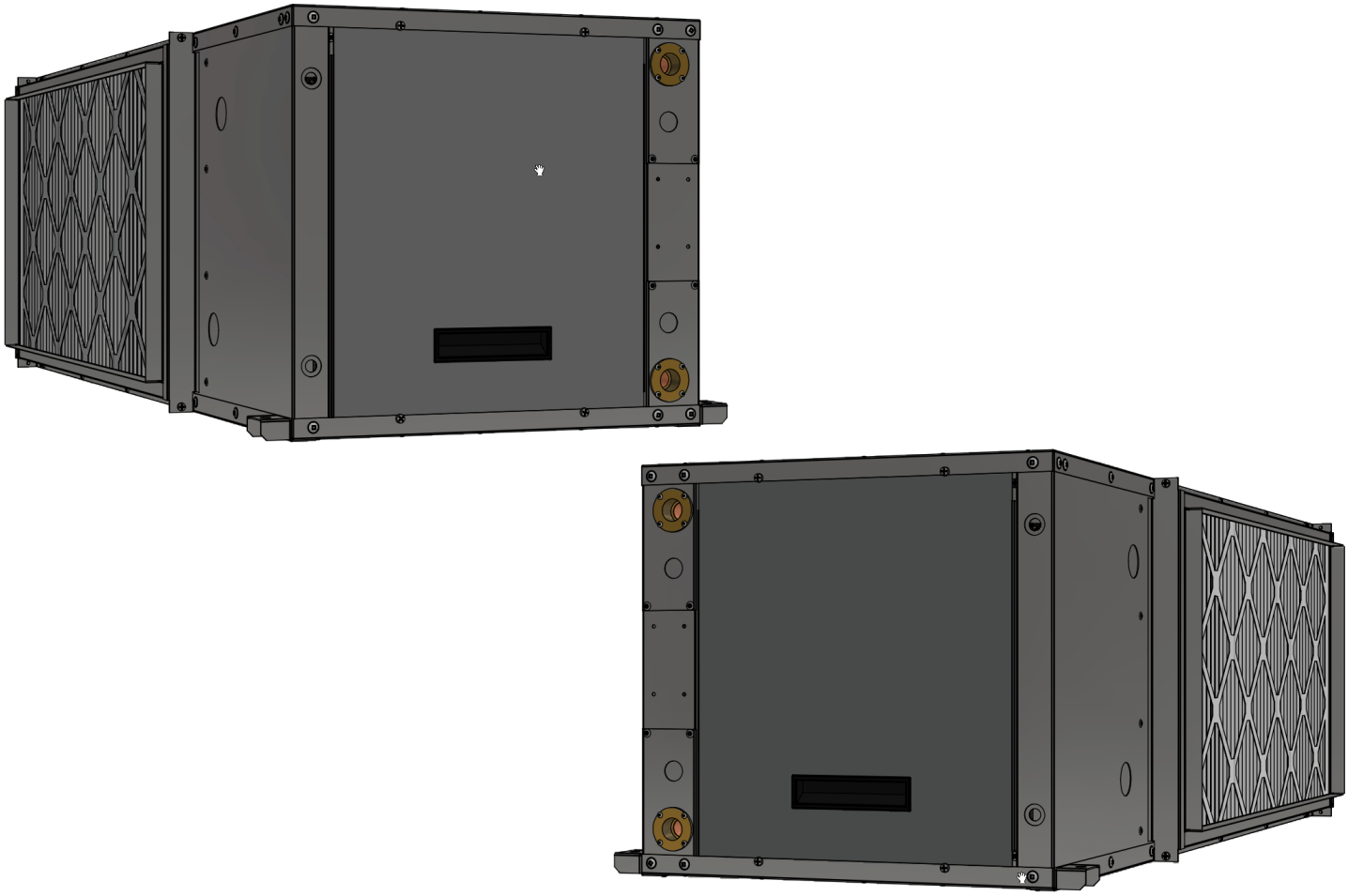
Engineering Specification / Submittal

RH-18-HAC-X-*L-*-SDE*F

Horizontal Liquid to Air Heat Pump

R454b, 60 Hz



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

info@nordicghp.com
www.nordicghp.com

003039SPC-01

A2L refrigerant: mildly flammable.

Read ***Application, Installation, and Service Manual*** for precautions and procedures.

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.

However, for units covered in this document, refrigerant charge is less than "$\mathbf{m_1}$" as defined in the UL/CSA 60335-2-40 standard (m_1=3.9lb / 1.8kg for R454b). Therefore, special installation considerations will be minimal.

Model Nomenclature

RH—18—HAC—X—1L—C—SDELT—01

Series:
RH = Reversing liquid to air (horizontal)

Nominal Size:
09 = 0.75 ton
12 = 1 ton
18 = 1.5 ton
24 = 2 ton

Functions:
H = Heating
AC = Active Cooling (reversing valve)

Refrigerant:
X = R454b **[A2L]**

Voltage Code:
1 = 208/230-1-60 VAC (factory set to 230-1-60)
3 = 265/277-1-60
9 = 208/230-1-60 VAC (factory set to 208-1-60)

Compressor:
L = fixed speed rotary

Revision:
01, 02 etc.

Air Supply Orientation:
F = field configurable (end or side)

Air Return Orientation:
L = left return
R = right return

Blower Motor:
E = ECM (5spd)

Blower Type:
D = direct drive

Air Coil:
S = standard (non-coated)
K = e-coated

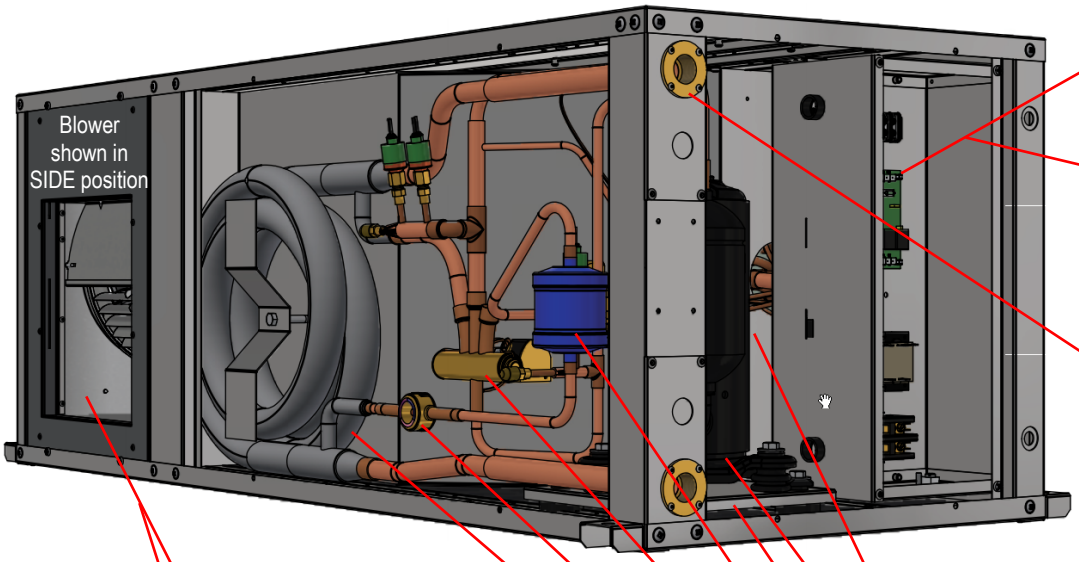
Outdoor Loop Exchanger:
C = copper coaxial coil
Z = CuNi coil

APPLICATION/AVAILABILITY TABLE											
MODEL	**FUNCTION**	**REFRIGERANT**	**VOLTAGE**	**COMPRESSOR**	**OUTDOOR COIL**	**FAN/CASE**	**REVISIONS**				
RH-18	HAC	X	1 3 9	L	C Z	SDELF SDERF	01				
This document 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

⇒ Suitable for **space heating/cooling** or **heat recovery** applications
⇒ **Premium features** and **NORDIC reliability** in a **low cost** design
⇒ **R454b** refrigerant (GWP=466) is climate change-friendly. Note that R454b is an A2L.
⇒ **TUV listed** (CSA/UL/ETL equivalent)



Electrical & Control

- Fault monitoring board with random start, anti-short cycle timer, auto-retry and permanent lockout mode
- Brownout and condensate overflow protection standard

Piping Connections

- 3/4” brass FNPT fittings for outdoor loop connections

Airflow

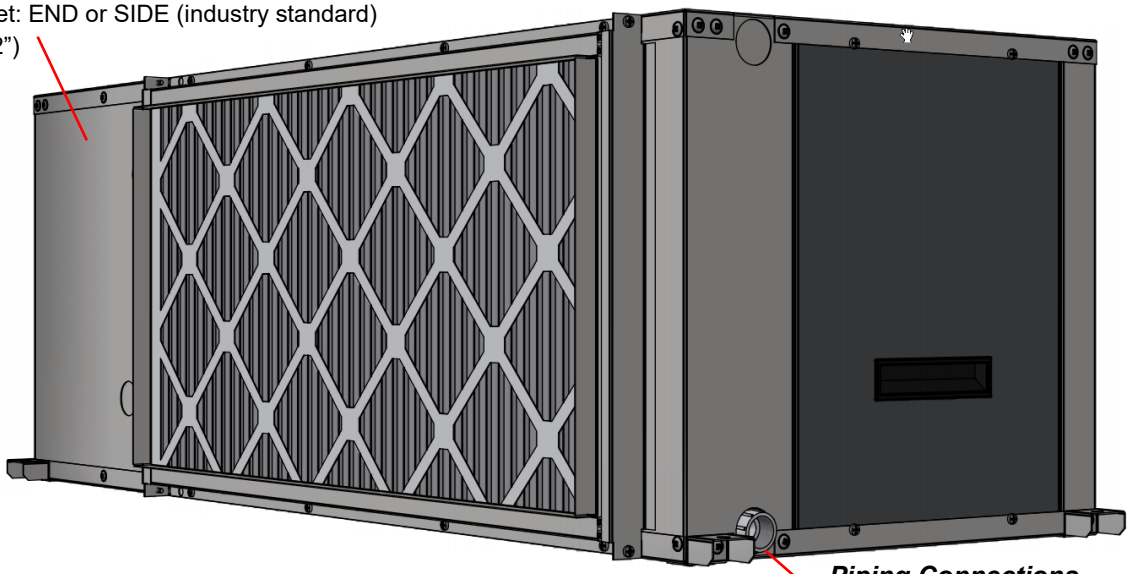
- ECM blower motor with 5 torque settings to adjust airflow
- Blower is easily removable through adjacent door for motor service

Refrigeration Circuit

- Balanced port thermostatic expansion valve (TXV) with internal bleed, providing off cycle equalization
- Single stage LG rotary compressor, with built in suction line accumulator
- Compressor is dual-grommet mounted for reduced noise and vibration
- solid core filter-dryer
- 4-way reversing valve
- sight glass
- Insulated coaxial heat exchanger and piping, copper or cupro-nickel (CuNi)

Frame & Enclosure

- Heavy duty satin galvanized steel cabinet, partial powder coat finish
- 4 corner hanging brackets for suspension applications
- Field configurable air outlet: END or SIDE (industry standard)
- Acoustically insulated (1/2”)
- Reversible air filter rack
- Formed condensate drip tray



Available Accessories

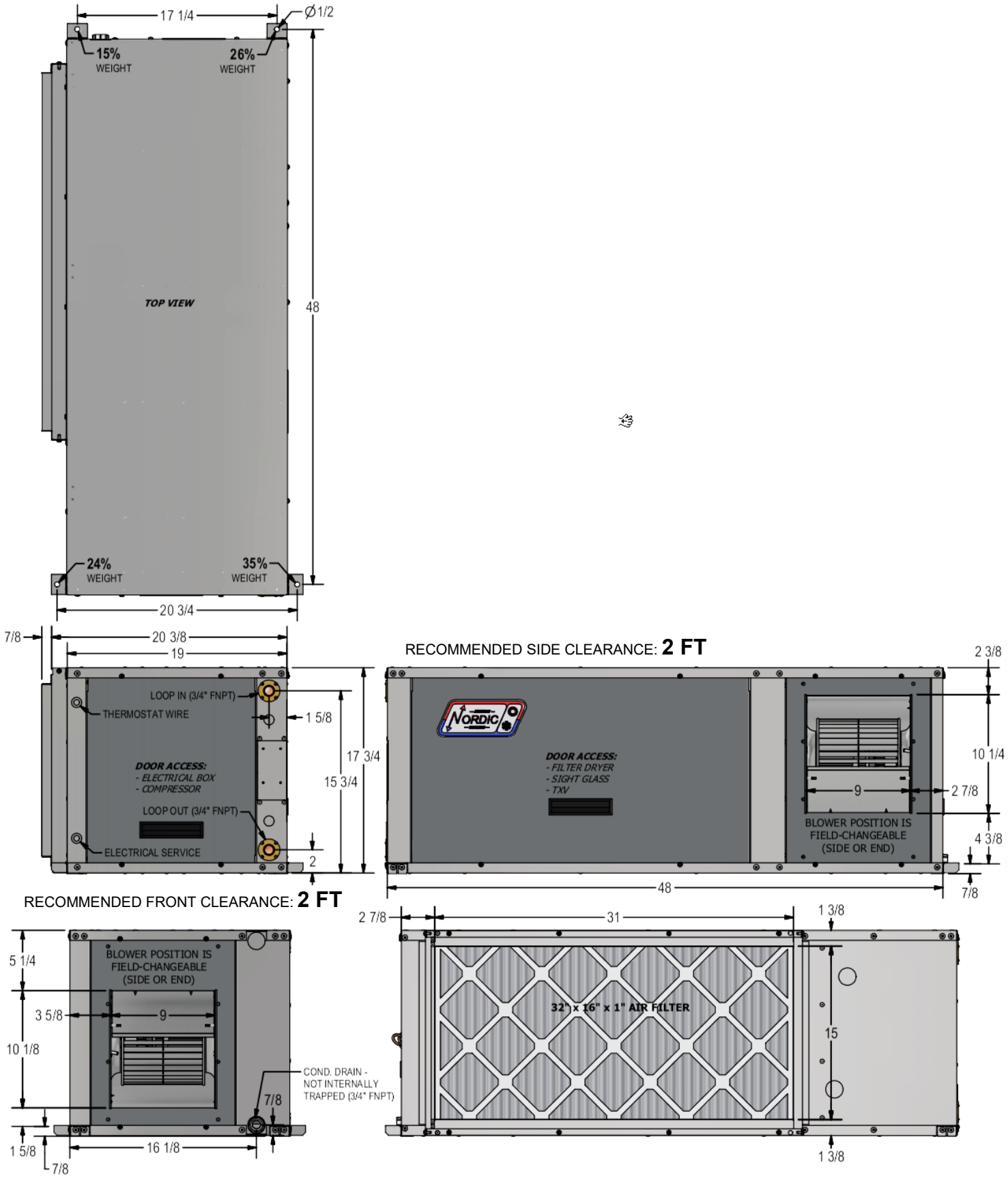
- Programmable thermostat, Wifi and standard versions
- Anti-vibration pad for under unit
- Compressor sound jacket
- 1” motorized water valve & wiring harness for open loop
- Electric plenum heaters 5 / 7 / 10 / 15 / 20 kW, for external mounting

Piping Connections

- 3/4” NPT condensate drain (externally trapped)

Dimensions: Left Return

All dimensions in inches.

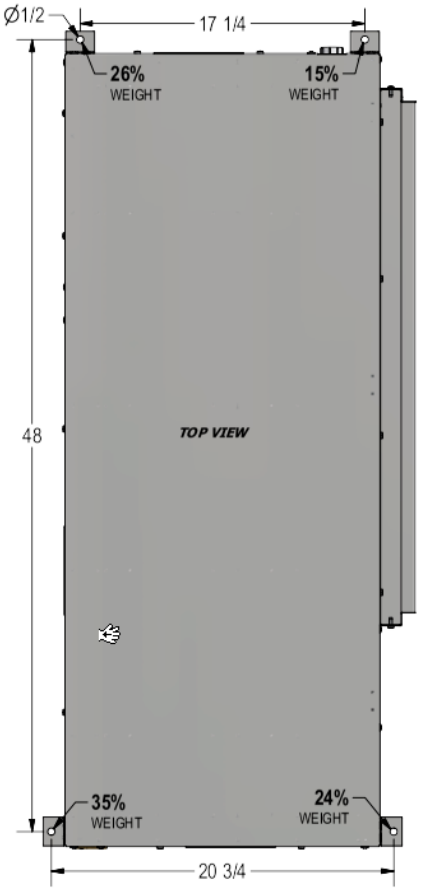


RECOMMENDED CLEARANCE FOR PANEL ADJACENT TO BLOWER:

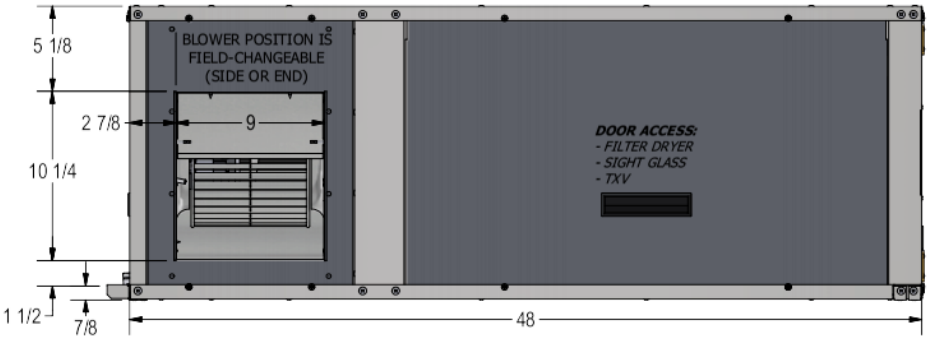
2 FT

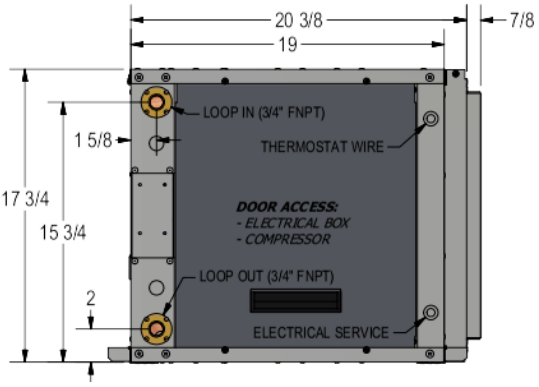
Dimensions: Right Return

All dimensions in inches.

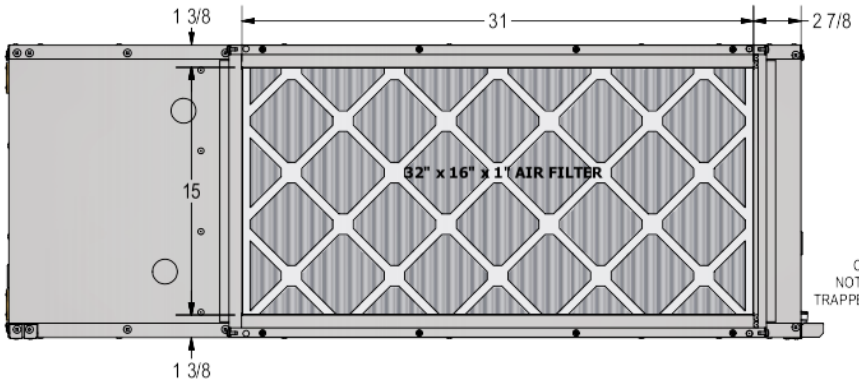


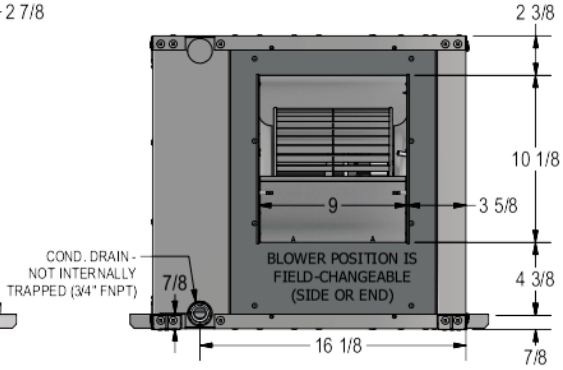
RECOMMENDED SIDE CLEARANCE: **2 FT**





RECOMMENDED FRONT CLEARANCE: **2 FT**





RECOMMENDED CLEARANCE FOR PANEL ADJACENT TO BLOWER:

2 FT

Specifications

Electrical Specifications (R454b)											
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
1	208/**230**-1-60	187	253	**7.6**	**36**	**2.8**	**1.5**	**12.1**	**14.0**	**20**	**#12-2**
3	265/277-1-60	226	304	**5.8**	**27**	**2.6**	**-**	**8.6**	**10.1**	**15**	**#14-2**
9	**208**/230-1-60	187	253	**7.6**	**36**	**2.8**	**1.5**	**12.1**	**14.0**	**20**	**#12-2**

A2L

Refrigerant Charge				
MODEL	lb	*kg*	Refrigerant	Oil Type
RH-18	2.3	1.0	R454b	POE

- Note that R454b charge per refrigeration circuit is below '***m1***' as defined in the UL/CSA 60335-2-40 standard
- **Refrigerant charge is subject to slight revision** but always below ***m1***; actual charge is indicated on the unit nameplate
- Oil capacity is marked on the compressor label

Shipping Information					
MODEL	SHIPPING WEIGHT lb (kg)	HANGING WEIGHT lb (kg)	DIMENSIONS inches (cm) L	W	H
RH-18	190 (86)	148 (67)	48 (122)	21 (53)	18 (46)

See ***Dimensions*** later in this manual for RH-series hanger weight distribution.

Operating Temperature Limits					
Loop	Mode	Parameter	°F	°C	Note
OUTDOOR (ground loop)	Heating (water/open loop)	Minimum ELT	41	*5*	
	Heating (antifreeze/ground loop)	Minimum ELT	23	*-5*	Adequate antifreeze concentration required.
	Heating	Maximum ELT	80	*27*	Reduce flow above this temperature.
	Cooling	Minimum ELT	41	*5*	Flow reduction may be required.
	Cooling	Maximum ELT	110	*43*	
INDOOR (air duct)	Heating	Minimum EAT	60	*16*	Reduce air flow if necessary during heating startup.
	Heating	Maximum EAT	100	*38*	
	Cooling	Minimum EAT	50	*10*	
	Cooling	Maximum EAT	100	*38*	Reduce air flow if necessary during cooling startup.

* Values in this table are for rated liquid and airflow values.

Loop Pressure Drop Data			Water 104°F		Water 50°F		15% Methanol 32°F		35% prop. glycol 32°F	
	gpm	*L/s*	psi	*kPa*	psi	*kPa*	psi	*kPa*	psi	*kPa*
RH-18	2.5	*0.16*	0.8	*5.5*	0.8	*5.5*	0.9	*6.2*	1.4	*9.7*
	3	*0.19*	1.0	*6.9*	1.1	*7.6*	1.2	*8.3*	1.9	*13*
	3.5	*0.22*	1.4	*9.7*	1.5	*10*	1.7	*12*	2.3	*16*
	4	*0.25*	1.7	*12*	1.8	*12*	2.0	*14*	2.6	*18*
	4.5	***0.28***	**2.1**	***15***	**2.3**	***16***	**2.6**	***18***	**3.2**	***22***
	5	*0.32*	2.5	*17*	2.7	*19*	3.0	*21*	3.8	*26*
	5.5	*0.35*	3.1	*21*	3.4	*23*	3.8	*26*	4.8	*33*
	6	*0.38*	3.6	*25*	3.9	*27*	4.3	*30*	5.5	*38*

Standard Capacity Ratings

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

Standard Capacity Ratings - Ground Loop Heating*									60Hz
EAT 68°F (20°C)	* 15% Methanol by Weight Ground Loop Fluid								ELT 32°F (0°C)
Model Size	Nominal Size	Liquid Flow		Airflow		Input Energy	Capacity		COP_H
	tons	gpm	L/s	cfm	L/s	Watts	Btu/hr	kW	W/W
18	1.5	4.5	0.28	650	307	1,128	13,900	4.1	3.61

Standard Capacity Ratings - Ground Water Heating									60Hz
EAT 68°F (20°C)									ELT 50°F (10°C)
Model Size	Nominal Size	Liquid Flow		Airflow		Input Energy	Capacity		COP_H
	tons	gpm	L/s	cfm	L/s	Watts	Btu/hr	kW	W/W
18	1.5	4.5	0.28	650	307	1,242	18,200	5.3	4.29

Standard Capacity Ratings - Ground Loop Cooling*										60Hz
EAT 80.6°F (27°C) , RH=46%	* 15% Methanol by Weight Ground Loop Fluid									ELT 77°F (25°C)
Model Size	Size	Liquid Flow		Airflow		Input Energy	Capacity		EER	COP_c
	tons	gpm	L/s	cfm	L/s	Watts	Btu/hr	kW	Btu/hr/W	W/W
18	1.5	4.5	0.28	650	307	1,023	17,500	5.1	5.01	17.1

Standard Capacity Ratings - Ground Water Cooling										60Hz
EAT 80.6°F (27°C) , RH=46%										ELT 59°F (15°C)
Model	Size	Liquid Flow		Airflow		Input Energy	Capacity		EER	COP_c
	tons	gpm	L/s	cfm	L/s	Watts	Btu/hr	kW	Btu/hr/W	W/W
18	1.5	4.5	0.28	650	307	871	18,900	5.5	6.36	21.7

Performance Tables

RH-18-HAC-X-1L *R454b, 60 Hz, KKN156*

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL			INDOOR LOOP *(Air)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Fan** (W)	Input Power (W)	EAT (°F)	Cond. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	25	15	4.5	21	-4.0	8,750	4.0	135	1,082	68	100	650	86	18	**12,350**	**3.35**
	30	20	4.5	26	-4.4	9,700	4.2	135	1,115		102	650	87	19	**13,450**	**3.54**
	35	25	4.5	30	-4.9	10,700	4.4	135	1,148		104	650	89	21	**14,550**	**3.71**
	40	30	4.5	35	-5.3	11,750	4.6	135	1,180		106	650	91	23	**15,700**	**3.90**
	45	34	4.5	39	-5.9	12,900	4.8	135	1,211		108	650	92	24	**16,950**	**4.10**
	50	39	4.5	44	-6.4	14,050	5.0	135	1,243		110	650	94	26	**18,250**	**4.30**
	55	44	4.5	48	-6.9	15,200	5.1	135	1,273		112	650	96	28	**19,500**	**4.49**
	60	48	4.5	53	-7.5	16,450	5.2	135	1,304		114	650	98	30	**20,850**	**4.69**
	65	53	4.5	57	-8.1	17,700	5.3	135	1,335		116	650	100	32	**22,200**	**4.87**
	70	58	4.5	61	-8.7	19,000	5.4	135	1,364		117	650	102	34	**23,600**	**5.07**

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL			INDOOR LOOP *(Air @ 46% RH)*								
	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)*	Fan** (W)	Input Power (W)	EAT (°F)	Evap. Temp.	Airflow (cfm)	LAT (°F)	Delta T (°F)	Latent (Btu/hr)	Sensible (Btu/hr)	**Cooling** (Btu/hr)	**EER**
COOLING	50	71	4.5	60	10.2	**22,300**	2.6	143	739	80.6	44	650	61	-19	6,100	13,700	19,800	**26.8**
	55	77	4.5	65	10.0	**22,000**	2.9	143	819		44	650	62	-19	5,900	13,400	19,300	**23.6**
	60	82	4.5	70	9.9	**21,700**	3.2	143	883		44	650	62	-19	5,600	13,200	18,800	**21.3**
	65	88	4.5	75	9.8	**21,500**	3.4	143	936		45	650	62	-18	5,400	13,000	18,400	**19.7**
	70	93	4.5	80	9.8	**21,300**	3.6	143	978		45	650	62	-18	5,200	12,800	18,000	**18.4**
	75	99	4.5	85	9.7	**21,100**	3.8	143	1,012		46	650	63	-18	5,000	12,700	17,700	**17.5**
	80	104	4.5	90	9.6	**20,800**	3.9	143	1,040		46	650	63	-18	4,800	12,500	17,300	**16.6**
	85	110	4.5	94	9.4	**20,500**	4.0	143	1,063		46	650	63	-17	4,600	12,300	16,900	**15.9**
	90	115	4.5	99	9.2	**20,000**	4.1	143	1,083		47	650	64	-17	4,400	12,000	16,400	**15.1**
	95	121	4.5	104	9.0	**19,500**	4.2	143	1,101		47	650	64	-17	4,100	11,700	15,800	**14.4**

METRIC

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL			INDOOR LOOP *(Air)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Fan** (W)	Input Power (W)	EAT (°C)	Cond. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
HEATING	-3.9	-9.3	0.28	-6.1	-2.2	2.6	4.0	135	1,082	20.0	37.8	307	29.8	9.8	**3.6**	**3.35**
	-1.1	-6.7	0.28	-3.5	-2.4	2.8	4.2	135	1,115		38.9	307	30.7	10.7	**3.9**	**3.54**
	1.7	-4.1	0.28	-1.0	-2.7	3.1	4.4	135	1,148		40.0	307	31.6	11.6	**4.3**	**3.71**
	4.4	-1.4	0.28	1.5	-2.9	3.4	4.6	135	1,180		41.1	307	32.5	12.5	**4.6**	**3.90**
	7.2	1.2	0.28	3.9	-3.3	3.8	4.8	135	1,211		42.1	307	33.5	13.5	**5.0**	**4.10**
	10.0	3.8	0.28	6.4	-3.6	4.1	5.0	135	1,243		43.2	307	34.5	14.5	**5.4**	**4.30**
	12.8	6.4	0.28	9.0	-3.8	4.5	5.1	135	1,273		44.2	307	35.5	15.5	**5.7**	**4.49**
	15.6	9.1	0.28	11.4	-4.2	4.8	5.2	135	1,304		45.3	307	36.6	16.6	**6.1**	**4.69**
	18.3	11.7	0.28	13.8	-4.5	5.2	5.3	135	1,335		46.4	307	37.7	17.7	**6.5**	**4.87**
	21.1	14.3	0.28	16.3	-4.8	5.6	5.4	135	1,364		47.4	307	38.8	18.8	**6.9**	**5.07**

	OUTDOOR LOOP *(15% Methanol)*						ELECTRICAL			INDOOR LOOP *(Air @ 46% RH)*								
	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (kW)	Compressor Current (A)	Fan** (W)	Input Power (W)	EAT (°C)	Evap. Temp.	Airflow (L/s)	LAT (°C)	Delta T (°C)	Latent (kW)	Sensible (kW)	**Cooling** (kW)	**COP_C**
COOLING	10.0	21.8	0.28	15.7	5.7	**6.5**	2.6	143	739	27.0	6.5	41.0	16.2	-10.8	1.8	4.0	5.8	**7.85**
	12.8	24.9	0.28	18.4	5.6	**6.5**	2.9	143	819		6.7	41.0	16.4	-10.6	1.7	3.9	5.7	**6.92**
	15.6	27.9	0.28	21.1	5.5	**6.4**	3.2	143	883		6.9	41.0	16.6	-10.4	1.6	3.9	5.5	**6.24**
	18.3	31.0	0.28	23.7	5.4	**6.3**	3.4	143	936		7.1	41.0	16.8	-10.2	1.6	3.8	5.4	**5.77**
	21.1	34.1	0.28	26.5	5.4	**6.2**	3.6	143	978		7.3	41.0	16.9	-10.1	1.5	3.8	5.3	**5.39**
	23.9	37.1	0.28	29.3	5.4	**6.2**	3.8	143	1,012		7.5	41.0	17.0	-10.0	1.5	3.7	5.2	**5.13**
	26.7	40.2	0.28	32.0	5.3	**6.1**	3.9	143	1,040		7.7	41.0	17.2	-9.8	1.4	3.7	5.1	**4.86**
	29.4	43.2	0.28	34.6	5.2	**6.0**	4.0	143	1,063		7.9	41.0	17.3	-9.7	1.4	3.6	5.0	**4.66**
	32.2	46.3	0.28	37.3	5.1	**5.9**	4.1	143	1,083		8.1	41.0	17.6	-9.4	1.3	3.5	4.8	**4.43**
	35.0	49.3	0.28	40.0	5.0	**5.7**	4.2	143	1,101		8.3	41.0	17.8	-9.2	1.2	3.4	4.6	**4.22**

** *Fan power at 24.9Pa (0.10inH_2O) external static.*

Engineering Guide Specifications

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 (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 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 partially 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. 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 rotary compressor with built in suction accumulator, coaxial heat exchanger, refrigerant to air exchanger, thermostatic expansion valve (TXV), reversing valve, factory installed high and low pressure safety switches, service ports, liquid line filter-dryer, and sight glass.

Refrigerant used shall have a global warming potential (GWP) of less than 500. For A2L refrigerants, a refrigerant leak detector shall not be required due to refrigerant charge being less than “m1” as defined in the UL/CSA 60335-2-40 standard.

Compressors shall be specified for heat pump duty with internal isolation consisting of two sets of rubber vibration isolators between the compressor and mounting plate, and between the mounting plate and cabinet floor. 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 thermostatic expansion valve shall be a balanced port bi-flow type with internal bleed and shall provide proper superheat control over the unit’s operating range with minimal deviation from the superheat setpoint.

Fan/Blower
The blower shall be a squirrel cage type, constructed of corrosion resistant material, with unobstructed removable venturi to allow one-side servicing of fan motor. The fan return may be specified as left or right at the time of manufacture. The air outlet may be end or side discharge and shall be field configurable.

The fan motor shall be direct drive electrically commutated motor (ECM) with soft start and 5 selectable discreet torque levels.

Auxiliary Heat (Plenum Heater)
An optional plenum heater may be field installed outside the unit. Electrical control connections shall be supplied.

Condensate Tray
The condensate tray shall be large enough to catch any condensation that may drip from the refrigerant to air exchanger during cooling operation. The condensate drain shall be 3/4" NPT female socket 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 3/4" 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) class II control transformer with 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 and power supply line connections. 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. Low grid voltage or 'brownout' protection, which will prevent compressor operation if low voltage is detected.
6. 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.

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.

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 or repaired parts and components are warranted only for the remaining portion of the original warranty period.

This warranty is subject to the following conditions:

1. The geothermal heat pump must be properly installed and maintained in accordance with MARITIME GEOTHERMAL LTD. guidelines.

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.

If a geothermal heat pump manufactured by MARITIME GEOTHERMAL LTD. fails to conform to this warranty, MARITIME GEOTHERMAL LTD.'s sole and exclusive liability shall be, at its option, to repair or replace any part or component which is returned by the customer during the applicable warranty period set forth above, provided that (1) MARITIME GEOTHERMAL LTD. is promptly notified in writing upon discovery by the customer that such part or component fails to conform to this warranty; (2) the customer returns such part or component to MARITIME GEOTHERMAL LTD., transportation charges prepaid, within (30) thirty days of failure, and (3) MARITIME GEOTHERMAL LTD.'s examination of such component discloses to its satisfaction that such part or component fails to conform to this warranty and the alleged defects were not caused by accident, misuse, neglect, alteration, improper installation, repair or improper testing. MARITIME GEOTHERMAL LTD. will not be responsible for any consequential damages or labour costs incurred. In additional, MARITIME GEOTHERMAL LTD. will not be responsible for the cost of replacement parts purchased from a third party.