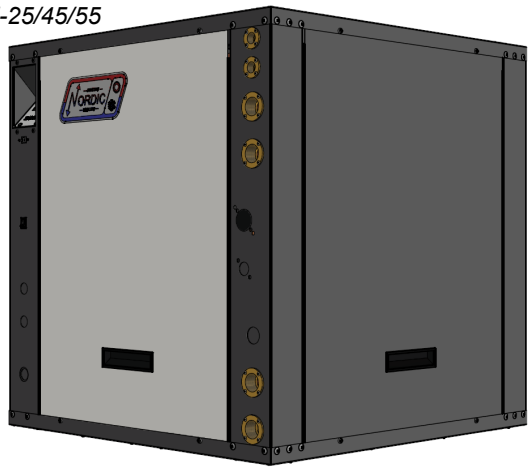
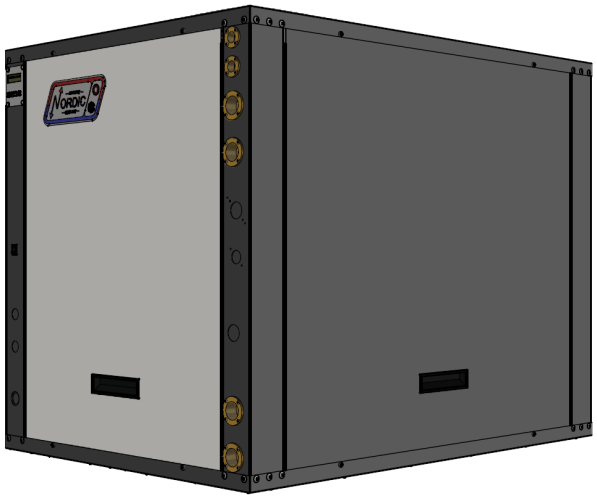
Application, Installation, & Service Manual

Water-to-Water Heat Pumps:
W-Series (Standard Range, R454b)
WP-Series (Pool Heating, R454b)
WH-Series (High Temperature, R513a)

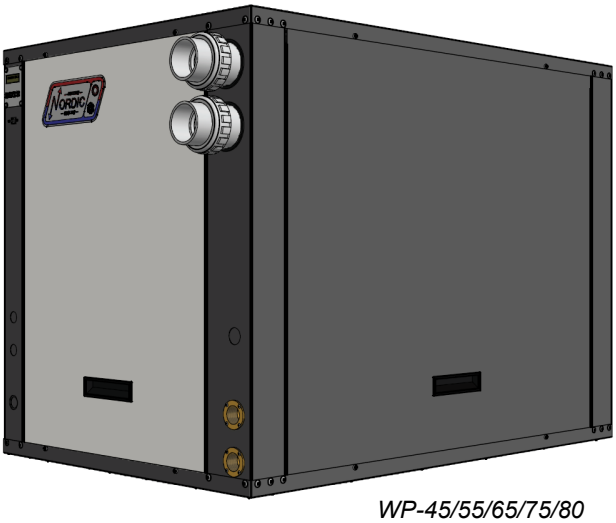
Model Sizes 25-80

W/WH-25/45/55





W/WH-65/75/80



WP-45/55/65/75/80

Maritime Geothermal Ltd.
P.O. Box 2555, 170 Plantation Road
Petitcodiac, NB E4Z 6H4
(506) 756-8135

info@nordicghp.com
www.nordicghp.com

002743MAN-01

1-Jun-2025

LOOK FOR GREY TEXT BOXES LIKE THIS ONE THROUGHOUT MANUAL FOR
***A2L-SPECIFIC WARNINGS / INSTRUCTIONS** (Applicable to **W/WP-series** only, which use **R454b** refrigerant)*

A2L refrigerant: mildly flammable.

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

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

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

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

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

GENERAL SAFETY PRECAUTIONS

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

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

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

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

go to TABLE OF CONTENTS

Model Nomenclature

WH - 65 - HACW - Y - 1S - CC - xx

Series:
W = standard temperature water to water
WH = high temperature water to water
WP = pool heating water to water

Nominal Size:
25 = 020/21 compressor
45 = 030/32 compressor
55 = 040/42 compressor
65 = 051/54 compressor
75 = 060/61 compressor
80 = 067 compressor

Functions:
H = heating
AC = active cooling
(reversing valve)
W = desuperheater for domestic hot Water

Refrigerant:
X = R454b **[A2L]** *(W/WP series)*
Y = R513a *(WH series)*

Revision:
01, 02 etc.

Indoor Loop Exchanger:
C = copper coaxial coil
Y = CuNi coaxial coil & piping
Z = CuNi coaxial coil only
T = titanium/PVC coaxial *(WP)*

Outdoor Loop Exchanger:
C = copper coaxial coil
Y = CuNi coaxial coil & piping
Z = CuNi coaxial coil only

Compressor:
T = 2-stage scroll
S = single stage scroll

Voltage Code:
1 = 208/230-1-60
2 = 208-3-60
4 = 460-3-60
5 = 575-3-60

APPLICATION/AVAILABILITY TABLE : W-SERIES

MODEL SERIES	MODEL SIZE	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESOR	OUTDOOR COIL	INDOOR COIL	REVISIONS		
W	25	HAC HACW	X	1 2 4	T	C Y Z	C Y Z	01		
W	45 55 65 75	HAC HACW	X	1 2 4 5	T	C Y Z	C Y Z	01		
W	80	HAC HACW	X	1 2 4 5	S	C Y Z	C Y Z	01		

APPLICATION/AVAILABILITY TABLE : WH-SERIES

MODEL SERIES	MODEL SIZE	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESOR	OUTDOOR COIL	INDOOR COIL	REVISIONS		
WH	25	H HAC HACW	Y	1 2 4	S	C Y Z	C Y Z	01		
WH	45 55 65 75 80	H HAC HACW	Y	1 2 4 5	S	C Y Z	C Y Z	01		

APPLICATION/AVAILABILITY TABLE: WP-SERIES

MODEL SERIES	MODEL SIZE	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESOR	OUTDOOR COIL	INDOOR COIL	REVISIONS		
WP	45 55 65 75 80	H	X	1 2 4 5	S	C Y Z	T	01		

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

go to TABLE OF CONTENTS

Table of Contents

go to TABLE OF CONTENTS

Documents

go to TABLE OF CONTENTS

Tables

go to TABLE OF CONTENTS

Series Description

Maritime Geothermal Ltd. has made NORDIC brand package water-to-water heat pumps in residential sizes (nominal 2 to 6 tons) for over 40 years. They are used for residential heating through hydronic distribution systems like radiant in-floor piping, radiant ceiling panels, radiators, hydronic baseboards, or hydronic air handlers/fan coils. Reversing units (-HAC/HACW) can also chill water for hydronic cooling applications.

Being a water source, 'geoexchange', or 'geothermal' heat pumps, these types of heat pumps do require a heat source in heating mode, or a place to reject heat in cooling mode. This can be:

a) a closed ground loop with a circulating water/ antifreeze solution; or
b) an open loop water well, with water re-injected in a second well or otherwise run off;
c) a waste heat loop, such as that used to cool machinery.

1. Heating Mode

In heating mode, the heat pump heats water in a buffer tank (or swimming pool) to a user-adjustable setpoint temperature, while extracting heat from the outdoor loop. If a closed ground loop is used, the pumps are powered and controlled by the heat pump; if open loop, a water valve is opened by the heat pump during heating operation and closed when the heat pump is idle.

Hydronic heating systems are easily zoned, and zones may be in-floor heating, hydronic air handlers, or other hydronic devices suitable for the water temperature capability of the heat pump series. When a zone requires heat, its zone thermostat calls for a zone circulator pump or zone valve to activate, so that hot water from the buffer tank is sent to the zone requiring heat. Note that there is no direct connection between the zone thermostat and the heat pump, the functions of each being separated by the buffer tank.

2. Cooling Mode *(Reversing models **HAC/HACW** only)*

In cooling mode, the heat pump cools water in the buffer tank. Heat is rejected to the outdoor loop.

Hydronic cooling is usually done through hydronic air handlers, which have condensate drains to remove water that is removed while dehumidifying the air. In less humid climates, in-floor or radiant ceiling cooling is sometimes performed; such systems can't remove humidity from the air. In this case, care must be taken to ensure the cooling surface does not fall below the dew point temperature in order to prevent condensation on floor surfaces.

W-series

This is the standard temperature geothermal space heating/cooling series, using R454b (an A2L or mildly flammable refrigerant). They can extract heat from cold northern ground loops, and heat water on the indoor side up to **120°F (49°C),** using a dual-capacity (2-stage) compressor.

WH-series

The WH-series is a high-temperature-range version of the W-series, using R513a (an A1 or non-flammable refrigerant). They can heat water on the indoor side up to **160°F (71°C),** but require a **minimum heat source fluid temperature 40°F (4°C)**.

For both W and WH series, the indoor and outdoor loop heat exchangers are heavy duty coaxial copper / steel models with optional CuNi inner tube. Scroll compressors and Electronic Expansion Valves (EEVs) are standard. The electronic control board has full hydronic temperature control, laptop connectivity via USB with free PC App, LCD interface, electronic readout of all pressures and temperatures, data logging & graphing, and BACnet.

WP-series

This is the dedicated pool heating version of the standard temperature W-series, using R454b (A2L). Normally used for outdoor pools, it has a titanium/PVC indoor loop coil, single stage compressor, and no reversing valve. It can heat pool water to as high as 105°F (41°C), which is a suitable temperature for a hot tub or spa.

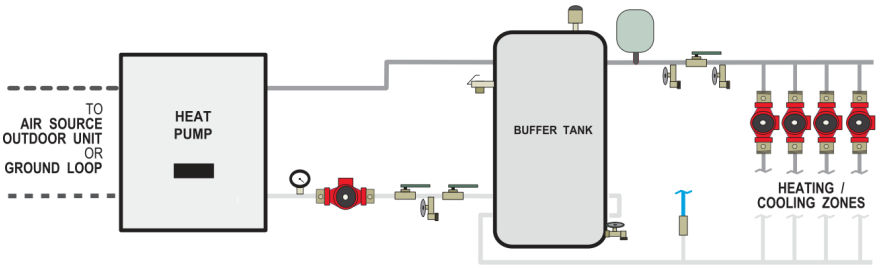
go to TABLE OF CONTENTS

One or Two Buffer Tanks?

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

Single Buffer Tank Systems

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

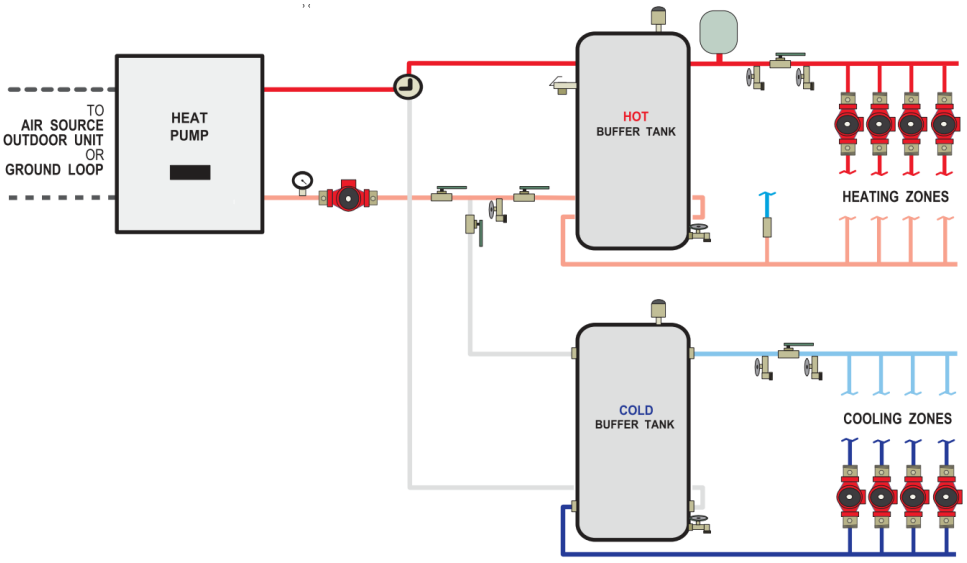


Advantages	Drawbacks
Simplest piping and control.	Seasonal switchover from heating to cooling required, either automatically through a zone controller or via a manual switch.
Is the go-to option for heating-only systems.	Simultaneous heating and cooling is not possible; heating and cooling in close proximity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

Dual Buffer Tank Systems

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

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



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

go to TABLE OF CONTENTS

Sizing for Space Heating/Cooling

W/WH-Series Heat Pump Sizing

Table 1 shows the above grade size of building that can typically be heated/cooled in northern climates for:

- W-series on a closed ground loop
- WH-series when indoor loop is normally being heated to near its maximum temperature **(160°F / 71°C)**.

TABLE 1 - Heat Pump Size vs. Heated Area		
Model	**ft^2**	**m^2**
W/WH-25	**800**	**75**
W/WH-45	**1400**	**130**
W/WH-55	**2000**	**185**
W/WH-65	**2600**	**240**
W/WH-75	**3100**	**290**
W/WH-80	**3500**	**325**

Table 2 shows the above grade size of building that can typically be heated/cooled in northern climates for:

- W-series on an open loop (well water)
- WH-series when indoor loop is normally being heated to a more moderate temperature **(~130°F / 54°C)**.

TABLE 2 - Heat Pump Size vs. Heated Area		
Model	**ft^2**	**m^2**
W/WH-25	**1000**	**95**
W/WH-45	**1800**	**165**
W/WH-55	**2500**	**230**
W/WH-65	**3200**	**295**
W/WH-75	**3800**	**355**
W/WH-80	**4200**	**390**

THE TABLES ABOVE ARE FOR ESTIMATION ONLY. THEY SHOULD NOT BE USED TO SELECT A FINAL UNIT SIZE. They simply show what size unit is required for a northern home with typical construction: R20 walls, R40 ceiling, and average size and number of windows. The heated area is the area of the above grade main level; the tables account for a basement the same size as the heated area.

MARITME GEOTHERMAL LTD. HIGHLY RECOMMENDS THAT A PROPER HEAT LOSS/GAIN ANALYSIS BE PERFORMED BY A PROFESSIONAL WITH APPROVED CSA F-280 SOFTWARE BEFORE SELECTING THE HEAT PUMP SIZE. For heating dominant climates, we recommend sizing the unit to 100% of the heating design load for maximum long term efficiency with minimal supplementary heat. The unit should be installed as per CSA standard 448.2-02. For ground loop applications, the ground loop should be designed using suitable software with a multi-year analysis.

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 then be selected by comparing the calculated heat load to the heat pump capacity at the design indoor loop temperature, which can be found in the performance tables in the **Model Specific Information** section. For W-series, the *Standard Capacity Ratings* rather than detailed performance tables can be used for simplicity. For 100% heat pump sizing, choose a heat pump with a standard capacity rating that matches or just slightly exceeds the calculated heat load.

Some background on *Standard Capacity Ratings*: closed ground loops are normally designed to reach a minimum temperature of just below freezing at the end of the heating season, in order to take advantage of the latent heat of groundwater (at least in northern climates). Hence, the Standard Capacity Ratings for Ground Loop Heating should apply in all northern climates. Conversely, the Standard Capacity Ratings for Ground Water (open loop) heat pumps assume a well water temperature of 50°F (10° C). In more southerly climates, the groundwater or ground loop will probably be at a warmer minimum temperature, and it will be necessary to consult the more detailed performance tables for heat pump output at a different ELT.

In cooling dominant climates, the heat pump should be similarly sized using the Ground Loop Cooling or Ground Water Cooling Standard Capacity Ratings. **Even in northern heating dominant climates, it should be ensured that 100% of the cooling load will be covered when sizing the heat pump, since there is normally no auxiliary or backup cooling available.**

Auxiliary Heat Sizing

The easiest way to provide auxiliary or backup heat for new installations is by installing a buffer tank that has electric elements. Buffer tanks with elements that are certified for space heating use are available as accessories from Maritime Geothermal Ltd., or others may be used. For retrofits, often an existing heat device can be used for auxiliary heat. Note that if the geothermal heat pump is sized for 100% of the coldest day heat load, auxiliary heat is not strictly required (unlike with an air source heat pump).

For full backup, an option which is good for peace of mind (should the heat pump experience a problem) but can require significant electrical service capacity, an element size can be chosen that covers 100% of the coldest day heat load, according to the heat loss analysis mentioned in the last section. If a heat loss analysis is not available, the following table may be used as a guide.

TABLE 3 - Auxiliary Heat Sizing		
Model Size	**Tank Element Size**	
	Recommended	**EcoUltra Tank Available**
25	**7 kW**	**12 kW (50 gal)**
45	**10 kW**	**12 kW (50 gal)**
55	**12 kW**	**15 kW (70 gal)**
65	**15 kW**	**15 kW (70 gal)**
75	**20 kW**	**20 kW (70 gal)**
80	**20 kW**	**20 kW (70 gal)**

For heat pumps that are sized to cover less than 100% of the coldest day heat load, the elements can be sized to make up the coldest-day difference. The CSA installation standard allows geothermal heat pumps to be sized to as little as 75% of the coldest day heat load.

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

go to TABLE OF CONTENTS

Sizing for Pool Heating

Indoor Pools

While both indoor and outdoor pools normally need to be heated, indoor pools have the additional consideration of requiring dehumidification of the pool room air, to avoid moisture damage to the building envelope.

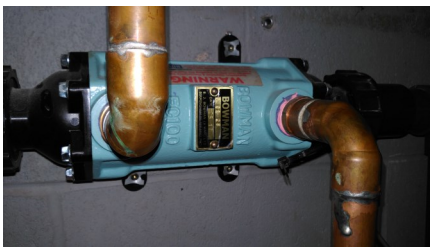
A NORDIC ***PC-series*** indoor pool room dehumidifier rejects its heat into the pool room air or pool water, and can provide all the heat needed for the water in a typical indoor pool while dehumidifying. Because it fulfills both purposes, it is the preferred way to heat indoor pools. It is sized according to the surface area of the indoor pool; see the PC-series manual for detailed sizing method.

Outdoor Pools / Hot Tubs

On the other hand, outdoor pools or hot tubs have no air dehumidification requirement. They may be economically heated by a water source heat pump, which may be:

a) A dedicated ***WP-series*** heat pump, which directly heats pool water circulated by the pool filter pump through its titanium/PVC heat exchanger; and extracts its heat from a closed ground loop / open loop water well that may or may not be shared with a heat pump that heats or cools the house.

b) A heating zone from a zoned hydronic heating system in the house, using a hydronic water to pool water heat exchanger.



Note that any water to water heat pump is designed to be installed in an indoor mechanical room, rather than outdoors near the pool like an air source pool heat pump.

Outdoor Pool/Hot Tub Heat Load

The heat load from an outdoor pool or hot tub is influenced by many factors:

- Difference between desired pool temperature and outdoor temperature during coldest month of use
- Wind exposure
- Humidity
- Covered vs. not covered

To calculate an approximate heat load for an outdoor swimming pool or spa, follow these steps:

1. Determine your desired swimming pool or hot tub temperature in °F. Pools are often kept at **80°F (27°C)** and hot tubs are often kept at **104°F (40°C)**.
2. Determine the average outdoor temperature in °F for the coldest month of pool use.
3. Subtract the average temperature for the coldest month from the desired pool temperature. This will give you the ***Temperature Rise*** needed in °F.
4. Calculate the ***Pool Surface Area*** in square feet.
5. Use the following formula to determine the pool heat load in Btu/hr:

   Pool Surface Area x ***Temperature Rise*** x **12**

This formula is based on a 1° to 1.25ºF temperature rise per hour and a 3.5 mph (5.5 km/h) average wind at the pool surface. Temperature rise is a function of the heat pump's output and depth of the pool, or how much water is in it; this can be checked after a model size is selected, below. For a 1.5ºF rise multiply by **1.5**. For a 2ºF rise multiply by **2.0**.

WP-Series Heat Pump Sizing

Once you have determined the pool's heat load, you can match it to a WP-Series model size in the **Capacity Ratings** table in the **Model Specific Information: WP-Series** section. The table shows the heating capacity at two water temperatures: **80°F (27°C)** for a pool, and **104°F (40°C)** for a hot tub. The table also lists two ground loop temperatures; normally in the summer (when heat is being rejected into a shared ground loop due to air conditioning) the higher of the two (50°F / 10°C) can be counted on, regardless of whether an open or closed loop is used.

Note that heat load from an outdoor pool can be very high, and even the largest model size **WP-80** might not meet the heat load. In this case, an auxiliary heater could be considered; or another approach would be to expect the pool to be cooler than the setpoint temperature during colder weather. The heating shortfall on colder days can be mitigated through consistent use of an insulated pool cover.

go to TABLE OF CONTENTS

Installation Basics

***A2L*-SPECIFIC WARNING / INSTRUCTION**
(W/WP-series only)

The **W-series** and **WP-series** use **R454b,** an **A2L** refrigerant which is a classification meaning “slightly flammable”. (The **WH-series** uses the **A1** refrigerant **R513a**, so no special measures apply to WH units.)

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

*It is highly recommended that a **mechanical consulting engineer** be involved in any project involving **A2L** refrigerating units, whether for new installation or replacement of non-A2L units.* This is because the mechanical room requirements can be onerous and also difficult to decipher for the layperson. If engineering services are unavailable, use of the **A1 WH-series** is suggested (after confirming temperature range is appropriate for the application).

The A2L W/WP-series heat pump / chiller can be considered an “enhanced tightness refrigerating system” with refrigerant charge $m_1 < m_c < m_2$ for the purposes of UL/CSA 60335-2-40, clause GG.10.

A2L W/WP-series heat pumps are equipped with a refrigerant detector. In case refrigerant is detected inside the enclosure, the heat pump will shut down and display a permanent alarm as well as activate a 24VAC control board output. This output signal can be used to activate external fans or alarms when such action is required by codes.

Unpacking the Unit

When the 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 claim filed.

Unit Placement

The placement of a hydronic heat pump has negligible effects on the efficiency and operation of the system. The buffer tank should be placed next to the heat pump. For open loop systems, the unit can be placed near the well water system. Ground loop system units can be placed near where the ground loop pipes enter the structure to keep the ground loop piping, heat pump and circulator pump module in one location. The hydronic layout may make a particular location ideal for the unit installation.

Looking at the side of the heat pump where the pipes come out, the front and right side access panels should remain clear of obstruction for a distance of **2 feet** to facilitate servicing. Two units may be stacked, with a **continuous** rubber pad (not just point supports) or pink/blue styrofoam between them.

It is recommended that the heat pump be placed on a piece of 2" Styrofoam, or the rubber pad available as an accessory from Maritime Geothermal. This will deaden compressor noise emitted from the bottom of the cabinet, and prevent cabinet corrosion.

go to TABLE OF CONTENTS

Sample Bill of Materials - W/WH Series on Ground Loop

FROM MARITIME GEOTHERMAL
- W/WH SERIES HEAT PUMP
- BUFFER TANK W/ELEMENTS __kW
  (or INDIRECT TANK FOR DEDICATED DHW)
- P/T PORTS AND HOSE ADAPTERS (2)
- 1 OR 2 PUMP PACK
- PIPE ADAPTERS FOR PUMP PACK

OPTIONAL FROM MARITIME GEOTHERMAL
- ANTI-VIBRATION PAD
- SOUND JACKET
- SECURE START
- AHW-65 AIR HANDLER(S)
- MODULATING WATER VALVE FOR OUTDOOR LOOP

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

GROUND LOOP
- ¾" PE PIPE
- 1-1/4" PE PIPE
- PE PIPE FITTINGS
- 1" CLEAR HOSE (HEAT PUMP TO PUMP PACK)
- HOSE CLAMPS
- ANTIFREEZE: METHANOL OR PROP. GLYCOL

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
- ZONE SUPPLY & RETURN HEADERS
- PIPE & FITTINGS TO ZONES
- EXPANSION TANK

ELECTRICAL
- HEAT PUMP SERVICE WIRE 6-3 OR 8-3
- BUFFER TANK ELEMENT SERVICE WIRE
- HEAT PUMP BREAKER
- BUFFER TANK ELEMENT BREAKER
- ELEMENT CONTACTOR & ELEC. BOX (IF NOT WITH TANK)
- THERMOSTAT WIRE 18-4
- THERMOSTAT WIRE 18-2
- FORK TERMINALS FOR TSTAT WIRE (6)

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

Sample Bill of Materials - W/WH Series on Open Loop

FROM MARITIME GEOTHERMAL
- W/WH SERIES HEAT PUMP
- BUFFER TANK W/ELEMENTS __kW
  (or INDIRECT TANK FOR DEDICATED DHW)
- P/T PORTS AND HOSE ADAPTERS (2)
- DOLE VALVE
- MOTORIZED WATER VALVE

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

WATER SYSTEM
- 1" BLACK PLASTIC WATER PIPE
- 1" BARBED FITTINGS & HOSE CLAMPS
- SUBMERSIBLE PUMP (IF NOT EXISTING)
- PRESSURE TANK (IF NOT EXISTING)
- CYCLE STOP VALVE (OPTIONAL)

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
- ZONE SUPPLY & RETURN HEADERS
- PIPE & FITTINGS TO ZONES
- EXPANSION TANK

ELECTRICAL
- HEAT PUMP SERVICE WIRE 6-3 OR 8-3
- BUFFER TANK ELEMENT SERVICE WIRE
- HEAT PUMP BREAKER
- BUFFER TANK ELEMENT BREAKER
- ELEMENT CONTACTOR & ELEC. BOX (IF NOT WITH TANK)
- THERMOSTAT WIRE 18-4
- THERMOSTAT WIRE 18-2
- FORK TERMINALS FOR TSTAT WIRE (6)

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

go to TABLE OF CONTENTS

Wiring

Power Supply Connections

Power supply for the heat pump from the breaker panel is supplied to the unit via concentric 1.093" / 0.875" knockouts. There are also several 0.875" knockouts and a 3/8" plastic grommet for electrical connections to the indoor circulator, ground loop circulator pump, and controls.

A schematic diagram (SCH) and electrical box layout diagram (ELB) can be found on the electrical box cover of the unit as well as in the **Model Specific Information** section of this manual. The Electrical Tables in the **Model Specific Information** section contain information about the wire and breaker

NOTE: A properly qualified electrician should be retained for all connections to the heat pump and associated controls.

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

TABLE 4 - Power Supply Connections

Line	Description	Voltages
L1	Line 1	All
L2	Line 2	All
L3	Line 3	3-phase only
N**	Neutral	208/230-1-60, 208-3-60
GND	Ground	All (connect to ground lug)

** For 208/230-1-60 and 208-3-60, **N** is required only if connecting 115VAC circulators to the unit. The heat pump itself does not require a neutral.

Indoor Circulator Pump Wiring

The indoor loop circulator provides flow between the heat pump and the buffer tank, and is powered from the heat pump. The heat pump has provisions for connecting the indoor circulator pump so that it will be turned on whenever the compressor operates, and also when sampling water temperature during the use of the *Setpoint Control* feature.

Connect the circulator pump 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. Ground wire 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 **460/575VAC models**, 24VAC and ground are provided on the terminal strip for use with an external contactor to control the circulator. Refer to the schematic and electrical box drawings in the **Model Specific Information** section and on the electrical box cover for more information.

Outdoor Loop Pump Module Wiring (Ground Loop Only)

The heat pump has provisions for connecting the circulator pump module so that the pumps will be turned on whenever the compressor operates. Connect the circulator pump module to the appropriate two terminals (115V or 230V) of the terminal strip marked **OUTDOOR CIRCULATORS** in the heat pump, as per the voltage of the circulator pump module. Ground wire 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 **460/575VAC models**, 24VAC and ground are provided on the terminal strip for use with an external contactor to control the circulator pump module.

TABLE 5 - Indoor & Outdoor Circulator Connections

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

Control Transformer

The low voltage controls for 208/230-1-60 and 208-3-60 models are powered by a class II transformer with resettable breaker on the secondary side for circuit protection. Should the breaker trip, locate and correct the problem and then reset the breaker by pressing in on it.

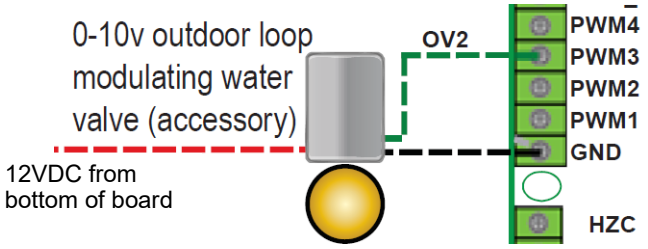
All other voltage models have a transformer with primary and secondary fuses for circuit protection.

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

Open/Closed Loop Wiring

The heat pump is provided configured for closed loop operation. For open loop operation, the jumper plug **must** be removed from the wiring harness found behind the pipe post and the water valve harness plugged in. This will select the proper temperature limit settings (although there may be no difference between the open/closed loop settings for WH). See the "Water Valve" section in the Open Loop Installations chapter for details.

A modulating water valve may be required; see **Piping** & **Open Loop Installation** chapters, and wiring diagram in **Model Specific Information** section.



go to TABLE OF CONTENTS

BACnet Connections

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

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

TABLE 6 - BACnet Connections	
Line	**Description**
A	**Communication +**
B	**Communication -**
GND	**Ground**
Use a shielded twisted pair cable.	

Setpoint Control Connections

If using the on-board Setpoint Control routine with sampling option (ICR) to control buffer tank temperature, no external temperature probe or aquastat is required. For either Setpoint Control option (ICR or HTS/CTS), only one control connection is required, and only for reversing models: a dry contact from **R** (24VAC) to **O** on the terminal strip to switch the heat pump into cooling mode. **C** (ground) may be used in powering relays as shown in diagrams on following pages.

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

TABLE 7 - Setpoint Control Connections	
Signal	**Description**
C	**24VAC common (ground)**
R	**24VAC hot**
O	**Cooling Mode (Reversing Valve)**
Use a 3-conductor 18ga cable.	

An external temperature probe may be used with the on-board Setpoint Control routine, or two probes (one for hot tank and one for cold tank) may be used. This is HTS/CTS Setpoint Control; see **Piping** and **Operation** sections for details.

Setpoint Control: Aux. Connections

When using Setpoint Control, there are 2 methods for activating hydronic auxiliary heat. See diagram on following page.

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

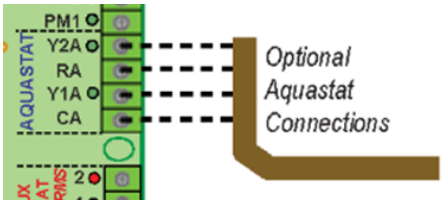
Second, a 24VAC signal can be used to power the coil of an external contactor to operate auxiliary heat. Choose this method if using a heating device that doesn't have its own electronic controller or control transformer, e.g. a bare heating element in the buffer tank. As per the diagram on the following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

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

TABLE 8 - Setpoint Control: Aux. Connections	
Signal	**Description**
D1	**Hydronic Auxiliary dry contacts**
D2	
R	**Jumper R and D1**
D1	
D2	**24vac to actuate aux. heat contactor coil**
CD	**Contactor coil ground**
Use a 2-conductor 18ga cable.	

Aquastat Connections (Optional)

Most installations will use the internal ***Setpoint Control*** routine to control buffer tank temperature. However, an aquastat or external controller can be used if required, for example if heating two loops with different setpoint temperatures, or using a time-of-day or lead/lag third-party programmable controller. This is ***Signals*** or ***Hardwired Control***.



The **CA, RA, Y1A,** & **Y2A** connections are located on the right side towards the top of the control board, as shown on the wiring diagram in the **Model Specific Information** section. The external device needs to send the 24VAC signal from **RA** back to the **Y1A** terminal to call for compressor ON, and **Y2A** to put the compressor in second stage (100% capacity). Note that Y2A is not applicable to WP and WH series, which have single stage compressors.

CA is the common terminal for use in powering the external device.

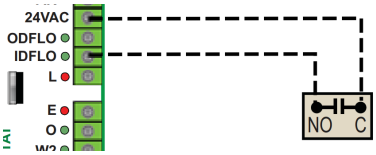
TABLE 9 - Aquastat (Signals Control) Connections	
Signal	**Description**
CA	**24VAC common (ground)**
RA	**24VAC hot**
Y1A	**Compressor ON**
Y2A	**Compressor stage 2** (not present for WH or WP)
Use an 18ga cable.	

go to TABLE OF CONTENTS

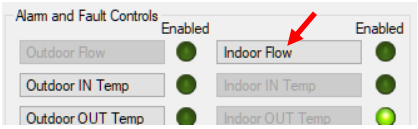
Pool Flow Switch Connections *(WP only)*

If the pool pump is not always on and the WP series heat pump can't be given control of the pool pump, an **accessory flow switch** may be connected. Operation in pool water heat mode will be delayed until the flow switch is closed.

Wire the dry contact flow switch between **24VAC** and **IDFLO** at the right side of control board.



Enable the ***Indoor Flow*** alarm in the PC App's **Tools—> Configuration** window by clicking on the button.



Ensure the flow switch paddle extends at least half way into the main 2" PVC pipe, that is, past the mid point of the pipe. If the paddle is too short (due to the tee used having too long a side connection), flow switch fluttering and intermittent operation may occur.

Refrigerant Vent Fan Connections

For A2L W/WP-series only, a 24VAC board output (labelled SOL#2) is available for activating a ventilation fan or alarm in case refrigerant is detected inside the enclosure.

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

Domestic Hot Water (Desuperheater)

The desuperheater function on HACW/HW models is pre-wired and no field connections are necessary.

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

Disable Switch (field installed)

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

Summer Setback Switch (field installed)

A switch to enable *summer setback* mode may be installed. On control board, toggle **R** to **PM2** to enable. See wiring diagrams in the **Model Specific Information** section.

Summer setback disables stage 3 (AUX), drops setpoints to 70°F (21°C), and decreases temperature sampling frequency to 2 days. Can also be enabled through PC App or LCD.

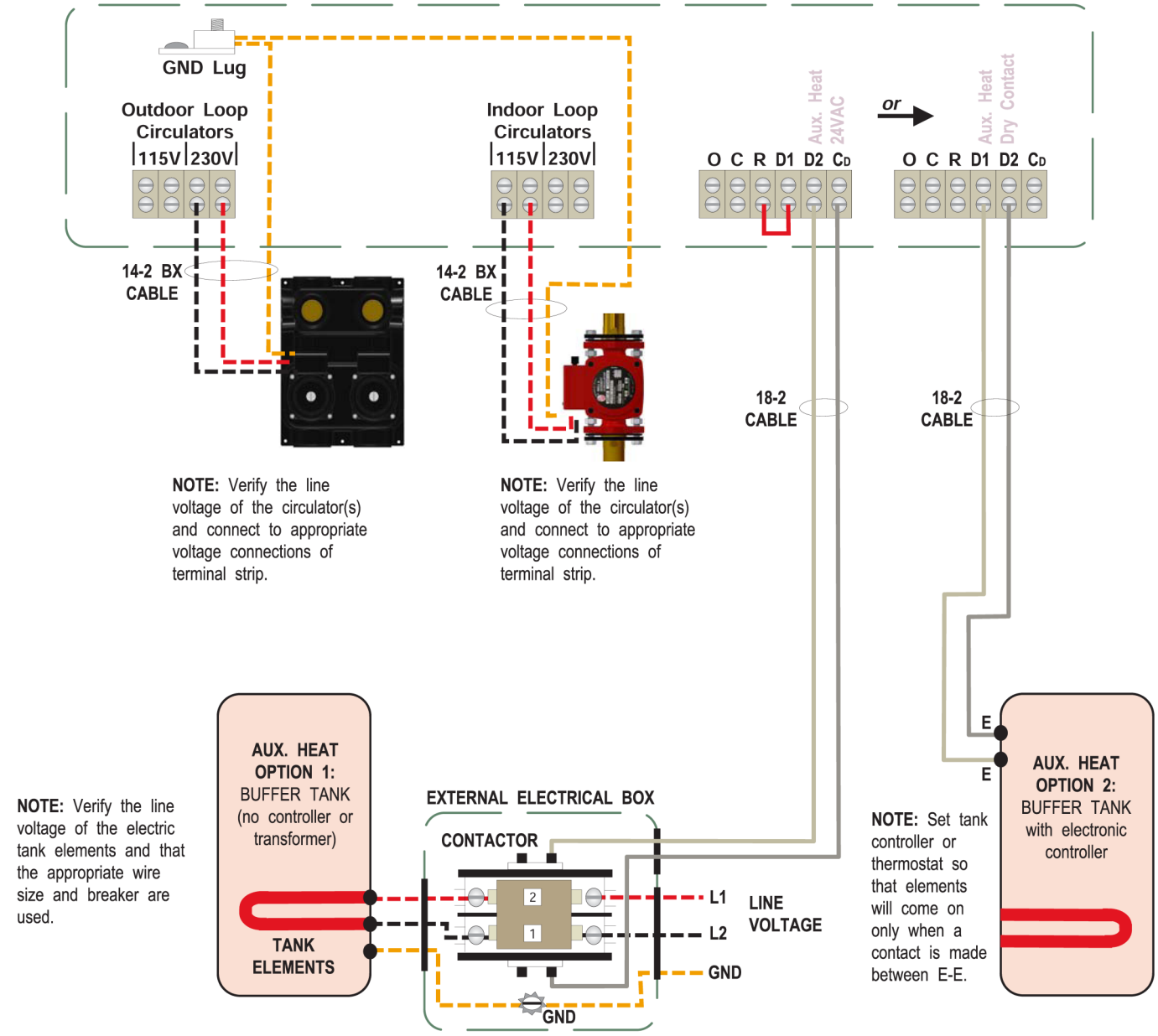
Other Connections

See the following chapters and the schematic (wiring) diagram in the **Model Specific Information** section for details.

- Hot tank and/or cold tank temperature sensors can be used in place of the **ICR** sampling routine with Setpoint Control. This is the **HTS/CTS** option.
- A 3-way valve can be controlled from the heat pump's L3 output, for use with the HTS/CTS 2-tank auto-maintain feature.
- An accessory outdoor temperature sensor can be used, to enable Outdoor Reset functionality.

go to TABLE OF CONTENTS

Typical GEN2 Auxiliary Heat & Circulator Wiring



REV	ECO #	IMPL BY	APVD BY	DATE
02	000282	Dan Rheault	Dan Rheault	1-Feb-2021
01	Initial Release	Dan Rheault	Dan Rheault	1-Sep-2017

Drawn By Dan Rheault	Date 1-Sep-2017	
Checked By Dan Rheault	Date 1-Sep-2017	
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	

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

Drawing Name: Typical GEN2 Auxiliary Heat & Circulator Wiring

Size	Drawing Number	Drawing Rev	Sheet
A	002241CDG	02	1 of 1

go to TABLE OF CONTENTS

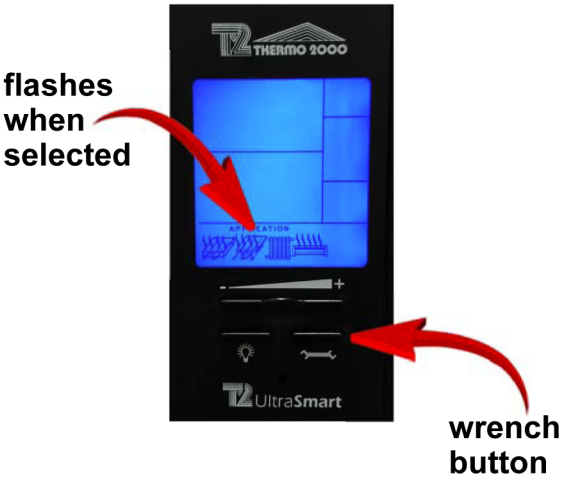
AltSource Tanks: Getting Started

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

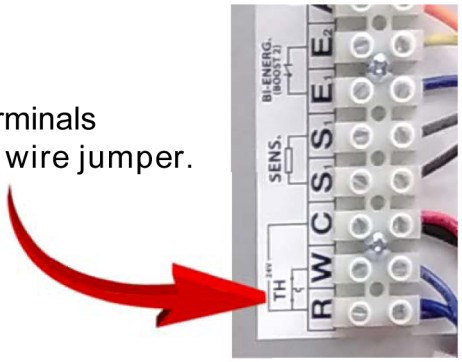
1. Put the tank in “Bi-Energy” rather than “Electric” mode, with switch on back of controller.

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

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



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



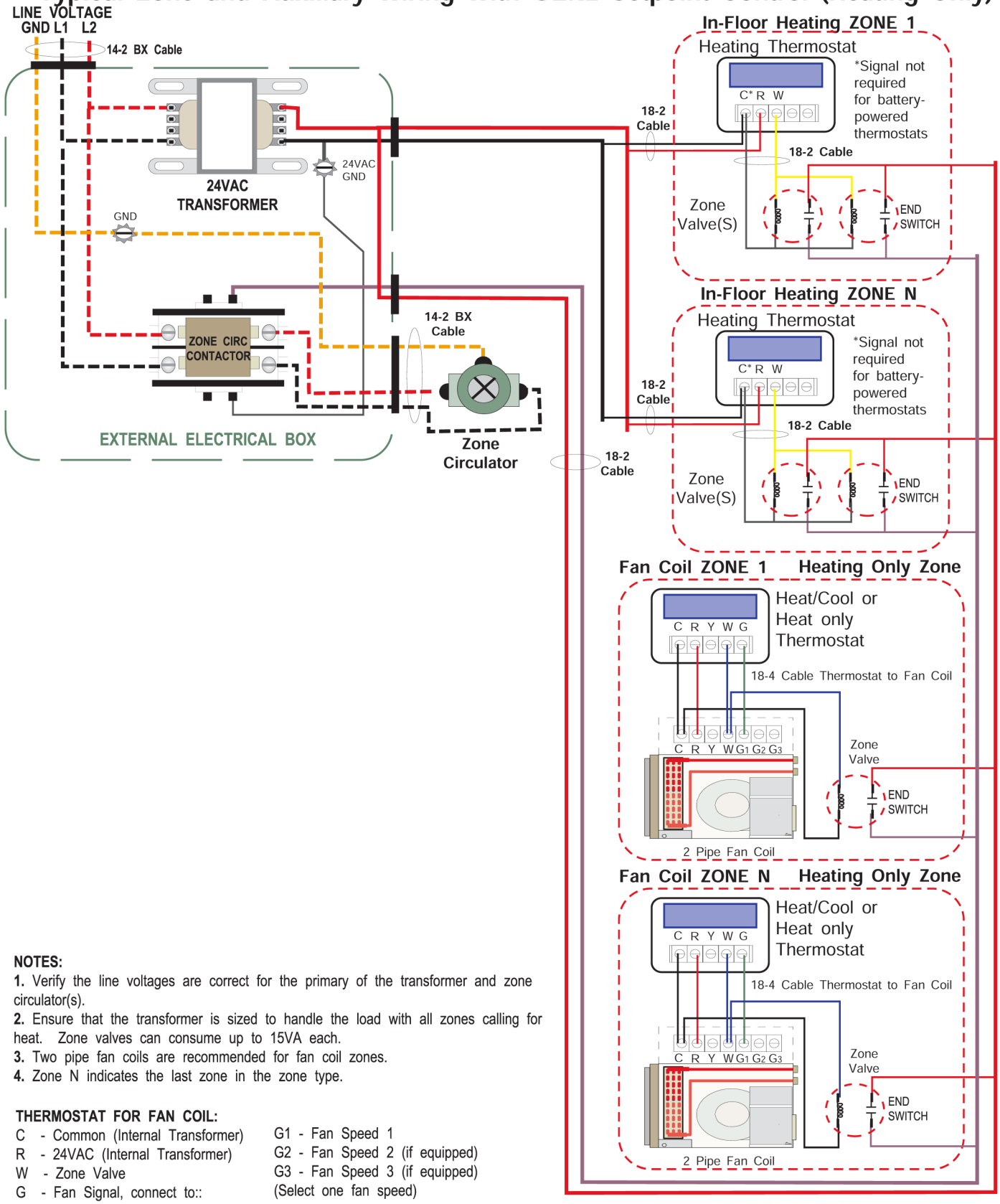
4. Now the tank elements will only be activated by a connection between the E_1-E_2 tank terminals, up to the 125°F maximum. This will be done by an 18-2 wire to the **D1-D2** terminals in the heat pump, activating the elements only when ***AUX*** heat is required.

See heat pump manual for further explanation.

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

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

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



NOTES:

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

THERMOSTAT FOR FAN COIL:

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

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

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

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

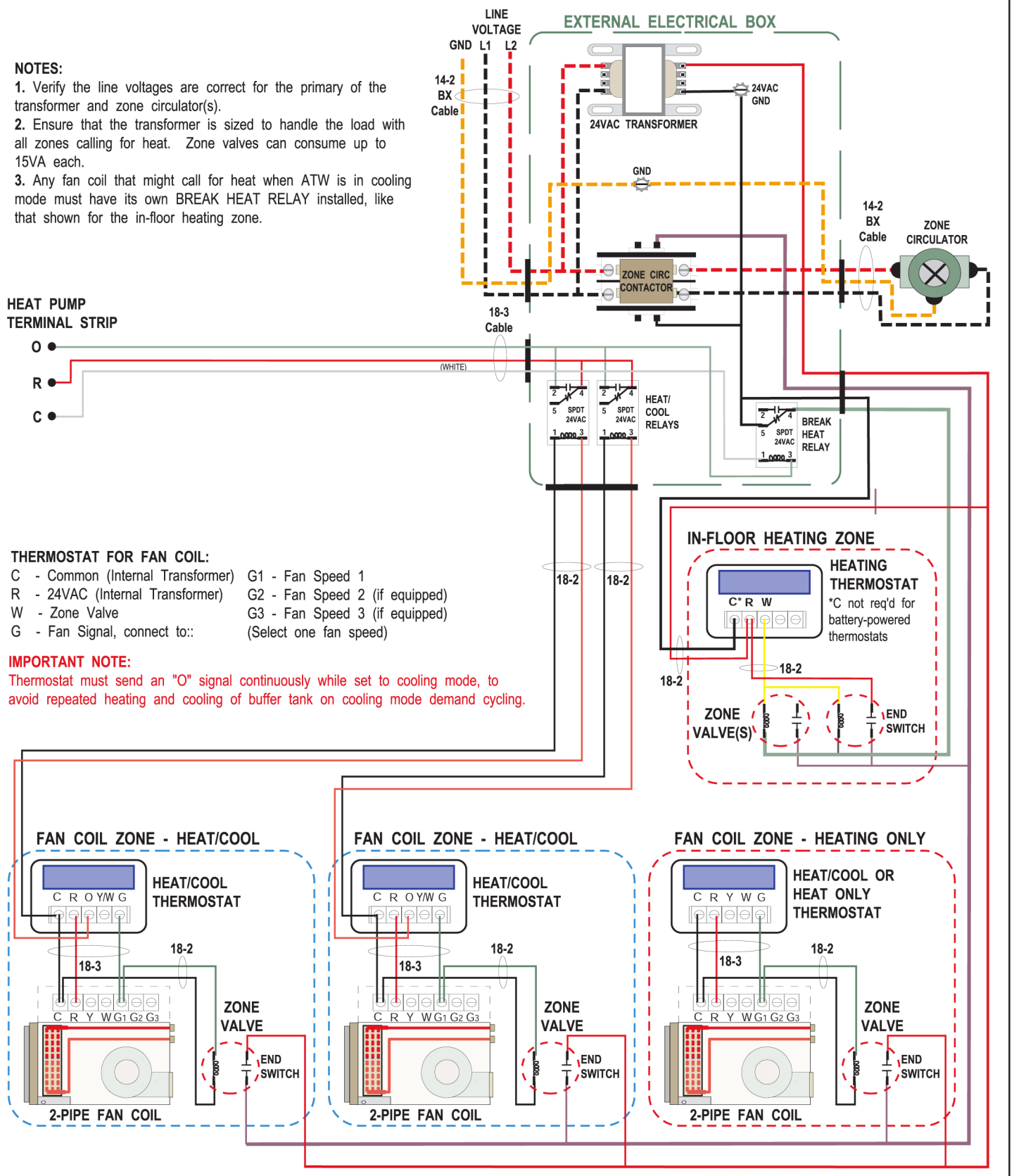
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

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

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

go to TABLE OF CONTENTS

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



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

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

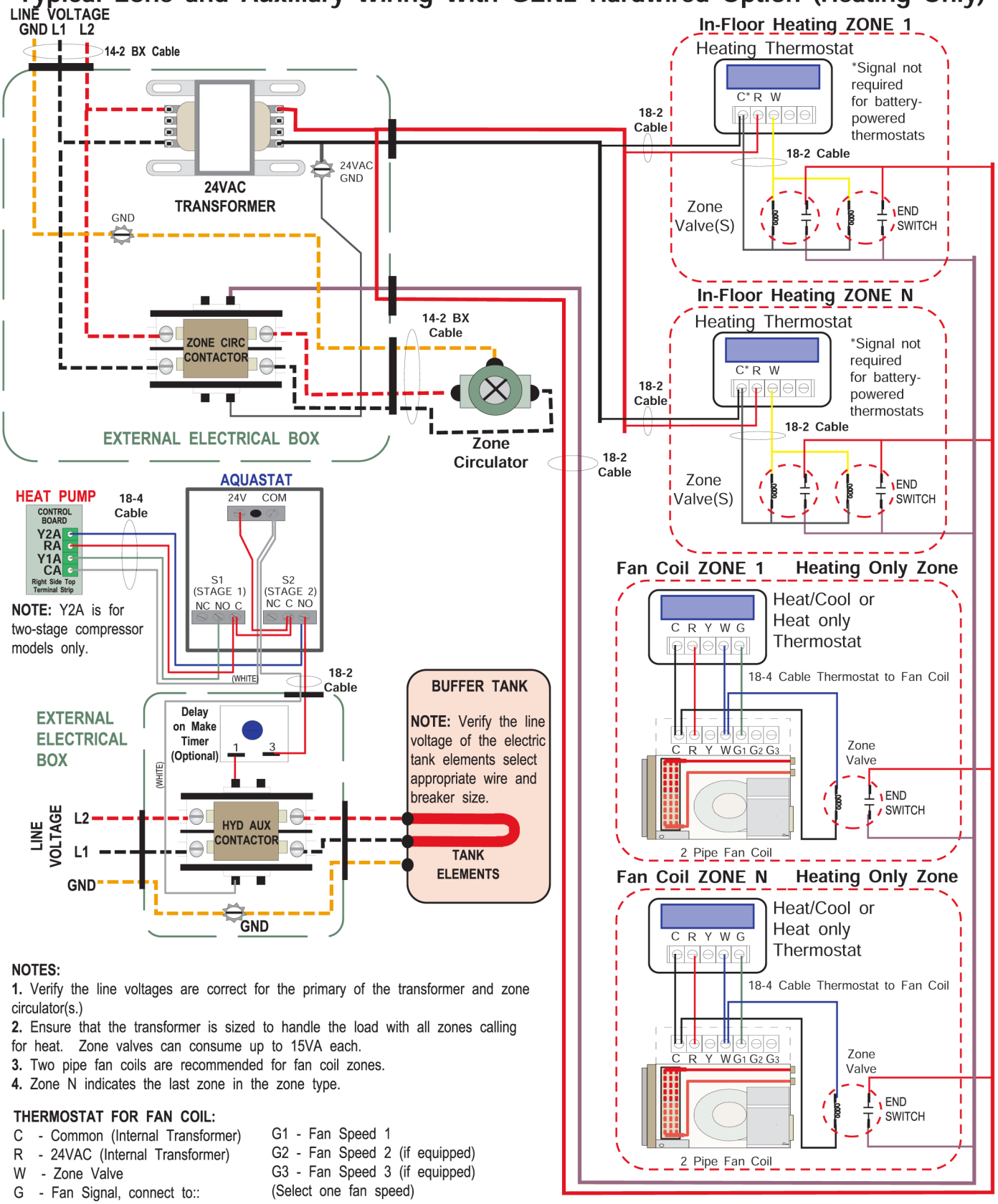
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

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

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

go to TABLE OF CONTENTS

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

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

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

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

go to TABLE OF CONTENTS

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

NOTES:

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

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

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

THERMOSTAT FOR FAN COIL:

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

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

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

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

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

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

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

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

go to TABLE OF CONTENTS

Piping

W/WH-Series: Number of Tanks

All **W/WH-series** systems will require at least **one buffer tank**. If there is one buffer tank, it will contain the heated or chilled water. Note that references to chilled water are only applicable to -HACW/HAC models, which have a reversing valve; or -H models in operating in *Chiller* mode (see **Operation** chapter). W/WH-H models in *Heat Pump* mode can still do cooling, using a simultaneous setup with external controller as shown on diagram **002288PDG**. A reversing rather than simultaneous setup is described here.

For reversing models, water in the tank will be chilled when the "**O**" signal is activated. This buffer tank may have electric elements for auxiliary heat, or an existing boiler may be used. See piping diagrams on following pages.

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

In addition to buffer tanks, domestic hot water **preheat** and **final** tanks are recommended, for use with the desuperheater (if present). These are part of the building's domestic water system, which is totally separate from the closed loop hydronic heating/cooling system. See diagram at end of this section.

Indoor Loop & Buffer Tank

W/WH-series connections for the indoor loop are 1" or 1-1/4" brass female NPT. They are labelled INDOOR IN and INDOOR OUT, and are located on the front of the unit.

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

NOTE: The water lines between the heat pump and the buffer tank should 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.

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

TABLE 10 - Buffer Tank Size

Heat Pump Size	Minimum Size gal (L)	Recommended Size gal (L)
25	16 (60)	50 (190)
45	24 (90)	50 (190)
55	32 (120)	70 (265)
65	40 (150)	70 (265)
75	48 (180)	70 (265)
80	52 (200)	70 (265)
If a tank size is not available, use the next size larger tank.		

Outdoor Loop

W/WH-series connections for the outdoor loop are 1" or 1-1/4" brass female NPT. They are labelled OUTDOOR IN and OUTDOOR OUT.

See the following chapters for details on ground loop and open loop installations.

Domestic Hot Water (Desuperheater) Connections

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

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

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

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

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

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

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

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

go to TABLE OF CONTENTS

WH-HAC: Modulating Water Valve

A high temperature heat pump may typically be heating the indoor loop to 130-160°F (54-71°C) using a cold (outdoor) loop temperature of 40-80°F (10-27°C). The amount of refrigerant in the system is appropriate for typical heating conditions.

If equipped with a reversing valve for cooling duty (models HAC/HACW), the hot loop becomes the outdoor loop at 40-80°F (4-27°C), and the indoor loop becomes the cold loop at 40-54°F (4-12°C). The close proximity of the loop temperatures will cause the refrigerating capacity to rise significantly. More capacity requires more refrigerant, and there may be an insufficient amount of refrigerant to avoid a low pressure safety control trip.

The solution is to reduce the outdoor loop flow under such conditions in order to raise the discharge pressure and lower the refrigerating capacity, using an electronic modulating water valve controlled by the Gen2 control board in the heat pump.

A suitable 1" NPT modulating water valve is available as an accessory from Maritime Geothermal Ltd, and should be installed on the **OUTDOOR OUT** connection of the heat pump using a short 1" NPT nipple. ***This valve should be installed for all reversing WH-series heat pumps that will be operated in cooling mode with outdoor loop temperatures of 80°F (27°C) or less.***

CAUTION: if a modulating water valve is not installed in the outdoor loop of a reversing WH-series heat pump, nuisance low pressure control trips may occur.

Note that on open loop installations, the modulating water valve will act as the water shutoff valve, and no additional solenoid or slow-closing valve is required.

The WH's control board has an output (signal **OV2**) to run the valve on terminal **PWM3**. The valve is powered by 12VDC from the control board. See wiring diagram (SCH) in the **Model Specific Information** section for valve wiring.

WP-Series Pool Piping Connections

WP-series connections for the outdoor loop are the same type as W/WH series: 1" brass female NPT. They are labelled OUTDOOR IN and OUTDOOR OUT.

WP-series connections for the indoor loop are 2" PVC unions. They are labelled INDOOR IN and INDOOR OUT.

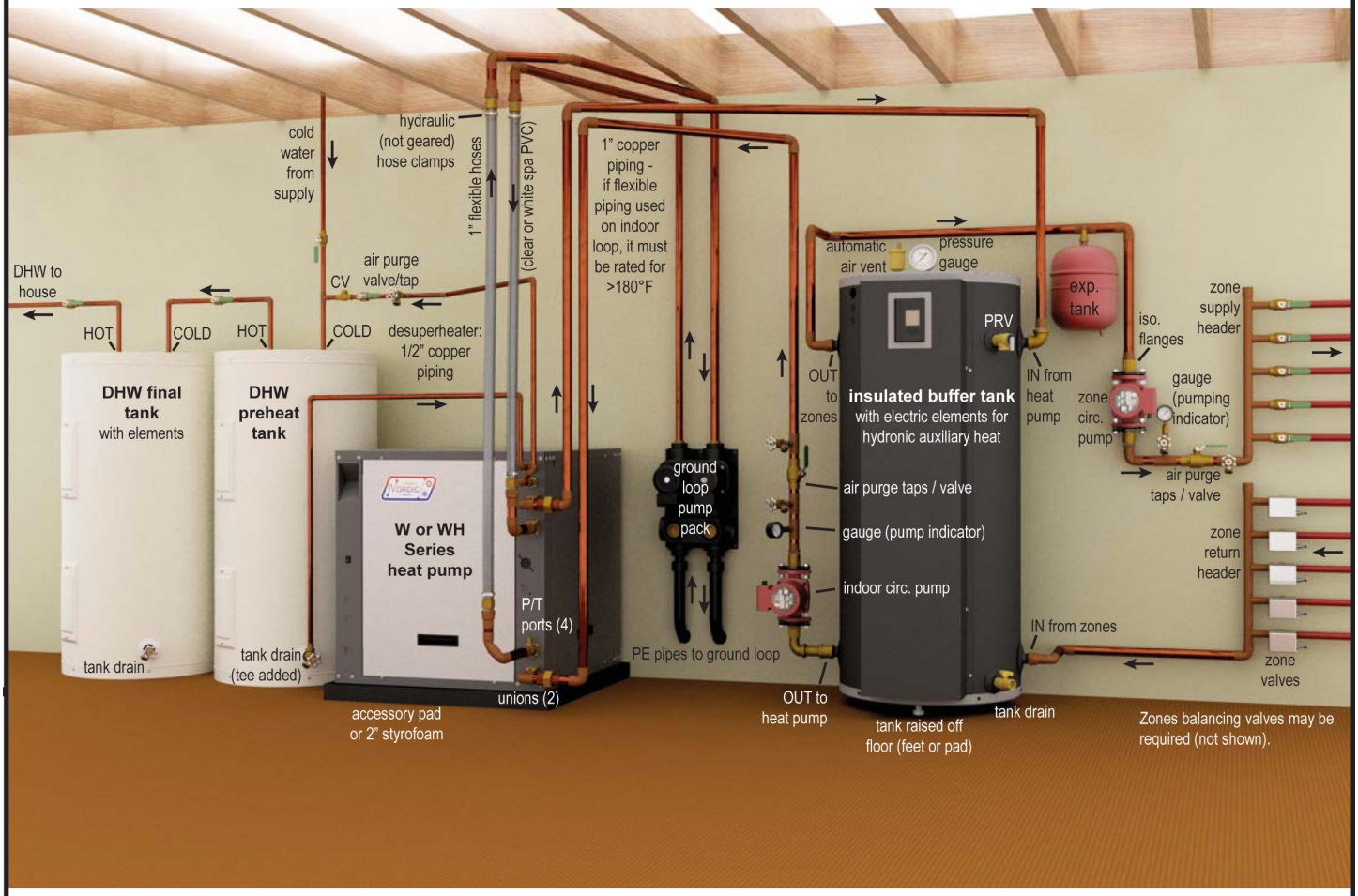
Dedicated pool heating heat pumps don't need a buffer tank, since the pool provides a very large volume to be heated that prevents frequent ON/OFF cycling.

The pool filter pump is often run continuously, and in this case can circulate water continuously through the heat pump. Using its **Setpoint Control / ICR** method, the heat pump will sense the water temperature every 8 minutes and come on when necessary to heat the water. The sampling routine logic will run, but since the pool water is always circulating it will not have any effect on the pool water pump.

If an existing pool water filter pump is not run continuously, e.g. if it is run on a timer, it can be re-wired so that it is powered from or controlled by the heat pump (as with the W/WH-series). This is necessary so the pool pump can be turned on by the heat pump when needed for sampling or water heating. Or alternatively, an accessory **flow switch** can be installed so that WP pool water heating operation is delayed until flow is sensed (see **Wiring** chapter).

go to TABLE OF CONTENTS

Typical Piping Connections - W/WH 25-80



See other diagrams and instructions in the manual for design, selection, and installation details of ground loop and 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.

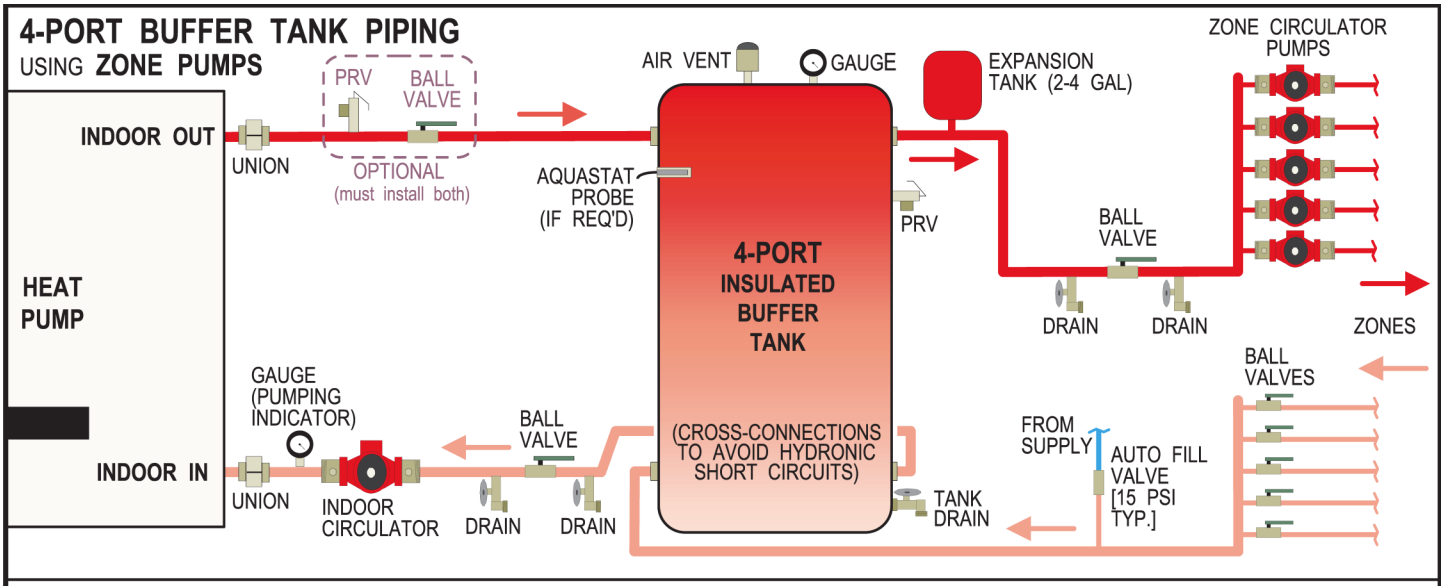
There are multiple valid connection methods or details which differ from those shown, including:

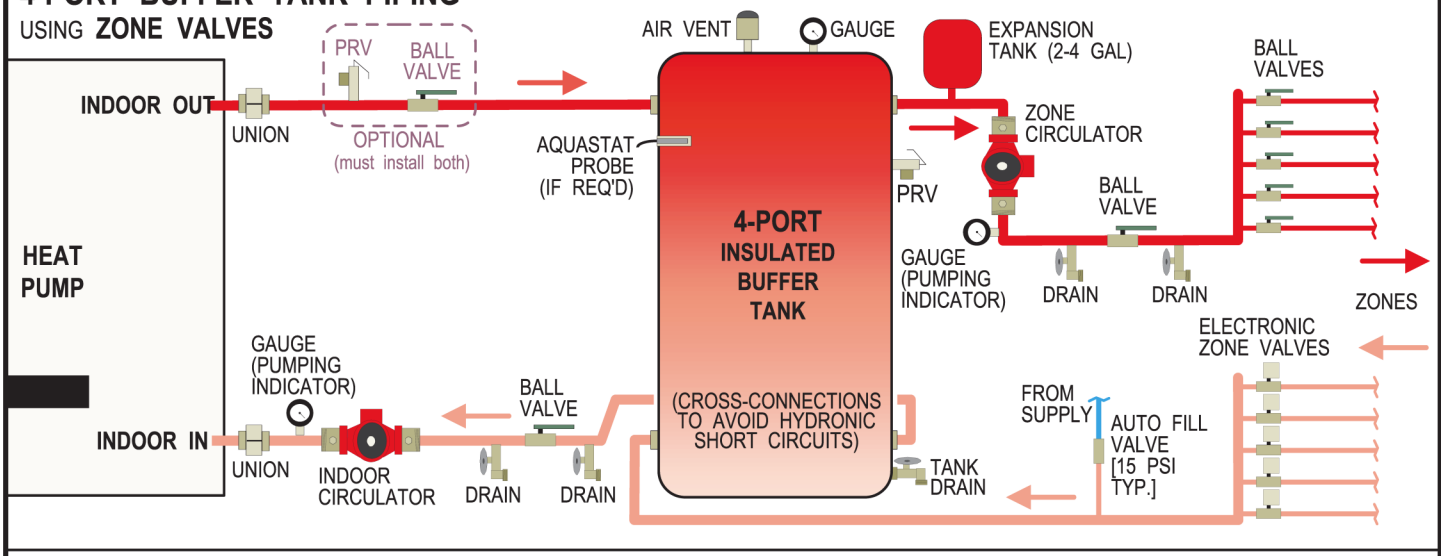
- Open loop installation, which uses a well water system in place of a ground loop.
- Hydronic heating zones that use one pump per zone instead of zone valves.
- Piping routed differently from that shown, or different piping & component types.

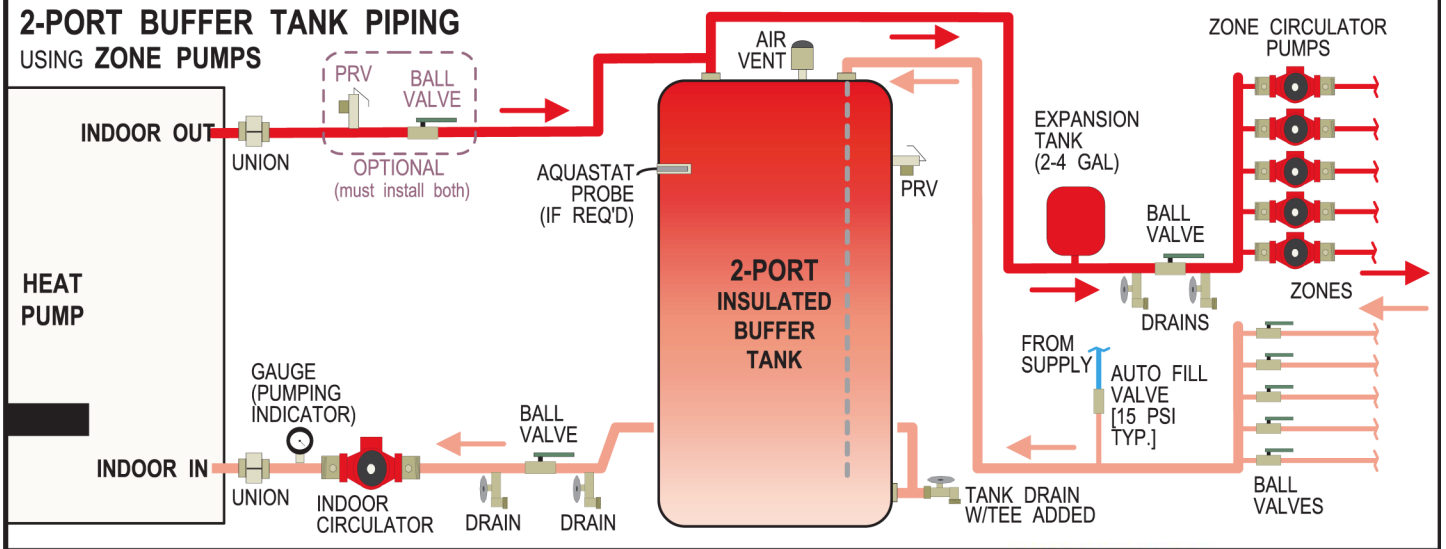
REV	ECO#	IMPL BY	APVD BY	DATE
02	-	Dan Rheault	Dan Rheault	1-May-2019
01	Initial Rel.	Dan Rheault	Dan Rheault	1-Mar-2018

Drawn By: Dan Rheault	Date: 1-Mar-2018	MARITIME GEOTHERMAL LTD.	P.O. Box 2555, 170 Plantation Rd., Petitcodiac, NB CANADA E4Z 6H4
Checked By: Dan Rheault	Date: 1-Mar-2018	Drawing Name: Typical Piping Connections - W/WH 25-80	
Eng. Approved By	Date		
Mfg. Approved By	Date		
Approved By	Date	Size: LET	Drawing Number: 002287PDG / Revision: 02 / Sheet: 1 / 2

go to TABLE OF CONTENTS







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

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

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

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

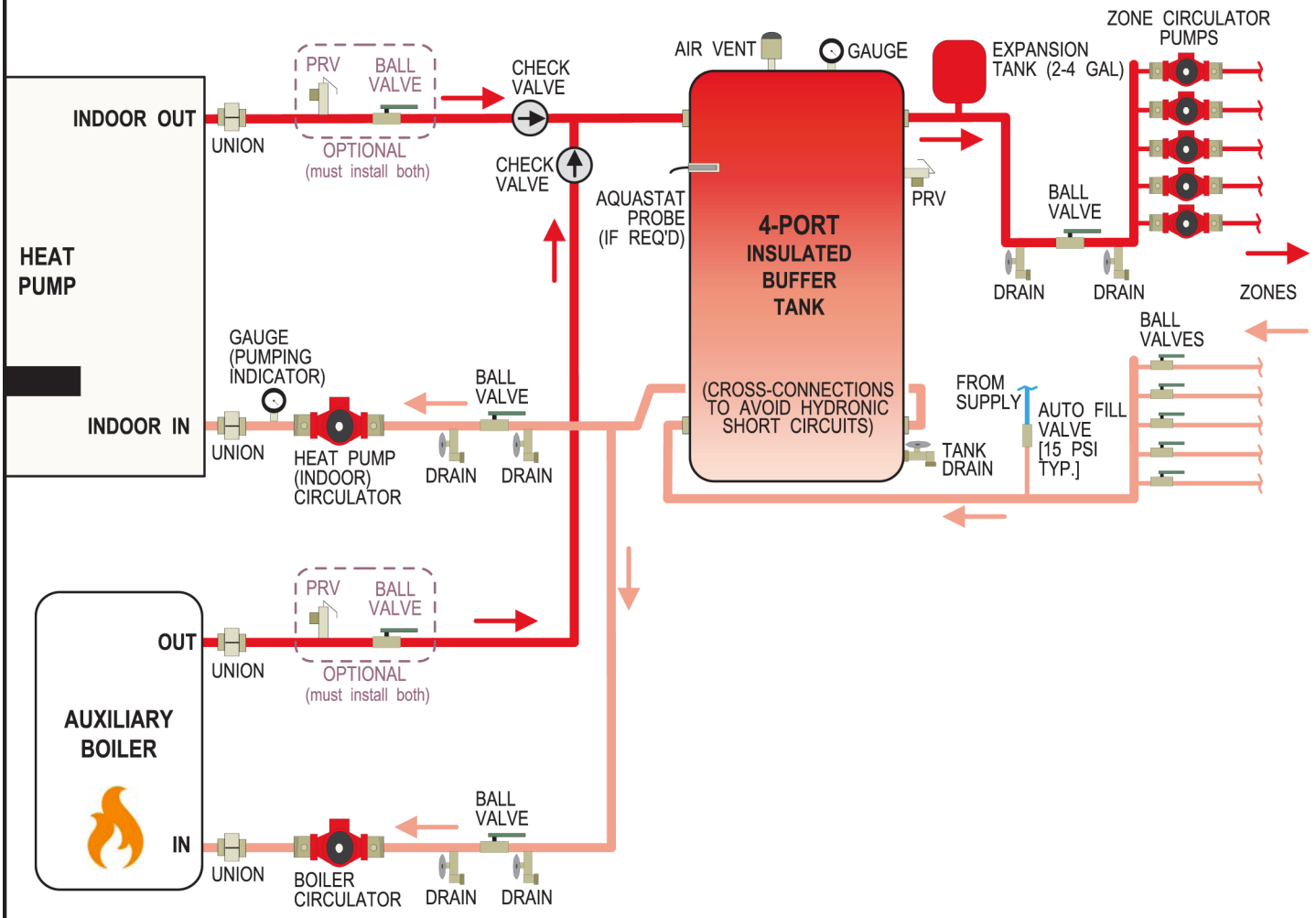
Size	Drawing Number	REV	SHEET
A	002366PDG	02	1 of 1

go to TABLE OF CONTENTS

Auxiliary Boiler Piping

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

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



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

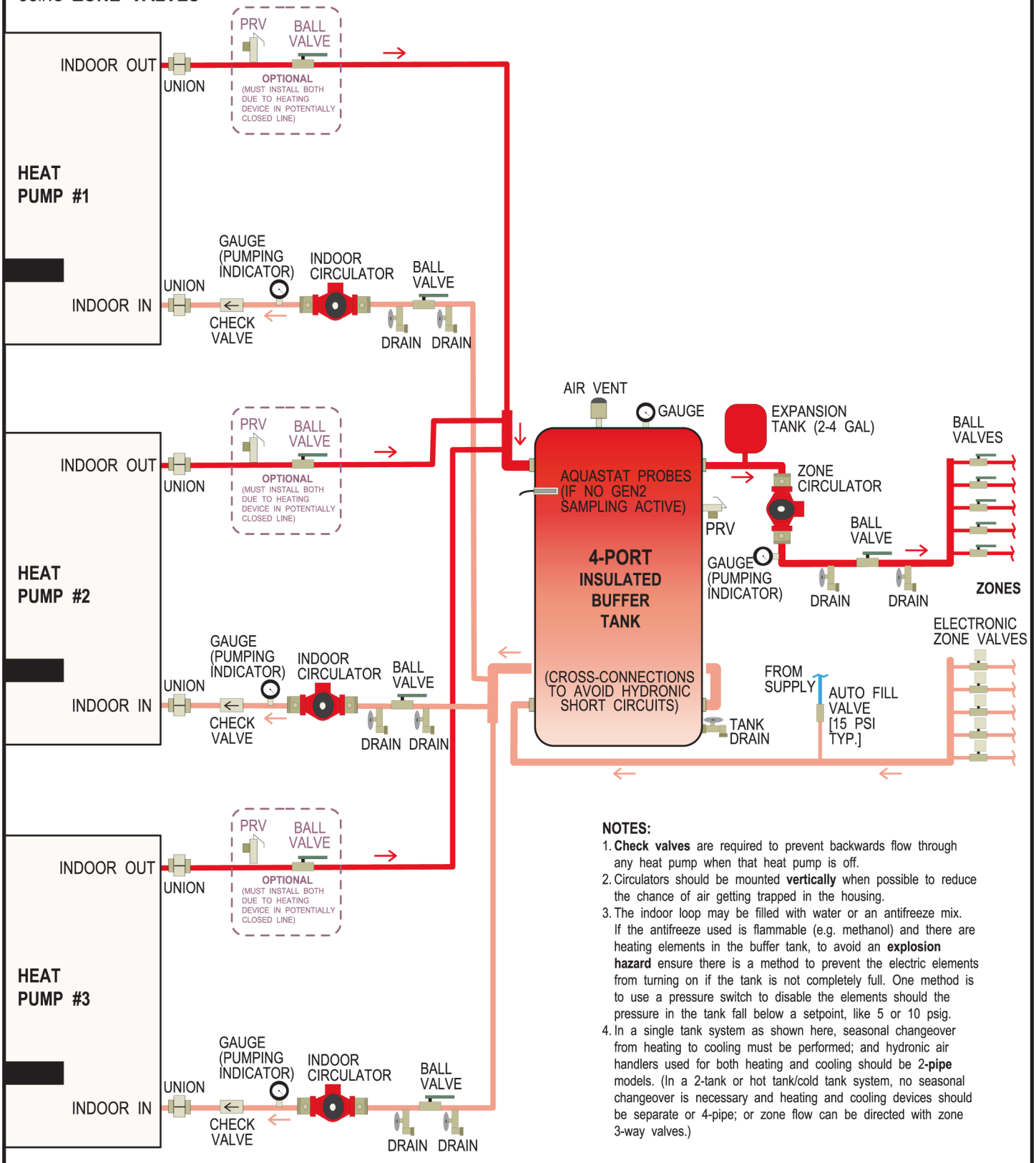
BOILER MUST BE CONTROLLED AS 3RD STAGE OF HEAT BY HEAT PUMP CONTROL BOARD OR EXTERNAL CONTROLLER. BOILER MAY THEN OPERATE AT A HIGHER OUTPUT TEMPERATURE THAN HEAT PUMP WITHOUT CAUSING HIGH TEMPERATURE/HIGH PRESSURE PROBLEMS AT THE HEAT PUMP.

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

Drawn By: Dan Rheault	Date: 14-Dec-2018	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 14-Dec-2018	
Approved By (ENG)	Date	Drawing Name: Auxiliary Boiler Piping
Approved By (MFG)	Date	
Approved By	Date	Size: A / Drawing Number: 002367PDG / REV: 02 / SHEET: 1 of 1

go to TABLE OF CONTENTS

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



NOTES:

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

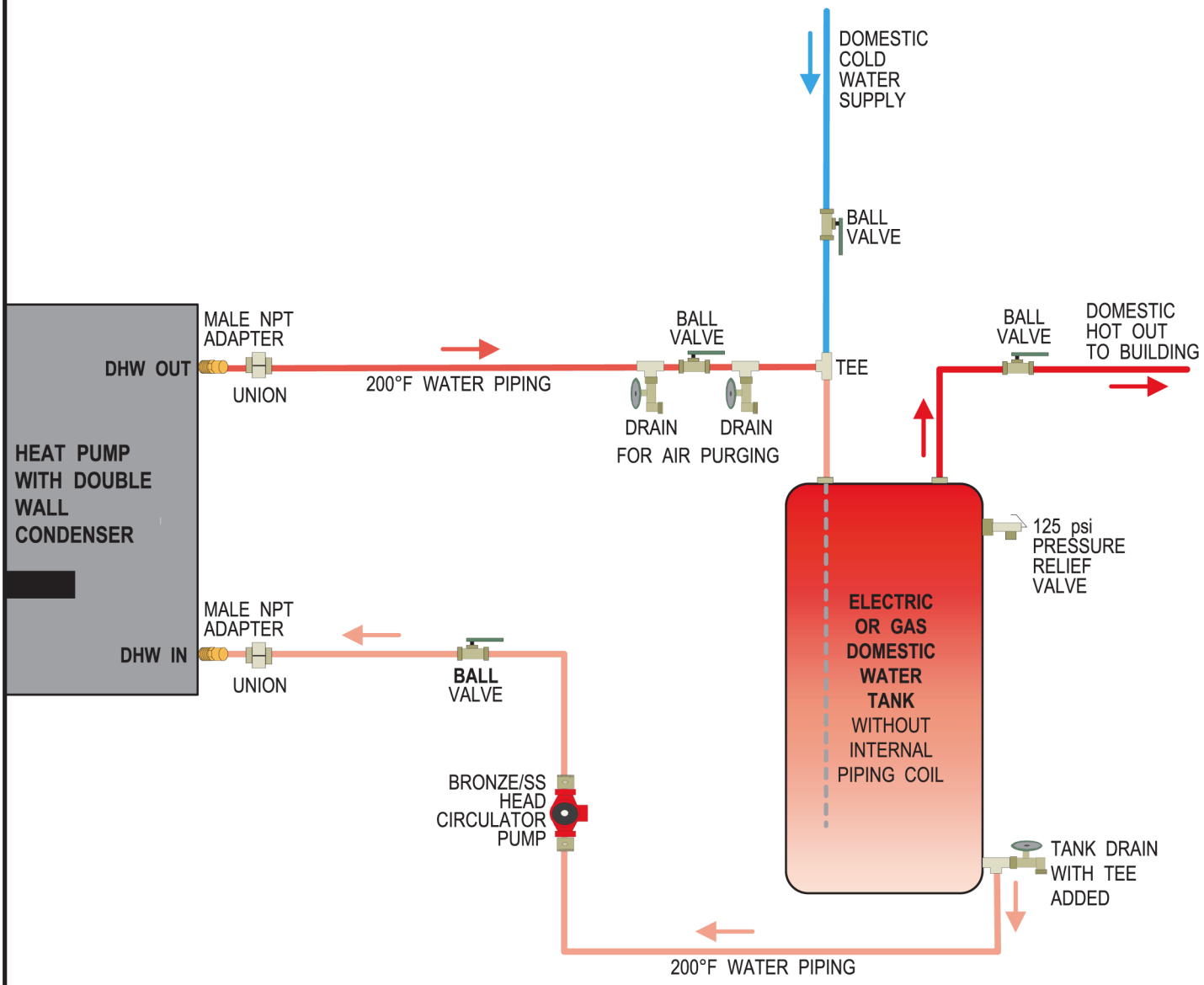
REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	9-Aug-2021

Drawn By: Dan Rheault	Date: 9-Aug-2021	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 9-Aug-2021	Drawing Name: **Buffer Tank Piping - Multiple Units**
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	Size: A; Drawing Number: **002528PDG**; REV: **01**; SHEET: 1 of 1

go to TABLE OF CONTENTS

DHW Tank Piping for Direct Domestic Water Heating

For Heat Pumps with Double Wall Condenser



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

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

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

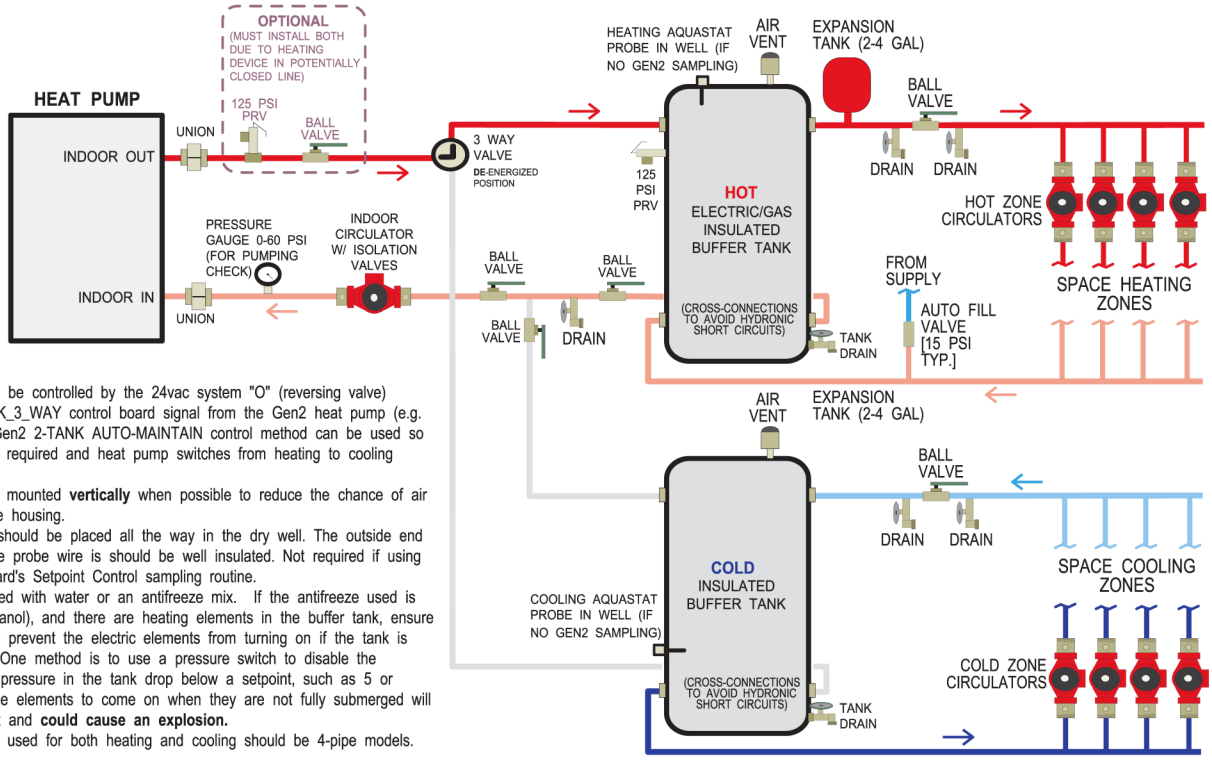
Drawing Name: Piping for Direct DHW Heating

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

go to TABLE OF CONTENTS

Two Tank System Piping with a Reversing Heat Pump

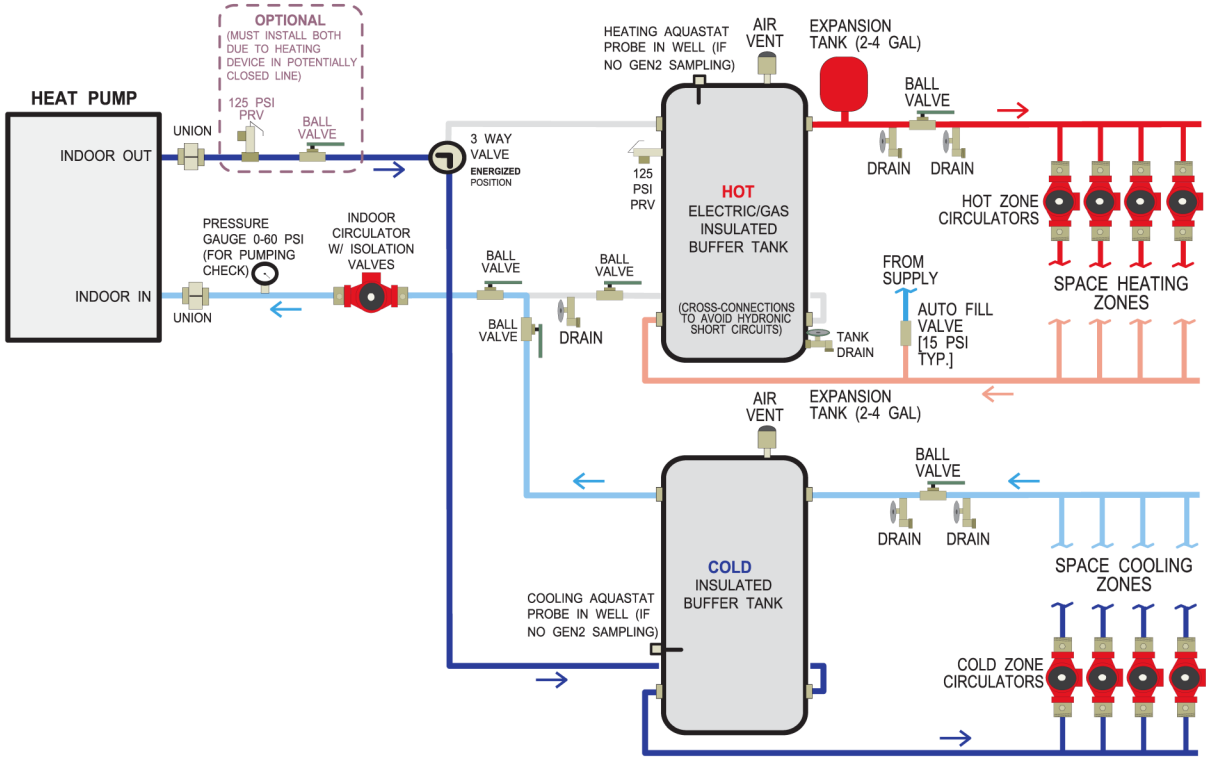
HEATING MODE



NOTES:

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

COOLING MODE



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

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

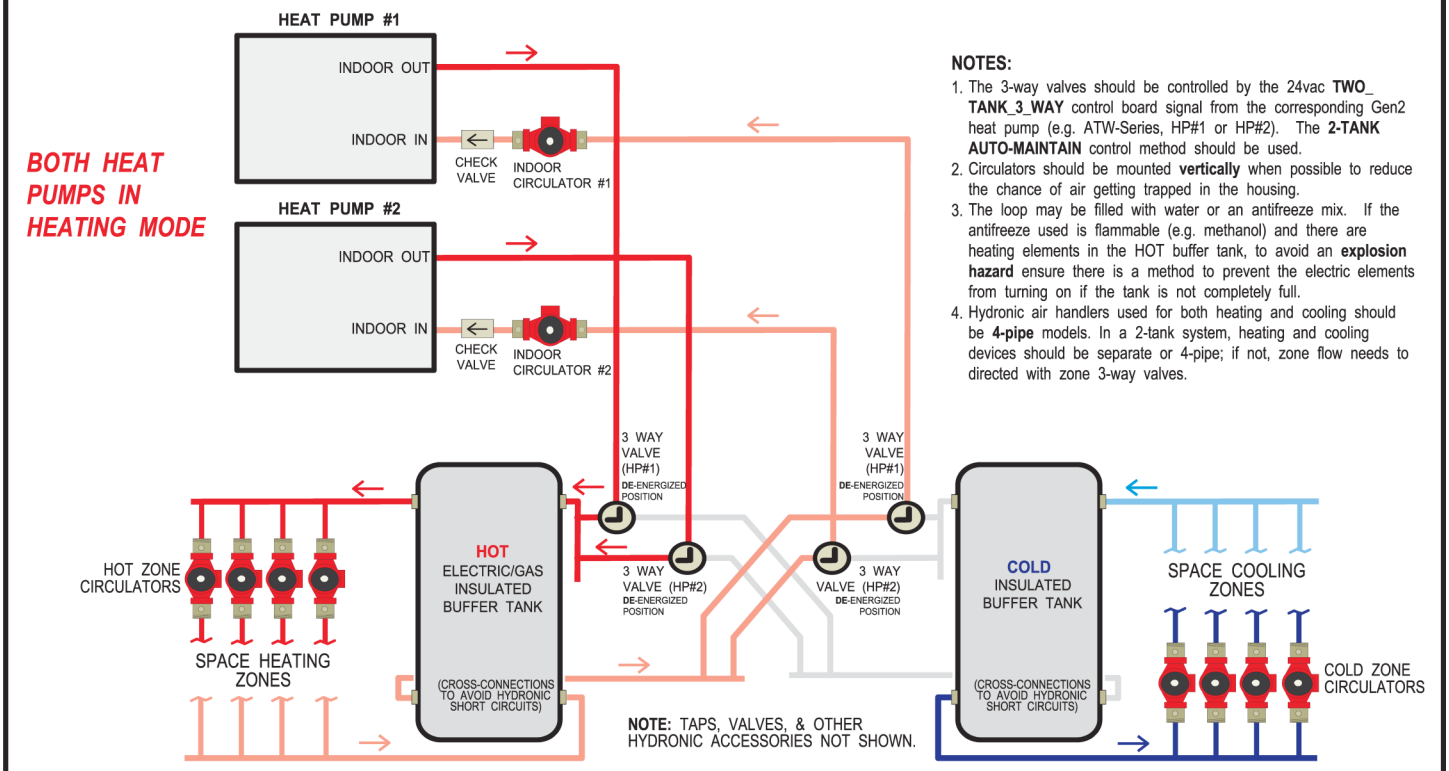
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

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

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

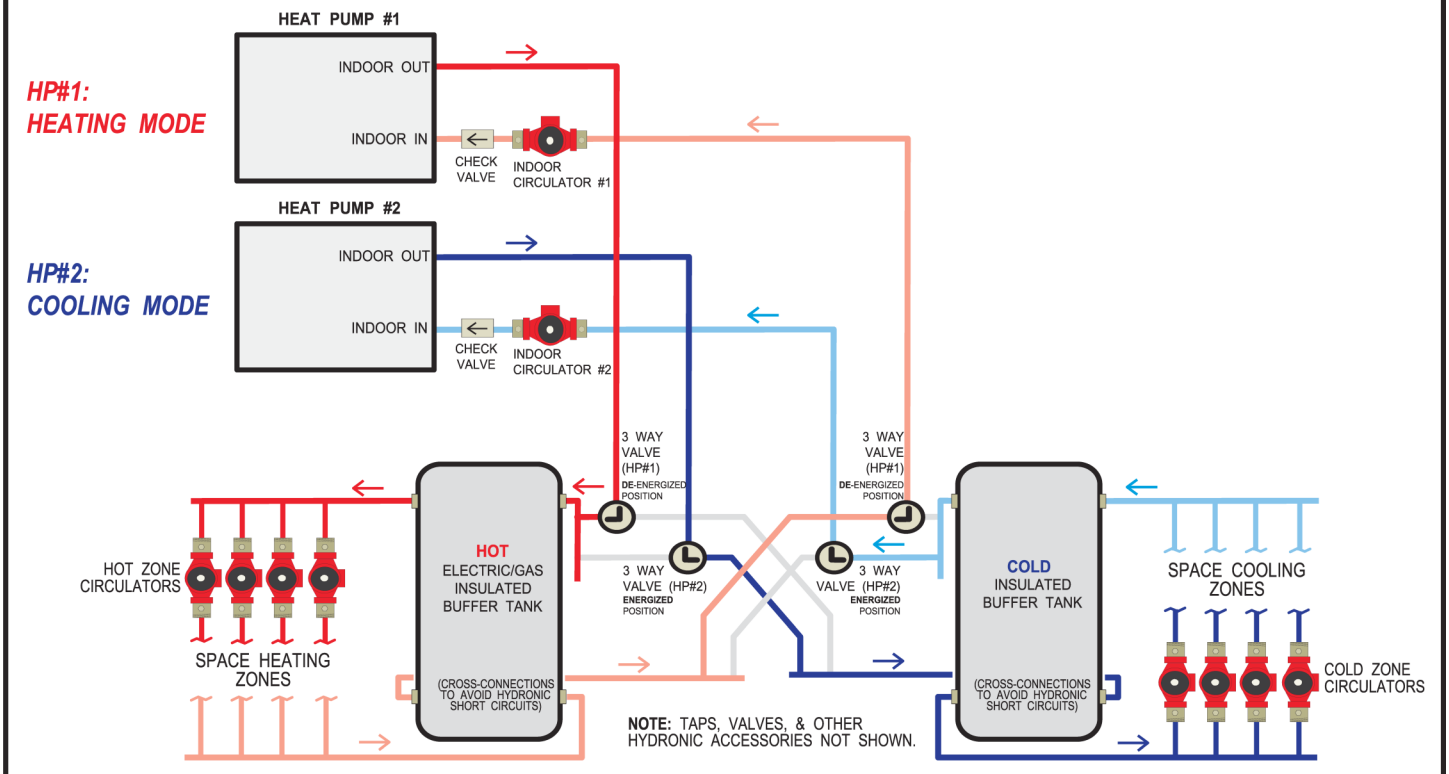
go to TABLE OF CONTENTS

Two Tank System Piping with Multiple Reversing Heat Pumps



NOTES:

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



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

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

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

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

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

go to TABLE OF CONTENTS

Two Tank Simultaneous Heating / Cooling

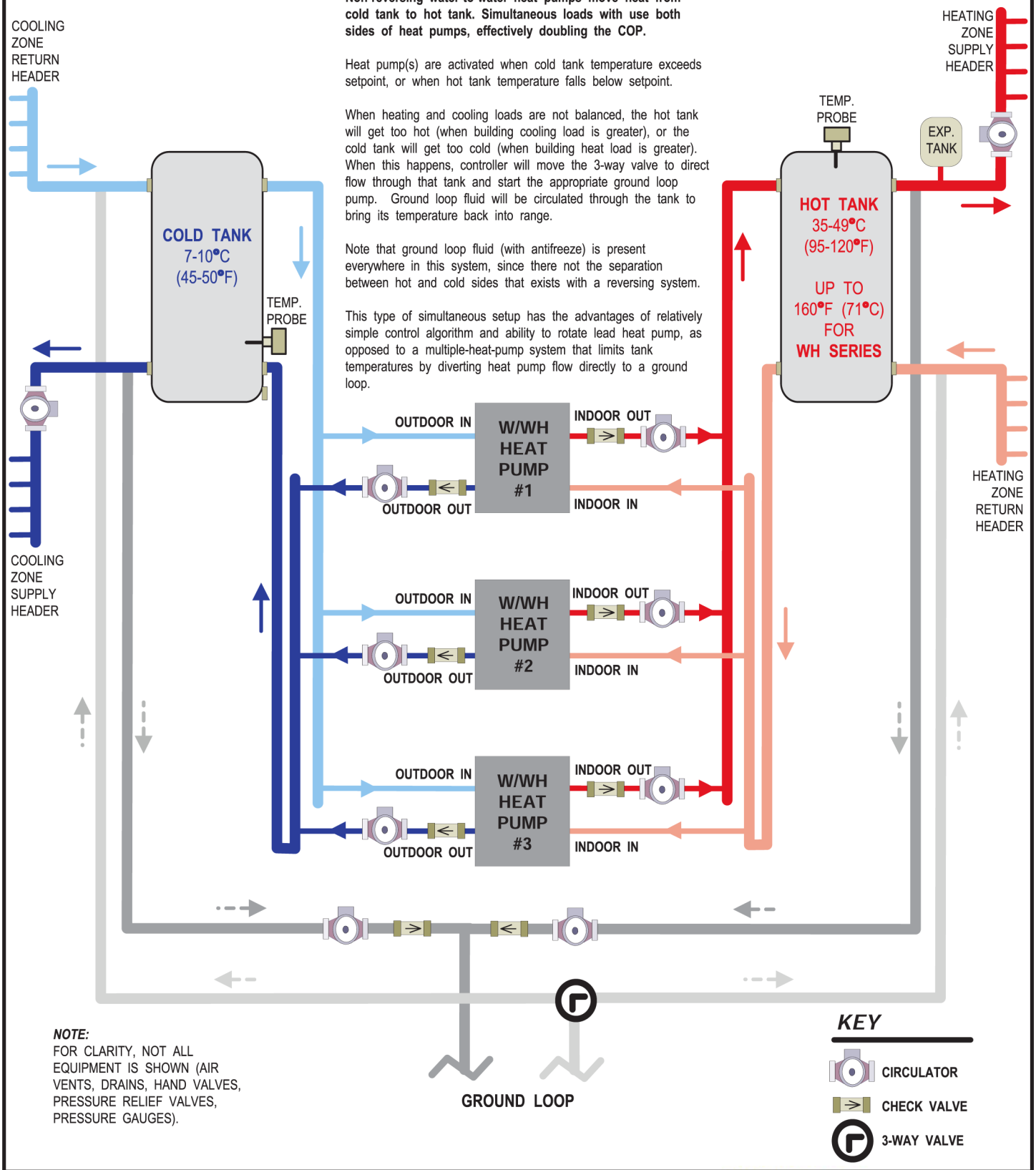
Non-reversing water-to-water heat pumps move heat from cold tank to hot tank. Simultaneous loads with use both sides of heat pumps, effectively doubling the COP.

Heat pump(s) are activated when cold tank temperature exceeds setpoint, or when hot tank temperature falls below setpoint.

When heating and cooling loads are not balanced, the hot tank will get too hot (when building cooling load is greater), or the cold tank will get too cold (when building heat load is greater). When this happens, controller will move the 3-way valve to direct flow through that tank and start the appropriate ground loop pump. Ground loop fluid will be circulated through the tank to bring its temperature back into range.

Note that ground loop fluid (with antifreeze) is present everywhere in this system, since there not the separation between hot and cold sides that exists with a reversing system.

This type of simultaneous setup has the advantages of relatively simple control algorithm and ability to rotate lead heat pump, as opposed to a multiple-heat-pump system that limits tank temperatures by diverting heat pump flow directly to a ground loop.



NOTE:
FOR CLARITY, NOT ALL EQUIPMENT IS SHOWN (AIR VENTS, DRAINS, HAND VALVES, PRESSURE RELIEF VALVES, PRESSURE GAUGES).

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	2-Mar-2018

Drawn By	Dan Rheault	Date	2-Mar-2018
Checked By	Dan Rheault	Date	2-Mar-2018
Approved By	(ENG)	Date	
Approved By	(MFG)	Date	
Approved By		Date	

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

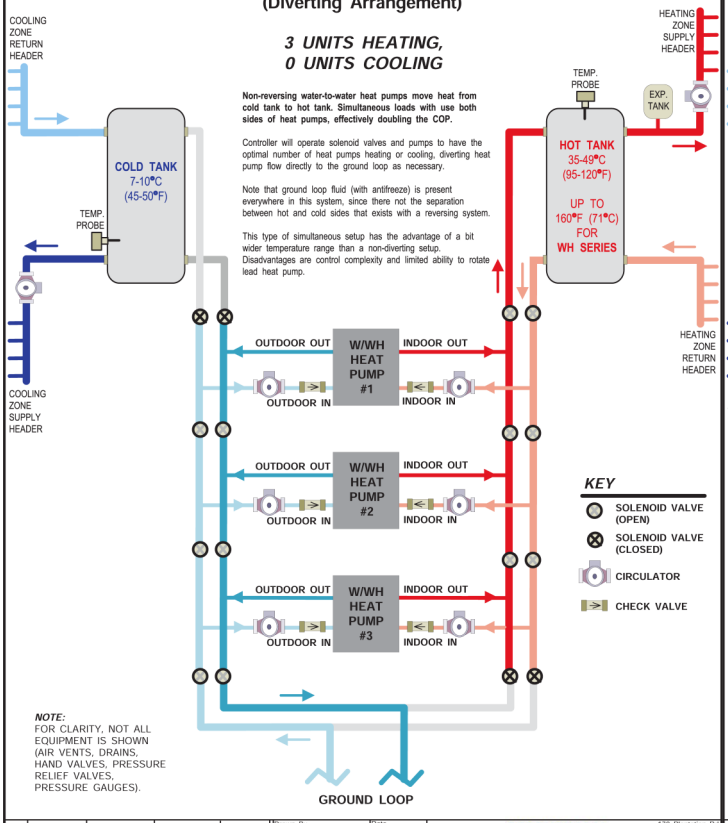
Drawing Name: Two Tank Simultaneous Heating / Cooling

Size	Drawing Number	REV	SHEET
A	002288PDG	01	1 of 1

go to TABLE OF CONTENTS

Two Tank Simultaneous Heating / Cooling
(Diverting Arrangement)

3 UNITS HEATING,
0 UNITS COOLING



Non-reversing water-to-water heat pumps move heat from cold tank to hot tank. Simultaneous loads with use both sides of heat pumps, effectively doubling the COP.

Controller will operate solenoid valves and pumps to have the optimal number of heat pumps heating or cooling, diverting heat pump flow directly to the ground loop as necessary.

Note that ground loop fluid (with antifreeze) is present everywhere in this system, since there not the separation between hot and cold sides that exists with a reversing system.

This type of simultaneous setup has the advantage of a bit wider temperature range than a non-diverting setup. Disadvantages are control complexity and limited ability to rotate lead heat pump.

NOTE:
FOR CLARITY, NOT ALL EQUIPMENT IS SHOWN (AIR VENTS, DRAINS, HAND VALVES, PRESSURE RELIEF VALVES, PRESSURE GAUGES).

REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

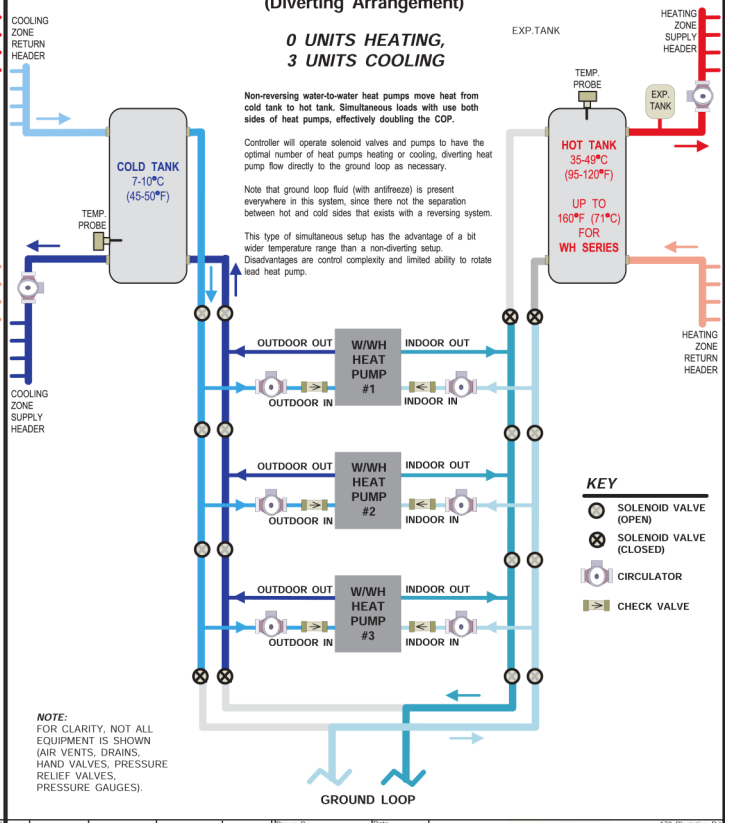
Drawn By: Dan Rheault — Date: 8-Aug-2012
Checked By: Dan Rheault — Date: 8-Aug-2012
Approved By (ENG): — Date:
Approved By (MFG): — Date:
Approved By: — Date:

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

Drawing Name: Two Tank Simultaneous Heating / Cooling (Diverting Arrangement)
Size: A | Drawing Number: 001680PDG | REV: 02 | SHEET: 1 of 4

Two Tank Simultaneous Heating / Cooling
(Diverting Arrangement)

0 UNITS HEATING,
3 UNITS COOLING



Non-reversing water-to-water heat pumps move heat from cold tank to hot tank. Simultaneous loads with use both sides of heat pumps, effectively doubling the COP.

Controller will operate solenoid valves and pumps to have the optimal number of heat pumps heating or cooling, diverting heat pump flow directly to the ground loop as necessary.

Note that ground loop fluid (with antifreeze) is present everywhere in this system, since there not the separation between hot and cold sides that exists with a reversing system.

This type of simultaneous setup has the advantage of a bit wider temperature range than a non-diverting setup. Disadvantages are control complexity and limited ability to rotate lead heat pump.

NOTE:
FOR CLARITY, NOT ALL EQUIPMENT IS SHOWN (AIR VENTS, DRAINS, HAND VALVES, PRESSURE RELIEF VALVES, PRESSURE GAUGES).

REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

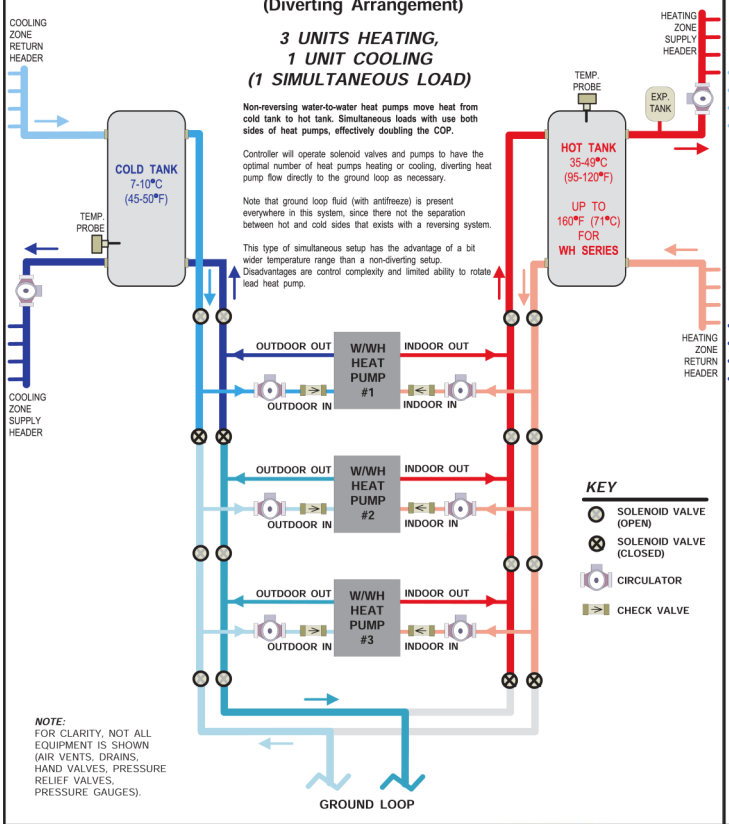
Drawn By: Dan Rheault — Date: 8-Aug-2012
Checked By: Dan Rheault — Date: 8-Aug-2012
Approved By (ENG): — Date:
Approved By (MFG): — Date:
Approved By: — Date:

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

Drawing Name: Two Tank Simultaneous Heating / Cooling (Diverting Arrangement)
Size: A | Drawing Number: 001680PDG | REV: 02 | SHEET: 2 of 4

Two Tank Simultaneous Heating / Cooling
(Diverting Arrangement)

3 UNITS HEATING,
1 UNIT COOLING
(1 SIMULTANEOUS LOAD)



Non-reversing water-to-water heat pumps move heat from cold tank to hot tank. Simultaneous loads with use both sides of heat pumps, effectively doubling the COP.

Controller will operate solenoid valves and pumps to have the optimal number of heat pumps heating or cooling, diverting heat pump flow directly to the ground loop as necessary.

Note that ground loop fluid (with antifreeze) is present everywhere in this system, since there not the separation between hot and cold sides that exists with a reversing system.

This type of simultaneous setup has the advantage of a bit wider temperature range than a non-diverting setup. Disadvantages are control complexity and limited ability to rotate lead heat pump.

NOTE:
FOR CLARITY, NOT ALL EQUIPMENT IS SHOWN (AIR VENTS, DRAINS, HAND VALVES, PRESSURE RELIEF VALVES, PRESSURE GAUGES).

REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

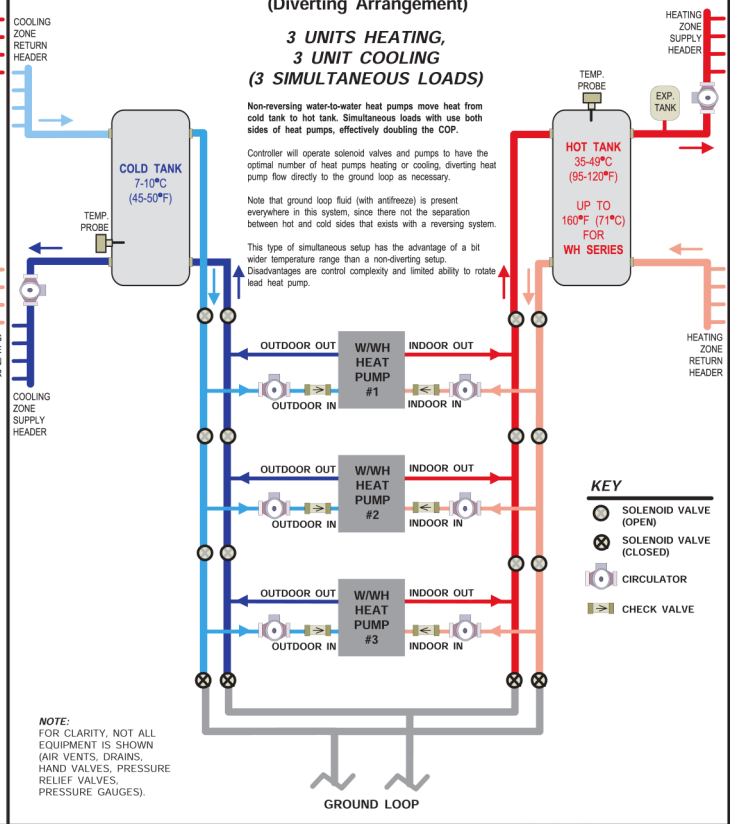
Drawn By: Dan Rheault — Date: 8-Aug-2012
Checked By: Dan Rheault — Date: 8-Aug-2012
Approved By (ENG): — Date:
Approved By (MFG): — Date:
Approved By: — Date:

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

Drawing Name: Two Tank Simultaneous Heating / Cooling (Diverting Arrangement)
Size: A | Drawing Number: 001680PDG | REV: 02 | SHEET: 3 of 4

Two Tank Simultaneous Heating / Cooling
(Diverting Arrangement)

3 UNITS HEATING,
3 UNIT COOLING
(3 SIMULTANEOUS LOADS)



Non-reversing water-to-water heat pumps move heat from cold tank to hot tank. Simultaneous loads with use both sides of heat pumps, effectively doubling the COP.

Controller will operate solenoid valves and pumps to have the optimal number of heat pumps heating or cooling, diverting heat pump flow directly to the ground loop as necessary.

Note that ground loop fluid (with antifreeze) is present everywhere in this system, since there not the separation between hot and cold sides that exists with a reversing system.

This type of simultaneous setup has the advantage of a bit wider temperature range than a non-diverting setup. Disadvantages are control complexity and limited ability to rotate lead heat pump.

NOTE:
FOR CLARITY, NOT ALL EQUIPMENT IS SHOWN (AIR VENTS, DRAINS, HAND VALVES, PRESSURE RELIEF VALVES, PRESSURE GAUGES).

REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D.RHEAULT	D.RHEAULT	2-Mar-2018
01	Initial Release	D.RHEAULT	D.RHEAULT	8-Aug-2012

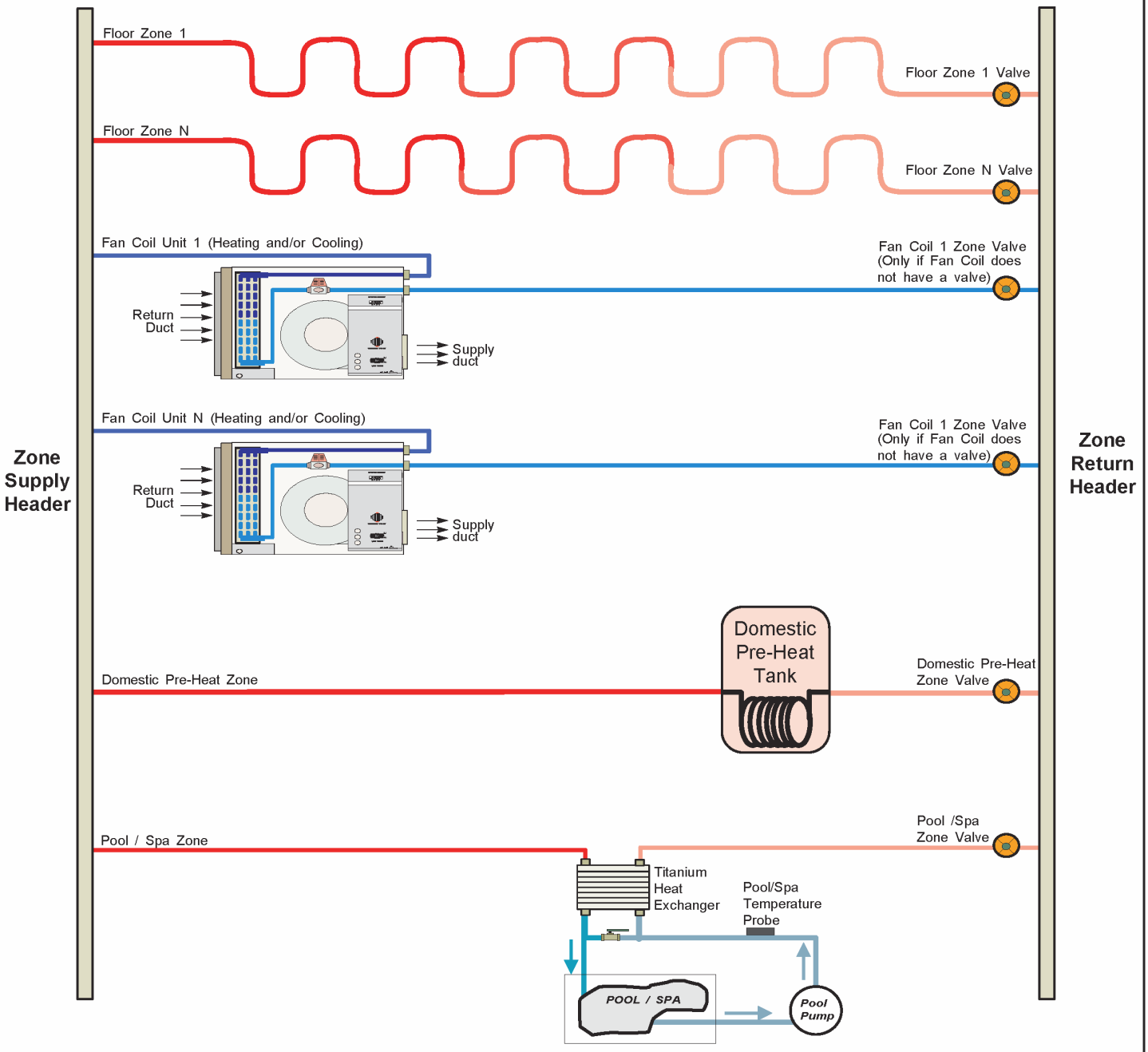
Drawn By: Dan Rheault — Date: 8-Aug-2012
Checked By: Dan Rheault — Date: 8-Aug-2012
Approved By (ENG): — Date:
Approved By (MFG): — Date:
Approved By: — Date:

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

Drawing Name: Two Tank Simultaneous Heating / Cooling (Diverting Arrangement)
Size: A | Drawing Number: 001680PDG | REV: 02 | SHEET: 4 of 4

go to TABLE OF CONTENTS

Typical Zone Types for Hydronic Applications



NOTES:

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

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

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

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

Drawing Name: Typical Zone Types for Hydronic Applications

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

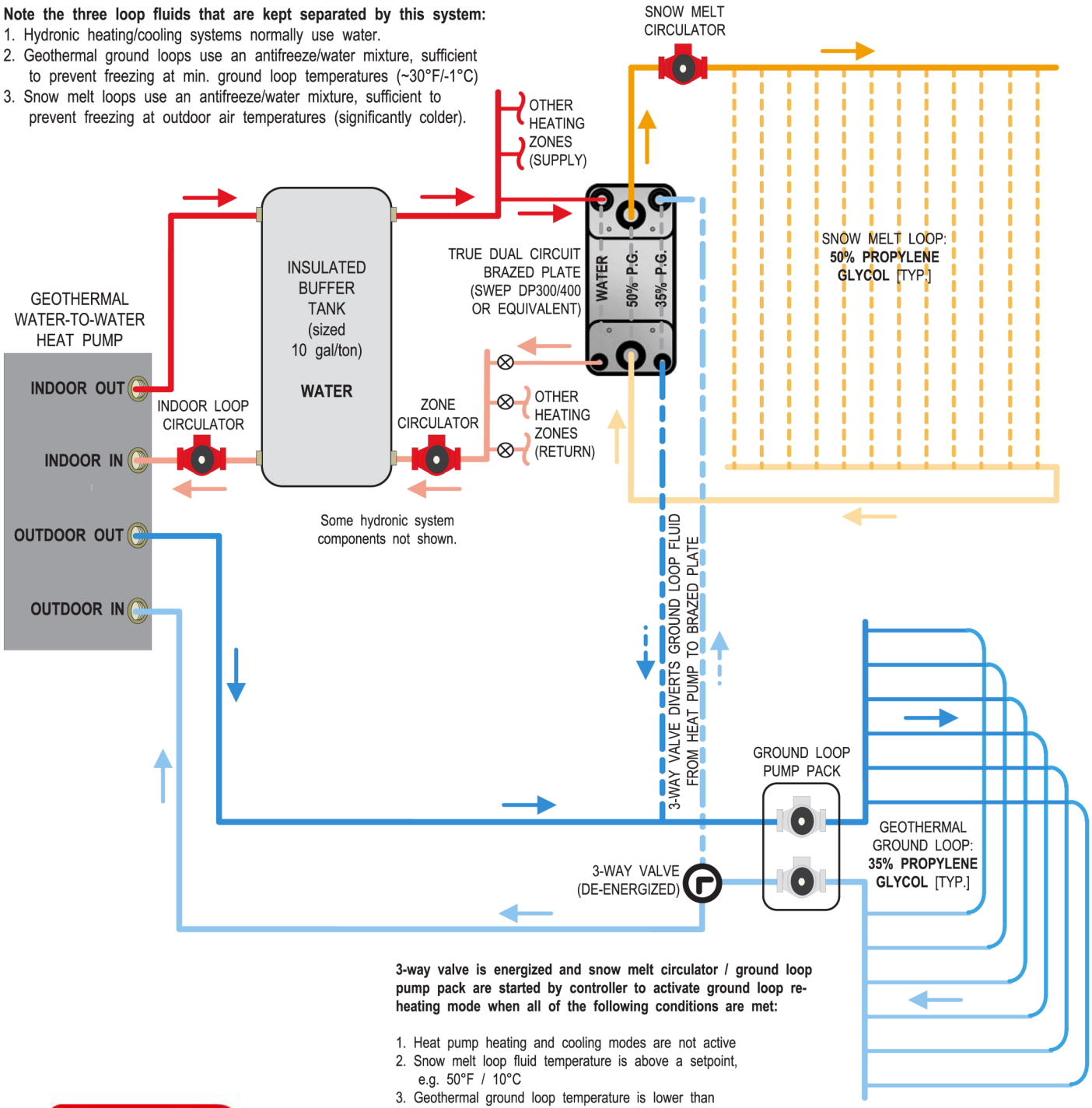
go to TABLE OF CONTENTS

Geothermal Snow Melt System with Warm-Weather Ground Loop Re-heating

The geothermal snow melt system, designed according to ASHRAE guidelines, will efficiently **melt snow and ice** in the winter, and will act as a **solar collector** during warn weather to re-heat the geothermal ground loop and increase its cold-weather performance.

Note the three loop fluids that are kept separated by this system:

1. Hydronic heating/cooling systems normally use water.
2. Geothermal ground loops use an antifreeze/water mixture, sufficient to prevent freezing at min. ground loop temperatures (~30°F/-1°C)
3. Snow melt loops use an antifreeze/water mixture, sufficient to prevent freezing at outdoor air temperatures (significantly colder).



3-way valve is energized and snow melt circulator / ground loop pump pack are started by controller to activate ground loop re-heating mode when all of the following conditions are met:

1. Heat pump heating and cooling modes are not active
2. Snow melt loop fluid temperature is above a setpoint, e.g. 50°F / 10°C
3. Geothermal ground loop temperature is lower than snow melt loop temperature by e.g. 10°F / 5°C

When 3-way valve is energized, snow melt hydronic heating zone is locked out.

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	31-Jan-2018

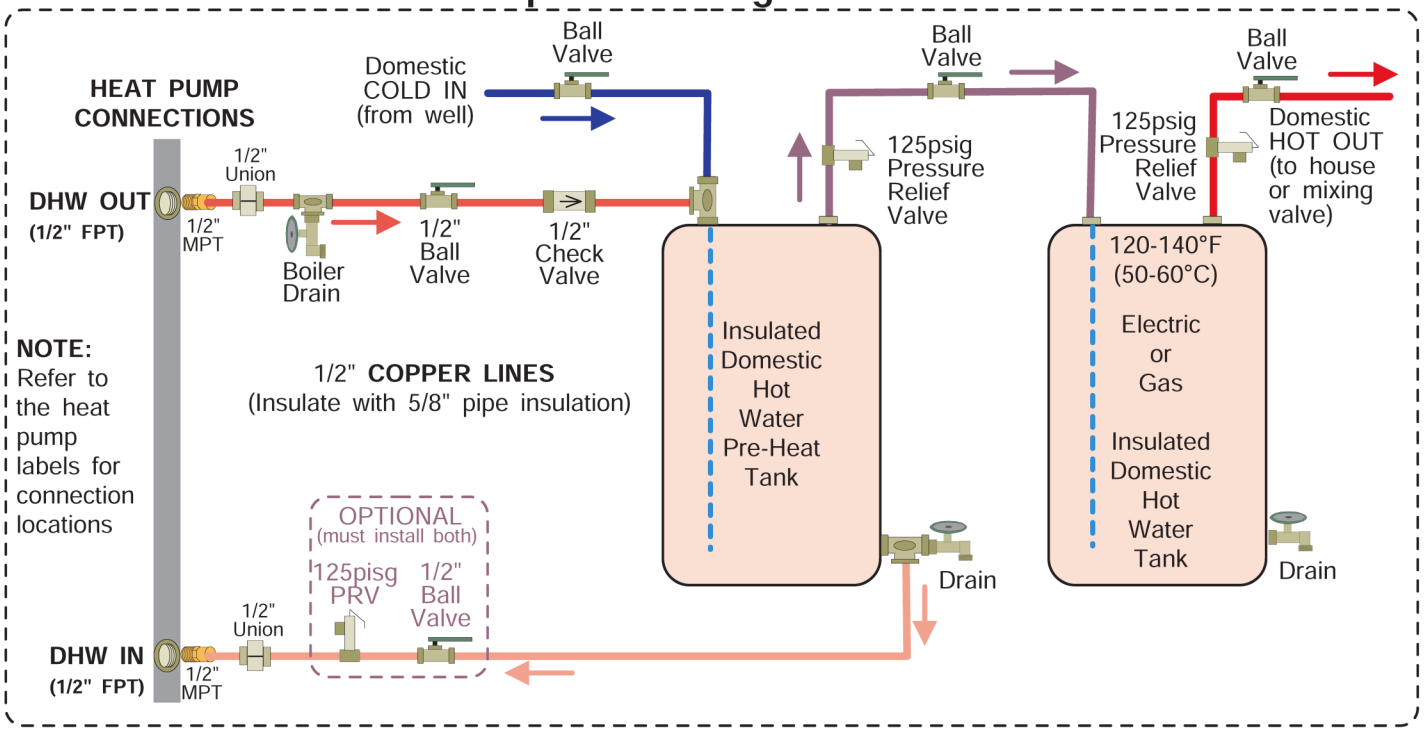
Drawn By: Dan Rheault	Date: 31-Jan-2018	MARITIME GEOTHERMAL LTD. www.nordicghp.com
Checked By: Dan Rheault	Date: 31-Jan-2018	Drawing Name: Piping for Snow Melt with Ground Loop Re-heating
Approved By (ENG): Dan Rheault	Date: 31-Jan-2018	
Approved By (MFG):	Date:	
Approved By:	Date:	

Size	Drawing Number	REV	SHEET
A	002286PDG	01	1 of 1

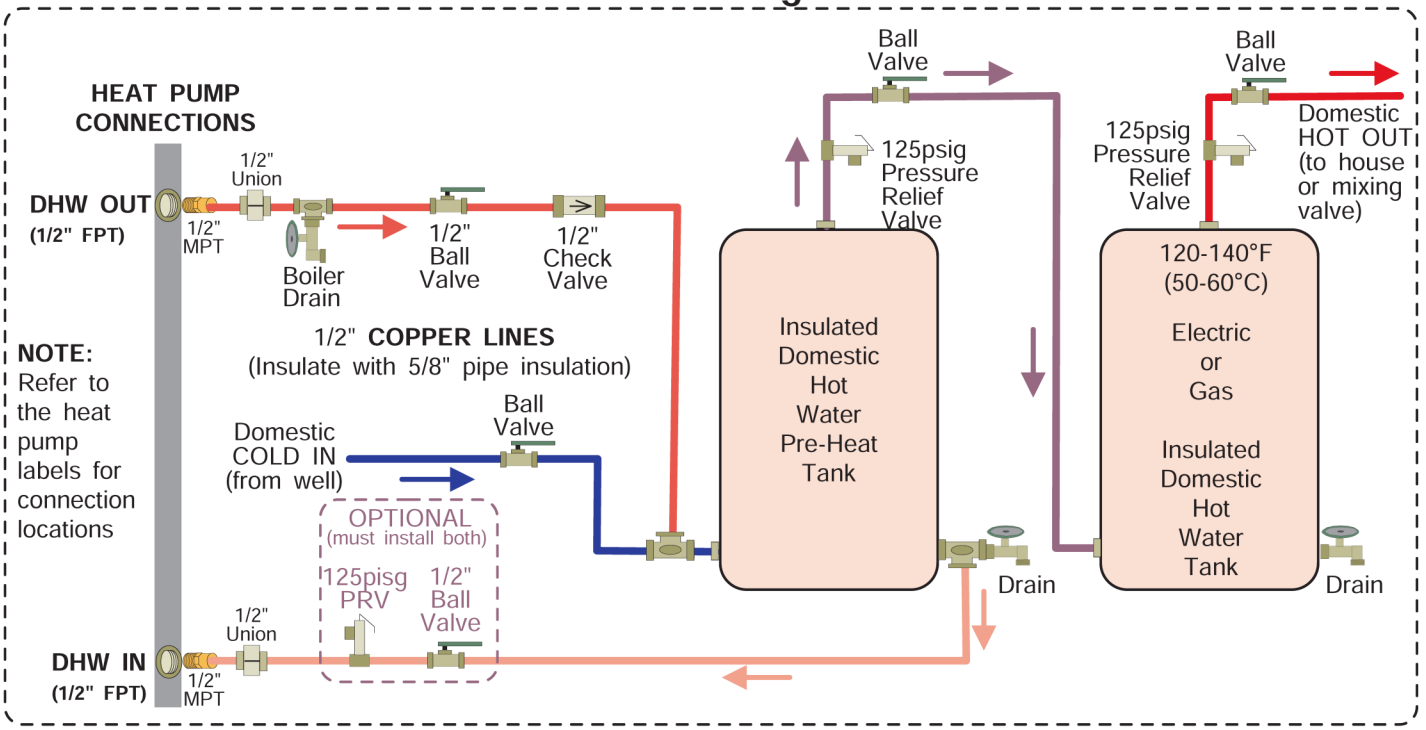
go to TABLE OF CONTENTS

Desuperheater Connection to DHW Pre-Heat Tank

Top Port Configuration



Side Port Configuration



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

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

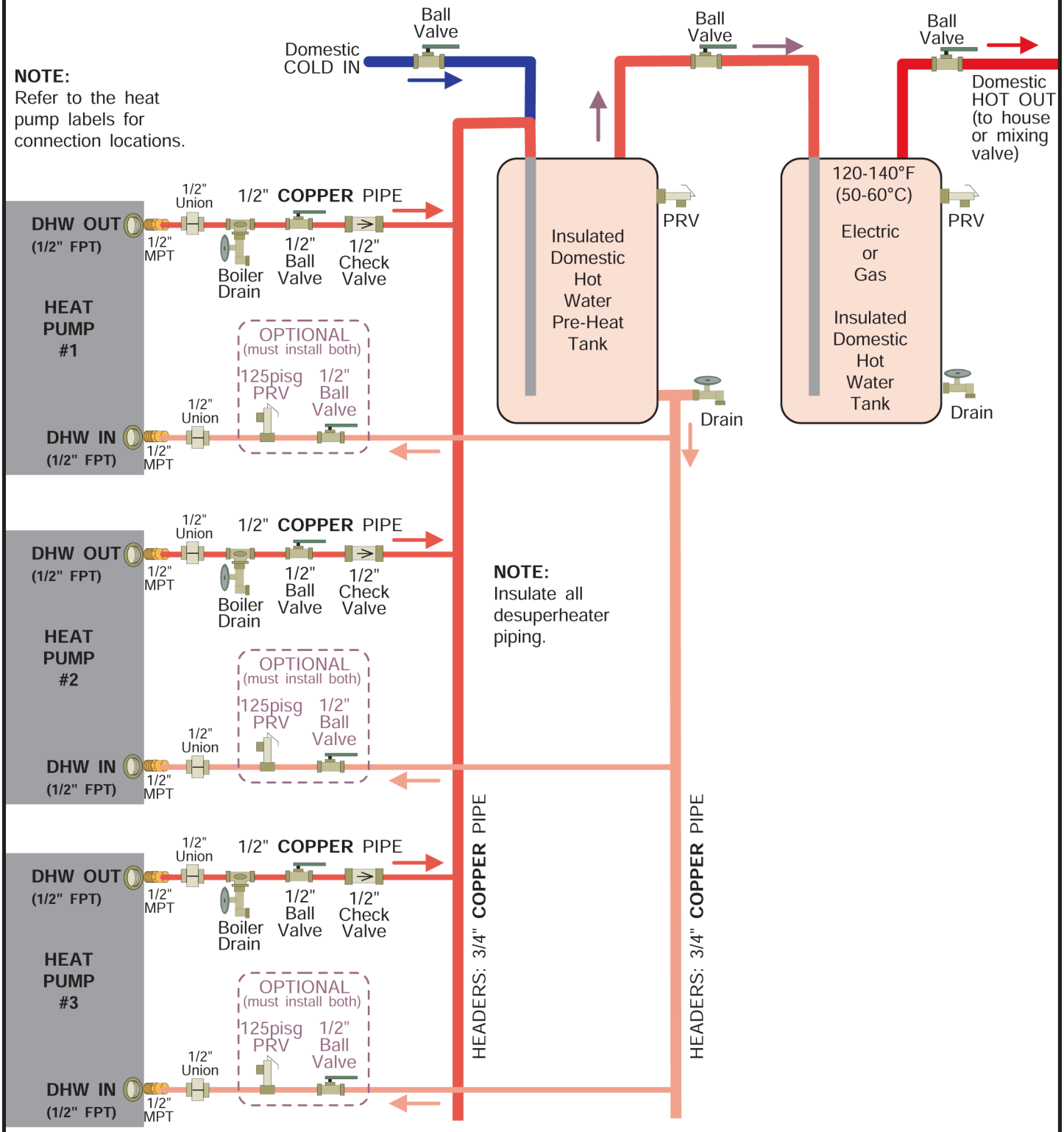
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

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

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

go to TABLE OF CONTENTS

Desuperheater Connection to DHW Pre-Heat Tank - Multiple Units



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

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

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

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

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

go to TABLE OF CONTENTS

Ground Loop Installations

WARNING: The R134a WH-series requires a source fluid temperature of 40°F (4°C) or greater. Therefore, the WH series may not use a ground loop except in suitably warm climates.

WARNING: Heating-only W/WH-H units only extract heat from (never reject heat to) the ground loop. This must be taken into account during ground loop design.

Refer to diagrams **000608INF** & **000609INF** at the end of this section for typical ground loop configurations. They are for reference only, and should not be used to replace formal training and computerized loop design.

Once the ground loop has been pressure tested and the header pipes have been connected to the circulator pump module, the heat pump can be connected to the circulator pump module. **The port connections for the Outdoor Loop are brass FPT fittings. They are marked as OUTDOOR IN and OUTDOOR OUT.**

Circulator Pump Module

Maritime Geothermal Ltd. offers compact pump modules with built in three way valves to facilitate filling and purging the ground loop. Refer to drawing **000906CDG** at the end of this section. Alternatively, Grundfoss Model UPS 26-99 or Taco Model 0011 pumps or other brands with similar pumping capability may be used. The single pump module will typically handle systems up to 3 tons (model sizes 25, 35, and 45); the two pump module will typically handle 4 to 6 ton systems (model sizes 55, 65, 75, 80). This is based on a typical parallel system with one circuit per ton.

Maritime Geothermal recommends calculating the total pressure drop of the ground loop (including headers, indoor piping and heat pump exchanger drop) based on the antifreeze type and concentration at the desired minimum loop temperature. A pump module that can deliver the flow required for the unit at the calculated total pressure drop should be selected. Refer to the **Model Specific Information** section for unit flow requirements.

Loop pressure drops can be calculated using software such as those mentioned in the Horizontal Ground loops section, or can be calculated in a spreadsheet using the pipe manufacturer's pressure drop tables for pipe diameter and fittings.

The circulator pump module must be connected to the heat pump Outdoor Loop ports with a lineset suitable for the flow required with minimum pressure drop. 1" rubber or plastic lines should be used.

The installation of P/T plugs/ports (pressure / temperature, pronounced "*Pete's plugs*") is recommended on both the entering and leaving lines at the heat pump. This will allow the installer or homeowner to check water flow through the loop by measuring the pressure difference through the heat exchanger and comparing it to that listed in the **Model Specific Information** section. P/T ports, adapters, and gauge adapters and are available as accessories from Maritime Geothermal Ltd..

Flushing & Purging

Once the groundloop has been installed and all connections are completed between the heat pump, circulator pump module and ground loop, the entire ground loop system should be **pressure tested with air to 100 PSIG** to make sure there are no leaks on any of the inside fittings. Soap all joints and observe that the pressure remains constant for 1 hour.

When satisfied that all connections are leak free, release the air pressure and connect a purge cart **(see Figure 1)** to the flushing access ports at the pump module **(refer to drawing 000906CDG)**. A temporary flushing system can alternately be constructed using a 45 gal. barrel and a pump with sufficient volume and head capability to circulate fluid at a **velocity of at least 2 ft/min** through all parts of the loop.

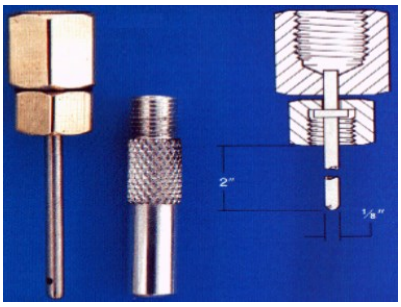
Figure 1: Ground Loop Accessories & Tools

2-pump module

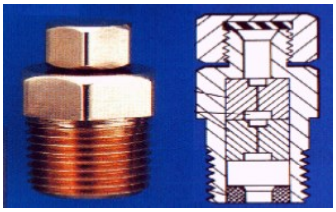
Barbed Adapters

PE Adapters

Purge Cart



Gauge adapter for P/T port



P/T port

P/T adapters for heat pump (1" NPT to barb)

go to TABLE OF CONTENTS

Adjust the circulator pump module valves to connect the purge cart to the ground loop. Begin pumping water through the ground loop, ensuring that the intake of the pump stays submerged at all times by continuously adding water. Water flowing back from the return line should be directed below the water level in the barrel or flush tank to prevent air being mixed with the outgoing water.

Once the lines have been filled and no more air bubbles are appearing in the line, adjust the circulator pump module valves to circulate water through the heat pump using the same technique as described above. When all air is removed reverse the flow of water through the lines by interchanging the flush cart lines and purge again. You will be able to visibly tell when all air is removed.

Adding Antifreeze Solution

In most mid and northern areas of the US and in all of Canada it is necessary to condition the loop fluid by the addition of some type of antifreeze solution so that it will not freeze during operation in the winter months. This antifreeze is required because the loop fluid will typically reach a low entering temperature of **28°F to 32°F (-2°C to 0°C)** and refrigerant temperatures inside the heat pump's heat exchanger may be as low as **20°F (11°C)** cooler. See table for details of freeze protection provided by different concentrations.

TABLE 11 - Antifreeze Percentages

BY VOLUME				
Protection to:	**10°F**	**15°F**	**20°F**	**25°F**
Methanol	25%	21%	16%	10%
Propylene Glycol	38%	30%	22%	15%
BY WEIGHT				
Protection to:	**10°F**	**15°F**	**20°F**	**25°F**
Methanol	16.8%	13.6%	10%	6.3%
Propylene Glycol	30%	23.5%	18.3%	12.9%

WARNING: Add enough antifreeze to allow for a temperature 20°F (11°C) lower than the expected lowest loop fluid temperature entering the heat pump. Insufficient anti-freeze concentration could cause the heat exchanger to freeze and rupture, voiding the warranty.

Although many different antifreeze solutions have been employed in geothermal systems, the alcohols such as methanol or ethanol have the most desirable characteristics for groundloop applications. The overall heat transfer characteristics of these fluids remain high although care must be taken when handling pure alcohols since they are extremely flammable. Once mixed in a typical 25% by volume ratio with water the solution is not flammable. In situations where alcohols are not allowed as a loop fluid due to local regulations then propylene glycol is a non-toxic alternative which can be substituted . Propylene glycol should only be used in cases where alcohols are not permitted since the heat transfer characteristics are less desirable and it becomes more viscous at low temperatures, increasing pumping power.

The volume of fluid that the loop system holds can be closely estimated by totaling the number of ft. of each size pipe in the system and referencing table the for approximate volume per 100 ft.

TABLE 12 - Volume of fluid per 100 ft. of pipe

		Volume /100ft.		
Type of Pipe	**Diameter**	**l.gal**	**gal**	**L**
Copper	**1"**	**3.4**	**4.1**	**15.5**
	1-1/4"	**5.3**	**6.4**	**24.2**
	1-1/2"	**7.7**	**9.2**	**34.8**
Rubber Hose	**1"**	**3.2**	**3.9**	**14.8**
Polyethylene	**3/4" IPS SDR11**	**2.3**	**2.8**	**10.6**
	1" IPS SDR11	**3.7**	**4.5**	**17.0**
	1-1/4" IPS SDR11	**6.7**	**8.0**	**30.3**
	1-1/2" IPS SDR11	**9.1**	**10.9**	**41.3**
	2" IPS SDR11	**15.0**	**18.0**	**68.1**
Other Item Volumes				
Heat Exchanger	**Average**	**1.2**	**1.5**	**5.7**
Purge Cart Tank	**See cart manual**	**TBD**		

When the volume of the loop has been calculated and the appropriate amount of antifreeze is ready for addition by referencing table; drain the equivalent amount of water from the flush cart or mixing barrel and replace it with the antifreeze.

When using alcohols, be sure to inject below the water line to reduce initial volatility of the pure antifreeze. If the loop is large it may be necessary to refill the tank with antifreeze several times to get all the antifreeze into the loop. Pump the loop for 5 to 10 minutes longer to ensure the remaining fluid has been well mixed.

Initial Pressurization

At this point open all valves in the flow circuit and slowly close off the supply and return flush cart valves in a manner that leaves about **20-30 psig** on the system. If an air bladder expansion tank is used it should be charged to the above pressure before actual water pressure is put on the system . Systems without an expansion tank will experience greater fluctuations in pressure between the heating and cooling seasons, causing pressure gauges to have different values as the loop temperature changes. This fluctuation is normal since expansion and contraction of the loop fluid must be handled by the elasticity of the plastic loop.

- Pressurize the loop to a static pressure of **45 psig**. when installing a system in the fall going into the heating season.
- Pressurize the loop to a static pressure of **25 psig**. when installing a system in the spring or summer going into the cooling season.

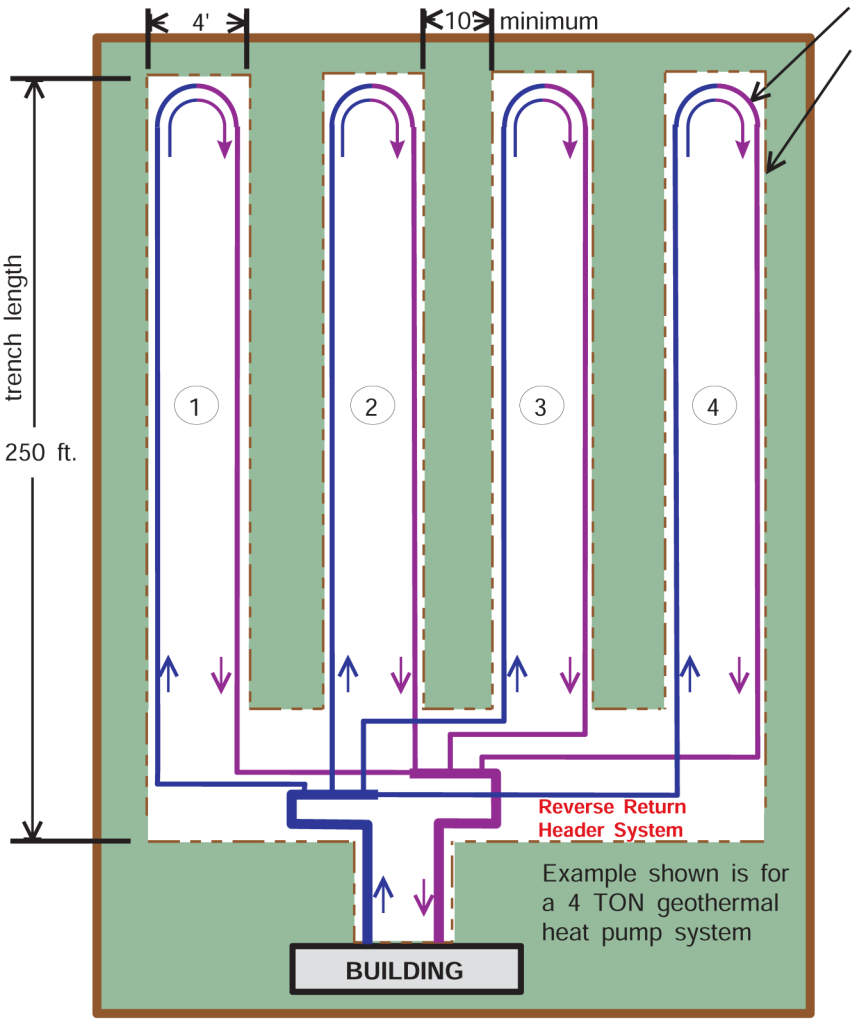
After operating the heat pump for a period of time, any residual air in the system should be bled off and the static pressure should be verified and adjusted if necessary. Add additional water / antifreeze mix with the purge cart to bring the pressure back to the original setting if required.

Pipe Insulation

All ground loop piping inside the structure (between the structure entry point and the heat pump) should be insulated with 3/8" thick closed cell pipe insulation to prevent condensation and dripping onto floors or walls.

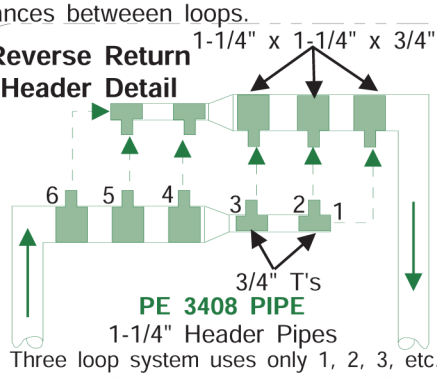
go to TABLE OF CONTENTS

TYPICAL HORIZONTAL GROUND LOOP CONFIGURATION



- Type PE 3408 Pipe
- Excavated trenches minimum 4' wide x 6' deep
- Trenches will be backfilled with material which will maximize the thermal conductivity of the adjacent earth.
- Each loop consists of 500ft. of 3/4" type 3408 PE 160 psig (SDR 11) geothermal heat pump polyethelene tubing.
- Each trench is 250ft. begining from the header. This allows one 500ft. rool of pipe to be used with only two fusion connections (one at each header).
- Allow a minimum of 10 ft. between each trench and preferably 15 - 20 ft. if space is available.
- Insulate all tubing within 12ft. of the structure with 1/2" thick closed cell armaflex insulation.
- Piping that is laid in a header trench should be insulated to a point where each loop branches to it's individual trench.
- The loop with the most pipe in the header trench could be left uninsulated to pick up heat from the header trench as long as the header trench is more than 12' out from the building.
- Reverse return headers minimize flow imbalances betweeen loops.

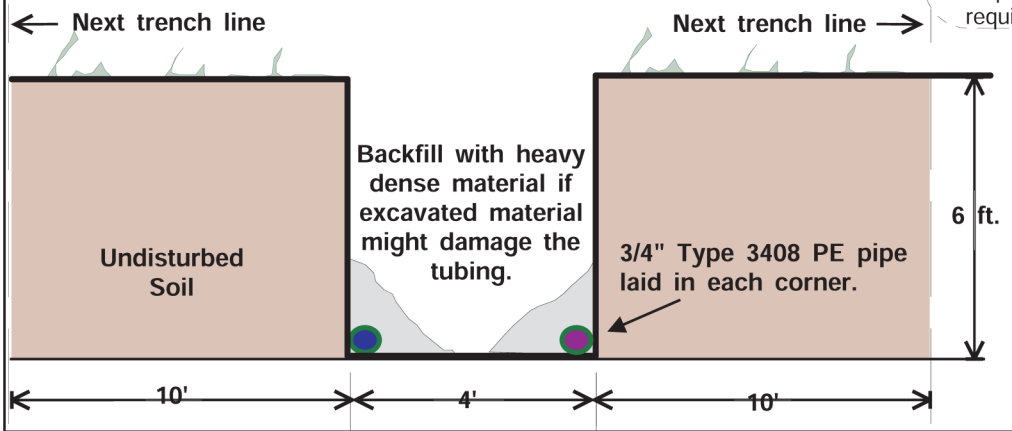
Reverse Return Header Detail



PE 3408 PIPE
1-1/4" Header Pipes

Three loop system uses only 1, 2, 3, etc. Minimum 2ft/sec to purge air. Each 3/4" loop requires 4USPGM to purge. 24USGPM to purge 6 loops, 20 for 5, 16 for 4, 12 for 3, 2 loops requires 10USGPM due to 1-1/4" header.

Elevation View of Trench



- Hand backfilling in the area just over the plastic pipe is recommended to prevent crushing or pinching of the pipe during backfilling operations.
- Horizontal style pipe runs should be placed 6' deep x minimum of 48" wide trench as shown above, with a minimum of 10ft. between trenches

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	17 JAN 08

Drawn By Chris Geddes	Date	17 JAN 08
Checked By Chris Geddes	Date	17 JAN 08
Approved By (ENG) Chris Geddes	Date	17 JAN 08
Approved By (MFG)	Date	
Approved By	Date	

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

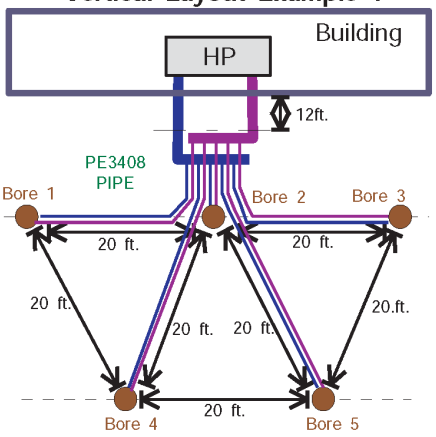
Drawing Name: Typical Horizontal Ground Loop Configuration

Size	Drawing Number	REV	SHEET
A	000608INF	01	1 of 1

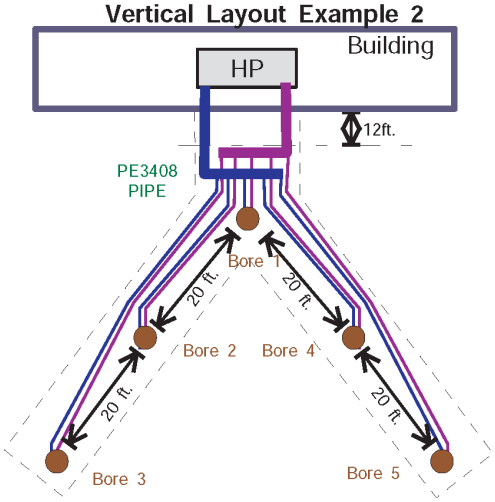
go to TABLE OF CONTENTS

TYPICAL VERTICAL GROUND LOOP CONFIGURATION

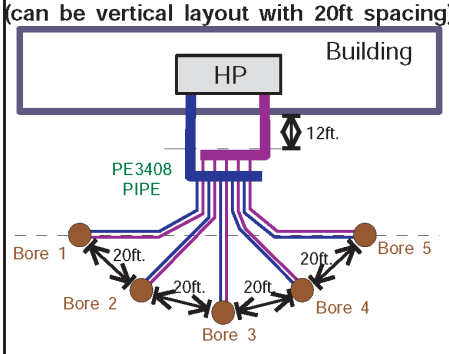
Vertical Layout Example 1



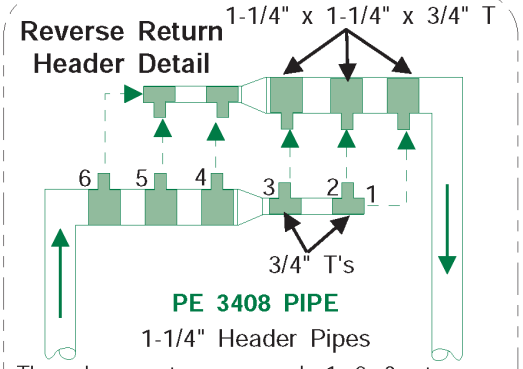
Vertical Layout Example 2



Angled Vertical Layout Example 1
(can be vertical layout with 20ft spacing)

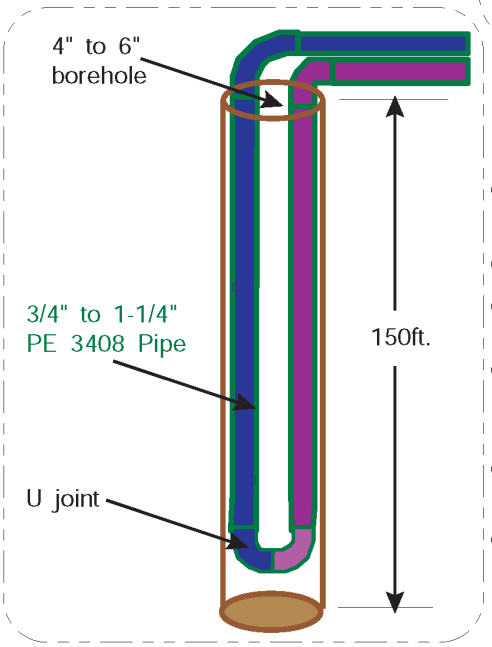


Reverse Return Header Detail



Three loop system uses only 1, 2, 3, etc. Minimum 2ft/sec to purge air. Each 3/4" loop requires 4USPGM to purge. 24USGPM to purge 6 loops, 20 for 5, 16 for 4, 12 for 3, 2 loops requires 10USGPM due to 1-1/4" header.

Borehole Detail



- Examples shown are for a 5 TON geothermal heat pump system
- Type PE 3408 Pipe
- Excavated trenches to boreholes minimum 4' wide x 6' deep
- Trenches should be backfilled with material which will maximize the thermal conductivity of the adjacent earth.
- Hand backfilling in the area just over the plastic pipe is recommended to prevent crushing or pinching of the pipe during backfilling operations.
- Allow a minimum of 20 ft. between each borehole for vertical boreholes and 10ft for vertical angled boreholes.
- Piping that is laid in a header trench should be insulated up to the individual trench to the borehole.
- Insulate all tubing within 12ft. of the structure with 1/2" thick closed cell armaflex insulation.
- Reverse return headers minimize flow imbalances betweeen loops.
- The number of boreholes can be reduced by increasing the depth of the boreholes. Care must be taken to size the circulator pump module accordingly.
- Be sure to obtain permission prior to drilling if angled boreholes enter neighbouring properties.
- Each loop consists of minimum 300ft. of 3/4" type 3408 PE 160 psig (SDR 11) geothermal heat pump polyethelene tubing.
- Each borehole is 4-6" diameter and 150ft deep for 1 loop per ton applications.
- Allow enough exra pipe to be able to reach the headers to minimize the number of fusion joints.
- "U" tubes should be taped together every 10ft. A heavy piece of rebar or galvanized pipe can be taped to the last 10ft. to help keep the end straight and also for added weight.
- Fill each "U" tube with water and pressurize to 100PSIG before insertion. The added weight of the water will help with the insertion process
- Tremie grout from the bottom to within 10ft of the top of the borehole. Use neat cement or a mixture of neat cement and bentonite. Check local codes, there may be regulations that must be adhered to.

REV	ECO #	IMPL BY	APVD BY	DATE
01	ISSUE 02	D. RHEAULT	D. RHEAULT	11 SEP 24
01	Initial Release	C. GEDDES	C. GEDDES	22 JAN 08

Drawn By Chris Geddes	Date	22 JAN 08
Checked By Chris Geddes	Date	22 JAN 08
Approved By (ENG) Chris Geddes	Date	22 JAN 08
Approved By (MFG)	Date	
Approved By	Date	

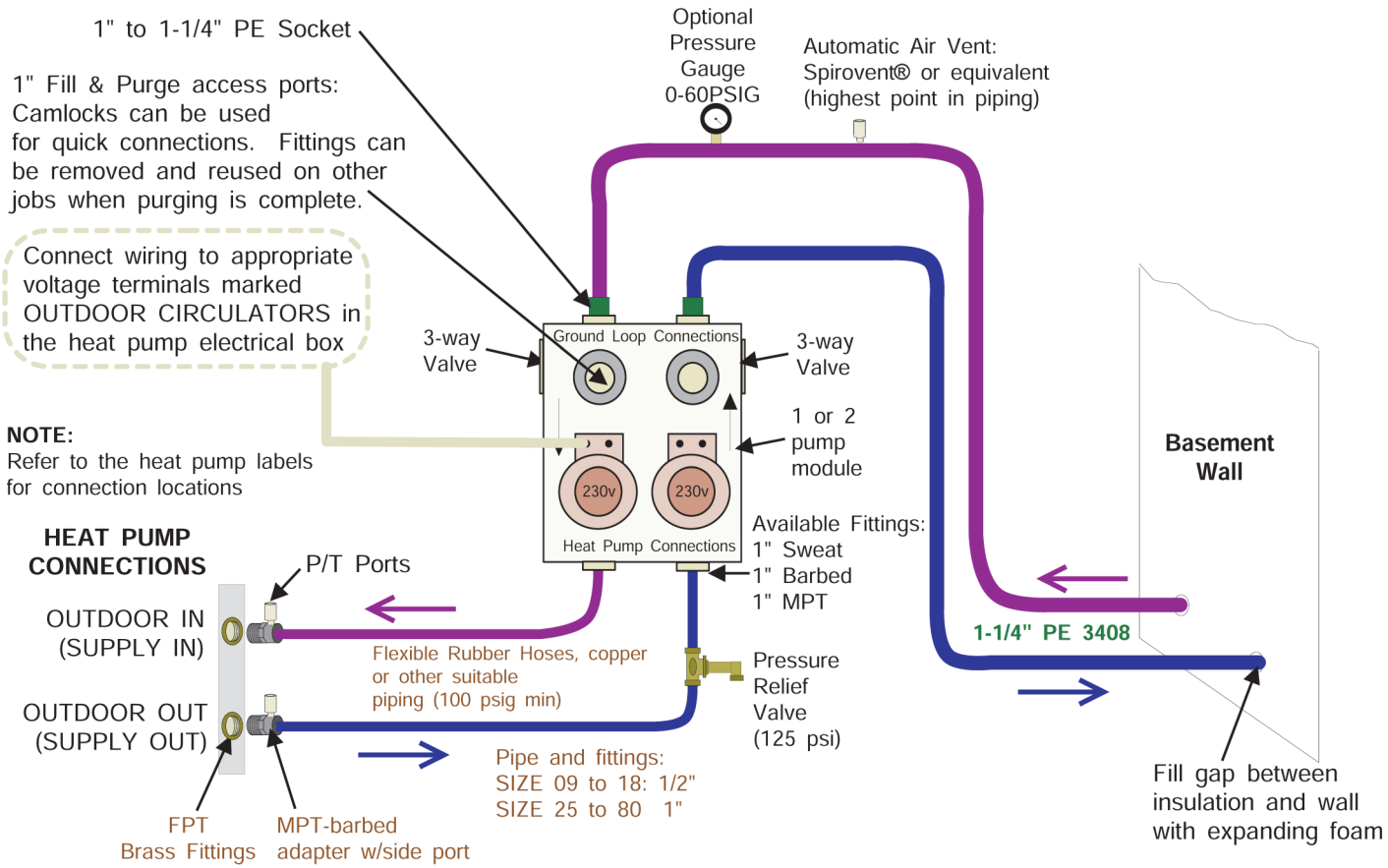
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Vertical Ground Loop Configuration

Size	Drawing Number	REV	SHEET
A	000609INF	01	1 of 1

go to TABLE OF CONTENTS

Geo-Flo Circulator Pump Module Installation
(Units with Brass FPT Fittings)

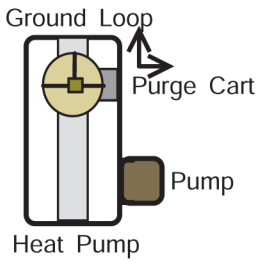


NOTES:

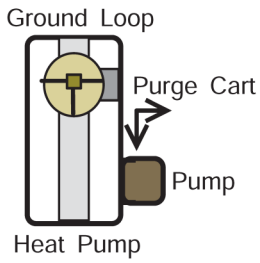
- Circulator Pump Module should be mounted vertically to minimize the possibility of air locking the circulators.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Holes through the foundation / structure should be filled with expanding foam from both sides to prevent leakage.
- Proper drainage material should be used on the outside of the wall to prevent water buildup.
- Pump module fittings are available from Maritime Geothermal Ltd.
- A pressure gauge is recommended if P/T plugs are not installed.
- For most applications, a 1 pump module will accomodate model sizes 09 to 45, and a 2 pump module will accomodate sizes 55 to 80. The total loop pressure drop including the headers, inside piping and heat exchanger drop should be calculated based on the antifreeze mixture and lowest desired entering water temperature. The pump module selected must provide the required flow at this calculated pressure drop value.

CIRCULATOR PUMP MODULE 3-WAY VALVE POSITONS (LEFT SIDE VIEW)

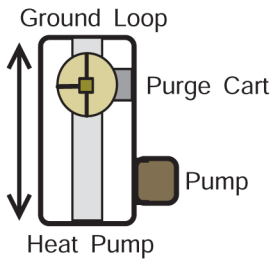
1. Valve in Loop fill/purge position.



2. Valve in HP fill/purge position



3. Valve in normal running position.



REV	ECO #	IMPL BY	APVD BY	DATE
03	000264	D. RHEAULT	D. RHEAULT	21-Aug-2018
02	000213	C. GEDDES	C. GEDDES	21-May-2013
01	Initial Release	C. GEDDES	C. GEDDES	9-Dec-2008

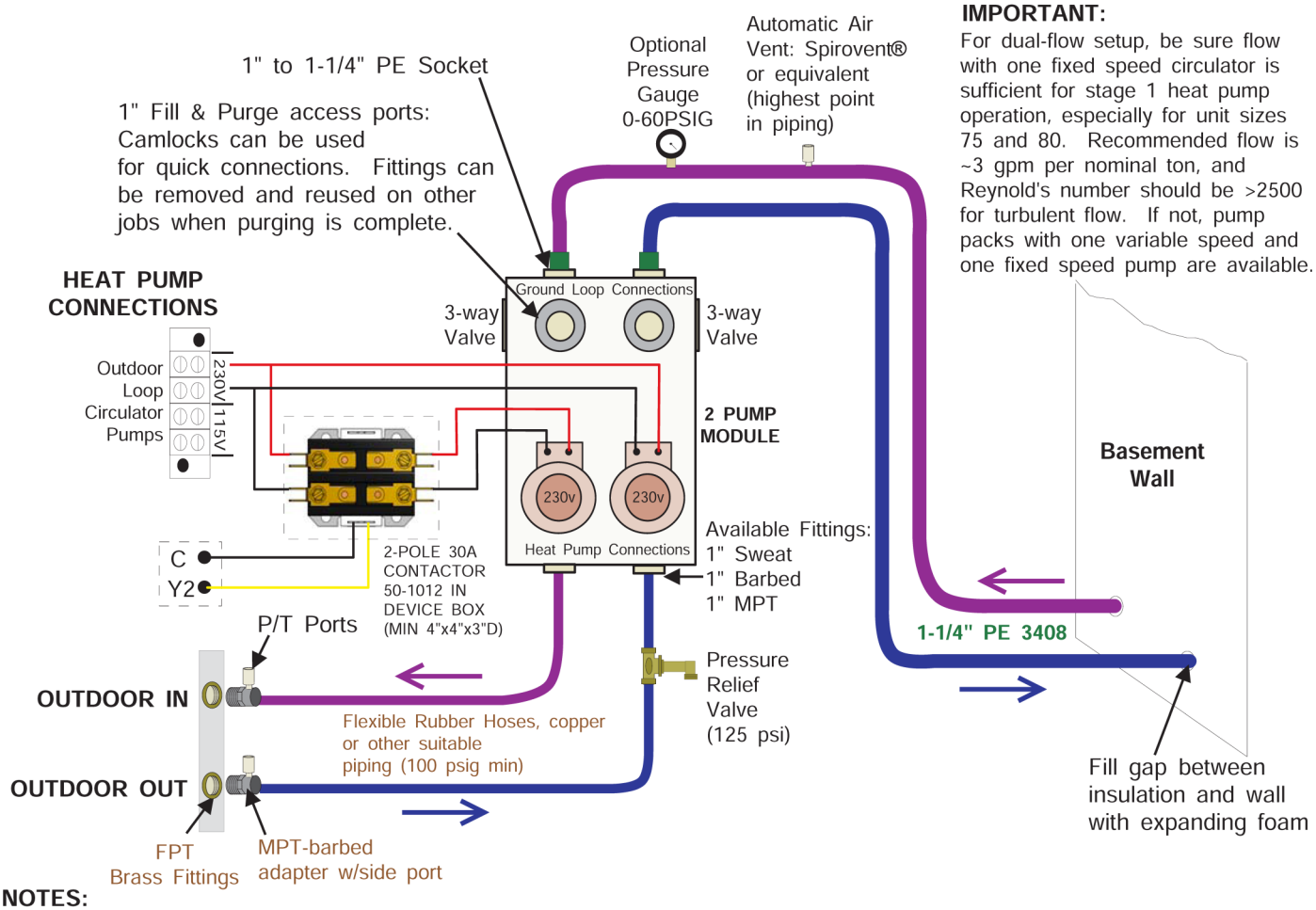
Drawn By	Chris Geddes	Date 09 DEC 08
Checked By	Chris Geddes	Date 09 DEC 08
Approved By (ENG)	Chris Geddes	Date 09 DEC 08
Approved By (MFG)		Date
Approved By		Date

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

Drawing Name	Size	Drawing Number	Drawing Rev	SHEET
Geo-Flo Circulator Pump Module Installation (Brass FPT)	A	000906PDG	03	1 of 1

go to TABLE OF CONTENTS

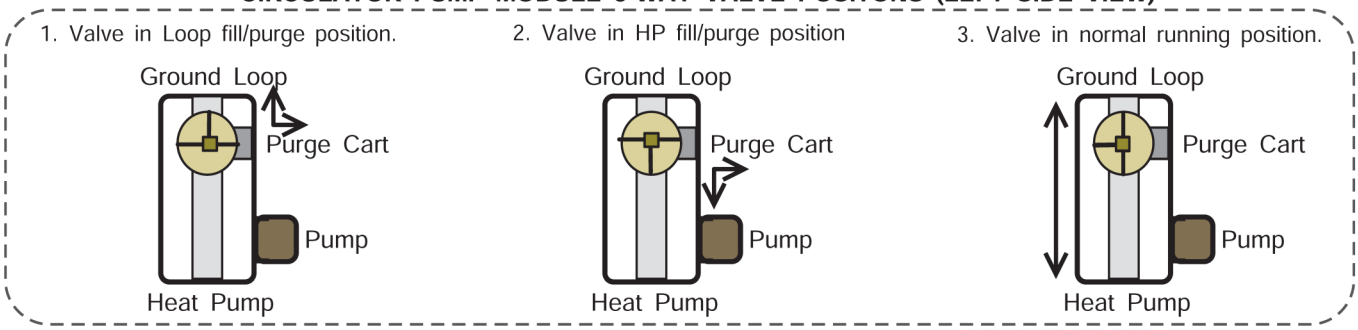
Dual Flow Circulator Pump Module Installation for 2-Stage Heat Pumps



NOTES:

- Circulator Pump Module should be mounted vertically to minimize the possibility of air locking the circulators.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Holes through the foundation / structure should be filled with expanding foam from both sides to prevent leakage.
- Proper drainage material should be used on the outside of the wall to prevent water buildup.
- Pump module fittings are available from Maritime Geothermal Ltd.
- A pressure gauge is recommended if P/T plugs are not installed.
- For most applications, a 1 pump module will accomodate model sizes 09 to 45, and a 2 pump module will accomodate sizes 55 to 80. The total loop pressure drop including the headers, inside piping and heat exchanger drop should be calculated based on the antifreeze mixture and lowest desired entering water temperature. The pump module selected must provide the required flow at this calculated pressure drop value.

CIRCULATOR PUMP MODULE 3-WAY VALVE POSITONS (LEFT SIDE VIEW)



REV	ECO #	IMPL BY	APVD BY	DATE
03	000264	D. RHEAULT	D. RHEAULT	21-Aug-2018
02	-	D. RHEAULT	D. RHEAULT	20-May-2014
01	Initial Release	D. RHEAULT	D. RHEAULT	22-Nov-2013

Drawn By Dan Rheault	Date 22-Nov-2013	
Checked By Dan Rheault	Date 22-Nov-2013	
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	

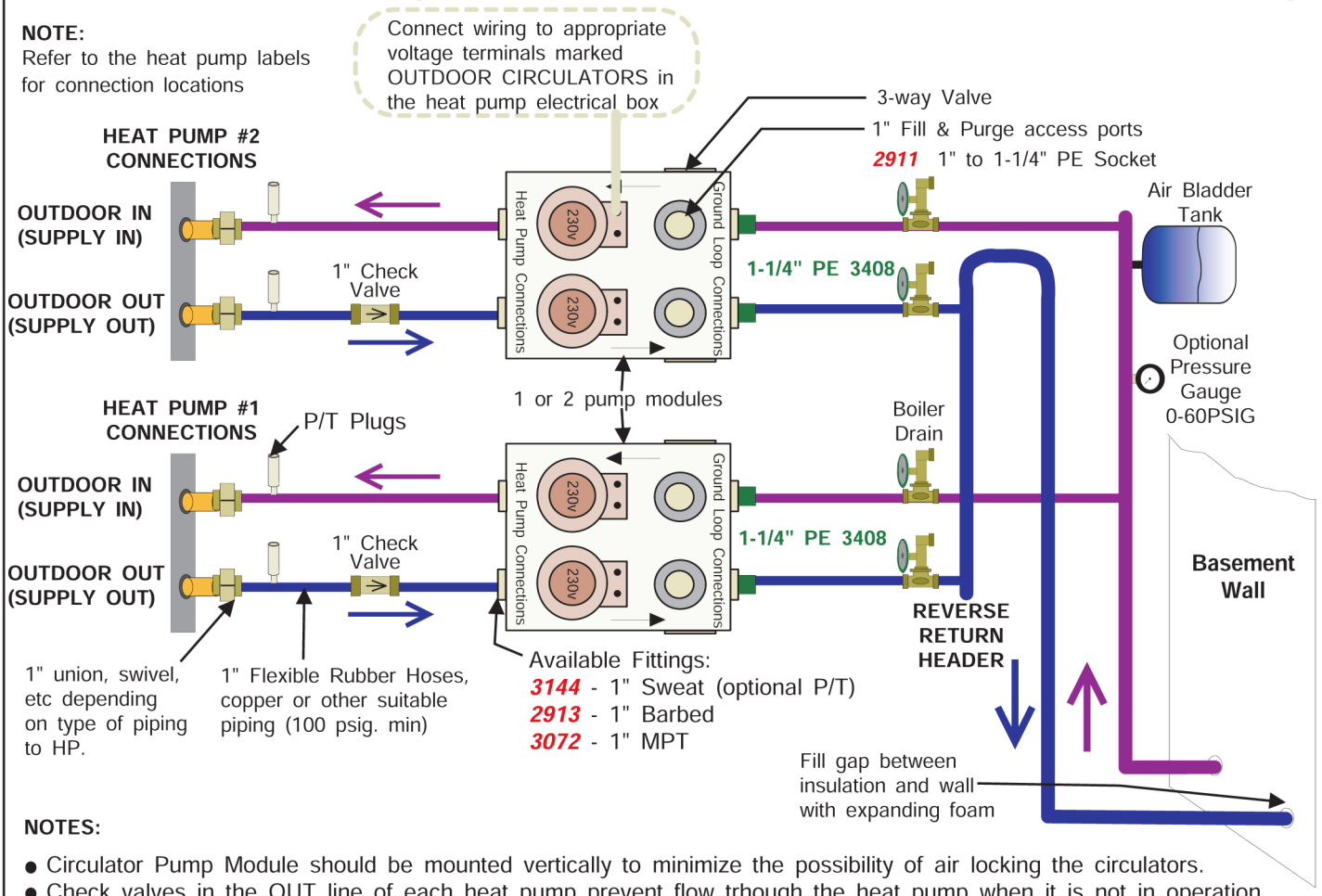
MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4

Drawing Name: Dual Flow Circulator Pump Module Installation for 2-Stage Heat Pumps

Size	Drawing Number	REV	SHEET
A	001823CDG	03	1 of 1

go to TABLE OF CONTENTS

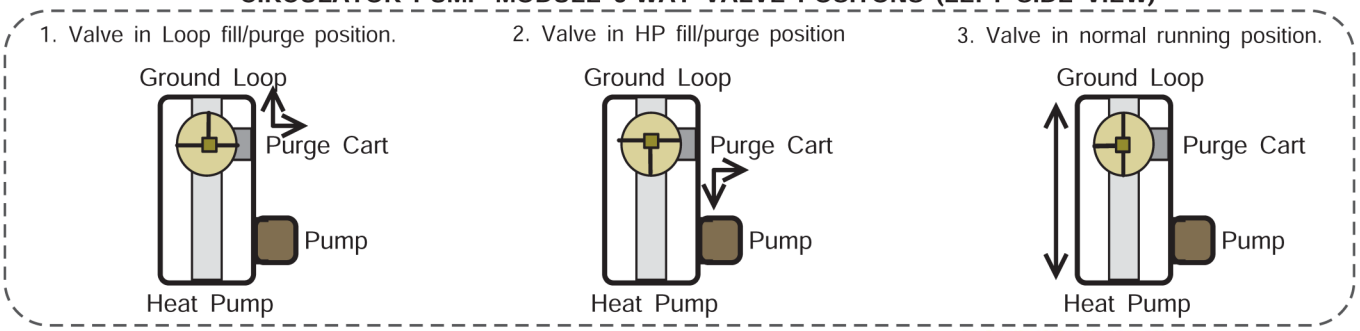
Geo-Flo Circulator Pump Module Installation - Two Units On One Ground Loop



NOTES:

- Circulator Pump Module should be mounted vertically to minimize the possibility of air locking the circulators.
- Check valves in the OUT line of each heat pump prevent flow trhough the heat pump when it is not in operation.
- Ensure that each pump module can provide the required flow to its heat pump when operating solo.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Holes through the foundation / structure should be filled with expanding foam from both sides to prevent leakage.
- Proper drainage material should be used on the outside of the wall to prevent water buildup.
- Pump module fittings are available from Maritime Geothermal Ltd., Geo-Flo Part Numbers are indicated above (italics).
- A pressure gauge is recommended if P/T plugs are not installed.
- The air bladder tank should be pressurized to the desired static pressure of the ground loop before installation.
- For most applications, a 1 pump module will accomodate NORDIC models sizes 25, 35, and 45, and a 2 pump module will accomodate sizes 55, 65 and 75. The total loop pressure drop including the headers, inside piping and heat exchanger drop should be calculated based on the antifreeze mixture and lowest desired entering water temperature. The pump module selected must provide the required flow at this calculated pressure drop value.

CIRCULATOR PUMP MODULE 3-WAY VALVE POSITONS (LEFT SIDE VIEW)



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	21 FEB 08

Drawn By Chris Geddes	Date 21 FEB 08	
Checked By Chris Geddes	Date 21 FEB 08	
Approved By (ENG) Chris Geddes	Date 21 FEB 08	
Approved By (MFG)	Date	
Approved By	Date	

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

Drawing Name: Geo Flo Circulator Pump Module Installation-Two Units on One Ground Loop

Size	Drawing Number	REV	SHEET
A	000629PDG	01	1 of 1

go to TABLE OF CONTENTS

Open Loop Installations

Well Water Temperature

The temperature of the well water should be a minimum of **41°F (5°C),** and should normally be **45°F+ (7°C+).** In general, groundwater temperatures across the Canadian prairie provinces and Northern Ontario may be close to the 41°F minimum, while in other parts of southern Canada it will probably be 46-50°F, although local exceptions will exist. In more southern locations, it will be warmer. The water temperature should be verified as the first step in a proposed open loop installation.

Well Water Flow

The water source is normally a drilled water well with submersible pump that is the same well which supplies domestic water needs. It must be able to supply the required water flow as listed under the Total Flow column in the table.

TABLE 13 - Required Flow (Open Loop)

Heat Pump Model Size	Heat Pump Flow* gpm (L/s)	Domestic Water Usage gpm (L/s)	Total Flow gpm (L/s)
25	8.0 (0.50)	4 (0.25)	12 (0.76)
45	10.0 (0.63)	4 (0.25)	14 (0.88)
55	12.0 (0.76)	4 (0.25)	16 (1.01)
65	14.0 (0.88)	4 (0.25)	18 (1.14)
75	16.0 (1.01)	4 (0.25)	20 (1.26)
80	17.0 (1.07)	4 (0.25)	21 (1.32)

* These are minimum water requirements based on an entering water temperature of 45° F.

For groundwater temperatures of 50°F or greater, these flows can be reduced by 25% if required.

Rather than being estimated by a well driller, the flow from a proposed source well should be measured by performing an extended flow test to be sure it is capable of supplying the required flow over an extended period of time. This is done by flowing the well at the highest possible rate, noting the static water level in the well, and monitoring the pumping fluid level until stable. Unless the fluid level is very high, fluid level monitoring will require a device called a water level sounder. The flow rate can then be measured either by a cumulative gallon meter, a flowmeter, or by timing the filling of a bucket of known size. The test data can be recorded as follows:

TIME	METER READING (USGAL)	TOTAL FLOW (USGAL)	FLOW RATE (USGPM)	WATER LEVEL (FT)	(IN)	WATER LEVEL (FT)
20:25	131735.5	0		20	6	20.5
20:27	131756	20.5	10.3	24	0	24.0
20:30	131779	23	6.0	26	0	26.0
20:42	131847	68	6.1	29	0	29.0
20:51	131906	59	6.6	29	0	29.0
21:03	131982	76	6.3	29	0	29.0
21:32	132156	174	6.0	29	0	29.0

It is best to flow the well for as long as possible (e.g. 12 hours) at the flow rate required by the proposed heat pump size. However, if the test is performed before a larger submersible pump is installed, it may be assumed that any unused water level drop during the test (that is, any distance remaining between the pumping fluid level and the pump intake) would contribute linearly to the flow rate should a larger pump be installed.

In the above example, it was recorded that the flow rate stabilized at 6 gpm, while the water level dropped from 20 to 29 feet (9 feet). If the intake of a larger pump could be placed so that a further pumping fluid level drop of 9 feet could be achieved (total 18 feet), it can be assumed that the flow would double to 12 gpm. Of course, it is best to verify this with a second test once the larger pump is actually installed.

Well Water Quality

The well water should be tested to be sure it meets minimum standards. Although the threat of poor water quality to open loop installations is often exaggerated, poor water quality can lead to rapid heat exchanger failure or frequent servicing.

First, the well should not produce any sand. Sand will physically erode heat exchanger surfaces, and quickly clog return (injection) wells. **Solids** or **TDS** should be less than **1 ppm (1 mg/L)** if a return well is used.

To avoid scale formation on the inside of the heat pump's outdoor loop coil, total **hardness** should be less than **350 ppm / 350 mg/L**. In practice, scaling is very rarely a problem at northern groundwater temperatures of 50°F or less because scale does not generally form at low well water temperatures (unlike, for example, in a domestic hot water tank). In more southern climates, the hardness guideline will be a more important consideration. Should scale form, heat pump performance will gradually deteriorate, and will require periodic flushing with a calcium/lime removing solution (see General Maintenance section). If the need for periodic flushing is anticipated, the optional Cupro-Nickel (CuNi) coil and piping should be ordered.

Corrosive (salty) water can cause failure of the inner tube of the heat exchanger, leading to loss of refrigerant and water entering the refrigeration circuit, which ruins the heat pump. If **chlorides** exceed **20 ppm (20 mg/L)**, the optional CuNi coil and piping should be ordered. If chlorides exceed **150 ppm (150 mg/L)**, or significant **Ammonia (>0.5 ppm)** or **H_2S (>0.2 ppm)** is present, the use of an open loop system should be reconsidered.

Water Discharge Methods

Water disposal methods vary from area to area. However, some consideration should be made to prevent the cooled discharge water from immediately coming in contact with the supply source. Attempting to return the water to the source well will eventually cool the water so much that the heat pump will shut off on its low pressure safety control.

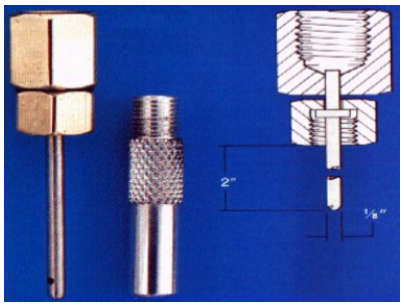
Acceptable methods for disposing of the waste water are listed below. The waste water is clean; the heat pump has no effect other than reducing the temperature of the water. Refer to drawing **000907INF** for typical disposal method diagrams.

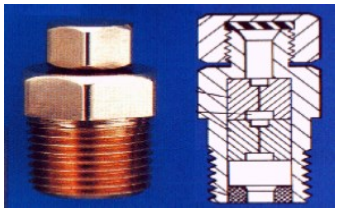
- Second well (return well)
- Percolation (Drain, ditch, leaching field)
- Pond, river or stream

ENSURE SELECTED METHOD CONFORMS TO LOCAL REGULATIONS.

go to TABLE OF CONTENTS

Figure 3: Open Loop Accessories & Tools





A return well should be a minimum of **80 ft.** from the supply well for residential applications. The water returned to the well will not necessarily be pumped into the same aquifer, depending on underground conditions. The return well must be able to supply at least the same quantity of water as the amount you wish to inject into it, preferably much more, since injection capacity will tend to decrease over time due to clogging. It may be necessary to place a pressure-tight cap on the well to keep the return water from flowing out the top of the well. This cap is commonly required since a certain amount of pressure may be needed to force the return water back down the well in cases of limited injectivity.

Water discharged by percolation will generally soak into the ground within a distance of 50 to 100 ft. If suitable care is taken to ensure that the drain pipe runs downhill and the end of the pipe is protected by a bale of hay or spruce bows, the end of the pipe will not freeze as the pipe will empty out when the heat pump shuts off and the water valve closes. A screen should be installed on the end of large discharge pipes, to prevent animals from building nests inside during extended 'off' periods and causing a backflooding risk for open water drains.

When snow comes it will usually cover the entire process much like a small spring. It is recommended that the pipe be below the frost line when possible for maximum freeze protection.

When discharging into a river or stream, or above the surface of a pond, the same guidelines should be followed as described in the paragraph above for the percolation method.

When discharging the waste water below the surface of a pond or lake, the discharge pipe should be placed below the frost line to prevent the pipe from freezing. As opposed to the percolation method, water will remain in the end of the pipe. It is recommended that the surface of the pond be lower than the installation location of the heat pump. This reduces the back pressure generated by the weight of the water in the pond.

Water Valve

Water flow through the heat pump is turned on and off by a water valve, which is controlled by a 24VAC signal from the heat pump. It should be installed on the OUT pipe of the heat pump, so that the heat exchanger remains full of water at all times. There are 3 types of water valves available from Maritime Geothermal.

- **Hailin** or equivalent slow acting **motorized ball valve**, which is powered open and powered closed.
- **Taco** slow acting **motorized ball valve**, which is powered on and stores the energy required to close using a capacitor.
- **Rainbird** or equivalent fast acting **solenoid valve**.

Most installations use a slow closing motorized ball valve. These take 5-15 seconds to close, so avoid the water hammer which can occur with fast acting valves. A fast acting solenoid valve can be used for applications where water hammer is not expected.

All valves come from Maritime Geothermal Ltd. with a wiring harness, which plugs into a connector behind the pipe post of the heat pump. (If buying a water valve elsewhere, be sure to get the wiring harness from Maritime Geothermal.) This both allows the heat pump to properly control the valve, turning the water flow on and off with the compressor, and also tells the heat pump to select the higher low pressure safety setting for open loop operation (since there is no antifreeze present).

A modulating water valve may be required for reversing WH-series heat pumps; see **Piping** chapter. In this case, it will

go to TABLE OF CONTENTS

act as the water valve and an additional valve is not required. The closed loop jumper plug can be left in place for WH-series.

Water Flow Control

A flow restricting ('Dole') valve is highly recommended, installed downstream of the water valve. This is a passive (non-electrical) device which automatically varies the size of its rubber orifice in order to restrict flow to its stamped gpm value, regardless of water pressure. This is important in order to provide some backpressure to the water system, which could otherwise be too low for the comfort of people taking showers or otherwise using the domestic water system. It also prevents excessively low refrigerant discharge pressure when in cooling mode. Dole valves are available as an accessory.

Dole valves can emit a 'whistling' sound if the pressure drop through them is high. Therefore, they should be placed where the noise will not cause a nuisance, e.g. outside the basement wall or perhaps in a well insulated box.

Submersible Pump Selection

Of course, the submersible pump must be large enough to supply the flow required by the heat pump. This is usually not a problem, pumps often being oversized by default.

However, if a conventional fixed speed pump is too large, its fixed capacity will exceed that of the Dole valve at reasonable pressure switch settings (<80 psi). This will cause the submersible pump to cycle on and off continuously while the heat pump is running, causing excessive wear to the submersible pump. The installation of a large air bladder tank will cause the cycles to have a longer duration, but will not solve the problem.

To avoid this problem, the fixed speed pump should be sized according to its head vs. flow curve. The required head should be calculated using height between the pumping fluid level in the well and the elevation of the heat pump, pipe pressure drop at nominal flow rate, desired system water pressure, and any back pressure from return well. Then a pump can be selected that delivers the nominal flow for the chosen heat pump size at that head. In case this calculation is not exact, a variety of Dole valves can be carried by the installer, and a larger Dole valve installed if submersible pump cycling is observed.

An alternate approach would be to install a variable speed submersible pump, which varies its speed to maintain a constant water system pressure. Or use a mechanical 'cycle stop' valve, which is installed upstream of the air bladder / pressure tank and varies its orifice to put backpressure on the pump during periods of low flow in order to keep it from cycling off.

Submersible Pump Power Draw

In an open loop installation, the submersible water pump draws significant power compared to the heat pump, especially for smaller heat pump sizes. This is particularly true when using a conventional fixed speed submersible pump. Under traditional usage, the efficiency of such a pump is not particularly important, due to its short run times in a domestic water system. But when used with a geothermal heat pump, which can run all day on the coldest days of the year, it is highly recommended that effort be made to select an energy efficient submersible pump. However, these may be hard to find.

For W-series heat pumps with a 2-stage/2-capacity compressor, the significant power draw of a fixed speed submersible pump will probably negate the COP benefit of running the heat pump on stage 1. In this case, it is recommended to jumper Y1 and Y2 together at the heat pump terminal strip, in order to satisfy the heating demand as quickly as possible and minimize run time. For the same reason, slightly oversizing the heat pump is acceptable on open loop applications, although this will require higher water flow.

Plumbing the Heat Pump

The port connections for the Outdoor Loop are 1" or 1-1/4" brass FPT fittings. They are marked OUTDOOR IN and OUT.

Plumbing lines, both IN (supply) and OUT (discharge), must be of adequate size to handle the water flow necessary for the heat pump. A 1" or 1-1/4" copper or plastic line should be run to the Outdoor IN (Supply IN) pipe of the heat pump. Similarly, a 1"' or 1-1/4" line should be run from the Outdoor OUT (Supply Out) pipe to the method of disposal. P/T plugs should be installed at each port. See diagram in the Ground Loop chapter for a description of P/T plugs. The water valve should be installed in the OUT (discharge) line. Refer to drawing **000907CDG** at the end of this section for the recommended setup. Placing the water valve in the discharge line ensures that the heat exchanger inside the heat pump remains full of water when the unit is not running. Unions or some other form of disconnect should be used so that the coaxial heat exchanger may be accessed should it required cleaning.

The heat pump has an electrical connector for the water valve just inside the case. After the water valve is installed, run the valve harness into the case through the hole provided. Remove the jumper plug from the Valve Connector and connect the harness in its place.

Optionally, a water flow meter can be installed in the discharge line so that the exact amount of water flowing can be determined at a glance. It should be placed between the Outdoor OUT (Supply OUT) pipe of the heat pump and the water valve.

With proper flow, there should be **5-7°F (3-4°C)** delta T between the IN and OUT water temperatures of the heat pump when operating in the heating mode.

All water line valves on both the supply and discharge lines should be either BALL or GATE valves. GLOBE valves have a higher pressure drop, meaning more pumping power to maintain the required flow to the heat pump.

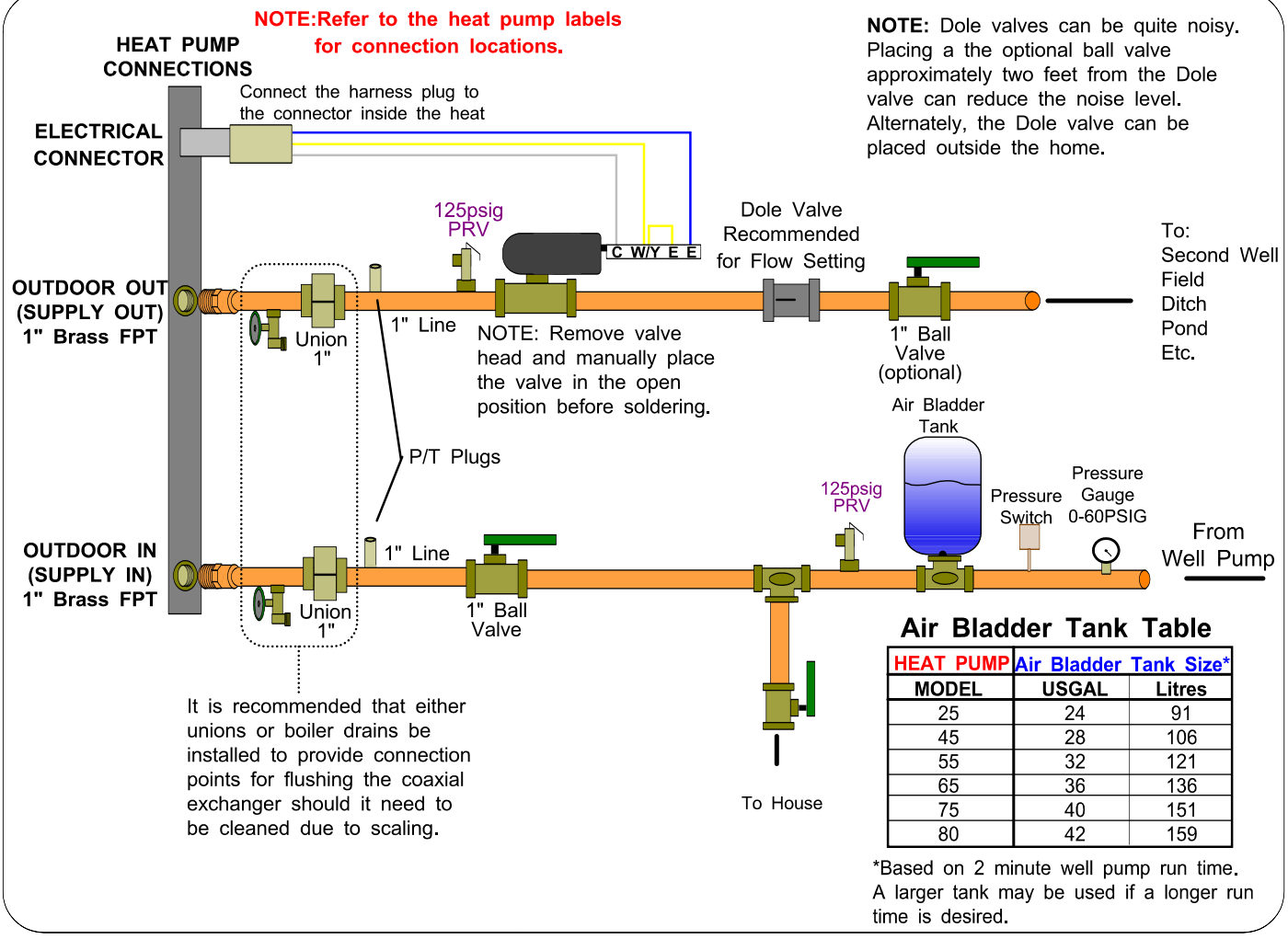
Pipe Insulation

All ground water piping to and from the Outdoor Loop ports on the heat pump should be insulated with 3/8" closed cell pipe insulation, to prevent condensation and dripping onto floors or walls.

go to TABLE OF CONTENTS

Typical Ground Water Installation for Size 25-80 Heat Pumps for Units With Brass FPT Fittings

TACO 24VAC EBV (Electronic Ball Valve)

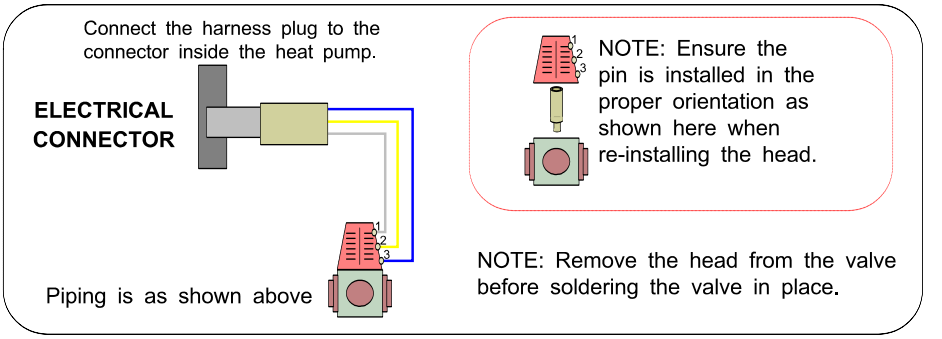


Air Bladder Tank Table

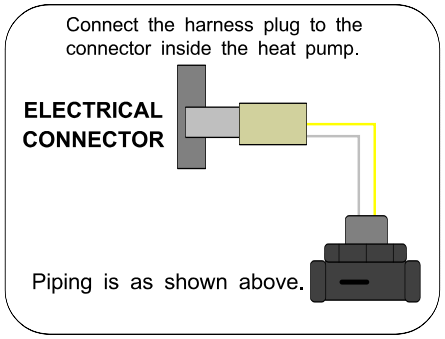
HEAT PUMP MODEL	Air Bladder Tank Size* USGAL	Litres
25	24	91
45	28	106
55	32	121
65	36	136
75	40	151
80	42	159

*Based on 2 minute well pump run time. A larger tank may be used if a longer run time is desired.

TACO 24VAC Slow Close Water Valve



Generic 24VAC Solenoid Water Valve



REV	ECO #	IMPL BY	APVD BY	DATE
02	000228	C. GEDDES	C. GEDDES	21 MAY 2014
01	Initial Release	C. GEDDES	C. GEDDES	10 DEC 08

Drawn By: Chris Geddes	Date: 10 DEC 08	
Checked By: Chris Geddes	Date: 10 DEC 08	
Approved By (ENG): Chris Geddes	Date: 10 DEC 08	
Approved By (MFG)	Date	
Approved By	Date	

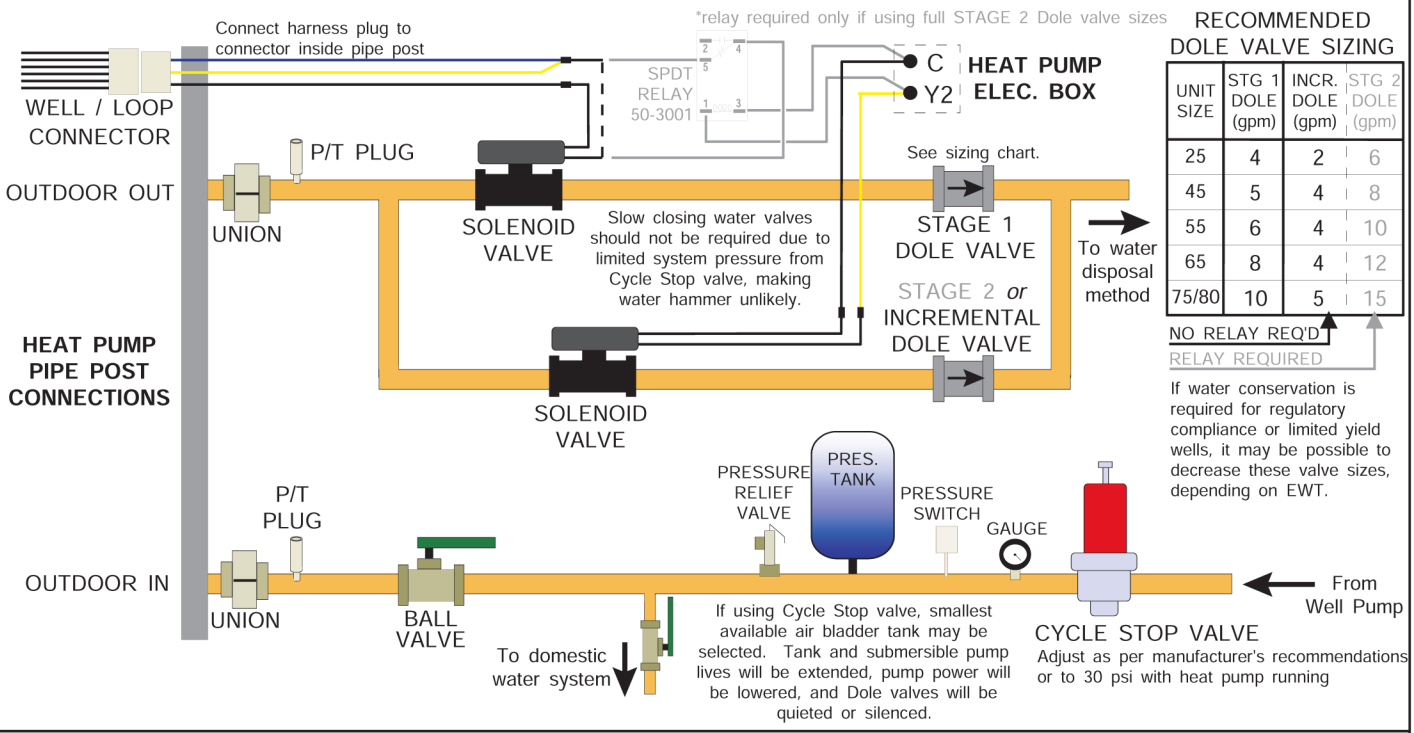
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Ground Water Installation for Size 25-80 Heat Pumps (Brass FPT)

Size	Drawing Number	Drawing Rev	SHEET
A	000907CDG	02	1 of 1

go to TABLE OF CONTENTS

1. Dual-Flow Groundwater (Well) Installation



RECOMMENDED DOLE VALVE SIZING

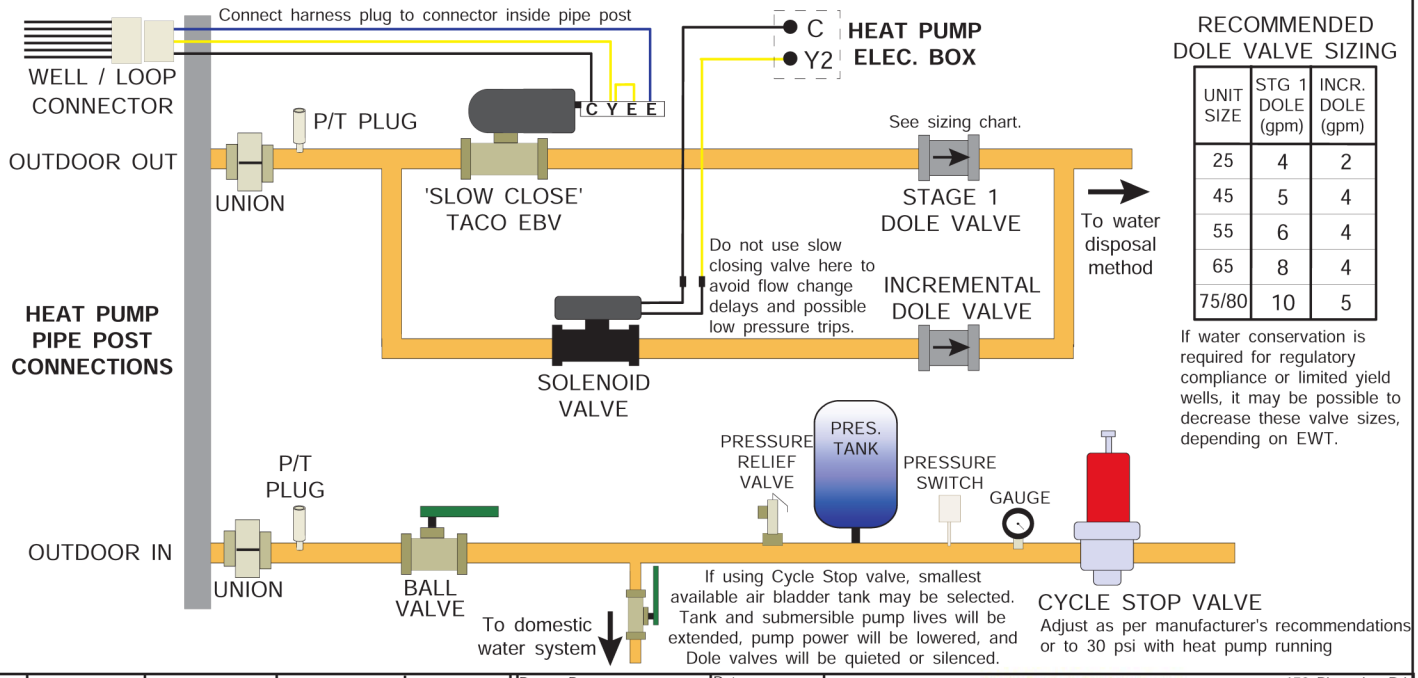
UNIT SIZE	STG 1 DOLE (gpm)	INCR. DOLE (gpm)	STG 2 DOLE (gpm)
25	4	2	6
45	5	4	8
55	6	4	10
65	8	4	12
75/80	10	5	15

NO RELAY REQ'D
RELAY REQUIRED

If water conservation is required for regulatory compliance or limited yield wells, it may be possible to decrease these valve sizes, depending on EWT.

2. Dual-Flow Groundwater (Well) Installation with Slow Closing Water Valve

For Installations Subject to Water Hammer Even at Low System Pressures, or Without Cycle Stop Valve



RECOMMENDED DOLE VALVE SIZING

UNIT SIZE	STG 1 DOLE (gpm)	INCR. DOLE (gpm)
25	4	2
45	5	4
55	6	4
65	8	4
75/80	10	5

If water conservation is required for regulatory compliance or limited yield wells, it may be possible to decrease these valve sizes, depending on EWT.

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	22-Nov-2013

Drawn By	Dan Rheault	Date	22-Nov-2013
Checked By	Dan Rheault	Date	22-Nov-2013
Approved By	(ENG)	Date	
Approved By	(MFG)	Date	
Approved By		Date	

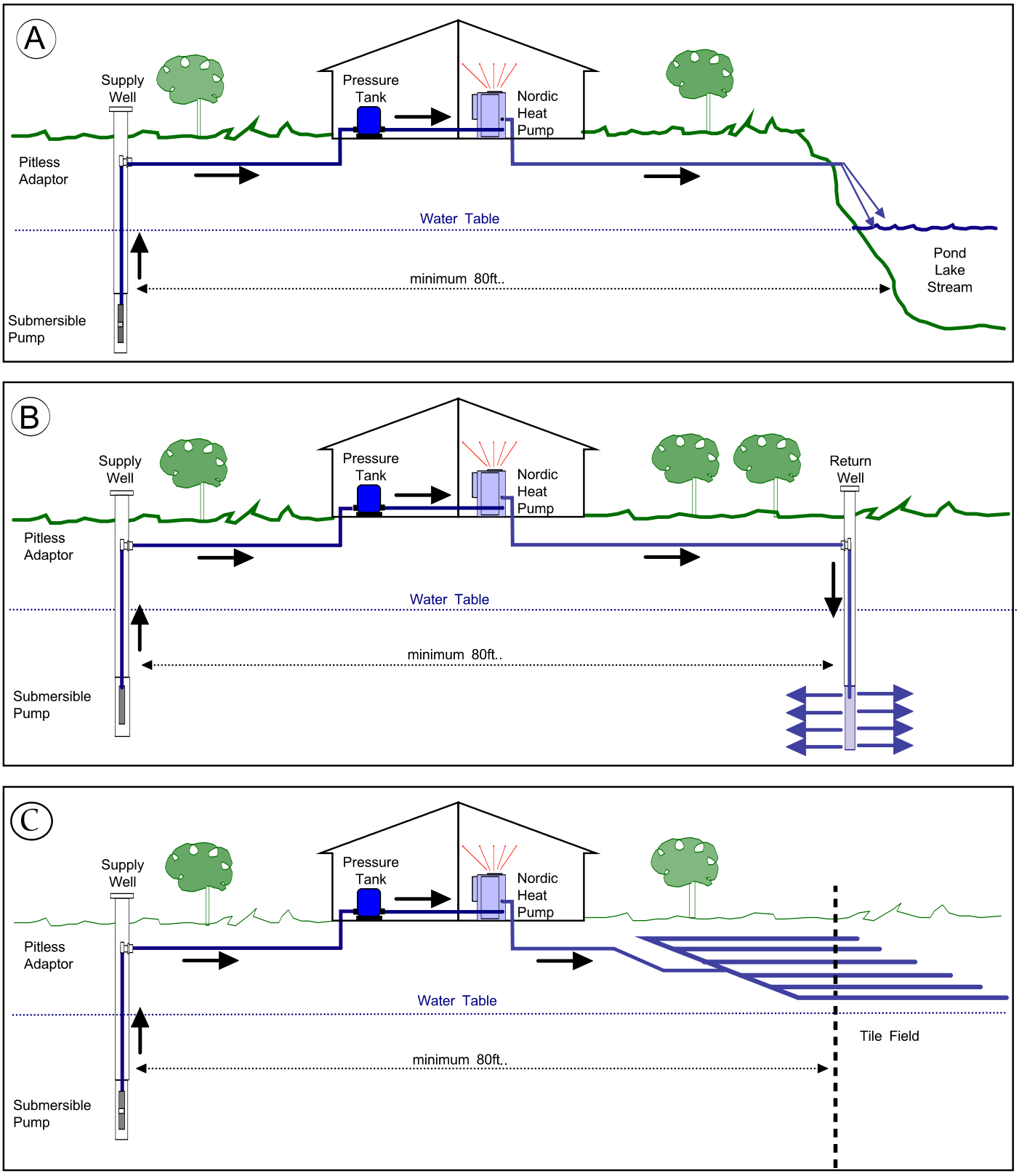
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Dual-Flow Groundwater (Well) Installation for Size 25-75 Heat Pumps

Size	Drawing Number	REV	SHEET
A	001822CDG	01	1 of 1

go to TABLE OF CONTENTS

GROUND WATER DISPOSAL METHODS



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	04 FEB 08

Drawn By: Chris Geddes	Date: 04 FEB 08	
Checked By: Chris Geddes	Date: 04 JAN 08	
Approved By (ENG): Chris Geddes	Date: 04 FEB 08	
Approved By (MFG):	Date:	
Approved By:	Date:	

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

Drawing Name: Ground Water Disposal Methods

Size	Drawing Number	REV	SHEET
A	000619INF	01	1 of 1

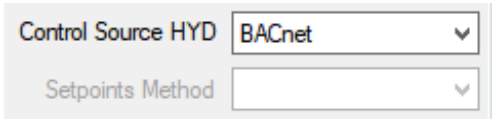
go to TABLE OF CONTENTS

Operation

1. BACnet Control

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

PC APP: Tools-->Configuration



LCD Interface: Configuration

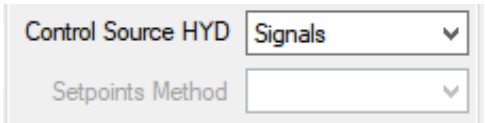
2. Signals / Hardwired Control

Similar to BACnet control, with **Signals Control** the heat pump will turn the compressor stage on and off and activate cooling mode when it is told to by 24VAC signals. These are provided via external dry contacts, most often from a 2-stage aquastat (available as an accessory) or a lead/lag controller for multiple heat pumps. See **Wiring** section. The heat pump's internal control logic will not be used, except to limit loop temperatures and activate alarm outputs.

Most installations will instead use **Setpoint Control**; however, **Signals Control** provides control flexibility for certain situations, for example if two water loops with different setpoints are being heated, or if a lead/lag controller will be used to give equal run time to multiple units. Temperature settings similar to those outlined in the following **Setpoint Control** section should be used.

When using Signals Control, the backup tank element thermostat can be set to maximum, allowing the electric elements to be controlled by an external contactor placed in the power supply connections (see diagrams in **Wiring** section). The contactor can be connected to stage 2 of the heating aquastat via an optional 0-2 hour timer. Alternatively, tanks with their own programmable controller can be set to run independently with a lower temperature setpoint than the aquastat(s).

PC APP: Tools-->Configuration



LCD Interface: Configuration

3. Setpoint Control

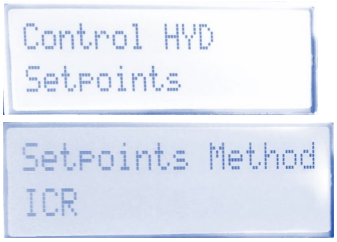
One of the features of the heat pump's GEN2 Control Board is built in temperature control functionality called "**Setpoint Control**". It is recommended that this method be used to control the system's hydronic heating and cooling demand since it eliminates the need for an external aquastat or temperature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

There are four options for Setpoint Control:

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

PC APP: Tools-->Configuration

LCD Interface: Configuration



ICR (Internal Circulator Relay) is the default method. It uses the **INDOOR OUT** temperature sensor inside the unit for temperature control (**INDOOOR IN** temperature for **WP** series). Its value is displayed in the **Tank Temperature** box on the PC App's **View-->Setpoint Control** window, shown below. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

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

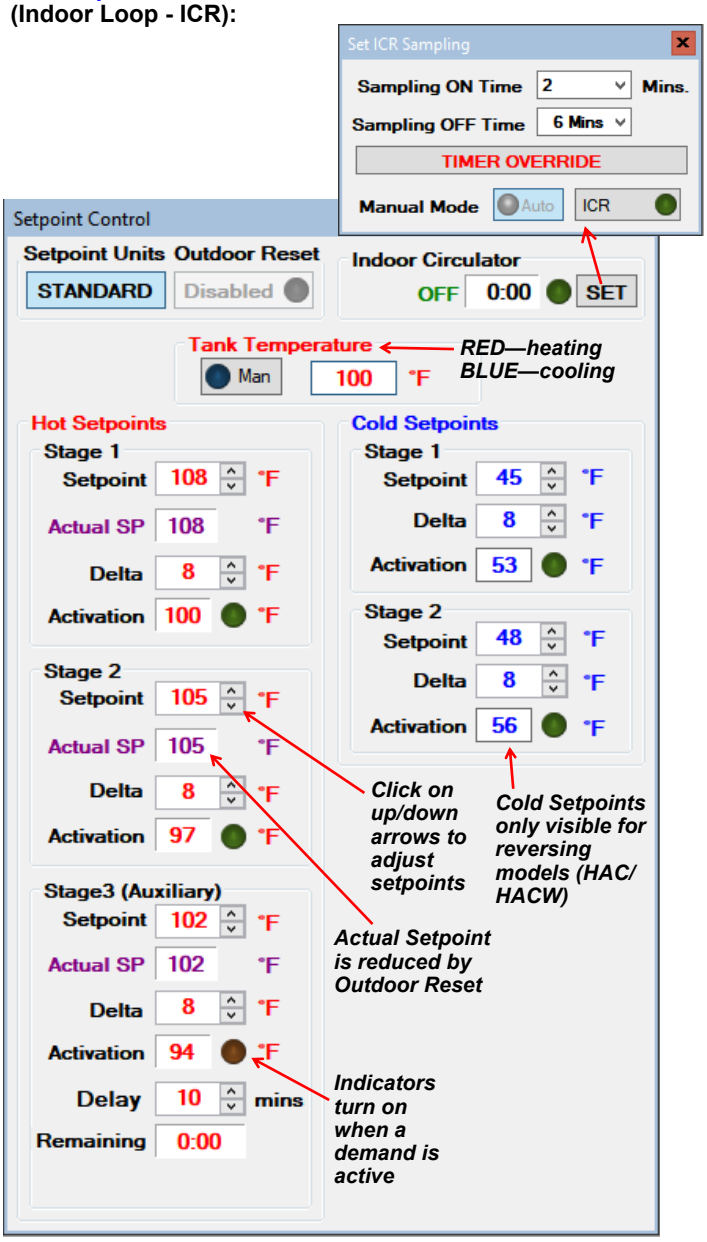
For reversing models only (HAC/HACW), cooling mode is selected by making a dry contact connection between **R** and **O** on the terminal strip. This is the one external control requirement. To prevent the tank from being repeatedly cycled between hot and cold, which would be undesirable, the **O** signal must be continuous through the cooling season.

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

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

go to TABLE OF CONTENTS

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



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

TABLE 14 - W-series Typical Temp. Setpoints

HEATING	Stage 1		Stage 2		Stage 3 (Aux)	
	°F	°C	°F	°C	°F	°C
Setpoint	**108**	***42***	**105**	***41***	**102**	***39***
Delta	**8**	***4***	**8**	***4***	**8**	***4***
Activation *	100	*38*	97	*37*	94	*35*
Delay					**10 minutes**	

COOLING	Stage 1		Stage 2		
	°F	°C	°F	°C	
Setpoint	**45**	***7***	**48**	***9***	*Activation is determined by the Setpoint and Delta values
Delta	**8**	***4***	**8**	***4***	
Activation *	53	*11*	56	*13*	

TABLE 15 - WP-series Typical Temp. Setpoints

	HEATING	Stage 1		Stage 2 (Aux)	
		°F	°C	°F	°C
POOL	**Setpoint**	**80**	***27***	**78**	***25***
	Delta	**2**	***1***	**2**	***1***
	Activation *	78	*26*	76	*24*
	Delay			**10 minutes**	
HOT TUB	**Setpoint**	**104**	***40***	**101**	***38***
	Delta	**2**	***1***	**2**	***1***
	Activation *	102	*39*	99	*37*
	Delay			**10 minutes**	

*Activation is determined by Setpoint and Delta values

TABLE 16 - WH-series Typical Temp. Setpoints

HEATING	Stage 1		Stage 2 (Aux)	
	°F	°C	°F	°C
Setpoint	**150**	***65***	**150**	***65***
Delta	**10**	***5***	**20**	***10***
Activation *	140	*60*	130	*55*
Delay			**10 minutes**	

COOLING	Stage 1		
	°F	°C	
Setpoint	**45**	***7***	*Activation is determined by the Setpoint and Delta values
Delta	**8**	***4***	
Activation *	53	*11*	

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

Heating setpoints will vary widely with the W and WH-series, depending on the application. Lower values may be able to be used, for example if using well-designed in-concrete-floor heating, the heating setpoints may be as low as the 90°F range. Lower heating setpoints will translate directly into a higher COP (efficiency). Heating setpoints should be set to the lowest values that still maintain an acceptable temperature in the building on the coldest day of the year; this may take some trial and error. Increasing Delta values will also increase efficiency due to longer runtimes, and lead to less wear on compressor due to a reduced number of compressor starts.

The maximum water temperature setpoint for **W-series** is **120°F / 49°C**, for **WP-series** is **105°F / 41°C**, and for **WH-series** is **160°F / 71°C**. The minimum setpoint for cooling is **45°F (7°C)**, lower if indoor loop fluid is set to an antifreeze mixture.

Summer Setback

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

Summer Setback disables stage 3 (AUX), drops setpoints to 70°F (21°C), and decreases temperature sampling frequency to 2 days. This minimizes electric power usage while keeping cast iron head circulation pumps operational.

For homeowner convenience, **Summer Setback** mode may also be enabled by an external switch from control board R to PM2 as shown on the wiring diagram in the **Model Specific Information** section.

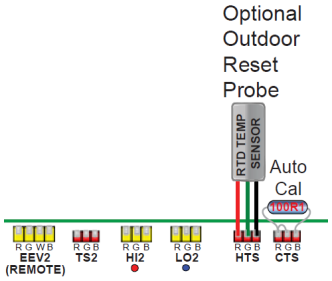
go to TABLE OF CONTENTS

Outdoor Reset

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

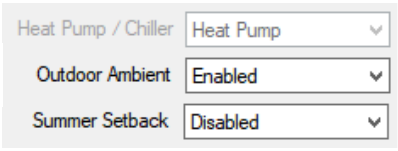
When **Control Source HYD** is set to **Setpoints**, an optional Outdoor Reset control algorithm is available for heating mode, which reduces the heating temperature setpoints at warmer outdoor temperatures as measured by an accessory outdoor temperature sensor.

To enable outdoor reset, first connect the outdoor temperature sensor accessory as shown on the wiring diagram (SCH) in the **Model Specific Information** section:

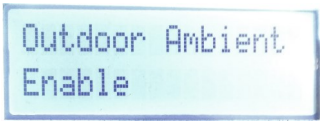


Then enable the outdoor sensor in the **Tools --> Configuration** window or LCD interface:

PC APP: Tools-->Configuration



LCD Interface: Configuration



Next, click on the **Outdoor Reset** button at the top of the **Setpoint Control** window. The button will change to say Enabled, the indicator will come on and the Outdoor Reset Table will appear. The table is created by subtracting the value of the Outdoor Reset Factor from the original setpoints once for each table row . The user-selected Hot Setpoints are located in the top row(<5°F), and the next row down equals the row above minus the Outdoor Reset Factor. The table row in use based on current outdoor temperature is shown in red.

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

Click to enable Outdoor Reset, or use LCD:

Change units of Setpoint Control only

Outdoor Reset Factor adjusts the temperature difference between table rows

Actual Setpoint is reduced by outdoor temperature de-rating and Outdoor Reset

Row in use will be RED

go to TABLE OF CONTENTS

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

It is possible to use all of the **Setpoint Control Method 1** settings, and operate two buffer tanks: one for heated water and one for chilled water. The heat pump will switch over to cooling tank in response to a dry contact between the **R** and **O** terminals on the terminal strip. The **O** signal (along with **C/GND**) will also energize a 3-way valve to divert flow to the cold tank (see **Piping** section).

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

go to TABLE OF CONTENTS

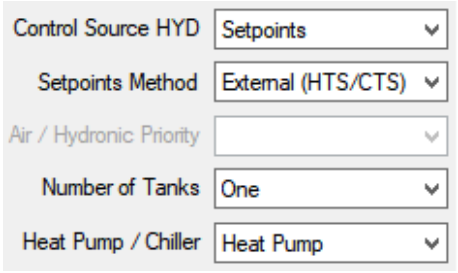
Setpoint Control Method 3 - External (HTS/CTS) One Tank

a) HTS/CTS w/ One Tank - Heat Pump Mode

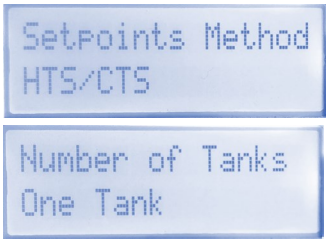
Most of the time, water heating/cooling heat pumps turn on and off in response to the temperature of the indoor loop (indoor buffer tank). All previous described control methods (1, 2) work this way, as does this one. This is ***Heat Pump Mode***, and is the only control option for reversing models (HAC/HACW).

[For non-reversing models (H/HW), it is also possible to control demand based on the temperature of the outdoor or cold loop. This is ***Chiller Mode***, described on next page.]

PC APP: Tools-->Configuration

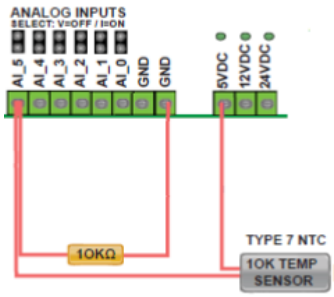


LCD Interface: Configuration



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

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

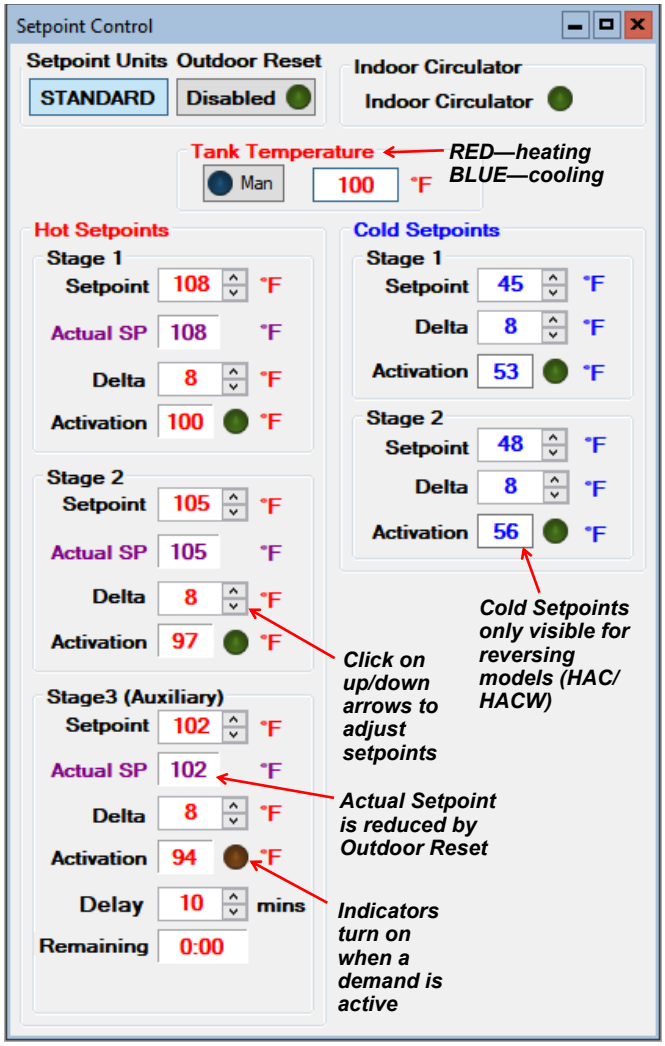


For reversing models only (HAC/HACW), cooling mode is selected by making a dry contact connection between the **R** and **O** terminals on the terminal strip in the electrical box. This is the one external control requirement.

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

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

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



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

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

- **Typical Temperature Settings**
- **Summer Setback**
- **Outdoor Reset function**

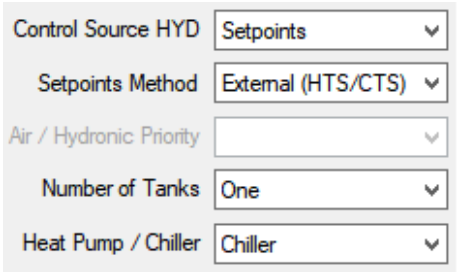
go to TABLE OF CONTENTS

b) HTS/CTS w/ One Tank - Chiller Mode

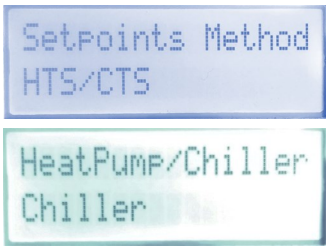
For ***non-reversing models only*** (H/HW), **Chiller Mode** allows the heat pump to be controlled from the Outdoor Loop (cold side) rather than the Indoor Loop (hot side) for applications that require controlled cooling with hot water heat rejection. The heat pump is still operating in "heating mode"; it is simply being started and stopped based on the cold side temperature.

Just as with Heat Pump Mode, a buffer tank should normally be used. With **Chiller Mode**, it will be on the cold side loop.

PC APP: Tools-->Configuration

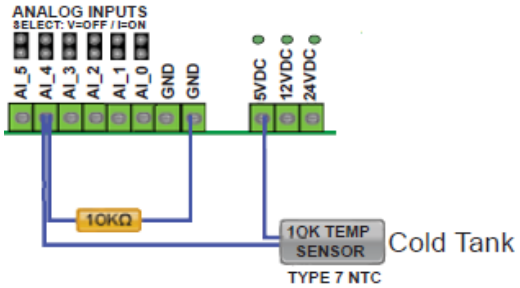


LCD Interface: Configuration



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

A 10K Type 7 (or Type 3) NTC thermistor along with a 10K 1% (or better) resistor must be used. These are available as accessories. Connect the sensor to the AI_4 input as shown below and on the wiring diagram (SCH) in the **Model Specific Information** section. This sensor will be used for both heating and cooling. ***Remove the AI_4 jumper on the control board.***



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

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

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

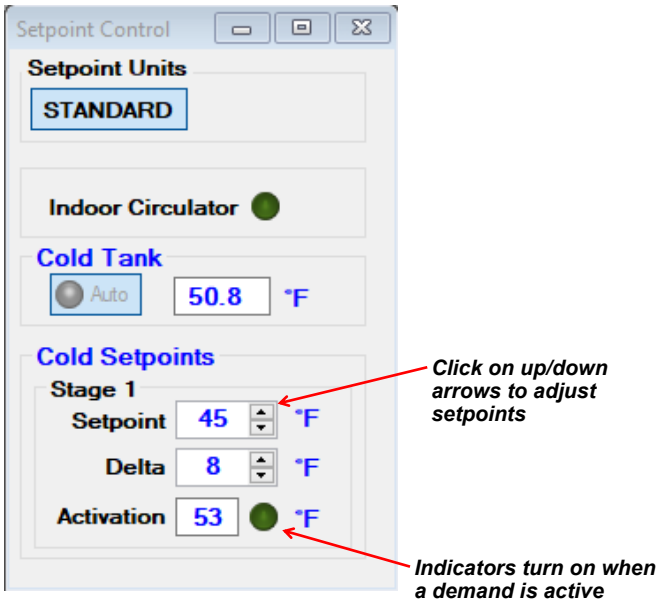
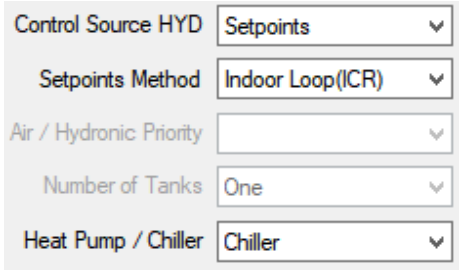


TABLE 17 - Typical Setpoints
HTS/CTS Method-Chiller Mode

	Stage 1		Stage 2		
	°F	°C	°F	°C	
Setpoint	**45**	**7**	**48**	**9**	*Activation is determined by the Setpoint and Delta values
Delta	**8**	**4**	**8**	**4**	
Activation *	53	11	56	13	

WARNING: When in 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.

Above is outlined the recommended method to use Chiller Mode. However, it is also possible to use the ICR setpoint control method (circulator sampling) for chiller mode:



The complication is that sampling will actually be done with the *outdoor* loop circulator, and there is no built in outdoor circulator relay. So two approaches can be taken:

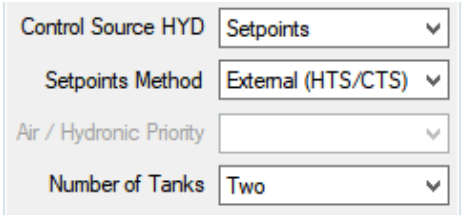
- Connect outdoor circulator to the indoor circulator terminal strip, and vice versa (indoor circulator to outdoor terminal strip) ***OR***
- Install an OCR relay, with coil connected between OV1 (control board DO_0) and C (24vac ground); and outdoor circulator powered from the normally open relay contacts.

go to TABLE OF CONTENTS

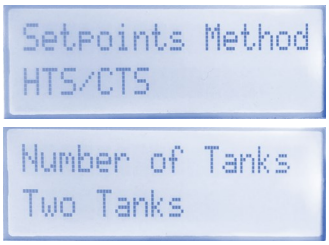
Setpoint Control Method 4 - External (HTS/CTS) Two Tanks

***REVERSING MODELS ONLY (HAC/HACW)**

PC APP: Tools-->Configuration

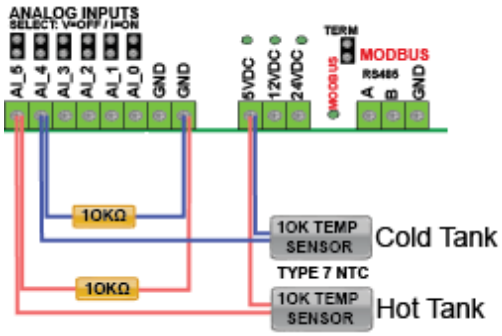


LCD Interface: Configuration



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

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



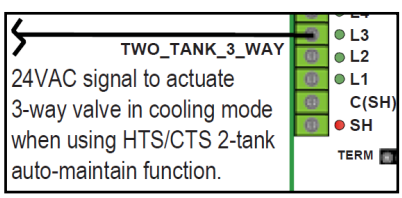
a) O Signal Control

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

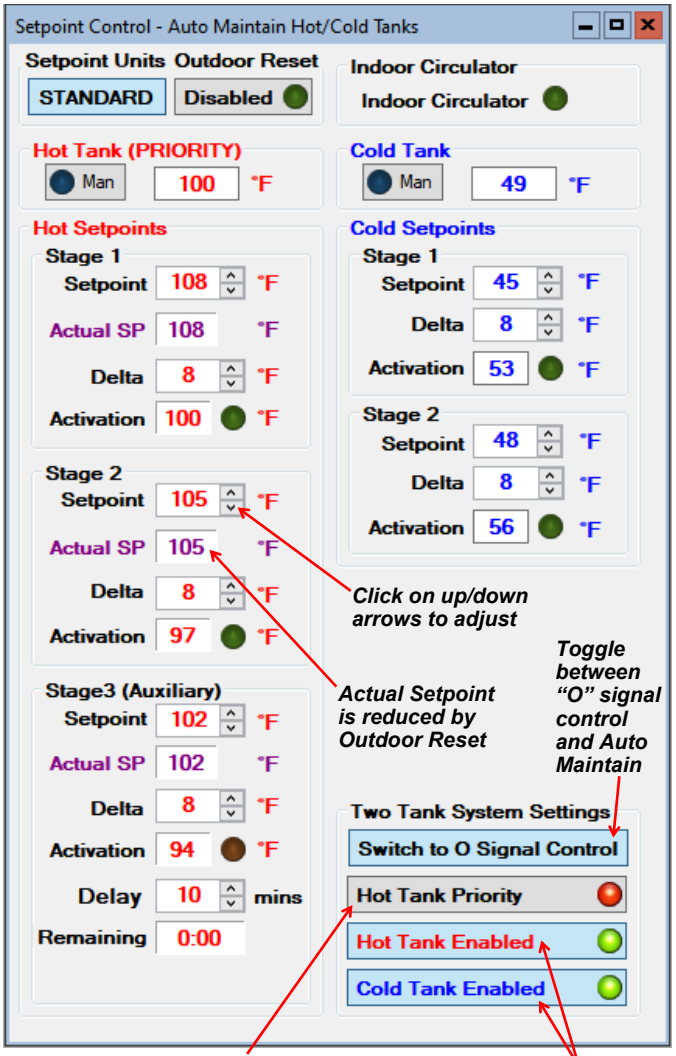
b) Auto Maintain

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

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



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



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

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

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

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

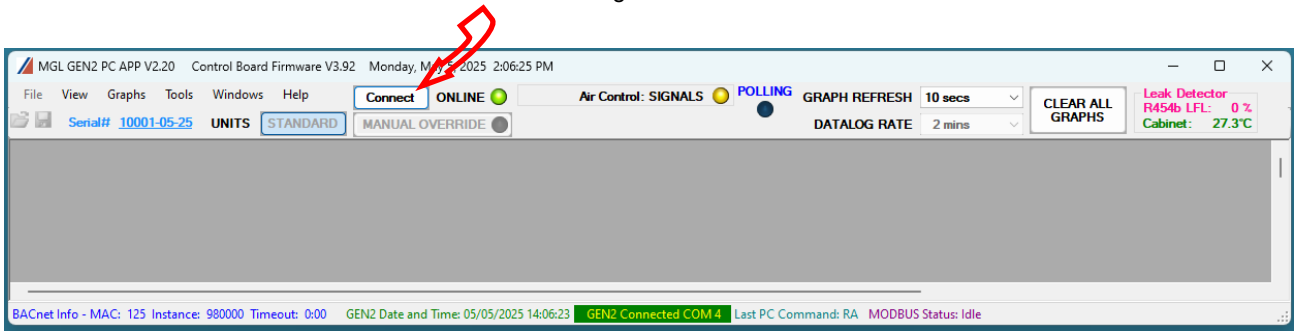
- **Typical Temperature Settings**
- **Summer Setback**
- **Outdoor Reset function**

go to TABLE OF CONTENTS

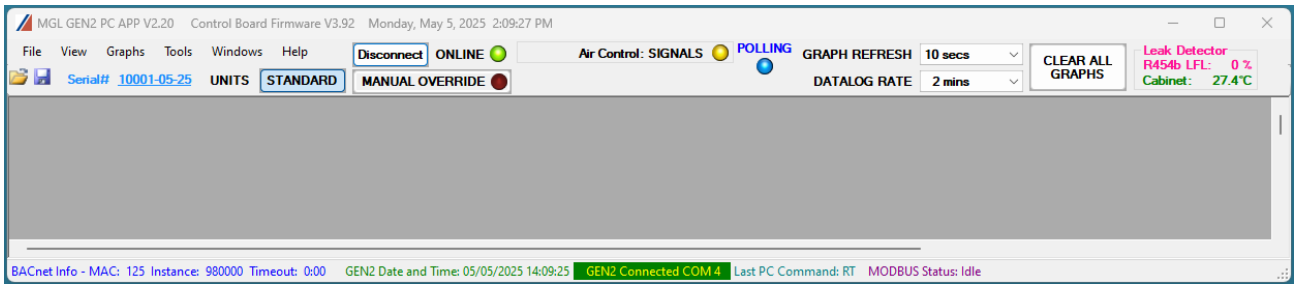
PC Application (PC App)

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

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



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



PC Application Menus

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

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

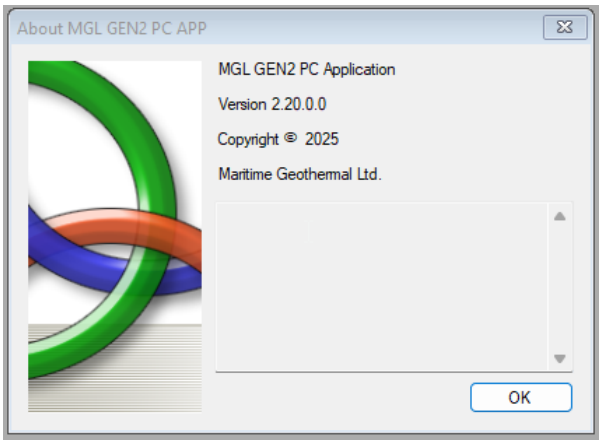
File-->Open: Opens a saved page arrangement.
File-->Save: Saves the current page arrangement.
File-->Exit: Exits the PC Application.

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

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

Help Menu: This shows information about the PC Application.

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

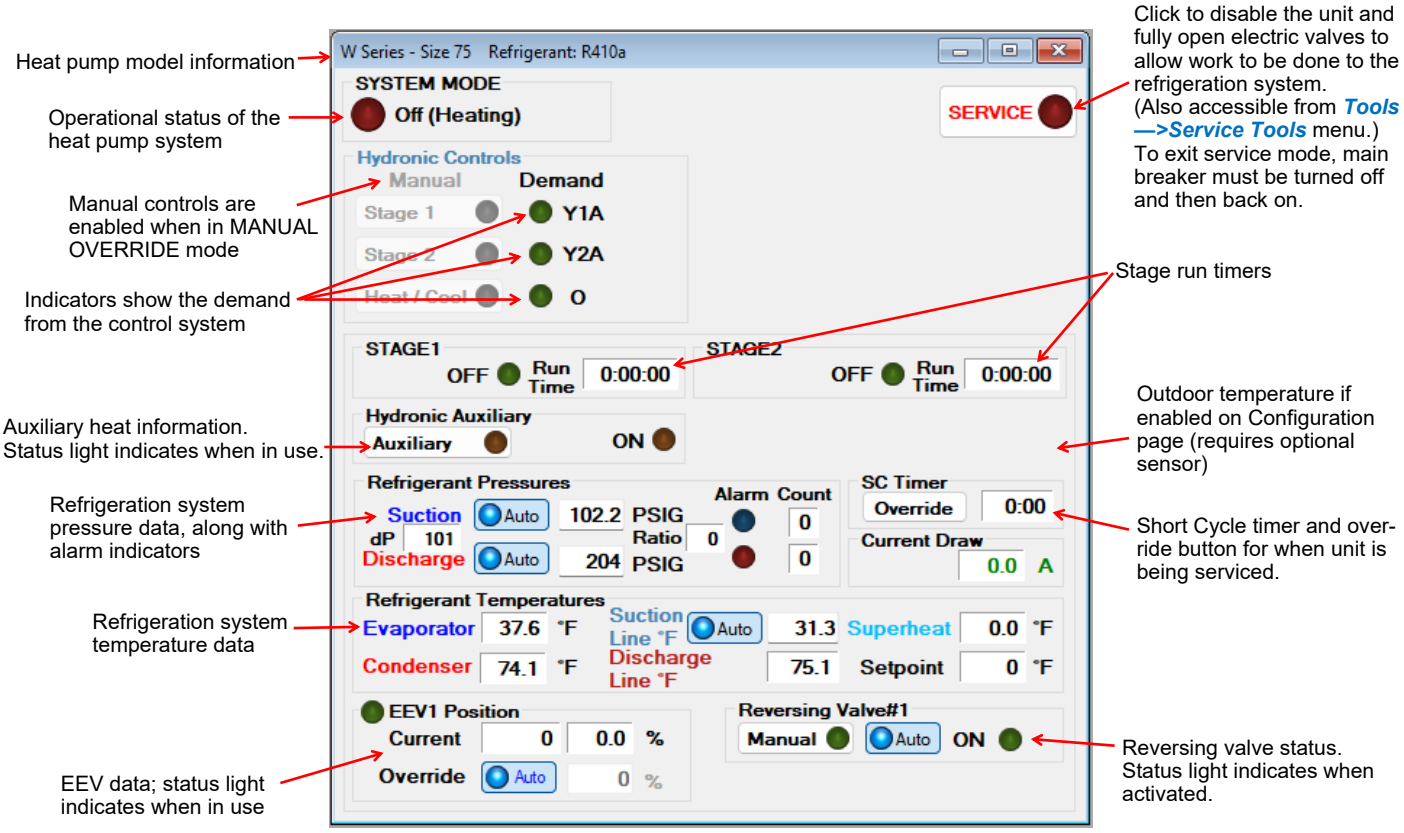


go to TABLE OF CONTENTS

View Menu:

This menu handles all of the operational viewing screens.

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



View-->Setpoint Control:

Shows the on-board temperature control screen. This screen is only available when **Control Source HYD** on the Configuration Page is set to **Setpoints** (not **Signals** or **BACnet**).

Refer to the **Operation** section earlier in this manual for details.

View-->Alarms, Limits and Faults

The alarms page has four tabs:

1. **ALARMS** - Current alarm status, alarm count, high and low refrigeration alarm cutout values, and short cycle timer.
2. **ALARMS LIST** - List of alarms that have occurred since the PC APP has been operating (this will be lost when the PC is disconnected from the control board.)
3. **LIMITS** - Limits in effect which prevent compressor operation but that do not cause an alarm.
4. **FAULTS** - List of board hardware faults.

go to TABLE OF CONTENTS

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

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

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

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

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

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

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

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

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

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

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

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

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

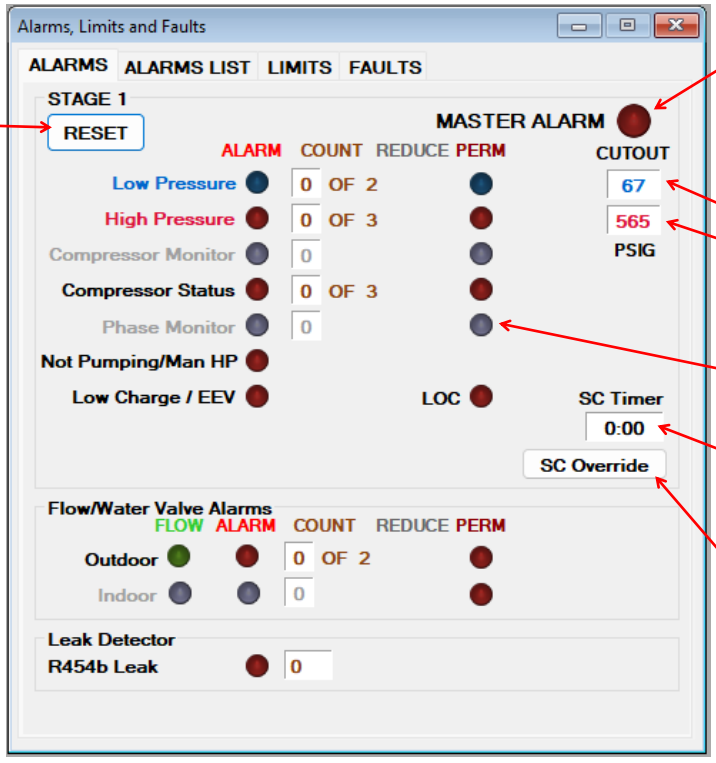
Outdoor Flow: Outdoor loop water valve end switch did not close (open loop only).

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

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

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

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



Master Alarm occurs when any alarm occurs.

Low Pressure cut out.
High Pressure cut out.

Greyed out alarms are not applicable to the system.

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

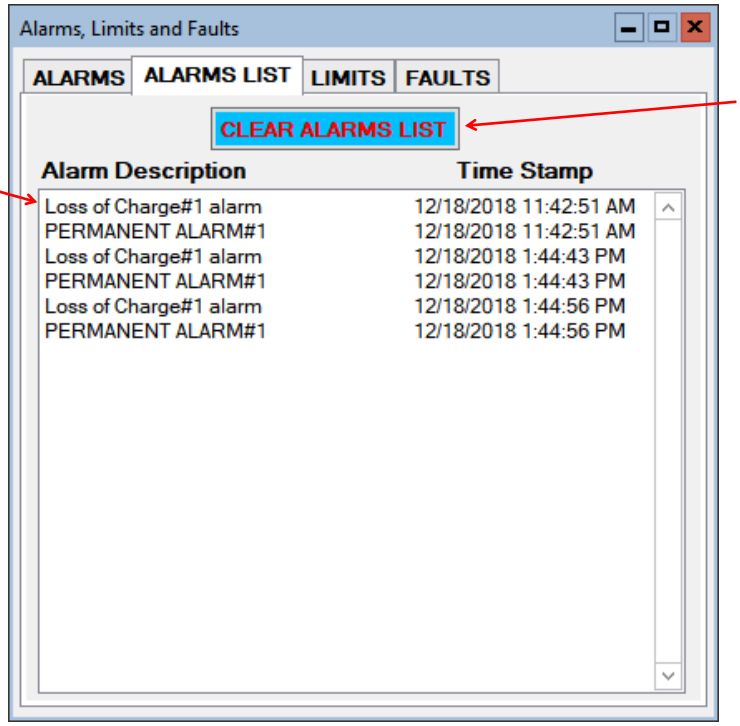
This button will reduce the short cycle timer value to 10 seconds.

go to TABLE OF CONTENTS

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

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

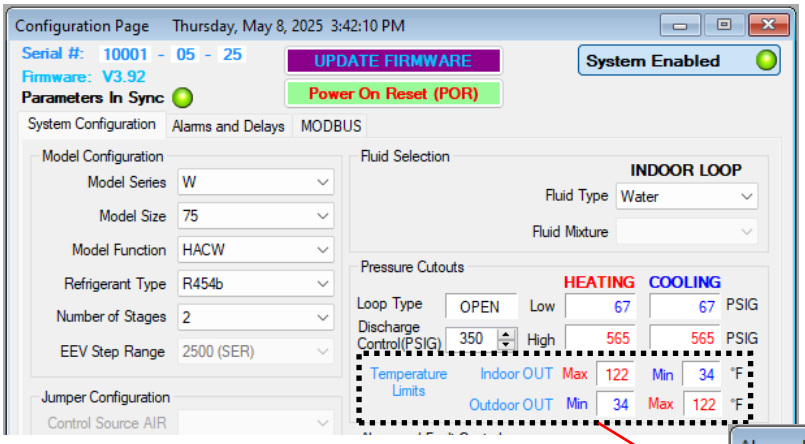
Each alarm that occurs while the PC APP is connected to the control board will appear here. The alarm type and a time stamp will be shown.

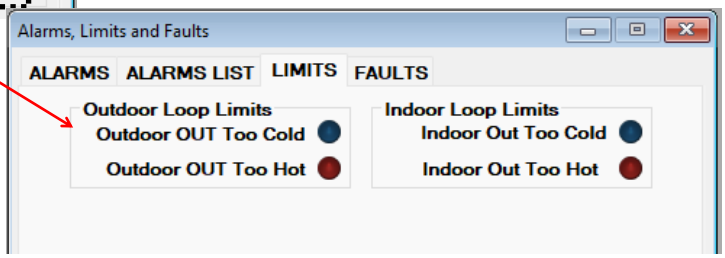


This button will erase the alarm events in the Alarm List.

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

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





go to TABLE OF CONTENTS

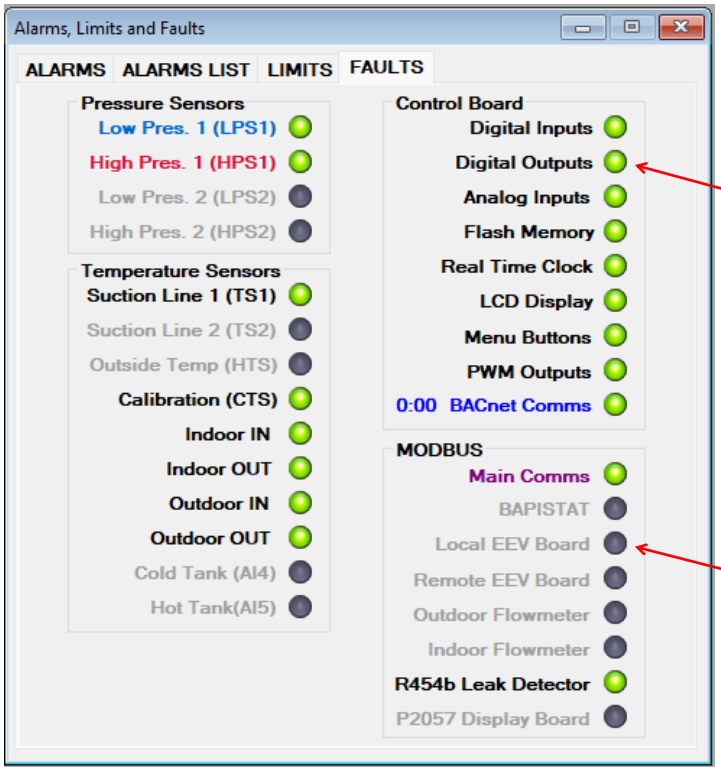
View-->Alarms, Limits and Faults (FAULTS tab)

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

If a fault occurs, some things to try:

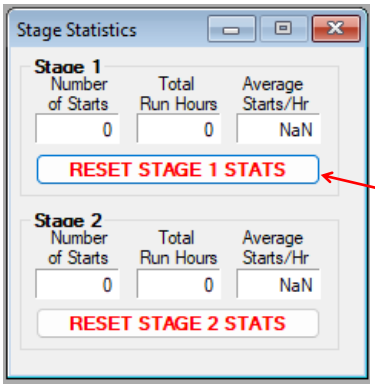
- Turn the power to the heat pump off for 20 seconds and then back on again.
- Use the menu item ***Tools-->Reset to Factory Defaults***. If this clears the fault then the system configuration will have to be set up again.
- For LCD interface or Menu Button faults, turn off the power, disconnect and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

If the fault persists then there is most likely a hardware problem, and the sensor, control board, or LCD interface board will need to be replaced.



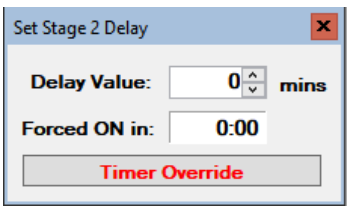
View-->Stage Stats

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



View-->Set Stage 2 Delay

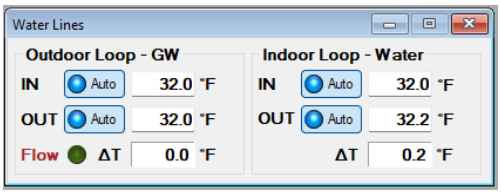
Sets the delay before stage 2 is engaged on a stage 1 demand. ("0" = no stage 2 engaged on a stage 1 call)



go to TABLE OF CONTENTS

View-->Water Lines

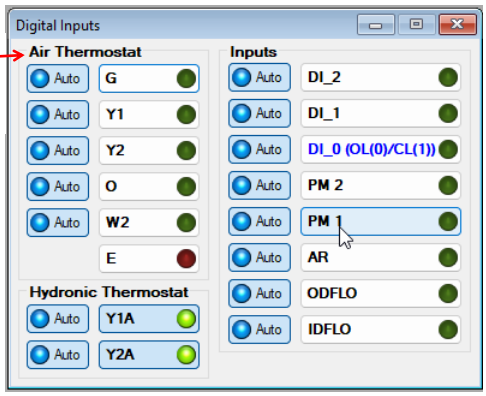
Displays the outdoor and indoor loop in, out, and delta temperatures.



View-->Digital Inputs

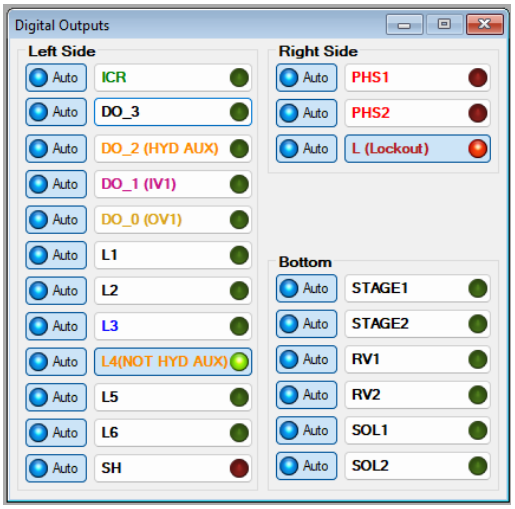
Shows the digital inputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.

N/A for W/WH/WP series



View-->Digital Outputs

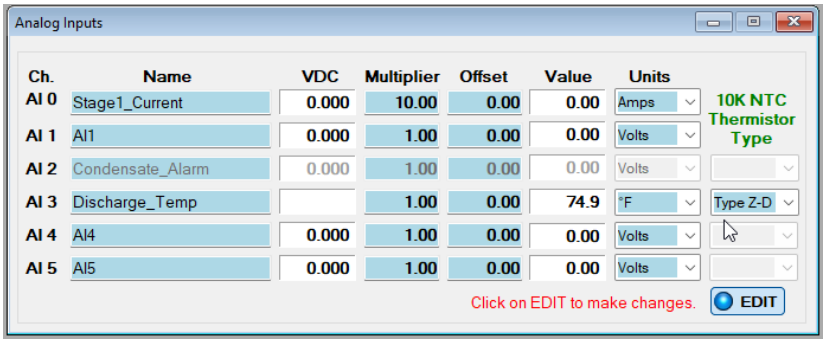
Shows the digital outputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode to facilitate troubleshooting.



View-->Analog Inputs

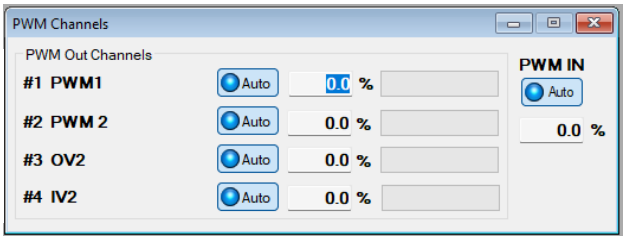
Shows the Analog inputs and their individual settings and values.

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



View-->PWM Channels

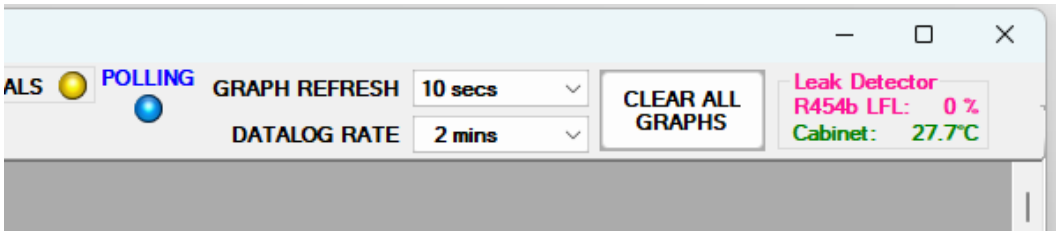
Shows the PWM channels and their individual status (0-100%). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.



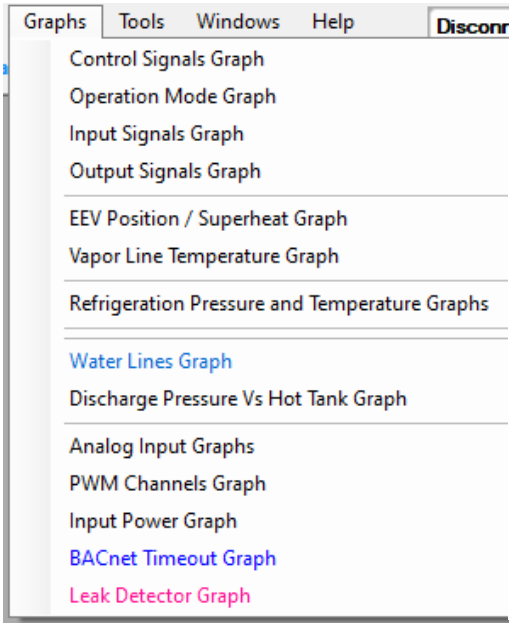
go to TABLE OF CONTENTS

Graphs Menu:

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



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



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

ON/OFF status of heating and cooling modes

ON/OFF status of digital inputs

ON/OFF status of digital outputs

EEV position and resulting superheat

Suction temperature

Suction and discharge pressures, evaporating and condensing temperatures

Outdoor & Indoor IN/OUT temperatures and delta T

Refrigerant discharge pressure and hot loop temperature

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

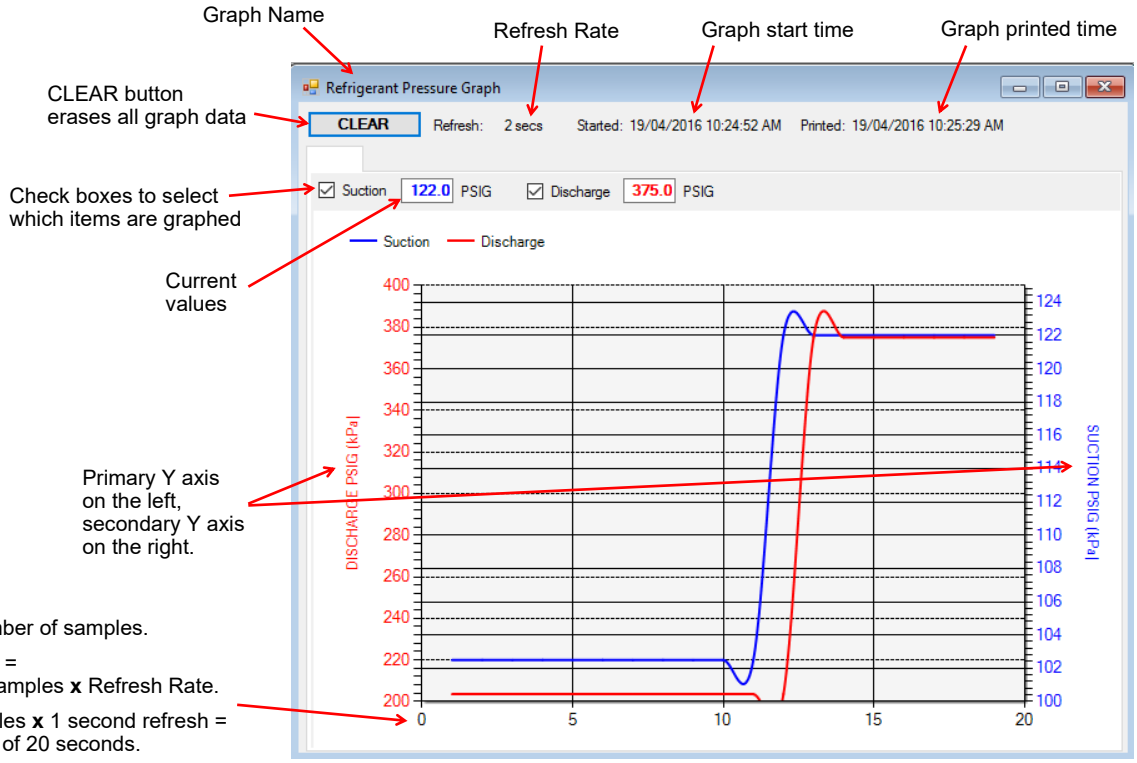
All PWM / 0-10VDC output channels and one PWM / 0-10VDC input channel.

For future use.

For troubleshooting synchronization with 3rd party BACnet controllers.

LFL and cabinet temperature (cabinet temperature may read higher than actual)

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



X axis = Number of samples.

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

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

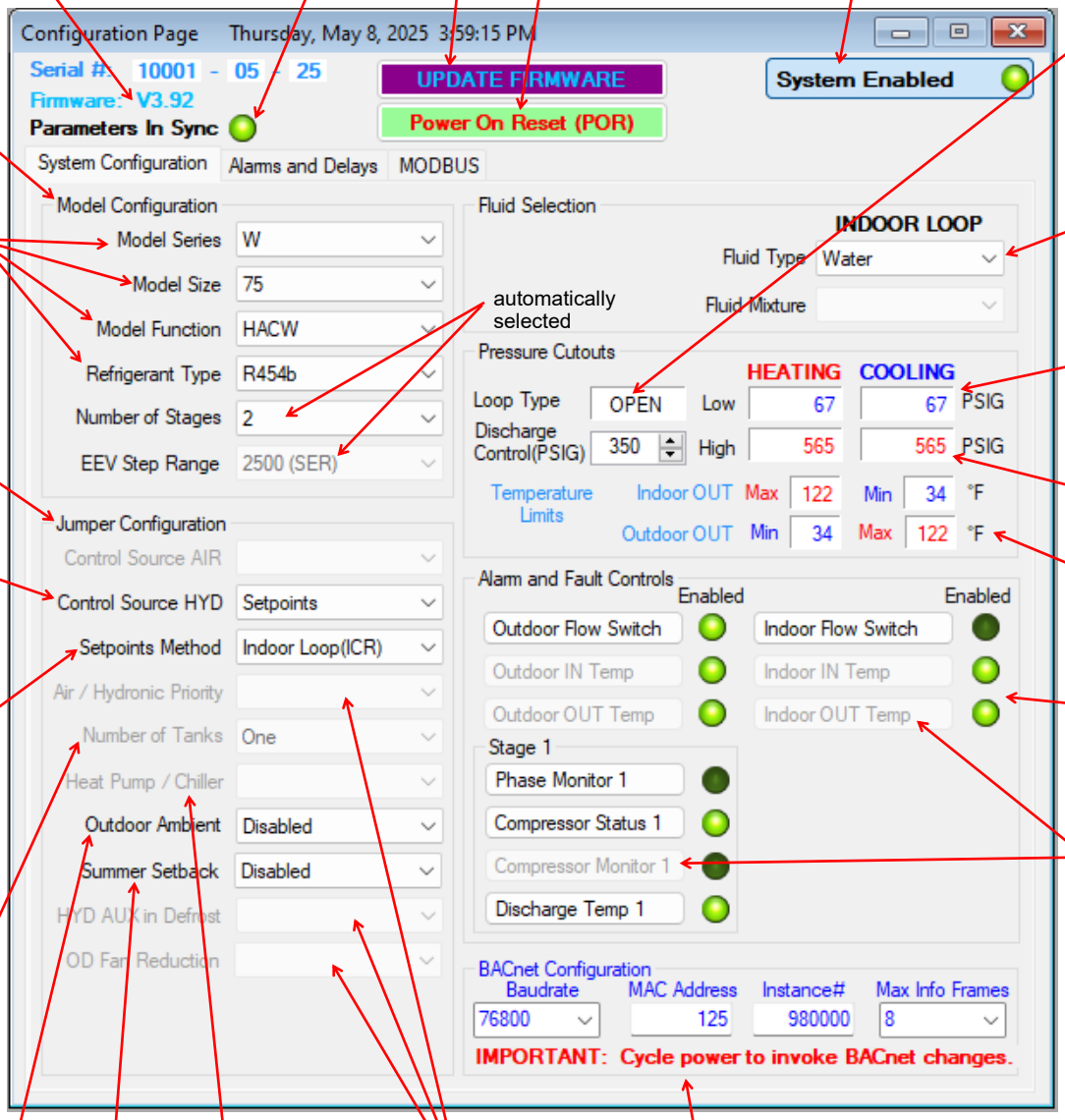
go to TABLE OF CONTENTS

Tools Menu:

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

Tools-->Configuration (System Configuration tab)

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



Green when parameters have been updated, red during update

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

Firmware update: see Appendix

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

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

Outdoor loop type as hardware selected by the closed loop jumper plug or open loop water valve harness

Model Configuration section to select the system type

Indoor loop fluid type and antifreeze concentration (default is Water)

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

automatically selected

Low pressure cutouts determined by outdoor loop type & indoor loop fluid type

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

High pressure cutout determined by refrigerant type

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

Temperature limits determined by series, outdoor loop type, & indoor loop fluid type

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

Enabled indicators show which alarms are active

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

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

Setpoint Control only: For non-reversing "H" units, chiller mode will control demand based on indoor loop temperature instead of outdoor loop.

N/A

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

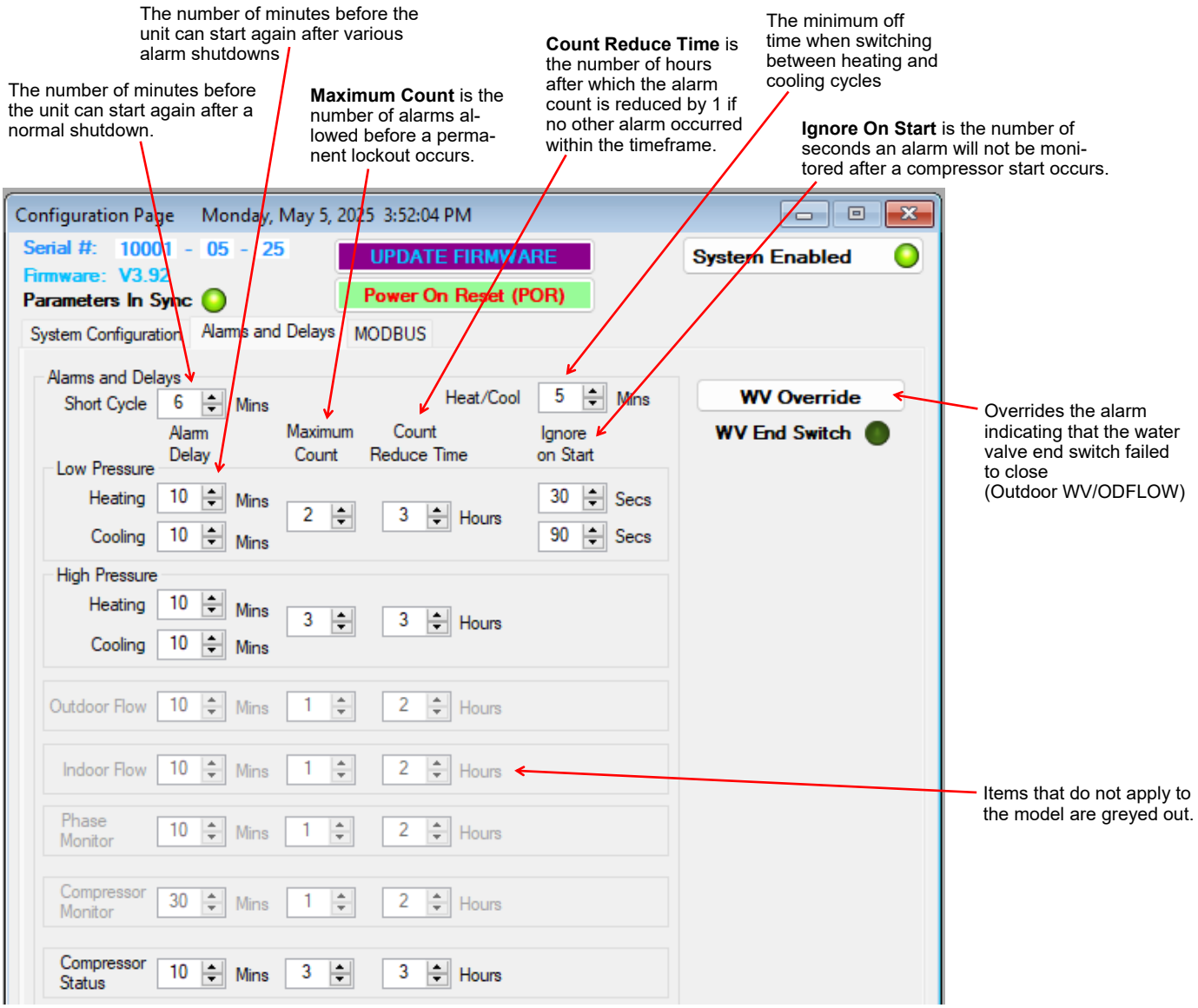
Setpoint Control only: Enable outdoor temperature sensor accessory for Outdoor Reset function

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

go to TABLE OF CONTENTS

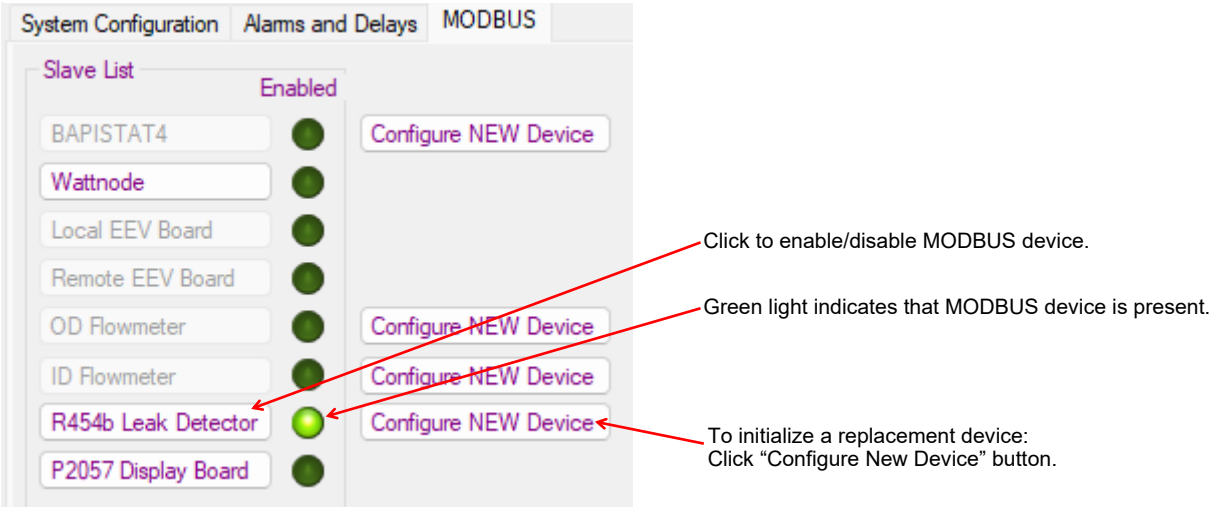
Tools-->Configuration (Alarms and Delays tab)

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



Tools-->Configuration (MODBUS tab)

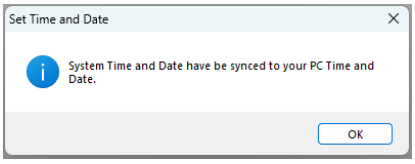
Use this tab to enable MODBUS accessories, or to initialize a replacement MODBUS device (e.g. refrigerant leak detector).



go to TABLE OF CONTENTS

Tools-->Set Date and Time

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



Tools-->Datalogging (Datalog tab)

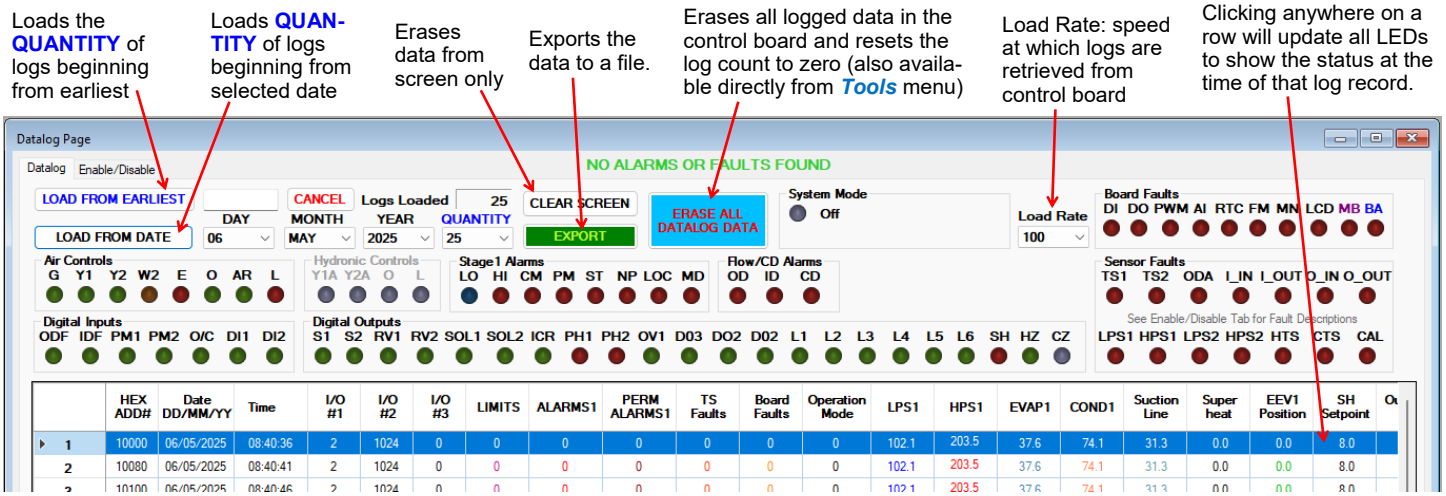
A log will be automatically recorded at the following rates:

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

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

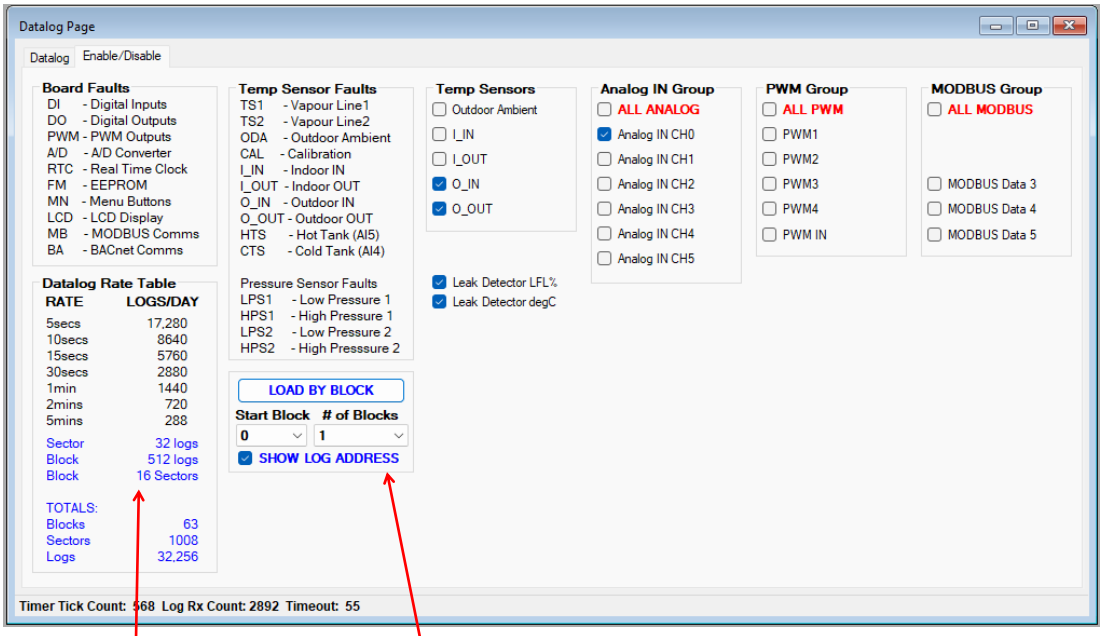
Note that loading datalogs at the standard **Load Rate** is time-consuming. It is suggested to leave **QUANTITY** at **25** until it is shown that the start date selected contains data and that any relevant alarm has been located in time.

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



Tools-->Datalogging (Enable/Disable tab)

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

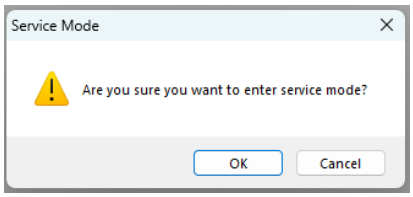


Datalog rate and capacity information

Load By Block: Developer use

go to TABLE OF CONTENTS

Tools-->Service Tools



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

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

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

Tools-->Service Tools-->Manual Override

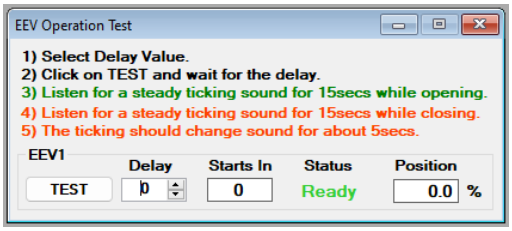
Allows individual control system demands or sensor values to be manually overridden for troubleshooting or service purposes. Also accessible via **MANUAL OVERRIDE** button in main window top bar—->

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

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

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

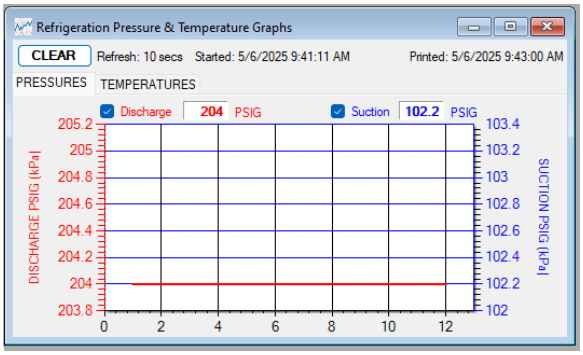
In addition, there is an adjustable delay so that the listener can go to the EEV's location before it starts to move. This is necessary when the EEV is in a remote location, as in air source split units like ATW-series.



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

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

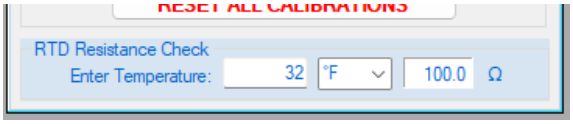
A declining pressure line (which is not associated with a declining temperature line) may indicate a leak.



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

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

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

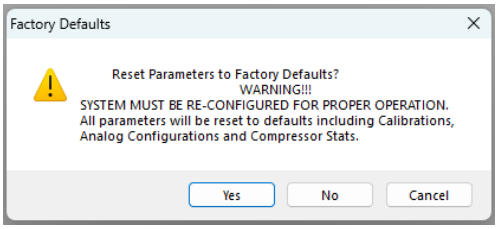


Tools-->Reset to Factory Defaults

This will reset all settings to default values.

THE SYSTEM MUST BE RECONFIGURED AFTER A RESET IS PERFORMED.

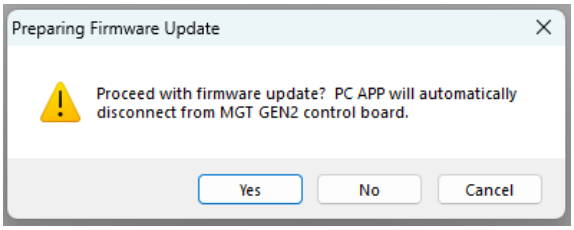
A reset will default the system to an ATW-65. Calibrations, alarm delays, analog configurations, compressor statistics, and Setpoint Control values will be returned to defaults as well.



Tools-->Update Firmware

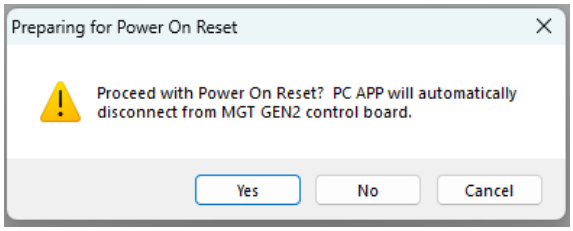
New function or bug fixes can be accessed by updating the firmware. This PC App function prepares the control board for a firmware update, by putting the board in boot loader mode and then disconnecting. The actual firmware update is done by a separate program which is downloaded along with the new firmware.

See appendix for details.



Tools-->Power On Reset (POR)

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

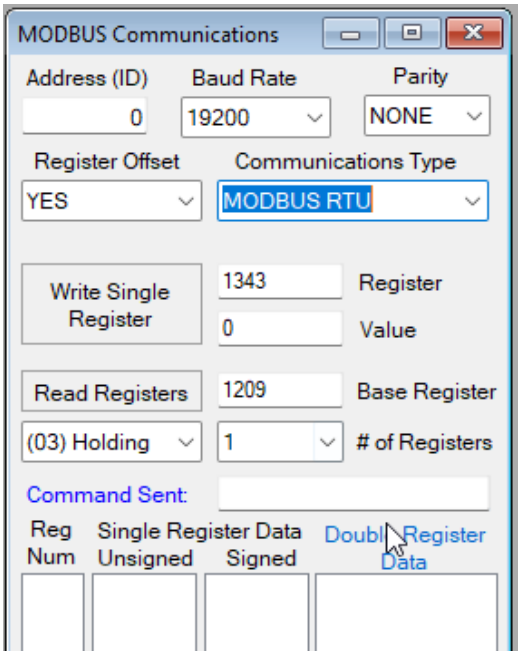


go to TABLE OF CONTENTS

Tools-->MODBUS-->Generic MODBUS

This window is for developer use.

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



Tools-->MODBUS-->Configuration

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

Tools-->Advanced

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

Tools-->Advanced-->Calibration

Tools-->Advanced-->Parameters

Tools-->Advanced-->EEV PID Parameters

Tools-->Advanced-->Objects

Tools-->Advanced-->Jumpers

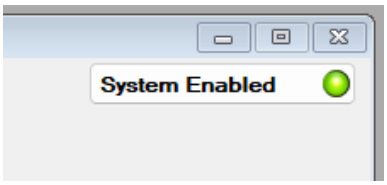
Tools-->Advanced-->SYSTEM TIMERS

Tools-->Advanced-->Performance

Tools-->System Enable/Disable

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

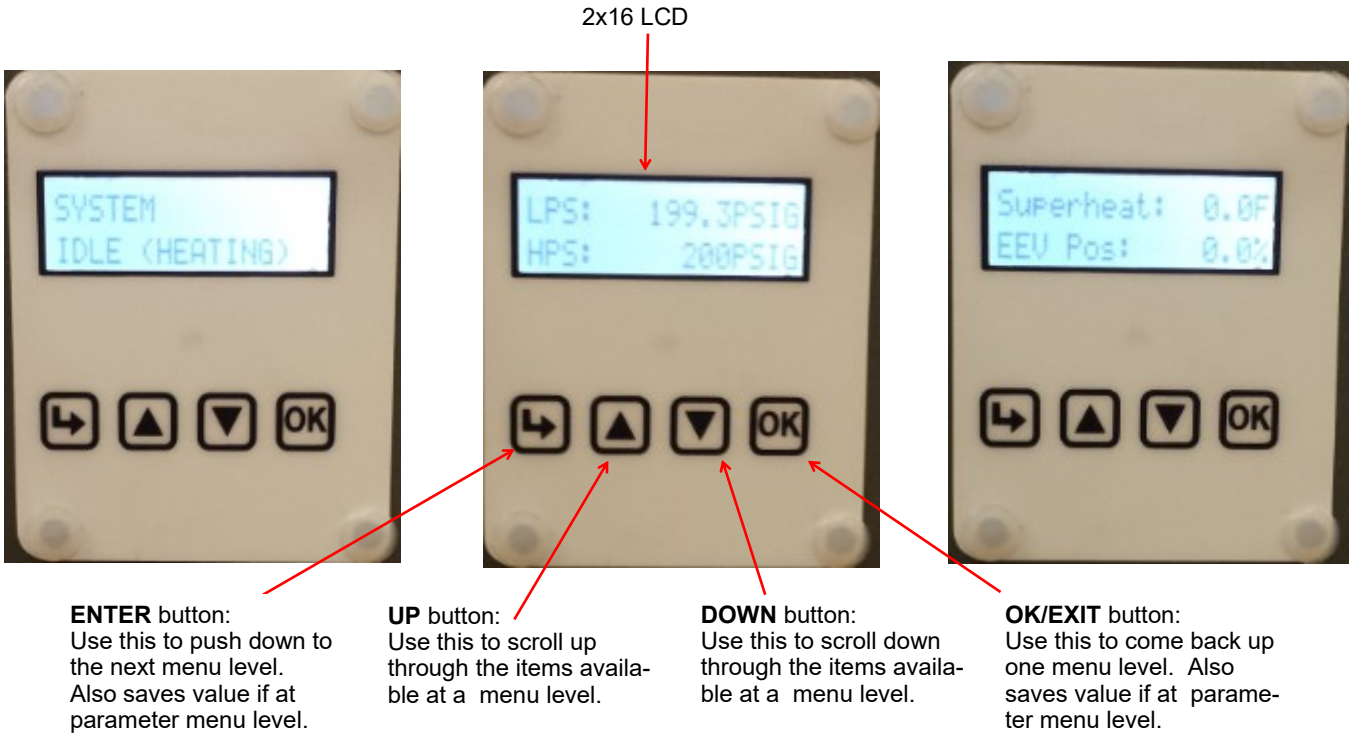
This is the same function as button at the top right of the 1st tab of the ***Tools-->Configuration*** window.



go to TABLE OF CONTENTS

LCD Interface & Menus

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



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

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

go to TABLE OF CONTENTS

Main Menu Tree Continued

ENTER (From Main)	ENTER (First Press)	ENTER (Second Press)	ENTER (Third Press)	Description
Summer Setback *(only if using Setpoint Control)*	***— Enable Setback?***	***— Enable***		Enable summer setback.
		— Disable		Disable summer setback.
System EN/DIS	***— Enable System?***	***— Enable***		Enable compressor, auxiliary, and ICR.
		— Disable		Disable compressor, auxiliary, and ICR.
Service Mode	***— Service Mode?***	***— No***		Do not enter Service Mode.
		— Yes		Enter into Service Mode.
EEV Control	***— EEV1***	***— Auto/Manual***	***— Auto***	Puts EEV in Auto mode
			— Manual	Puts EEV in Manual mode
		— Manual Position	***— EEV Position (%)***	Enter desired EEV position
Configuration	***— Control HYD***	***— Setpoints***		On-board water temp. control—see **Setpoint Control** section
		— Signals		Hardwired Signal control
		— BACnet		BACnet control—see **BACnet** section
	— Outdoor Reset *(only if using Setpoint Control)*	***— Enable***		Enables Outdoor Reset functionality
		— Disable		Disables Outdoor Reset functionality
	— Outdoor Ambient	***— Enable***		Enables accessory outdoor temp. sensor
		— Disable		Disables accessory outdoor temp. sensor
	— Setpoints Method *(only if using Setpoint Control)*	***— ICR***		Use Indoor Circulator Relay sampling
		— HTS/CTS		Use external temperature sensors
	— Heat Pump / Chiller *(only if using Setpoint Control, H/HW models)*	***— Heat Pump***		Control on indoor loop water temperature
		— Chiller		Control on outdoor loop water temperature
	— Number of Tanks *(only if using Setpoint control with HTS/CTS)*	***— One Tank***		One tank for heating/cooling functions
		— Two Tanks		Separate hot and cold tanks
	— Time Delays	***— Short Cycle***	***— Short Cycle (min)***	Enter short-cycle timer value
		— Heat/Cool	***— Heat/Cool (min)***	Enter minimum off time between modes
	— Units	***— Standard***		Standard units
		— Metric		Metric units (does not affect calibration units)
	— Set Time	***— Hours***		Set the system hours.
		— 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.

go to TABLE OF CONTENTS

BACnet Interface

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

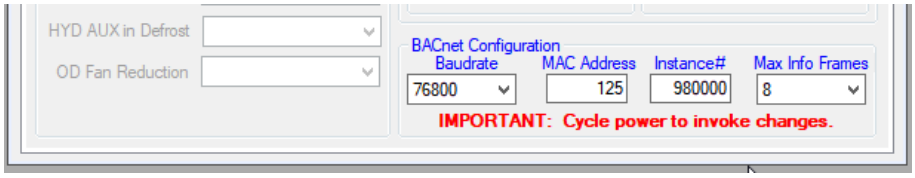
The connector on the control board is a three wire removable screw connector. The signals are as follows:
A: Communications line (+) (right pin)
B: Communications line (-) (middle pin)
C: Ground connection (left pin)

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

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

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

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



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

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

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

TABLE 18 - BACnet OBJECTS - CONTROL SIGNALS (READ/WRITE)

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

TABLE 19 - BACnet OBJECTS - OPERATION MODE Description (Read Only)

Name	Data Type	ID	Present Value	Description
Operation Mode	Analog Value	**AV5**	2	Hydronic heating
			3	Hydronic cooling (HAC/HACW units only)
			11	Hydronic heating OFF
			12	Hydronic cooling OFF (HAC/HACW units only)
Note: Object is type Analog Value but value will always be an integer value.				

TABLE 20 - BACnet OBJECTS - LIMITS Description (Read Only)

Name	ID	BIT #	Decimal Value*	Bit Description
Limits (Present Value)	**AV6**	0	1	Low Indoor OUT temperature
		1	2	High Indoor OUT temperature
		2	4	Low Outdoor OUT temperature
		3	8	High Outdoor OUT temperature
Note: Limits object is type Analog Value but value is bit coded and may be decoded as such (integer value). Note * : Value is for a single alarm and reference only.				

go to TABLE OF CONTENTS

TABLE 21 - BACnet OBJECTS - DATA (Read Only)					
	Name	**ID**	**Property**	**Units**	**Description**
Type - Analog Input	AI0 (Comp1_Current)	AI0	Present Value	Amps	Compressor current draw
	AI1 (Comp2_Current)	AI1	Present Value	User	N/A
	AI2	AI2	Present Value	User	N/A
	AI3	AI3	Present Value	degF (degC)	Compressor discharge line temperature
	AI4 (CTS)	AI4	Present Value	degF (degC)	Cold tank temperature from sensor - requires accessory
	AI5 (HTS)	AI5	Present Value	degF (degC)	Hot tank temperature from sensor - requires accessory
	LPS1	AI6	Present Value	PSIG (kPa)	Low pressure value (suction pressure)
	HPS1	AI7	Present Value	PSIG (kPa)	High pressure value (discharge pressure)
	EVAP1	AI8	Present Value	degF (degC)	Evaporating Temperature
	COND1	AI9	Present Value	degF (degC)	Condensing Temperature
	Suction Line 1	AI10	Present Value	degF (degC)	Suction line temperature
	Superheat 1	AI11	**Setpoint Value**	degF (degC)	Evaporator superheat
	EEV1 Position	AI12	Present Value	%	EEV position (% open)
	LPS2	AI13	Present Value	PSIG (kPa)	N/A
	HPS2	AI14	Present Value	PSIG (kPa)	N/A
	EVAP2	AI15	Present Value	degF (degC)	N/A
	COND2	AI16	**Setpoint Value**	degF (degC)	N/A
	Suction Line 2	AI17	Present Value	degF (degC)	N/A
	Superheat 2	AI18	**Setpoint Value**	degF (degC)	N/A
	EEV2 Position	AI19	Present Value	%	N/A
	Outside Ambient	AI20	Present Value	degF (degC)	Outdoor Ambient temperature - requires accessory
	O_IN	AI21	Present Value	degF (degC)	Outdoor IN temperature
	O_OUT	AI22	Present Value	degF (degC)	Outdoor OUT temperature
	I_IN	AI23	Present Value	degF (degC)	Indoor IN temperature
	I_OUT	AI24	Present Value	degF (degC)	Indoor OUT temperature
Type - Analog Value	PWM_IN	AV0	Present Value	%	N/A
	PWM1 (OD Fan)	AV1	Present Value	%	N/A
	PWM2	AV2	Present Value	%	N/A
	PWM3 (OV2)	AV3	Present Value	%	OV2 - PWM or 0-10VDC for outdoor loop water valve
	PWM4 (IV2)	AV4	Present Value	%	IV2 - PWM or 0-10VDC for indoor loop water valve
	Operation Mode	AV5	Present Value	N/A	Description of mode - see Operation Mode Description table
	Limits description	AV6	Present Value	N/A	Description of active limits - see Limits Description table
	Permanent Alarms 1	AV7	Present Value	N/A	Description of active alarms - see Alarm Descriptions table
	Permanent Alarms 2	AV8	Present Value	N/A	N/A
	Board Faults	AV9	Present Value	N/A	Description of active faults - see Fault Descriptions table
	Sensor Faults	AV10	Present Value	N/A	Description of active faults - see Fault Descriptions table
Type - Binary Output	STAGE1	BO0	Present Value	N/A	Compressor contactor
	STAGE2	BO1	Present Value	N/A	Compressor stage 2 solenoid (2-stage units only)
	ICR (Indoor Circ)	BO2	Present Value	N/A	Indoor circulator control
	DO0 (OV1)	BO3	Present Value	N/A	OV1 (to 24VAC Outdoor Loop water valve)
	DO1 (IV1)	BO4	Present Value	N/A	IV1 (to 24VAC Indoor Loop water valve)
	DO2 (HYD_AUX)	BO5	Present Value	N/A	Hydronic Auxiliary ON
	DO3 (AUX_ONLY)	BO6	Present Value	N/A	N/A
	PHS1	BO7	Present Value	N/A	Stage 1 dry contact pin for locked out on alarm
	PHS2	BO8	Present Value	N/A	N/A
Type - Binary Value	CONTROLS	BV9	Present Value	N/A	Control indicator: 0=local (man.override), 1=remote (BACnet)
	Outdoor Flow	BV10	Present Value	N/A	Outdoor loop water valve ON
	Indoor Flow	BV11	Present Value	N/A	Indoor Loop flow switch - requires accessory
	Phase Monitor1	BV12	Present Value	N/A	3 Phase Monitor - requires accessory
	Phase Monitor2	BV13	Present Value	N/A	N/A
	Comp Monitor1	BV14	Present Value	N/A	N/A
	Comp Monitor2	BV15	Present Value	N/A	N/A

go to TABLE OF CONTENTS

TABLE 22 - BACnet OBJECTS - ALARM Descriptions (Read Only)			
Name	**Data Type**	**ID**	**Description**
AI0 (Comp1 Current)	Analog Input	AI0	Status alarm (Start / Stop Failure)
AI1 (Comp2 Current)	Analog Input	AI1	N/A
LPS1	Analog Input	AI6	Low pressure alarm
HPS1	Analog Input	AI7	High pressure alarm
LPS2	Analog Input	AI13	N/A
HPS2	Analog Input	AI14	N/A
Outdoor Flow	Binary Value	BV10	Outdoor loop water valve
Indoor Flow	Binary Value	BV11	Indoor loop flow alarm - requires accessory
Phase Monitor1	Binary Value	BV12	3-Phase Monitor alarm - requires accessory
Phase Monitor2	Binary Value	BV13	N/A
Comp Monitor1	Binary Value	BV14	N/A
Comp Monitor2	Binary Value	BV15	N/A

Name	**ID**	**BIT #**	**Decimal Value***	**Bit Description**
Permanent Alarms 1 (Present Value)	**AV7**	0	1	Master permanent alarm (occurs when any alarm occurs)
		1	3	Low pressure heating mode alarm (suction pressure)
		2	5	Low pressure cooling mode alarm (suction pressure)
		3	9	High pressure heating mode alarm (discharge pressure)
		4	17	High pressure cooling mode alarm (discharge pressure)
		5	33	Loss of charge alarm
		6	65	Phase monitor alarm - requires accessory
		7	129	Compressor monitor alarm - N/A
		8	257	Status alarm from current sensor
		14	16,385	Outdoor loop water valve
		15*	32,769	Indoor loop flow alarm - requires accessory
Permanent Alarms 2 (Present Value)	**AV8**	13	8192	A2L refrigerant leak detector alarm (may or may not be a permanent alarm)

Note: Permanent Alarm objects are type Analog Value but values are bit coded and may be decoded as such (integer value).
Note * : Value is for a single alarm and reference only. Value includes + 1 for Master Alarm

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

go to TABLE OF CONTENTS

TABLE 23 - BACnet OBJECTS - FAULT Descriptions (Read Only)			
Name	**Data Type**	**ID**	**Description**
AI3 (Disch Temp)	Analog Input	AI3	Compressor discharge line temperature sensor faulty or disconnected
AI4 (Cold Tank)	Analog Input	AI0	Cold tank temperature sensor faulty or disconnected - requires accessory
AI5 (Hot Tank)	Analog Input	AI1	Hot tank temperature sensor faulty or disconnected - requires accessory
LPS1	Analog Input	AI6	Low pressure sensor faulty or disconnected
HPS1	Analog Input	AI7	High pressure sensor faulty or disconnected
LPS2	Analog Input	AI13	N/A
HPS2	Analog Input	AI14	N/A
Suction Line1	Analog Input	AI10	Suction line 1 temperature sensor faulty or disconnected.
Suction Line2	Analog Input	AI17	N/A
Outdoor Ambient	Analog Input	AI20	Outdoor temperature sensor faulty or disconnected - requires accessory
O_IN	Analog Input	AI21	Outdoor IN temperature sensor faulty or disconnected
O_OUT	Analog Input	AI22	Outdoor OUT temperature sensor faulty or disconnected
I_IN	Analog Input	AI23	Indoor IN temperature sensor faulty or disconnected
I_OUT	Analog Input	AI24	Indoor OUT temperature sensor faulty or disconnected

Name	ID	BIT #	Decimal Value*	Bit Description
Board Faults (Present Value)	**AV9**	0	1	Digital inputs
		1	2	Digital outputs
		2	4	PWM outputs
		3	8	Analog to digital conversion
		4	16	Real time clock
		5	32	EEPROM memory
		6	64	Menu buttons
		7	128	LCD interface
Sensor Faults (Present Value)	**AV10**	0	1	Suction line temperature sensor
		1	2	N/A
		2	4	Outdoor Ambient temperature sensor - accessory
		3	8	Calibration temperature resistor plug
		4	16	Indoor IN temperature sensor
		5	32	Indoor OUT temperature sensor
		6	64	Outdoor IN temperature sensor
		7	128	Outdoor OUT temperature sensor
		8	256	Cold tank temperature sensor on AI4 - accessory
		9	512	Hot tank temperature sensor on AI5 - accessory

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

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

go to TABLE OF CONTENTS

Startup Procedure

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

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

Pre-Start Inspection

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.

Outdoor Loop (Ground Loop):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the ground 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 for the intended application. 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.

Outdoor Loop (Ground Water):

1. Verify there are no leaks in the connections to the unit. Verify the water valve is installed and properly oriented in the OUT line.
2. Verify that there is flow control in the OUT line.

Domestic Hot Water (Desuperheater): *HACW/HW only*

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.

go to TABLE OF CONTENTS

Unit Startup

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

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

The LCD will automatically scroll through various data including low (suction) pressure, high (discharge) pressure, superheat, EEV position and water in/out temperatures.

Preparation:

1. Set all controls (including zone thermostats) to OFF. Turn power on to the heat pump. All LED's on the control board should turn on, the LCD should say "**MGT GEN2 VERx.xx**" on line 1 and "**Zeroing EEV's**" on line 2. You should be able to hear the EEV moving (a clicking sound).
2. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.
3. Connect a USB cable between the USB connector on the board and a laptop with the PC App installed (recommended but optional).
4. Select the desired Control Source HYD via the PC APP Configuration Page or via the LCD Configuration Menu.
5. Enable the system either with the PC App's Configuration Page **System Enable/Disable** button or via the LCD display.

Heating Mode:

1. Adjust the Setpoint Control settings via the PC App or LCD to activate stage 1 (or activate via BACnet or 24V signal if used). The EEV will begin to open and the compressor will start, as will the circulator pumps.
2. Check the PC App or LCD. The suction and discharge pressures will vary based on the outdoor loop temperature and the indoor loop temperature, but for a typical startup they should be **90-110 psig** and **260-360 psig** for W/WP-series or **25-35 psig** and **105-200 psig** for WH-series.
3. Monitor the unit via the PC APP or LCD while the unit runs, and record the following after 10 minutes of run time:
    1. Suction pressure
    2. Discharge pressure
    3. Four water line temperatures: Indoor IN, Indoor OUT, Outdoor IN, Outdoor OUT
    4. Outdoor Delta T (should be **5-8°F, 3-4°C**)
    5. Indoor Delta T (should be **8-12°F, 4-6°C**)
    6. 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.
5. For units with desuperheater (HACW/HW), turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown on the electrical box diagram. Turn the DHW switch in the unit post on. Turn the power to the unit on.
6. Open a zone (or zones) and let the tank cool down until stage 1 is activated. Close the zone(s) again.
7. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand **(caution: pipes can 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.
8. Activate AUX heat if equipped by changing the AUX setpoints. Be sure the auxiliary heat breaker at the panel is ON. Measure the L1 current draw with an clamp meter and record the value.

Cooling Mode: *HACW/HAC only*

1. Set a zone thermostat to cooling mode or otherwise activate cooling mode by sending an "O" signal to the heat pump. Adjust the setpoints via the PC App or LCD to activate stage 1.
2. Monitor the unit via the PC APP or LCD Display while the unit runs, and record the following after 10 minutes of run time:
    1. Suction pressure
    2. Discharge pressure
    3. Four water line temperatures: Indoor IN, Indoor OUT, Outdoor IN, Outdoor OUT
    4. Outdoor Delta T (should be **8-12°F, 4-6°C**)
    5. Indoor Delta T (should be **5-8°F, 3-4°C**)
3. Adjust the setpoints and let the unit run through a cycle.

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/spills and ensure the area is clean.
4. Turn the power on to the unit. Set the heat pump setpoints and zone thermostats to their final settings.

go to TABLE OF CONTENTS

Startup Record

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

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

PRE-START INSPECTION

Indoor Loop (Hydronic)	All shut-off valve are open (full flow available)							
	Loop is full and purged of air							
	Antifreeze type, if any							
	Antifreeze concentration, if any		% Volume		% Weight			
	Loop static pressure		PSI	kPa				
Ground Loop System	All shut-off valve are open (full flow available)							
	Loop is full and purged of air							
	Antifreeze type							
	Antifreeze concentration		% Volume		% Weight			
	Loop static pressure		PSI	kPa				
Ground Water System	Water valve installed in return line							
	Flow control installed in return line							
Domestic Hot Water *HACW/HW only*	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 (Outdoor 1, Outdoor 2, Indoor 1)		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	
	Outdoor In, Outdoor Out, and Delta T		In		Out		°F	°C
	Outdoor Flow		Igpm	USgpm		L/s		
	Compressor L1 (black wire) current		A					
	Heating setpoint and discharge pressure at cycle end		°F	°C		psig	kPa	
	Domestic Hot Water functioning (if equipped)?							
Cooling Mode (10 minutes) *HACW/HAC only*	Suction Pressure / Discharge Pressure					psig	kPa	
	Outdoor In, Outdoor Out, and Delta T		In		Out		°F	°C
	Cooling setpoint and suction pressure at cycle end		°F	°C		psig	kPa	
Final Setpoints	Heating S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C	
	Cooling S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C	

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

go to TABLE OF CONTENTS

Routine Maintenance

MAINTENANCE SCHEDULE			
Item		**Interval**	**Procedure**
Compressor Contactor		1 year	Inspect for pitted or burned points. Replace if necessary.
LCD Interface or PC App		When heat pump problem is suspected	Check for alarms and faults (only necessary if alarms not reported through a BACnet system). Rectify problem if alarms found. See **Troubleshooting** chapter.
Coaxial Heat Exchangers		When experiencing performance degradation that is not explained by a refrigeration circuit problem or low loop flow rate	Disconnect the loop and flush heat exchanger with a calcium removing solution. Generally not required for closed loop or cold water open loop systems or indoor loops; whenever system performance is reduced for warm water open loop systems. See instructions below.

Coaxial Heat Exchanger Flushing Procedure - Open Loop

1. Isolate the heat exchanger by closing the valves in the IN and OUT ports to the heat exchanger.
2. Blow out the heat exchanger into a clean 5 gallon bucket using compressed air.
3. If a purge cart is not available, use a 5 gallon plastic bucket, a circulator and some plastic piping to create a make-shift pump system. Connect a the inlet and outlet to the heat exchanger ports.
4. Place 2 gallons of RYDLYME or similar in the purge cart (or bucket). Circulate the fluid through the heat exchanger for at least 2 hours (3 hours recommended).
5. Disconnect the purge system and dispose of the solution. RYDLYME is non-toxic and biodegradable and as such can be poured down a drain.
6. Connect fresh water and a drain to the heat exchanger ports and flush the exchanger for several minutes.
7. Return the plumbing to its original configuration and open the IN and OUT valves. Operate the system and check for improved performance.

Coaxial Heat Exchanger Flushing Procedure - Closed Ground Loop

1. Isolate the heat exchanger by placing the pump module valves in the exchanger flushing position.
2. Connect a compressed air and a drain pipe to the pump module purge ports and blow the anti-freeze solution into a clean 5 gallon bucket.
3. Connect a purge cart to the pump module purge ports.
4. Place 2 gallons of RYDLYME or similar in the purge cart. Circulate the fluid through the heat exchanger for at least 2 hours (3 hours recommended).
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.
6. Connect fresh water and a drain to the pump module purge ports and flush the exchanger for several minutes.
7. Blow the heat exchanger out with compressed air as per STEP 2 and dump the water down a drain.
8. Connect the purge cart to the pump module purge ports. Re-fill and purge the heat exchanger with as per standard procedures (the antifreeze from STEP 2 can be re-used).
9. Disconnect the purge cart and set the pump module valves back to the original positions. Operate the system and check for improved performance.

go to TABLE OF CONTENTS

Troubleshooting Guide

The following steps are for troubleshooting the heat pump. Repair procedures and reference refrigeration circuit diagrams can be found later in this manual.

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

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

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

STEP 4: If the compressor starts and sounds normal, 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.

go to TABLE OF CONTENTS

ALARM TROUBLESHOOTING

Alarm/Fault	Description	Recommended Action
The data logging function of the GEN2 Control Board is a very useful tool for troubleshooting alarms. It provides a history of the unit operation up to and including the time at which the alarm(s) occurred. Note that some alarms require accessory components.		
Low Pressure	A low pressure alarm occurs when the suction pressure drops to or below the ***Low Pressure Cutout*** value. The low pressure is checked just before a compressor start; if it is OK the compressor will start, otherwise an alarm will occur. When the compressor starts, the low pressure alarm will be ignored for the number of seconds that ***Low Pressure Ignore*** is set to, after which the low pressure alarm will be re-enabled. This allows a dip in suction pressure below the cutout point during startup without causing a nuisance alarm.	Go to the Low Pressure section of the mode the unit was operating in at the time of the alarm.
High Pressure	A high pressure alarm occurs when the discharge pressure rises to or above the ***High Pressure Cutout*** value.	Go to the High Pressure section of the mode the unit was operating in at the time of the alarm.
Compressor Status (current sensor)	This alarm occurs when there is a current draw on the compressor as measured by the current sensor but no call for the compressor to be on (i.e. welded contactor) or when there is a call for the compressor to be on but there is no compressor current draw (i.e. manual high pressure control is open or contactor failure).	Check contactor if compressor is staying on when it should be off. Go to Compressor section if compressor is not on when it should be. Also check for tripped manual high pressure control.
Not Pumping / Man HP	Discharge pressure is less than 30 psi higher than suction pressure after 2 minutes run time. It indicates leaking reversing valve, compressor very hot and tripped on internal overload, manual high pressure control trip, bad contactor, or defective compressor.	Check for reversing valve not seated properly, tripped manual high pressure control, or a contactor or compressor problem.
Low Charge / EEV	EEV position has been above 99% for 20 minutes within the first hour of cycle.	Check system for refrigerant leak. Also check EEV for proper operation (see **EEV Troubleshooting** section)
LOC (Loss of Charge)	This alarm occurs if the low pressure and/or high pressure sensors are below 30 psig (207 kPa).	Check system for refrigerant leak. Check for incorrect pressure sensor reading.
Outdoor Flow (ODFLOW)	For open loop, 24vac signal from water valve end switch indicating water valve open was not received in the time limit (90 seconds).	Verify water valve operation and that it is wired properly using the factory wiring harness (see wiring diagram in the **Model Specific Information** section later in this manual).
Leak Detector / R454b Leak (A2L W/WP-series only)	Refrigerant sensor detected the presence of refrigerant inside the enclosure.	Locate and fix leak, taking all necessary precautions associated with **A2L** refrigerants. See **Service Procedures** chapter.

go to TABLE OF CONTENTS

FAULT TROUBLESHOOTING		
Alarm/Fault	**Description**	**Recommended Action**
Pressure Sensors	The sensor is reading outside of the acceptable range. Check to ensure connector is on securely.	Replace the pressure sensor. If this does not rectify the problem, replace the control board.
Temperature Sensors	The sensor is reading outside of the acceptable range. Check to ensure connector is on securely.	Replace the temperature sensor. If this does not rectify the problem, replace the control board.
Control Board: *- Digital Inputs* *- Digital Outputs* *- Analog Inputs* *- Real Time Clock* *- PWM Outputs*	A failure has occurred and the indicated section of the control board may no longer work properly.	Cycle the power a few times; if the fault persists replace the control board.
Control Board: *- Flash Memory*	A failure has occurred and stored data may be corrupt.	It may be possible to correct this by using the menu item ***Tools—Reset to Factory Defaults***. If this clears the fault then the system configuration will have to be set up again.
Control Board: *- Menu Buttons*	A failure has occurred and the control board may no longer respond to menu button key presses.	Try turning off the power, disconnecting and reconnecting the cable between the LCD Interface board and the Control Board, and then turning the power back on again. If this does not work then either the LDC Display board, the cable, or the driver section of the Control Board may be faulty.
Control Board: *- LCD Interface / LCD Display*	A failure has occurred and display may show erratic data, no data or may not turn on at all.	
Control Board: *- BACnet Comms*	BACnet communications experienced a timeout.	See **BACnet TROUBLESHOOTING** below.
MODBUS: *- Main Comms*	Hardware problem on heat pump control board.	24V**DC** is not present across **24VDC** and **GND** at lower right of control board. Replace board if voltage not correct.
		Remove MODBUS screw terminal connector from board as well as jumper from **TERM** (located just above the MODBUS connector). Using a multimeter set to DC volts with negative probe on **B** and positive probe on **A**, confirm there is **+2.5VDC**. Replace board if voltage not correct.
	MODBUS termination problem.	Verify MODBUS **TERM** jumper is in place on control board. Install jumper if missing.
MODBUS: *- R454b Leak Detector*	Refrigerant detector communications experienced a timeout.	See **LEAK DETECTOR TROUBLESHOOTING** on next page.

go to TABLE OF CONTENTS

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

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

go to TABLE OF CONTENTS

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

go to TABLE OF CONTENTS

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 or no indoor loop flow	Verify that indoor delta T is 8-12°F (4-7°C)	Verify pump is working and sized correctly. Check for restrictions in the circuit, e.g. valve partially closed.
	Temperature setpoint(s) too high (if using BACnet or Signals control)	Use PC APP to verify that Indoor OUT does not exceed 120°F (49°C) for W/WP-series or 160°F (71°C) for WH-series.	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. High superheat and low suction pressure.	Go to EEV troubleshooting section.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Unit is overcharged (after servicing)	High subcooling, low Indoor Loop delta T.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces. Or remove charge and weigh back in the amount listed on nameplate.
Low suction pressure	Low or no outdoor loop flow	Verify that indoor delta T is 5-7°F (3-4°C).	Determine the cause of the flow restriction and correct it. Verify pumps are working and sized correctly for ground loop systems, and not air locked. Verify well pump and water valve is working for ground water systems.
	Outdoor loop ELT too cold	Measure the entering liquid temperature. Most likely caused by undersized ground loop or cold well water.	Increase the size of the ground loop.
	Dirty or fouled outdoor loop coaxial heat exchanger (typically for open loop, unlikely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Backflush the coaxial exchanger with a lime/calcium removing solution according to instructions in **General Maintenance** section.
	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.
	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.

go to TABLE OF CONTENTS

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Low suction pressure (continued)	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High 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.
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 low discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve if present (can cause compressor to overheat and trip internal overload)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	Switch back and forth into cooling mode to try to free up valve. If it can't be freed, replace reversing valve.
	Faulty compressor, not pumping (unusual)	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. High superheat and discharge pressure.	Go to EEV troubleshooting section.
Random high pressure trip (may not occur while on site)	Faulty indoor circulator relay (ICR)	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.

go to TABLE OF CONTENTS

OPERATION TROUBLESHOOTING - COOLING MODE (HACW / HAC models only)			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Heating instead of cooling	Zone thermostat interconnection or zone controller not set up properly.	Verify that there is 24VAC across O and C of the terminal strip when buffer tank should be cooled.	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 loop flow	Verify that indoor delta T is 5-7°F (3-4°C).	Determine the cause of the flow restriction and correct it. Verify pumps are working and sized correctly for ground loop systems, and not air locked. Verify well pump and water valve is working for ground water systems.
	Outdoor loop ELT too hot	Measure the entering liquid temperature. Most likely caused by undersized ground loop.	Increase the size of the ground loop.
	Dirty or fouled outdoor loop coaxial heat exchanger (typically for open loop, unlikely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Backflush the coaxial exchanger with a lime/calcium removing solution according to instructions in General Maintenance 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 (after servicing)	High subcooling, low Indoor Loop delta T.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces. Or remove charge and weigh back in the amount listed on nameplate.

go to TABLE OF CONTENTS

OPERATION TROUBLESHOOTING - COOLING MODE (HACW / HAC models only)			
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 low discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve (can cause compressor to overheat and trip internal overload)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	Switch back and forth into cooling mode to try to free up valve. If it can't be freed, replace reversing valve.
	Faulty compressor, not pumping (unusual)	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Low suction pressure	Low or no indoor loop flow	Verify that indoor delta T is 8-12°F (4-7°C).	Verify pump is working and sized correctly. Check for restrictions in the circuit, e.g. valve partially closed.
	Temperature setpoint(s) too low (if using BACnet or Signals control)	Use PC APP to verify that Indoor OUT is not less than the minimums listed in the **Model Specific Information** section.	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. High superheat and high discharge pressure.	Go to EEV troubleshooting section.
	TS1 temperature sensor not reading properly	If the sensor is reading low it will cause the superheat to appear high, which causes the EEV to continually close.	Verify EEV position is low compared to normal. Check temperature sensor, replace if necessary.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes high discharge pressure.	Replace filter-dryer.
	Low refrigerant charge	Indoor loop EWT and flow are good but suction is low. Check static refrigeration pressure of unit for a low value. Weigh out charge to verify amount.	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. High 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.

go to TABLE OF CONTENTS

EEV (Electronic Expansion Valve) TROUBLESHOOTING

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

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

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

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

Tests to determine if an EEV is working

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

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

The EEV can be checked electrically:

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

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

Check with a new EEV:

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

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

go to TABLE OF CONTENTS

DOMESTIC HOT WATER (DESUPERHEATER) TROUBLESHOOTING (HACW / HW models only)			
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.
	Wire is not connected at contactor (shipped disconnected to prevent unintentional startup)	Check that brown wire with blue insulated terminal is connected to contactor as shown on electrical box diagram.	Connect wire.
	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.

go to TABLE OF CONTENTS

A2L-SPECIFIC WARNING / INSTRUCTION (W/WP-series only)

Servicing a Unit with an A2L Refrigerant

1. Work procedure

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

2. General work area

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

3. Checking for presence of refrigerant

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

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

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

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

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

5. Presence of fire extinguisher

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

6. No ignition sources

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

6. Ventilation of area

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

7. Checks of the refrigeration equipment

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

go to TABLE OF CONTENTS

A2L-SPECIFIC WARNING / INSTRUCTION (W/WP-series only)

Servicing a Unit with an A2L Refrigerant (continued)

8. Checks to electrical devices & wiring

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

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

Initial safety checks should include:

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

9. Refrigerant removal and circuit evacuation

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

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

10. Charging

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

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

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

go to TABLE OF CONTENTS

Pumpdown Procedure

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

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

General Repair Procedure

1. Perform repairs to system.

    - Always ensure nitrogen is flowing through the system at the lowest flow rate that can be felt at the discharge during any brazing procedures to prevent soot buildup inside the pipes.
    - It is recommended to replace the liquid line filter-dryer any time the refrigeration system has been exposed to the atmosphere.
    - Place a wet rag around any valves being installed, as almost all valve types have non-metallic seats or seals that will be damaged by excessive heat, and aim the torch flame away from the valve body. Solder only one joint at a time and cool joints down in between.

2. Pressure test the system with nitrogen. It is recommended to check for leaks using leak detection spray, Spray Nine, or soapy water. Check at 10, 25, 50 and 100 psig. Allow the system to sit at 100 psig for at least an hour, then re-check. With a laptop connected, the **PC App** may be used to graph the nitrogen pressure (**Graphs** menu--> **Refrigeration Pressure and Temperature Graphs**) to make any downward trend due to a leak apparent. Be aware that changing room temperature can also cause upward or downward trends in nitrogen pressure.

Vacuuming & Charging Procedure

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

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

go to TABLE OF CONTENTS

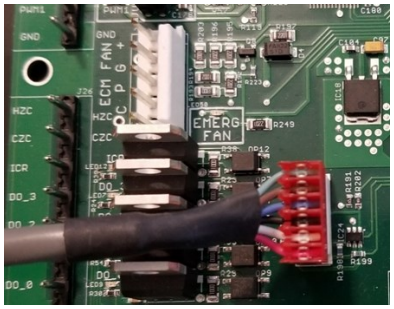
Compressor Replacement Procedure

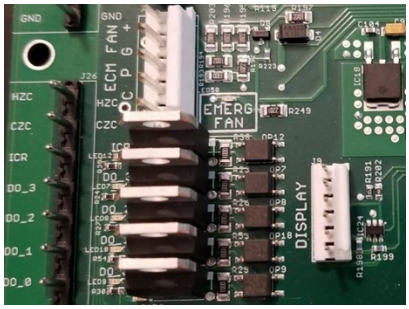
1. Pump down the unit as per the Pumpdown Procedure above. **If there was a compressor burn out (motor failure), the refrigerant cannot be reused and must be disposed of according to local codes**.
2. Disconnect piping.
3. Replace the compressor. Replace the liquid line filter-dryer. Always ensure nitrogen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

go to TABLE OF CONTENTS

Control Board Replacement Procedure

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





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

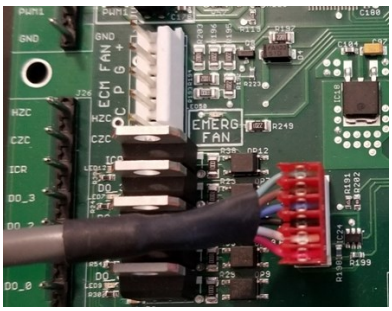
    Note that the connector with the resistor (no cable) goes on **CTS**.
    Note that the connector to the left of **CTS** is marked **HTS** on older boards, and **ODTS** on newer boards.

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

go to TABLE OF CONTENTS

LCD Interface (Display) Board Replacement Procedure

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



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

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

go to TABLE OF CONTENTS

Decommissioning

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

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

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

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

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

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

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

go to TABLE OF CONTENTS

Model Specific Information: W-Series

Table 24 - W-Series Refrigerant Charge				
MODEL	lb	*kg*	TYPE	OIL
W-25	4.0	*1.8*	R454b	POE
W-45	5.5	*2.5*	R454b	POE
W-55	7.0	*3.2*	R454b	POE
W-65	8.5	*3.9*	R454b	POE
W-75	9.0	*4.1*	R454b	POE
W-80	10.0	*4.5*	R454b	POE

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

Table 25 - W-Series Shipping Information				
MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
W-25	305 (138)	34 (86)	34 (86)	35 (89)
W-45	330 (150)	34 (86)	34 (86)	35 (89)
W-55	390 (177)	34 (86)	34 (86)	35 (89)
W-65	490 (222)	45 (114)	37 (94)	37 (94)
W-75	540 (245)	45 (114)	37 (94)	37 (94)
W-80	590 (268)	45 (114)	37 (94)	37 (94)

Table 26 - W-Series Operating Temperature Limits					
Loop	Mode	Parameter	(°F)	*(°C)*	Note
Indoor	Heating	Minimum EWT	50	*10*	Reduce flow if necessary during startup.
	Heating	Maximum LWT	120	*49*	
	Cooling	Minimum LWT	41	*5*	Water system (no antifreeze).
	Cooling	Minimum LLT	32	*0*	Antifreeze system. Adequate freeze protection required.
	Cooling	Maximum EWT	80	*27*	
Outdoor	Heating	Minimum ELT	39	*4*	Ground water (open loop) system.
	Heating	Minimum ELT	23	*-5*	Ground loop system. Adequate freeze protection required.
	Cooling	Minimum ELT	39	*4*	Ground water (open loop) system.
	Cooling	Minimum ELT	32	*0*	Ground loop system. Adequate freeze protection required.
	Cooling	Maximum LLT	120	*49*	

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

Table 27 - W-Series Required Indoor & Outdoor Loop Flow Rates		
MODEL	gpm	*L/s*
W-25	8	*0.50*
W-45	10	*0.63*
W-55	12	*0.76*
W-65	14	*0.88*
W-75	16	*1.0*
W-80	17	*1.1*

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

Table 28 - W-Series Sound Levels (dBA)*		
MODEL	1 ft distance	3 ft distance
W-25	57.1	55.8
W-45	57.2	56.0
W-55	56.4	54.9
W-65	55.7	53.0
W-75	55.7	53.0
W-80	55.7	53.0

* With all doors installed.

go to TABLE OF CONTENTS

Table 29: W-Series Pressure Drop Data

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

go to TABLE OF CONTENTS

Table 29: W-Series Pressure Drop Data (cont'd)

			INDOOR (water 104°F)		OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% prop. glycol 32°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*	psi	*kPa*	psi	*kPa*
W-65	8	*0.50*	1.8	*12*	1.9	*13*	2.2	*15*	2.9	*20*
	9	*0.57*	2.1	*14*	2.3	*16*	2.7	*19*	3.6	*24*
	10	*0.63*	2.4	*17*	2.6	*18*	3.3	*23*	4.3	*30*
	11	*0.69*	2.9	*20*	3.2	*22*	4	*28*	5.3	*36*
	12	*0.76*	3.6	*25*	3.9	*27*	4.6	*32*	6.0	*42*
	13	*0.82*	4.1	*28*	4.4	*30*	5.2	*36*	6.8	*47*
	14	***0.88***	**4.7**	***32***	**5**	***34***	**5.8**	***40***	**7.6**	***53***
	15	*0.95*	5.5	*38*	5.7	*39*	6.5	*45*	8.5	*59*
	16	*1.01*	6.3	*43*	6.5	*45*	7.3	*50*	9.6	*66*
W-75	8	*0.50*	1.2	*8.3*	1.3	*9.0*	1.3	*9.0*	1.7	*12*
	9	*0.57*	1.5	*10*	1.6	*11*	1.6	*11*	2.1	*14*
	10	*0.63*	1.8	*12*	1.9	*13*	2.1	*14*	2.8	*19*
	11	*0.69*	2.1	*14*	2.3	*16*	2.4	*17*	3.2	*22*
	12	*0.76*	2.4	*17*	2.6	*18*	2.9	*20*	3.8	*26*
	13	*0.82*	2.8	*19*	3.0	*21*	3.3	*23*	4.3	*30*
	14	*0.88*	2.9	*20*	3.2	*22*	3.7	*26*	4.9	*33*
	15	*0.95*	3.2	*22*	3.5	*24*	4.1	*28*	5.4	*37*
	16	***1.01***	**3.8**	***26***	**4.0**	***28***	**4.7**	***32***	**6.2**	***43***
	17	*1.07*	4.2	*29*	4.4	*30*	5.2	*36*	6.8	*47*
W-80	9	*0.57*	1.2	*8.3*	1.3	*9.0*	1.4	*10*	1.8	*13*
	10	*0.63*	1.5	*10*	1.6	*11*	1.7	*12*	2.2	*15*
	11	*0.69*	1.8	*12*	1.9	*13*	2.2	*15*	2.9	*20*
	12	*0.76*	2.2	*15*	2.4	*17*	2.6	*18*	3.4	*24*
	13	*0.82*	2.5	*17*	2.7	*19*	3.1	*21*	4.1	*28*
	14	*0.88*	2.9	*20*	3.1	*21*	3.5	*24*	4.6	*32*
	15	*0.95*	3.1	*21*	3.3	*23*	3.8	*26*	5.0	*34*
	16	*1.01*	3.3	*23*	3.6	*25*	4.1	*28*	5.4	*37*
	17	***1.07***	**3.7**	***26***	**4.1**	***28***	**4.6**	***32***	**6.0**	***42***
	18	*1.14*	4.2	*29*	4.5	*31*	4.9	*34*	6.4	*44*

go to TABLE OF CONTENTS

W-series: Standard Capacity Ratings - Closed Loop

Standards ARI/ISO/CSA 13256-2

Table 30 - Standard Capacity Ratings - Ground Loop Heating*							60Hz
EWT 104°F (40°C)		*15% Methanol by Weight Ground Loop Fluid			STAGE 1 - ELT 41°F (5°C) STAGE 2 - ELT 32°F (0°C)		
Model	Liquid Flow (Outdoor & Indoor)		Mode	Input Energy	Capacity		COP_H
	gpm	*L/s*		Watts	Btu/hr	*kW*	W/W
W-25	8.0	*0.50*	Stage 1	1,237	13,300	3.9	3.15
			Stage 2	1,566	16,300	4.8	3.05
W-45	10.0	*0.63*	Stage 1	1,720	17,900	5.2	3.05
			Stage 2	2,303	24,000	7.0	3.05
W-55	12.0	*0.76*	Stage 1	2,498	26,000	7.6	3.05
			Stage 2	3,140	32,700	9.6	3.05
W-65	14.0	*0.88*	Stage 1	3,094	32,200	9.4	3.05
			Stage 2	3,867	40,200	11.8	3.05
W-75	16.0	*1.0*	Stage 1	3,610	38,800	11.4	3.15
			Stage 2	4,450	46,300	13.6	3.05
W-80	17.0	*1.1*	(Stage 2)	5,310	54,300	15.9	3.00

Table 31 - Standard Capacity Ratings - Ground Loop Cooling*								60Hz
EWT 53.6°F (12°C)		*15% Methanol by Weight Ground Loop Fluid				STAGE 1 - ELT 68°F (20°C) STAGE 2 - ELT 77°F (25°C)		
Model	Liquid Flow (Outdoor & Indoor)		Mode	Input Energy	Capacity		COP_C	EER
	gpm	*L/s*		Watts	Btu/hr	*kW*	W/W	Btu/hr/W
W-25	8.0	*0.50*	Stage 1	897	16,500	4.8	5.39	18.4
			Stage 2	1,403	20,200	5.9	4.22	14.4
W-45	10.0	*0.63*	Stage 1	1,163	22,100	6.5	5.57	19.0
			Stage 2	2,021	29,300	8.6	4.25	14.5
W-55	12.0	*0.76*	Stage 1	1,561	30,300	8.9	5.69	19.4
			Stage 2	2,604	38,800	11.4	4.37	14.9
W-65	14.0	*0.88*	Stage 1	1,910	37,600	11.0	5.77	19.7
			Stage 2	3,202	47,700	14.0	4.37	14.9
W-75	16.0	*1.0*	Stage 1	2,451	43,900	12.9	5.25	17.9
			Stage 2	3,634	53,800	15.8	4.34	14.8
W-80	17.0	*1.1*	(Stage 2)	4,272	62,300	18.3	4.27	14.6

go to TABLE OF CONTENTS

W-series: Standard Capacity Ratings - Open Loop

Standards ARI/ISO/CSA 13256-2

Table 32 - Standard Capacity Ratings - Ground Water Heating							60Hz
EWT 104°F (40°C)							ELT 50°F (10°C)
Model	Liquid Flow (Outdoor & Indoor)		Mode	Input Energy	Capacity		COP_H
	gpm	*L/s*		Watts	Btu/hr	*kW*	W/W
W-25	**8.0**	***0.50***	**Stage 1**	1,256	**16,200**	**4.7**	**3.78**
			Stage 2	1,685	**22,300**	**6.5**	**3.88**
W-45	**10.0**	***0.63***	**Stage 1**	1,792	**22,500**	**6.6**	**3.68**
			Stage 2	2,436	**33,100**	**9.7**	**3.98**
W-55	**12.0**	***0.76***	**Stage 1**	2,394	**31,700**	**9.3**	**3.88**
			Stage 2	3,445	**44,400**	**13.0**	**3.78**
W-65	**14.0**	***0.88***	**Stage 1**	3,090	**38,800**	**11.4**	**3.68**
			Stage 2	4,206	**54,200**	**15.9**	**3.78**
W-75	**16.0**	***1.0***	**Stage 1**	3,660	**47,200**	**13.8**	**3.78**
			Stage 2	4,691	**63,700**	**18.7**	**3.98**
W-80	**17.0**	***1.1***	(Stage 2)	5,731	**74,000**	**21.7**	**3.78**

Table 33 - Standard Capacity Ratings - Ground Water Cooling									60Hz
EWT 53.6°F (12°C)									ELT 59°F (15°C)
Model	Liquid Flow (Outdoor & Indoor)		Mode	Input Energy	Capacity		COP_C	EER	
	gpm	*L/s*		Watts	Btu/hr	*kW*	W/W	Btu/hr/W	
W-25	**8.0**	***0.50***	**Stage 1**	656	**16,800**	**4.9**	**7.50**	**25.6**	
			Stage 2	1,043	**22,000**	**6.4**	**6.18**	**21.1**	
W-45	**10.0**	***0.63***	**Stage 1**	935	**23,300**	**6.8**	**7.30**	**24.9**	
			Stage 2	1,575	**32,300**	**9.5**	**6.01**	**20.5**	
W-55	**12.0**	***0.76***	**Stage 1**	1,298	**32,200**	**9.4**	**7.27**	**24.8**	
			Stage 2	2,058	**42,400**	**12.4**	**6.04**	**20.6**	
W-65	**14.0**	***0.88***	**Stage 1**	1,660	**39,200**	**11.5**	**6.92**	**23.6**	
			Stage 2	2,561	**52,000**	**15.2**	**5.95**	**20.3**	
W-75	**16.0**	***1.0***	**Stage 1**	2,003	**47,300**	**13.9**	**6.92**	**23.6**	
			Stage 2	2,930	**59,200**	**17.4**	**5.92**	**20.2**	
W-80	**17.0**	***1.1***	(Stage 2)	3,457	**67,400**	**19.8**	**5.71**	**19.5**	

go to TABLE OF CONTENTS

Performance Tables - W-Series (US UNITS)

W-25-HACW-X-1T *R454b, 60 Hz, YAS20K1E-PFV*

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	18	8	23	-2.4	9,500	6.3	1,521	104	112	8	108	3.6	**14,500**	**2.79**
	30	23	8	27	-2.7	10,700	6.4	1,552		112	8	108	4.0	**15,800**	**2.98**
	35	28	8	32	-3.1	12,000	6.6	1,585		113	8	108	4.3	**17,200**	**3.18**
	40	33	8	37	-3.5	13,500	6.7	1,618		113	8	109	4.7	**18,800**	**3.41**
	45	37	8	41	-3.8	15,000	6.9	1,653		114	8	109	5.1	**20,400**	**3.62**
	50	42	8	46	-4.3	16,800	7.1	1,685		114	8	110	5.6	**22,300**	**3.88**
	55	47	8	50	-4.8	18,600	7.2	1,715		115	8	110	6.1	**24,300**	**4.15**
	60	51	8	55	-5.3	20,600	7.4	1,748		116	8	111	6.6	**26,400**	**4.43**
	65	56	8	59	-5.9	22,900	7.5	1,776		116	8	111	7.2	**28,800**	**4.75**
	70	61	8	64	-6.5	25,200	7.6	1,802		117	8	112	7.8	**31,200**	**5.07**
	25	19	8	23	-2.2	8,600	7.2	1,717	116.4	124	8	120	3.6	**14,200**	**2.42**
	30	24	8	28	-2.5	9,800	7.3	1,734	116.1	124	8		3.9	**15,500**	**2.62**
	35	29	8	32	-2.8	11,100	7.4	1,754	115.8	124	8		4.2	**16,900**	**2.82**
	40	33	8	37	-3.2	12,500	7.5	1,772	115.4	124	8		4.6	**18,300**	**3.03**
	45	38	8	41	-3.6	14,000	7.6	1,794	115.0	124	8		5.0	**19,900**	**3.25**
	50	43	8	46	-4.0	15,600	7.7	1,812	114.6	124	8		5.4	**21,600**	**3.49**
	55	47	8	51	-4.5	17,400	7.7	1,829	114.1	124	8		5.9	**23,400**	**3.75**
	60	52	8	55	-5.0	19,400	7.8	1,849	113.6	125	8		6.4	**25,500**	**4.04**
	65	57	8	60	-5.5	21,500	7.9	1,864	113.0	125	8		7.0	**27,700**	**4.36**
	70	61	8	64	-6.1	23,800	8.0	1,880	112.4	125	8		7.6	**30,000**	**4.68**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING	50	67	8	57	6.6	**25,900**	3.4	847	54	41	8	48	-5.8	23,100	**27.3**
	55	72	8	62	6.6	**25,700**	3.9	958		42	8	48	-5.7	22,500	**23.5**
	60	77	8	67	6.5	**25,400**	4.4	1,064		42	8	48	-5.5	21,900	**20.6**
	65	82	8	72	6.5	**25,300**	4.8	1,165		43	8	48	-5.4	21,400	**18.4**
	70	87	8	77	6.5	**25,100**	5.2	1,265		43	8	48	-5.3	20,900	**16.5**
	75	92	8	81	6.4	**24,900**	5.7	1,363		44	8	49	-5.1	20,400	**15.0**
	80	97	8	86	6.4	**24,800**	6.1	1,463		44	8	49	-5.0	19,900	**13.6**
	85	102	8	91	6.4	**24,700**	6.5	1,566		45	8	49	-4.9	19,500	**12.5**
	90	107	8	96	6.4	**24,600**	7.0	1,673		45	8	49	-4.8	19,000	**11.4**
	95	112	8	101	6.4	**24,600**	7.5	1,787		46	8	49	-4.7	18,600	**10.4**

go to TABLE OF CONTENTS

Performance Tables - W-Series (METRIC UNITS)

W-25-HACW-X-1T *R454b, 60 Hz, YAS20K1E-PFV*

METRIC

OUTDOOR LOOP (15% Methanol)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-7.6	0.51	-5.2	-1.3	2.8	6.3	1,521	40	44.3	0.51	42.0	2.0	**4.3**	**2.79**
-1.1	-4.9	0.51	-2.6	-1.5	3.1	6.4	1,552		44.6	0.51	42.2	2.2	**4.6**	**2.98**
1.7	-2.3	0.51	0.0	-1.7	3.5	6.6	1,585		44.9	0.51	42.4	2.4	**5.0**	**3.18**
4.4	0.3	0.51	2.5	-1.9	4.0	6.7	1,618		45.2	0.51	42.6	2.6	**5.5**	**3.41**
7.2	2.9	0.51	5.1	-2.1	4.4	6.9	1,653		45.5	0.51	42.8	2.8	**6.0**	**3.62**
10.0	5.6	0.51	7.6	-2.4	4.9	7.1	1,685		45.8	0.51	43.1	3.1	**6.5**	**3.88**
12.8	8.2	0.51	10.1	-2.7	5.5	7.2	1,715		46.1	0.51	43.4	3.4	**7.1**	**4.15**
15.6	10.8	0.51	12.7	-2.9	6.0	7.4	1,748		46.4	0.51	43.7	3.7	**7.7**	**4.43**
18.3	13.4	0.51	15.0	-3.3	6.7	7.5	1,776		46.7	0.51	44.0	4.0	**8.4**	**4.75**
21.1	16.1	0.51	17.5	-3.6	7.4	7.6	1,802		46.9	0.51	44.3	4.3	**9.1**	**5.07**
-3.9	-7.1	0.51	-5.1	-1.2	2.5	7.2	1,717	46.9	50.8	0.51	49	2.0	**4.2**	**2.42**
-1.1	-4.5	0.51	-2.5	-1.4	2.9	7.3	1,734	46.7	50.9	0.51		2.2	**4.5**	**2.62**
1.7	-1.9	0.51	0.1	-1.6	3.3	7.4	1,754	46.6	51.0	0.51		2.3	**5.0**	**2.82**
4.4	0.7	0.51	2.6	-1.8	3.7	7.5	1,772	46.3	51.1	0.51		2.6	**5.4**	**3.03**
7.2	3.3	0.51	5.2	-2.0	4.1	7.6	1,794	46.1	51.2	0.51		2.8	**5.8**	**3.25**
10.0	5.9	0.51	7.8	-2.2	4.6	7.7	1,812	45.9	51.2	0.51		3.0	**6.3**	**3.49**
12.8	8.5	0.51	10.3	-2.5	5.1	7.7	1,829	45.6	51.3	0.51		3.3	**6.9**	**3.75**
15.6	11.1	0.51	12.8	-2.8	5.7	7.8	1,849	45.3	51.4	0.51		3.6	**7.5**	**4.04**
18.3	13.7	0.51	15.2	-3.1	6.3	7.9	1,864	45.0	51.4	0.51		3.9	**8.1**	**4.36**
21.1	16.3	0.51	17.7	-3.4	7.0	8.0	1,880	44.7	51.6	0.51		4.2	**8.8**	**4.68**

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0	19.4	0.51	13.7	3.7	**7.59**	3.4	847	12	5.0	0.51	8.8	-3.2	6.77	**8.00**
12.8	22.2	0.51	16.5	3.7	**7.53**	3.9	958		5.3	0.51	8.8	-3.2	6.59	**6.89**
15.6	25.0	0.51	19.2	3.6	**7.44**	4.4	1,064		5.6	0.51	8.9	-3.1	6.42	**6.04**
18.3	27.8	0.51	21.9	3.6	**7.41**	4.8	1,165		5.9	0.51	9.0	-3.0	6.27	**5.39**
21.1	30.6	0.51	24.7	3.6	**7.36**	5.2	1,265		6.2	0.51	9.1	-2.9	6.13	**4.84**
23.9	33.3	0.51	27.5	3.6	**7.30**	5.7	1,363		6.6	0.51	9.2	-2.8	5.98	**4.40**
26.7	36.1	0.51	30.3	3.6	**7.27**	6.1	1,463		6.8	0.51	9.2	-2.8	5.83	**3.99**
29.4	38.9	0.51	33.0	3.6	**7.24**	6.5	1,566		7.2	0.51	9.3	-2.7	5.71	**3.66**
32.2	41.7	0.51	35.8	3.6	**7.21**	7.0	1,673		7.4	0.51	9.3	-2.7	5.57	**3.34**
35.0	44.4	0.51	38.6	3.6	**7.21**	7.5	1,787		7.8	0.51	9.4	-2.6	5.45	**3.05**

go to TABLE OF CONTENTS

Performance Tables - W-Series (US UNITS)

W-45-HACW-X-1T *R454b, 60 Hz, YAS30K1E-PFV*

HEATING

OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
25	14	10	22	-2.8	13,700	9.4	2,247	104	112	10	108	4.2	**21,100**	**2.75**
30	19	10	27	-3.2	15,600	9.6	2,288		113	10	109	4.6	**23,200**	**2.97**
35	24	10	31	-3.6	17,600	9.8	2,325		113	10	109	5.1	**25,300**	**3.19**
40	29	10	36	-4.1	19,900	10.0	2,364		114	10	110	5.6	**27,800**	**3.45**
45	33	10	40	-4.6	22,300	10.2	2,399		114	10	110	6.1	**30,300**	**3.70**
50	38	10	45	-5.1	25,000	10.4	2,436		115	10	111	6.6	**33,100**	**3.98**
55	43	10	49	-5.7	27,800	10.6	2,474		116	10	111	7.2	**36,100**	**4.28**
60	47	10	54	-6.4	31,000	10.8	2,509		116	10	112	7.9	**39,400**	**4.60**
65	52	10	58	-7.1	34,400	11.0	2,546		117	10	113	8.6	**42,900**	**4.94**
70	57	10	62	-7.9	38,100	11.1	2,581		117	10	113	9.4	**46,800**	**5.31**
25	15	10	23	-2.5	12,500	10.6	2,518	115.8	123	10	120	4.2	**20,900**	**2.43**
30	20	10	27	-2.9	14,300	10.8	2,543	115.4	123	10		4.6	**22,800**	**2.63**
35	25	10	32	-3.3	16,300	10.9	2,571	115.0	123	10		5.0	**24,900**	**2.84**
40	29	10	36	-3.8	18,500	11.0	2,592	114.6	123	10		5.4	**27,100**	**3.06**
45	34	10	41	-4.3	20,800	11.1	2,615	114.1	124	10		5.9	**29,500**	**3.31**
50	39	10	45	-4.8	23,400	11.3	2,634	113.5	124	10		6.5	**32,200**	**3.58**
55	43	10	50	-5.4	26,200	11.4	2,651	112.9	124	10		7.1	**35,100**	**3.88**
60	48	10	54	-6.0	29,200	11.5	2,673	112.3	124	10		7.7	**38,200**	**4.19**
65	53	10	58	-6.7	32,600	11.6	2,689	111.6	124	10		8.4	**41,600**	**4.53**
70	57	10	63	-7.5	36,200	11.7	2,708	110.9	124	10		9.1	**45,300**	**4.90**

COOLING

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
50	70	10	58	7.9	**38,400**	5.9	1,391	54	38	10	47	-6.8	33,800	**24.3**
55	75	10	63	7.8	**37,900**	6.3	1,491		38	10	47	-6.6	33,000	**22.1**
60	80	10	68	7.7	**37,400**	6.8	1,597		39	10	47	-6.4	32,100	**20.1**
65	85	10	73	7.6	**36,900**	7.3	1,711		39	10	47	-6.3	31,300	**18.3**
70	90	10	78	7.5	**36,600**	7.8	1,834		40	10	48	-6.1	30,500	**16.6**
75	95	10	83	7.5	**36,100**	8.4	1,966		40	10	48	-5.9	29,600	**15.1**
80	100	10	87	7.4	**35,800**	9.0	2,107		41	10	48	-5.8	28,800	**13.7**
85	105	10	92	7.3	**35,400**	9.6	2,262		41	10	48	-5.6	27,900	**12.3**
90	110	10	97	7.3	**35,100**	10.3	2,427		42	10	48	-5.4	27,000	**11.1**
95	115	10	102	7.2	**34,800**	11.1	2,610		43	10	48	-5.2	26,100	**10.0**

go to TABLE OF CONTENTS

Performance Tables - W-Series (METRIC UNITS)

W-45-HACW-X-1T *R454b, 60 Hz, YAS30K1E-PFV*

METRIC

HEATING

OUTDOOR LOOP (15% Methanol)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-9.8	0.63	-5.5	-1.6	4.0	9.4	2,247	40	44.6	0.63	42.3	2.3	**6.2**	**2.75**
-1.1	-7.2	0.63	-2.9	-1.8	4.6	9.6	2,288		44.9	0.63	42.6	2.6	**6.8**	**2.97**
1.7	-4.6	0.63	-0.3	-2.0	5.2	9.8	2,325		45.2	0.63	42.8	2.8	**7.4**	**3.19**
4.4	-1.9	0.63	2.1	-2.3	5.8	10.0	2,364		45.5	0.63	43.1	3.1	**8.2**	**3.45**
7.2	0.7	0.63	4.6	-2.6	6.5	10.2	2,399		45.8	0.63	43.4	3.4	**8.9**	**3.70**
10.0	3.3	0.63	7.2	-2.8	7.3	10.4	2,436		46.1	0.63	43.7	3.7	**9.7**	**3.98**
12.8	5.9	0.63	9.6	-3.2	8.1	10.6	2,474		46.4	0.63	44.0	4.0	**10.6**	**4.28**
15.6	8.6	0.63	12.0	-3.6	9.1	10.8	2,509		46.7	0.63	44.4	4.4	**11.5**	**4.60**
18.3	11.2	0.63	14.4	-3.9	10.1	11.0	2,546		47.1	0.63	44.8	4.8	**12.6**	**4.94**
21.1	13.8	0.63	16.7	-4.4	11.2	11.1	2,581		47.3	0.63	45.2	5.2	**13.7**	**5.31**
-3.9	-9.3	0.63	-5.3	-1.4	3.7	10.6	2,518	46.6	50.5	0.63	49	2.3	**6.1**	**2.43**
-1.1	-6.7	0.63	-2.7	-1.6	4.2	10.8	2,543	46.3	50.6	0.63		2.6	**6.7**	**2.63**
1.7	-4.1	0.63	-0.1	-1.8	4.8	10.9	2,571	46.1	50.7	0.63		2.8	**7.3**	**2.84**
4.4	-1.5	0.63	2.3	-2.1	5.4	11.0	2,592	45.9	50.7	0.63		3.0	**7.9**	**3.06**
7.2	1.1	0.63	4.8	-2.4	6.1	11.1	2,615	45.6	50.8	0.63		3.3	**8.7**	**3.31**
10.0	3.7	0.63	7.3	-2.7	6.9	11.3	2,634	45.3	50.9	0.63		3.6	**9.4**	**3.58**
12.8	6.3	0.63	9.8	-3.0	7.7	11.4	2,651	44.9	50.9	0.63		3.9	**10.3**	**3.88**
15.6	8.8	0.63	12.3	-3.3	8.6	11.5	2,673	44.6	51.1	0.63		4.3	**11.2**	**4.19**
18.3	11.4	0.63	14.6	-3.7	9.6	11.6	2,689	44.2	51.1	0.63		4.7	**12.2**	**4.53**
21.1	14.1	0.63	16.9	-4.2	10.6	11.7	2,708	43.8	51.2	0.63		5.1	**13.3**	**4.90**

COOLING

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0	20.9	0.63	14.4	4.4	**11.30**	5.9	1,391	12	3.1	0.63	8.2	-3.8	9.91	**7.12**
12.8	23.8	0.63	17.1	4.3	**11.10**	6.3	1,491		3.4	0.63	8.3	-3.7	9.67	**6.48**
15.6	26.6	0.63	19.9	4.3	**11.00**	6.8	1,597		3.7	0.63	8.4	-3.6	9.41	**5.89**
18.3	29.4	0.63	22.5	4.2	**10.80**	7.3	1,711		4.0	0.63	8.5	-3.5	9.17	**5.36**
21.1	32.2	0.63	25.3	4.2	**10.70**	7.8	1,834		4.3	0.63	8.6	-3.4	8.94	**4.86**
23.9	35.0	0.63	28.1	4.2	**10.60**	8.4	1,966		4.6	0.63	8.7	-3.3	8.67	**4.43**
26.7	37.8	0.63	30.8	4.1	**10.50**	9.0	2,107		4.9	0.63	8.8	-3.2	8.44	**4.02**
29.4	40.6	0.63	33.5	4.1	**10.40**	9.6	2,262		5.2	0.63	8.9	-3.1	8.18	**3.60**
32.2	43.4	0.63	36.3	4.1	**10.30**	10.3	2,427		5.5	0.63	9.0	-3.0	7.91	**3.25**
35.0	46.2	0.63	39.0	4.0	**10.20**	11.1	2,610		5.8	0.63	9.1	-2.9	7.65	**2.93**

go to TABLE OF CONTENTS

Performance Tables - W-Series (US UNITS)

W-55-HACW-X-1T *R454b, 60 Hz, YAS40K1E-PFV*

HEATING

OUTDOOR LOOP (15% Methanol)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
25	14	12	22	-3.2	18,900	12.9	3,012	104	115	12	109	4.8	**28,900**	**2.81**
30	19	12	26	-3.6	21,200	13.2	3,106		116	12	109	5.3	**31,500**	**2.97**
35	24	12	31	-4.1	23,800	13.6	3,192		116	12	110	5.7	**34,400**	**3.16**
40	29	12	36	-4.5	26,600	14.0	3,279		117	12	110	6.3	**37,500**	**3.35**
45	33	12	40	-5.1	29,700	14.4	3,360		117	12	111	6.8	**40,900**	**3.57**
50	38	12	44	-5.6	32,900	14.8	3,445		118	12	111	7.4	**44,400**	**3.78**
55	43	12	49	-6.2	36,300	15.3	3,530		119	12	112	8.0	**48,100**	**3.99**
60	47	12	53	-6.9	40,000	15.7	3,611		119	12	113	8.7	**52,100**	**4.23**
65	52	12	57	-7.6	44,000	16.1	3,699		120	12	113	9.4	**56,400**	**4.47**
70	57	12	62	-8.3	48,200	16.6	3,787		120	12	114	10.2	**60,900**	**4.71**
25	15	12	22	-2.9	17,200	14.6	3,388	115.2	125	12	120	4.8	**28,500**	**2.47**
30	20	12	27	-3.3	19,400	14.9	3,459	114.8	125	12		5.2	**30,900**	**2.62**
35	25	12	31	-3.7	21,900	15.1	3,529	114.4	125	12		5.6	**33,700**	**2.80**
40	29	12	36	-4.2	24,600	15.3	3,589	113.9	125	12		6.1	**36,600**	**2.99**
45	34	12	40	-4.7	27,500	15.6	3,652	113.3	126	12		6.7	**39,700**	**3.19**
50	39	12	45	-5.2	30,700	15.9	3,706	112.8	126	12		7.2	**43,100**	**3.41**
55	43	12	49	-5.8	34,100	16.1	3,758	112.2	126	12		7.8	**46,700**	**3.64**
60	48	12	54	-6.5	37,800	16.4	3,816	111.5	126	12		8.5	**50,600**	**3.89**
65	53	12	58	-7.2	41,700	16.7	3,867	110.8	126	12		9.2	**54,700**	**4.15**
70	57	12	62	-7.9	45,900	17.1	3,928	110.1	126	12		9.9	**59,100**	**4.41**

COOLING

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
50	72	12	59	8.6	**50,300**	8.2	1,874	54	38	12	46	-7.4	44,100	**23.5**
55	77	12	64	8.5	**49,700**	8.8	1,970		38	12	46	-7.2	43,200	**21.9**
60	82	12	68	8.4	**49,100**	9.4	2,083		39	12	47	-7.0	42,200	**20.3**
65	87	12	73	8.3	**48,500**	10.0	2,213		39	12	47	-6.9	41,200	**18.6**
70	91	12	78	8.3	**48,100**	10.6	2,363		40	12	47	-6.7	40,300	**17.1**
75	96	12	83	8.2	**47,600**	11.3	2,531		40	12	47	-6.5	39,200	**15.5**
80	101	12	88	8.1	**47,200**	12.0	2,719		41	12	47	-6.4	38,200	**14.0**
85	106	12	93	8.1	**46,800**	12.8	2,921		41	12	47	-6.2	37,100	**12.7**
90	110	12	98	8.0	**46,500**	13.7	3,145		42	12	48	-6.0	36,000	**11.4**
95	115	12	103	8.0	**46,200**	14.6	3,387		42	12	48	-5.8	34,900	**10.3**

go to TABLE OF CONTENTS

Performance Tables - W-Series (METRIC UNITS)

W-55-HACW-X-1T *R454b, 60 Hz, YAS40K1E-PFV*

METRIC

HEATING

OUTDOOR LOOP (15% Methanol)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-9.8	0.76	-5.7	-1.8	5.5	12.9	3,012	40	46.2	0.76	42.7	2.7	**8.5**	**2.81**
-1.1	-7.2	0.76	-3.1	-2.0	6.2	13.2	3,106		46.6	0.76	42.9	2.9	**9.2**	**2.97**
1.7	-4.6	0.76	-0.6	-2.3	7.0	13.6	3,192		46.8	0.76	43.2	3.2	**10.1**	**3.16**
4.4	-1.9	0.76	1.9	-2.5	7.8	14.0	3,279		47.2	0.76	43.5	3.5	**11.0**	**3.35**
7.2	0.7	0.76	4.4	-2.8	8.7	14.4	3,360		47.4	0.76	43.8	3.8	**12.0**	**3.57**
10.0	3.3	0.76	6.9	-3.1	9.6	14.8	3,445		47.8	0.76	44.1	4.1	**13.0**	**3.78**
12.8	5.9	0.76	9.4	-3.4	10.6	15.3	3,530		48.1	0.76	44.4	4.4	**14.1**	**3.99**
15.6	8.6	0.76	11.8	-3.8	11.7	15.7	3,611		48.4	0.76	44.8	4.8	**15.3**	**4.23**
18.3	11.2	0.76	14.1	-4.2	12.9	16.1	3,699		48.7	0.76	45.2	5.2	**16.5**	**4.47**
21.1	13.8	0.76	16.5	-4.6	14.1	16.6	3,787		49.0	0.76	45.7	5.7	**17.8**	**4.71**
-3.9	-9.3	0.76	-5.5	-1.6	5.0	14.6	3,388	46.2	51.7	0.76	49	2.7	**8.4**	**2.47**
-1.1	-6.7	0.76	-2.9	-1.8	5.7	14.9	3,459	46.0	51.7	0.76		2.9	**9.1**	**2.62**
1.7	-4.1	0.76	-0.4	-2.1	6.4	15.1	3,529	45.8	51.8	0.76		3.1	**9.9**	**2.80**
4.4	-1.5	0.76	2.1	-2.3	7.2	15.3	3,589	45.5	51.9	0.76		3.4	**10.7**	**2.99**
7.2	1.1	0.76	4.6	-2.6	8.1	15.6	3,652	45.2	52.0	0.76		3.7	**11.6**	**3.19**
10.0	3.7	0.76	7.1	-2.9	9.0	15.9	3,706	44.9	52.1	0.76		4.0	**12.6**	**3.41**
12.8	6.3	0.76	9.6	-3.2	10.0	16.1	3,758	44.6	52.1	0.76		4.3	**13.7**	**3.64**
15.6	8.8	0.76	12.0	-3.6	11.1	16.4	3,816	44.2	52.2	0.76		4.7	**14.8**	**3.89**
18.3	11.4	0.76	14.3	-4.0	12.2	16.7	3,867	43.8	52.3	0.76		5.1	**16.0**	**4.15**
21.1	14.1	0.76	16.7	-4.4	13.5	17.1	3,928	43.4	52.4	0.76		5.5	**17.3**	**4.41**

COOLING

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0	22.3	0.76	14.8	4.8	**14.70**	8.2	1,874	12	3.1	0.76	7.9	-4.1	12.90	**6.89**
12.8	25.0	0.76	17.5	4.7	**14.60**	8.8	1,970		3.3	0.76	8.0	-4.0	12.70	**6.42**
15.6	27.7	0.76	20.3	4.7	**14.40**	9.4	2,083		3.6	0.76	8.1	-3.9	12.40	**5.95**
18.3	30.3	0.76	22.9	4.6	**14.20**	10.0	2,213		3.9	0.76	8.2	-3.8	12.10	**5.45**
21.1	32.9	0.76	25.7	4.6	**14.10**	10.6	2,363		4.2	0.76	8.3	-3.7	11.80	**5.01**
23.9	35.6	0.76	28.5	4.6	**14.00**	11.3	2,531		4.5	0.76	8.4	-3.6	11.50	**4.54**
26.7	38.3	0.76	31.2	4.5	**13.80**	12.0	2,719		4.8	0.76	8.4	-3.6	11.20	**4.10**
29.4	40.9	0.76	33.9	4.5	**13.70**	12.8	2,921		5.1	0.76	8.6	-3.4	10.90	**3.72**
32.2	43.6	0.76	36.6	4.4	**13.60**	13.7	3,145		5.4	0.76	8.7	-3.3	10.60	**3.34**
35.0	46.2	0.76	39.4	4.4	**13.50**	14.6	3,387		5.7	0.76	8.8	-3.2	10.20	**3.02**

go to TABLE OF CONTENTS

Performance Tables - W-Series (US UNITS)

W-65-HACW-X-1T *R454b, 60 Hz, YAS51K1E-PFV*

HEATING

OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
25	15	14	22	-3.4	23,400	16.6	3,734	104	116	14	109	5.1	**35,700**	**2.80**
30	20	14	26	-3.8	26,200	17.1	3,831		117	14	110	5.5	**38,800**	**2.97**
35	25	14	31	-4.3	29,300	17.6	3,922		117	14	110	6.0	**42,300**	**3.16**
40	29	14	35	-4.8	32,700	18.0	4,019		118	14	111	6.6	**46,000**	**3.35**
45	34	14	40	-5.3	36,400	18.5	4,110		118	14	111	7.2	**50,000**	**3.57**
50	39	14	44	-5.9	40,200	19.0	4,206		119	14	112	7.8	**54,200**	**3.78**
55	43	14	49	-6.5	44,400	19.4	4,301		120	14	112	8.4	**58,700**	**4.00**
60	48	14	53	-7.2	48,900	19.9	4,390		120	14	113	9.1	**63,500**	**4.24**
65	52	14	57	-7.9	53,600	20.3	4,482		121	14	114	9.8	**68,600**	**4.49**
70	57	14	61	-8.7	58,800	20.7	4,567		121	14	115	10.6	**74,100**	**4.76**
25	16	14	22	-3.1	21,300	18.6	4,192	115.0	126	14	120	5.0	**35,200**	**2.46**
30	21	14	27	-3.5	24,100	19.0	4,261	114.5	126	14		5.5	**38,200**	**2.63**
35	25	14	31	-3.9	27,000	19.4	4,333	114.1	126	14		5.9	**41,400**	**2.80**
40	30	14	36	-4.4	30,200	19.7	4,401	113.6	126	14		6.4	**44,800**	**2.98**
45	35	14	40	-4.9	33,700	20.1	4,473	113.0	126	14		7.0	**48,600**	**3.18**
50	39	14	45	-5.5	37,500	20.4	4,539	112.4	126	14		7.6	**52,600**	**3.40**
55	44	14	49	-6.1	41,500	20.7	4,603	111.8	127	14		8.2	**56,900**	**3.62**
60	48	14	53	-6.7	45,900	21.1	4,671	111.2	127	14		8.8	**61,500**	**3.86**
65	53	14	58	-7.4	50,600	21.4	4,731	110.4	127	14		9.6	**66,400**	**4.11**
70	58	14	62	-8.2	55,500	21.7	4,794	109.7	127	14		10.3	**71,500**	**4.37**

COOLING

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
50	71	14	59	9.0	**61,400**	10.3	2,254	54	38	14	46	-7.8	54,100	**24.0**
55	76	14	64	8.9	**60,800**	10.9	2,424		38	14	46	-7.6	52,900	**21.8**
60	81	14	69	8.9	**60,300**	11.6	2,596		39	14	46	-7.4	51,800	**20.0**
65	86	14	74	8.8	**59,600**	12.3	2,766		39	14	46	-7.3	50,600	**18.3**
70	91	14	79	8.7	**59,000**	13.1	2,944		40	14	47	-7.1	49,400	**16.8**
75	96	14	84	8.6	**58,400**	13.9	3,126		40	14	47	-6.9	48,200	**15.4**
80	101	14	89	8.6	**57,900**	14.8	3,320		41	14	47	-6.7	47,000	**14.2**
85	106	14	94	8.5	**57,300**	15.7	3,520		41	14	47	-6.6	45,700	**13.0**
90	111	14	98	8.4	**56,600**	16.7	3,738		41	14	47	-6.4	44,300	**11.9**
95	116	14	103	8.3	**56,100**	17.7	3,967		42	14	47	-6.2	43,000	**10.8**

go to TABLE OF CONTENTS

Performance Tables - W-Series (METRIC UNITS)

W-65-HACW-X-1T *R454b, 60 Hz, YAS51K1E-PFV*

METRIC

HEATING

OUTDOOR LOOP (15% Methanol)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-9.3	0.88	-5.8	-1.9	6.9	16.6	3,734	40	46.8	0.88	42.8	2.8	**10.5**	**2.80**
-1.1	-6.7	0.88	-3.2	-2.1	7.7	17.1	3,831		47.1	0.88	43.1	3.1	**11.4**	**2.97**
1.7	-4.1	0.88	-0.7	-2.4	8.6	17.6	3,922		47.4	0.88	43.3	3.3	**12.4**	**3.16**
4.4	-1.6	0.88	1.7	-2.7	9.6	18.0	4,019		47.7	0.88	43.7	3.7	**13.5**	**3.35**
7.2	1.1	0.88	4.3	-2.9	10.7	18.5	4,110		48.0	0.88	44.0	4.0	**14.7**	**3.57**
10.0	3.6	0.88	6.7	-3.3	11.8	19.0	4,206		48.3	0.88	44.3	4.3	**15.9**	**3.78**
12.8	6.2	0.88	9.2	-3.6	13.0	19.4	4,301		48.7	0.88	44.7	4.7	**17.2**	**4.00**
15.6	8.8	0.88	11.6	-4.0	14.3	19.9	4,390		48.9	0.88	45.1	5.1	**18.6**	**4.24**
18.3	11.3	0.88	13.9	-4.4	15.7	20.3	4,482		49.3	0.88	45.4	5.4	**20.1**	**4.49**
21.1	13.9	0.88	16.3	-4.8	17.2	20.7	4,567		49.6	0.88	45.9	5.9	**21.7**	**4.76**
-3.9	-8.9	0.88	-5.6	-1.7	6.2	18.6	4,192	46.1	52.1	0.88	49	2.8	**10.3**	**2.46**
-1.1	-6.3	0.88	-3.0	-1.9	7.1	19.0	4,261	45.8	52.1	0.88		3.1	**11.2**	**2.63**
1.7	-3.7	0.88	-0.5	-2.2	7.9	19.4	4,333	45.6	52.2	0.88		3.3	**12.1**	**2.80**
4.4	-1.2	0.88	2.0	-2.4	8.9	19.7	4,401	45.3	52.3	0.88		3.6	**13.1**	**2.98**
7.2	1.4	0.88	4.5	-2.7	9.9	20.1	4,473	45.0	52.4	0.88		3.9	**14.2**	**3.18**
10.0	3.9	0.88	6.9	-3.1	11.0	20.4	4,539	44.7	52.4	0.88		4.2	**15.4**	**3.40**
12.8	6.5	0.88	9.4	-3.4	12.2	20.7	4,603	44.3	52.5	0.88		4.6	**16.7**	**3.62**
15.6	9.1	0.88	11.9	-3.7	13.5	21.1	4,671	44.0	52.6	0.88		4.9	**18.0**	**3.86**
18.3	11.6	0.88	14.2	-4.1	14.8	21.4	4,731	43.6	52.7	0.88		5.3	**19.5**	**4.11**
21.1	14.2	0.88	16.5	-4.6	16.3	21.7	4,794	43.2	52.8	0.88		5.7	**21.0**	**4.37**

COOLING

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0	21.8	0.88	15.0	5.0	**18.00**	10.3	2,254	12	3.2	0.88	7.7	-4.3	15.90	**7.03**
12.8	24.5	0.88	17.7	4.9	**17.80**	10.9	2,424		3.4	0.88	7.8	-4.2	15.50	**6.39**
15.6	27.3	0.88	20.5	4.9	**17.70**	11.6	2,596		3.7	0.88	7.9	-4.1	15.20	**5.86**
18.3	30.0	0.88	23.2	4.9	**17.50**	12.3	2,766		3.9	0.88	7.9	-4.1	14.80	**5.36**
21.1	32.8	0.88	25.9	4.8	**17.30**	13.1	2,944		4.2	0.88	8.1	-3.9	14.50	**4.92**
23.9	35.5	0.88	28.7	4.8	**17.10**	13.9	3,126		4.4	0.88	8.2	-3.8	14.10	**4.51**
26.7	38.3	0.88	31.5	4.8	**17.00**	14.8	3,320		4.7	0.88	8.3	-3.7	13.80	**4.16**
29.4	41.0	0.88	34.1	4.7	**16.80**	15.7	3,520		5.0	0.88	8.3	-3.7	13.40	**3.81**
32.2	43.8	0.88	36.9	4.7	**16.60**	16.7	3,738		5.2	0.88	8.4	-3.6	13.00	**3.49**
35.0	46.5	0.88	39.6	4.6	**16.40**	17.7	3,967		5.5	0.88	8.6	-3.4	12.60	**3.17**

go to TABLE OF CONTENTS

Performance Tables - W-Series (US UNITS)

W-75-HACW-X-1T *R454b, 60 Hz, YAS60K1E-PFV*

HEATING

OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
25	16	16	22	-3.3	26,300	13.3	4,352	104	114	16	109	5.1	**40,800**	**2.75**
30	20	16	26	-3.8	29,900	13.4	4,420		115	16	110	5.6	**44,600**	**2.96**
35	25	16	31	-4.3	33,900	13.6	4,493		116	16	110	6.1	**48,900**	**3.19**
40	29	16	35	-4.9	38,200	13.7	4,558		116	16	111	6.7	**53,400**	**3.43**
45	34	16	40	-5.5	43,000	13.9	4,629		117	16	111	7.3	**58,500**	**3.70**
50	38	16	44	-6.2	48,000	14.1	4,691		118	16	112	8.0	**63,700**	**3.98**
55	42	16	48	-6.9	53,500	14.2	4,751		118	16	113	8.7	**69,400**	**4.28**
60	47	16	52	-7.6	59,500	14.4	4,813		119	16	114	9.5	**75,600**	**4.60**
65	51	16	57	-8.5	65,900	14.6	4,866		119	16	114	10.3	**82,200**	**4.95**
70	56	16	61	-9.4	72,800	14.8	4,919		120	16	115	11.2	**89,300**	**5.32**
25	17	16	22	-3.0	23,900	15.2	4,867	115.0	124	16	120	5.0	**40,100**	**2.41**
30	21	16	27	-3.5	27,400	15.2	4,906	114.5	125	16		5.5	**43,800**	**2.62**
35	25	16	31	-4.0	31,200	15.2	4,949	114.0	125	16		6.0	**47,700**	**2.82**
40	30	16	36	-4.5	35,400	15.2	4,988	113.5	125	16		6.5	**52,100**	**3.06**
45	34	16	40	-5.1	39,900	15.2	5,019	112.9	125	16		7.1	**56,700**	**3.31**
50	38	16	44	-5.8	44,900	15.2	5,052	112.2	125	16		7.8	**61,800**	**3.59**
55	42	16	49	-6.4	50,200	15.3	5,083	111.5	125	16		8.5	**67,200**	**3.87**
60	47	16	53	-7.2	56,100	15.3	5,102	110.8	126	16		9.2	**73,200**	**4.20**
65	51	16	57	-8.0	62,400	15.4	5,124	110.0	126	16		10.0	**79,600**	**4.55**
70	55	16	61	-8.9	69,200	15.5	5,140	109.1	126	16		10.9	**86,500**	**4.93**

COOLING

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
50	71	16	59	9.0	**70,200**	12.5	2,648	54	37	16	46	-7.7	61,500	**23.2**
55	76	16	64	8.9	**69,400**	12.9	2,800		38	16	46	-7.5	60,200	**21.5**
60	81	16	69	8.8	**68,700**	13.5	2,965		38	16	46	-7.4	58,900	**19.9**
65	86	16	74	8.7	**67,900**	14.1	3,143		39	16	46	-7.2	57,500	**18.3**
70	91	16	79	8.6	**67,000**	14.9	3,335		39	16	47	-7.0	56,000	**16.8**
75	96	16	84	8.5	**66,100**	15.8	3,545		40	16	47	-6.8	54,400	**15.3**
80	101	16	88	8.4	**65,300**	16.8	3,775		40	16	47	-6.6	52,800	**14.0**
85	105	16	93	8.3	**64,400**	17.9	4,019		41	16	47	-6.4	51,100	**12.7**
90	110	16	98	8.3	**63,700**	19.0	4,283		41	16	47	-6.2	49,500	**11.6**
95	115	16	103	8.2	**62,900**	20.3	4,568		42	16	48	-6.0	47,700	**10.4**

go to TABLE OF CONTENTS

Performance Tables - W-Series (METRIC UNITS)

W-75-HACW-X-1T *R454b, 60 Hz, YAS60K1E-PFV*

METRIC

HEATING

OUTDOOR LOOP (15% Methanol)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-9.1	1.0	-5.7	-1.8	7.7	13.3	4,352	40	45.7	1.0	42.8	2.8	**12.0**	**2.75**
-1.1	-6.6	1.0	-3.2	-2.1	8.8	13.4	4,420		46.1	1.0	43.1	3.1	**13.1**	**2.96**
1.7	-4.1	1.0	-0.7	-2.4	9.9	13.6	4,493		46.4	1.0	43.4	3.4	**14.3**	**3.19**
4.4	-1.7	1.0	1.7	-2.7	11.2	13.7	4,558		46.8	1.0	43.7	3.7	**15.7**	**3.43**
7.2	0.8	1.0	4.1	-3.1	12.6	13.9	4,629		47.2	1.0	44.1	4.1	**17.1**	**3.70**
10.0	3.3	1.0	6.6	-3.4	14.1	14.1	4,691		47.5	1.0	44.4	4.4	**18.7**	**3.98**
12.8	5.7	1.0	9.0	-3.8	15.7	14.2	4,751		47.8	1.0	44.8	4.8	**20.3**	**4.28**
15.6	8.2	1.0	11.4	-4.2	17.4	14.4	4,813		48.2	1.0	45.3	5.3	**22.2**	**4.60**
18.3	10.7	1.0	13.6	-4.7	19.3	14.6	4,866		48.6	1.0	45.7	5.7	**24.1**	**4.95**
21.1	13.2	1.0	15.9	-5.2	21.3	14.8	4,919		48.9	1.0	46.2	6.2	**26.2**	**5.32**
-3.9	-8.6	1.0	-5.6	-1.7	7.0	15.2	4,867	46.1	51.3	1.0	49	2.8	**11.8**	**2.41**
-1.1	-6.2	1.0	-3.0	-1.9	8.0	15.2	4,906	45.8	51.4	1.0		3.1	**12.8**	**2.62**
1.7	-3.8	1.0	-0.5	-2.2	9.1	15.2	4,949	45.6	51.5	1.0		3.3	**14.0**	**2.82**
4.4	-1.4	1.0	1.9	-2.5	10.4	15.2	4,988	45.3	51.6	1.0		3.6	**15.3**	**3.06**
7.2	1.0	1.0	4.4	-2.8	11.7	15.2	5,019	44.9	51.7	1.0		3.9	**16.6**	**3.31**
10.0	3.4	1.0	6.8	-3.2	13.2	15.2	5,052	44.6	51.8	1.0		4.3	**18.1**	**3.59**
12.8	5.8	1.0	9.2	-3.6	14.7	15.3	5,083	44.2	51.9	1.0		4.7	**19.7**	**3.87**
15.6	8.2	1.0	11.6	-4.0	16.4	15.3	5,102	43.8	51.9	1.0		5.1	**21.5**	**4.20**
18.3	10.6	1.0	13.9	-4.4	18.3	15.4	5,124	43.3	52.1	1.0		5.6	**23.3**	**4.55**
21.1	12.9	1.0	16.2	-4.9	20.3	15.5	5,140	42.8	52.2	1.0		6.1	**25.4**	**4.93**

COOLING

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0	21.7	1.0	15.0	5.0	**20.60**	12.5	2,648	12	3.0	1.0	7.7	-4.3	18.00	**6.80**
12.8	24.4	1.0	17.7	4.9	**20.30**	12.9	2,800		3.3	1.0	7.8	-4.2	17.60	**6.30**
15.6	27.1	1.0	20.5	4.9	**20.10**	13.5	2,965		3.6	1.0	7.9	-4.1	17.30	**5.83**
18.3	29.8	1.0	23.1	4.8	**19.90**	14.1	3,143		3.8	1.0	8.0	-4.0	16.90	**5.36**
21.1	32.6	1.0	25.9	4.8	**19.60**	14.9	3,335		4.1	1.0	8.1	-3.9	16.40	**4.92**
23.9	35.3	1.0	28.6	4.7	**19.40**	15.8	3,545		4.4	1.0	8.2	-3.8	15.90	**4.48**
26.7	38.1	1.0	31.4	4.7	**19.10**	16.8	3,775		4.7	1.0	8.3	-3.7	15.50	**4.10**
29.4	40.8	1.0	34.0	4.6	**18.90**	17.9	4,019		4.9	1.0	8.4	-3.6	15.00	**3.72**
32.2	43.5	1.0	36.8	4.6	**18.70**	19.0	4,283		5.2	1.0	8.6	-3.4	14.50	**3.40**
35.0	46.2	1.0	39.6	4.6	**18.40**	20.3	4,568		5.5	1.0	8.7	-3.3	14.00	**3.05**

go to TABLE OF CONTENTS

Performance Tables - W-Series (US UNITS)

W-80-HACW-X-1T *R454b, 60 Hz, YA67K1E-PFV*

HEATING

OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
25	16	17	21	-3.7	30,600	23.7	5,159	104	117	17	110	5.6	**47,800**	**2.72**
30	20	17	26	-4.2	34,800	24.1	5,263		117	17	110	6.2	**52,400**	**2.92**
35	24	17	30	-4.7	39,300	24.5	5,378		118	17	111	6.8	**57,300**	**3.12**
40	28	17	35	-5.3	44,100	24.9	5,489		119	17	111	7.4	**62,500**	**3.34**
45	32	17	39	-5.9	49,300	25.5	5,613		119	17	112	8.0	**68,100**	**3.56**
50	37	17	43	-6.6	54,800	26.0	5,730		120	17	113	8.7	**74,000**	**3.78**
55	41	17	48	-7.3	60,800	26.5	5,852		121	17	114	9.5	**80,400**	**4.03**
60	45	17	52	-8.1	67,200	27.0	5,985		121	17	114	10.3	**87,300**	**4.27**
65	49	17	56	-9.0	74,100	27.5	6,110		122	17	115	11.2	**94,600**	**4.54**
70	53	17	60	-9.9	81,600	28.1	6,247		123	17	116	12.1	**102,600**	**4.81**
25	16	17	22	-3.3	27,400	26.3	5,902	114.4	126	17	120	5.6	**47,100**	**2.34**
30	20	17	26	-3.8	31,500	26.4	5,961	113.9	126	17		6.1	**51,400**	**2.53**
35	25	17	31	-4.3	35,800	26.7	6,029	113.4	126	17		6.6	**56,000**	**2.72**
40	29	17	35	-4.9	40,500	26.9	6,089	112.8	126	17		7.2	**60,900**	**2.93**
45	33	17	40	-5.5	45,500	27.2	6,160	112.2	126	17		7.8	**66,200**	**3.15**
50	37	17	44	-6.2	51,000	27.5	6,222	111.5	126	17		8.5	**71,900**	**3.39**
55	41	17	48	-6.9	57,000	27.8	6,285	110.7	127	17		9.3	**78,100**	**3.64**
60	45	17	52	-7.7	63,300	28.2	6,359	110.0	127	17		10.0	**84,700**	**3.90**
65	50	17	57	-8.5	70,300	28.4	6,422	109.1	127	17		10.9	**91,900**	**4.19**
70	54	17	61	-9.4	77,800	28.7	6,496	108.2	127	17		11.8	**99,700**	**4.50**

COOLING

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
50	76	17	60	9.7	**80,200**	17.3	3,122	54	38	17	45	-8.2	69,900	**22.4**
55	81	17	65	9.6	**79,400**	17.8	3,301		38	17	46	-8.1	68,500	**20.8**
60	85	17	70	9.5	**78,600**	18.5	3,498		39	17	46	-7.9	67,100	**19.2**
65	89	17	74	9.4	**77,900**	19.1	3,704		39	17	46	-7.7	65,700	**17.7**
70	94	17	79	9.4	**77,400**	19.9	3,931		40	17	46	-7.6	64,400	**16.4**
75	98	17	84	9.3	**76,700**	20.6	4,170		41	17	46	-7.4	62,900	**15.1**
80	103	17	89	9.3	**76,100**	21.5	4,432		41	17	46	-7.2	61,400	**13.9**
85	107	17	94	9.2	**75,500**	22.4	4,707		42	17	47	-7.1	59,900	**12.7**
90	112	17	99	9.2	**75,100**	23.4	5,011		42	17	47	-6.9	58,400	**11.7**
95	116	17	104	9.1	**74,600**	24.4	5,328		43	17	47	-6.7	56,800	**10.7**

go to TABLE OF CONTENTS

Performance Tables - W-Series (METRIC UNITS)

W-80-HACW-X-1T *R454b, 60 Hz, YA67K1E-PFV*

METRIC

OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
-3.9	-9.2	1.1	-6.0	-2.1	9.0	23.7	5,159	40	47.1	1.1	43.1	3.1	**14.0**	**2.72**
-1.1	-6.8	1.1	-3.4	-2.3	10.2	24.1	5,263		47.4	1.1	43.4	3.4	**15.4**	**2.92**
1.7	-4.5	1.1	-0.9	-2.6	11.5	24.5	5,378		47.8	1.1	43.8	3.8	**16.8**	**3.12**
4.4	-2.2	1.1	1.5	-2.9	12.9	24.9	5,489		48.2	1.1	44.1	4.1	**18.3**	**3.34**
7.2	0.2	1.1	3.9	-3.3	14.4	25.5	5,613		48.6	1.1	44.4	4.4	**20.0**	**3.56**
10.0	2.5	1.1	6.3	-3.7	16.1	26.0	5,730		48.9	1.1	44.8	4.8	**21.7**	**3.78**
12.8	4.8	1.1	8.7	-4.1	17.8	26.5	5,852		49.2	1.1	45.3	5.3	**23.6**	**4.03**
15.6	7.2	1.1	11.1	-4.5	19.7	27.0	5,985		49.6	1.1	45.7	5.7	**25.6**	**4.27**
18.3	9.5	1.1	13.3	-5.0	21.7	27.5	6,110		49.9	1.1	46.2	6.2	**27.7**	**4.54**
21.1	11.8	1.1	15.6	-5.5	23.9	28.1	6,247		50.3	1.1	46.7	6.7	**30.1**	**4.81**
-3.9	-8.7	1.1	-5.7	-1.8	8.0	26.3	5,902	45.8	52.1	1.1	49	3.1	**13.8**	**2.34**
-1.1	-6.4	1.1	-3.2	-2.1	9.2	26.4	5,961	45.5	52.1	1.1		3.4	**15.1**	**2.53**
1.7	-4.1	1.1	-0.7	-2.4	10.5	26.7	6,029	45.2	52.2	1.1		3.7	**16.4**	**2.72**
4.4	-1.8	1.1	1.7	-2.7	11.9	26.9	6,089	44.9	52.3	1.1		4.0	**17.8**	**2.93**
7.2	0.5	1.1	4.1	-3.1	13.3	27.2	6,160	44.6	52.4	1.1		4.3	**19.4**	**3.15**
10.0	2.8	1.1	6.6	-3.4	14.9	27.5	6,222	44.2	52.4	1.1		4.7	**21.1**	**3.39**
12.8	5.2	1.1	9.0	-3.8	16.7	27.8	6,285	43.7	52.5	1.1		5.2	**22.9**	**3.64**
15.6	7.4	1.1	11.3	-4.3	18.6	28.2	6,359	43.3	52.6	1.1		5.6	**24.8**	**3.90**
18.3	9.8	1.1	13.6	-4.7	20.6	28.4	6,422	42.8	52.7	1.1		6.1	**26.9**	**4.19**
21.1	12.1	1.1	15.9	-5.2	22.8	28.7	6,496	42.3	52.8	1.1		6.6	**29.2**	**4.50**

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (kW)	**COP_C**
10.0	24.5	1.1	15.4	5.4	**23.50**	17.3	3,122	12	3.3	1.1	7.4	-4.6	20.50	**6.56**
12.8	26.9	1.1	18.1	5.3	**23.30**	17.8	3,301		3.6	1.1	7.5	-4.5	20.10	**6.10**
15.6	29.4	1.1	20.9	5.3	**23.00**	18.5	3,498		3.8	1.1	7.6	-4.4	19.70	**5.63**
18.3	31.9	1.1	23.5	5.2	**22.80**	19.1	3,704		4.1	1.1	7.7	-4.3	19.30	**5.19**
21.1	34.4	1.1	26.3	5.2	**22.70**	19.9	3,931		4.4	1.1	7.8	-4.2	18.90	**4.81**
23.9	36.8	1.1	29.1	5.2	**22.50**	20.6	4,170		4.7	1.1	7.9	-4.1	18.40	**4.43**
26.7	39.3	1.1	31.9	5.2	**22.30**	21.5	4,432		5.0	1.1	8.0	-4.0	18.00	**4.07**
29.4	41.8	1.1	34.5	5.1	**22.10**	22.4	4,707		5.3	1.1	8.1	-3.9	17.60	**3.72**
32.2	44.3	1.1	37.3	5.1	**22.00**	23.4	5,011		5.6	1.1	8.2	-3.8	17.10	**3.43**
35.0	46.7	1.1	40.1	5.1	**21.90**	24.4	5,328		5.9	1.1	8.3	-3.7	16.60	**3.14**

go to TABLE OF CONTENTS

W-Series Electrical Specifications

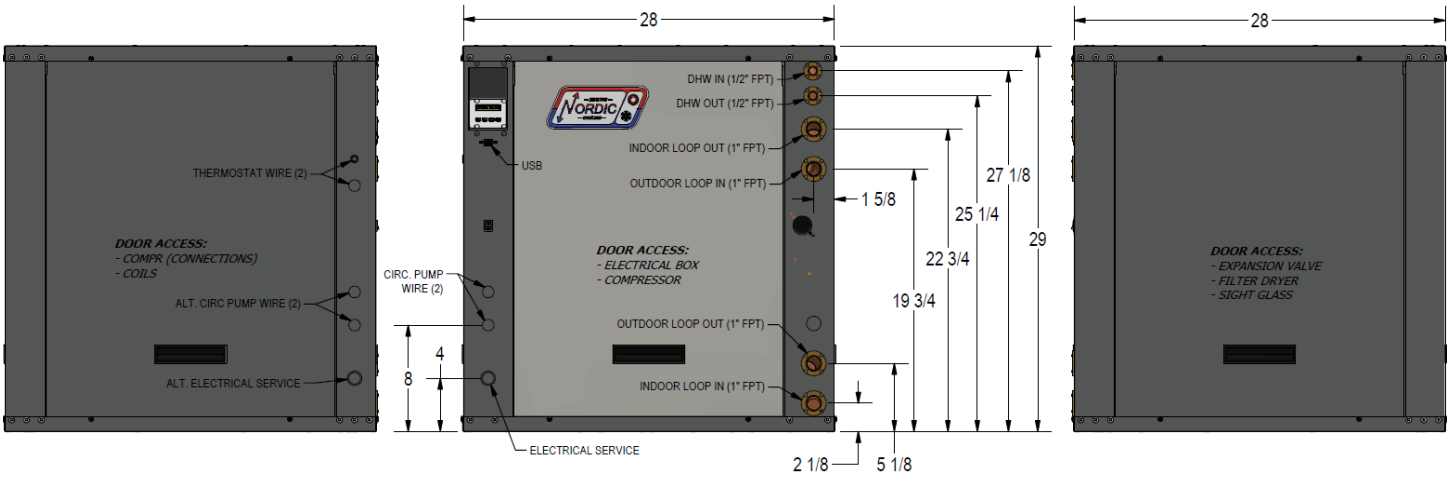
TABLE 34 - W-Series (R454b) Electrical Specifications											
	Code	Power Supply			Compressor		Circulators	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	Max. A	Amps	Amps	Amps	ga
W-25	1	208/230-1-60	187	253	10.3	62	5.0	16.1	18.7	30	#10-2*
	2	208-3-60	187	229	6.3	56	5.0	12.1	13.7	20	#12-3*
	4	460-3-60	414	506	3.8	29	-	4.6	5.6	15	#14-3
	5	-	-	-	-	-	-	-	-	-	-
W-45	1	208/230-1-60	187	253	14.6	90	5.0	20.4	24.1	40	#8-2*
	2	208-3-60	187	229	9.9	82	5.0	15.7	18.2	30	#10-3*
	4	460-3-60	414	506	4.8	44	-	5.6	6.8	15	#14-3
	5	575-3-60	518	632	3.5	29	-	4.3	5.2	15	#14-3
W-55	1	208/230-1-60	187	253	18.3	138	7.0	26.1	30.7	50	#8-2*
	2	208-3-60	187	229	11.9	112	7.0	19.7	22.7	40	#8-3*
	4	460-3-60	414	506	6.8	62	-	7.6	9.3	15	#14-3
	5	575-3-60	518	632	4.8	39	-	5.6	6.8	15	#14-3
W-65	1	208/230-1-60	187	253	25.2	147	7.0	33.0	39.3	60	#6-2*
	2	208-3-60	187	229	13.8	150	7.0	21.6	25.1	40	#8-3*
	4	460-3-60	414	506	6.9	58	-	7.7	9.4	15	#14-3
	5	575-3-60	518	632	5.8	48	-	6.6	8.1	15	#14-3
W-75	1	208/230-1-60	187	253	28.0	166	7.0	35.8	42.8	60	#6-2*
	2	208-3-60	187	229	19.2	162	7.0	27.0	31.8	50	#8-3*
	4	460-3-60	414	506	9.1	71	-	9.9	12.2	20	#12-3
	5	575-3-60	518	632	6.2	58	-	7.0	8.6	15	#14-3
W-80	1	208/230-1-60	187	253	32.8	184	7.0	40.6	48.8	80	#4-2*
	2	208-3-60	187	229	22.4	166	7.0	30.2	35.8	60	#6-3*
	4	460-3-60	414	506	8.8	75	-	9.6	11.8	20	#12-3
	5	575-3-60	518	632	7.2	54	-	8.0	9.8	20	#12-3

* For 208/230-1-60 and 208-3-60, 1 additional conductor (neutral) is required if connecting 115VAC circulators to the unit.

go to TABLE OF CONTENTS

Dimensions: W-25/45/55

All dimensions in inches.



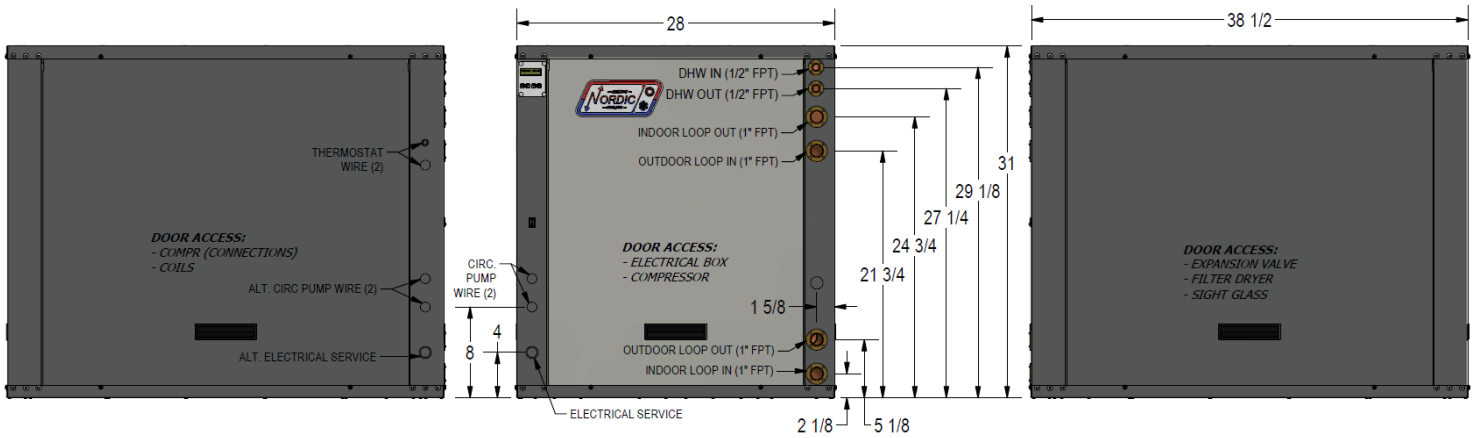
LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE:
2 FT

RECOMMENDED RIGHT SIDE CLEARANCE:
2 FT

NO BACK CLEARANCE REQUIRED

Dimensions: W-65/75/80



LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE:
2 FT

RECOMMENDED RIGHT SIDE CLEARANCE:
2 FT

NO BACK CLEARANCE REQUIRED

go to TABLE OF CONTENTS

Model Specific Information: WH-Series

Table 35 - WH-Series Refrigerant Charge

MODEL	lb	*kg*	Refrigerant	Oil Type
WH-25	4.0	*1.8*	R513a	POE
WH-45	5.5	*2.5*	R513a	POE
WH-55	7.0	*3.0*	R513a	POE
WH-65	8.5	*3.9*	R513a	POE
WH-75	9.0	*4.1*	R513a	POE
WH-80	10.0	*4.8*	R513a	POE

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

Table 36 - WH-Series Shipping Information

MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
WH-25	285 (129)	34 (86)	34 (86)	35 (89)
WH-45	310 (141)	34 (86)	34 (86)	35 (89)
WH-55	370 (168)	34 (86)	34 (86)	35 (89)
WH-65	460 (208)	45 (114)	37 (94)	37 (94)
WH-75	510 (231)	45 (114)	37 (94)	37 (94)
WH-80	560 (254)	45 (114)	37 (94)	37 (94)

Table 37 - WH-Series Operating Temperature Limits

Loop	Mode	Parameter	(°F)	*(°C)*	Note
Indoor Loop	**HEATING** (indoor is hot loop)	Minimum EWT	70 - 110	*21 - 43*	Use formula (Outdoor ELT + 20°F) or (Outdoor ELT + 11°C).
		Maximum LWT	160	*71*	
	COOLING (indoor is cold loop)	Minimum LWT NEW	**32**	***0***	EWT should normally be **40°F** or greater.
		Maximum EWT	90	*32*	Reduce flow above this temp. to limit refrigerant suction pressure.
Outdoor Loop	**HEATING** (outdoor is cold loop)	Minimum LWT NEW	**32**	***0***	EWT should normally be **40°F** or greater.
		Maximum ELT	90	*32*	Reduce flow above this temp. to limit refrigerant suction pressure.
	COOLING (outdoor is hot loop)	Minimum ELT	70 - 110	*21 - 43*	Use formula (Indoor EWT + 20°F) or (Indoor EWT + 11°C).
		Maximum LLT	160	*71*	

Values in this table are for rated liquid flow values.
EWT - Entering Water Temp., LWT - Leaving Water Temp., ELT - Entering Liquid Temp., LLT - Leaving Liquid Temp.

Table 38 - WH-Series Required Indoor & Outdoor Loop Flow Rates

SIZE	gpm	*L/s*
WH-25	8	*0.50*
WH-45	10	*0.63*
WH-55	12	*0.76*
WH-65	14	*0.88*
WH-75	16	*1.0*
WH-80	17	*1.1*

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

Table 39 - WH-Series Sound Levels (dBA)*

MODEL	1 ft distance	3 ft distance
WH-25	57.1	55.8
WH-45	57.2	56.0
WH-55	56.4	54.9
WH-65	55.7	53.0
WH-75	55.7	53.0
WH-80	55.7	53.0

* With all doors installed.

go to TABLE OF CONTENTS

Table 40: WH-Series Pressure Drop Data

			INDOOR (water 104°F)		OUTDOOR (water 50°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*
WH-25	4	*0.25*	0.8	*5.5*	0.9	*6.2*
	5	*0.32*	1.3	*9.0*	1.4	*10*
	6	*0.38*	1.6	*11*	1.7	*12*
	7	*0.44*	2.1	*14*	2.3	*16*
	8	***0.50***	**3.0**	***21***	**3.2**	***22***
	9	*0.57*	3.1	*21*	3.4	*23*
	10	*0.63*	4.1	*28*	4.4	*30*
	11	*0.69*	4.8	*33*	5.1	*35*
	12	*0.76*	5.7	*39*	6.0	*41*
	13	*0.82*	6.7	*46*	6.9	*48*
WH-45	6	*0.38*	1.6	*11*	1.7	*12*
	7	*0.44*	1.9	*13*	2.1	*14*
	8	*0.50*	2.6	*18*	2.8	*19*
	9	*0.57*	3.2	*22*	3.5	*24*
	10	***0.63***	**3.8**	***26***	**4.0**	***28***
	11	*0.69*	4.3	*30*	4.6	*32*
	12	*0.76*	5.2	*36*	5.5	*38*
	13	*0.82*	5.9	*41*	6.2	*43*
	14	*0.88*	6.7	*46*	7.0	*48*
	15	*0.95*	8.0	*55*	8.2	*57*
WH-55	6	*0.38*	1.1	*7.6*	1.2	*8.3*
	7	*0.44*	1.5	*10*	1.6	*11*
	8	*0.50*	1.8	*12*	1.9	*13*
	9	*0.57*	2.2	*15*	2.4	*17*
	10	*0.63*	2.7	*19*	2.9	*20*
	11	*0.69*	2.8	*19*	3.1	*21*
	12	***0.76***	**3.4**	***23***	**3.7**	***26***
	13	*0.82*	4	*28*	4.3	*30*
	14	*0.88*	4.7	*32*	5	*34*
	15	*0.95*	5.6	*39*	5.8	*40*
	16	*1.01*	6.1	*42*	6.3	*43*

go to TABLE OF CONTENTS

Table 40: (cont'd) WH-Series Pressure Drop Data

			INDOOR (water 104°F)		OUTDOOR (water 50°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*
WH-65	8	*0.50*	1.8	*12*	1.9	*13*
	9	*0.57*	2.1	*14*	2.3	*16*
	10	*0.63*	2.4	*17*	2.6	*18*
	11	*0.69*	2.9	*20*	3.2	*22*
	12	*0.76*	3.6	*25*	3.9	*27*
	13	*0.82*	4.1	*28*	4.4	*30*
	14	***0.88***	**4.7**	***32***	**5**	***34***
	15	*0.95*	5.5	*38*	5.7	*39*
	16	*1.01*	6.3	*43*	6.5	*45*
WH-75	8	*0.50*	1.2	*8.3*	1.3	*9.0*
	9	*0.57*	1.5	*10*	1.6	*11*
	10	*0.63*	1.8	*12*	1.9	*13*
	11	*0.69*	2.1	*14*	2.3	*16*
	12	*0.76*	2.4	*17*	2.6	*18*
	13	*0.82*	2.8	*19*	3.0	*21*
	14	*0.88*	2.9	*20*	3.2	*22*
	15	*0.95*	3.2	*22*	3.5	*24*
	16	***1.01***	**3.8**	***26***	**4.0**	***28***
	17	*1.07*	4.2	*29*	4.4	*30*
WH-80	9	*0.57*	1.2	*8.3*	1.3	*9.0*
	10	*0.63*	1.5	*10*	1.6	*11*
	11	*0.69*	1.8	*12*	1.9	*13*
	12	*0.76*	2.2	*15*	2.4	*17*
	13	*0.82*	2.5	*17*	2.7	*19*
	14	*0.88*	2.9	*20*	3.1	*21*
	15	*0.95*	3.1	*21*	3.3	*23*
	16	*1.01*	3.3	*23*	3.6	*25*
	17	***1.07***	**3.7**	***26***	**4.1**	***28***
	18	*1.14*	4.2	*29*	4.5	*31*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (US UNITS)

WH-25-H***-Y-1S *R513a, 60 Hz, ZR21K5E-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	45	36	8.0	43	-2.1	8,400	5.1	1,268	117	129	8.0	120	3.2	**12,600**	**2.91**
	50	40	8.0	48	-2.3	9,400	5.2	1,291	117	129	8.0		3.4	**13,700**	**3.11**
	55	45	8.0	52	-2.6	10,600	5.3	1,311	116	129	8.0		3.7	**14,900**	**3.33**
	60	49	8.0	57	-2.9	11,800	5.4	1,329	116	129	8.0		4.1	**16,200**	**3.57**
	65	53	8.0	62	-3.3	13,200	5.6	1,343	116	128	8.0		4.4	**17,600**	**3.84**
	70	58	8.0	66	-3.6	14,500	5.7	1,358	115	128	8.0		4.8	**19,000**	**4.10**
	75	62	8.0	71	-4.0	16,000	6.0	1,372	115	128	8.0		5.2	**20,500**	**4.38**
	80	66	8.0	76	-4.4	17,500	6.2	1,383	114	128	8.0		5.6	**22,100**	**4.68**
	85	71	8.0	80	-4.8	19,100	6.6	1,392	114	128	8.0		6.0	**23,700**	**4.99**
	90	75	8.0	85	-5.2	20,700	7.0	1,403	114	127	8.0		6.4	**25,300**	**5.28**
	45	37	8.0	44	-1.5	6,100	5.8	1,431	137	149	8.0	140	2.7	**10,800**	**2.21**
	50	41	8.0	48	-1.8	7,100	5.9	1,459	137	148	8.0		3.0	**11,900**	**2.39**
	55	46	8.0	53	-2.0	8,100	6.0	1,484	137	148	8.0		3.3	**13,000**	**2.57**
	60	50	8.0	58	-2.3	9,200	6.1	1,507	136	148	8.0		3.6	**14,200**	**2.76**
	65	54	8.0	62	-2.6	10,300	6.2	1,528	136	148	8.0		3.9	**15,400**	**2.95**
	70	59	8.0	67	-2.9	11,600	6.3	1,547	136	148	8.0		4.2	**16,700**	**3.16**
	75	63	8.0	72	-3.2	12,800	6.5	1,563	136	147	8.0		4.5	**18,000**	**3.38**
	80	67	8.0	76	-3.6	14,200	6.7	1,578	135	147	8.0		4.9	**19,500**	**3.62**
	85	72	8.0	81	-3.9	15,600	7.0	1,590	135	147	8.0		5.3	**20,900**	**3.85**
	90	76	8.0	86	-4.3	17,100	7.3	1,601	134	147	8.0		5.7	**22,400**	**4.10**
	45	38	8.0	44	-1.3	5,100	6.8	1,651	157	168	8.0	160	2.7	**10,600**	**1.88**
	50	42	8.0	49	-1.5	6,000	6.8	1,685	157	167	8.0		2.9	**11,600**	**2.02**
	55	47	8.0	53	-1.7	7,000	6.9	1,715	157	167	8.0		3.2	**12,700**	**2.17**
	60	51	8.0	58	-2.0	8,000	6.9	1,742	157	167	8.0		3.5	**13,800**	**2.32**
	65	55	8.0	63	-2.3	9,100	7.0	1,767	156	167	8.0		3.8	**15,000**	**2.49**
	70	60	8.0	67	-2.6	10,200	7.1	1,793	156	167	8.0		4.1	**16,200**	**2.65**
	75	64	8.0	72	-2.9	11,400	7.2	1,813	156	166	8.0		4.4	**17,400**	**2.81**
	80	68	8.0	77	-3.2	12,600	7.3	1,831	155	166	8.0		4.7	**18,700**	**2.99**
	85	73	8.0	82	-3.5	13,800	7.5	1,846	155	166	8.0		5.1	**20,000**	**3.18**
	90	77	8.0	86	-3.8	15,100	7.8	1,861	155	166	8.0		5.4	**21,300**	**3.35**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	50**	70	8.0	54	4.0	16,000	2.5	620	54	39	8.0	50	-3.5	**14,000**	**22.6**
	55**	75	8.0	59	3.9	15,700	2.6	666		40	8.0	50	-3.4	**13,600**	**20.4**
	60**	80	8.0	64	3.9	15,500	2.8	714		40	8.0	50	-3.3	**13,200**	**18.5**
	65**	85	8.0	69	3.9	15,400	3.0	766		41	8.0	50	-3.2	**12,900**	**16.8**
	70	90	8.0	74	3.8	15,100	3.3	821		41	8.0	51	-3.1	**12,500**	**15.2**
	75	95	8.0	79	3.8	15,000	3.5	881		42	8.0	51	-3.0	**12,100**	**13.7**
	80	100	8.0	84	3.7	14,900	3.8	948		42	8.0	51	-3.0	**11,800**	**12.4**
	85	105	8.0	89	3.7	14,700	4.1	1,020		43	8.0	51	-2.9	**11,400**	**11.2**
	90	110	8.0	94	3.7	14,700	4.4	1,099		43	8.0	51	-2.8	**11,100**	**10.1**
	95	115	8.0	99	3.7	14,700	4.8	1,187		44	8.0	51	-2.7	**10,800**	**9.1**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (METRIC)

WH-25-H***-Y-1S *R513a, 60 Hz, ZR21K5E-PFV*

METRIC

HEATING

OUTDOOR LOOP (Water)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
7.2	2.2	0.51	6.0	-1.2	2.5	5.1	1,268	47.1	54.1	0.51	49	1.8	**3.7**	**2.91**
10.0	4.6	0.51	8.7	-1.3	2.8	5.2	1,291	47.0	53.9	0.51		1.9	**4.0**	**3.11**
12.8	7.0	0.51	11.4	-1.4	3.1	5.3	1,311	46.8	53.8	0.51		2.1	**4.4**	**3.33**
15.6	9.4	0.51	14.0	-1.6	3.5	5.4	1,329	46.6	53.7	0.51		2.3	**4.8**	**3.57**
18.3	11.8	0.51	16.5	-1.8	3.9	5.6	1,343	46.4	53.6	0.51		2.4	**5.2**	**3.84**
21.1	14.2	0.51	19.1	-2.0	4.3	5.7	1,358	46.2	53.4	0.51		2.7	**5.6**	**4.10**
23.9	16.7	0.51	21.7	-2.2	4.7	6.0	1,372	46.0	53.3	0.51		2.9	**6.0**	**4.38**
26.7	19.1	0.51	24.3	-2.4	5.1	6.2	1,383	45.8	53.2	0.51		3.1	**6.5**	**4.68**
29.4	21.5	0.51	26.7	-2.7	5.6	6.6	1,392	45.6	53.1	0.51		3.3	**7.0**	**4.99**
32.2	23.9	0.51	29.3	-2.9	6.1	7.0	1,403	45.3	52.9	0.51		3.6	**7.4**	**5.28**
7.2	2.8	0.51	6.4	-0.8	1.8	5.8	1,431	58.5	64.7	0.51	60	1.5	**3.2**	**2.21**
10.0	5.2	0.51	9.0	-1.0	2.1	5.9	1,459	58.3	64.6	0.51		1.7	**3.5**	**2.39**
12.8	7.6	0.51	11.7	-1.1	2.4	6.0	1,484	58.2	64.5	0.51		1.8	**3.8**	**2.57**
15.6	10.0	0.51	14.3	-1.3	2.7	6.1	1,507	58.0	64.4	0.51		2.0	**4.2**	**2.76**
18.3	12.4	0.51	16.9	-1.4	3.0	6.2	1,528	57.8	64.3	0.51		2.2	**4.5**	**2.95**
21.1	14.8	0.51	19.5	-1.6	3.4	6.3	1,547	57.7	64.2	0.51		2.3	**4.9**	**3.16**
23.9	17.2	0.51	22.1	-1.8	3.8	6.5	1,563	57.5	64.1	0.51		2.5	**5.3**	**3.38**
26.7	19.6	0.51	24.7	-2.0	4.2	6.7	1,578	57.3	63.9	0.51		2.7	**5.7**	**3.62**
29.4	22.1	0.51	27.2	-2.2	4.6	7.0	1,590	57.1	63.8	0.51		2.9	**6.1**	**3.85**
32.2	24.4	0.51	29.8	-2.4	5.0	7.3	1,601	56.8	63.7	0.51		3.2	**6.6**	**4.10**
7.2	3.3	0.51	6.5	-0.7	1.5	6.8	1,651	69.6	75.3	0.51	71	1.5	**3.1**	**1.88**
10.0	5.7	0.51	9.2	-0.8	1.8	6.8	1,685	69.5	75.2	0.51		1.6	**3.4**	**2.02**
12.8	8.2	0.51	11.9	-0.9	2.1	6.9	1,715	69.3	75.1	0.51		1.8	**3.7**	**2.17**
15.6	10.6	0.51	14.5	-1.1	2.3	6.9	1,742	69.2	74.9	0.51		1.9	**4.0**	**2.32**
18.3	13.0	0.51	17.0	-1.3	2.7	7.0	1,767	69.0	74.8	0.51		2.1	**4.4**	**2.49**
21.1	15.4	0.51	19.7	-1.4	3.0	7.1	1,793	68.8	74.8	0.51		2.3	**4.8**	**2.65**
23.9	17.8	0.51	22.3	-1.6	3.3	7.2	1,813	68.7	74.7	0.51		2.4	**5.1**	**2.81**
26.7	20.2	0.51	24.9	-1.8	3.7	7.3	1,831	68.5	74.6	0.51		2.6	**5.5**	**2.99**
29.4	22.7	0.51	27.5	-1.9	4.0	7.5	1,846	68.3	74.4	0.51		2.8	**5.9**	**3.18**
32.2	25.1	0.51	30.1	-2.1	4.4	7.8	1,861	68.1	74.3	0.51		3.0	**6.2**	**3.35**

COOLING*

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0**	21.1	0.51	12.2	2.2	4.7	2.5	620	12	3.9	0.51	10.1	-1.9	**4.1**	**6.62**
12.8**	23.9	0.51	15.0	2.2	4.6	2.6	666		4.2	0.51	10.1	-1.9	**4.0**	**5.98**
15.6**	26.7	0.51	17.8	2.2	4.5	2.8	714		4.5	0.51	10.2	-1.8	**3.9**	**5.42**
18.3**	29.4	0.51	20.5	2.2	4.5	3.0	766		4.8	0.51	10.2	-1.8	**3.8**	**4.92**
21.1	32.2	0.51	23.2	2.1	4.4	3.3	821		5.1	0.51	10.3	-1.7	**3.7**	**4.45**
23.9	35.0	0.51	26.0	2.1	4.4	3.5	881		5.4	0.51	10.3	-1.7	**3.6**	**4.02**
26.7	37.8	0.51	28.8	2.1	4.4	3.8	948		5.7	0.51	10.3	-1.7	**3.5**	**3.63**
29.4	40.6	0.51	31.5	2.1	4.3	4.1	1,020		6.1	0.51	10.4	-1.6	**3.3**	**3.28**
32.2	43.3	0.51	34.3	2.1	4.3	4.4	1,099		6.3	0.51	10.4	-1.6	**3.3**	**2.96**
35.0	46.1	0.51	37.1	2.1	4.3	4.8	1,187		6.7	0.51	10.5	-1.5	**3.2**	**2.67**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (US UNITS)

WH-45-H***-Y-1S *R513a, 60 Hz, ZR32K5E-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	45	36	10	42	-2.7	13,600	8.1	1,948	116	130	10	120	4.0	**20,100**	**3.02**
	50	40	10	47	-3.0	15,200	8.2	1,972	116	129	10		4.3	**21,700**	**3.22**
	55	44	10	52	-3.4	16,900	8.3	1,998	115	129	10		4.7	**23,500**	**3.45**
	60	49	10	56	-3.8	18,800	8.3	2,021	115	129	10		5.1	**25,500**	**3.70**
	65	53	10	61	-4.2	20,800	8.4	2,049	115	129	10		5.5	**27,600**	**3.95**
	70	57	10	65	-4.6	22,900	8.5	2,078	114	129	10		6.0	**29,800**	**4.20**
	75	62	10	70	-5.1	25,200	8.5	2,104	114	128	10		6.5	**32,200**	**4.49**
	80	66	10	75	-5.5	27,600	8.6	2,136	113	128	10		7.0	**34,700**	**4.76**
	85	71	10	79	-6.1	30,300	8.6	2,166	113	128	10		7.5	**37,500**	**5.07**
	90	75	10	83	-6.7	33,100	8.6	2,199	112	128	10		8.1	**40,400**	**5.38**
	45	37	10	43	-2.1	10,500	9.5	2,311	136	149	10	140	3.7	**18,200**	**2.31**
	50	41	10	48	-2.4	11,900	9.6	2,334	136	149	10		4.0	**19,700**	**2.47**
	55	46	10	52	-2.7	13,500	9.7	2,358	136	148	10		4.3	**21,400**	**2.66**
	60	50	10	57	-3.0	15,100	9.8	2,383	135	148	10		4.7	**23,100**	**2.84**
	65	54	10	62	-3.4	16,800	9.9	2,407	135	148	10		5.0	**24,800**	**3.02**
	70	59	10	66	-3.7	18,700	10.0	2,434	135	148	10		5.4	**26,800**	**3.23**
	75	63	10	71	-4.2	20,700	10.0	2,460	134	148	10		5.8	**28,900**	**3.44**
	80	67	10	75	-4.6	22,900	10.1	2,489	134	147	10		6.3	**31,200**	**3.67**
	85	72	10	80	-5.1	25,200	10.1	2,519	133	147	10		6.8	**33,600**	**3.91**
	90	76	10	84	-5.6	27,700	10.1	2,549	133	147	10		7.3	**36,200**	**4.16**
	45	38	10	43	-1.8	8,900	11.0	2,679	156	168	10	160	3.6	**17,900**	**1.96**
	50	42	10	48	-2.1	10,300	11.1	2,693	156	168	10		3.9	**19,300**	**2.10**
	55	47	10	53	-2.4	11,800	11.2	2,707	156	167	10		4.2	**20,900**	**2.26**
	60	51	10	57	-2.7	13,300	11.3	2,721	156	167	10		4.5	**22,400**	**2.41**
	65	55	10	62	-3.0	14,900	11.3	2,736	155	167	10		4.9	**24,100**	**2.58**
	70	60	10	67	-3.3	16,500	11.4	2,757	155	167	10		5.2	**25,700**	**2.73**
	75	64	10	71	-3.7	18,300	11.4	2,773	154	167	10		5.6	**27,600**	**2.92**
	80	68	10	76	-4.1	20,200	11.4	2,791	154	166	10		6.0	**29,500**	**3.10**
	85	73	10	81	-4.5	22,200	11.4	2,810	154	166	10		6.4	**31,600**	**3.30**
	90	77	10	85	-4.9	24,200	11.4	2,830	153	166	10		6.8	**33,700**	**3.49**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	50**	71	10	55	4.9	24,700	4.2	963	54	39	10	49	-4.3	**21,600**	**22.4**
	55**	76	10	60	4.9	24,400	4.5	1,025		39	10	49	-4.2	**21,100**	**20.6**
	60**	81	10	65	4.8	24,000	4.7	1,085		40	10	50	-4.1	**20,500**	**18.9**
	65**	86	10	70	4.7	23,600	4.9	1,147		40	10	50	-4.0	**19,900**	**17.3**
	70	91	10	75	4.6	23,200	5.1	1,210		41	10	50	-3.9	**19,300**	**16.0**
	75	96	10	80	4.6	22,800	5.4	1,276		41	10	50	-3.8	**18,700**	**14.7**
	80	101	10	85	4.5	22,500	5.6	1,345		42	10	50	-3.7	**18,100**	**13.5**
	85	106	10	89	4.4	22,100	5.9	1,419		42	10	50	-3.5	**17,500**	**12.3**
	90	111	10	94	4.4	21,800	6.2	1,497		43	10	50	-3.4	**16,900**	**11.3**
	95	116	10	99	4.3	21,500	6.5	1,584		44	10	50	-3.3	**16,300**	**10.3**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (METRIC)

WH-45-H***-Y-1S *R513a, 60 Hz, ZR32K5E-PFV*

METRIC

HEATING

OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
7.2	2.1	0.63	5.7	-1.5	4.0	8.1	1,948	46.7	54.2	0.63	49	2.2	**5.9**	**3.02**
10.0	4.4	0.63	8.3	-1.7	4.5	8.2	1,972	46.5	54.1	0.63		2.4	**6.4**	**3.22**
12.8	6.9	0.63	10.9	-1.9	5.0	8.3	1,998	46.3	54.0	0.63		2.6	**6.9**	**3.45**
15.6	9.3	0.63	13.5	-2.1	5.5	8.3	2,021	46.1	53.8	0.63		2.8	**7.5**	**3.70**
18.3	11.7	0.63	16.0	-2.3	6.1	8.4	2,049	45.8	53.7	0.63		3.1	**8.1**	**3.95**
21.1	14.1	0.63	18.5	-2.6	6.7	8.5	2,078	45.6	53.6	0.63		3.3	**8.7**	**4.20**
23.9	16.6	0.63	21.1	-2.8	7.4	8.5	2,104	45.3	53.4	0.63		3.6	**9.4**	**4.49**
26.7	18.9	0.63	23.6	-3.1	8.1	8.6	2,136	45.0	53.3	0.63		3.9	**10.2**	**4.76**
29.4	21.4	0.63	26.0	-3.4	8.9	8.6	2,166	44.7	53.2	0.63		4.2	**11.0**	**5.07**
32.2	23.8	0.63	28.5	-3.7	9.7	8.6	2,199	44.4	53.1	0.63		4.5	**11.8**	**5.38**
7.2	2.7	0.63	6.0	-1.2	3.1	9.5	2,311	57.9	64.8	0.63	60	2.1	**5.3**	**2.31**
10.0	5.1	0.63	8.7	-1.3	3.5	9.6	2,334	57.8	64.7	0.63		2.2	**5.8**	**2.47**
12.8	7.5	0.63	11.3	-1.5	4.0	9.7	2,358	57.6	64.6	0.63		2.4	**6.3**	**2.66**
15.6	9.9	0.63	13.9	-1.7	4.4	9.8	2,383	57.4	64.5	0.63		2.6	**6.8**	**2.84**
18.3	12.3	0.63	16.4	-1.9	4.9	9.9	2,407	57.2	64.4	0.63		2.8	**7.3**	**3.02**
21.1	14.7	0.63	19.0	-2.1	5.5	10.0	2,434	57.0	64.3	0.63		3.0	**7.9**	**3.23**
23.9	17.2	0.63	21.6	-2.3	6.1	10.0	2,460	56.8	64.2	0.63		3.2	**8.5**	**3.44**
26.7	19.6	0.63	24.1	-2.6	6.7	10.1	2,489	56.5	64.1	0.63		3.5	**9.1**	**3.67**
29.4	22.0	0.63	26.6	-2.8	7.4	10.1	2,519	56.2	63.9	0.63		3.8	**9.9**	**3.91**
32.2	24.4	0.63	29.1	-3.1	8.1	10.1	2,549	55.9	63.8	0.63		4.1	**10.6**	**4.16**
7.2	3.2	0.63	6.2	-1.0	2.6	11.0	2,679	69.1	75.4	0.63	71	2.0	**5.3**	**1.96**
10.0	5.6	0.63	8.8	-1.2	3.0	11.1	2,693	68.9	75.3	0.63		2.2	**5.7**	**2.10**
12.8	8.1	0.63	11.5	-1.3	3.5	11.2	2,707	68.8	75.2	0.63		2.3	**6.1**	**2.26**
15.6	10.4	0.63	14.1	-1.5	3.9	11.3	2,721	68.6	75.1	0.63		2.5	**6.6**	**2.41**
18.3	12.9	0.63	16.6	-1.7	4.4	11.3	2,736	68.4	74.9	0.63		2.7	**7.1**	**2.58**
21.1	15.3	0.63	19.3	-1.8	4.8	11.4	2,757	68.2	74.9	0.63		2.9	**7.5**	**2.73**
23.9	17.7	0.63	21.8	-2.1	5.4	11.4	2,773	68.0	74.8	0.63		3.1	**8.1**	**2.92**
26.7	20.1	0.63	24.4	-2.3	5.9	11.4	2,791	67.8	74.7	0.63		3.3	**8.7**	**3.10**
29.4	22.6	0.63	26.9	-2.5	6.5	11.4	2,810	67.6	74.6	0.63		3.6	**9.3**	**3.30**
32.2	24.9	0.63	29.5	-2.7	7.1	11.4	2,830	67.3	74.4	0.63		3.8	**9.9**	**3.49**

COOLING*

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0**	21.5	0.63	12.7	2.7	7.2	4.2	963	12	3.6	0.63	9.6	-2.4	**6.3**	**6.56**
12.8**	24.3	0.63	15.5	2.7	7.2	4.5	1,025		3.9	0.63	9.7	-2.3	**6.2**	**6.04**
15.6**	27.1	0.63	18.3	2.7	7.0	4.7	1,085		4.2	0.63	9.7	-2.3	**6.0**	**5.54**
18.3**	29.9	0.63	20.9	2.6	6.9	4.9	1,147		4.6	0.63	9.8	-2.2	**5.8**	**5.07**
21.1	32.7	0.63	23.7	2.6	6.8	5.1	1,210		4.8	0.63	9.8	-2.2	**5.7**	**4.69**
23.9	35.6	0.63	26.5	2.6	6.7	5.4	1,276		5.2	0.63	9.9	-2.1	**5.5**	**4.31**
26.7	38.3	0.63	29.2	2.5	6.6	5.6	1,345		5.4	0.63	9.9	-2.1	**5.3**	**3.96**
29.4	41.2	0.63	31.8	2.4	6.5	5.9	1,419		5.8	0.63	10.1	-1.9	**5.1**	**3.60**
32.2	43.9	0.63	34.6	2.4	6.4	6.2	1,497		6.1	0.63	10.1	-1.9	**5.0**	**3.31**
35.0	46.8	0.63	37.4	2.4	6.3	6.5	1,584		6.4	0.63	10.2	-1.8	**4.8**	**3.02**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (US UNITS)

WH-55-H***-Y-1S *R513a, 60 Hz, ZR42K5E-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	45	35	12	42	-2.9	17,600	11.1	2,611	116	130	12	120	4.4	**26,300**	**2.95**
	50	40	12	47	-3.3	19,700	11.2	2,637	115	130	12		4.8	**28,500**	**3.17**
	55	44	12	51	-3.7	22,000	11.3	2,667	115	129	12		5.2	**30,900**	**3.40**
	60	48	12	56	-4.1	24,500	11.4	2,695	114	129	12		5.6	**33,500**	**3.64**
	65	53	12	61	-4.5	27,100	11.4	2,728	114	129	12		6.1	**36,200**	**3.89**
	70	57	12	65	-5.0	29,900	11.5	2,758	113	129	12		6.6	**39,100**	**4.15**
	75	62	12	70	-5.5	33,000	11.5	2,794	113	128	12		7.1	**42,300**	**4.44**
	80	66	12	74	-6.1	36,200	11.5	2,829	112	128	12		7.7	**45,600**	**4.72**
	85	70	12	78	-6.6	39,700	11.5	2,869	112	128	12		8.3	**49,300**	**5.04**
	90	75	12	83	-7.3	43,400	11.5	2,906	111	128	12		8.9	**53,100**	**5.36**
	45	37	12	43	-2.3	13,600	13.3	3,096	136	149	12	140	4.0	**23,900**	**2.26**
	50	41	12	47	-2.6	15,500	13.4	3,125	136	149	12		4.4	**25,900**	**2.43**
	55	45	12	52	-2.9	17,500	13.5	3,152	135	148	12		4.7	**28,000**	**2.60**
	60	50	12	57	-3.3	19,600	13.6	3,181	135	148	12		5.1	**30,200**	**2.78**
	65	54	12	61	-3.7	22,000	13.7	3,212	135	148	12		5.5	**32,700**	**2.98**
	70	58	12	66	-4.1	24,500	13.8	3,243	134	148	12		6.0	**35,400**	**3.20**
	75	63	12	71	-4.5	27,200	13.8	3,276	134	148	12		6.4	**38,200**	**3.42**
	80	67	12	75	-5.0	30,000	13.8	3,311	133	147	12		6.9	**41,100**	**3.64**
	85	71	12	79	-5.6	33,200	13.8	3,347	133	147	12		7.5	**44,400**	**3.89**
	90	76	12	84	-6.1	36,500	13.8	3,385	132	147	12		8.1	**47,800**	**4.14**
	45	37	12	43	-1.9	11,600	15.3	3,522	156	168	12	160	3.9	**23,400**	**1.95**
	50	42	12	48	-2.2	13,400	15.4	3,545	156	168	12		4.3	**25,300**	**2.09**
	55	46	12	52	-2.6	15,400	15.6	3,567	155	167	12		4.6	**27,400**	**2.25**
	60	50	12	57	-2.9	17,300	15.7	3,590	155	167	12		4.9	**29,300**	**2.39**
	65	55	12	62	-3.3	19,500	15.8	3,614	155	167	12		5.3	**31,600**	**2.56**
	70	59	12	66	-3.6	21,600	15.9	3,644	154	167	12		5.7	**33,800**	**2.72**
	75	64	12	71	-4.0	24,000	15.9	3,669	154	167	12		6.1	**36,300**	**2.90**
	80	68	12	76	-4.4	26,500	15.9	3,697	153	167	12		6.6	**38,900**	**3.08**
	85	72	12	80	-4.9	29,100	15.9	3,725	153	166	12		7.0	**41,600**	**3.27**
	90	77	12	85	-5.3	31,900	15.9	3,755	153	166	12		7.5	**44,500**	**3.47**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	50**	73	12	55	5.4	32,400	5.3	1,268	54	39	12	49	-4.7	**28,300**	**22.3**
	55**	78	12	60	5.3	31,900	5.7	1,352		39	12	49	-4.6	**27,500**	**20.3**
	60**	83	12	65	5.2	31,300	6.0	1,433		40	12	49	-4.5	**26,700**	**18.6**
	65**	88	12	70	5.2	30,900	6.3	1,515		40	12	49	-4.4	**26,000**	**17.2**
	70	92	12	75	5.1	30,400	6.6	1,599		41	12	49	-4.2	**25,200**	**15.8**
	75	97	12	80	5.0	29,900	7.0	1,686		41	12	50	-4.1	**24,400**	**14.5**
	80	102	12	85	4.9	29,400	7.4	1,778		42	12	50	-4.0	**23,600**	**13.3**
	85	107	12	90	4.8	28,900	7.8	1,873		42	12	50	-3.8	**22,800**	**12.2**
	90	111	12	95	4.8	28,500	8.2	1,976		43	12	50	-3.7	**22,000**	**11.1**
	95	116	12	100	4.7	28,000	8.6	2,086		43	12	50	-3.6	**21,200**	**10.2**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (METRIC)

WH-55-H***-Y-1S *R513a, 60 Hz, ZR42K5E-PFV*

METRIC

HEATING

OUTDOOR LOOP (Water)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
7.2	1.9	0.76	5.6	-1.6	5.2	11.1	2,611	46.4	54.4	0.76	49	2.4	**7.7**	**2.95**
10.0	4.3	0.76	8.2	-1.8	5.8	11.2	2,637	46.2	54.2	0.76		2.7	**8.4**	**3.17**
12.8	6.7	0.76	10.7	-2.1	6.5	11.3	2,667	46.0	54.1	0.76		2.9	**9.1**	**3.40**
15.6	9.1	0.76	13.3	-2.3	7.2	11.4	2,695	45.8	53.9	0.76		3.1	**9.8**	**3.64**
18.3	11.6	0.76	15.8	-2.5	7.9	11.4	2,728	45.5	53.8	0.76		3.4	**10.6**	**3.89**
21.1	13.9	0.76	18.3	-2.8	8.8	11.5	2,758	45.2	53.7	0.76		3.7	**11.5**	**4.15**
23.9	16.4	0.76	20.8	-3.1	9.7	11.5	2,794	44.9	53.6	0.76		3.9	**12.4**	**4.44**
26.7	18.8	0.76	23.3	-3.4	10.6	11.5	2,829	44.6	53.4	0.76		4.3	**13.4**	**4.72**
29.4	21.2	0.76	25.7	-3.7	11.6	11.5	2,869	44.3	53.3	0.76		4.6	**14.4**	**5.04**
32.2	23.6	0.76	28.1	-4.1	12.7	11.5	2,906	43.9	53.1	0.76		4.9	**15.6**	**5.36**
7.2	2.5	0.76	5.9	-1.3	4.0	13.3	3,096	57.8	64.9	0.76	60	2.2	**7.0**	**2.26**
10.0	4.9	0.76	8.6	-1.4	4.5	13.4	3,125	57.6	64.8	0.76		2.4	**7.6**	**2.43**
12.8	7.3	0.76	11.2	-1.6	5.1	13.5	3,152	57.4	64.7	0.76		2.6	**8.2**	**2.60**
15.6	9.7	0.76	13.8	-1.8	5.7	13.6	3,181	57.2	64.6	0.76		2.8	**8.9**	**2.78**
18.3	12.2	0.76	16.2	-2.1	6.5	13.7	3,212	56.9	64.4	0.76		3.1	**9.6**	**2.98**
21.1	14.6	0.76	18.8	-2.3	7.2	13.8	3,243	56.7	64.3	0.76		3.3	**10.4**	**3.20**
23.9	17.0	0.76	21.4	-2.5	8.0	13.8	3,276	56.4	64.2	0.76		3.6	**11.2**	**3.42**
26.7	19.4	0.76	23.9	-2.8	8.8	13.8	3,311	56.2	64.1	0.76		3.8	**12.0**	**3.64**
29.4	21.8	0.76	26.3	-3.1	9.7	13.8	3,347	55.8	64.0	0.76		4.2	**13.0**	**3.89**
32.2	24.2	0.76	28.8	-3.4	10.7	13.8	3,385	55.5	63.9	0.76		4.5	**14.0**	**4.14**
7.2	3.0	0.76	6.1	-1.1	3.4	15.3	3,522	68.9	75.4	0.76	71	2.2	**6.9**	**1.95**
10.0	5.4	0.76	8.8	-1.2	3.9	15.4	3,545	68.7	75.3	0.76		2.4	**7.4**	**2.09**
12.8	7.8	0.76	11.4	-1.4	4.5	15.6	3,567	68.6	75.2	0.76		2.6	**8.0**	**2.25**
15.6	10.2	0.76	14.0	-1.6	5.1	15.7	3,590	68.4	75.1	0.76		2.7	**8.6**	**2.39**
18.3	12.7	0.76	16.5	-1.8	5.7	15.8	3,614	68.2	75.0	0.76		2.9	**9.3**	**2.56**
21.1	15.1	0.76	19.1	-2.0	6.3	15.9	3,644	67.9	74.9	0.76		3.2	**9.9**	**2.72**
23.9	17.5	0.76	21.7	-2.2	7.0	15.9	3,669	67.7	74.8	0.76		3.4	**10.6**	**2.90**
26.7	19.9	0.76	24.3	-2.4	7.8	15.9	3,697	67.4	74.7	0.76		3.7	**11.4**	**3.08**
29.4	22.3	0.76	26.7	-2.7	8.5	15.9	3,725	67.2	74.6	0.76		3.9	**12.2**	**3.27**
32.2	24.7	0.76	29.3	-2.9	9.3	15.9	3,755	66.9	74.5	0.76		4.2	**13.0**	**3.47**

COOLING*

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0**	22.9	0.76	13.0	3.0	9.5	5.3	1,268	12	3.6	0.76	9.4	-2.6	**8.3**	**6.54**
12.8**	25.6	0.76	15.7	2.9	9.4	5.7	1,352		3.9	0.76	9.4	-2.6	**8.1**	**5.95**
15.6**	28.2	0.76	18.5	2.9	9.2	6.0	1,433		4.2	0.76	9.5	-2.5	**7.8**	**5.45**
18.3**	30.8	0.76	21.2	2.9	9.1	6.3	1,515		4.4	0.76	9.6	-2.4	**7.6**	**5.04**
21.1	33.5	0.76	23.9	2.8	8.9	6.6	1,599		4.8	0.76	9.7	-2.3	**7.4**	**4.63**
23.9	36.2	0.76	26.7	2.8	8.8	7.0	1,686		5.1	0.76	9.7	-2.3	**7.2**	**4.25**
26.7	38.8	0.76	29.4	2.7	8.6	7.4	1,778		5.3	0.76	9.8	-2.2	**6.9**	**3.90**
29.4	41.4	0.76	32.1	2.7	8.5	7.8	1,873		5.6	0.76	9.9	-2.1	**6.7**	**3.58**
32.2	44.1	0.76	34.9	2.7	8.4	8.2	1,976		5.9	0.76	9.9	-2.1	**6.5**	**3.25**
35.0	46.8	0.76	37.6	2.6	8.2	8.6	2,086		6.2	0.76	10.0	-2.0	**6.2**	**2.99**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (US UNITS)

WH-65-H***-Y-1S *R513a, 60 Hz, ZR54K5E-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	45	35	14	42	-3.2	22,700	14.0	3,308	115	130	14	120	4.8	**33,600**	**2.98**
	50	40	14	46	-3.6	25,300	14.3	3,383	115	130	14		5.2	**36,500**	**3.16**
	55	44	14	51	-4.0	28,300	14.6	3,452	114	130	14		5.7	**39,700**	**3.37**
	60	48	14	56	-4.5	31,400	14.9	3,510	114	129	14		6.2	**43,000**	**3.59**
	65	53	14	60	-5.0	34,900	15.2	3,567	113	129	14		6.7	**46,700**	**3.84**
	70	57	14	65	-5.5	38,500	15.5	3,617	113	129	14		7.3	**50,500**	**4.09**
	75	61	14	69	-6.1	42,400	15.7	3,653	112	129	14		7.8	**54,500**	**4.37**
	80	66	14	73	-6.7	46,500	15.9	3,688	112	128	14		8.4	**58,700**	**4.66**
	85	70	14	78	-7.3	51,000	16.2	3,710	111	128	14		9.1	**63,300**	**5.00**
	90	74	14	82	-8.0	55,500	16.4	3,729	110	128	14		9.8	**67,900**	**5.34**
	45	36	14	43	-2.5	17,300	16.6	3,888	136	149	14	140	4.3	**30,200**	**2.28**
	50	41	14	47	-2.8	19,600	17.0	3,973	135	149	14		4.7	**32,800**	**2.42**
	55	45	14	52	-3.2	22,200	17.3	4,049	135	149	14		5.1	**35,700**	**2.58**
	60	49	14	56	-3.6	24,900	17.6	4,119	134	148	14		5.6	**38,600**	**2.75**
	65	54	14	61	-4.0	27,900	17.9	4,180	134	148	14		6.0	**41,800**	**2.93**
	70	58	14	66	-4.5	31,100	18.2	4,239	134	148	14		6.5	**45,200**	**3.12**
	75	63	14	70	-5.0	34,700	18.4	4,281	133	148	14		7.1	**49,000**	**3.35**
	80	67	14	75	-5.5	38,400	18.6	4,314	132	148	14		7.6	**52,800**	**3.59**
	85	71	14	79	-6.1	42,500	18.7	4,335	132	147	14		8.2	**57,000**	**3.85**
	90	76	14	83	-6.7	46,700	18.9	4,347	131	147	14		8.8	**61,200**	**4.13**
	45	37	14	43	-2.2	15,300	19.3	4,447	156	168	14	160	4.3	**30,100**	**1.98**
	50	42	14	48	-2.5	17,400	19.7	4,542	155	168	14		4.7	**32,500**	**2.10**
	55	46	14	52	-2.8	19,700	20.0	4,627	155	168	14		5.1	**35,100**	**2.22**
	60	50	14	57	-3.1	22,000	20.4	4,713	155	167	14		5.5	**37,700**	**2.34**
	65	55	14	62	-3.5	24,700	20.6	4,781	154	167	14		5.9	**40,700**	**2.49**
	70	59	14	66	-3.9	27,500	20.9	4,840	154	167	14		6.3	**43,700**	**2.65**
	75	63	14	71	-4.4	30,500	21.1	4,886	153	167	14		6.8	**46,800**	**2.81**
	80	68	14	75	-4.8	33,500	21.3	4,932	153	167	14		7.2	**50,000**	**2.97**
	85	72	14	80	-5.3	36,800	21.4	4,958	152	167	14		7.7	**53,400**	**3.16**
	90	76	14	84	-5.8	40,200	21.5	4,973	152	166	14		8.2	**56,800**	**3.35**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	50**	72	14	56	5.8	40,900	6.4	1,631	54	39	14	49	-5.1	**35,700**	**21.9**
	55**	77	14	61	5.7	40,200	6.9	1,726		39	14	49	-5.0	**34,700**	**20.1**
	60**	82	14	66	5.6	39,500	7.3	1,823		40	14	49	-4.8	**33,700**	**18.5**
	65**	87	14	71	5.6	38,900	7.8	1,919		40	14	49	-4.7	**32,800**	**17.1**
	70	92	14	76	5.5	38,300	8.2	2,023		41	14	49	-4.6	**31,800**	**15.7**
	75	97	14	80	5.4	37,800	8.7	2,132		41	14	49	-4.4	**30,900**	**14.5**
	80	102	14	85	5.3	37,200	9.2	2,252		42	14	49	-4.3	**29,900**	**13.3**
	85	107	14	90	5.3	36,700	9.8	2,380		42	14	49	-4.2	**29,000**	**12.2**
	90	112	14	95	5.2	36,100	10.4	2,524		42	14	50	-4.0	**27,900**	**11.1**
	95	117	14	100	5.1	35,600	11.1	2,681		43	14	50	-3.9	**26,900**	**10.0**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (METRIC)

WH-65-H***-Y-1S *R513a, 60 Hz, ZR54K5E-PFV*

METRIC

HEATING

OUTDOOR LOOP (Water)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
7.2	1.8	0.88	5.4	-1.8	6.7	14.0	3,308	46.2	54.4	0.88	49	2.7	**9.9**	**2.98**
10.0	4.2	0.88	8.0	-2.0	7.4	14.3	3,383	46.0	54.3	0.88		2.9	**10.7**	**3.16**
12.8	6.7	0.88	10.6	-2.2	8.3	14.6	3,452	45.7	54.2	0.88		3.2	**11.6**	**3.37**
15.6	9.1	0.88	13.1	-2.5	9.2	14.9	3,510	45.4	54.0	0.88		3.4	**12.6**	**3.59**
18.3	11.5	0.88	15.5	-2.8	10.2	15.2	3,567	45.2	53.9	0.88		3.7	**13.7**	**3.84**
21.1	13.9	0.88	18.0	-3.1	11.3	15.5	3,617	44.8	53.8	0.88		4.1	**14.8**	**4.09**
23.9	16.3	0.88	20.5	-3.4	12.4	15.7	3,653	44.6	53.6	0.88		4.3	**16.0**	**4.37**
26.7	18.7	0.88	23.0	-3.7	13.6	15.9	3,688	44.2	53.5	0.88		4.7	**17.2**	**4.66**
29.4	21.2	0.88	25.3	-4.1	14.9	16.2	3,710	43.8	53.3	0.88		5.1	**18.6**	**5.00**
32.2	23.6	0.88	27.8	-4.4	16.3	16.4	3,729	43.4	53.2	0.88		5.4	**19.9**	**5.34**
7.2	2.4	0.88	5.8	-1.4	5.1	16.6	3,888	57.6	64.9	0.88	60	2.4	**8.9**	**2.28**
10.0	4.8	0.88	8.4	-1.6	5.7	17.0	3,973	57.4	64.8	0.88		2.6	**9.6**	**2.42**
12.8	7.3	0.88	11.0	-1.8	6.5	17.3	4,049	57.2	64.7	0.88		2.8	**10.5**	**2.58**
15.6	9.7	0.88	13.6	-2.0	7.3	17.6	4,119	56.9	64.6	0.88		3.1	**11.3**	**2.75**
18.3	12.1	0.88	16.1	-2.2	8.2	17.9	4,180	56.7	64.5	0.88		3.3	**12.3**	**2.93**
21.1	14.5	0.88	18.6	-2.5	9.1	18.2	4,239	56.4	64.4	0.88		3.6	**13.2**	**3.12**
23.9	16.9	0.88	21.1	-2.8	10.2	18.4	4,281	56.1	64.3	0.88		3.9	**14.4**	**3.35**
26.7	19.3	0.88	23.6	-3.1	11.3	18.6	4,314	55.8	64.2	0.88		4.2	**15.5**	**3.59**
29.4	21.8	0.88	26.0	-3.4	12.5	18.7	4,335	55.4	64.1	0.88		4.6	**16.7**	**3.85**
32.2	24.2	0.88	28.5	-3.7	13.7	18.9	4,347	55.1	64.0	0.88		4.9	**17.9**	**4.13**
7.2	2.9	0.88	6.0	-1.2	4.5	19.3	4,447	68.7	75.5	0.88	71	2.4	**8.8**	**1.98**
10.0	5.3	0.88	8.6	-1.4	5.1	19.7	4,542	68.5	75.4	0.88		2.6	**9.5**	**2.10**
12.8	7.8	0.88	11.2	-1.6	5.8	20.0	4,627	68.3	75.3	0.88		2.8	**10.3**	**2.22**
15.6	10.2	0.88	13.9	-1.7	6.4	20.4	4,713	68.1	75.2	0.88		3.1	**11.0**	**2.34**
18.3	12.6	0.88	16.4	-1.9	7.2	20.6	4,781	67.8	75.1	0.88		3.3	**11.9**	**2.49**
21.1	15.0	0.88	18.9	-2.2	8.1	20.9	4,840	67.6	75.0	0.88		3.5	**12.8**	**2.65**
23.9	17.4	0.88	21.5	-2.4	8.9	21.1	4,886	67.3	74.9	0.88		3.8	**13.7**	**2.81**
26.7	19.8	0.88	24.0	-2.7	9.8	21.3	4,932	67.1	74.8	0.88		4.0	**14.7**	**2.97**
29.4	22.3	0.88	26.5	-2.9	10.8	21.4	4,958	66.8	74.7	0.88		4.3	**15.7**	**3.16**
32.2	24.7	0.88	29.0	-3.2	11.8	21.5	4,973	66.6	74.6	0.88		4.6	**16.6**	**3.35**

COOLING*

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0**	22.3	0.88	13.2	3.2	12.0	6.4	1,631	12	3.7	0.88	9.2	-2.8	**10.5**	**6.42**
12.8**	25.1	0.88	16.0	3.2	11.8	6.9	1,726		3.9	0.88	9.2	-2.8	**10.2**	**5.89**
15.6**	27.8	0.88	18.7	3.1	11.6	7.3	1,823		4.2	0.88	9.3	-2.7	**9.9**	**5.42**
18.3**	30.6	0.88	21.4	3.1	11.4	7.8	1,919		4.5	0.88	9.4	-2.6	**9.6**	**5.01**
21.1	33.3	0.88	24.2	3.1	11.2	8.2	2,023		4.7	0.88	9.4	-2.6	**9.3**	**4.60**
23.9	36.1	0.88	26.9	3.0	11.1	8.7	2,132		5.0	0.88	9.6	-2.4	**9.1**	**4.25**
26.7	38.8	0.88	29.6	2.9	10.9	9.2	2,252		5.3	0.88	9.6	-2.4	**8.8**	**3.90**
29.4	41.6	0.88	32.3	2.9	10.8	9.8	2,380		5.6	0.88	9.7	-2.3	**8.5**	**3.58**
32.2	44.3	0.88	35.1	2.9	10.6	10.4	2,524		5.8	0.88	9.8	-2.2	**8.2**	**3.25**
35.0	47.1	0.88	37.8	2.8	10.4	11.1	2,681		6.1	0.88	9.8	-2.2	**7.9**	**2.93**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (US UNITS)

WH-75-H***-Y-1S *R513a, 60 Hz, ZR61KCE-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	45	36	16	42	-3.2	25,700	20.6	3,733	115	129	16	120	4.8	**38,100**	**2.99**
	50	40	16	46	-3.6	28,800	21.0	3,829	115	129	16		5.2	**41,500**	**3.18**
	55	44	16	51	-4.0	32,200	21.4	3,930	114	129	16		5.7	**45,300**	**3.38**
	60	49	16	56	-4.5	35,800	21.8	4,031	114	129	16		6.2	**49,200**	**3.58**
	65	53	16	60	-5.0	40,000	22.2	4,125	113	129	16		6.8	**53,800**	**3.82**
	70	57	16	65	-5.5	44,300	22.7	4,216	113	128	16		7.3	**58,400**	**4.06**
	75	62	16	69	-6.2	49,200	23.1	4,297	112	128	16		8.0	**63,600**	**4.34**
	80	66	16	73	-6.8	54,300	23.6	4,363	111	128	16		8.7	**68,900**	**4.63**
	85	70	16	78	-7.5	60,100	24.0	4,403	111	128	16		9.4	**74,800**	**4.98**
	90	75	16	82	-8.3	66,100	24.5	4,424	110	127	16		10.2	**80,900**	**5.36**
	45	37	16	43	-2.5	20,300	23.5	4,524	136	149	16	140	4.5	**35,400**	**2.29**
	50	41	16	47	-2.8	22,800	23.7	4,572	135	148	16		4.8	**38,100**	**2.44**
	55	45	16	52	-3.2	25,600	23.9	4,630	135	148	16		5.2	**41,100**	**2.60**
	60	50	16	56	-3.6	28,700	24.1	4,693	134	148	16		5.6	**44,400**	**2.77**
	65	54	16	61	-4.0	32,100	24.4	4,759	134	148	16		6.1	**48,000**	**2.96**
	70	58	16	66	-4.5	35,700	24.6	4,823	133	148	16		6.6	**51,900**	**3.15**
	75	63	16	70	-5.0	39,800	24.9	4,884	133	147	16		7.1	**56,200**	**3.37**
	80	67	16	75	-5.5	44,100	25.2	4,937	132	147	16		7.7	**60,700**	**3.60**
	85	71	16	79	-6.2	49,000	25.5	4,979	132	147	16		8.3	**65,700**	**3.87**
	90	76	16	83	-6.8	54,100	25.8	5,006	131	147	16		9.0	**70,900**	**4.15**
	45	38	16	43	-2.2	17,300	25.5	5,135	156	168	16	160	4.4	**34,500**	**1.97**
	50	42	16	48	-2.4	19,400	25.8	5,175	155	167	16		4.7	**36,800**	**2.08**
	55	46	16	52	-2.7	21,900	26.1	5,227	155	167	16		5.0	**39,400**	**2.21**
	60	51	16	57	-3.1	24,500	26.4	5,289	155	167	16		5.3	**42,200**	**2.34**
	65	55	16	62	-3.4	27,400	26.7	5,359	154	167	16		5.8	**45,400**	**2.48**
	70	59	16	66	-3.8	30,500	27.1	5,438	154	167	16		6.2	**48,800**	**2.63**
	75	64	16	71	-4.3	34,000	27.5	5,513	153	167	16		6.7	**52,500**	**2.79**
	80	68	16	75	-4.7	37,700	27.9	5,587	153	166	16		7.2	**56,500**	**2.96**
	85	72	16	80	-5.2	41,800	28.3	5,656	152	166	16		7.7	**60,800**	**3.15**
	90	77	16	84	-5.8	46,200	28.7	5,718	152	166	16		8.3	**65,400**	**3.35**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	50**	72	16	56	5.9	47,500	13.0	1,897	54	38	16	48	-5.2	**41,300**	**21.8**
	55**	77	16	61	5.8	46,700	13.4	1,997		39	16	49	-5.0	**40,200**	**20.1**
	60**	82	16	66	5.7	45,900	13.8	2,101		39	16	49	-4.9	**39,100**	**18.6**
	65**	87	16	71	5.6	45,100	14.3	2,215		40	16	49	-4.8	**37,900**	**17.1**
	70	92	16	76	5.6	44,500	14.7	2,335		40	16	49	-4.6	**36,900**	**15.8**
	75	97	16	81	5.5	43,800	15.2	2,466		41	16	49	-4.5	**35,700**	**14.5**
	80	102	16	85	5.4	43,100	15.7	2,609		41	16	49	-4.4	**34,600**	**13.3**
	85	106	16	90	5.3	42,500	16.2	2,760		42	16	49	-4.2	**33,500**	**12.1**
	90	111	16	95	5.3	42,100	16.8	2,924		42	16	50	-4.1	**32,500**	**11.1**
	95	116	16	100	5.2	41,500	17.5	3,099		43	16	50	-3.9	**31,300**	**10.1**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (METRIC)

WH-75-H***-Y-1S *R513a, 60 Hz, ZR61KCE-PFV*

METRIC

HEATING

OUTDOOR LOOP (Water)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
7.2	1.9	1.0	5.4	-1.8	7.5	20.6	3,733	46.2	54.1	1.0	49	2.7	**11.2**	**2.99**
10.0	4.3	1.0	8.0	-2.0	8.4	21.0	3,829	46.0	54.0	1.0		2.9	**12.2**	**3.18**
12.8	6.8	1.0	10.6	-2.2	9.4	21.4	3,930	45.7	53.9	1.0		3.2	**13.3**	**3.38**
15.6	9.2	1.0	13.1	-2.5	10.5	21.8	4,031	45.4	53.8	1.0		3.4	**14.4**	**3.58**
18.3	11.6	1.0	15.5	-2.8	11.7	22.2	4,125	45.1	53.6	1.0		3.8	**15.8**	**3.82**
21.1	14.0	1.0	18.0	-3.1	13.0	22.7	4,216	44.8	53.5	1.0		4.1	**17.1**	**4.06**
23.9	16.4	1.0	20.5	-3.4	14.4	23.1	4,297	44.4	53.4	1.0		4.4	**18.6**	**4.34**
26.7	18.8	1.0	22.9	-3.8	15.9	23.6	4,363	44.1	53.3	1.0		4.8	**20.2**	**4.63**
29.4	21.3	1.0	25.2	-4.2	17.6	24.0	4,403	43.7	53.1	1.0		5.2	**21.9**	**4.98**
32.2	23.7	1.0	27.6	-4.6	19.4	24.5	4,424	43.2	53.0	1.0		5.7	**23.7**	**5.36**
7.2	2.6	1.0	5.8	-1.4	5.9	23.5	4,524	57.5	64.8	1.0	60	2.5	**10.4**	**2.29**
10.0	4.9	1.0	8.4	-1.6	6.7	23.7	4,572	57.3	64.7	1.0		2.7	**11.2**	**2.44**
12.8	7.4	1.0	11.0	-1.8	7.5	23.9	4,630	57.1	64.6	1.0		2.9	**12.0**	**2.60**
15.6	9.8	1.0	13.6	-2.0	8.4	24.1	4,693	56.9	64.4	1.0		3.1	**13.0**	**2.77**
18.3	12.2	1.0	16.1	-2.2	9.4	24.4	4,759	56.6	64.3	1.0		3.4	**14.1**	**2.96**
21.1	14.6	1.0	18.6	-2.5	10.5	24.6	4,823	56.3	64.2	1.0		3.7	**15.2**	**3.15**
23.9	17.1	1.0	21.1	-2.8	11.7	24.9	4,884	56.1	64.1	1.0		3.9	**16.5**	**3.37**
26.7	19.4	1.0	23.6	-3.1	12.9	25.2	4,937	55.7	64.0	1.0		4.3	**17.8**	**3.60**
29.4	21.9	1.0	26.0	-3.4	14.4	25.5	4,979	55.4	63.9	1.0		4.6	**19.3**	**3.87**
32.2	24.3	1.0	28.4	-3.8	15.9	25.8	5,006	55.0	63.8	1.0		5.0	**20.8**	**4.15**
7.2	3.1	1.0	6.0	-1.2	5.1	25.5	5,135	68.7	75.3	1.0	71	2.4	**10.1**	**1.97**
10.0	5.5	1.0	8.7	-1.3	5.7	25.8	5,175	68.5	75.2	1.0		2.6	**10.8**	**2.08**
12.8	7.9	1.0	11.3	-1.5	6.4	26.1	5,227	68.3	75.1	1.0		2.8	**11.5**	**2.21**
15.6	10.3	1.0	13.9	-1.7	7.2	26.4	5,289	68.2	75.0	1.0		2.9	**12.4**	**2.34**
18.3	12.8	1.0	16.4	-1.9	8.0	26.7	5,359	67.9	74.9	1.0		3.2	**13.3**	**2.48**
21.1	15.2	1.0	19.0	-2.1	8.9	27.1	5,438	67.7	74.8	1.0		3.4	**14.3**	**2.63**
23.9	17.6	1.0	21.5	-2.4	10.0	27.5	5,513	67.4	74.7	1.0		3.7	**15.4**	**2.79**
26.7	20.0	1.0	24.1	-2.6	11.0	27.9	5,587	67.1	74.6	1.0		4.0	**16.6**	**2.96**
29.4	22.4	1.0	26.5	-2.9	12.3	28.3	5,656	66.8	74.5	1.0		4.3	**17.8**	**3.15**
32.2	24.8	1.0	29.0	-3.2	13.5	28.7	5,718	66.5	74.4	1.0		4.6	**19.2**	**3.35**

COOLING*

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
10.0**	22.2	1.0	13.3	3.3	13.9	13.0	1,897	12	3.6	1.0	9.1	-2.9	**12.1**	**6.39**
12.8**	24.9	1.0	16.0	3.2	13.7	13.4	1,997		3.8	1.0	9.2	-2.8	**11.8**	**5.89**
15.6**	27.7	1.0	18.8	3.2	13.5	13.8	2,101		4.1	1.0	9.3	-2.7	**11.5**	**5.45**
18.3**	30.4	1.0	21.4	3.1	13.2	14.3	2,215		4.4	1.0	9.3	-2.7	**11.1**	**5.01**
21.1	33.1	1.0	24.2	3.1	13.0	14.7	2,335		4.7	1.0	9.4	-2.6	**10.8**	**4.63**
23.9	35.8	1.0	27.0	3.1	12.8	15.2	2,466		4.9	1.0	9.5	-2.5	**10.5**	**4.25**
26.7	38.6	1.0	29.7	3.0	12.6	15.7	2,609		5.2	1.0	9.6	-2.4	**10.1**	**3.90**
29.4	41.3	1.0	32.3	2.9	12.5	16.2	2,760		5.5	1.0	9.7	-2.3	**9.8**	**3.55**
32.2	44.1	1.0	35.1	2.9	12.3	16.8	2,924		5.8	1.0	9.7	-2.3	**9.5**	**3.25**
35.0	46.8	1.0	37.9	2.9	12.2	17.5	3,099		6.1	1.0	9.8	-2.2	**9.2**	**2.96**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (US UNITS)

WH-80-H***-Y-1S *R513a, 60 Hz, ZR68KCE-PFV*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	45	35	17	42	-3.4	29,300	21.7	4,484	115	130	17	120	5.2	**44,200**	**2.89**
	50	40	17	46	-3.8	32,700	21.8	4,506	114	130	17		5.6	**47,700**	**3.10**
	55	44	17	51	-4.3	36,400	21.9	4,536	114	129	17		6.1	**51,500**	**3.33**
	60	48	17	55	-4.8	40,400	22.0	4,572	113	129	17		6.6	**55,700**	**3.57**
	65	53	17	60	-5.3	44,800	22.2	4,610	113	129	17		7.1	**60,200**	**3.83**
	70	57	17	64	-5.8	49,400	22.3	4,655	112	129	17		7.7	**64,900**	**4.09**
	75	61	17	69	-6.4	54,500	22.5	4,708	112	129	17		8.3	**70,200**	**4.37**
	80	66	17	73	-7.1	59,900	22.7	4,765	111	128	17		9.0	**75,800**	**4.66**
	85	70	17	77	-7.8	65,800	23.0	4,823	110	128	17		9.7	**81,900**	**4.98**
	90	74	17	82	-8.5	71,900	23.2	4,888	110	128	17		10.5	**88,300**	**5.29**
	45	36	17	42	-2.6	22,600	25.4	5,435	135	149	17	140	4.8	**40,800**	**2.20**
	50	41	17	47	-3.0	25,700	25.4	5,445	135	149	17		5.2	**43,900**	**2.36**
	55	45	17	52	-3.4	29,100	25.5	5,468	134	148	17		5.6	**47,400**	**2.54**
	60	49	17	56	-3.9	32,800	25.7	5,501	134	148	17		6.1	**51,200**	**2.73**
	65	54	17	61	-4.3	36,900	25.9	5,546	133	148	17		6.6	**55,500**	**2.93**
	70	58	17	65	-4.9	41,200	26.1	5,606	133	148	17		7.1	**60,000**	**3.14**
	75	63	17	70	-5.4	46,000	26.4	5,671	132	148	17		7.7	**65,000**	**3.36**
	80	67	17	74	-6.0	51,100	26.6	5,746	132	148	17		8.4	**70,400**	**3.59**
	85	71	17	78	-6.7	56,800	26.9	5,833	131	147	17		9.1	**76,400**	**3.84**
	90	76	17	83	-7.4	62,800	27.3	5,928	130	147	17		9.8	**82,700**	**4.09**
	45	37	17	43	-2.3	19,700	13.6	6,033	155	168	17	160	4.8	**39,900**	**1.94**
	50	42	17	47	-2.6	22,300	13.7	6,035	155	168	17		5.1	**42,600**	**2.07**
	55	46	17	52	-3.0	25,300	13.8	6,051	155	167	17		5.4	**45,600**	**2.21**
	60	50	17	57	-3.3	28,400	13.9	6,089	154	167	17		5.8	**48,800**	**2.35**
	65	55	17	61	-3.7	31,800	14.0	6,134	154	167	17		6.3	**52,400**	**2.50**
	70	59	17	66	-4.2	35,400	14.1	6,193	153	167	17		6.7	**56,200**	**2.66**
	75	64	17	70	-4.6	39,300	14.3	6,267	153	167	17		7.2	**60,400**	**2.82**
	80	68	17	75	-5.1	43,400	14.5	6,361	152	167	17		7.7	**64,800**	**2.99**
	85	72	17	79	-5.7	47,900	14.7	6,464	152	166	17		8.3	**69,600**	**3.16**
	90	77	17	84	-6.2	52,700	14.9	6,581	151	166	17		8.9	**74,800**	**3.33**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
COOLING*	50**	74	17	56	6.4	54,600	13.2	2,194	54	39	17	48	-5.6	**47,500**	**21.6**
	55**	79	17	61	6.3	53,700	13.5	2,338		39	17	48	-5.4	**46,100**	**19.7**
	60**	84	17	66	6.2	52,700	13.9	2,482		40	17	48	-5.3	**44,600**	**18.0**
	65**	89	17	71	6.1	51,800	14.3	2,622		40	17	49	-5.1	**43,200**	**16.5**
	70	94	17	76	6.0	50,900	14.7	2,760		41	17	49	-5.0	**41,900**	**15.2**
	75	99	17	81	5.9	49,900	15.1	2,900		42	17	49	-4.8	**40,400**	**13.9**
	80	104	17	86	5.8	49,100	15.5	3,041		42	17	49	-4.6	**39,100**	**12.9**
	85	109	17	91	5.7	48,100	15.9	3,181		43	17	49	-4.5	**37,700**	**11.9**
	90	114	17	96	5.6	47,300	16.4	3,329		43	17	49	-4.3	**36,400**	**10.9**
	95	119	17	101	5.5	46,500	16.9	3,481		44	17	50	-4.1	**35,000**	**10.1**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

Performance Tables - WH-Series (METRIC)

WH-80-H***-Y-1S *R513a, 60 Hz, ZR68KCE-PFV*

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
HEATING	7.2	1.8	1.1	5.3	-1.9	8.6	21.7	4,484	46.0	54.3	1.1	49	2.9	**13.0**	**2.89**
	10.0	4.2	1.1	7.9	-2.1	9.6	21.8	4,506	45.8	54.2	1.1		3.1	**14.0**	**3.10**
	12.8	6.7	1.1	10.4	-2.4	10.7	21.9	4,536	45.5	54.1	1.1		3.4	**15.1**	**3.33**
	15.6	9.1	1.1	12.9	-2.7	11.8	22.0	4,572	45.2	54.0	1.1		3.7	**16.3**	**3.57**
	18.3	11.5	1.1	15.4	-2.9	13.1	22.2	4,610	44.9	53.8	1.1		3.9	**17.6**	**3.83**
	21.1	13.9	1.1	17.9	-3.2	14.5	22.3	4,655	44.6	53.7	1.1		4.3	**19.0**	**4.09**
	23.9	16.3	1.1	20.3	-3.6	16.0	22.5	4,708	44.3	53.6	1.1		4.6	**20.6**	**4.37**
	26.7	18.7	1.1	22.8	-3.9	17.6	22.7	4,765	43.9	53.5	1.1		5.0	**22.2**	**4.66**
	29.4	21.2	1.1	25.1	-4.3	19.3	23.0	4,823	43.5	53.3	1.1		5.4	**24.0**	**4.98**
	32.2	23.6	1.1	27.5	-4.7	21.1	23.2	4,888	43.1	53.2	1.1		5.8	**25.9**	**5.29**
	7.2	2.4	1.1	5.8	-1.4	6.6	25.4	5,435	57.3	64.9	1.1	60	2.7	**12.0**	**2.20**
	10.0	4.8	1.1	8.3	-1.7	7.5	25.4	5,445	57.1	64.8	1.1		2.9	**12.9**	**2.36**
	12.8	7.3	1.1	10.9	-1.9	8.5	25.5	5,468	56.9	64.7	1.1		3.1	**13.9**	**2.54**
	15.6	9.7	1.1	13.4	-2.2	9.6	25.7	5,501	56.6	64.6	1.1		3.4	**15.0**	**2.73**
	18.3	12.1	1.1	15.9	-2.4	10.8	25.9	5,546	56.3	64.4	1.1		3.7	**16.3**	**2.93**
	21.1	14.5	1.1	18.4	-2.7	12.1	26.1	5,606	56.1	64.4	1.1		3.9	**17.6**	**3.14**
	23.9	16.9	1.1	20.9	-3.0	13.5	26.4	5,671	55.7	64.3	1.1		4.3	**19.0**	**3.36**
	26.7	19.3	1.1	23.4	-3.3	15.0	26.6	5,746	55.3	64.2	1.1		4.7	**20.6**	**3.59**
	29.4	21.8	1.1	25.7	-3.7	16.6	26.9	5,833	54.9	64.1	1.1		5.1	**22.4**	**3.84**
	32.2	24.2	1.1	28.1	-4.1	18.4	27.3	5,928	54.6	63.9	1.1		5.4	**24.2**	**4.09**
	7.2	3.0	1.1	5.9	-1.3	5.8	13.6	6,033	68.4	75.4	1.1	71	2.7	**11.7**	**1.94**
	10.0	5.4	1.1	8.6	-1.4	6.5	13.7	6,035	68.3	75.3	1.1		2.8	**12.5**	**2.07**
	12.8	7.8	1.1	11.1	-1.7	7.4	13.8	6,051	68.1	75.2	1.1		3.0	**13.4**	**2.21**
	15.6	10.2	1.1	13.8	-1.8	8.3	13.9	6,089	67.9	75.2	1.1		3.2	**14.3**	**2.35**
	18.3	12.7	1.1	16.2	-2.1	9.3	14.0	6,134	67.6	75.1	1.1		3.5	**15.4**	**2.50**
	21.1	15.1	1.1	18.8	-2.3	10.4	14.1	6,193	67.4	74.9	1.1		3.7	**16.5**	**2.66**
	23.9	17.5	1.1	21.3	-2.6	11.5	14.3	6,267	67.1	74.8	1.1		4.0	**17.7**	**2.82**
	26.7	19.9	1.1	23.9	-2.8	12.7	14.5	6,361	66.8	74.8	1.1		4.3	**19.0**	**2.99**
	29.4	22.3	1.1	26.2	-3.2	14.0	14.7	6,464	66.5	74.7	1.1		4.6	**20.4**	**3.16**
	32.2	24.7	1.1	28.8	-3.4	15.4	14.9	6,581	66.2	74.6	1.1		4.9	**21.9**	**3.33**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (kW)**	**COP_C**
COOLING*	10.0**	23.2	1.1	13.6	3.6	16.0	13.2	2,194	12	3.8	1.1	8.9	-3.1	**13.9**	**6.33**
	12.8**	25.9	1.1	16.3	3.5	15.7	13.5	2,338		4.1	1.1	9.0	-3.0	**13.5**	**5.77**
	15.6**	28.8	1.1	19.0	3.4	15.4	13.9	2,482		4.4	1.1	9.1	-2.9	**13.1**	**5.28**
	18.3**	31.6	1.1	21.7	3.4	15.2	14.3	2,622		4.7	1.1	9.2	-2.8	**12.7**	**4.84**
	21.1	34.4	1.1	24.4	3.3	14.9	14.7	2,760		5.0	1.1	9.2	-2.8	**12.3**	**4.45**
	23.9	37.3	1.1	27.2	3.3	14.6	15.1	2,900		5.3	1.1	9.3	-2.7	**11.8**	**4.07**
	26.7	40.1	1.1	29.9	3.2	14.4	15.5	3,041		5.6	1.1	9.4	-2.6	**11.5**	**3.78**
	29.4	42.9	1.1	32.6	3.2	14.1	15.9	3,181		5.8	1.1	9.5	-2.5	**11.0**	**3.49**
	32.2	45.7	1.1	35.3	3.1	13.9	16.4	3,329		6.2	1.1	9.6	-2.4	**10.7**	**3.19**
	35.0	48.6	1.1	38.1	3.1	13.6	16.9	3,481		6.4	1.1	9.7	-2.3	**10.3**	**2.96**

* *Cooling via reversing models (-HAC), or switching indoor/outdoor*
** *Lower cooling mode outdoor loop ELT's may require flow control*

go to TABLE OF CONTENTS

WH-Series Electrical Specifications

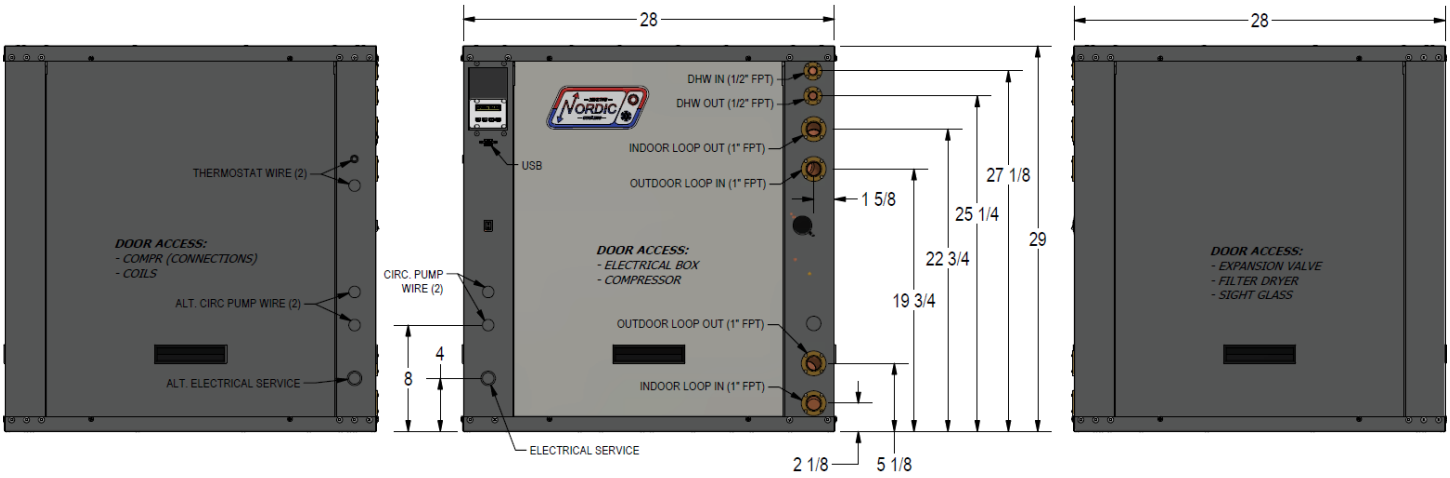
TABLE 41 - WH-Series (R513a) Electrical Specifications											
		Power Supply			Compressor		Circulators	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	Max. A	Amps	Amps	Amps	ga
WH-25	1	208/230-1-60	187	253	10.8	56	5.0	16.0	18.7	30	#10-2*
	2	208-3-60	187	229	7.7	58	5.0	12.9	14.8	20	#12-3*
	4	460-3-60	414	506	3.8	29	-	4.0	5.0	15	#14-3
	5	-	-	-	-	-	-	-	-	-	-
WH-45	1	208/230-1-60	187	253	15.4	87	5.0	20.6	24.5	40	#8-2*
	2	208-3-60	187	229	10.8	73	5.0	16.0	18.7	30	#10-3*
	4	460-3-60	414	506	5.8	38	-	6.0	7.5	15	#14-3
	5	575-3-60	518	632	4.2	28	-	4.4	5.5	15	#14-3
WH-55	1	208/230-1-60	187	253	19.9	104	7.0	27.1	32.1	50	#8-2*
	2	208-3-60	187	229	12.8	93	7.0	20.0	23.2	30	#10-3*
	4	460-3-60	414	506	5.8	48	-	6.0	7.5	15	#14-3
	5	575-3-60	518	632	4.7	38	-	4.9	6.1	15	#14-3
WH-65	1	208/230-1-60	187	253	25.3	137	7.0	32.5	38.8	60	#6-2*
	2	208-3-60	187	229	15.4	114	7.0	22.6	26.5	40	#8-3*
	4	460-3-60	414	506	7.1	52	-	7.3	9.1	15	#14-3
	5	575-3-60	518	632	5.3	40	-	5.5	6.8	15	#14-3
WH-75	1	208/230-1-60	187	253	23.7	144	7.0	30.9	36.8	60	#6-2*
	2	208-3-60	187	229	18.6	128	7.0	25.8	30.5	50	#8-3*
	4	460-3-60	414	506	9.0	63	-	9.2	11.5	20	#12-3
	5	575-3-60	518	632	6.6	49	-	6.8	8.5	15	#14-3
WH-80	1	208/230-1-60	187	253	28.8	176	7.0	36.0	43.2	60	#6-2*
	2	208-3-60	187	229	18.6	156	7.0	25.8	30.5	50	#8-3*
	4	460-3-60	414	506	9.0	75	-	9.2	11.5	20	#12-3
	5	575-3-60	518	632	7.4	54	-	7.6	9.5	15	#14-3

* For 208/230-1-60 and 208-3-60, 1 additional conductor (neutral) is required if connecting 115VAC circulators to the unit.

go to TABLE OF CONTENTS

Dimensions: WH-25/45/55

All dimensions in inches.



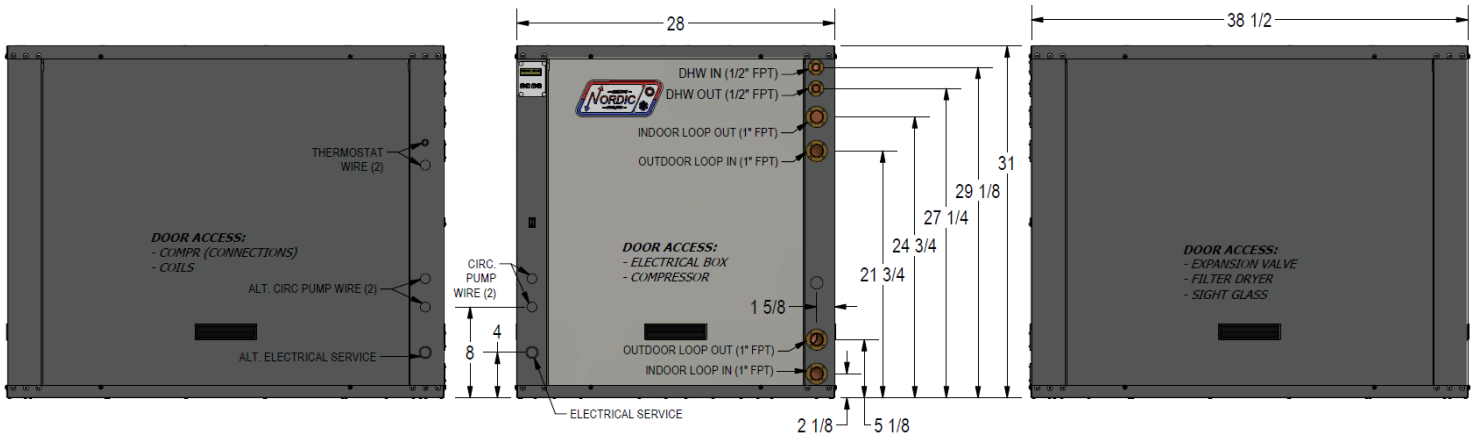
LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE: **2 FT**

RECOMMENDED RIGHT SIDE CLEARANCE: **2 FT**

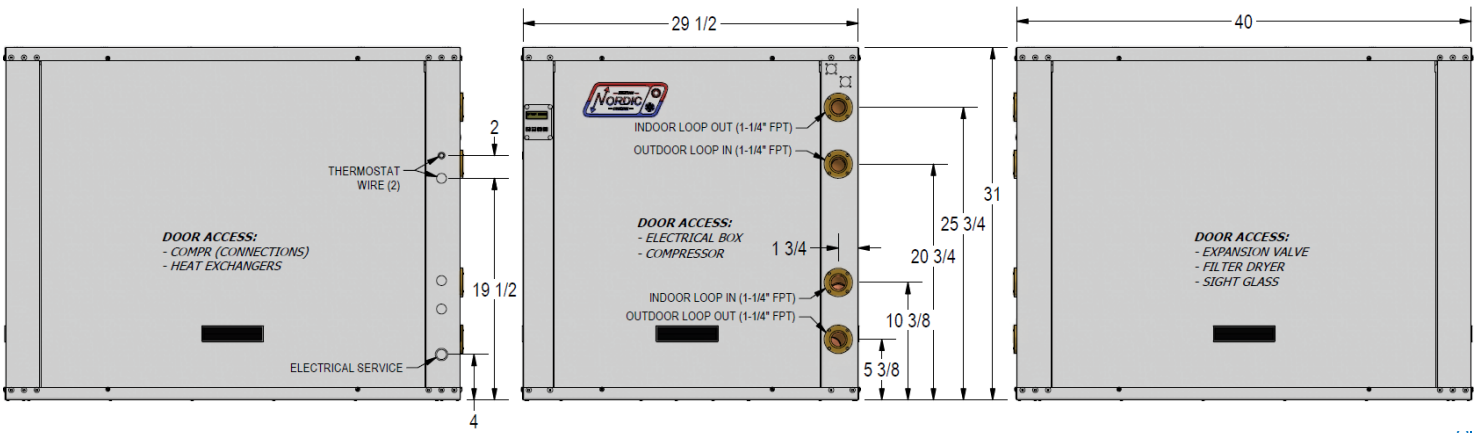
NO BACK CLEARANCE REQUIRED

Dimensions: WH-65/75/80



CLEARANCES: AS ABOVE

Dimensions: WH-85



CLEARANCES: AS ABOVE

go to

Model Specific Information: WP-Series

Table 24 - W-Series Refrigerant Charge				
MODEL	lb	*kg*	TYPE	OIL
WP-45	5.5	*2.5*	R454b	POE
WP-55	7.0	*3.2*	R454b	POE
WP-65	8.5	*3.9*	R454b	POE
WP-75	9.0	*4.1*	R454b	POE
WP-80	10.0	*4.5*	R454b	POE

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

Table 43 - WP-Series Shipping Information				
MODEL	WEIGHT	DIMENSIONS in (cm)		
	lb. (kg)	L	W	H
WP-45	320 (145)	48 (122)	37 (94)	37 (94)
WP-55	380 (173)	48 (122)	37 (94)	37 (94)
WP-65	480 (218)	48 (122)	37 (94)	37 (94)
WP-75	520 (236)	48 (122)	37 (94)	37 (94)
WP-80	570 (259)	48 (122)	37 (94)	37 (94)

Table 44 - WP-Series Operating Temperature Limits					
Loop	Mode	Parameter	(°F)	*(°C)*	Note
Pool	Heating	Minimum EWT	50	*10*	Reduce flow if necessary during startup.
	Heating	Maximum LWT	**105**	***38***	
Outdoor	Heating	Minimum ELT	39	*4*	Ground water (open loop) system.
	Heating	Minimum ELT	23	*-5*	Ground loop system. Adequate freeze protection required.

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

Table 45 - WP-Series Required Loop Flow Rates				
	OUTDOOR LOOP		POOL WATER LOOP	
MODEL	gpm	*L/s*	gpm	*L/s*
WP-45	10	*0.63*	21	*1.3*
WP-55	12	*0.76*	28	*1.8*
WP-65	14	*0.88*	35	*2.2*
WP-75	16	*1.0*	40	*2.5*
WP-80	17	*1.1*	45	*2.8*

Note for pool pump sizing: These flow rates are greater than those required for space heating heat pumps of a similar heating capacity.

Table 46 - Sound Levels (dBA)*		
MODEL	1 ft distance	3 ft distance
WP-45	57.2	56.0
WP-55	56.4	54.9
WP-65	55.7	53.0
WP-75	55.7	53.0
WP-80	55.7	53.0

* With all doors installed.

Table 47 - WP-Series Pool Water Pressure Drop (all model sizes)			
Flow (gpm)	psi	*kPa*	Comments
20	1.5	*10*	
21	1.6	*11*	This is flow required for WP-45.
25	2.2	*15*	
28	2.6	*18*	This is flow required for WP-55.
30	2.9	*20*	
35	3.8	*26*	This is flow required for WP-65.
40	4.7	*32*	This is flow required for WP-75.
45	5.8	*40*	This is flow required for WP-80.
50	6.9	*48*	
60	9.5	*66*	

go to TABLE OF CONTENTS

Table 48: WP Outdoor Loop Pressure Drop			OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% prop. glycol 32°F)	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*	psi	*kPa*
WP-45	6	*0.38*	1.7	*12*	2.0	*14*	2.6	*18*
	7	*0.44*	2.1	*14*	2.5	*17*	3.3	*23*
	8	*0.50*	2.8	*19*	3.0	*21*	4.0	*27*
	9	*0.57*	3.5	*24*	3.8	*26*	5.0	*34*
	10	***0.63***	**4.0**	***28***	**4.7**	***32***	**6.2**	***43***
	11	*0.69*	4.6	*32*	5.5	*38*	7.2	*50*
	12	*0.76*	5.5	*38*	6.6	*45*	8.7	*60*
	13	*0.82*	6.2	*43*	7.4	*51*	9.7	*67*
	14	*0.88*	7.0	*48*	8.6	*59*	11.3	*78*
	15	*0.95*	8.2	*57*	9.5	*65*	12.5	*86*
WP-55	6	*0.38*	1.2	*8.3*	1.3	*9.0*	1.7	*12*
	7	*0.44*	1.6	*11*	1.6	*11*	2.1	*14*
	8	*0.50*	1.9	*13*	2.1	*14*	2.8	*19*
	9	*0.57*	2.4	*17*	2.4	*17*	3.2	*22*
	10	*0.63*	2.9	*20*	3.1	*21*	4.1	*28*
	11	*0.69*	3.1	*21*	3.6	*25*	4.7	*33*
	12	***0.76***	**3.7**	***26***	**4.4**	***30***	**5.8**	***40***
	13	*0.82*	4.3	*30*	5	*34*	6.6	*45*
	14	*0.88*	5	*34*	5.7	*39*	7.5	*52*
	15	*0.95*	5.8	*40*	6.4	*44*	8.4	*58*
	16	*1.01*	6.3	*43*	7.1	*49*	9.3	*64*
WP-65	8	*0.50*	1.9	*13*	2.2	*15*	2.9	*20*
	9	*0.57*	2.3	*16*	2.7	*19*	3.6	*24*
	10	*0.63*	2.6	*18*	3.3	*23*	4.3	*30*
	11	*0.69*	3.2	*22*	4	*28*	5.3	*36*
	12	*0.76*	3.9	*27*	4.6	*32*	6.0	*42*
	13	*0.82*	4.4	*30*	5.2	*36*	6.8	*47*
	14	***0.88***	**5**	***34***	**5.8**	***40***	**7.6**	***53***
	15	*0.95*	5.7	*39*	6.5	*45*	8.5	*59*
	16	*1.01*	6.5	*45*	7.3	*50*	9.6	*66*
WP-75 WP-80	8	*0.50*	1.3	*9.0*	1.3	*9.0*	1.7	*12*
	9	*0.57*	1.6	*11*	1.6	*11*	2.1	*14*
	10	*0.63*	1.9	*13*	2.1	*14*	2.8	*19*
	11	*0.69*	2.3	*16*	2.4	*17*	3.2	*22*
	12	*0.76*	2.6	*18*	2.9	*20*	3.8	*26*
	13	*0.82*	3.0	*21*	3.3	*23*	4.3	*30*
	14	*0.88*	3.2	*22*	3.7	*26*	4.9	*33*
	15	*0.95*	3.5	*24*	4.1	*28*	5.4	*37*
	16	***1.01***	**4.0**	***28***	**4.7**	***32***	**6.2**	***43***
	17	*1.07*	4.4	*30*	5.2	*36*	6.8	*47*

go to TABLE OF CONTENTS

WP-Series Capacity Ratings

The tables show the heat pump performance when heating a pool to 80°F (27°C), or a hot tub to 104°F (40°C).
All data is for ***60 Hz operation*** with ***water*** as the pool loop fluid.

Table 49 - Standard Capacity Ratings: HEATING							
Model	Out-door Loop Flow	Pool Water Flow	Pool Water LWT	Ground Loop ELT	Input Energy (W)	Capacity (Btu/hr)	COP_H
WP-45	8.0 gpm	21 gpm	80°F	50°F	1,758	34,300	5.7
				32°F	1,651	24,700	4.4
			104°F	50°F	2,379	32,300	4.0
				32°F	2,211	23,000	3.1
WP-55	10.0 gpm	28 gpm	80°F	50°F	2,503	46,100	5.4
				32°F	2,286	33,500	4.3
			104°F	50°F	3,443	44,400	3.8
				32°F	3,140	32,700	3.1
WP-65	12.0 gpm	35 gpm	80°F	50°F	3,066	56,300	5.4
				32°F	2,832	41,400	4.3
			104°F	50°F	4,204	54,200	3.8
				32°F	3,862	40,200	3.1
WP-75	14.0 gpm	40 gpm	80°F	50°F	3,605	67,000	5.4
				32°F	3,402	47,800	4.1
			104°F	50°F	4,696	63,700	4.0
				32°F	4,451	46,300	3.1
WP-80	16.0 gpm	45 gpm	80°F	50°F	4,176	76,600	5.4
				32°F	3,764	54,900	4.3
			104°F	50°F	5,740	74,000	3.8
				32°F	5,213	54,300	3.1

METRIC

Table 49a - Standard Capacity Ratings: HEATING (METRIC)							
Model	Out-door Loop Flow	Pool Water Flow	Pool Water LWT	Ground Loop ELT	Input Energy (W)	Capacity (kW)	COP_H
WP-45	0.50 L/s	1.3 L/s	27°C	10°C	1,759	10.1	5.7
				0°C	1,651	7.2	4.4
			40°C	10°C	2,379	9.5	4.0
				0°C	2,211	6.7	3.1
WP-55	0.63 L/s	1.8 L/s	27°C	10°C	2,503	13.5	5.4
				0°C	2,286	9.8	4.3
			40°C	10°C	3,443	13.0	3.8
				0°C	3,140	9.6	3.1
WP-65	0.76 L/s	2.2 L/s	27°C	10°C	3,066	16.5	5.4
				0°C	2,832	12.1	4.3
			40°C	10°C	4,204	15.9	3.8
				0°C	3,862	11.8	3.1
WP-75	0.88 L/s	2.5 L/s	27°C	10°C	3,605	19.6	5.4
				0°C	3,402	14.0	4.1
			40°C	10°C	4,696	18.7	4.0
				0°C	4,451	13.6	3.1
WP-80	1.0 L/s	2.8 L/s	27°C	10°C	4,176	22.4	5.4
				0°C	3,764	16.1	4.3
			40°C	10°C	5,740	21.7	3.8
				0°C	5,213	15.9	3.1

go to TABLE OF CONTENTS

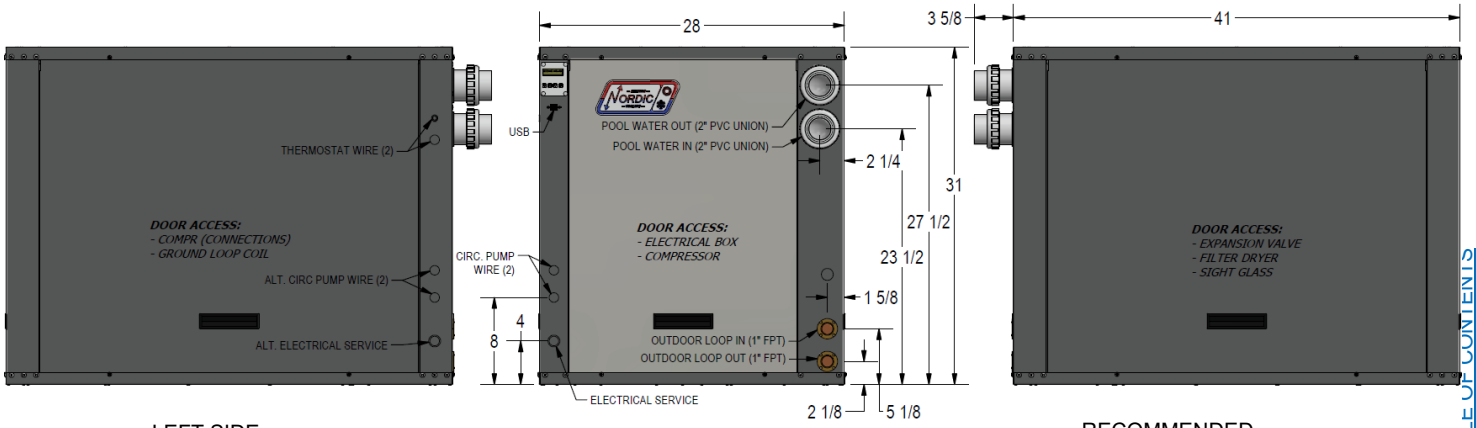
WP-Series Electrical Specifications

TABLE 50 - WP-Series (R454b) Electrical Specifications											
		Power Supply			Compressor		Circulators	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	Max. A	Amps	Amps	Amps	ga
WP-45	1	208/230-1-60	187	253	16.7	94	5.0	21.9	26.1	40	#8-2*
	2	208-3-60	187	229	12.2	98	5.0	17.4	20.5	30	#10-3*
	4	460-3-60	414	506	5.8	44	-	6.0	7.5	15	#14-3
	5	575-3-60	518	632	4.5	27	-	4.7	5.8	15	#14-3
WP-55	1	208/230-1-60	187	253	22.4	126	7.0	29.6	35.2	50	#8-2*
	2	208-3-60	187	229	12.8	120	7.0	20.0	23.2	40	#8-3*
	4	460-3-60	414	506	6.0	49	-	6.2	7.7	15	#14-3
	5	575-3-60	518	632	5.8	41	-	6.0	7.5	15	#14-3
WP-65	1	208/230-1-60	187	253	25.6	155	7.0	32.8	39.2	60	#6-2*
	2	208-3-60	187	229	18.6	155	7.0	25.8	30.5	50	#8-3*
	4	460-3-60	414	506	8.3	58	-	8.5	10.6	20	#12-3
	5	575-3-60	518	632	7.7	48	-	7.9	9.8	15	#14-3
WP-75	1	208/230-1-60	187	253	30.1	170	7.0	37.3	44.8	60	#6-2*
	2	208-3-60	187	229	21.2	157	7.0	28.4	33.7	50	#8-3*
	4	460-3-60	414	506	9.1	75	-	9.3	11.6	20	#12-3
	5	575-3-60	518	632	7.7	48	-	7.9	9.8	15	#14-3
WP-80	1	208/230-1-60	187	253	32.8	184	7.0	40.0	48.2	80	#4-2*
	2	208-3-60	187	229	22.4	166	7.0	29.6	35.2	60	#6-3*
	4	460-3-60	414	506	8.8	75	-	9.0	11.2	20	#12-3
	5	575-3-60	518	632	7.2	54	-	7.4	9.2	15	#14-3

* For 208/230-1-60 & 208-3-60: 1 additional conductor (neutral) is required if connecting 115VAC circulators to the unit.

Dimensions: WP-45/55/65/75/80

All dimensions in inches.



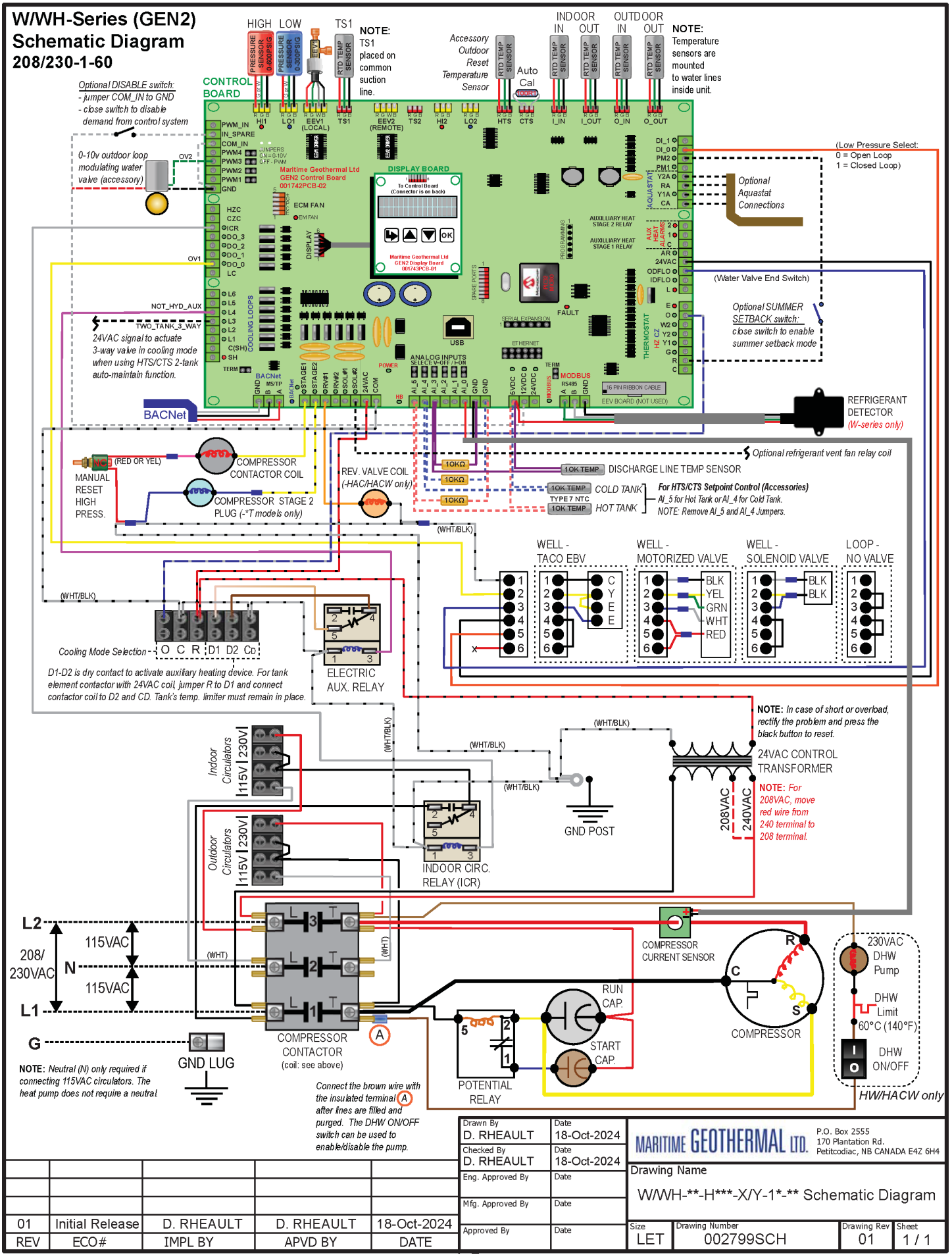
LEFT SIDE CLEARANCE OPTIONAL

RECOMMENDED FRONT CLEARANCE: **3 FT** (NO BACK CLEARANCE REQUIRED)

RECOMMENDED RIGHT SIDE CLEARANCE: **2 FT**

go to TABLE OF CONTENTS

W/WH-Series (GEN2) Schematic Diagram 208/230-1-60



REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	18-Oct-2024

Drawn By: D. RHEAULT	Date: 18-Oct-2024	
Checked By: D. RHEAULT	Date: 18-Oct-2024	
Eng. Approved By	Date	
Mfg. Approved By	Date	
Approved By	Date	

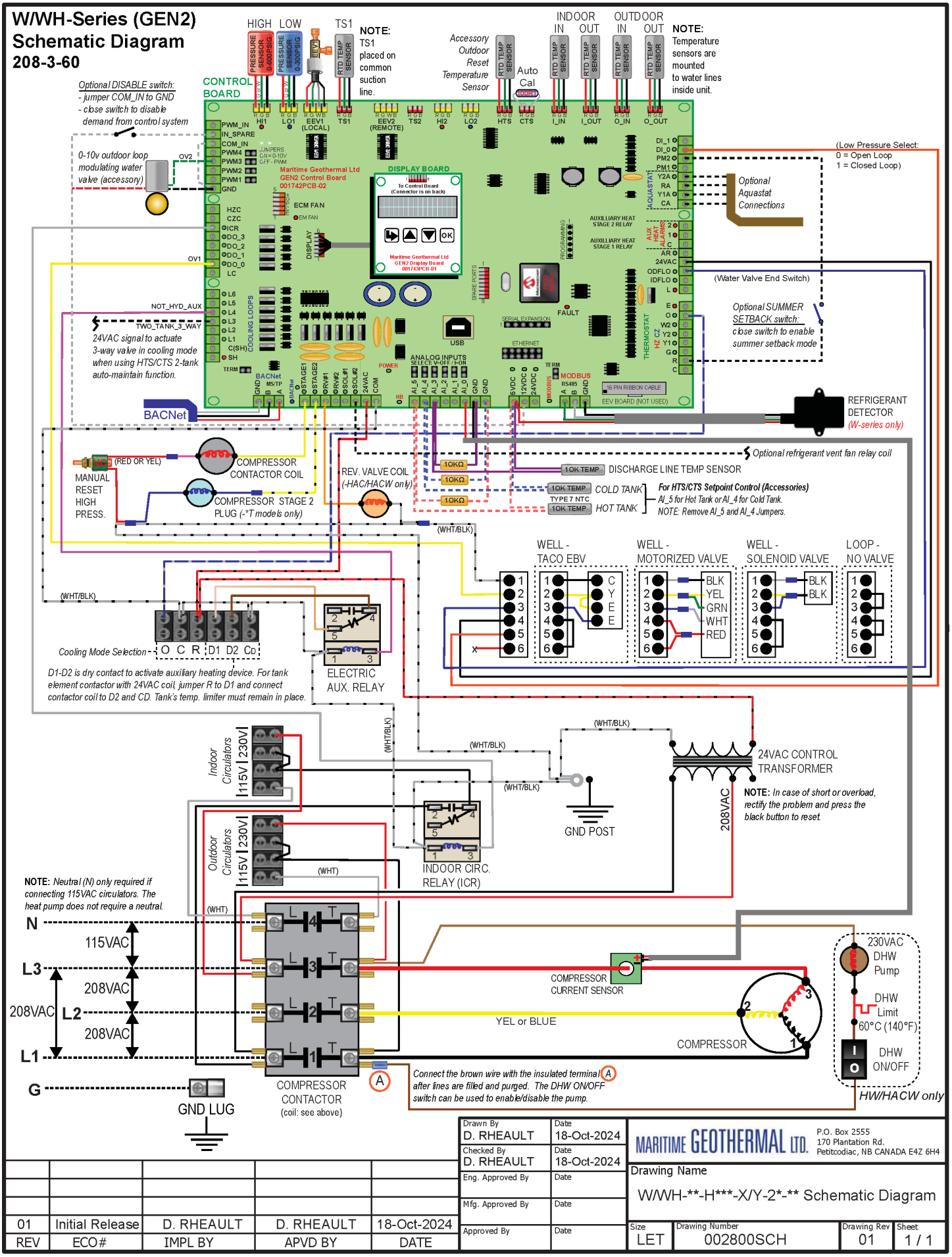
MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: W/WH-**-H***-X/Y-1*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002799SCH	01	1 / 1

go to TABLE OF CONTENTS

W/WH-Series (GEN2) Schematic Diagram 208-3-60



REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	18-Oct-2024

Drawn By	D. RHEAULT	Date	18-Oct-2024
Checked By	D. RHEAULT	Date	18-Oct-2024
Eng. Approved By		Date	
Mfg. Approved By		Date	
Approved By		Date	

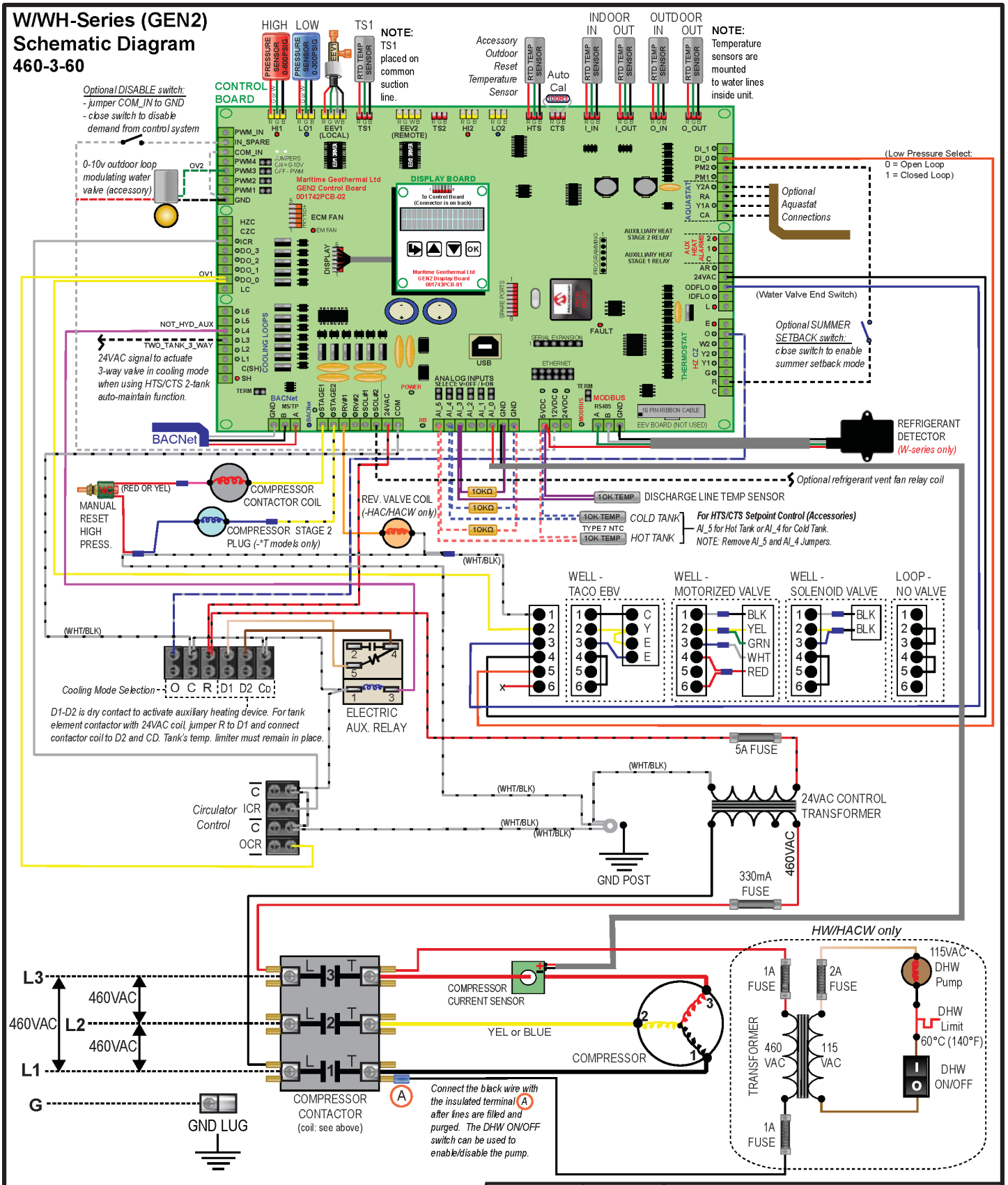
MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: W/WH-**-H***-X/Y-2*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002800SCH	01	1 / 1

go to TABLE OF CONTENTS

W/WH-Series (GEN2) Schematic Diagram 460-3-60



01	Initial Release	D. RHEAULT	D. RHEAULT	18-Oct-2024
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By: D. RHEAULT	Date: 18-Oct-2024
Checked By: D. RHEAULT	Date: 18-Oct-2024
Eng. Approved By	Date
Mfg. Approved By	Date
Approved By	Date

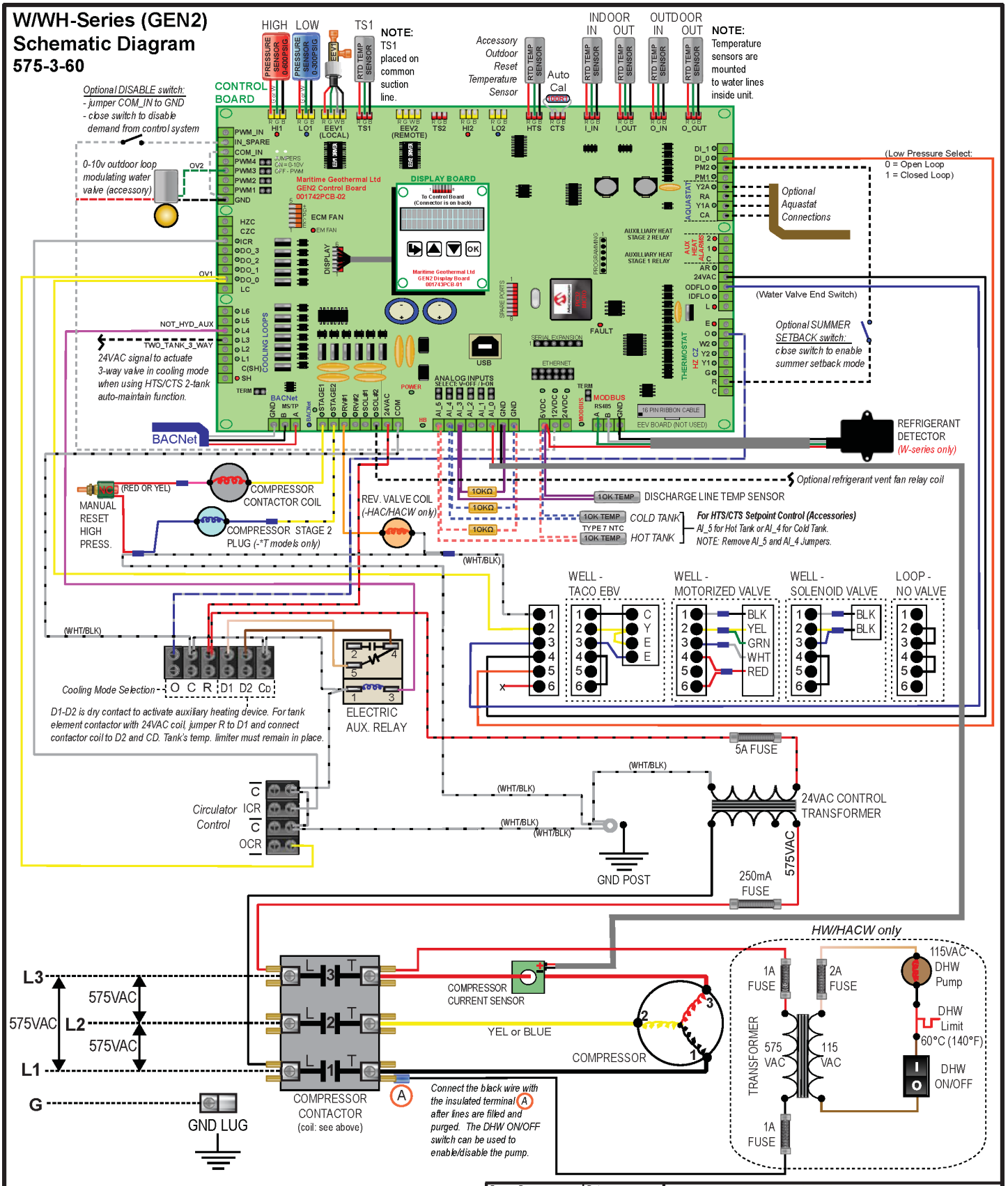
MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: W/WH-**-H***-X/Y-4*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002801SCH	01	1 / 1

go to TABLE OF CONTENTS

W/WH-Series (GEN2) Schematic Diagram 575-3-60



REV	ECO#	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	18-Oct-2024

Drawn By	D. RHEAULT	Date 18-Oct-2024
Checked By	D. RHEAULT	Date 18-Oct-2024
Eng. Approved By		Date
Mfg. Approved By		Date
Approved By		Date

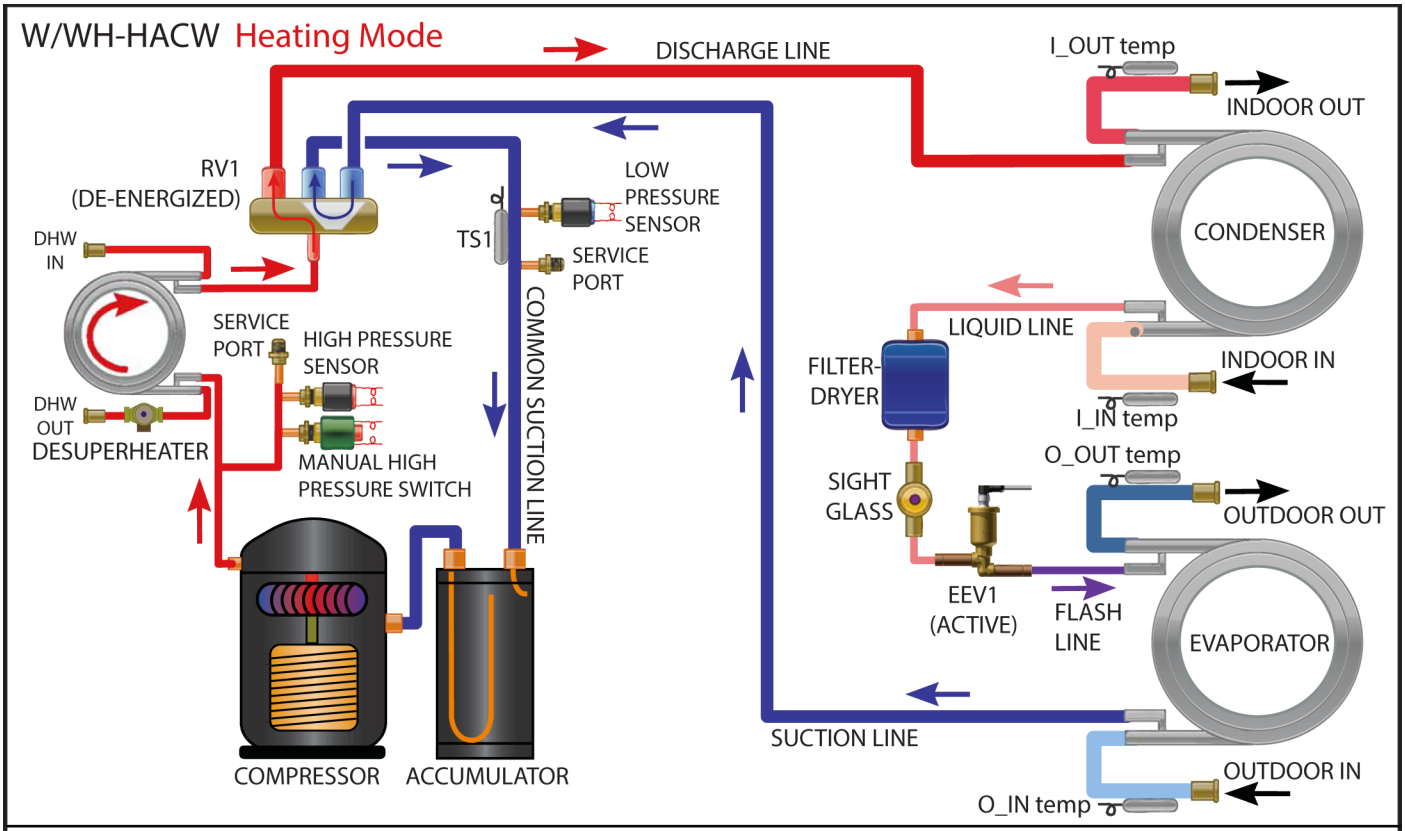
MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

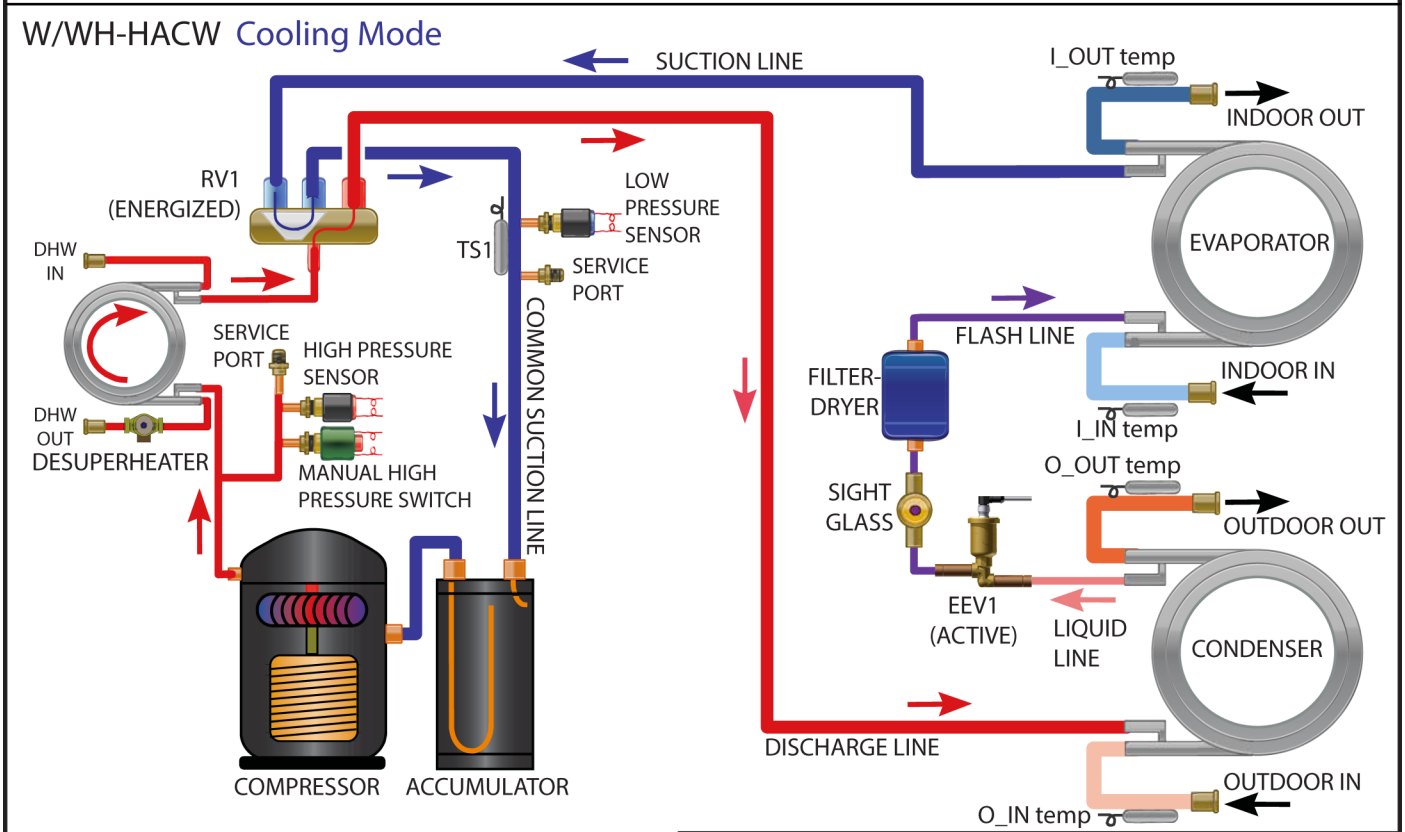
Drawing Name: W/WH-**-H***-X/Y-5*-** Schematic Diagram

Size	Drawing Number	Drawing Rev	Sheet
LET	002802SCH	01	1 / 1

go to TABLE OF CONTENTS

Refrigeration Circuit Diagram: Sizes 25 to 80, Reversing





01	Initial Release	D. RHEAULT	D. RHEAULT	17-JUN-2019
REV	ECO#	IMPL BY	APVD BY	DATE

Drawn By: Dan Rheault	Date: 17-JUN-2019
Checked By: Dan Rheault	Date: 17-JUN-2019
Eng. Approved By: Dan Rheault	Date: 17-JUN-2019
Mfg. Approved By	Date
Approved By	Date

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

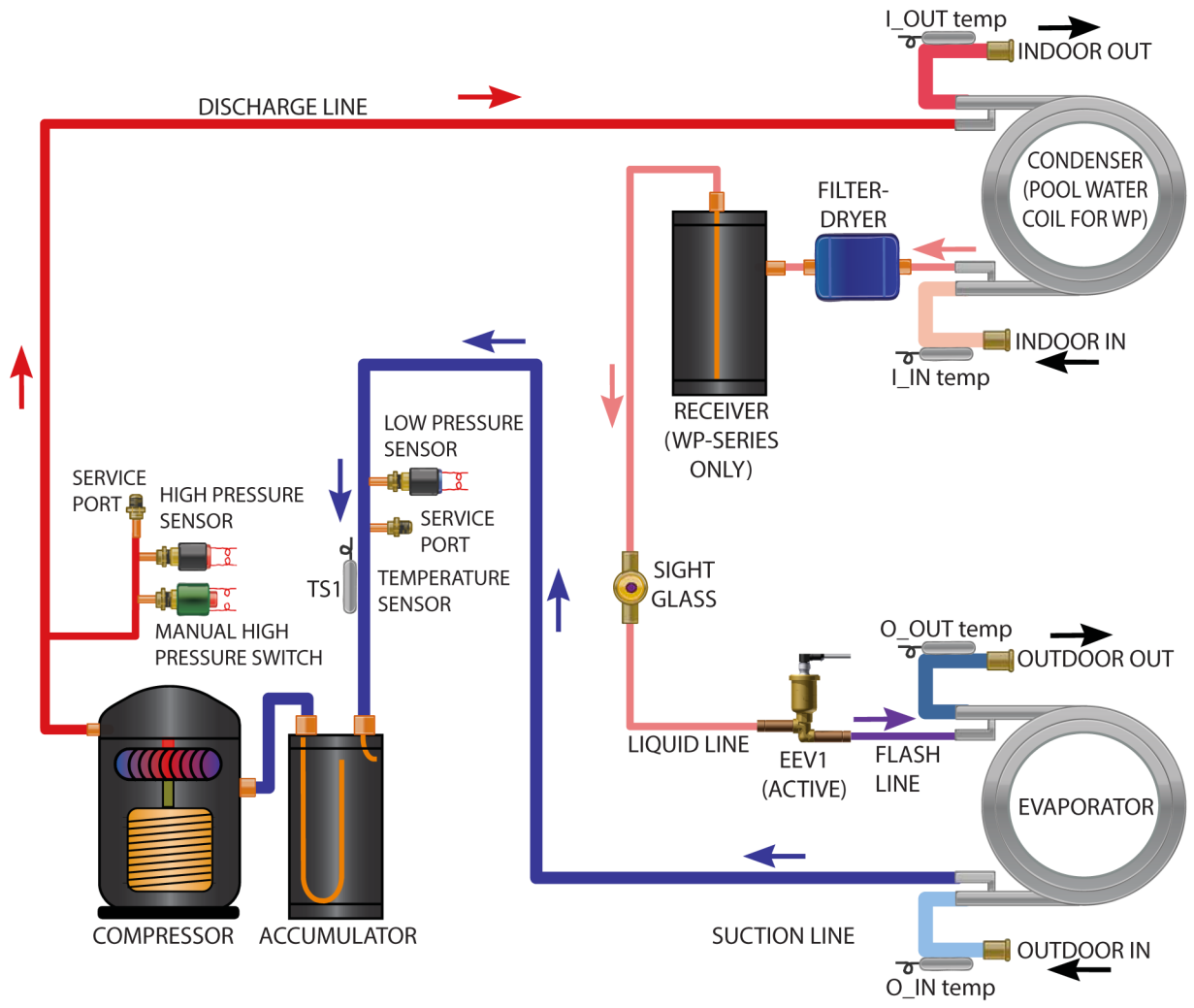
Drawing Name: W/WH-HACW Series Refrigeration Circuit (GEN2, Reversing, with Desuperheater)

Size	Drawing Number	Drawing Revision	Sheet
LET	002398RCD	01	1 / 1

go to TABLE OF CONTENTS

Refrigeration Circuit Diagram: Sizes 25 to 80, Non-Reversing

W/WH/WP-H Heating Mode
(Non-Reversing)



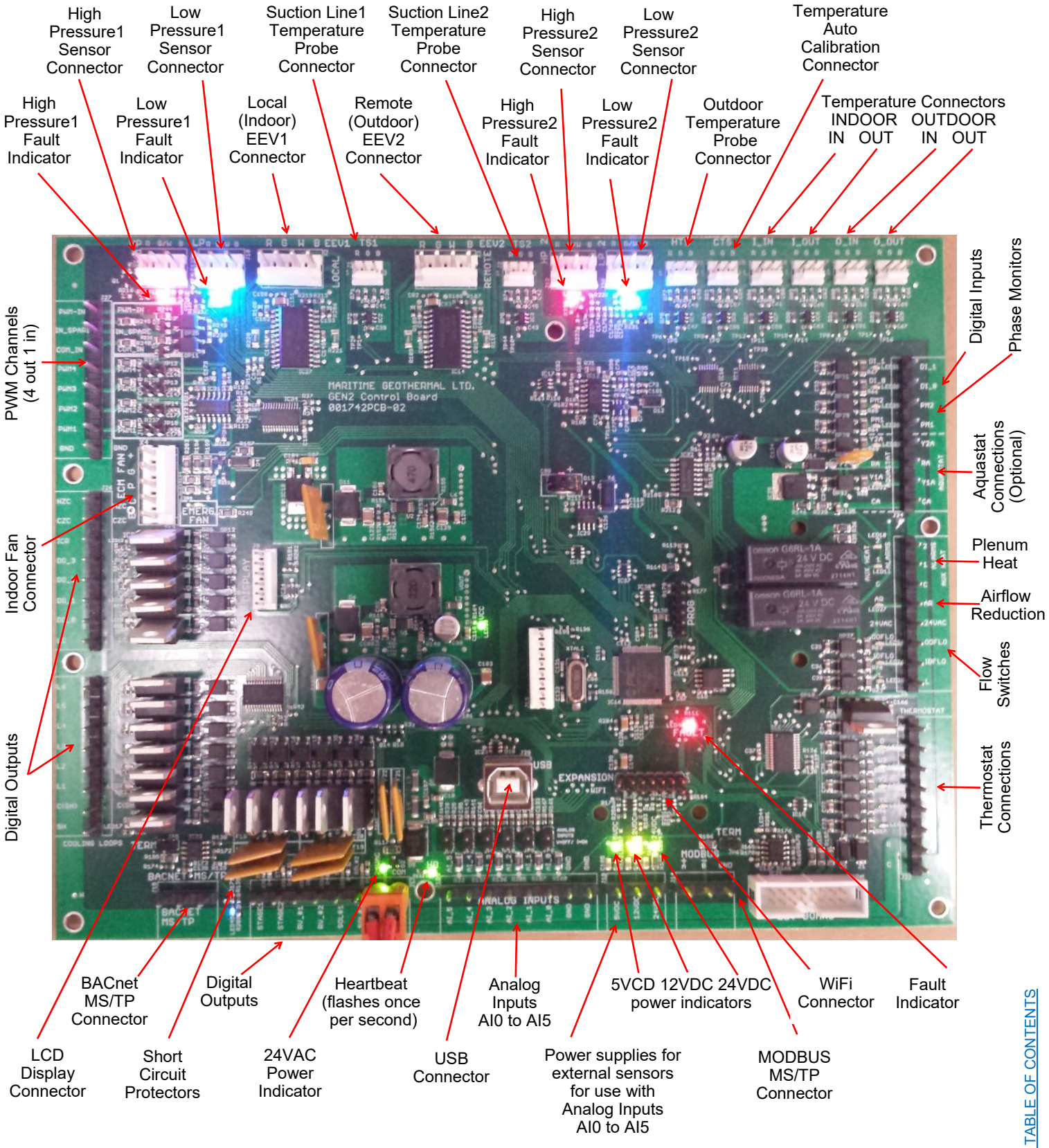
REV	ECO#	IMPL BY	APVD BY	DATE
02	-	D. RHEAULT	D. RHEAULT	1 FEB 2021
01a	-	D. RHEAULT	D. RHEAULT	1 JUL 2019
01	Initial Release	C. GEDDES	C. GEDDES	29 OCT 2014

Drawn By C.GEDDES	Date 29 OCT 2014	MARITIME GEOTHERMAL LTD.	P.O. Box 2555, 170 Plantation Rd., Petitcodiac, NB CANADA E4Z 6H4
Checked By C.GEDDES	Date 29 OCT 2014	Drawing Name: W/WH/WP-H Refrigeration Circuit (Non-Reversing)	
Eng. Approved By C.GEDDES	Date 29 OCT 2014		
Mfg. Approved By	Date		
Approved By	Date	Size LET	Drawing Number 001877RCD / Drawing Revision 02 / Sheet 1 / 1

go to TABLE OF CONTENTS

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.



go to TABLE OF CONTENTS

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

TABLE A1 - Control Board Connector Descriptions (Top)		
Name	**Description**	
HPS1/HI1	High Pressure Sensor 1	Measures compressor discharge pressure.
LPS1/LO1	Low Pressure Sensor 1	Measures compressor suction pressure.
EEV1	Local EEV	Control of Electronic Expansion Valve.
TS1	Suction Line Temperature 1	Mounted to common suction line inside unit.
EEV2	Remote EEV	Not used.
TS2	Suction Line Temperature 2	Not used.
HPS2/HI2	High Pressure Sensor 2	Not used.
LPS2/LO2	Low Pressure Sensor 2	Not used.
HTS/ODTS	Outdoor Temperature	Accessory RTD outdoor temperature sensor for outdoor reset feature.
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	Mounted to pipe inside unit.
O_OUT	Outdoor Loop OUT	Mounted to pipe inside unit.

TABLE A2 - Control Board Connector Descriptions (Left Side)		
Name	**Description**	
PWM_IN	Signal for PWM IN	Not used.
IN_SPARE	Spare digital input	Switch or dry contact from 12VDC to disable unit (also COM_IN to GND)
COM_IN	Common for PWM IN	Jumper to GND for disable functionality.
PWM4	PWM / 0-10VDC output	Not used.
PWM3	OV2	0-10VDC output for optional outdoor loop modulating water valve
PWM2	PWM / 0-10VDC output	Not used.
PWM1	PWM / 0-10VDC output	Not used.
GND	Ground	Jumper to COM_IN for disable functionality.
HZC	Hot Zone Circulator	Not used.
CZC	Cold Zone Circulator	Not used.
ICR	Internal Circulator Relay	Operates the indoor circulator.
DO_3	Auxiliary Only	Not used.
DO_2	HYD_AUX	ON when hydronic auxiliary on (Setpoint Control only).
DO_1	Digital output	Not used.
DO_0	OV1	To open loop water valve end switch or closed loop jumper plug (back to ODFLO).
LC	Loop common (ground)	Not used.
L6	Loop6	Not used.
L5	Loop5	Not used.
L4	NOT_HYD_AUX	Output OFF when auxiliary heat required; operates D1-D2 dry contacts.
L3	TWO_TANK_3_WAY	Energizes 3-way valve to direct flow to cold tank when using HTS/CTS with 2 tanks.
L2	Loop2	Not used.
L1	Loop1	Not used.
C(SH)	Soaker Hose common	Not used.
SH	Soaker Hose	Not used.

go to TABLE OF CONTENTS

TABLE A3 - Control Board Connector Descriptions (Bottom)		
Name	**Description**	
GND	BACnet MS/TP	Ground for shield if required.
B	BACnet MS/TP	RS-485.
A	BACnet MS/TP	RS-485.
STAGE1	Compressor Stage 1	Starts / stops the compressor.
STAGE2	Compressor Stage 2	Not used.
RV#1	Reversing Valve#1	Off in heating mode, on in cooling mode (reversing models only).
RV#2	Reversing Valve#2	Not used.
SOL#1	Solenoid#1	Not used.
SOL#2	Solenoid#2	Optional refrigerant vent fan relay/contactor.
24VAC	Power supply for board	24VAC power for control board.
COM	Power supply for board	GND for control board.
AI_5	Analog In Channel 5	Optional type 3/7 10k hot tank temperature sensor for HTS/CTS Setpoint Control.
AI_4	Analog In Channel 4	Optional type 3/7 10k cold tank temperature sensor for HTS/CTS Setpoint Control.
AI_3	Analog In Channel 3	Compressor discharge line temperature sensor.
AI_2	Analog In Channel 2	Not used.
AI_1	Analog In Channel 1	Not used.
AI_0	Analog In Channel 0	Compressor current sensor.
GND	Ground pin	Ground for analog sensors.
GND	Ground pin	Ground for analog sensors.
5VDC	Power for analog sensors	5VDC regulated power supply for sensors.
12VDC	Power for analog sensors	12VDC regulated power supply for sensors.
24VDC	Power for analog sensors	24VDC unregulated power supply for sensors.
A	MODBUS	RS485 communication for refrigerant leak detector.
B	MODBUS	RS485 communication for refrigerant leak detector.
GND	MODBUS	Ground for shield if required.

go to TABLE OF CONTENTS

TABLE A4 - Control Board Connector Descriptions (Right Side)		
Signal	**Description**	
DI_1	Digital Input1	Not used.
DI_0	Digital Input0	Low pressure select from open/closed loop harness (0=open loop, 1=closed loop)
PM2	Phase Monitor2	Switch or dry contact from R to activate Summer Setback mode.
PM1	Phase Monitor1	Not used.
Y2A*	Aquastat Stage2	Optional water heat stage 2 24VAC input for use with Signals/Hardwired control.
RA*	Aquastat Power (24VAC)	Optional 24VAC for aquastat used with Signals/Hardwired control.
Y1A*	Aquastat Stage1	Optional water heat stage 1 24VAC input for use with Signals/Hardwired control.
CA*	Aquastat Power (Ground)	Optional 24VAC ground for aquastat used with Signals/Hardwired control.
2	Plenum Heat Stage2	Not used.
1	Plenum Heat Stage1	Not used.
C	Plenum Heat Common	Not used.
AR	Airflow Reductions	Not used.
24VAC	Power	Power to low pressure select (DI_0).
ODFLO	Outdoor Flow Switch	Return signal from open loop water valve end switch, or closed loop jumper plug.
IDFLO	Indoor Flow Switch	Not used.
L	Thermostat Lockout Indicator	24VAC output for trouble LED.
E	Thermostat Emergency Heat	Not used.
O	Thermostat Heat/Cool	24VAC input from external dry contact to activate cooling mode.
W2	Thermostat Auxiliary Heat	Not used.
Y2	Thermostat Stage2	Not used.
Y1	Thermostat Stage1	Not used.
G	Thermostat Fan	Not used.
R	Thermostat Power (24VAC)	Not used.
C	Thermostat Power (Ground)	Not used.

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

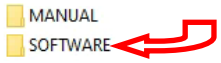
go to TABLE OF CONTENTS

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

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

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

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

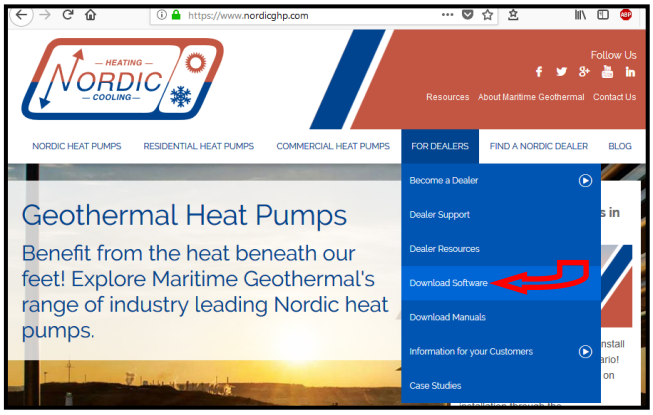


Double click on the SOFTWARE folder to show its contents:

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

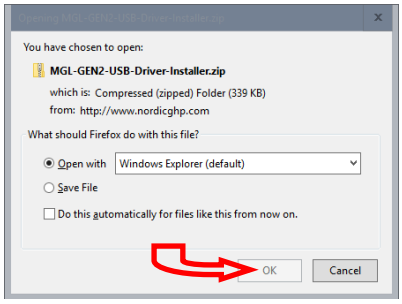
If the USB drive is not available, the same files can be **down-loaded from the web page**.

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

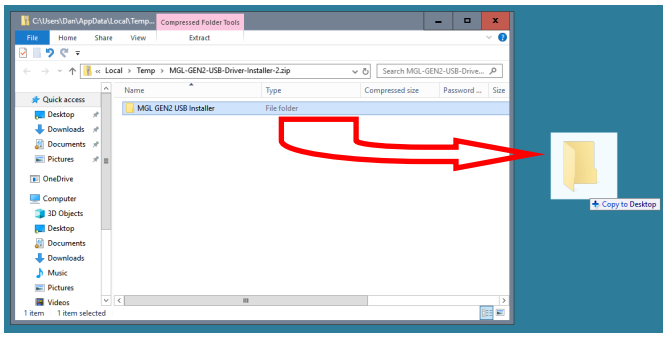


2. Click on **MGL GEN2 USB Driver Installer** to download it:

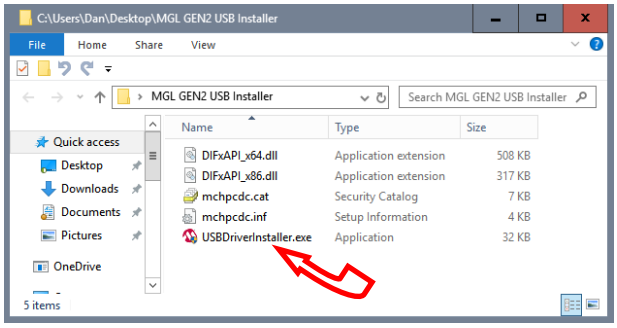
3. Choose "Open with Windows Explorer", and hit "OK". *(If the choice window doesn't pop up, find the downloaded file in your browser downloads and double click on it.)*



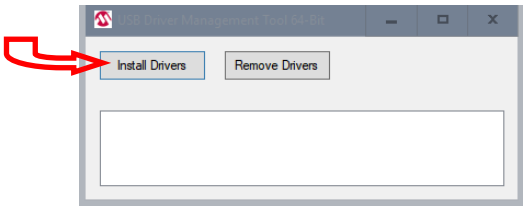
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



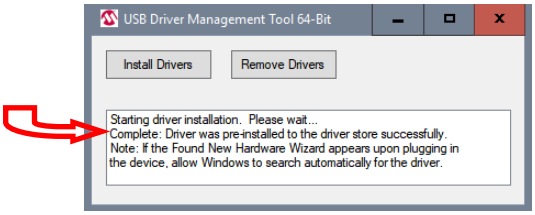
5. Double click on the folder you just dragged onto the desktop, then double click on the "USBDriverInstaller" file:



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



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

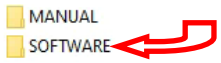


go to TABLE OF CONTENTS

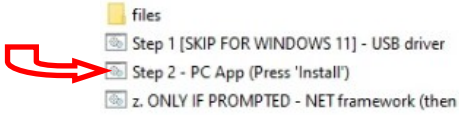
Appendix C - PC App Installation (Windows 11)

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

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



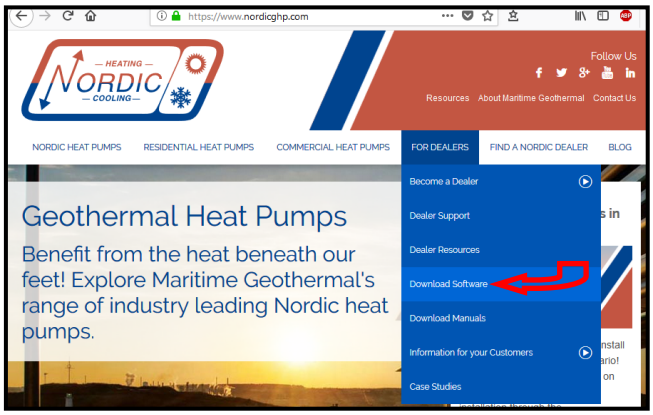
Double click on the SOFTWARE folder to show its contents:



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

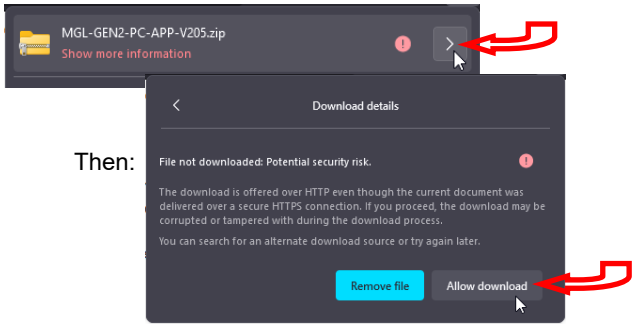
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

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

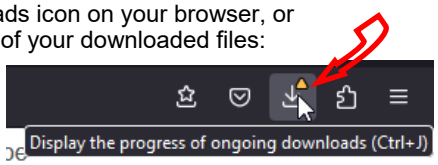


2. Click on **MGL GEN2 PC APP V2__** to download it:

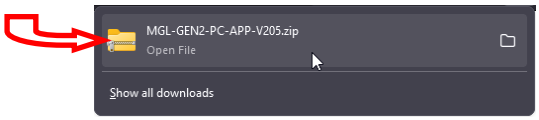
3. You may see a warning like this one. Click as shown:



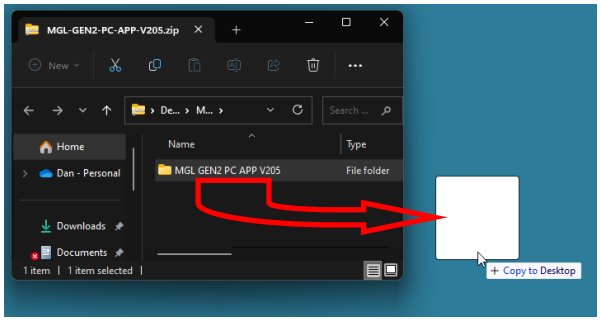
4. Click on the downloads icon on your browser, or otherwise view a list of your downloaded files:



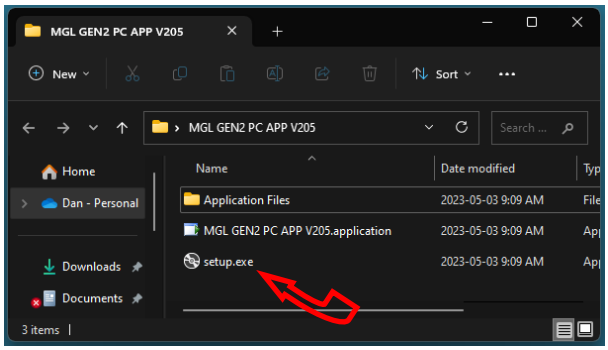
5. Then click on the .zip file to open it in a File Explorer window:



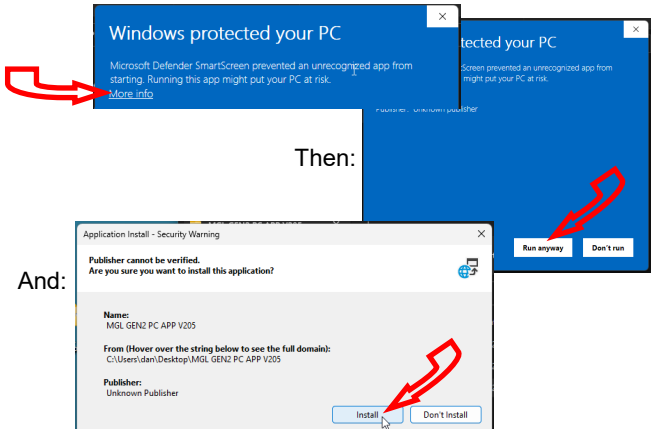
6. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



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



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



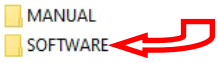
9. The PC App will open when it is finished installing. (In the future, it should be started from the start menu.) You are now ready to connect a USB cord between the laptop computer and GEN2 control board, and connect.

go to TABLE OF CONTENTS

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

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

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

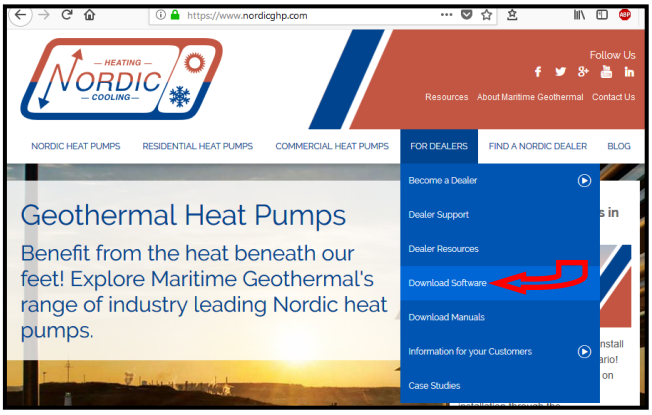


Double click on the SOFTWARE folder to show its contents:

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

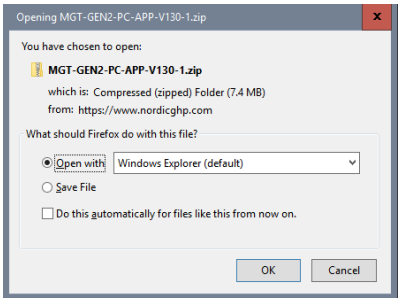
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

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

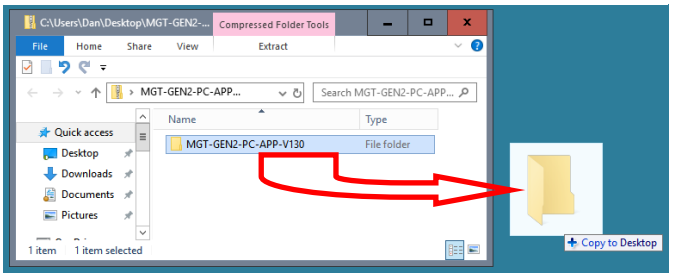


2. Click on **MGL GEN2 PC APP V2__** to download it:

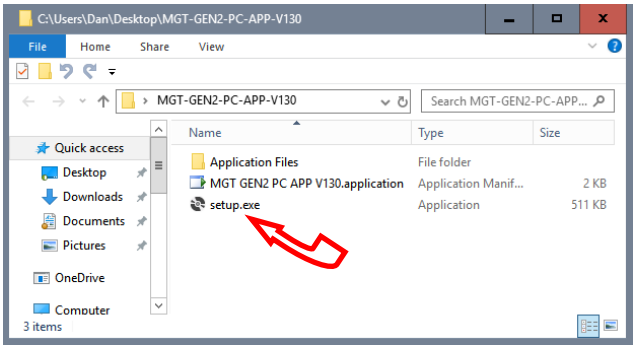
3. Choose "Open with Windows Explorer", and hit "OK":



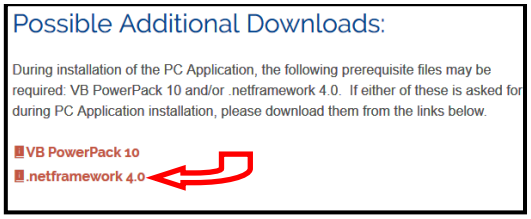
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



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



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



Then go back to step 5.

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

go to TABLE OF CONTENTS

Appendix E: Updating Firmware

METHOD 1: Updating Firmware Using PC App

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

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

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

   \Desktop\MGL GEN2 Bootload Firmware V376

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

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

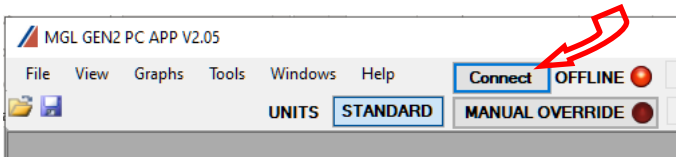
MGL_GEN2_V376.production.hex	(firmware file)
PIC32UBL.exe	(the programmer)
USB Bootloader Instructions.pdf	(these instructions)

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

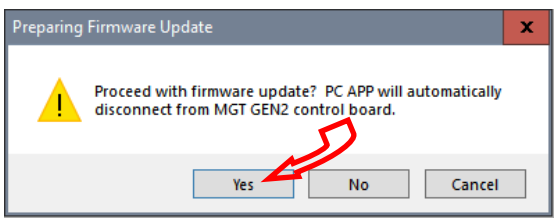
3. Connect a USB (printer) cable between computer and control board.

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

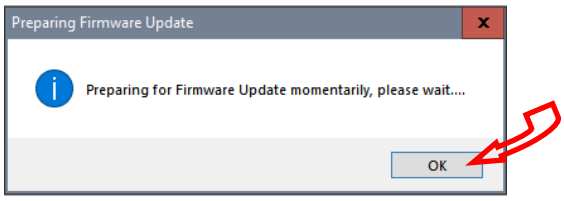
5. In the PC App, click on the **Connect** button to connect to the control board.



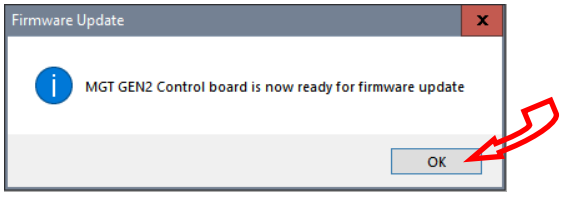
6. Go to menu **Tools --> Update Firmware**. The following message box will appear:



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

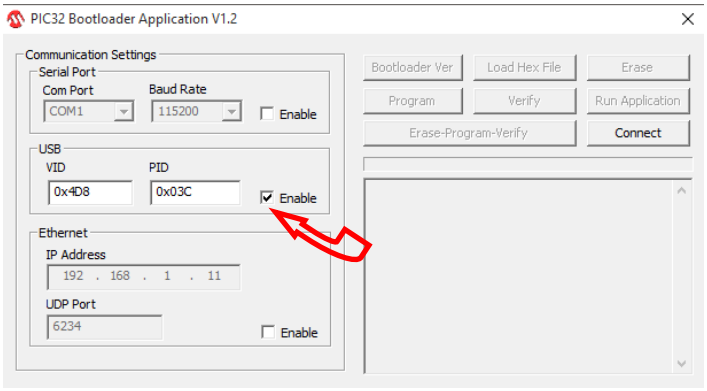


8. Click on **OK**. After a minute, the following message box will appear:

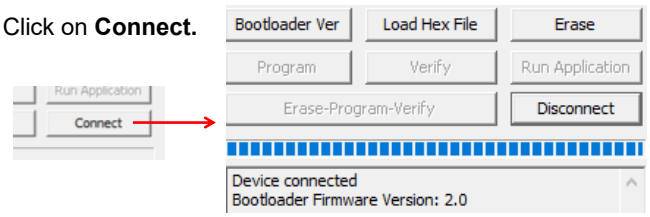


9. Click on **OK**. The control board is now in bootloader mode and is ready to be programmed.

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



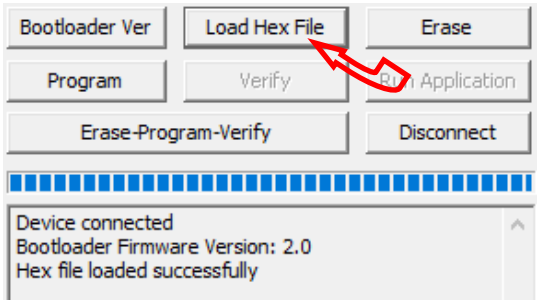
11. Click on **Connect.**



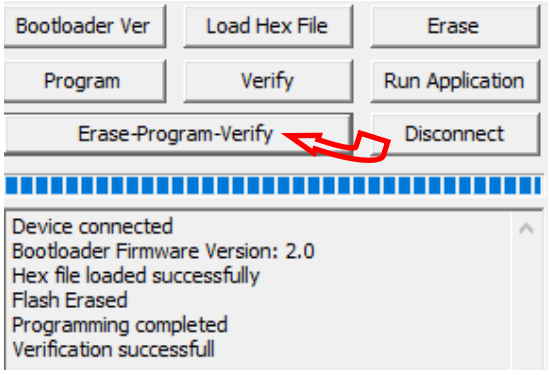
*If device fails to connect and an error message is displayed, the board's bootloader may be older than v2.0. It will be necessary to instead update the firmware via jumper pins (**METHOD 2**), as per the next section.*

go to TABLE OF CONTENTS

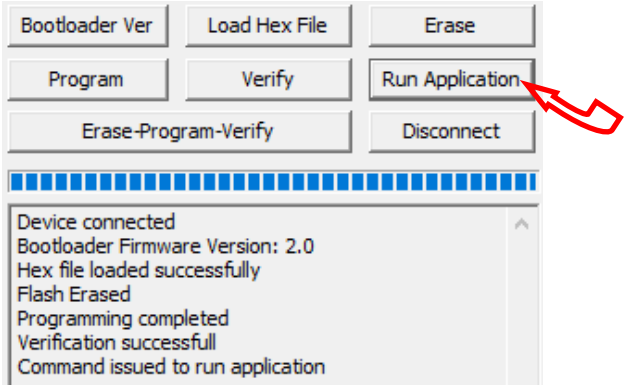
12. Click on **Load Hex File**. Select the M*GL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.



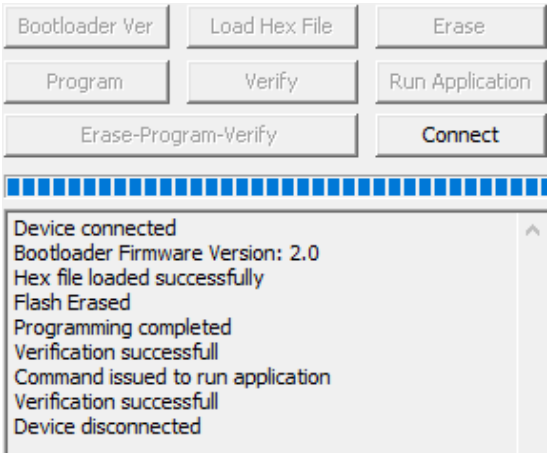
13. Click on **Erase—Program—Verify.** Programming…. Wait while status bar shows progress. The messages should read as below when finished:



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



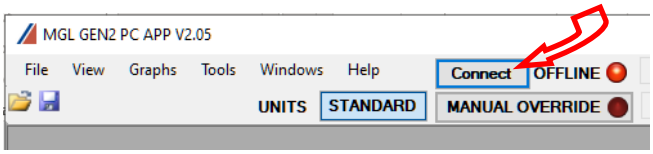
15. **Wait until the programmer disconnects itself.** The messages should read as follows:



16. Close the PIC32 program.

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

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



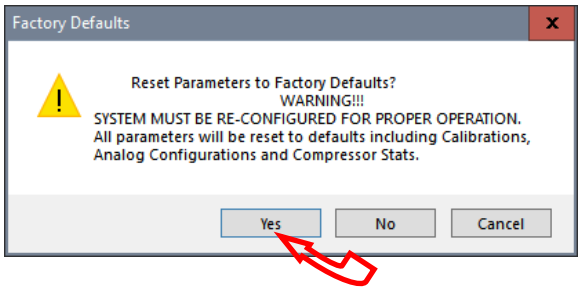
NOTE: Updating the firmware does not affect the configuration settings.

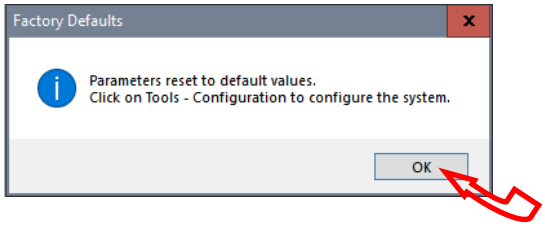
Reset to Defaults?

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

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

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





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

go to TABLE OF CONTENTS

METHOD 2: Updating Firmware Using Jumper Pins

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

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

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

   \Desktop\MGL GEN2 Bootload Firmware V376

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

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

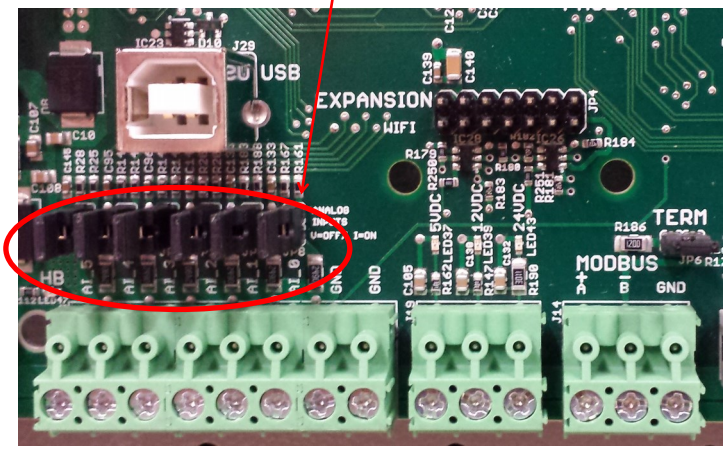
   Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

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

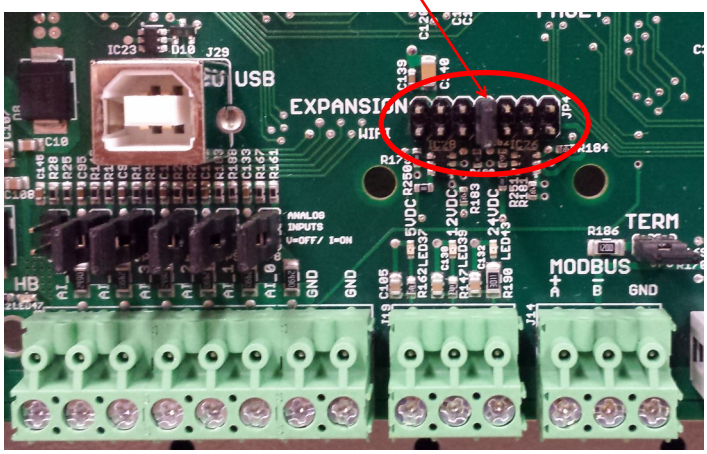
4. Turn power off to the heat pump.

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

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

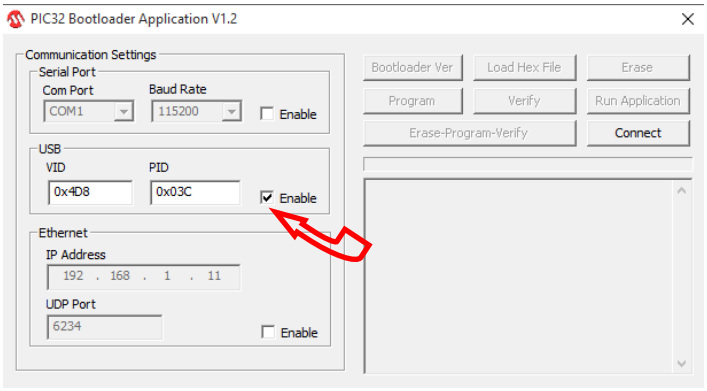


Place jumper here

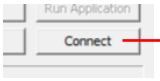


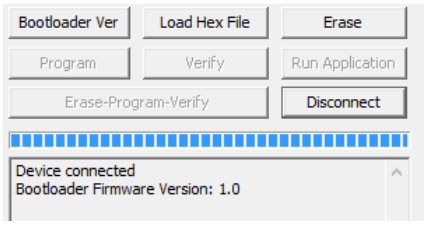
6. Turn the power back on. The control board is now in boot loader mode and is ready to be programmed.

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

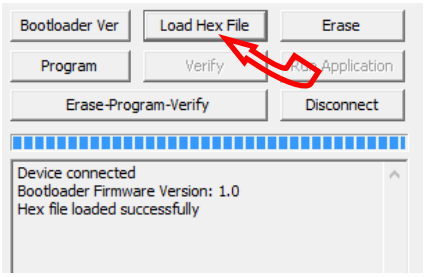


8. Click on **Connect.**



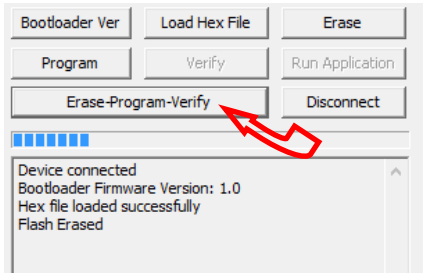


9. Click on **Load Hex File**. Select the *MGL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.

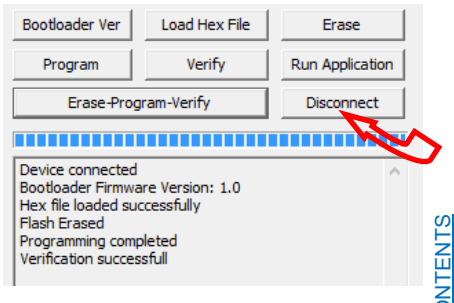


10. Click on **Erase—Program—Verify**

Programming…



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



12. Turn power off to the heat pump again.

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

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

go to TABLE OF CONTENTS

Warranty: W-Series

RESIDENTIAL LIMITED EXPRESS WARRANTY

Unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd. ("MG") or its representatives relating to MG's products, whether oral, written or contained in any sales literature, catalogue or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely MG's opinion or commendation of MG's products.
SET FORTH HERE IS THE ONLY EXPRESS WARRANTY THAT APPLIES TO MG'S PRODUCTS. MG MAKES NO WARRANTY AGAINST LATENT DEFECTS. MG MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.

LIMITED EXPRESS RESIDENTIAL WARRANTY - PARTS
MG warrants its Residential Class products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows:
(1) Air conditioning, heating and/or heat pump units built or sold by MG ("MG Units") for five (5) years from the Warranty Inception Date (as defined below).
(2) Thermostats, auxiliary electric heaters and geothermal pumping modules built or sold by MG, when installed with MG Units, for five (5) years from the Warranty Inception Date (as defined below).
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for ten (10) years from the Warranty Inception Date (as defined below).
(4) Other accessories and parts built or sold by MG, when installed and purchased with MG Units, for five (5) years from the date of shipment from MG.
(5) Other accessories, when purchased separately, for (1) year from the date of shipment from MG.

The "Warranty Inception Date" shall be the date of original unit installation, as per the date on the installation Startup Record; or six (6) months from date of unit shipment from MG, whichever comes first.

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

LIMITED EXPRESS RESIDENTIAL WARRANTY - LABOUR
This Limited Express Residential Labour Warranty shall cover the **labour** incurred by MG authorized service personnel in connection with the installation of a new or repaired warranty part that is covered by this Limited Express Residential Warranty only to the extent specifically set forth in the current **labour** allowance schedule "A" provided by MG's Warranty Department and only as follows:
(1) MG Units for two (2) years from the Warranty Inception Date.
(2) Thermostats, auxiliary electric heaters and geothermal pump modules built or sold by MG, when installed with MG Units, for two (2) years from the Warranty Inception Date.
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for five (5) years from the Warranty Inception Date.

Labour costs are not covered by this Limited Express Residential Warranty to the extent they **exceed** the amount allowed under said allowance schedule, they are not specifically provided for in said allowance schedule, they are not the result of work performed by MG authorized service personnel, they are incurred in connection with a part not covered by this Limited Express Residential Warranty, or they are incurred more than the time periods set forth in this paragraph after the Warranty Inception Date.

This warranty does not cover and does not apply to:
(1) Air filters, fuses, refrigerant, fluids, oil.
(2) Products relocated after initial installation.
(3) Any portion or component of any system that is not supplied by MG, regardless of the cause of the failure of such portion or component.
(4) Products on which the unit identification tags or labels have been removed or defaced.
(5) Products on which payment to MG, or to the owner's seller or installing contractor, is in default.
(6) Products subjected to improper or inadequate installation, maintenance, repair, wiring or voltage conditions.
(7) Products subjected to accident, misuse, negligence, abuse, fire, flood, lightning, unauthorized alteration, misapplication, contaminated or corrosive liquid or air supply, operation at abnormal air or liquid temperatures or flow rates, or opening of the refrigerant circuit by unqualified personnel.
(8) Mold, fungus or bacteria damage
(9) Corrosion or abrasion of the product.
(10) Products supplied by others.
(11) Products which have been operated in a manner contrary to MG's printed instructions.
(12) Products which have insufficient performance as a result of improper system design or improper application, installation, or use of MG's products.
(13) Electricity or fuel, or any increases or unrealized savings in same, for any reason whatsoever.

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

This Limited Express Residential Warranty applies to MG Residential Class products manufactured on or after February 15, 2010. MG'S LIABILITY UNDER THE TERMS OF THIS LIMITED WARRANTY SHALL APPLY ONLY TO THE MG UNITS REGISTERED WITH MG THAT BEAR THE MODEL AND SERIAL NUMBERS STATED ON THE INSTALLATION START UP RECORD, AND MG SHALL NOT, IN ANY EVENT, BE LIABLE UNDER THE TERMS OF THIS LIMITED WARRANTY UNLESS THIS INSTALLATION START UP RECORD HAS BEEN ENDORSED BY OWNER & DEALER/INSTALLER AND RECIEVED BY MG LIMITED WITHIN 90 DAYS OF START UP.

Limitation: This Limited Express Residential Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without imitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Residential Warranty.

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

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

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

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

go to TABLE OF CONTENTS

Warranty: WH/WP-Series

COMMERCIAL LIMITED EXPRESS WARRANTY

Unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd. ("MG") or its representatives relating to MG's products, whether oral, written or contained in any sales literature, catalogue or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely MG's opinion or commendation of MG's products.
SET FORTH HERE IS THE ONLY EXPRESS WARRANTY THAT APPLIES TO MG'S PRODUCTS. MG MAKES NO WARRANTY AGAINST LATENT DEFECTS. MG MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.

LIMITED EXPRESS COMMERCIAL WARRANTY - PARTS
MG warrants its Commercial Class products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows:
(1) Air conditioning, heating and/or heat pump units built or sold by MG ("MG Units") for one (1) year from the Warranty Inception Date (as defined below).
(2) Thermostats, auxiliary electric heaters and geothermal pumping modules built or sold by MG, when installed with MG Units, for one (1) year from the Warranty Inception Date (as defined below).
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for one (1) year from the Warranty Inception Date (as defined below).
(4) Other accessories, when purchased separately, for (1) year from the date of shipment from MG.

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

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

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

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

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

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

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

Limitation: This Limited Express Commercial Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without imitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Commercial Warranty.

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

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

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

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

go to TABLE OF CONTENTS

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

RESIDENTIAL WARRANTY REGISTRATION

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

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

Model: _____

Serial Number: _____

Install Date: _____

Installed By: _____
(company name)

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

Installation Type: ☐ new construction ☐ replacement/retrofit

Address of installation: _____

City: _____

Province / State: _____

Postal Code / Zip: _____

Where do I find my model and serial number?

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