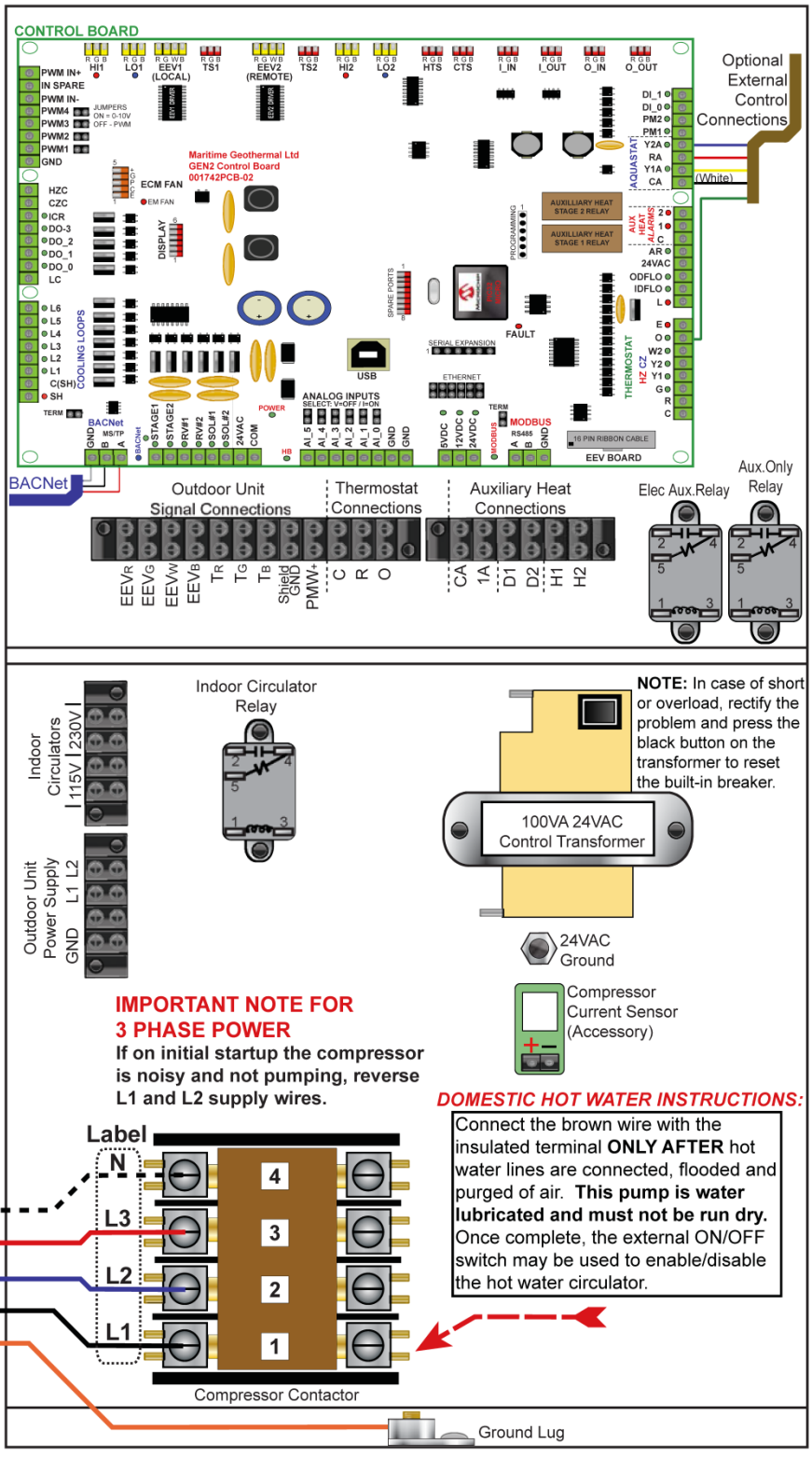
CIRCULATOR CONNECTIONS (208~230/115VAC)

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

POWER SUPPLY CONNECTIONS

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

208/115VAC CONNECTIONS		
Wire	**Colour**	**Contactor (Label)**
Neutral*	White	N*
Line 3	Red	L3
Line 2	Blue	L2
Line 1	Black	L1
Connect "GND" to Gnd.Lug		



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

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

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 external ON/OFF switch may be used to enable/disable the hot water circulator.

REV	ECO#	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
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Checked By D. RHEAULT	Date 01-NOV-2016	
Eng. Approved By D. RHEAULT	Date 01-NOV-2016	
Mfg. Approved By	Date	
Approved By	Date	

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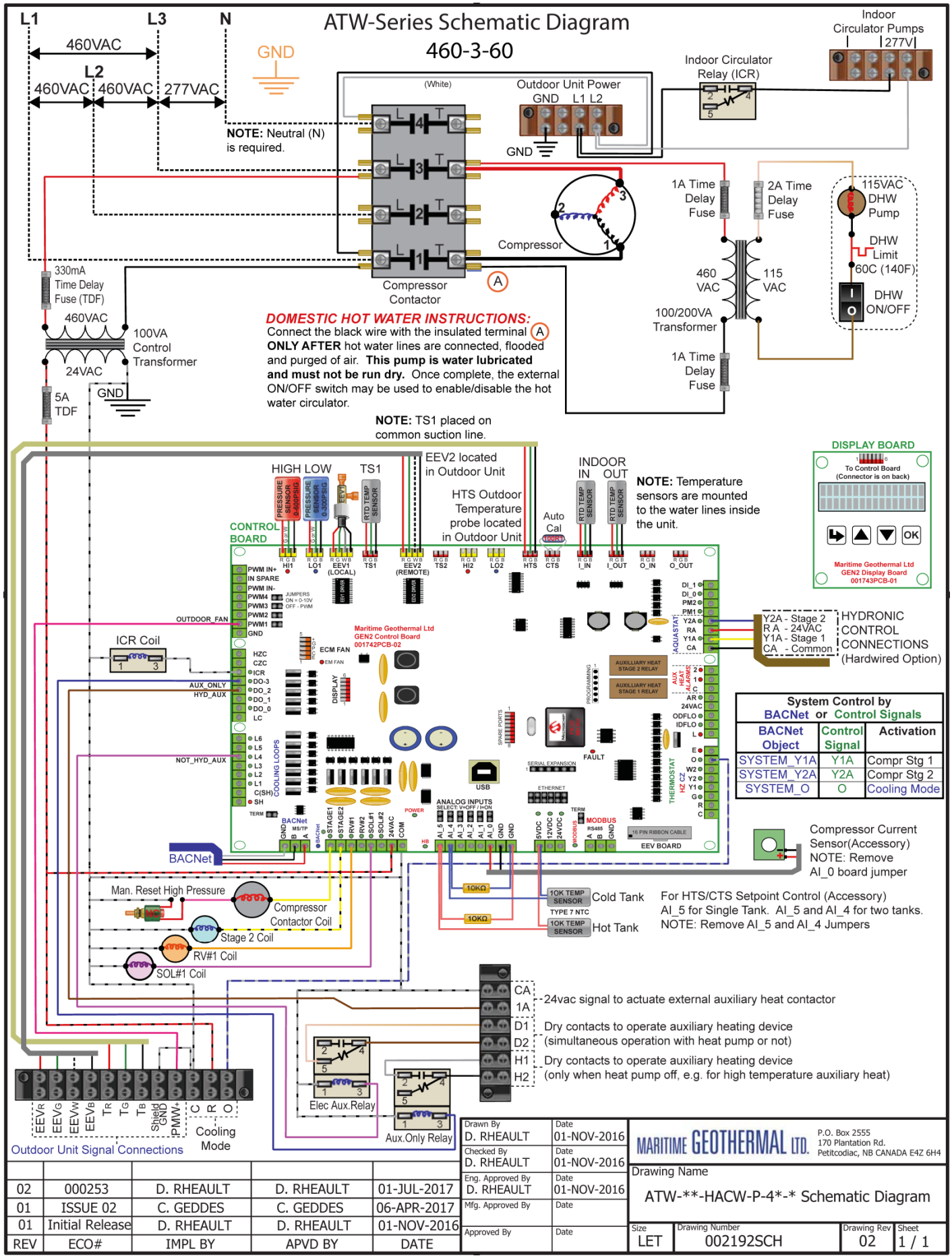
Drawing Name: ATW-**-HACW-P-2*-* Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002189ELB	02	1 / 1

Wiring Diagram (460-3-60)



REV	ECO#	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	ISSUE 02	C. GEDDES	C. GEDDES	06-APR-2017
01	Initial Release	D. RHEAULT	D. RHEAULT	01-NOV-2016

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Checked By	D. RHEAULT	Date	01-NOV-2016
Eng. Approved By	D. RHEAULT	Date	01-NOV-2016
Mfg. Approved By		Date	
Approved By		Date	

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

Size	Drawing Number	Drawing Rev	Sheet
LET	002192SCH	02	1 / 1

Electrical Box Layout (460-3-60)

ATW-Series Electrical Box Diagram 460-3-60

SYSTEM CONTROL DESCRIPTION

Sytem Control by BACNet or External Control Signals		
BACNet Object	**External**	**Activation**
SYSTEM_Y1A	Y1A	Compressor Stage 1
SYSTEM_Y2A	Y2A	Compressor Stage 2
SYSTEM_O	O	Heating (OFF) / Cooling (ON)

BACNet INTERFACE CONNECTIONS (MS/TP RS-485)

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

EXTERNAL CONTROL CONNECTIONS (24VAC)

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

If using an external aquastat ("Signals" control method), use these connections in addition:
C - 24VAC Common (terminal strip)
Y1A - Compressor Stage1 (right board connector)
Y2A - Compressor Stage2 (right board connector)

A dry contact connection between R and any external control connection (Y1A, Y2A or O) will activate the external control signal input to the control board.

AUXILIARY HEAT CONTROL CONNECTIONS

Use an 18-2 conductor cable.
Choose one of 3 types of auxiliary heat connections:

CA / 1A — 24VAC signal to operate external auxiliary heat contactor (**Max load 500mA**.)

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

H1 / H2 — Dry contacts, closed when ATW calls for aux. heat (only when compressor OFF; use for high temperature backup heating devices)

OUTDOOR UNIT SIGNAL CONNECTIONS (24VAC)

Use an 18-8 shielded cable to connect the Outdoor Unit Signal Connections to the matching Outdoor Unit Signal Connections in the heat pump electrical box. Connect the shield ground to the Shield Ground terminal.

OUTDOOR UNIT POWER CONNECTIONS (277VAC)

Use a minimum of #14-2 outdoor rated cabling to connect the power supply of the outdoor unit to the matching terminals of the Outdoor Power Supply terminal strip in the electrical box of the heat pump.

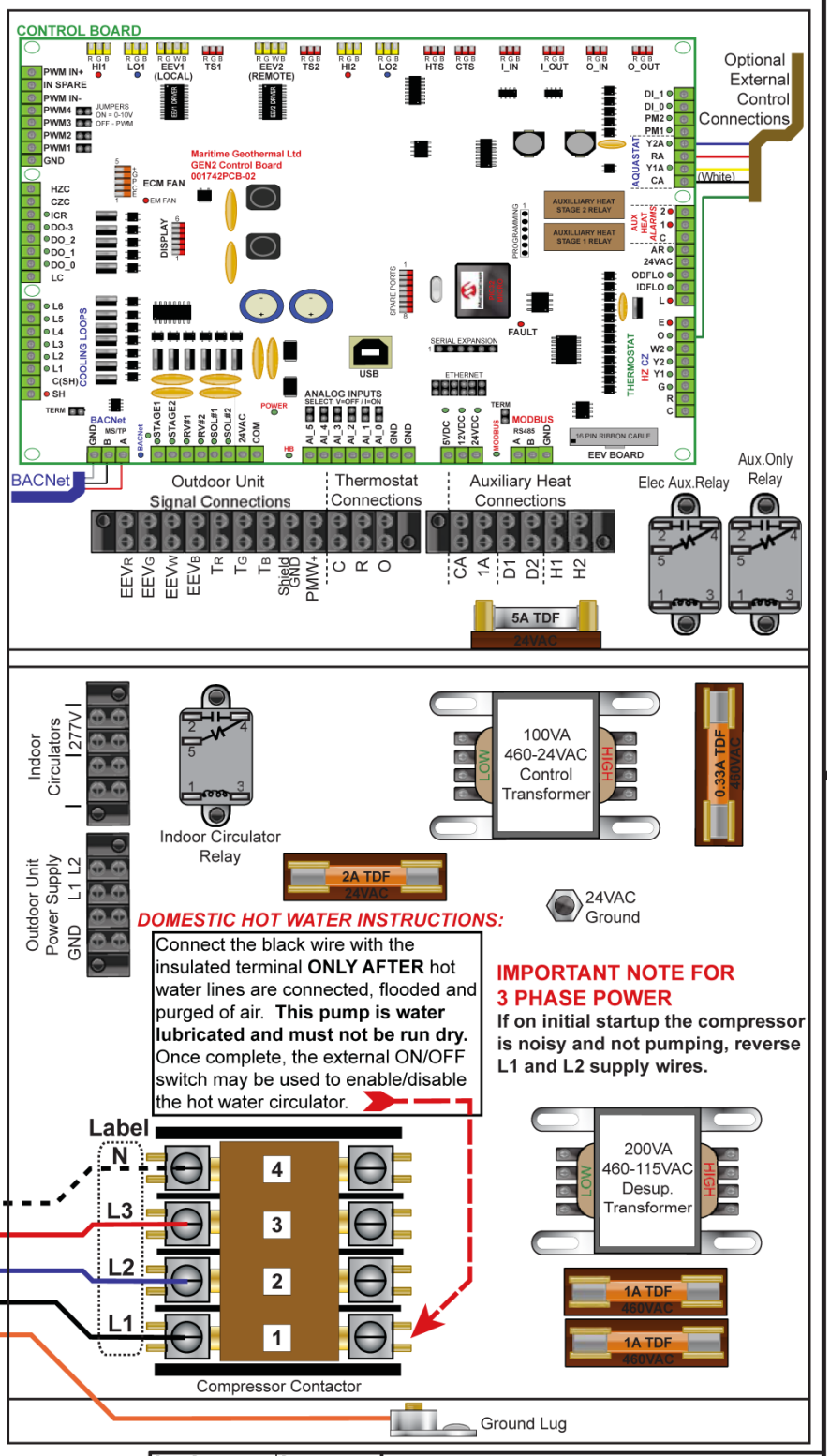
CIRCULATOR CONNECTIONS (277VAC)

REFER TO LABEL IN UNIT FOR MAX LOAD (AMPS)
Connect 277VAC circulators to 277V

POWER SUPPLY CONNECTIONS

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

460/277VAC CONNECTIONS		
Wire	**Colour**	**Contactor (Label)**
Neutral*	White	N*
Line 3	Red	L3
Line 2	Blue	L2
Line 1	Black	L1
Connect "GND" to Gnd.Lug		



REV	ECO#	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	Initial Release	D. RHEAULT	D. RHEAULT	01-NOV-2016

Drawn By: D. RHEAULT	Date: 01-NOV-2016		
Checked By: D. RHEAULT	Date: 01-NOV-2016		
Eng. Approved By: D. RHEAULT	Date: 01-NOV-2016		
Mfg. Approved By:	Date:		
Approved By:	Date:		

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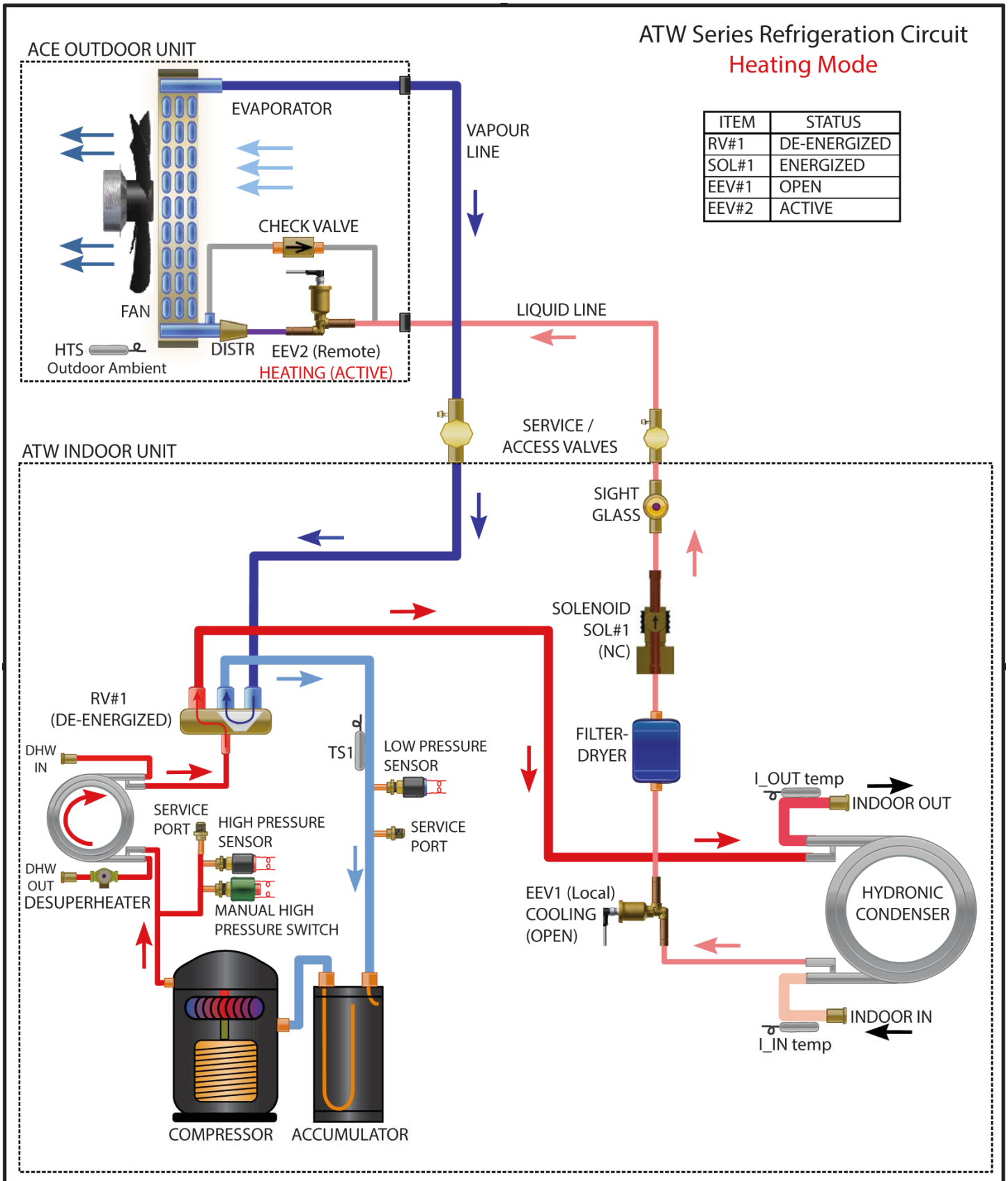
Drawing Name: ATW-**-HACW-P-4*-* Electrical Box Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002191ELB	02	1 / 1

ATW Series Refrigeration Circuit
Heating Mode

ITEM	STATUS
RV#1	DE-ENERGIZED
SOL#1	ENERGIZED
EEV#1	OPEN
EEV#2	ACTIVE



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

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

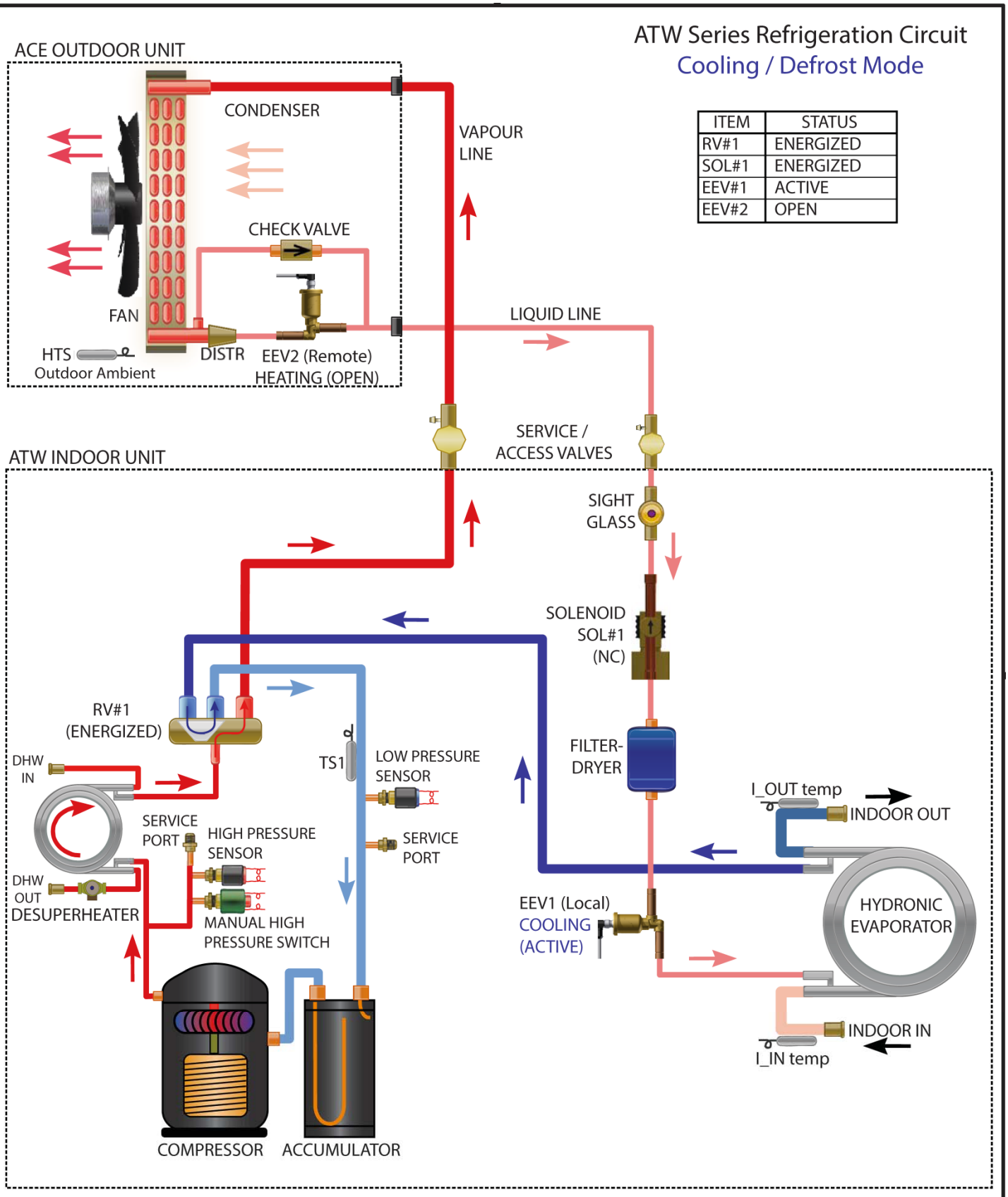
MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: ATW-Series Refrigeration Circuit Heating Mode

Size	Drawing Number	Drawing Revision	Sheet
LET	001840RCD	01	1 / 1

ATW Series Refrigeration Circuit
Cooling / Defrost Mode

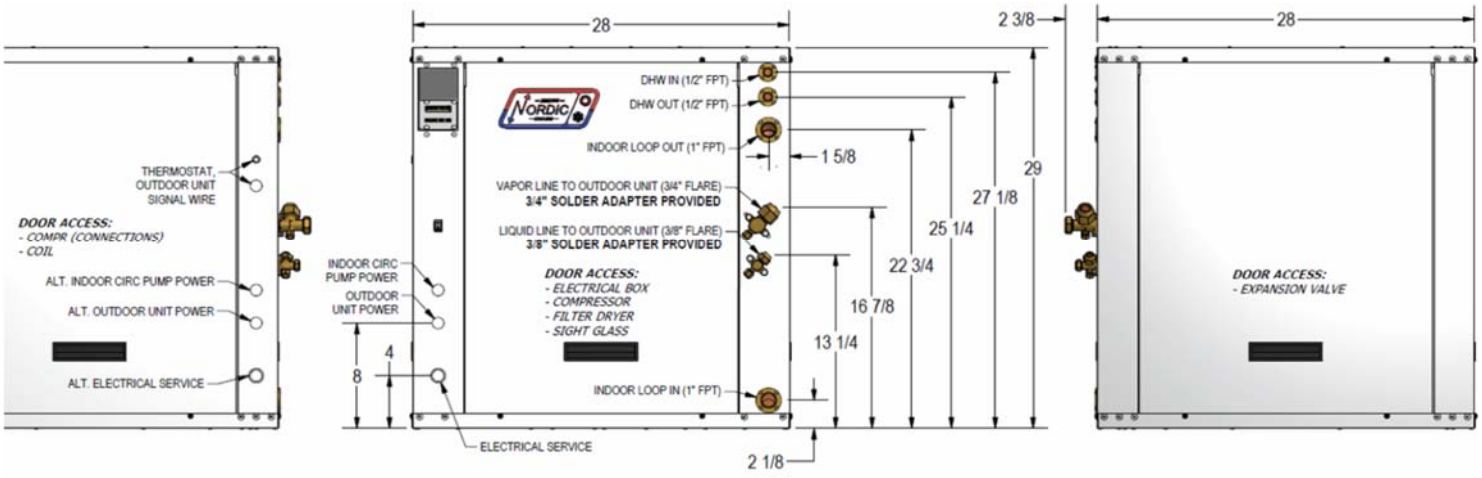
ITEM	STATUS
RV#1	ENERGIZED
SOL#1	ENERGIZED
EEV#1	ACTIVE
EEV#2	OPEN

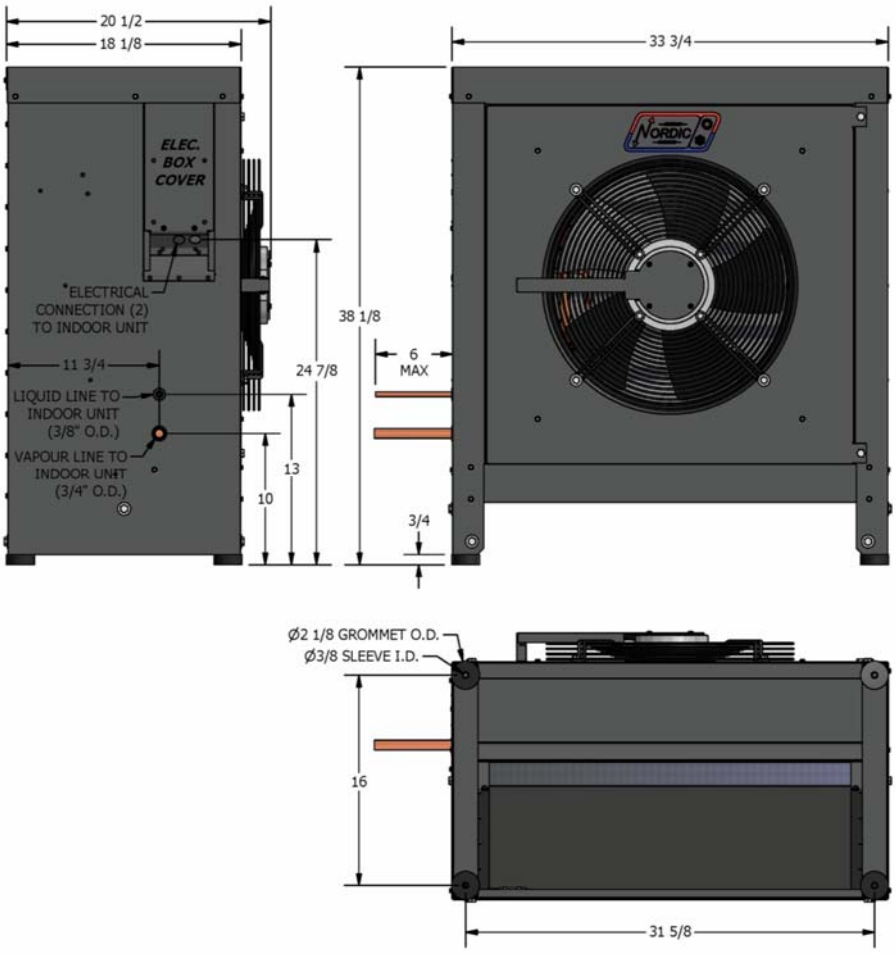


REV	ECO#	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	Initial Release	C. GEDDES	C. GEDDES	16-JUL-2014

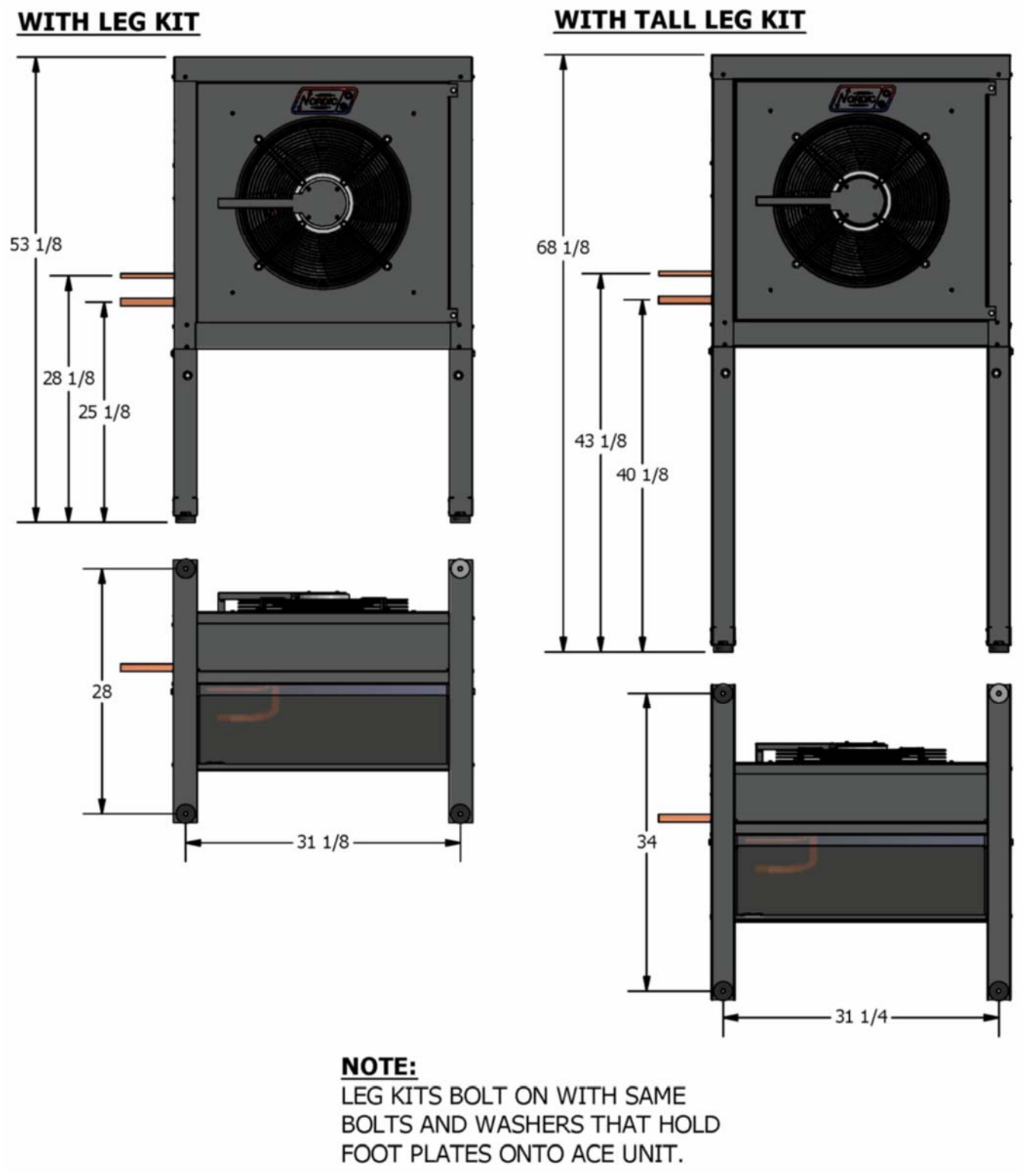
Drawn By C.GEDDES	Date 16-JUL-2014	MARITIME GEOTHERMAL LTD.	P.O. Box 2555 170 Plantation Rd. Petitcodiac, NB CANADA E4Z 6H4
Checked By C.GEDDES	Date 16-JUL-2014	Drawing Name	ATW-Series Refrigeration Circuit Cooling / Defrost Mode
Eng. Approved By C.GEDDES	Date 16-JUL-2014		
Mfg. Approved By	Date		
Approved By	Date	Size LET	Drawing Number 001841RCD / Drawing Revision 02 / Sheet 1 / 1

Dimensions: ATW-25/45

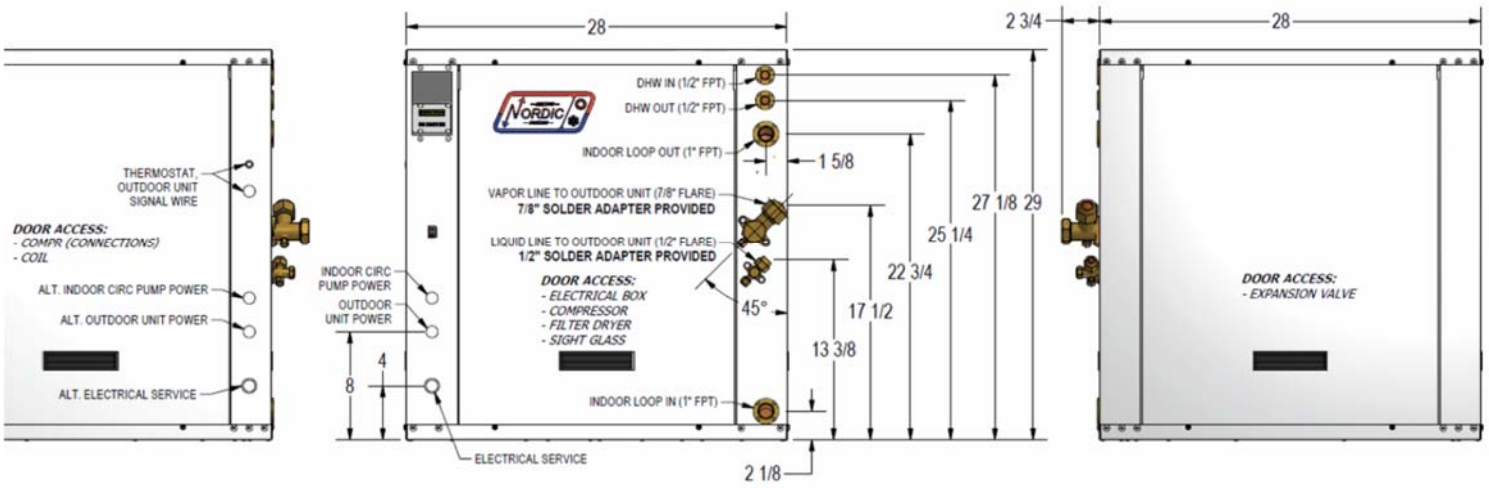


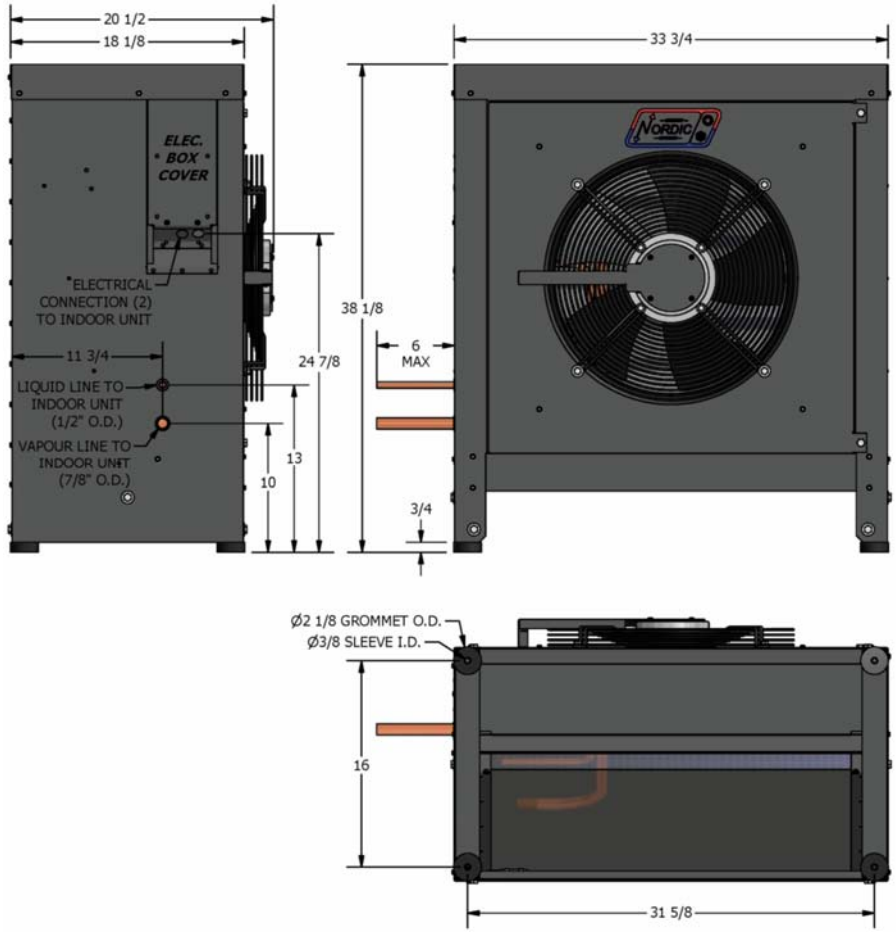


Dimensions: ATW-25/45



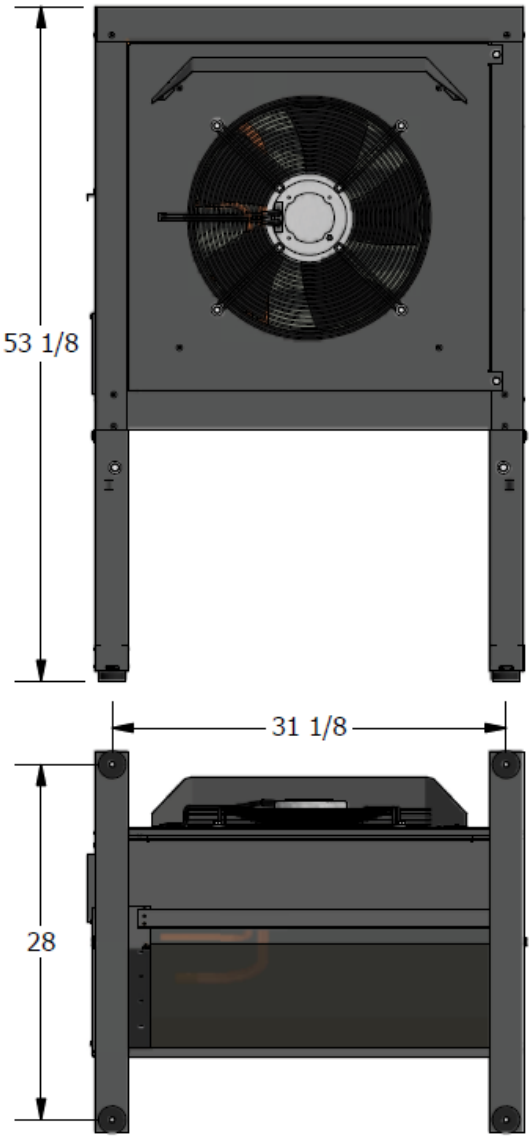
Dimensions: ATW-55



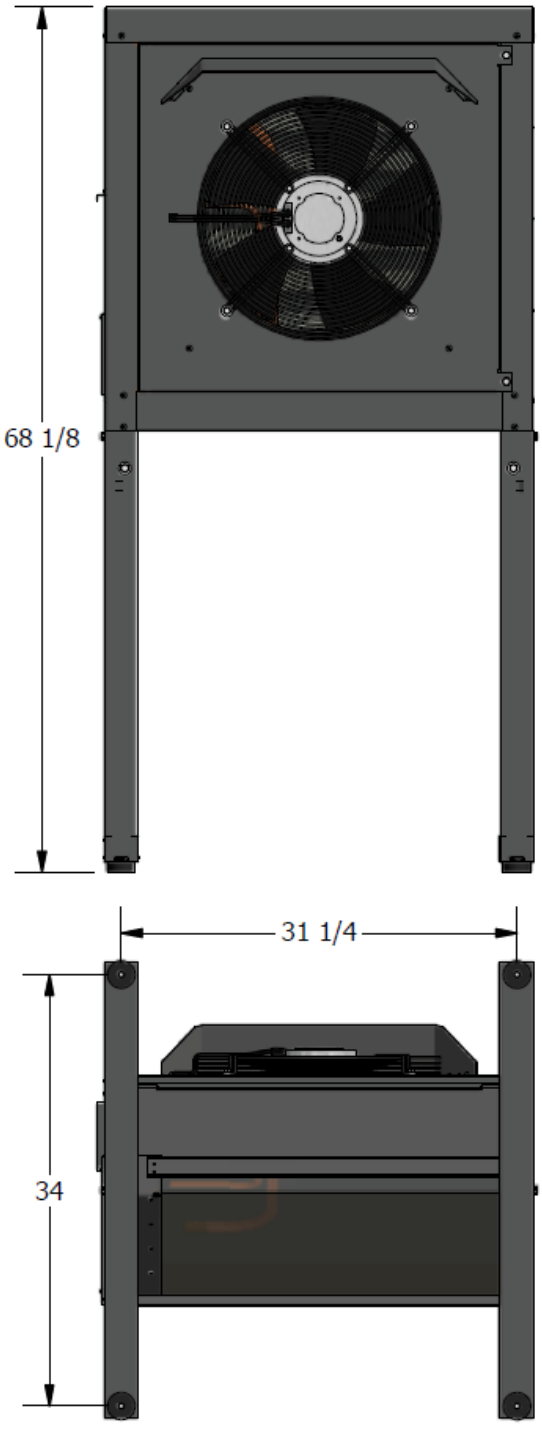


Dimensions: ATW-55

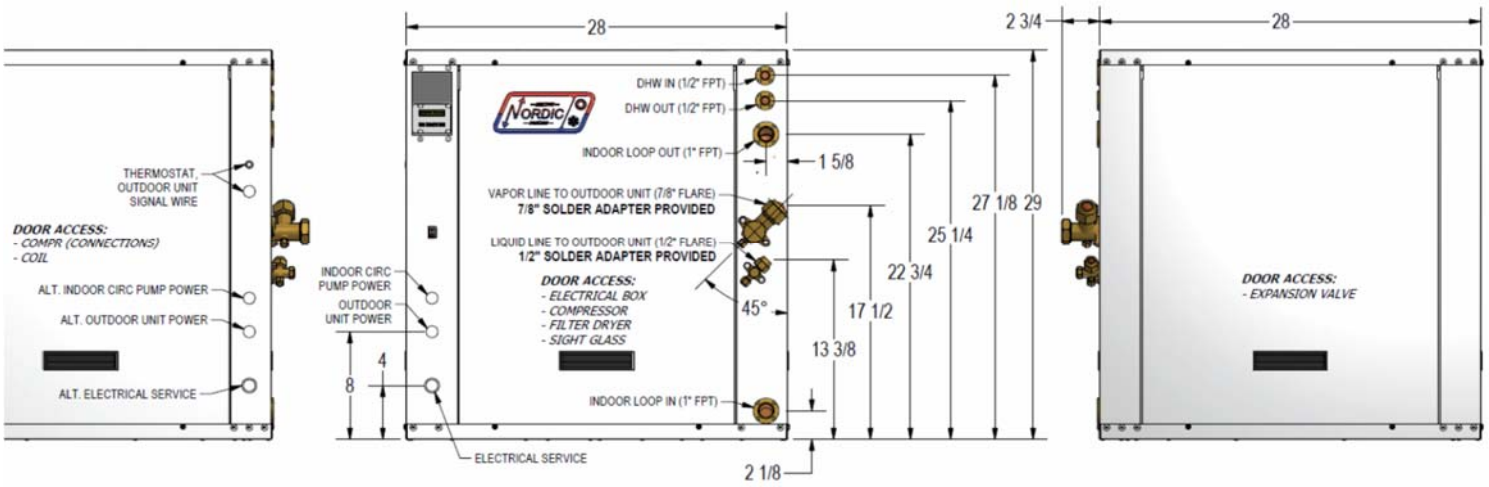
WITH LEG KIT

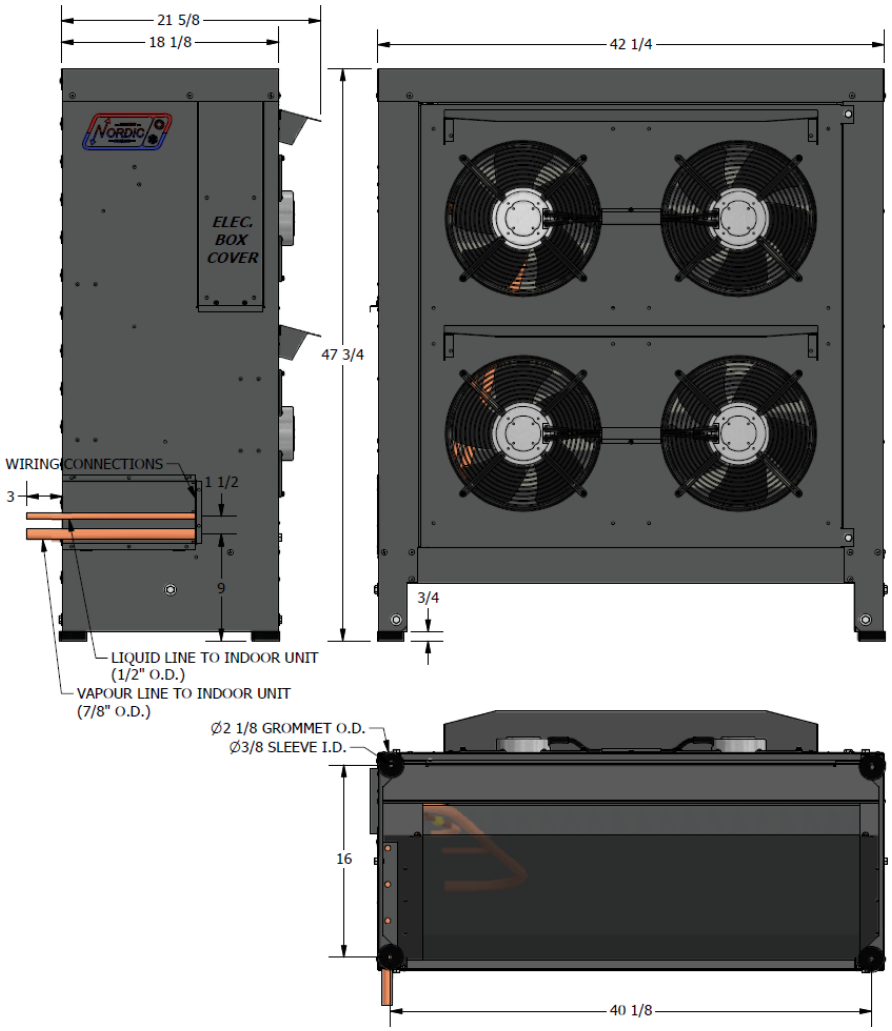


WITH TALL LEG KIT



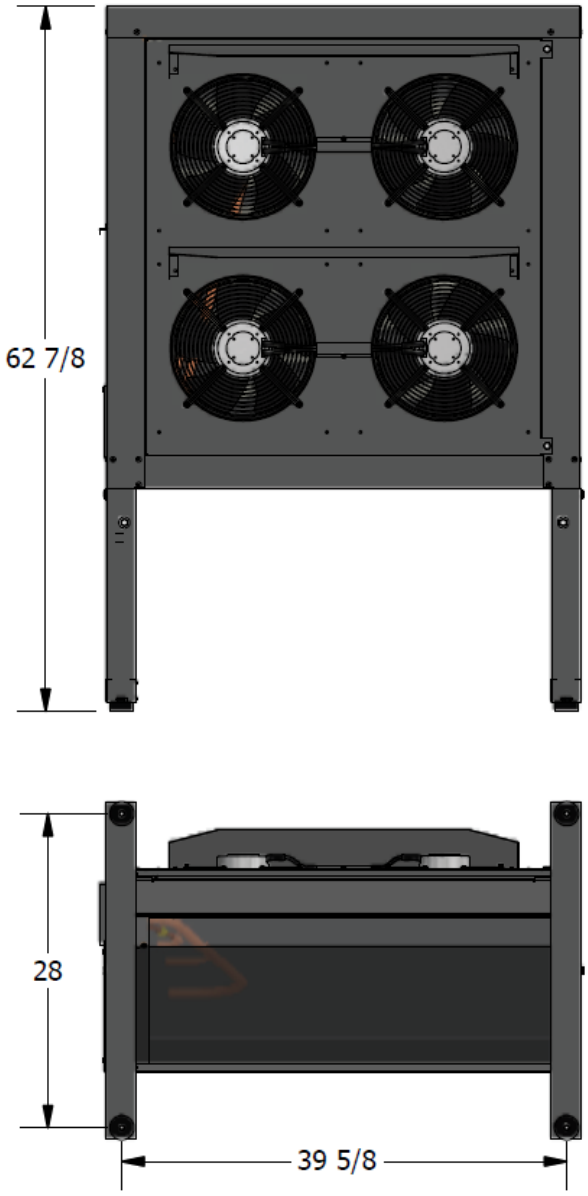
Dimensions: ATW-65/75



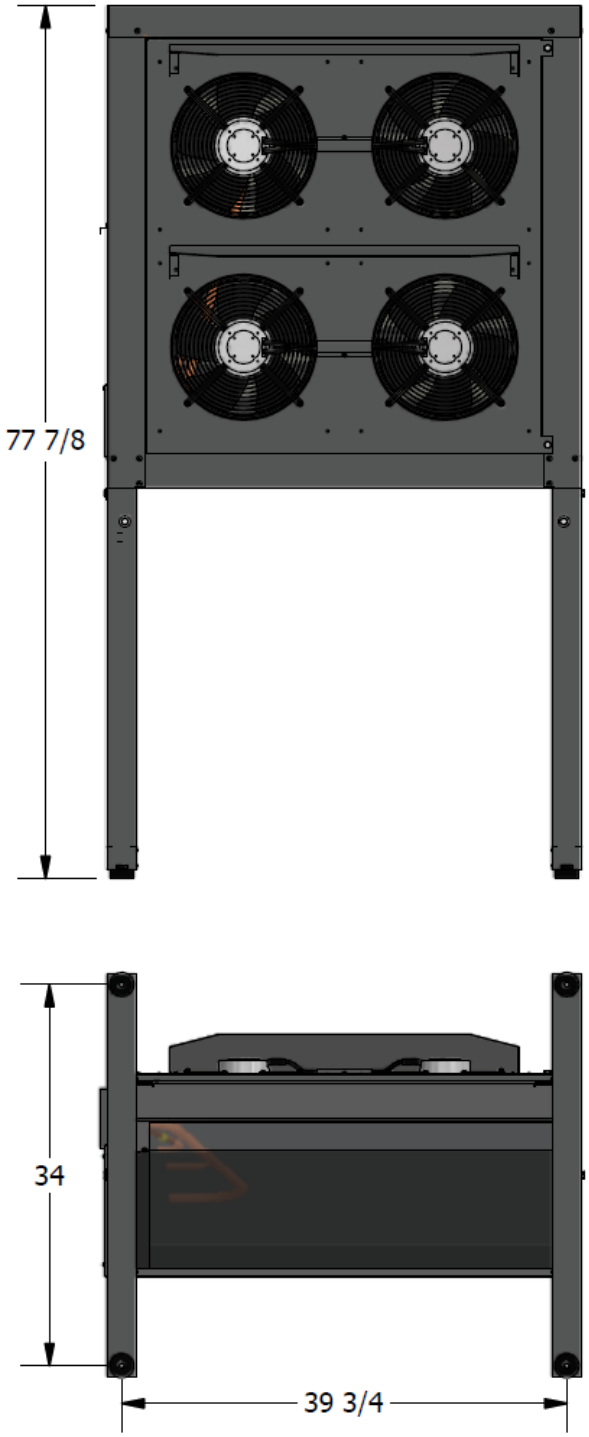


Dimensions: ATW-65/75

WITH LEG KIT

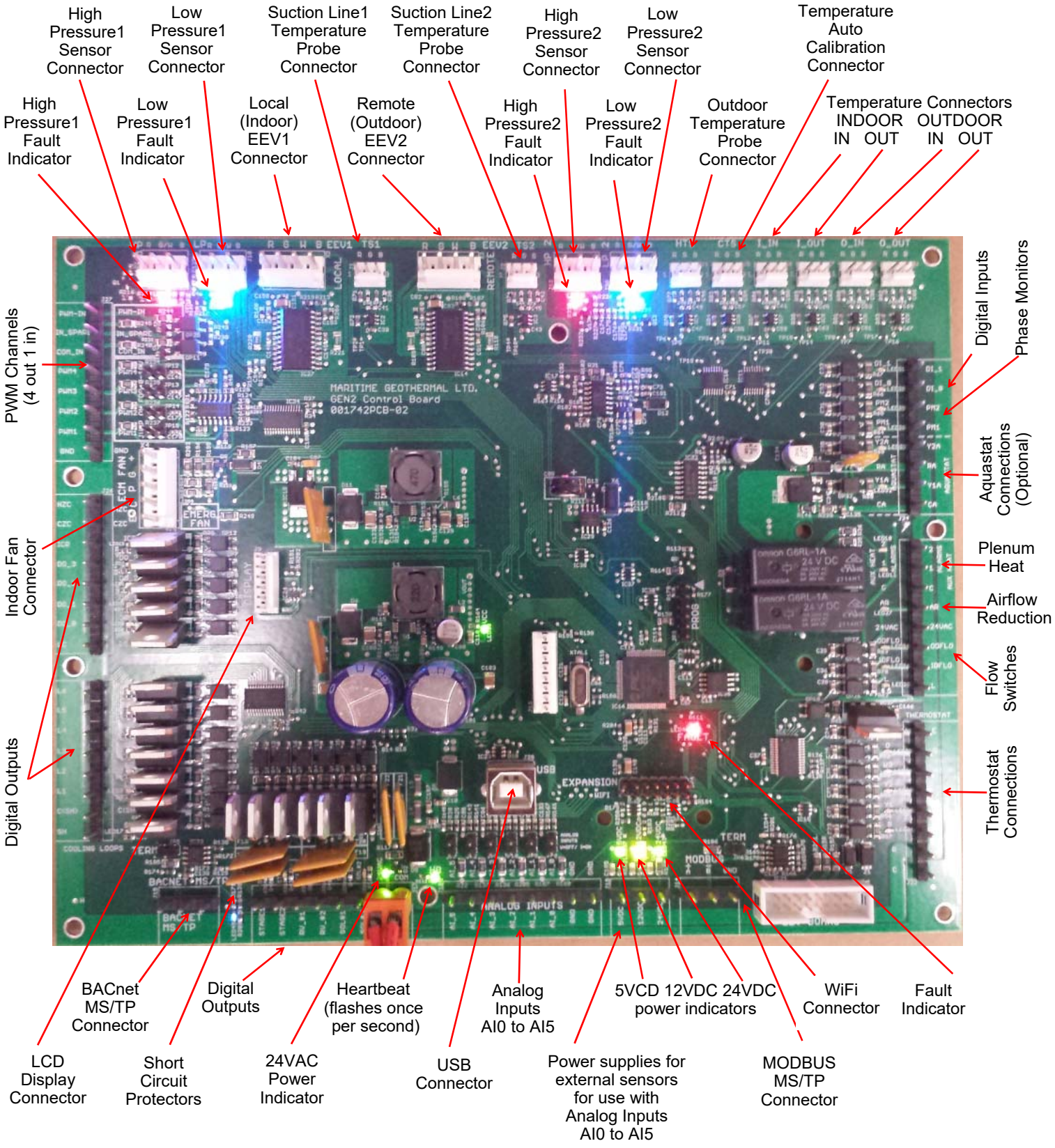


WITH TALL LEG KIT



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.



Below is a picture of the control board . The tables following this picture describe the connections starting with the top of the board and working around the board counter clock-wise.

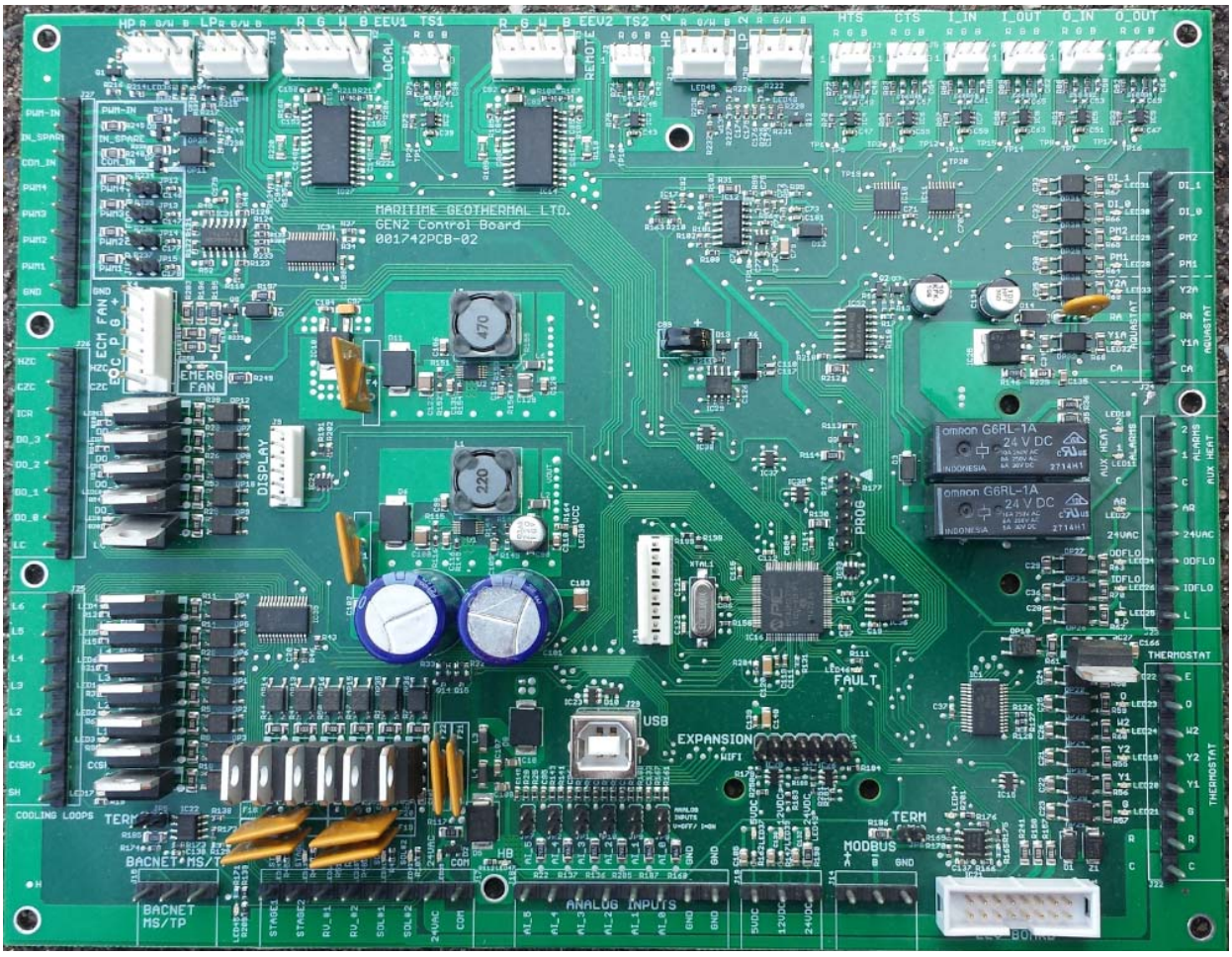


TABLE 35 - Control Board Connector Descriptions (Top)		
Signal	**Description**	
HPS1	High Pressure Sensor 1	Mounted in Indoor Unit, measures discharge pressure.
LPS1	Low Pressure Sensor 1	Mounted in Indoor Unit, measures suction pressure.
EEV1	Local EEV	Mounted in Indoor Unit, used in cooling mode.
TS1	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	High Pressure Sensor 2	Unused.
LPS2	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 36 - Control Board Connector Descriptions (Left Side)		
Name	**Description**	
PWM_IN	Signal for PWM IN	Unused.
IN_SPARE	Spare digital input	Unused.
COM_IN	Common for PWM IN	Unused.
PWM4	PWM / 0-10VDC output	Unused.
PWM3	PWM / 0-10VDC output	Unused.
PWM2	PWM / 0-10VDC output	Unused.
PWM1	PWM / 0-10VDC output	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	Digital output	Unused.
DO_2	Hydronic Auxiliary	Operates the hydronic auxiliary, pins CA and 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	Loop4	Unused.
L3	Loop3	Unused.
L2	Loop2	Unused.
L1	Loop1	Unused.
C(SH)	Soaker Hose common	Unused.
SH	Soaker Hose	Unused.

TABLE 37 - 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 on/off the compressor Stage 2 solenoid.
RV_#1	Reversing Valve#1	Off in heating mode, on in cooling mode.
RV_#2	Reversing Valve#2	Unused.
SOL#1	Solenoid#1	On when unit operating, off when unit is off (prevents refrigerant migration).
SOL#2	Solenoid#2	Unused.
24VAC	Power supply for board	24VAC power for control board.
COM	Power supply for board	GND for control board.
AI_5	Analog In Channel 5	0 to 5VDC or 4-20mA user settable with board jumper.
AI_4	Analog In Channel 4	0 to 5VDC or 4-20mA user settable with board jumper.
AI_3	Analog In Channel 3	0 to 5VDC or 4-20mA user settable with board jumper.
AI_2	Analog In Channel 2	0 to 5VDC or 4-20mA user settable with board jumper.
AI_1	Analog In Channel 1	0 to 5VDC or 4-20mA user settable with board jumper.
AI_0	Analog In Channel 0	0 to 5VDC or 4-20mA user settable with board jumper.
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 supplu 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 38 - Control Board Connector Descriptions (Right Side)		
Signal	**Description**	
DI_1	Digital Input1	Unused.
DI_0	Digital Input0	Unused.
PM2	Phase Monitor2	Unused.
PM1	Phase Monitor1	Accessory for 3 phase models.
Y2A*	Aquastat Stage2	Used only for external aquastat control.
RA*	Aquastat Power (24VAC)	Used only for external aquastat control.
Y1A*	Aquastat Stage1	Used only for external aquastat control.
CA*	Aquastat Power (Ground)	Used only for external aquastat control.
2	Plenum Heat Stage2	Unused.
1	Plenum Heat Stage1	Unused.
C	Plenum Heat Common	Unused.
AR	Ariflow Reductions	Unused.
24VAC	Power	Accessory.
ODFLO	Outdoor Flow Switch	Unused.
IDFLO	Indoor Flow Swtich	Accessory.
L	Thermostat Lockout Indicator	Unused.
E	Thermostat Emergency Heat	Unused.
O	Thermostat Heat/Cool	Unused.
W2	Thermostat Auxiliary Heat	Unused.
Y2	Thermostat Stage2	Unused.
Y1	Thermostat Stage1	Unused.
G	Thermostat Fan	Unused.
R	Thermostat Power (24VAC)	Unused.
C	Thermostat Power (Ground)	Unused.

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

Appendix B: PC Software Installation

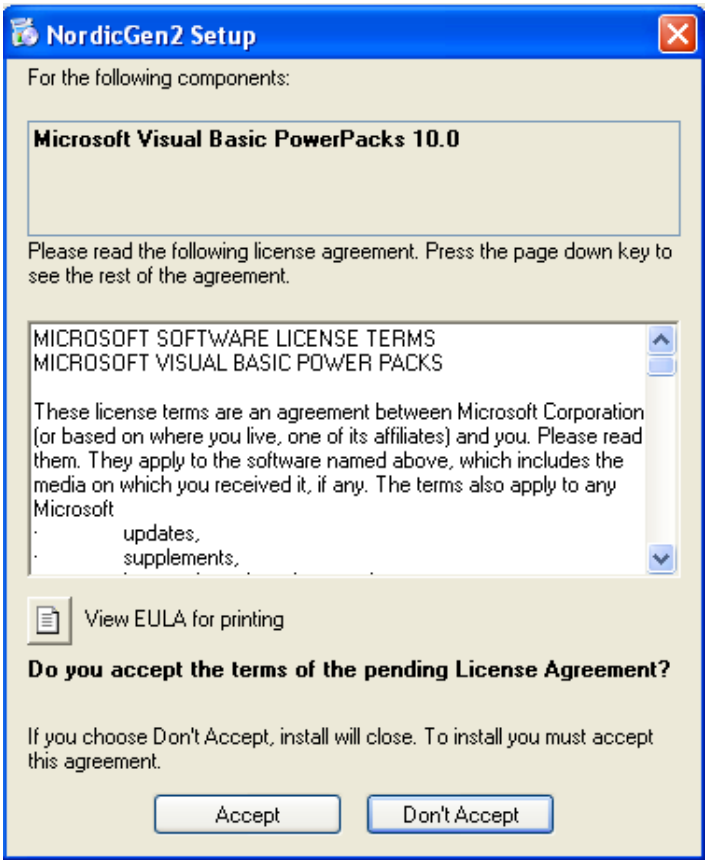
The PC Application MGL GEN2 PC APP is compatible with the following systems:

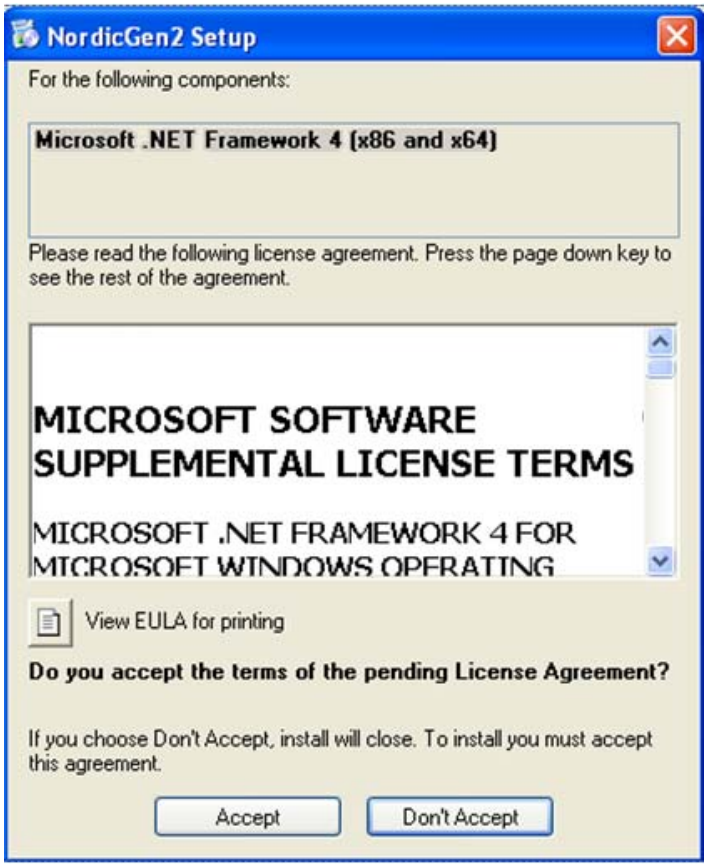
Windows 10
Windows 8
Windows 7
Windows Vista
Windows XP Service Pack 2

Here are the installation steps for the PC APP, with screen-shots from Windows XP.

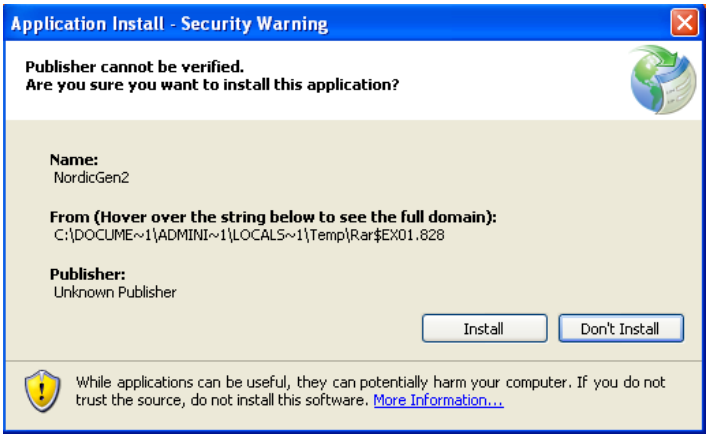
NOTE: An internet connection may be required if your computer does not already have Miscrosoft Visual Basic PowerPaks 10.0 or .Net Framework.

1. Copy **MGL GEN2 PC APP Vxxx.zip** (or .rar) to the desktop.
2. Double click it to open the zip file.
3. Double click **setup.exe**. If the file was received via e-mail then it may be named **setup.abc**, if so, change it back to **.exe** first.
4. The following window may appear asking to install Microsoft Visual Basic PowerPaks 10.0. If it does, click on ***Accept*** to download and install the power packs. NOTE: If you already have an earlier version of PowerPaks installed, you may need to upgrade to PowerPaks10 for the application to work.
5. The following may appear asking to install **.Net Framework**. Click ***Accept***. A re-start may be required once Framework has installed; if asked to reboot click ***YES***. Continue once Windows starts again, you may have to run **setup.exe** again.





6. The following window should appear; click on ***Install***.



7. The installation will complete and the program should launch afterwards.

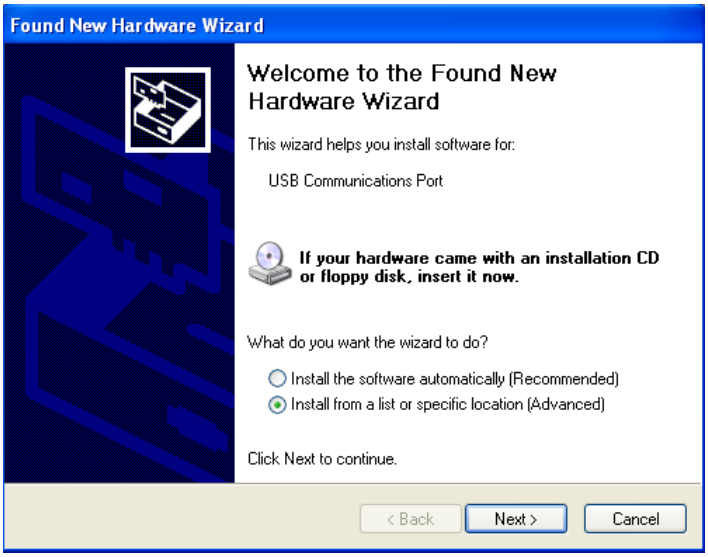
Appendix C: USB Driver Setup

The PC Application MGL GEN2 PC APP is compatible with the following systems:

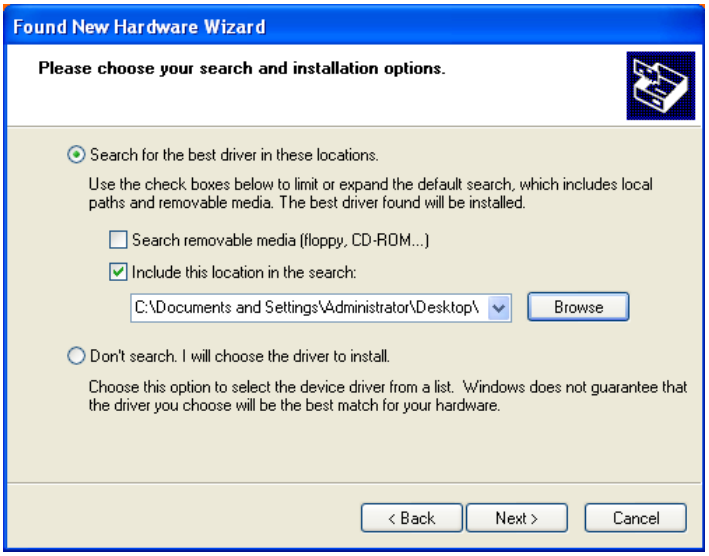
Windows 10
Windows 8
Windows 7
Windows Vista
Windows XP Service Pack 2

Here are the installation steps for the USB driver, with screenshots from Windows XP.

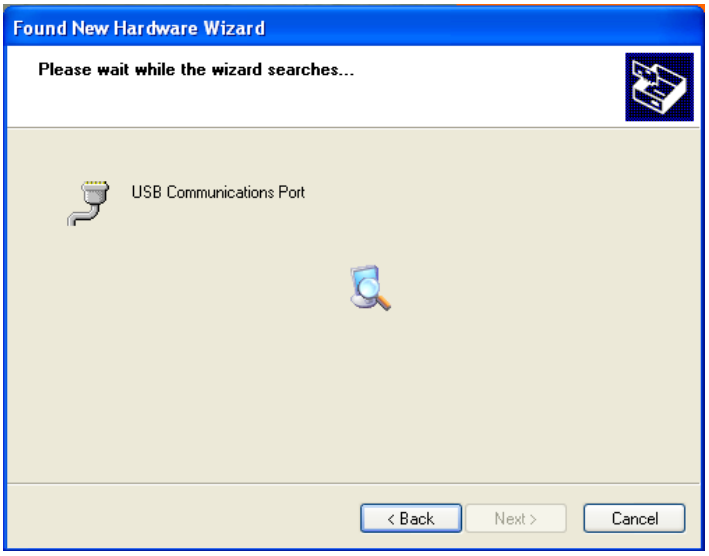
1. Copy **MGL GEN2 USB INSTALLER.zip** (or .rar) to the desktop.
2. Double click it to open the zip file.
3. Double click on the **MGL GEN2 USB Installer** folder.
4. Verify that there is a file named **USBDriverInstaller.exe**. If the file was received via e-mail then it may be named **USBDriverInstaller.abc**, if so, change it back to **.exe**.
5. Close the zip(or rar) file and then right click and ***Extract Here***. This will place the **MGL GEN2 USB Installer** folder on the desktop.
6. Connect the a USB cable between the control board and the PC. The Found New Hardware window should appear.



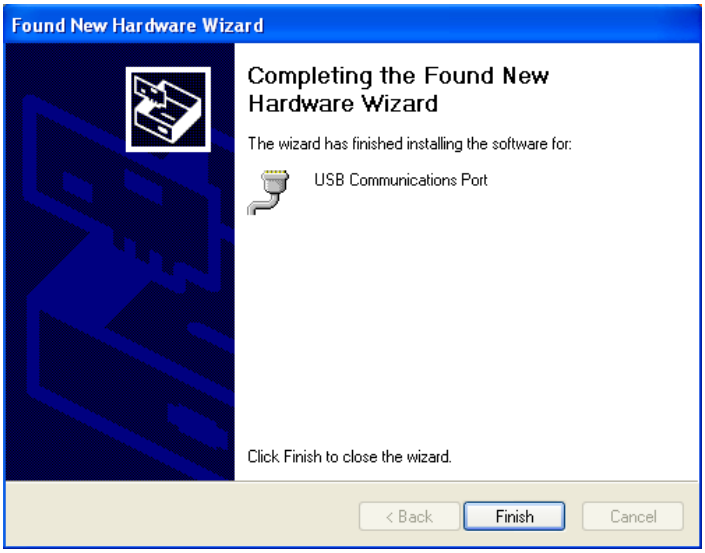
7. Select **Install from a list or specific location (Advanced)** and then click ***Next***.
8. Select **Include this location in the search** and then click ***Browse*** and select the **MGL GEN2 USB Installer** folder from the Desktop.



9. Click ***Next***. The following window should appear.



10. Once the following window appears, click ***Finish*** to complete the install. The USB connection should now work properly.



Appendix D: Updating Firmware

Following are step by step instructions to update the firmware in the control board to the latest release.

The firmware comes as a ZIP file named:
MGT GEN2 Bootload Firmware Vxxx.zip
where xxx is the version reference, e.g. 245 (in this example, version 2.45; this will be used for the remainder of this procedure). This file can be downloaded from www.nordicghp.com.

1. Download the file to your PC. We recommend creating a folder like the following:

   Desktop\MGT GEN2 Bootload Firmware\V2.45

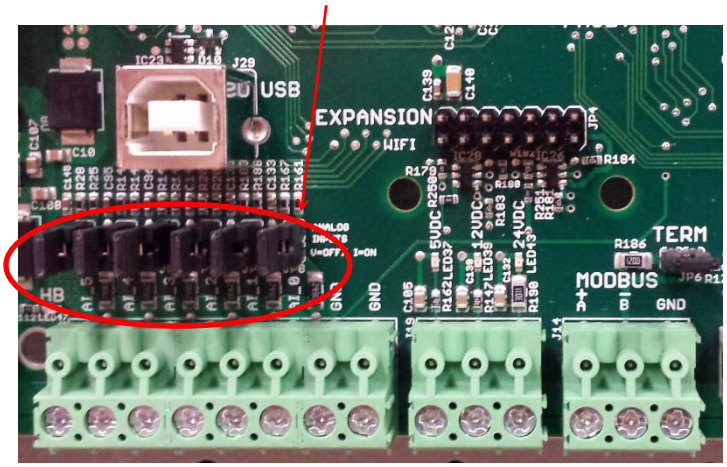
2. Unzip the file in the created folder. There will be two files:
   The firmware file: MGT_GEN2_V245.production.hex
   The programmer: PIC32UBL.exe

3. Connect a USB cable to the control board.

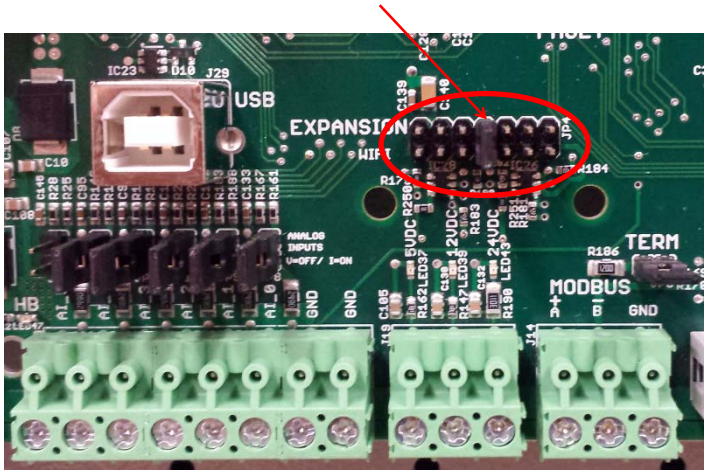
4. Turn the power off to the unit.

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

Remove a jumper from here.

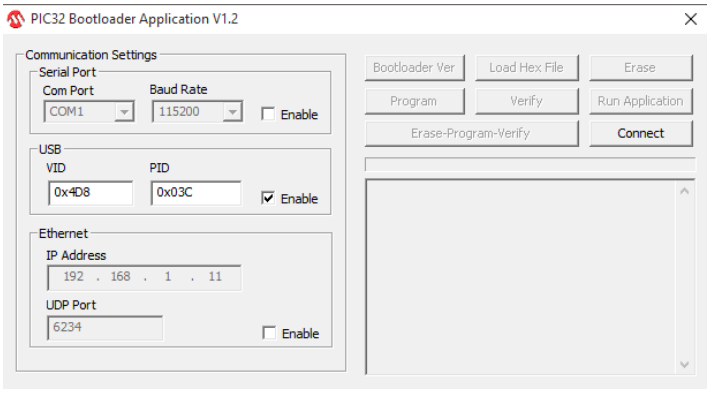


Place jumper here.

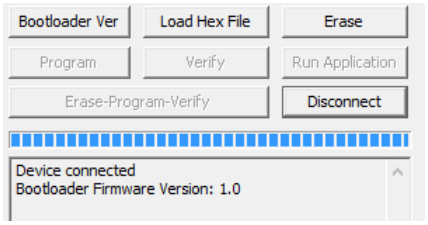


6. Turn the power back on. The control board is now in boot loader mode and is ready to be programmed.

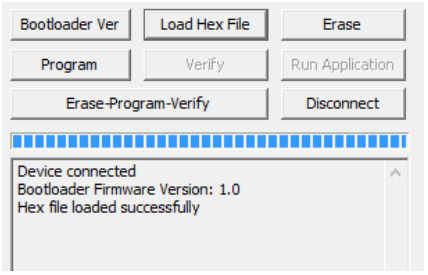
7. Run PIC32UBL.exe. Click on the USB Enable check box. The screen should look like the picture below.



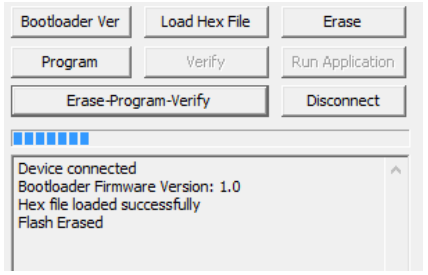
8. Click on **Connect.**



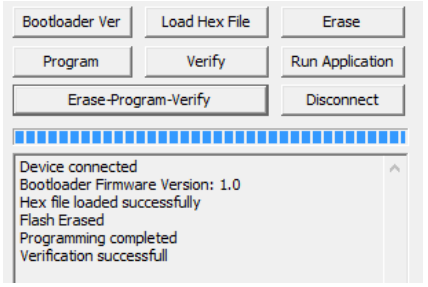
9. Click on **Load Hex File**. Select the MGT_GEN2_V245.production,hex file.



10. Programming…



11. Programmed and verified. Click on Disconnect and then close the program.



12. Turn the power off.

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

14. Turn the power back on. Check that the LCD Display shows MGT GEN2 V2.45 on the top line.

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.