

Engineering Specification / Submittal

WH-45-H*-Y-*S-****

**High Temperature Water to Water Heat Pump
Single Compressor, Coaxial Coils, R513a, 60 Hz**

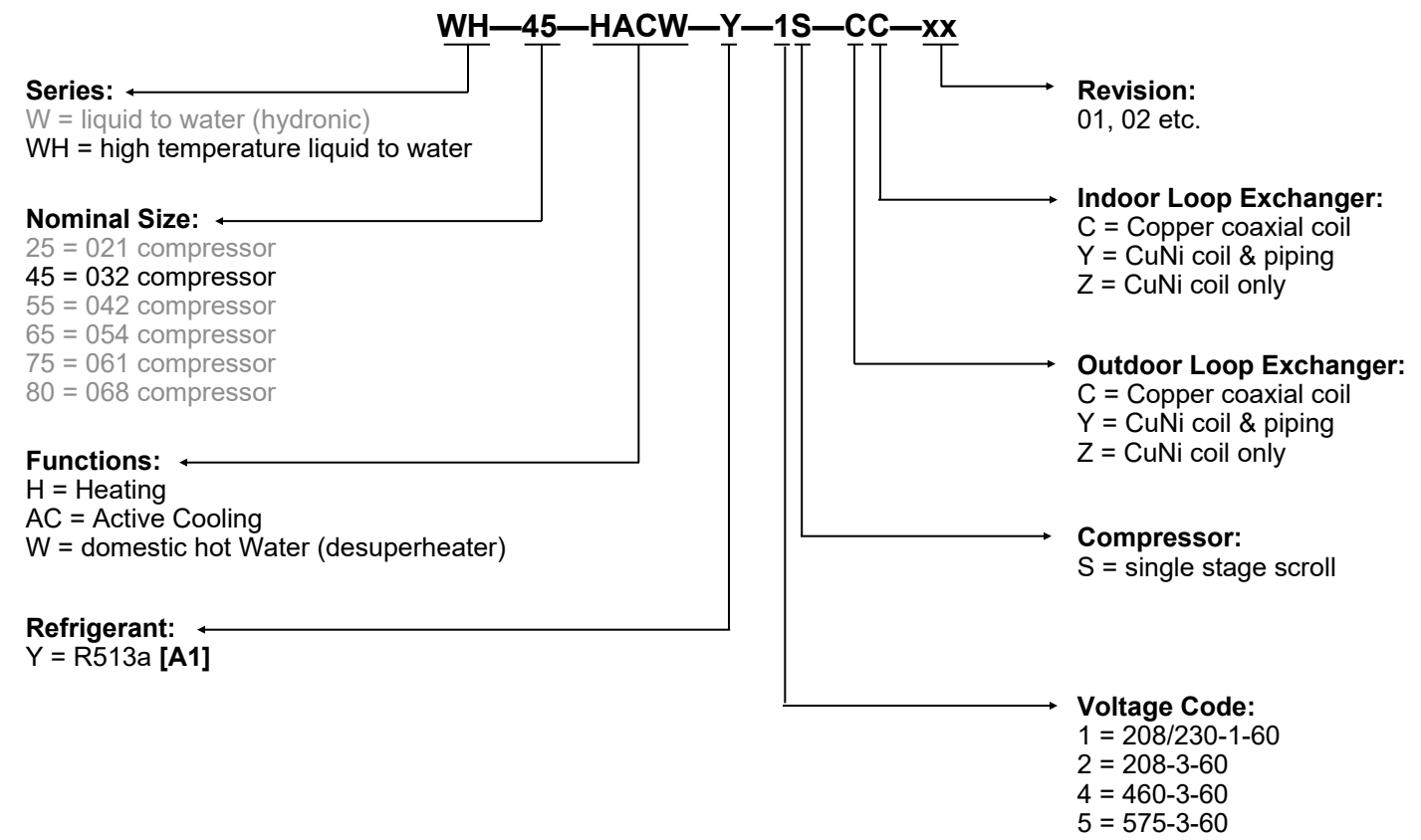


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Model Nomenclature

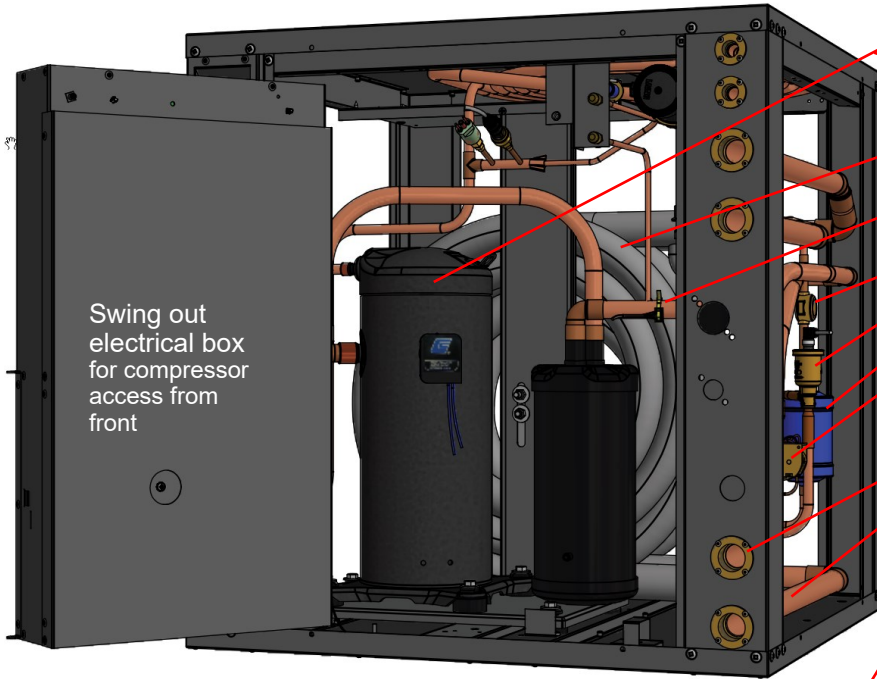


APPLICATION/AVAILABILITY TABLE										
MODEL	FUNCTION	REFRIGERANT	VOLTAGE	COMPR.	OUTDOOR COIL	INDOOR COIL	REVISIONS			
WH-45	H HACW	Y	1 2 4 5	S	C Y Z	C Y Z	01			
This manual applies only to the models and revisions listed in this table.										

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

Features

- ⇒ **Single compressor** design, with coaxial heat exchangers for good tolerance of open loop conditions
- ⇒ **R513a** refrigerant (GWP=573) is climate change-friendly & complies with 2025 regulations.
Note that R513a is an A1 refrigerant with no special mechanical room considerations.
- ⇒ **High temperature:** 160°F (71°C) hot loop, with source loop at minimum 40°F (4°C)
- ⇒ **TUV listed** (CSA/UL/ETL equivalent)



Refrigeration Circuit

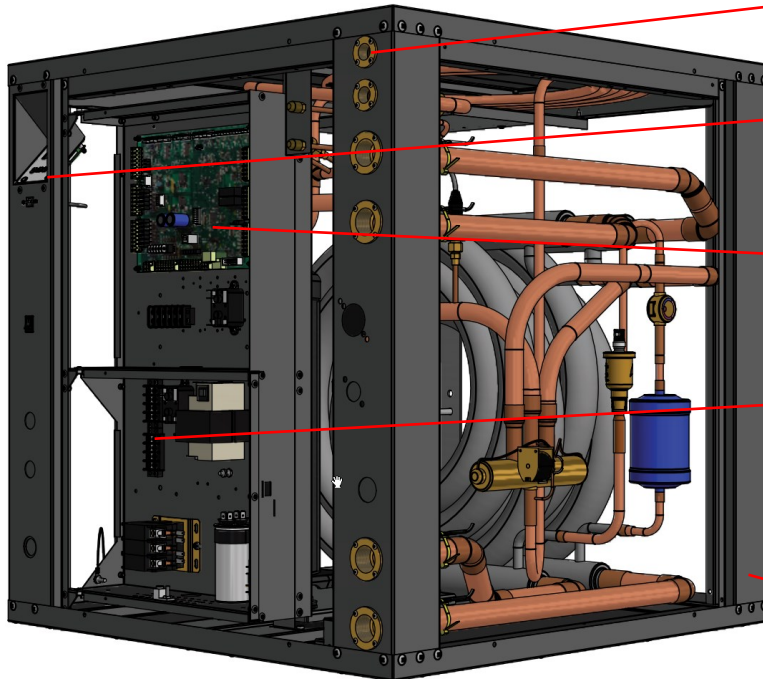
- Copeland single stage scroll compressor w/ suction accumulator
- Dual-grommet-mounted compressor for reduced noise and vibration
- Insulated coaxial heat exchangers and piping, available in copper or cupro-nickel (CuNi)
- High and low pressure & suction temperature sensors
- Sight glass
- Electronic Expansion Valve (EEV)
- Solid core filter-dryer
- Optional reversing valve (-HAC/HACW models)

Loop Connections

- 1" brass FNPT fittings
- Temperature sensor on each water line

Desuperheater (DHW)

- Double wall Domestic Hot Water (DHW) desuperheater suitable for passive heating of potable water (optional, -HACW/HW models)
- Built in circulator
- 1/2" brass FNPT fittings



Electrical & Control

- 2 x 16 LCD display for control and data access
- 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
- Advanced control board with BACnet MS/TP interface for remote control and data access including all sensor data & alarm conditions
- Onboard water temperature control, with outdoor reset (requires outdoor temperature sensor accessory)
- Connection points for outdoor and indoor circulator pump power
- 24VAC and 0-10VDC output for external pump / water valve control (24VAC 500mA max)

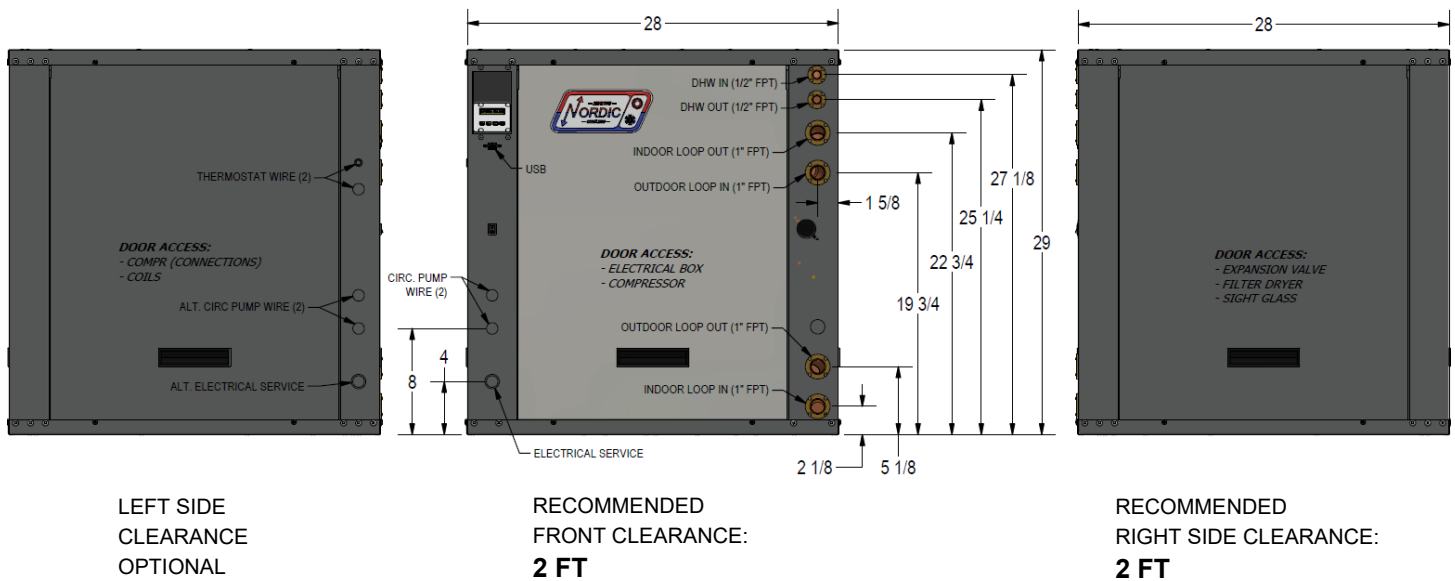
Frame & Enclosure

- Heavy duty cabinet constructed of satin galvanized steel with powder coat finish and 1/2" / 1" insulation
- Access panels on all 4 sides, serviceable from 2

Available Accessories



- Hydronic buffer tank with 12, 15, or 20kW electric elements
- Circulator pump module with loop / unit isolation valves (230VAC) for ground loop applications
- Barbed P/T port adapters for heat pump
- Anti-vibration pad for under unit
- Compressor sound jacket
- Secure Start module
- 1" motorized water valve & wiring harness for open loop
- Outdoor temperature sensor with enclosure, for outdoor reset functionality

Dimensions



NO BACK CLEARANCE REQUIRED

Specifications

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 EWT + 20°F) or (Outdoor EWT + 11°C). Lower temperatures require 0-10VDC modulating water valve, or manual flow reduction at startup.
		Maximum LWT	160	71	
	COOLING (reversing HAC units only, indoor is cold loop)	Minimum LWT  32	32	0	EWT should normally be 40°F (4°C) or greater.
		Maximum ELT	90	32	0-10VDC modulating water valve required on indoor loop above this temperature, or manual flow reduction at startup
Outdoor Loop	HEATING (outdoor is cold loop)	Minimum LWT  32	32	0	EWT should normally be 40°F (4°C) or greater.
		Maximum ELT	90	32	0-10VDC modulating water valve required on outdoor loop above this temperature to limit suction pressure (contact Engineering for firmware revision of this feature)
	COOLING (reversing HAC units only, outdoor is hot loop)	Minimum EWT	70 - 110	21 - 43	Use formula (Outdoor EWT + 20°F) or (Outdoor EWT + 11°C). Lower temperatures require 0-10VDC modulating water valve.
		Maximum LLT/LWT	160	71	
EWT: Entering Water Temperature LWT: Leaving Water Temperature Values in these tables are for rated liquid and water flows.					

Specifications

Electrical Specifications (R513a)										
Nomenclature Identifier	Power Supply			Compressor		Circulators	FLA	MCA	Max. Breaker	Minimum Wire Size
	V-ø-Hz	MIN	MAX	RLA	LRA	Max. A	Amps	Amps	Amps	ga
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

* additional conductor required if connecting 115VAC circulators to the unit

Shipping Information				
MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
WH-45	310 (141)	34 (86)	34 (86)	35 (89)

Sound Levels (dBA)*		
MODEL	1 ft distance	3 ft distance
WH-45	57.2	56.0

* With all doors installed.

Refrigerant Charge				
MODEL	lb	kg	Refrigerant	Oil Type
WH-45	5.5	2.5	R513a [A1]	POE

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

Required Indoor & Outdoor Loop Flow Rate		
MODEL	gpm	L/s
WH-45	10	0.63

Note for circ pump sizing: flow rate may be greater than required for boiler of a similar heating capacity.

Loop Pressure Drop Data			INDOOR (water 104°F)		OUTDOOR (water 50°F)	
WH-45	gpm	L/s	psi	kPa	psi	kPa
	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

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.

Refer to *Application, Installation, & Service Manual* for BACnet objects (read and write).

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
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

Performance Tables - WH-Series (METRIC)

WH-45-H***-Y-1S R513a, 60 Hz, ZR32K5E-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	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

Engineering Guide Specifications

General

The liquid source reversing water-to-air heat pump shall be a single high temperature range package unit, with optional reversing valve and optional desuperheating circuit for domestic hot water heating. The unit shall be listed by a nationally recognized safety-testing laboratory (NRTL), such as TUV, ETL, UL, or 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 indoor and outdoor loops. 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 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 three 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 scroll compressor, Electronic Expansion Valve (EEV), coaxial heat exchangers, factory installed high and low pressure sensors, manual reset high pressure switch, service ports, liquid line filter-drier, sight glass, and suction accumulator.

Refrigerant used shall have a global warming potential (GWP) of less than 700 and shall have an A1 classification (non-flammable).

Compressors shall be specified for heat pump duty with internal isolation consisting of rubber vibration isolators and mounting plate with rubber vibration isolators. Compressor motors shall have internal high temperature 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 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.

The suction accumulator shall be insulated with minimum 3/8" thick closed cell insulation to prevent condensation. The accumulator's internal oil return port shall be sized properly for the unit's operating range. To ensure proper oil return, suction accumulator shall not be 'oversized'.

Piping and Connections

The unit shall have two sets of primary water in and out connections (for indoor and outdoor loops). The primary connection type shall be 1" nominal female National Pipe Thread (NPT). Optional domestic hot water (desuperheater) water connectors shall be 1/2" 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 24 volt alternating current (24VAC) activated compressor contactor, and 24VAC 100VA transformer with built in circuit breaker or fused on both primary and secondary sides. A terminal strip with screw in terminals shall be provided for field control wiring. Units shall be name-plated for use with time delay fuses or circuit breakers. Unit controls shall be 24VAC and provide heating as required by the remote thermostat or controller, or on-board controller. Unit shall provide remote fault indication to the control system via serial communications as well as provide fault messages on the front panel LCD display.

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. An override shall be provided to disable this delay for unit commissioning and testing purposes.
2. Random compressor start delay of 0-120 seconds on unit power up to facilitate starting multiple units after a power failure.
3. Compressor shutdown for high or low refrigerant pressures, Loss of Charge (LOC), optional low flow conditions, and for optional phase protection faults on three phase models.
4. Automatic intelligent reset: unit shall automatically restart after a trip short cycle delay expires if after trip if the fault has cleared. Should a fault reoccur 3 times sequentially then permanent lockout shall occur, requiring cycling of the power to the unit in order to reset.
5. Manual reset high pressure in case of electronic board failure.
6. The low pressure shall not be monitored for the first 90 seconds after a compressor start to prevent nuisance safety trips.
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.
9. BACnet connectivity for control by building automation system, and providing alarm & operating data feedback.

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 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.

Warranty: WH-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 RECEIVED 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 limitation 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.