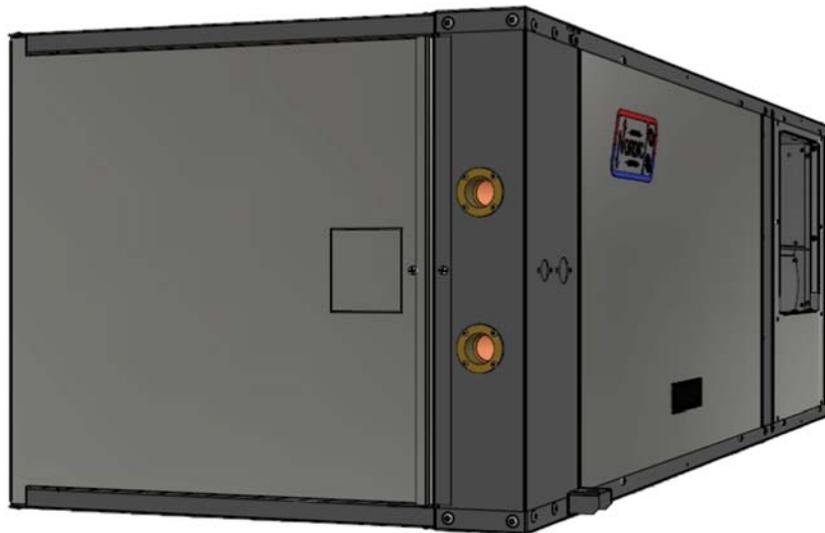




## Engineering Specification

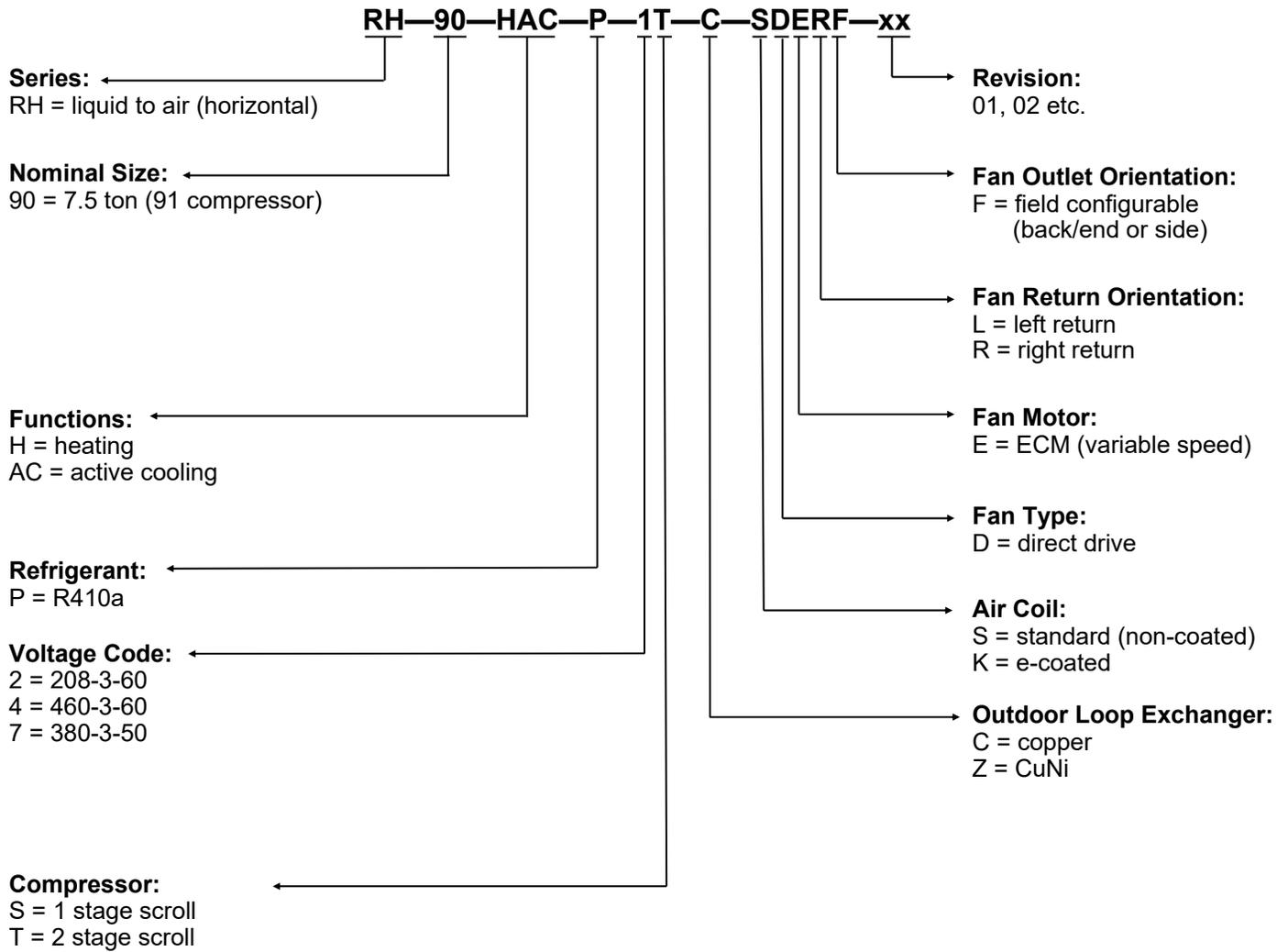
### **RH-90-HAC-P-\*T\*-\*SDE\*F** **Horizontal Liquid to Air Heat Pump** **Nominal Size 7.5 Ton**



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

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002317SPC-00

# Model Nomenclature



APPLICATION TABLE										
MODEL	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESSOR STAGES	OUTDOOR COIL	FAN/CASE	REVISIONS			
RH-90	HAC	P	2 4	T	C Z	SDELF	01			
						SDERF	01			
This manual applies only to the models and revisions listed in this table.										

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

# Design Features

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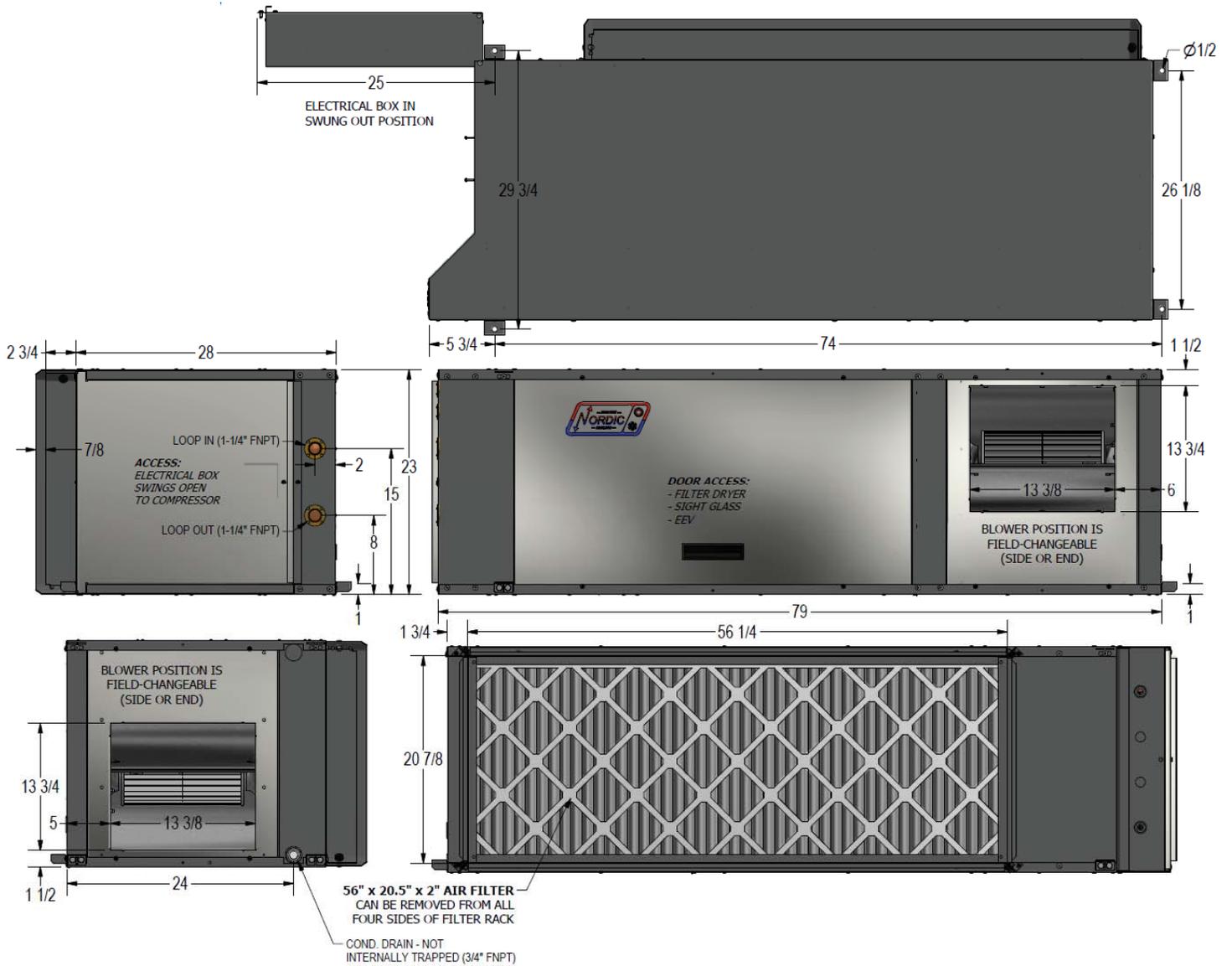
- Satin galvanized steel cabinet, with hangers for concealed ceiling mounting
- Powder coat finish
- Acoustically insulated cabinet (1/2")
- Standard horizontal heat pump layout, with left or right air return
- Field configurable fan outlet position: side opposite return, or back/end
- Dual ECM direct drive blower, with entire blower removable for motor servicing
- Air filter rack, with all 4 sides removable for air filter change from any side
- Stainless steel condensate drip tray
- Direct hoseless condensate drain with 3/4" female NPT threaded connection, not internally trapped
- Condensate overflow protection standard
- Multi-circuit high efficiency air coil
- Refrigeration service ports located inside unit (1/4" Schrader)
- Insulated coaxial heat exchanger, available in copper or cupro-nickel (CuNi) inner tube
- 1-1/4" brass FPT fittings for loop connections
- Provisions for powering pump module for ground loop applications
- Two-stage scroll compressor
- Dual-grommet-mounted compressor for reduced noise and vibration
- Suction line accumulator
- Liquid line filter-dryer
- Liquid line sight glass
- Electronic Expansion Valve (EEV) for precise refrigerant control
- 4-way reversing valve
- High and low pressure safety controls
- 3-phase protection
- High and low pressure sensors
- Suction line temperature sensor
- Temperature sensors on both water lines (outdoor in, outdoor out)
- Advanced control board with BACNet interface for remote operation and data access including all sensor data and alarm conditions, PWM outputs (or 0-10VDC), configurable analog inputs (0-10VDC or 4-20mA) with onboard 5VDC, 12VDC and 24VDC power supplies.
- USB port for complete data access using laptop computer and provided software; including real-time charting, data logging, and diagnostic functionality with manual override operation
- 2 x 16 LCD display for control and data access
- Random start on power up (between 0-2 minutes)

## Available Accessories

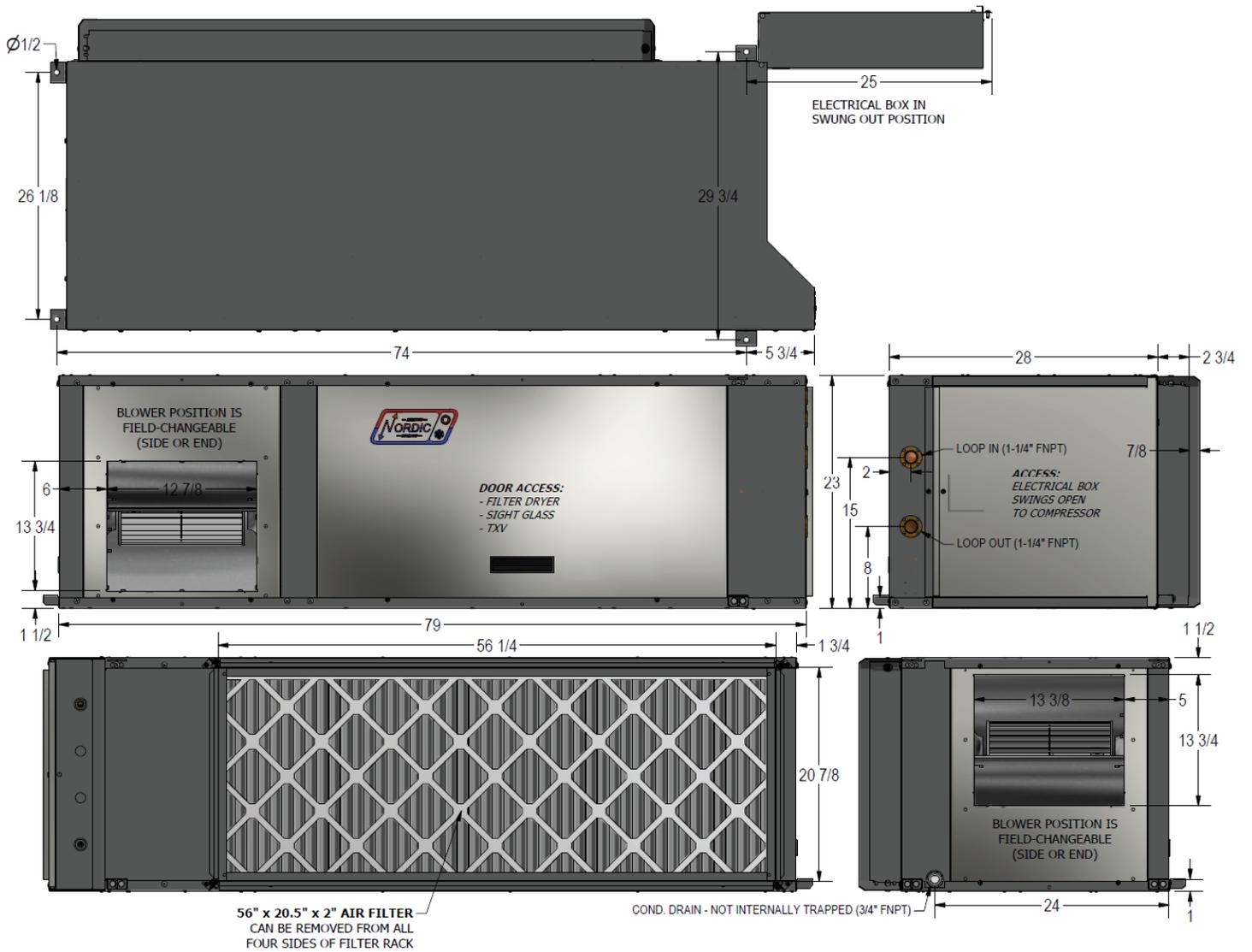
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- 3-stage heat / 2-stage cool programmable thermostat, Wifi and standard versions
- Anti-vibration pad for under unit
- Compressor sound jacket
- 1-1/4" water solenoid valve, ON/OFF or 0-10VDC modulating
- Electric plenum heaters 5 / 7 / 10 / 15 / 20 kW, for external mounting

# Dimensions (Left Return)



# Dimensions (Right Return)



# Specifications

Electrical Data											
Code	Power Supply			Compressor		Fan	Outd. Circ.	FLA	MCA	Maximum Fuse/Breaker	Minimum Wire Size
	V-ø-Hz	MIN	MAX	RLA	LRA	RLA	Max A	Amps	Amps	Amps	ga
2	208-3-60	187	253	28.8	223	9.0	5.0	43.6	50.8	80	#4-3
4	460-3-60	391	529	12.5	100	9.0	5.0	27.3	30.4	40	#8-4

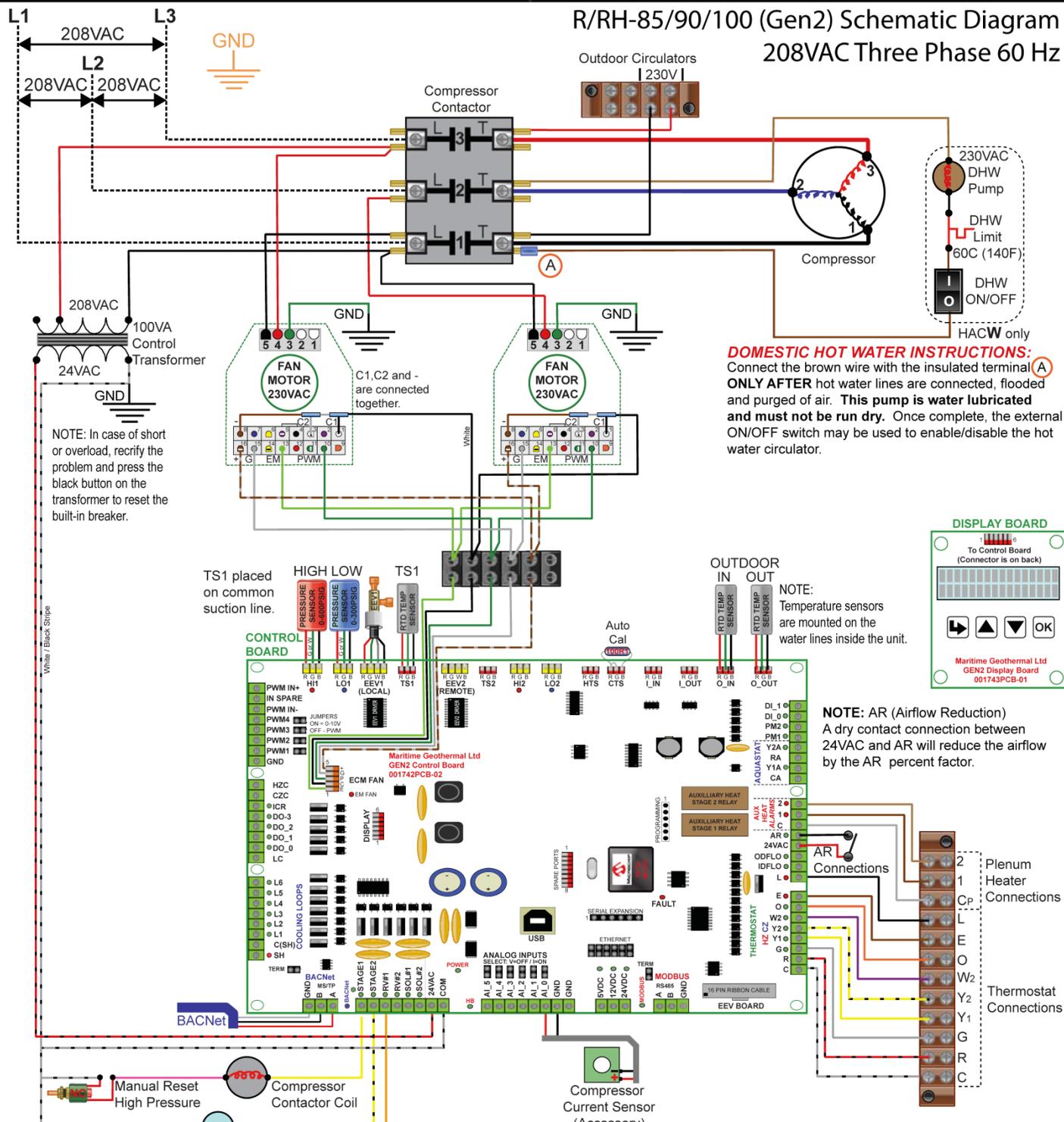
Refrigerant Charge				
MODEL	lb	kg	Refrigerant	Oil Type
RH-90	14	6.4	R410a	POE
- Oil capacity is marked on the compressor label. - <b>Refrigerant charge is subject to revision</b> ; actual charge is indicated on the unit nameplate.				

Shipping Information				
MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
RH-90	724 (329)	85 (216)	38 (97)	29 (74)

Operating Temperature Limits					
Loop	Parameter	Mode	(°F)	(°C)	Note
Outdoor	Minimum ELT	Heating / Cooling	41	5	Ground water system.
	Minimum ELT	Heating / Cooling	23	-5	Ground loop system. Adequate freeze protection required.
	Maximum ELT	Heating	80	27	
	Maximum ELT	Cooling	110	43	
Indoor (Duct)	Minimum EAT	Heating / Cooling	60	16	Reduce air flow if necessary during heating startup.
	Maximum EAT	Heating	80	27	
* Values in this table are for rated liquid and airflow values.					

# R/RH-85/90/100 (Gen2) Schematic Diagram

## 208VAC Three Phase 60 Hz



**SYSTEM CONTROL DESCRIPTION**

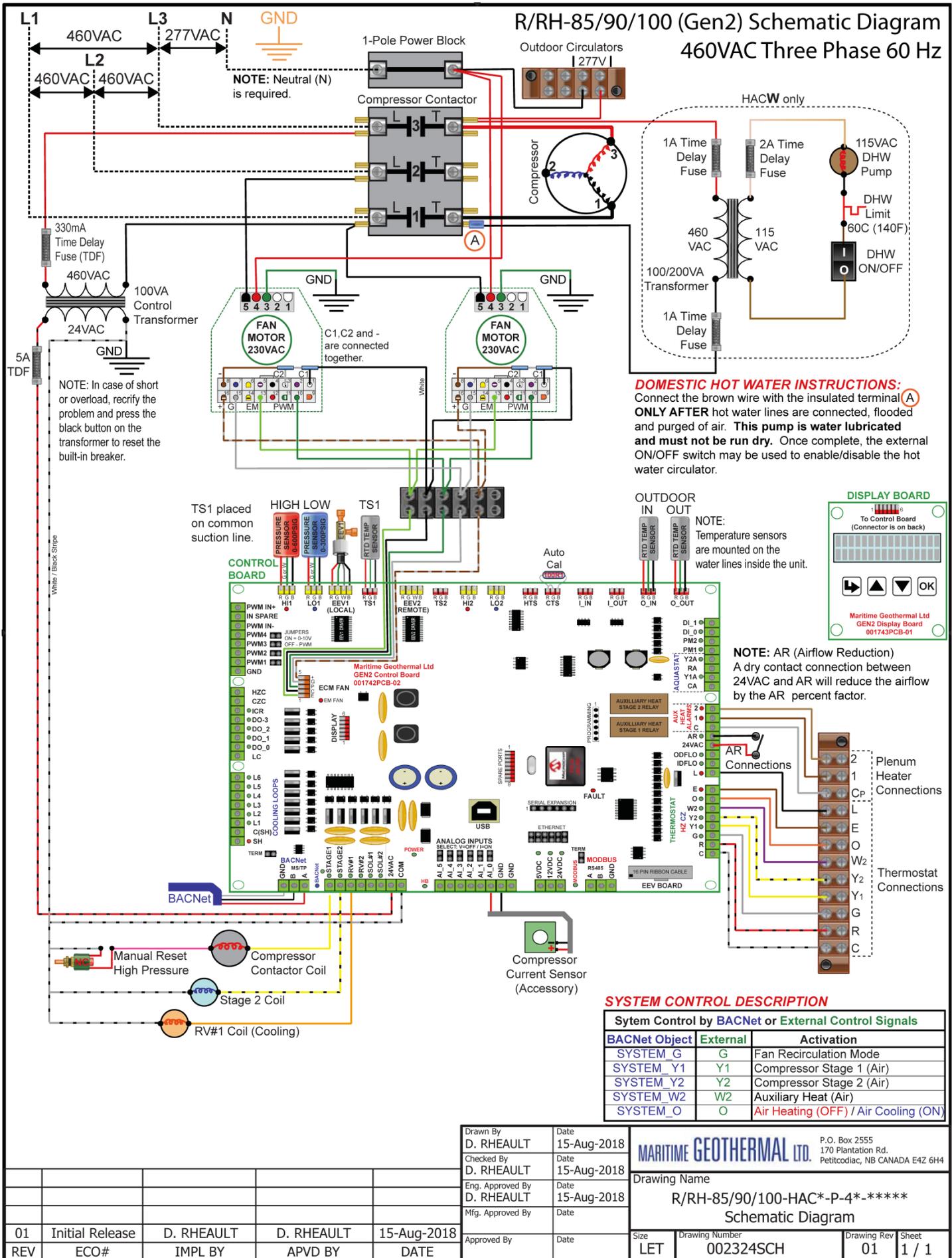
System Control by BACNet or External Control Signals

BACNet Object	External	Activation
SYSTEM_G	G	Fan Recirculation Mode
SYSTEM_Y1	Y1	Compressor Stage 1 (Air)
SYSTEM_Y2	Y2	Compressor Stage 2 (Air)
SYSTEM_W2	W2	Auxiliary Heat (Air)
SYSTEM_O	O	Air Heating (OFF) / Air Cooling (ON)

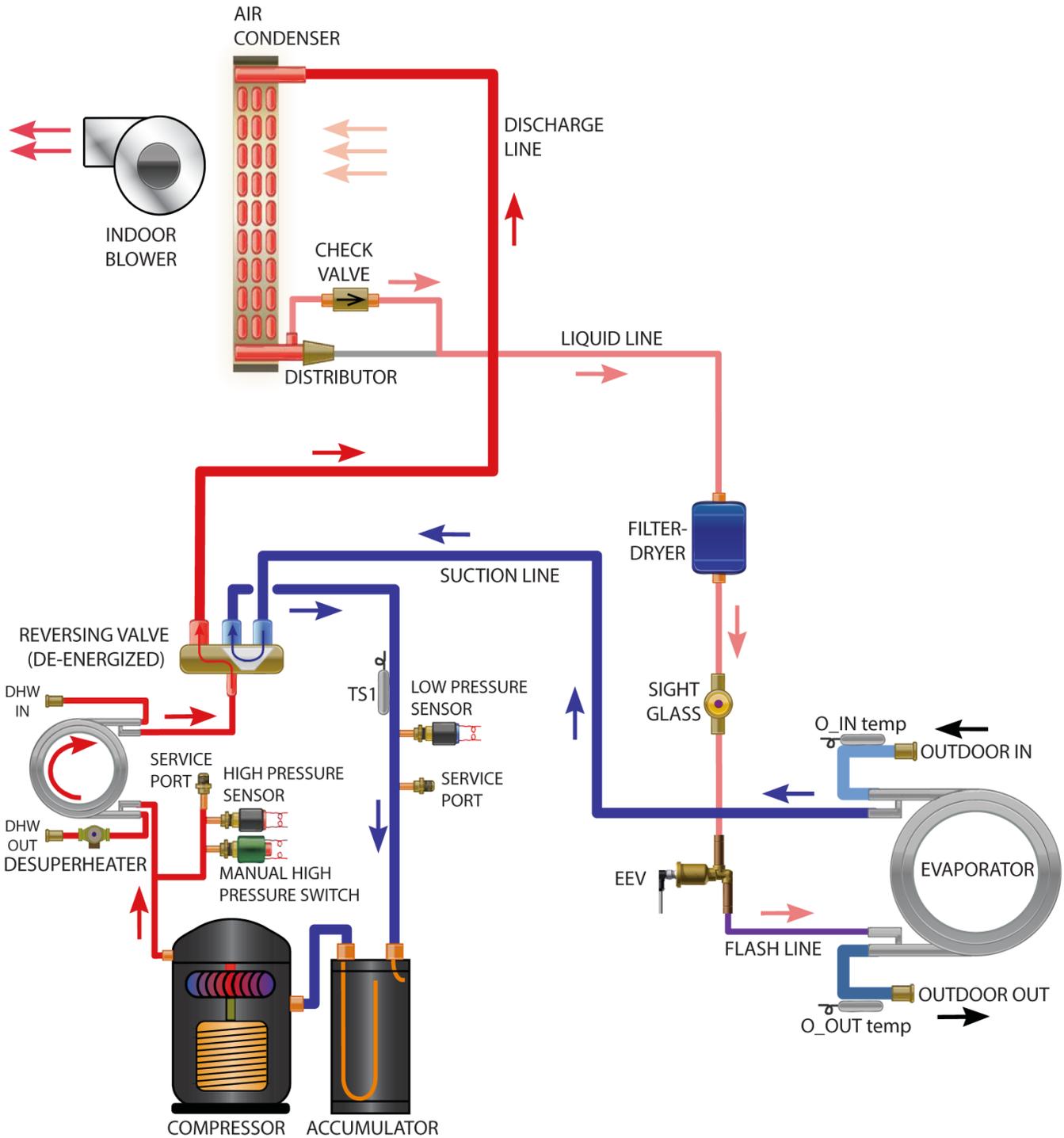
Drawn By	D. RHEAULT	Date	15-Aug-2018
Checked By	D. RHEAULT	Date	15-Aug-2018
Eng. Approved By	D. RHEAULT	Date	15-Aug-2018
Mfg. Approved By		Date	
Approved By		Date	

<b>MARITIME GEOTHERMAL LTD.</b>		P.O. Box 2555 170 Plantation Rd. Pettitcodiac, NB CANADA E4Z 6H4	
Drawing Name			
R/RH-85/90/100-HAC*-P-2*-*****			
Schematic Diagram			
Size	LET	Drawing Number	002322SCH
Drawing Rev	01	Sheet	1 / 1

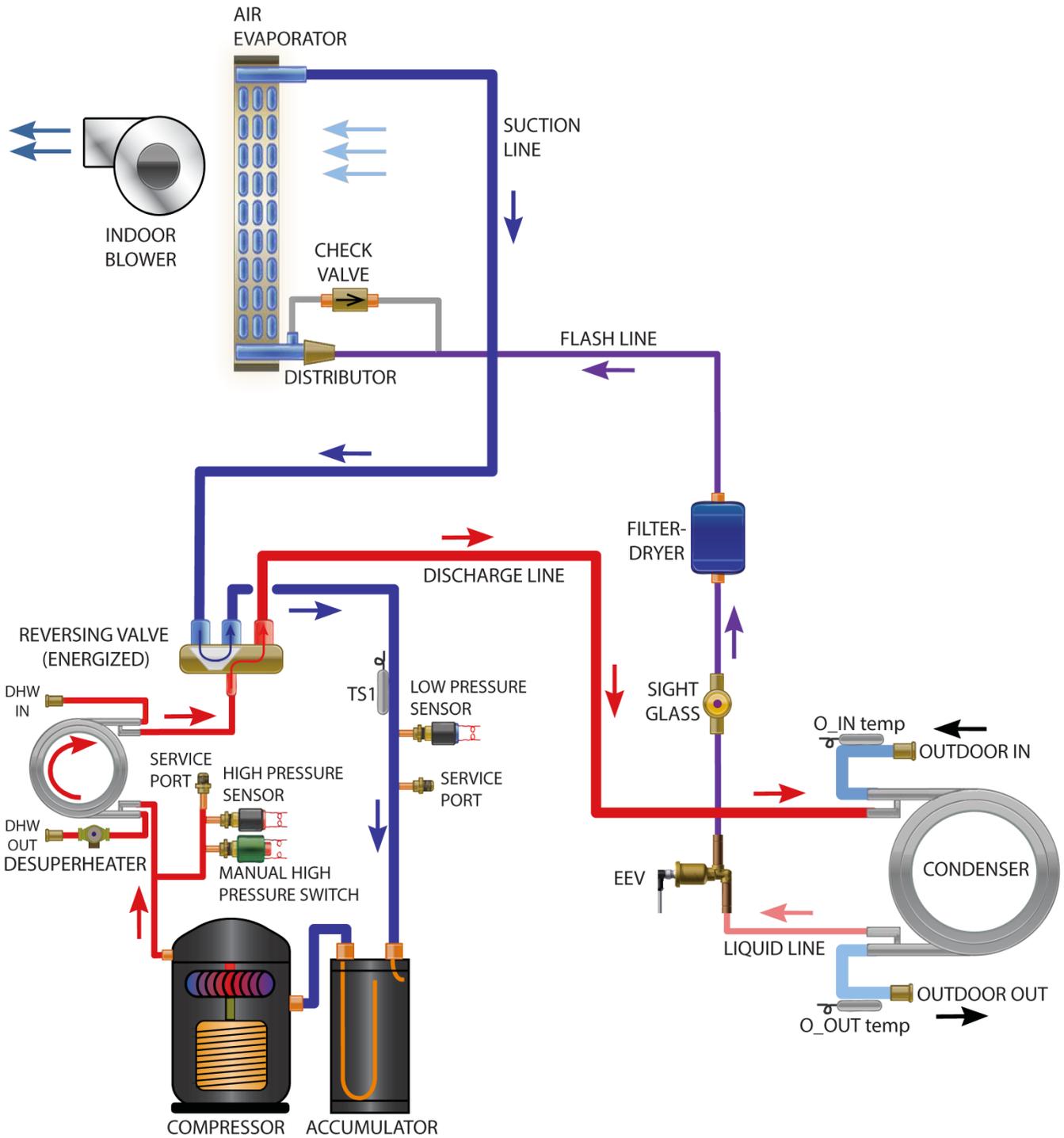


## R/RH (Gen2) Refrigeration Circuit Heating Mode



01	Initial Release	D. RHEAULT	D. RHEAULT	15-AUG-2018	Drawn By D. RHEAULT	Date 15-AUG-2018	<b>MARITIME GEOTHERMAL LTD.</b> <small>P.O. Box 2555 170 Plantation Rd. Petitcodiac, NB CANADA E4Z 6H4</small>	Drawing Name		
REV	ECO#	IMPL BY	APVD BY	DATE	Checked By D. RHEAULT	Date 15-AUG-2018		R/RH (Gen2) Refrigeration Circuit Heating Mode		
					Eng. Approved By D. RHEAULT	Date 15-AUG-2018		Size LET	Drawing Number 002326RCD	Drawing Revision 01

## R/RH (Gen2) Refrigeration Circuit Cooling Mode



01	Initial Release	D. RHEAULT	D. RHEAULT	15-AUG-2018	Drawn By D. RHEAULT	Date 15-AUG-2018	<b>MARITIME GEOTHERMAL LTD.</b> <small>P.O. Box 2555 170 Plantation Rd. Petitcodiac, NB CANADA E4Z 6H4</small>	Drawing Name <b>R/RH (Gen2) Refrigeration Circuit Cooling Mode</b>	
REV	ECO#	IMPL BY	APVD BY	DATE	Checked By D. RHEAULT	Date 15-AUG-2018		Size <b>LET</b>	
					Eng. Approved By D. RHEAULT	Date 15-AUG-2018		Drawing Number <b>002327RCD</b>	
					Mfg. Approved By	Date		Drawing Revision <b>01</b>	
					Approved By	Date	Sheet <b>1 / 1</b>		

# Standard Capacity Ratings

Standards C13256-1 / ISO13256-1 / ARI 13256-1

Standard Capacity Ratings - Ground Loop Heating*											60Hz			
EAT 68°F (20°C) * 15% NaCl by Weight Ground Loop Fluid										STAGE 1 - ELT 41°F (5°C)			STAGE 2 - ELT 32°F (0°C)	
Model	Nominal Size	Liquid Flow		Pressure Drop		Mode	Airflow		Input Energy	Capacity		COP <sub>H</sub>		
		gpm	L/s	psi	kPa		cfm	L/s		Watts	Btu/hr		kW	W/W
RH-90	7.5	24	1.5				Stage 1	2300	1090	6220	81,800	24.0	3.86	
							Stage 2	3000	1420					

Standard Capacity Ratings - Ground Water Heating											60Hz		
EAT 68°F (20°C)										ELT 50°F (10°C)			
Model	Nominal Size	Liquid Flow		Pressure Drop		Mode	Airflow		Input Energy	Capacity		COP <sub>H</sub>	
		gpm	L/s	psi	kPa		cfm	L/s		Watts	Btu/hr		kW
RH-90	7.5	24	1.5				Stage 1	2300	1090	6790	104,000	30.5	4.49
							Stage 2	3000	1420				

Standard Capacity Ratings - Ground Loop Cooling*											60Hz			
EAT 80.6°F (27°C) * 15% NaCl by Weight Ground Loop Fluid										STAGE 1 - ELT 68°F (20°C)			STAGE 2 - ELT 77°F (25°C)	
Model	Size	Liquid Flow		Pressure Drop		Mode	Airflow		Input Energy	Capacity		COP <sub>c</sub>	EER	
		gpm	L/s	psi	kPa		cfm	L/s		Watts	Btu/hr			kW
RH-90	7.5	24	1.5				Stage 1	2300	1090	6330	103,000	30.2	4.77	16.3
							Stage 2	3000	1420					

Standard Capacity Ratings - Ground Water Cooling											60Hz			
EAT 80.6°F (27°C)										ELT 59°F (15°C)				
Model	Size	Liquid Flow		Pressure Drop		Mode	Airflow		Input Energy	Capacity		COP <sub>c</sub>	EER	
		gpm	L/s	psi	kPa		cfm	L/s		Watts	Btu/hr			kW
RH-90	7.5	24	1.5				Stage 1	2300	1090	5750	109,900	32.2	5.60	19.1
							Stage 2	3000	1420					

# Performance Tables

## Heating Mode

<b>RH-90-HAC-P-2T</b>											<b>R410a 60 Hz</b>					
Source Data (Outdoor Loop)						Power Consumption					Sink Data (Indoor Loop)					
ELT	Evap. Temp	Flow	LLT	Delta T	HAB	Compressor		Fan	Effective	COPh	EAT	Cond. Temp.	Air Flow	LAT	Delta T	Net Output
°F	°F	gpm	°F	°F	Btu/hr	Watts	Amps*	Watts	Watts	W/W	°F	°F	cfm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts						°C	°C	L/s	°C	°C	Watts
28.0	15	24.0	22.9	5.1	57,874	5,301	9.4	800	6,090	<b>3.76</b>	68	97	3000	95.6	27.6	<b>78,167</b>
-2.2	-9.4	1.514	-5.0	2.8	16,957						20.0	36.1	1420	35.4	15.4	<b>22,903</b>
34.0	20	24.0	28.4	5.6	63,797	5,428	9.5	800	6,217	<b>3.98</b>	68	99	3000	97.9	29.9	<b>84,524</b>
1.1	-6.7	1.514	-2.0	3.1	18,692						20.0	37.2	1420	36.6	16.6	<b>24,765</b>
40.0	25	24.0	33.9	6.1	69,689	5,622	9.7	800	6,411	<b>4.16</b>	68	102	3000	100.2	32.2	<b>91,079</b>
4.4	-3.9	1.514	1.0	3.4	20,419						20.0	38.9	1420	37.9	17.9	<b>26,686</b>
46.0	30	24.0	39.3	6.7	76,363	5,784	9.9	800	6,573	<b>4.38</b>	68	104	3000	102.8	34.8	<b>98,306</b>
7.8	-1.1	1.514	4.1	3.7	22,374						20.0	40.0	1420	39.3	19.3	<b>28,803</b>
51.0	35	24.0	44.1	6.9	82,930	6,022	10.1	800	6,791	<b>4.56</b>	68	107	3000	104.6	36.6	<b>105,692</b>
10.6	1.7	1.514	6.7	3.8	24,298						20.0	41.7	1420	40.4	20.4	<b>30,967</b>
57.0	40	24.0	49.5	7.5	90,450	6,165	10.3	800	6,934	<b>4.80</b>	68	109	3000	107.4	39.4	<b>113,701</b>
13.9	4.4	1.514	9.7	4.2	26,502						20.0	42.8	1420	41.9	21.9	<b>33,314</b>
65.0	47	24.0	56.5	8.5	102,291	6,318	10.4	800	7,087	<b>5.21</b>	68	111	3000	111.7	43.7	<b>126,062</b>
18.3	8.3	1.514	13.6	4.7	29,971						20.0	43.9	1420	44.3	24.3	<b>36,936</b>
69.0	50	24.0	60.1	8.9	106,884	6,472	10.6	800	7,241	<b>5.31</b>	68	113	3000	113.5	45.5	<b>131,181</b>
20.6	10.0	1.514	15.6	5.0	31,317						20.0	45.0	1420	45.3	25.3	<b>38,436</b>

Compressor: ZPS91KCE-TFD

\* Multiply by 2.2 for 208VAC

\* @ 49.7Pa (0.20inH2o) Ext. Static

## Cooling Mode

<b>RH-90-HAC-P-2T</b>											<b>R410a 60 Hz</b>							
Source Data (Indoor Loop)							Power Consumption					Sink Data (Outdoor Loop)						
EAT	Evap. Temp	Airflow	LAT	Delta T	Latent	Sensible	HAB	Compressor		Fan	Effective	Efficiency	ELT	Cond. Temp.	Flow	LLT	Delta T	Rejection
°F	°F	cfm	°F	°F	Btu/hr	Btu/hr	Btu/hr	Watts	Amps*	Watts	Watts	EER	°F	°F	gpm	°F	°F	Btu/hr
°C	°C	L/s	°C	°C	Watts	Watts	Watts					COPc	°C	°C	L/s	°C	°C	Watts
80.6	44	3000	56.7	23.9	36,268	77,070	<b>113,338</b>	4,576	8.2	900	5,448	<b>20.8</b>	52	70	24.0	63.0	11.0	132,029
27.0	6.7	1420	13.7	13.3	10,627	22,581	<b>33,208</b>					<b>6.10</b>	11.1	21.1	1.514	17.2	6.1	38,684
80.6	44.1	3000	57.4	23.2	35,179	74,756	<b>109,935</b>	4,878	8.4	900	5,750	<b>19.1</b>	59	77	24.0	69.8	10.8	129,656
27.0	6.7	1420	14.1	12.9	10,307	21,903	<b>32,211</b>					<b>5.60</b>	15.0	25.0	1.514	21.0	6.0	37,989
80.6	44.2	3000	57.7	22.9	34,740	73,823	<b>108,564</b>	5,019	8.5	900	5,891	<b>18.4</b>	62	80	24.0	72.7	10.7	128,765
27.0	6.8	1420	14.3	12.7	10,179	21,630	<b>31,809</b>					<b>5.40</b>	16.7	26.7	1.514	22.6	6.0	37,728
80.6	44.3	3000	58.0	22.6	34,178	72,629	<b>106,807</b>	5,122	8.8	900	5,993	<b>17.8</b>	67	85	24.0	77.6	10.6	127,359
27.0	6.8	1420	14.5	12.5	10,014	21,280	<b>31,294</b>					<b>5.22</b>	19.4	29.4	1.514	25.3	5.9	37,316
80.6	44	3000	57.4	23.2	31,502	73,504	<b>105,005</b>	5,231	9.0	900	6,107	<b>17.2</b>	73	90	24.0	84.0	11.0	125,931
27.0	6.9	1420	14.1	12.9	9,230	21,536	<b>30,766</b>					<b>5.04</b>	22.8	32.2	1.514	28.9	6.1	36,897
80.6	45	3000	57.8	22.8	30,886	72,067	<b>102,952</b>	5,453	9.2	900	6,328	<b>16.3</b>	77	94	24.0	87.9	10.9	124,634
27.0	6.9	1420	14.3	12.7	9,049	21,115	<b>30,165</b>					<b>4.77</b>	25.0	34.4	1.514	31.1	6.1	36,518
80.6	45	3000	58.5	22.1	29,909	69,788	<b>99,697</b>	5,815	9.6	900	6,690	<b>14.9</b>	83	100	24.0	93.8	10.8	122,614
27.0	7.0	1420	14.7	12.3	8,763	20,448	<b>29,211</b>					<b>4.37</b>	28.3	37.8	1.514	34.3	6.0	35,926
80.6	45	3000	60.1	20.5	27,812	64,895	<b>92,707</b>	6,662	10.5	900	7,537	<b>12.3</b>	95	112	24.0	105.4	10.4	118,515
27.0	7.1	1420	15.6	11.4	8,149	19,014	<b>27,163</b>					<b>3.60</b>	35.0	44.4	1.514	40.8	5.8	34,725

Compressor: ZPS91KCE-TFD

\* Multiply by 2.2 for 208VAC

\* @ 49.7Pa (0.20inH2o) Ext. Static

# Engineering Guide Specifications

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## General

The liquid source reversing water-to-air heat pump shall be a single packaged reverse-cycle heating/cooling unit. The unit shall be listed by a nationally recognized safety-testing laboratory or agency, such as ETL Testing Laboratory, Underwriters Laboratory (UL), or Canadian Standards Association (CSA). The unit shall be rated in accordance with applicable standards of the Air Conditioning, Heating, and Refrigeration Institute / International Standards Organization (AHRI/ISO) and/or Canadian Standards Association (CSA). The liquid source water to water heat pump unit, as manufactured by Maritime Geothermal, Petitcodiac, New Brunswick, shall be designed to operate correctly within liquid temperature ranges specified on the "Minimum and Maximum Operating Temperatures" page of this engineering specification document.

## Factory Quality

Each unit shall be run tested at the factory with water circulating through the outdoor loop and air circulating through the indoor loop. Quality control system checks shall include: computerized nitrogen pressurized leak test, evacuation of refrigeration circuit to sustained vacuum, accurate system charge, detailed heating and cooling mode tests, and quality cross check all operational and test conditions to pass/fail criteria. Units tested without water and air flow are not acceptable. The units shall be warranted by the manufacturer against defects in materials and workmanship in accordance with the warranty section at the end of this document. Optional extended factory warranty coverage may be available.

## Cabinet

Each unit shall be enclosed in a sheet metal cabinet. Cabinet shall be constructed of powder coated galvanized sheet metal of minimum 20 gauge. Sheet metal gauge shall be higher where structurally required. Design and construction of cabinet shall be such that it is rigid and passes the CSA/UL Loading Test requirements (200 lb roof test and 25 lb guard test). All panels shall be lined with minimum 1/2 inch [12.7 mm] thick acoustic type glass fiber insulation. All insulation shall meet the fire retardant provisions of NFPA 90A. This material shall also provide acoustical benefit. The unit must have a minimum of two access panels for serviceability of the compressor compartment. Units having only one access panel to compressor/heat exchangers/expansion device/refrigerant piping shall not be acceptable. The electrical box shall have separate holes and knockouts for entrance of line voltage and low voltage control wiring. All factory-installed wiring passing through factory knockouts and openings shall be protected from sheet metal edges at openings by plastic grommets.

## Refrigerant Circuit

All units shall contain only one sealed refrigerant circuit, containing a hermetic motor 2-stage scroll compressor, coaxial heat exchanger, refrigerant to air exchanger, electronic expansion valve (EEV), reversing valve, factory installed high and low pressure sensors, manual reset high pressure switch, service ports, liquid line filter-dryer, sight glass, and suction accumulator.

Compressors shall be specified for heat pump duty with internal isolation consisting of rubber vibration isolators between the compressor and mounting plate, and rubber vibration isolators between the mounting plate and cabinet. Compressor motors shall have internal overload protection.

The water to refrigerant heat exchangers shall consist of a steel outer jacket with twisted copper inner tube, designed and certified for 600 psig [4136 kPa] working pressure on the refrigerant side and 450 psig [3108 kPa] on the water side. Heat exchangers headered together in parallel shall use a reverse-return or symmetrical arrangement on the water side and symmetrical arrangement on the refrigerant side to ensure even flow splitting. Heat exchangers shall be insulated over all of their outside surface with minimum 3/8" thick closed cell insulation. Insulation consisting of 1/8" closed-cell insulating tape shall not be acceptable. Cupro-nickel (CuNi) inner tube shall be available as a factory option.

The refrigerant to air heat exchanger shall be a multi-circuit design with copper tubing and aluminum fins with refrigerant distributor for cooling mode. It shall be designed and certified for 650 psig [4482kPa] working pressure on the refrigerant side.

The electronic expansion valve shall be of stepper-motor rather than pulsing type, and shall provide proper superheat control over the unit's operating range with minimal deviation from superheat setpoint. Superheat shall be determined through the suction pressure-temperature method. Externally mounted pressure controlled water regulating flow valves or thermostatic expansion valves (TXV's) in place of electronic expansion valves are not acceptable.

## Fan/Blower

The blower shall be a squirrel cage type, constructed of corrosion resistant material. The entire blower shall be removable without disconnecting supply duct to allow servicing of fan motor. The air return may be specified as left or right at the time of manufacture. The airflow may be side or back (end) discharge and shall be field configurable.

The fan motors shall be direct drive electrically commutated motor (ECM) type, with soft start and variable speed functionality.

## Auxiliary Heat (Plenum Heater)

Provisions for controlling an externally mounted electric air heater shall be supplied.

## Condensate Tray

The condensate tray shall be made of stainless steel and be large enough to catch any condensation that may drip from the refrigerant to air exchanger during cooling operation. The condensate drain shall be a 3/4" female NPT fitting for external drain connection.

## Piping and Connections

The unit shall have one set of primary water in and water out connections (outdoor loop). The primary connection type shall be 1-1/4" nominal female National Pipe Thread (NPT). All water connectors shall be rigidly mounted to cabinet with corrosion resistant fasteners to prevent relative movement. All water connectors shall be constructed of copper or brass material for corrosion resistance.

All internal water and refrigerant piping shall be insulated with minimum 3/8" thick closed cell insulation. Insulation consisting of 1/8" closed-cell insulating tape shall not be acceptable.

## Electrical

Controls and safety devices shall be factory wired and mounted within the unit. Controls shall include a 24 volt alternating current (24VAC) min. 75VA class II control transformer with resettable breaker for short circuit protection for providing power to all internal controls as well as a remote thermostat. Terminal strips with screw terminals shall be provided for field control wiring, power supply line connections, and power supply for outdoor loop (ground loop) circulators. Units shall be name-plated for use with time delay fuses or circuit breakers.

## Unit Control

The control system shall have the following features:

1. Anti-short cycle time delay on compressor operation. Time delay shall be a minimum of 5 minutes, for both thermostat demand and safety control reset starts. A test jumper shall be provided to disable this delay for unit commissioning and testing purposes. The unit shall revert to normal operation after a time delay if the test jumper is accidentally left in place.
2. Random compressor start delay of 0-120 seconds (in addition to 5 minute anti-short cycle timer) on unit power up to facilitate starting multiple units on one disconnect switch or after a power failure.
3. Compressor shutdown for high or low refrigerant pressures.
4. Condensate overflow protection, using two contacts in the drip tray (not a mechanical or electronic switch).
5. Automatic intelligent reset: unit shall automatically restart 5 minutes after a trip if the fault has cleared. Should a fault reoccur again within 60 minutes then a permanent lockout shall occur, requiring cycling of the power to the unit in order to reset.
6. Manual reset high pressure in case of electronic board failure.
7. 2 x 16 backlit Liquid Crystal Display (LCD) and four buttons provide basic configuration and data access . Unit may be configured for stand alone operation.
8. Universal Serial Bus (USB) port for full data access and diagnostic information, including manual override of all inputs and outputs, data-logging and real-time charting.

Maritime Geothermal works continually to improve its products. As a result, the design and specifications of any product may be changed without notice. Please contact Maritime Geothermal at 1-506-756-8135 or visit [www.nordicghp.com](http://www.nordicghp.com) for latest design and specifications. Purchaser's approval of this data set signifies that the equipment is acceptable under the provisions of the job specification. Statements and other information contained herein are not express warranties and do not form the basis of any commercial contract or other agreement between any parties, but are merely Maritime Geothermal's statement of opinion regarding its products.

# LIMITED WARRANTY

MARITIME GEOTHERMAL LTD. warrants that its commercial geothermal heat pumps shall be free from defects in materials and workmanship for a period of ONE (1) YEAR after the date of installation or for a period of ONE (1) YEAR AND SIXTY (60) DAYS after the date of shipment, whichever occurs first. This warranty covers all internal components of the heat pump.

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

## This warranty is subject to the following conditions:

1. The geothermal heat pump(s) must be properly installed and maintained in accordance with MARITIME GEOTHERMAL LTD.'s guidelines. Improper installation **includes but is not limited to** the following conditions:
  - 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 or in a fashion which directly or indirectly leads to failure of components or the entire heat pump
  - 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 or optional spring feet
  - 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
2. The installer must complete the **Startup Record** and return it to MARITIME GEOTHERMAL LTD. within 21 days of unit installation.
3. For new construction, it is the responsibility of the building or general contractor to supply temporary heat to the structure prior to occupancy. Geothermal heat pumps are designed to provide heat only to the completely finished and insulated structure. Startup of the unit shall not be scheduled prior to completion of construction and final duct installation for validation of this warranty.
4. It is the customer's responsibility to supply the proper quantity and quality of water or properly sized ground loop with adequate freeze protection.

MARITIME GEOTHERMAL LTD.'s sole and exclusive liability shall be, at its option, to repair or replace any part or component which is returned by the customer during the applicable warranty period set forth above, provided that (1) MARITIME GEOTHERMAL LTD. is promptly notified in writing upon discovery by the customer that such part or component fails or is defective (2) the customer returns such part or component to MARITIME GEOTHERMAL LTD., transportation charges prepaid, within (30) thirty days of failure, and (3) MARITIME GEOTHERMAL LTD.'s examination of such component discloses to its satisfaction that such part or component has failed or is defective and was not caused by one of the circumstances listed above. MARITIME GEOTHERMAL LTD. will not be responsible for any consequential damages or labour costs incurred. In addition, MARITIME GEOTHERMAL LTD. will not be responsible for the cost of replacement parts purchased from a third party.