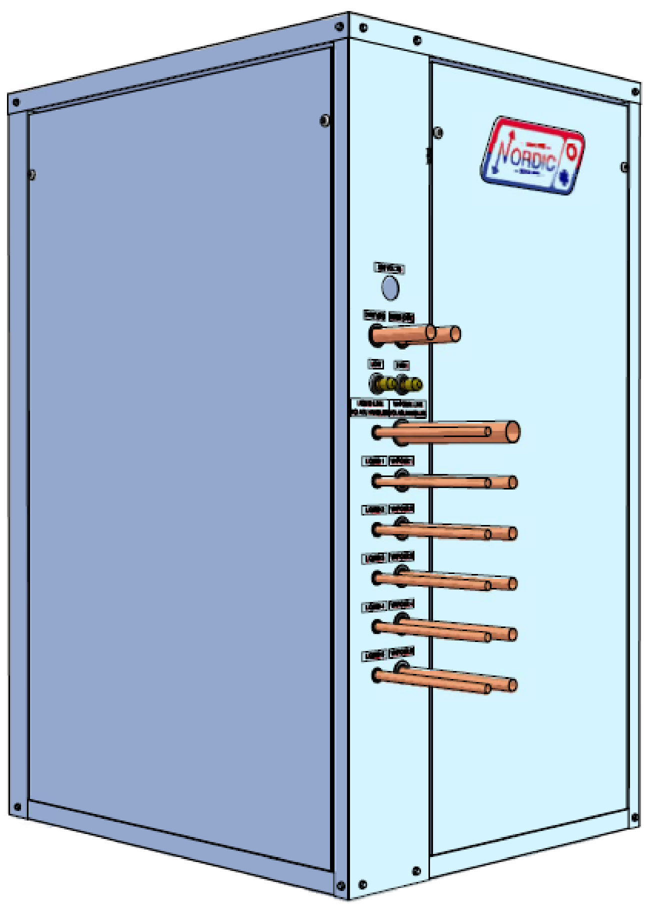
MARITIME GEOTHERMAL LTD.

Installation and Service Manual

DXS-Series
Single-Stage R410a
Model Sizes 25-65

Direct Expansion Heat Pumps - Split Systems



Maritime Geothermal Ltd.
P.O. Box 2555
Petitcodiac, N.B. E4Z 6H4
Ph. (506) 756-8135

Email: info@nordicghp.com
Web: www.nordicghp.com
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SAFETY PRECAUTIONS

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

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

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

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

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

MODEL NOMENCLATURE

DXS—65—HACW—P—1S—L—xx

Series:
DXS = Split Direct Expansion

Nominal Size:
25 = 2 Ton*
45 = 3 Ton
55 = 4 Ton
65 = 5 Ton
*Not available
in 575-3-60

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

Refrigerant:
P = R410a

Revision:
01, 02 etc.

Extra Loop:
= No
L = Yes

Compressor Stages*:
S = 1 Stage

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

APPLICATION TABLE									
SIZE	FUNCTION	REFRIGERANT	VOLTAGE	STAGES	REVISIONS				
25	HACW	P	1	S	02				
			2	S	02				
			6	S	02				
			7	S	02				
45	HACW	P	1	S	02				
			2	S	02				
			6	S	02				
			7	S	02				
55	HACW	P	1	S	02				
			2	S	02				
			6	S	02				
			7	S	02				
65	HACW	P	1	S	02				
			2	S	02				
			6	S	02				
			7	S	02				
This manual applies only to the models and revisions listed in this table									

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Tables, Diagrams and Drawings

TABLES

DRAWINGS

UNIT DESCRIPTION

The DXS-Series unit is a high efficiency single-stage split direct expansion (DX) heat pump with R410a refrigerant. It extracts and rejects heat from the earth via direct contact with copper loops, eliminating the need for a secondary heat exchanger and associated components. It must be connected to an air handler to complete the system.

Direct expansion units require less “loop” per ton and are more efficient than conventional ground loop systems. The reduced thermal resistance between the earth and the refrigerant circuit provides better heat transfer, resulting in a higher suction pressure and increased output.

The unit has several key features that are described in the specifications document for the particular heat pump. Please request a copy if desired or visit **www.nordicghp.com**

UNPACKING THE UNIT

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

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

OPTIMUM PLACEMENT

The placement of the unit has negligible effects on the operation of the system. The unit can be placed wherever it can most easily be connected to.

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

Raising the heat pump off the floor a few inches is generally a good practice since this will prevent rusting of the bottom panel of the unit. We recommend that the heat pump be placed on a piece of 2'' thick styrofoam. The styrofoam will smooth out any irregularities in the cement floor and deaden any compressor noise emitted from the bottom of the cabinet.

ELECTRICAL CONNECTIONS

The heat pump has a concentric 1.093” / 0.875” knockout for power supply connection to the electrical box. There is also a 0.875” knockout. There are two 1/2” openings with plastic grommets (grommet hole is 3/8”) in the upper section of the electrical box, one for the thermostat connections, and one for the optional plenum heater connections.

A schematic diagram and electrical box layout diagram (ELB) can be found inside the electrical box cover of the unit as well as in the Model Specific section of this manual. The Electrical Tables in the Model Specific section and the ELB diagram contain information about the size of wire for the connections, as well as the recommended breaker size.

A properly qualified electrician should be retained to make the connections to the heat pump and associated controls. The connections to the heat pump MUST CONFORM TO LOCAL CODES.

THERMOSTAT REQUIREMENTS

The DXS-Series unit requires a two-stage heating and one stage cooling thermostat with relay outputs for proper operation. **Triac output thermostats are incompatible with the control board in the heat pump.** The stages are S1 = Stage 1 compressor, S2 = electric auxiliary (heating only). One can be purchased with the unit, or other thermostats with the same number of stages can be used. The electrical box diagram (ELB) on the electrical box cover and **TABLE 1** provide a description of the signals.

TABLE 1 - Control Signal Description

Signal	Description
C	**24VAC Common (Ground)**
G	**Fan low speed (for air circulation)**
Y_1	**Heat Pump Stage 1 (Compressor Stage 1)**
R_H	**24VAC Hot**
L	**Fault (24VAC when fault condition)**
W_2	**Heat Pump Stage 3 (auxiliary heat) / Emergency Heat**
O/B/W_1	**Cooling Mode (reversing valve)**
Y_2	**Not Applicable**
I	**Plenum Heater dry contact**
1	**Plenum Heater dry contact**

NOTE: Some models are not available in two-stage at the present time (see Electrical Tables). The Y2 signal is not used for these units.

AIR HANDLER CONNECTIONS

The DXS unit is the master and is connected to the thermostat. It must provide control signals to the slave air handler as required for proper system operation. The available connections are shown in **TABLE 2**. These are all dry contact connections, meaning the control transformers for the DXS unit and the air handler remain separated.

For multi-speed or ECM fan motors all of the signals may be required. For single speed fan motors only F_G is required. Refer to the electrical box diagram and schematic for more information. The air handler power supply is separate from the DXS unit power supply and should be on it’s own breaker.

TABLE 2 - Air Handler Control Signals

Signal	Description
F	**24VAC Common**
F_G	**Fan low speed (for air circulation)**
F_{Y2}	**Fan high speed**
F_{W2}	**Fan auxiliary / emergency heat speed**
Use F_G only if the air handler has a single speed fan.	

CONTROL TRANSFORMER

The low voltage controls for all models are powered by a 100VA transformer with either primary and secondary fuses or a 100VA transformer with a secondary resettable breaker for circuit protection. Should a fuse blow, determine the problem and rectify it before replacing the fuse or resetting the breaker.
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.

SAFETY CONTROLS

The heat pump has two built in safety controls which are designed to protect the unit from situations which could damage it should the operation of the refrigeration circuit fall outside the allowable operating range.

A. Low Pressure Control

The low pressure control monitors the compressor suction pressure and will shut the compressor down if the refrigerant evaporating pressure becomes too low.

B. High Pressure Control

The high pressure safety control monitors the compressor discharge pressure and will shut the compressor down if the condensing pressure becomes too high.

Each of the controls are auto-reset controls. There is also a manual reset high pressure control (HACW only) should the control board be faulty and fail to disengage the compressor. It can be reset by pressing the rubber button on the end of it. It is electrically located between the Y output of the control board and the compressor contactor coil.

HW units contain a control board that monitors the safety controls and operates the compressor accordingly. Refer to **APPENDIX A** for control board specifications. The low pressure control is connected to LP1 and LP2. The high pressure control is connected to HP1 and HP2.

The **HW** control board has an on-board LED and a FAULT pin with a 24VAC output. An external indicator or relay can be connected across the FAULT pin and ground if external signaling is desired. Should a fault occur, the LED will flash the code of the fault condition while the safety control in question is open The codes are shown in **TABLE 3.** The control board will lock out the compressor for five minutes when a fault occurs. Three retries per fault condition are allowed within a 60 minute period.

If the fault condition occurs a fourth time the control board will permanently lock out the compressor and energize the FAULT pin. This can only be reset by powering down the unit. The LED will flash the fault code until the unit is reset.

TABLE 3 - Control Board Fault Codes

Fault	Code (HW)	LED (HACW)
High Pressure	**1**	**HI (red)**
Low Pressure	**2**	**LOW (green)**
Flow	**3**	**N/A**

If the control board enters permanent lockout mode there is a serious problem with the system and it must be rectified if the unit is to maintain good service.

HACW units contain a control board that monitors the safety controls and operates the compressor accordingly. The HACW control board also controls loop switching in cooling mode. Refer to the **Direct Expansion** section for more information.

The HACW control board monitors the pressure controls and shuts the compressor off immediately for a set period of time (adjustable) should there be a fault. Refer to **TABLE 3** for the LED indicators. The counter for the safety control in question will be increased by 1. The LED indicator for the control will flash until the control is reset as the pressures equalize in the unit. The unit may restart after the timer period has expired. Should the unit trip on the safety control again , the compressor will once again shut down and the counter will be incremented by one again. Each time this occurs the count is incremented until the counter reaches the max value (default is 3) at which point a permanent lockout will occur if this occurred within a set period of time (default 6 hours) and the compressor cannot be started again until the control board is reset by shorting the reset pins together or turning the power off and on again. The lockout count is decreased after a set period of time (default 6 hours) if there are no more occurrences.

If the control board enters permanent lockout mode there is a serious problem with the system and it must be rectified if the unit is to maintain good service.

DOMESTIC HOT WATER CONNECTIONS

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

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

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

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.

Connect the brown wire with the **blue insulated terminal** to L1 of the compressor contactor (fuse terminal for 575-3-60 units). **Ensure the power is off when connecting the wire.**

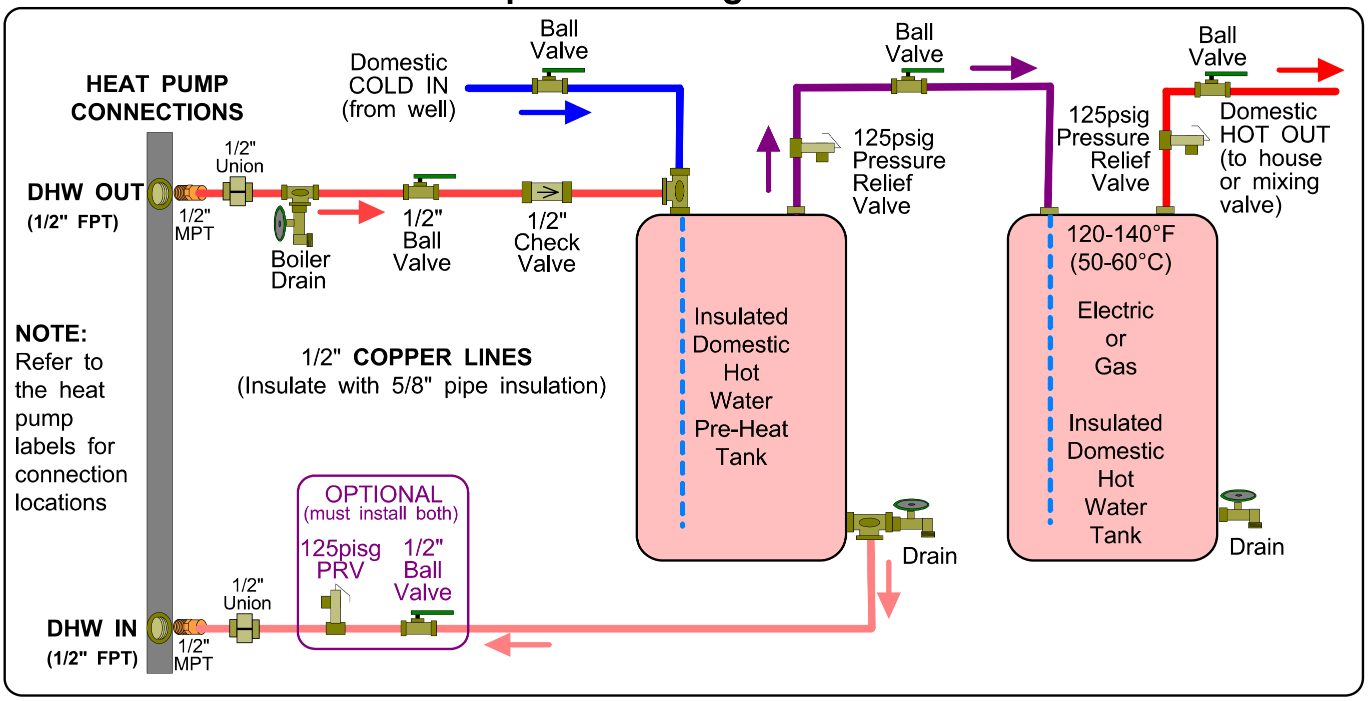
The DHW loop may have to be purged of air several times before good circulation is obtained. A temperature difference between the DHW In and DHW Out can be felt by hand when the circulator pump is operating properly.

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

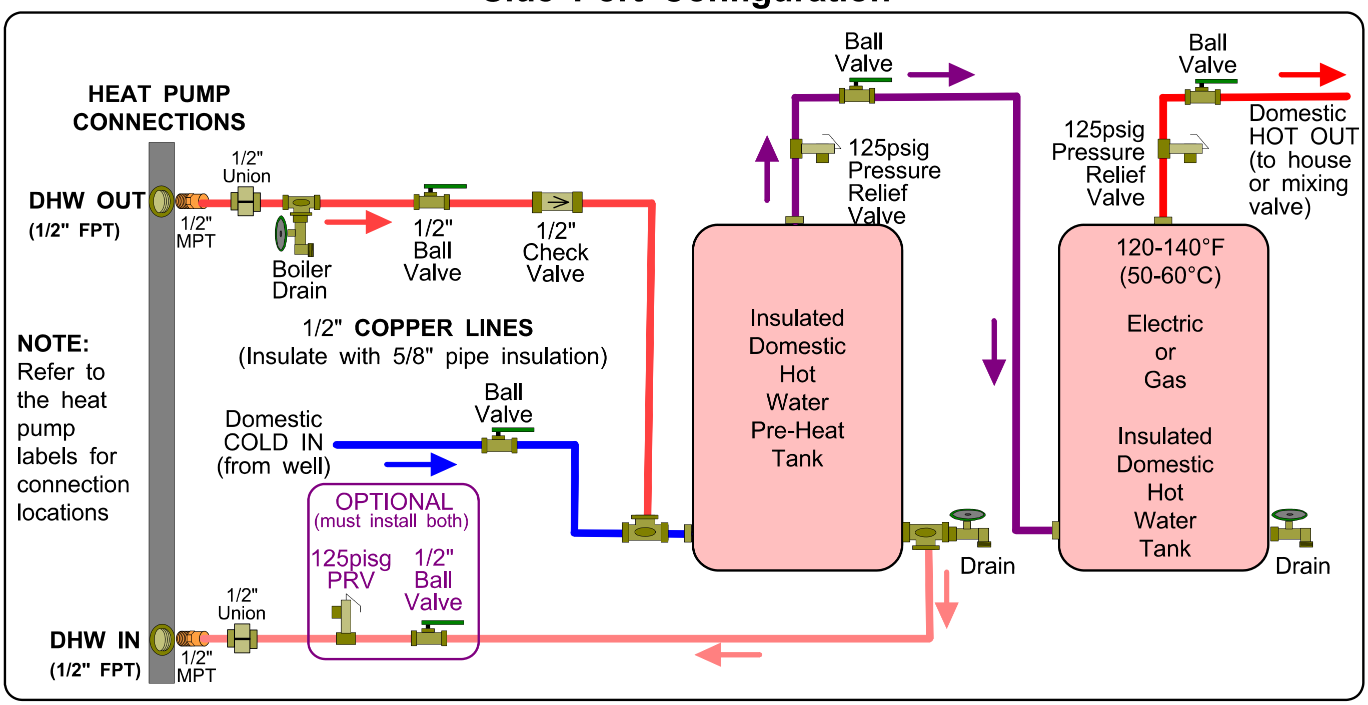
CAUTION: If two (2) shut-off valves are located on the domestic hot water ines as shown in the diagram, a pressure relief valve must be installed to prevent possible damage to the domestic hot water circulator pump should both valves be closed.

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

Top Port Configuration



Side Port Configuration



					Drawn By Chris Geddes	Date 10 MAR 09	MARITIME GEOTHERMAL LTD.		170 Plantation Rd. Petitcodiac, NB E4Z 6H4	
					Checked By Chris Geddes	Date 10 MAR 09	Drawing Name	Single Unit Connection to DHW Pre-Heat Tank (Brass FPT)		
					Approved By (ENG) Chris Geddes	Date 10 MAR 09				
01	Initial Release	C. GEDDES	C. GEDDES	10 MAR 09	Approved By (MFG)	Date	Size	Drawing Number	REV	SHEET
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REFRIGERATION

Direct expansion operation is essentially the same as any other heat pump. The main difference is in the outdoor loop section. Direct expansion heat pumps eliminate the intermediate ground loop exchanger and pumping equipment by using copper loops to interact directly with the earth. For each ton of capacity, the evaporator (heating mode) consists of one three-way valve, one heating thermostatic expansion valve (TXV), a pair of check valves and one outdoor copper loop with one vapour and one liquid connection to the heat pump. For each additional ton of capacity, there is a parallel evaporator circuit added to the unit.

In heating mode, all loops are used simultaneously to create a large evaporator. This allows maximum heat transfer from the loop field. Since each loop has it's own TXV, its superheat can be individually tailored, allowing each loop to obtain the same superheat even it may have different soil conditions. The loop select valves default to open in heating mode, and as such none of the loop select valve solenoid coils are energized.

In cooling mode (HACW only), running all loops at the same time would create far too large a condenser and the unit would have very low head pressure, causing the suction pressure to fall off until the low pressure safety control was reached. To circumvent this problem, the direct expansion unit will begin cooling mode by using only Loop 1.

Loops are selected by activating the solenoid on the loop select valve for the loop in question. The remaining loops are scavenged to the suction line.

Using one loop greatly reduces the size of the condenser, allowing the unit to operate properly. As the ground temperature warms up, rejecting the heat to the ground becomes more difficult, causing the head pressure to increase. When the loop is sufficiently hot enough to reach the **Loop Switch set point (290psig)**, the unit will switch to Loop 2. This starts the cycle over with a new loop and allows the previous loop time to recover. Heat pump operation will continue, switching through the loops as required.

The time between loop changes is monitored and should it fall below the adjustable threshold (default 15 minutes), indicating that the loops are sufficiently hot, the heat pump will begin using two loops at a time, and continue cycling. If the loop switch time falls below the threshold on two loop mode, the soaker hose will be turned on (if installed). The soaker hose cools the loops down with water. The loop sequences are shown in **TABLE 4**.

TABLE 4 - Cooling Mode Loop Sequences

# of Loops	1	2	3	4	5	6
2	1 & 2					
3	1 & 2	2 & 3	1 & 3			
4	1 & 2	3 & 4				
5	1 & 2	3 & 4	1 & 5	2 & 3	1 & 3	4 & 5

As the transition from summer to fall begins and the cooling load is greatly reduced, the loops begin to cool down on their own. Eventually a point is reached at which the loops are cooled down enough that two loops becomes too large a condenser. This may occur naturally or there may be a few heating days and then a warm spell again (the loops settings are not affected by a switch to heating mode). Two loop operation can no longer be sustained and the unit will trip the low pressure safety control. This occurrence will set the heat pump back to one loop mode and allow the unit to run properly when it automatically restarts after the lockout timer expires.

CONTROL BOARD (HACW only)

All heating / cooling direct expansion units contain a control board that monitors the thermostat signals, safety controls and loop pressures. It controls the operation of the compressor, fan and auxiliary / emergency heat. It also activates the reversing valve and controls the loop sequencing when in cooling mode. Heating only units do not have a control board.

The number of cooling loops must be configured (done at the factory). There are two jumpers to the top right of the microcontroller. The configuration is shown in **TABLE 5.**

There is also a jumper marked DEFAULT that should be left in place. The jumper marked IF NO B TERMINAL should be left place as well unless the thermostat used has a B terminal that is constantly powered in heating mode.

TABLE 5 - Cooling Loop Configuration

# of Loops	Left Jumper	Right Jumper
2	OFF	OFF
3	ON	OFF
4	OFF	ON
5	ON	ON

The control board has 4 connectors: one for the thermostat connections; one for the heat pump component connections; one for the loop solenoid connections; and one for the safety control and loop pressure switch connections. There are also several LEDs to indicate the status of the control board. **Refer to drawing 000301CDG** for the location of the connectors and LEDs.

The Heart Beat LED flashes once every second. This indicates that the control board is operational. An on-board COP watchdog timer resets the microprocessor should anything affect code execution.

The high and low pressure control LEDs flash once per second when a control is open. They will stay on if there is a permanent lockout.

The loop switch LED will come on when the loop pressure switch is activated. Note that the loop switch is only for cooling mode, it does not affect heating mode operation.

There is a compressor short-cycle timer (default 2 minutes) and also a mode switch timer (default 5 minutes). Both are adjustable through the control board communications port.

The high pressure, low pressure and loop switch are 5VDC signals. The low pressure control connects to L and L on the control board. The high pressure control connects to H and H. The loop switch connects to S and S. All other inputs and outputs are 24VAC.

When the thermostat calls for heat, the compressor will start (Stage 1), as will the fan after a short delay (adjustable). The unit will run until the thermostat is satisfied and the unit shuts off (the fan will continue to run for an adjustable period); or, a set period of time elapses (default 40 minutes). Should the set period elapse, the auxiliary heat (Stage 2) will be engaged to help the unit on cold days when the load is too large for the unit.

When the thermostat calls for cooling, the compressor will start (Stage 1), as will the fan after a short delay (adjustable). The unit will run until the thermostat is satisfied and the unit shuts off (the fan will continue to run for an adjustable period). During operation, the control board will cycle through the loops as required.

The control board has an RS-232 communications port on board. A simple program such as Hyper Terminal and an adapter cable can be used to communicate with the control board. **Drawing 000301CDG** shows how to build the communications cable. The port settings are shown in **TABLE 6**. The commands available are listed in **TABLE 7**. Note that the COP must be unlocked by command U before using command C to change system settings. The list of settings for command C is shown in **TABLE 8**. It is recommended that the settings be left at the defaults values.

TABLE 6 - RS232 Port Configuration

Item	Setting
Baud	9600
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	Xon / Xoff

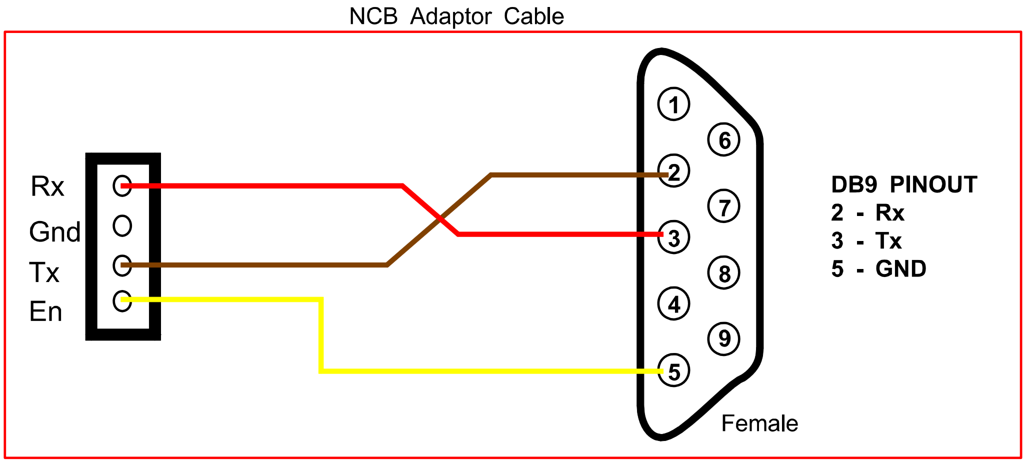
TABLE 7 - Control Board Commands

Command	Description
H	Help - displays the list of commands
U	Lock / unlock the COP watchdog
L	Display loop status
M	Display loop history
S	Display system status
D	Display system configuration
C	Change system settings (use U first)
T	System runtimes
!	Advance system time by 59 minutes
Z	Reset loop timers to zero

TABLE 8 - Control Board Default Settings

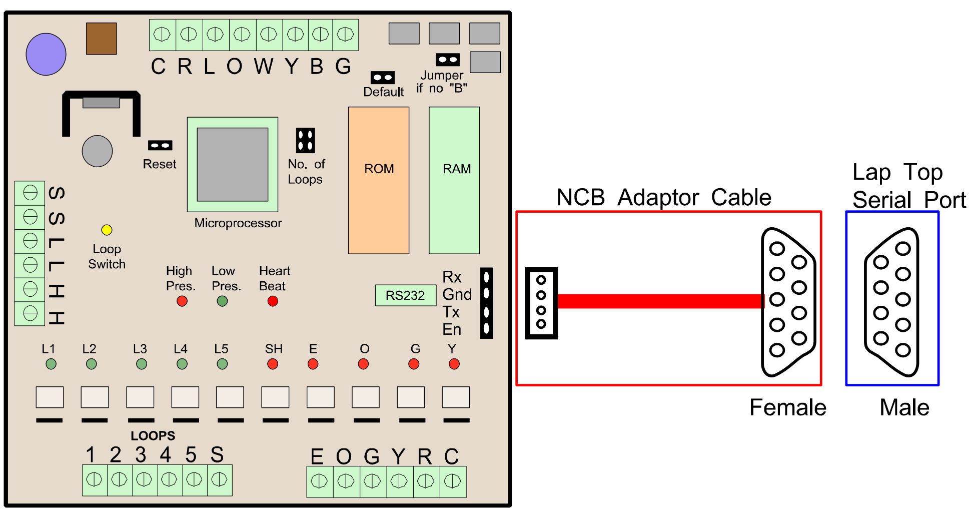
Command	Air Unit
Blower wait time after comp. start	2sec
Blower run time after comp. stops	5sec
Blower run time after aux. heat off	59sec
Aux. heat on time after comp. on	40min
Comp. off if low lockout (HEAT)	5min
Comp. off if low lockout (COOL)	30min
Comp. off if high lockout (HEAT)	5min
Comp. off if high lockout (COOL)	30min
Comp. off time between heat & cool	5min
Comp. delay since being off	2min
Min. loop time before mode increase	15min
Loop pressure testing wait time	7sec
Soaker start after comp. on time	2hrs
Soaker hose run time (maintenance)	4hrs
Soaker hose run time (emergency)	12hrs
System check interval	2sec
Low pres. lockout counter reduce time	6hrs
High pres. lockout counter reduce time	6hrs
Low pres. lock ignore counter	3 times
High pres. lock ignore counter	3 times
Reset mode = 1 and loop memory time	2 weeks
Maximum mode to be allowed	2
Ignore low pres. for	5min
Ignore low pres. for	0sec

NCB Lap Top Communication Cable



Take a 9-pin serial cable and cut the male end off. A 0.100" spacing 4 pin header can be obtained from a floppy drive power cable in an old computer. Connect the wires as shown in the diagram above. A multimeter set to continuity may be used to find the correct wires fron the 9-pin cable. A small paper clip will fit in the 9-pin connector holes.

Hyperterminal can be used to communicate with the control board. The com ports settings are 9600 baud, 8 data bits, no parity, 1 stop bit, Xon/Xoff control. The board echos commands so echo is not required in hyperterminal. Once connected, press H to display the available commands for the control board.



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	19 OCT 06

Drawn By: Chris Geddes	Date: 19 OCT 06
Checked By: Chris Geddes	Date: 19 OCT 06
Approved By (ENG): Chris Geddes	Date: 19 OCT 06
Approved By (MFG)	Date
Approved By	Date

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

Drawing Name: NCB Lap Top Communication Cable

Size	Drawing Number	REV	SHEET
A	000301CDG	01	1 of 1

HEAT PUMP SIZING

TABLE 9 depicts a rough guideline as to the size of home each heat pump size can handle direct expansion installations.

TABLE 9 - Heat Pump Size vs. Heated Area			
Model	**Size (tons)**	**Sq.ft.**	**Sq.m.**
25	2	800	75
45	3	1,400	130
55	4	2,000	185
65	5	2,600	240

THE TABLE ABOVE IS FOR INFORMATION ONLY, IT SHOULD NOT BE USED TO SELECT A UNIT SIZE. It simply shows on average what size unit is required for a typical two-level home (main level and below grade basement) with R-20 walls, R-40 ceiling and average size and number of windows. The Heated Area is the area of the main level, The tables account for a basement the same size as the heated area.

MARITME GEOTHERMAL LTD. HIGHLY RECOMMENDS THAT A PROPER HEAT LOSS/GAN ANALYSIS BE PERFORMEDE BY A PROFESSIONAL INSTALLER WITH CSA APPROVED SOFTWARE BEFORE SELECTING THE SIZE OF UNIT REQUIRED FOR THE APPLICATION. For heating dominant areas, 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 448.2-02.

There are many factors to consider when sizing the heat pump. Some of these factors include the number of levels, the size of the windows, the orientation of the home, attached garage, bonus rooms, walk-in basement, coldest outdoor temperature, etc. The heat loss program will take all of these factors into consideration in its calculations. An undersized installation will not be as efficient and will require expensive supplementary heat to maintain a comfortable temperature in the home, and the cost savings of having a geothermal heat pump are greatly reduced.

Once the total heat loss has been calculated, the unit can be sized using the performance tables (from the specifications document) in conjunction with the minimum expected entering liquid temperature of the ground loop (well water temperature for ground water system). The heat pump output must be able to match the total heat loss at the selected entering water temperature in order to provide a comfortable environment with minimal auxiliary heat.

AIR HANDLER SELECTION AND SIZING

The air handler selected should match the size of the DXS unit as close as possible for heating and cooling loads. The air handler should be able to provide the air flow required (within 10%) by the DXS unit in order to maximize system efficiency. See **TABLE 10** for the air flow values per unit size.

The air handler must have its own cooling TXV as well as a bypass around the TXV for heating mode in order to function properly with the DXS unit.

It is recommended that an air handler with an A coil setup be selected. It is important that the air coil total volume be close to the volume shown in **TABLE 10** to minimize refrigerant charge adjustment. If a match is unavailable then select a higher air coil volume unit. Undersized air coils can cause problems with refrigerant back up in the coils, reducing output and efficiency.

TABLE 10 - Air Flow and Air Coil Volume					
		Air Flow		**Air Coil Volume**	
Model	**Size (tons)**	**cfm**	**L/s**	**cu in**	**CC**
25	2	800	472	176	2884
45	3	1200	661	265	4342
55	4	1500	802	265	4342
65	5	1900	991	353	5785

DUCT SYSTEMS - GENERAL

Ductwork layout for a heat pump will differ from traditional hot air furnace design in the number of leads and size of main trunks required. Air temperature leaving the heat pump is normally **95º -105ºF (35-40ºC)**, much cooler than that of a conventional warm air furnace. To compensate for this, larger volumes of lower temperature air must be moved and consequently duct sizing must be able to accommodate the greater air flow without creating a high static pressure or high velocity at the floor diffusers.

A duct system capable of supplying the required air flow is of utmost importance. Maritime Geothermal Ltd. recommends that the static pressure be kept below 0.2 inches of water total. In some instances the number of floor diffusers will actually double when compared to the number that would be used for a hot air oil-fired furnace. Refer to **TABLE 13** at the end of this section.

1. Generally allow **100 cfm** for each floor grill.
2. All leads to the grills should be 6'' in diameter (28sq.in. each).
3. The main hot air trunks should be at least 75% of the square surface area of leads being fed at any given point.
4. Return air grills should have a minimum of the same total square surface area as the total of the supply grills.
5. The square surface area of the return trunks should equal the square surface area of the grills being handled at any given point along the trunk.

It is ***VERY IMPORTANT*** that all turns in both the supply trunks and the return trunks be made with ***TURNING RADII***. Air acts like a fluid and, just like water, pressure drop is increased when air is forced to change direction rapidly around a sharp or irregular corner.

It is recommended that flexible collars be used to connect the main trunks to the heat pump. This helps prevent any vibrations from travelling down the ductwork. If a plenum heater is installed, the collar should be at least 12" away from the heater elements.

The first 5-10 feet of the main supply trunks should be insulated with acoustical duct insulation to further inhibit any noise from the unit from travelling down the ductwork. If a plenum heater is installed, insulation should not be placed within 12" of the heater elements. **Drawing 000644CDG** shows a typical installation.

DUCT SYSTEMS - GRILL LAYOUT

Most forced air heating systems in homes have the floor grills placed around the perimeter of the room to be heated. Supply grills should be placed under a window when possible to help prevent condensation on the window. As mentioned in the previous sub-section, supply grill leads should be 6" in diameter (28 sq.in. each) to allow **100cfm** of air flow.

In a typical new construction, there should be one supply grill for every 100sq.ft. of area in the room. When rooms require more than one grill, they should be placed in a manner that promotes even heat distribution, such as one at each end of the room. It is always a good idea to place a damper in each grill supply or place adjustable grills so that any imbalances in the heat distribution can be corrected.

The total number of supply grills available is based on the heat pump nominal airflow. **TABLE 11** shows the number of grills available per heat pump size.

Return grills should be mounted on the floor. At minimum they should be the same size as the supply grill, **it is highly recommended that they be 25% to 50% larger than the total supply.** They should be placed opposite the supply grills when possible to ensure distribution across the room. For rooms requiring more than one supply grill, it may be possible to use one larger return grill if it can be centrally positioned opposite of the supply grills, however it is preferred to have one return for each supply to maximize heat distribution across the room.

TABLE 11 - Heat Pump Size vs. Hot Air Grills

Model	Size (tons)	# of Grills (@100cfm)
25	2	8
45	3	12
55	4	15
65	5	19

THERMOSTAT LOCATION

Most homes are a single zone with one thermostat. The thermostat should be centrally located within the home, typically on the main floor. It should be placed away from any supply grills, and should not be positioned directly above a return grill. Most installations have the thermostat located in a hallway, or in the inner wall of the living room. It should be noted that most homes do not have any supply ducts in the hallway. This can lead to a temperature lag at the thermostat if there is very little air movement in the hallway, causing the home to be warmer than indicated by the thermostat.

PLENUM HEATER (OPTIONAL)

For installations that do not already have a backup heat source such as electric baseboard, wood stove, propane etc, it is recommended that a plenum heater be installed. This provides two functions.

The first function of the plenum heater is to act as an auxiliary heat source. As such it will provide additional heat on extremely cold days if the heat pump is unable to bring the home temperature up quickly enough, eliminating any discomfort to the homeowner.

The second function of the plenum heater is to provide emergency heat should a problem occur that causes the heat pump to be locked out. This can be engaged by setting the thermostat to emergency heat, allowing the plenum heater to function while preventing the heat pump from operating. Should the heat pump fail while the home is vacant, the auxiliary function of the thermostat will maintain the temperature setting of the thermostat.

The plenum heater is powered separately from the heat pump. Only two control wires are needed to connect the plenum heater to the heat pump. Refer to the label on the plenum heater or the electrical box diagram on the inside of the electrical box cover of the unit for details on the connections.

The plenum heater should be mounted in the supply duct in a manner that allows all of the airflow to pass through it to prevent any hot spots in the heater elements.

TABLE 12 shows the recommended size plenum heater, as well as the wire size and breaker size needed to provide power to the plenum heater.

TABLE 12 - Plenum Heater Sizing

Heat Pump		Plenum Heater (230-1-60)			
Model	Size (Tons)	Size (kW)	Current (A)	Breaker (A)	Wire Size
25	2	5	21	40	#10
45	3	10	42	60	#6
55	4	15	62	100	#3
65	5	20	84	125	#3

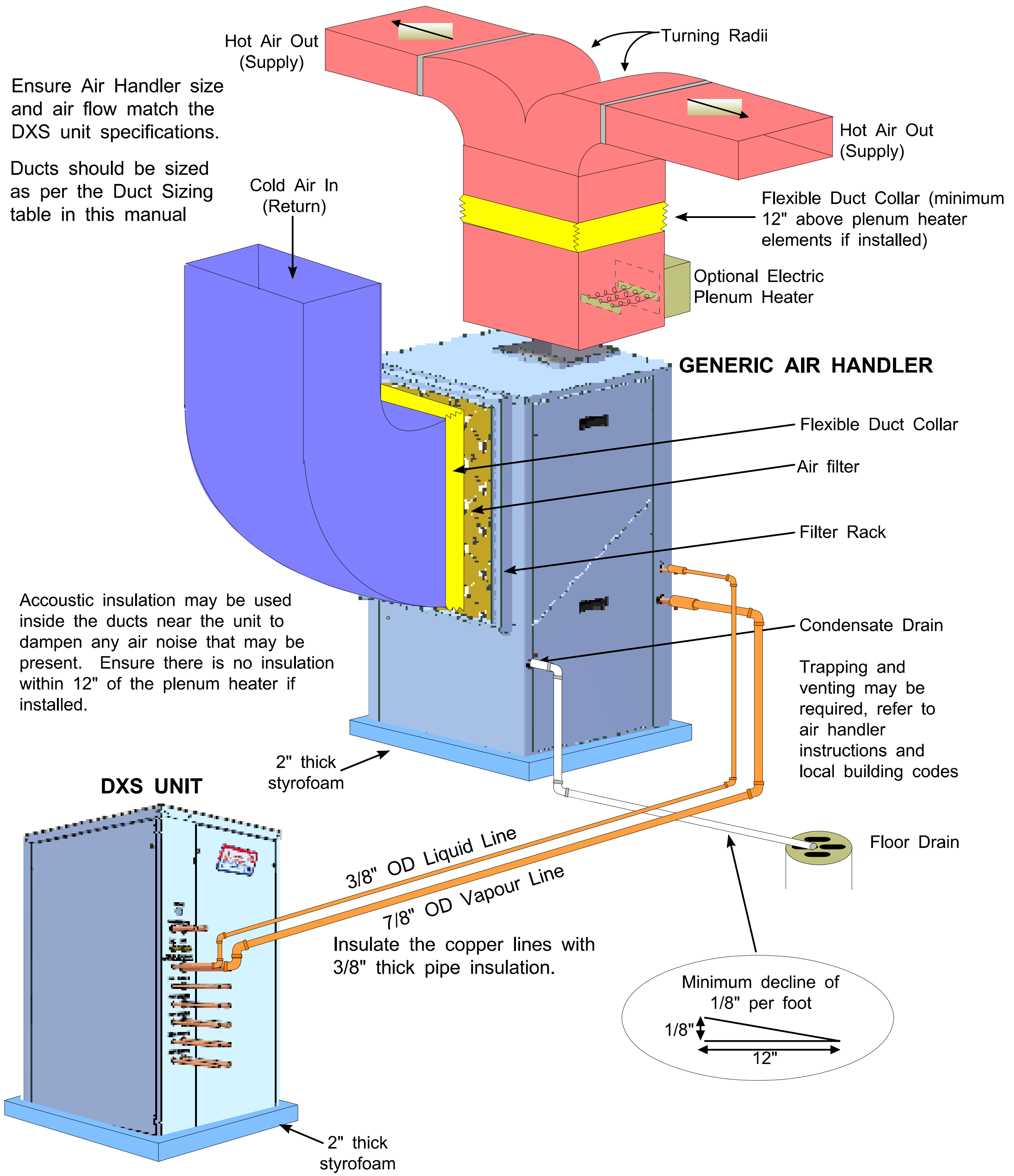
CONDENSATE DRAIN

The air handler will have a condensate drain that allows the condensate which forms during the air-conditioning cycle to be removed from the unit. The drain should be connected as per the instruction provided with the air handler as well as local codes. During high humidity weather, there could be as much as 25 gallons of water formed per day.

Care should be taken in the spring to ensure that this pipe is not plugged with dust that has collected during the winter causing the condensate to overflow into the bottom of the heat pump and onto the floor. The condensate drain is internally trapped; however, proper venting is required external to the heat pump. Refer to local codes to ensure the installation is done properly.

Drawing 000644CDG shows a typical installation.

Typical DXS-Series Split System Duct and Condensate Connections



					Drawn By Chris Geddes	Date 07 MAR 08	MARITIME GEOTHERMAL LTD.	170 Plantation Rd. Petitcodiac, NB E4Z 6H4
					Checked By Chris Geddes	Date 17 MAR 08	Drawing Name	Typical DXS-Series Split System Duct and Condensate Connections
					Approved By (ENG) Chris Geddes	Date 07 MAR 08		
					Approved By (MFG)	Date		
01	Initial Release	C. GEDDES	C. GEDDES	07 MAR 08	Approved By	Date	Size: A	Drawing Number: 000644CDG / REV: 01 / SHEET: 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE				

TABLE 13 - Duct Sizing Guide (external static of 0.20"H2O)

Airflow (CFM)	Minimum Duct Area (sq.in)	Diameter (in)	Rectangular Equivalents (in)						Return Air Diameter (in)	Airflow (L/s)
37	20	5	2.25 x 10	3 x 8	3.5 x 6	4 x 5.5	5 x 5	`	5	17
63	20	5	2.25 x 10	3 x 8	3.5 x 6	4 x 5.5	5 x 5		6	30
100	28	6	3.25 x 10	4 x 8	5 x 6	5.5 x 5.5	6 x 6		7	47
152	38	7	3.25 x 14	4 x 11	5 x 8.5	6 x 7	6.5 x 6.5		8	72
212	50	8	4 x 15	5 x 12	6 x 10	7 x 8	8 x 8		9	100
226	50	8	4 x 15	5 x 12	6 x 10	7 x 8	8 x 8		10	107
277	64	9	5 x 15	6 x 12	7 x 10	8 x 9	8.5 x 8.5		10	131
304	64	9	5 x 15	6 x 12	7 x 10	8 x 9	8.5 x 8.5		12	143
393	79	10	6 x 15	7 x 13	8 x 11	9 x 10	9.5 x 9.5		12	185
411	113	12	7 x 18	8 x 16	9 x 14	10 x 12	11 x 11		12	194
655	113	12	7 x 18	8 x 16	9 x 14	10 x 12	11 x 11		14	309
680	154	14	8 x 22	9 x 19	10 x 17	11 x 15	12 x 14	13 x 13	14	321
995	154	14	8 x 22	9 x 19	10 x 17	11 x 15	12 x 14	13 x 13	16	470
1325	201	16	8 x 30	10 x 22	12 x 18	14 x 16	15 x 15		18	625
1450	201	16	8 x 30	10 x 22	12 x 18	14 x 16	15 x 15		20	684
1750	254	18	8 x 40	10 x 30	12 x 24	14 x 20	16 x 17	16.5 x 16.5	20	826
2000	254	18	8 x 40	10 x 30	12 x 24	14 x 20	16 x 17	16.5 x 16.5	22	944
2250	314	20	10 x 38	12 x 30	14 x 26	16 x 22	18 x 19	18.5 x 18.5	22	1062
2600	314	20	10 x 38	12 x 30	14 x 26	16 x 22	18 x 19	18.5 x 18.5	24	1227
2900	380	22	12 x 36	14 x 30	16 x 26	18 x 23	20 x 20		24	1369
3400	380	22	12 x 36	14 x 30	16 x 26	18 x 23	20 x 20		26	1605
3600	452	24	14 x 38	16 x 32	18 x 28	20 x 25	22 x 22		26	1699
4300	452	24	14 x 38	16 x 32	18 x 28	20 x 25	22 x 22		28	2029
5250	531	26	16 x 38	18 x 32	20 x 30	22 x 24	24 x 24		30	2478
6125	616	28	18 x 38	20 x 34	22 x 30	24 x 28	26 x 26		32	2891
6500	616	28	18 x 38	20 x 34	22 x 30	24 x 28	26 x 26		34	3068
7250	707	30	20 x 40	22 x 38	24 x 32	26 x 30	28 x 28		34	3422
7800	707	30	20 x 40	22 x 38	24 x 32	26 x 30	28 x 28		36	3681
8500	804	32	22 x 40	24 x 38	26 x 34	28 x 32	30 x 30		36	4012
9200	804	32	22 x 40	24 x 38	26 x 34	28 x 32	30 x 30		38	4342
9800	908	34	24 x 42	25 x 40	26 x 38	28 x 34	30 x 32	31 x 31	38	4625
10900	908	34	24 x 42	25 x 40	26 x 38	28 x 34	30 x 32	31 x 31	40	5144
			28 x 40	30 x 36	32 x 34	33 x 33				
			30 x 42	32 x 38	34 x 36	35 x 35				
			30 x 45	34 x 40	36 x 38	37 x 37				

Direct Expansion Loop Connection & Charging

LINE SET INTERCONNECT TUBING AND AIR HANDLER TUBING

Once the outside loops have been installed and run into the building, the piping to the ports on the unit can be constructed. Each line set has a liquid line and a vapour line. The vapour line is 1/2" (OD) and the liquid line is 3/8" (OD). For horizontal loops, both lines are 1/2" (OD), reduce one of the lines in each line set down to 3/8" (OD) before running the lines over to the heat pump. These reduced lines will be the liquid line for each line set.

Do a final pressure check on each line set and then remove the pressure and cut the ends off the lines. The heat pump has ports labeled Liquid 1 to 5 and Vapour 1 to 5. Run each line set over to the designated ports on the heat pump. Refer to **Diagram 000769CDG** for more information on how to connect to the heat pump.

Piping between the DXS unit and the air handler consists of two lines, a 7/8" OD vapour line and a 3/8" OD liquid line. Run the piping as required between each unit and connect to each unit with copper couplings.

The tubing used for this procedure must be refrigeration tubing (cleaned & dehydrated) suitable for the job. Every effort must also be made to insure that the tubing does not become contaminated during installation. We recommend that caps be placed on the open ends of tubing immediately after cuts are made and that these caps are only removed after all bends have been made and the pipe fixed in its permanent location ready to make the silver soldered joints. It is very important to keep a refrigeration system perfectly clean and dry. Removing the caps just prior to silver soldering will ensure minimum exposure to the humidity in the atmosphere.

PIPE INSULATION

All line set piping inside the structure (between the structure entry point and the heat pump), as well as the piping between the DXS unit and the air handler should be insulated with 3/8" thick closed cell pipe insulation to prevent condensation and dripping onto floors or walls during the heating season. It can be slid onto the capped tubing without having to slice it down the side. Ensure that any joints in in the line sets are accessible for leak testing.

Liquid and Vapour ports and any remaining exposed tubing should be insulated with 3/8" thick closed cell pipe insulation once the silver soldering and pressure testing is complete. Ensure that all individual pieces of pipe insulation are glued to each other so there are no air gaps.

SILVER SOLDERING LINE SETS

Once all the line sets have been routed, insulated and fastened in place, the connections to the heat pump ports can be made. Remove the pressure from the heat pump and cut the ends off of the Liquid and Vapour ports. Remove the caps from the line set tubing. The line sets can be connected to the ports on the heat pump using couplings, or alternately the tubing can be "swaged". The joints should be silver soldered with 5% silfos.

Maritime Geothermal Ltd. <u>absolutely requires</u> that dry nitrogen be bled through the system during all silver soldering procedures so that no oxidation occurs on the inside of the copper tubing. The service ports on the unit can be used to connect the nitrogen with a refrigeration manifold.

If necessary, a wet rag can be wrapped around the each of the ports to prevent melting the grommet when silver soldering. Ensure that no water enters any of the ports or tubing.

PRESSURE TESTING

Once all connections are complete, the system should be pressure tested to **100PSIG (690kPa)** with dry nitrogen. Check all joints at the unit and any made in the interconnect tubing for leaks using soap suds, Spray nine, etc. It is important not to bypass this step as vacuuming the system with a leak will be impossible and attempting to do so will introduce moisture into the system, making the vacuum process take much longer than if the leak had been found and repaired first.

VACUUMING THE SYSTEM

Remove the pressure from the system and connect the vacuum pump to the refrigeration manifold. Tighten all hose connections, open the valves on the manifold and start the vacuum pump.

Vacuum the system until the reading on an electronic vacuum gauge remains below **500 microns** for a period of 5 minutes after the vacuum pump is shut off and the system is sealed.

CHARGING THE SYSTEM

Once the system has been vacuumed, refrigerant can be added by weighing in 1/3 of the prescribed refrigerant charge into the low side of the system. Start the heat pump in the heating mode and continue to add refrigerant as a liquid at a rate of no more than 1 lb. per minute until the prescribed charge is reached.

Alternately, before the machine is started, the entire charge can be weighed into the system through the high side of the system. **TABLE 14** shows the typical charge per unit size. This allows for:

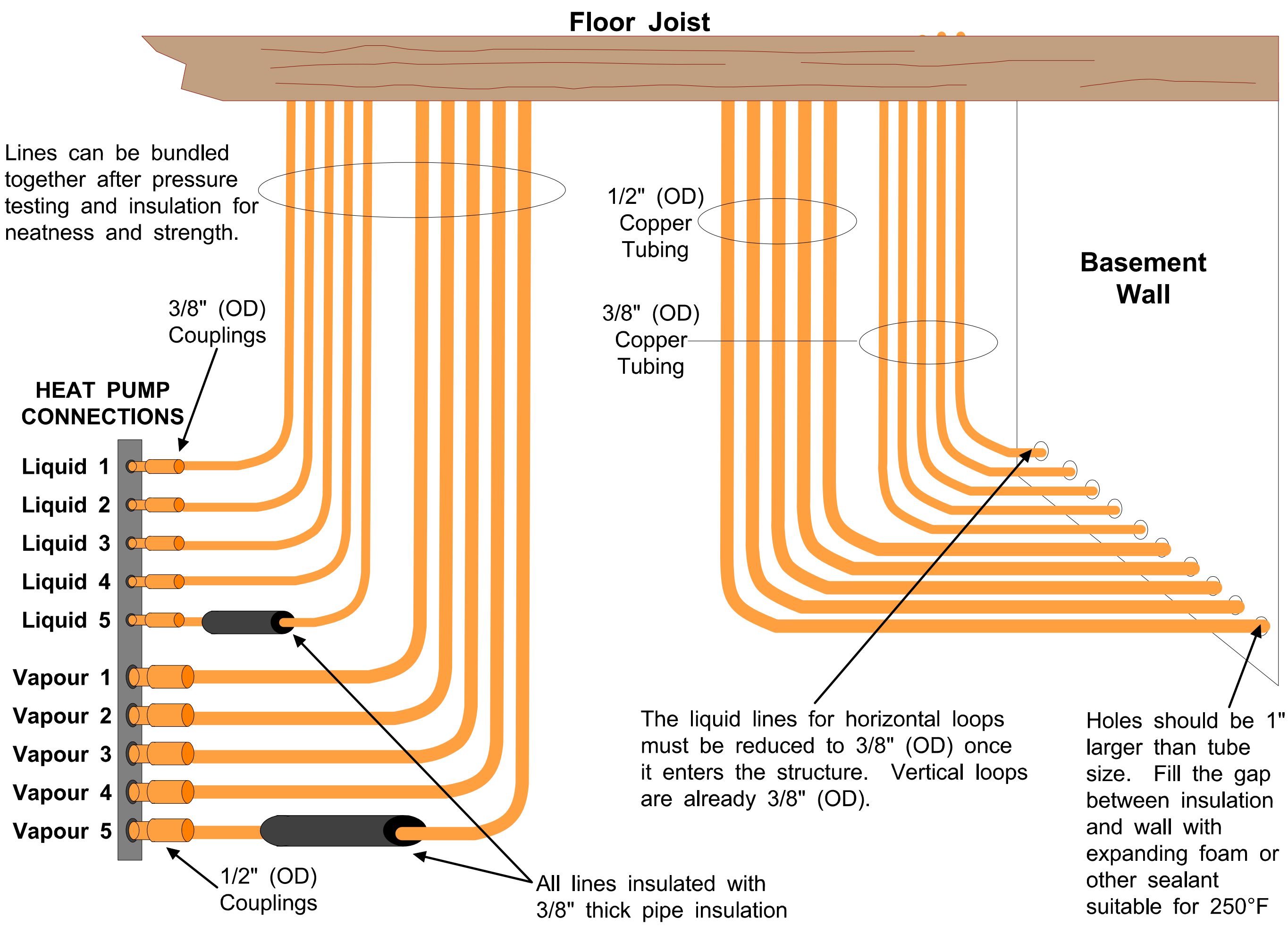
- 20ft of distance (40ft of pipe) interconnect tubing from the unit to the wall,
- 20ft of distance from the wall to the borehole /trench,
- standard loops (100ft borehole or 150ft trench).
- 20ft of distance to the air handler

Additional refrigerant is required as per **TABLE 14** if the installation exceeds these parameters.

TABLE 14 - DXS Charge Chart (R410a)

Model	Size (tons)	Lbs.	kg
25	2	8	3.6
45	3	12	5.4
55	4	16	7.3
65	5	20	9.1
Extra loop (borehole)		1	0.5
Extra loop (trench)		1.5	0.7
Extra distance to borehole Extra depth of borehole Extra distance to trench Extra length of trench Extra distance in structure Extra distance to air handler		0.1oz per foot	0.003

DX Line Set Interconnect Tubing Installation (R410a)



NOTES:

- Ensure the line sets are kept in order and routed to the proper ports on the heat pump.
- 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.
- All joints should be soldered with 5% silver solder.
- Pressure test to 100PSIG and check for leaks once all connections are complete.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Ensure adjoining pipe insulation pieces are glued or tapes together to prevent gaps.
- Tubing should be securely fastened to prevent accidental bending.

REV	ECO #	IMPL BY	APVD BY	DATE
02	000141	C. GEDDES	C. GEDDES	19 MAY 09
01	Initial Release	C. GEDDES	C. GEDDES	05 AUG 08

Drawn By: Chris Geddes	Date: 05 AUG 08
Checked By: Chris Geddes	Date: 05 AUG 08
Approved By (ENG): Chris Geddes	Date: 05 AUG 08
Approved By (MFG):	Date:
Approved By:	Date:

MARITIME GEOTHERMAL LTD.

170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name			
DX Line Set Interconnect Tubing Installation (R410a)			
Size	Drawing Number	REV	SHEET
A	000769PDG	02	1 of 1

Startup Procedure

The following steps describe how to perform the startup procedure of the geothermal heat pump.

The DXS-Series Two-Stage R410a Startup Record located in this manual is used in conjunction with this startup procedure to provide a detailed record of the installation. A completed copy should be left on site, a copy kept on file by the installer and a copy should be sent to Maritime Geothermal Ltd.

Check the boxes or fill in the data as each step is completed. For data boxes, circle the appropriate units. Fill in the top section of all three copies, or one copy if photocopies can be made after the startup has been completed.

PRE-START INSPECTION

Ductwork:

1. Verify that all ductwork has been completed and is firmly attached to the unit. Verify that any dampers or diverters are properly set for operation of the heat pump.
2. Verify that all registers are open and clear of any objects that would restrict the airflow.
3. Verify that a new air filter is installed and the cover is secured.
4. Verify the condensate drain is connected, properly vented and free of debris.
5. If a plenum heater has been installed, verify that it is securely fastened to the ductwork.

Line Sets Inside structure (Loops and Air Handler Connections):

1. Verify that all line sets are connected to the proper ports on the heat pump.
2. Verify that the line sets are completely insulated and securely fastened in place.

Domestic Hot Water (if equipped):

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. Ensure the power to the plenum heater is off if equipped.**
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 for the heat pump, air handler and plenum heater.
3. Record the fuse / circuit breaker size and wire gauge for the heat pump. Record the fuse / circuit breaker size, wire gauge and size of the plenum heater if installed.
4. Verify that the control connections to the thermostat, air handler and plenum heater (if installed) are properly connected and all control signals are off, so that the unit will not start up when the power is turned on.
5. Ensure all access panels except the lower one that provides access to the electrical box are in place.

Unit Charge:

1. Ensure the unit has been vacuumed and has refrigerant in it. If the unit is not fully charged, the remainder can be added during the start up procedure. Record the current amount of refrigerant in the system.

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.**

Preparation:

ENSURE UNIT IS CHARGED WITH REFRIGERANT BEFORE TURNING THE POWER ON. STARTING A COMPRESSOR UNDER VACUUM WILL DESTROY IT IN A MATTER OF SECONDS, VOIDING THE WARRANTY. IF THE UNITIS NOT FULLY CHARGED, THE REMAINDER CAN BE ADDED DURING HEATING MODE STEP 2.

1. Remove the caps from the service ports and connect a refrigeration manifold set to the unit.
2. Turn the power on to the heat pump and set the thermostat to OFF. Set up the thermostat as per the instructions provided with it so that it will function properly with the heat pump system (set for heat pump, not for heating and cooling). The O signal should be set to active in cooling mode.
3. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.

Heating Mode:

1. Set the thermostat to heating mode and adjust the setpoint to activate Stage 2. The fan should slowly ramp up to speed after the time delay of the thermostat expires (if applicable) and the compressor will start.
2. Check the refrigeration gauges. The suction and discharge pressures will depend on the loop temperatures, but they should be about **75-95PSIG** and **290-365PSIG** respectively for a typical start-up. If the unit was not completely charged, add the remaining refrigerant through the suction side only.
3. Monitoring the refrigeration gauges while the unit runs. Record the following data at the time interval(s) indicated: Numbers 1 to 4, record at 10, 15, 20, 25, 30 and then average the values. Record numbers 5 to 8 at 30 minutes. The average superheat for each line set should be **8-14°F (4-8°C).** The TXV's are set to four turns in (from all the way out) at the factory and typically should not require any adjustments. Should adjustment be required, follow the Heating TXV Adjustment procedure in this manual. Proceed to Step 4 once adjustments have been completed.
    1. Suction pressure
    2. Discharge pressure
    3. Each loop Vapour Line temperature
    4. Each loop superheat (Vapour line temperature - evaporating temperature (from suction gauge)
    5. Duct Return temperature (poke a small hole in the flex collar and insert probe in airstream)
    6. Duct Supply temperature (poke a small hole in the flex collar and insert probe in airstream)
    7. Duct Delta T (should be between **22-32°F, 12-18°C**)
    8. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
4. Adjust the thermostat setpoint to the desired room temperature and let the unit run through a cycle. Record the setpoint and the discharge pressure when the unit shuts off.
5. For units with a desuperheater, turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown in the electrical box diagram. Turn the power to the unit on.
6. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand **(caution: pipes get hot).** If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.
7. Remove the electrical cover from the plenum heater. Place a current clamp meter around one of the supply wires. Turn on the power to the plenum heater. Adjust the thermostat setpoint to **85°F (29°C).** Verify that the current draw increase as each stage is activated. (10kW has 2 stages, 15kW has 3 stages and 20kW has 4 stages).

Cooling Mode:

1. Set the thermostat to cooling mode and adjust the setpoint to activate Stage 1 and Stage 2.
2. Monitoring the refrigeration gauges while the unit runs. Record the following after 10 minutes of runtime:
    1. Suction pressure
    2. Discharge pressure
    3. Duct Return temperature
    4. Duct Supply Out temperature
    5. Duct Delta T
3. Adjust the thermostat setpoint to the desired room temperature if possible, otherwise set it just low enough to allow the unit to run (ie 1°F (0.5°C) less than room temperature) and let the unit run through a cycle. Record the thermostat setpoint and the suction pressure when the unit shuts off.

Final Inspection:

1. Turn the power off to the unit (and plenum heater if installed) 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. Install the electrical cover on the plenum heater if applicable.
3. Do a final check around the heat pump and ensure the area is clean.
4. Turn the power on to the unit and the plenum heater if installed. Set the thermostat to the final settings.

Startup Record:

1. The installer shall sign and date the Startup Record and have the homeowner sign as well. The installer shall leave the Startup Record with the homeowner, retain a copy for filing and send a copy to Maritime Geothermal Ltd. for warranty registration.

Startup Record —DXS-Series Size 25-65 Two-Stage R410a

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

Check boxes unless asked to record data. Circle data units.

PRE-START INSPECTION

Ductwork	Ductwork is completed, dampers/ diverters are adjusted							
	Registers are open and clear of objects							
	Air filter and end cap are installed in air handler							
	Condensate Drain is connected, properly vented and free of debris							
	Plenum heater is securely fastened (if applicable)							
Line Sets	Connected to proper ports, insulated and secured in place							
Domestic Hot Water	All shut-off valves are open							
	Lines are full and purged							
	Desuperheater pump wire is disconnected							
Electrical	High voltage connections are correct and securely fastened							
	Circuit breaker (or fuse) size and wire gauge for Heat Pump		A		Ga.			
	Circuit breaker (or fuse) size, wire gauge, and Plenum Heater size		A		Ga.		kW	
	Low voltage connections are correct and securely fastened							
Unit Charge	Refrigerant charge before power is turned on		Lbs	kg				

STARTUP DATA

Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3							VAC
	Final refrigerant charge		Lbs	kg				

Heating Mode	Suction	Discharge	V1	S1	V2	S2	V3	S3	V4	S4	V5	S5	V6	S6	
10 minutes															
15 minutes															°F
20 minutes															°C
25 minutes															
30 minutes															
Average															

	Duct Return, Duct Supply, and Delta T		In		Out		°F	°C
	Compressor L1 (black wire) current		A					
	Domestic Hot Water functioning							
	Thermostat setpoint and discharge pressure at cycle end		°F	°C		psig	kPa	
Cooling Mode	Suction Pressure / Discharge Pressure					psig	kPa	
	Duct Return, Indoor Out, and Delta T		In		Out		°F	°C
	Thermostat setpoint and suction pressure at cycle end		°F	°C		psig	kPa	

Date:		**Installer Signature:**		**Homeowner Signature:**	

A total of three copies are required, one for the homeowner, one for the installer and on to be sent to Maritime Geothermal Ltd.

Heating TXV Adjustment

If it is determined during the start up procedure that one or more of the heating TXV's need to be adjusted, the following procedure and record sheet should be used to ensure that adjustments are recorded and performed in a systematic way. **TABLE 15** describes what each of the columns in the Heating TXV record sheet table represents.

TABLE 15 - TXV Adjustment Record Column Descriptions	
Column	**Description**
Time Actual	**Actual time of the reading**
Time EL	**Elapsed time since the first reading**
Common S	**Suction pressure**
Common ET	**Evaporating temperature (from suction gauge or P/T chart)**
Common D	**Discharge pressure**
Loop P	**Loop TXV position. (Number of turns in from all the way out)**
Loop V	**Loop Vapour Line temperature**
Loop S	**Loop Superheat (Vapour Line temperature - Evaporating temperature**
TXV #	**The TXV that is being adjusted**
Turns	**The number of turns the TXV is being adjusted**
In/Out	**The direction the TXV is being adjusted (In=clockwise, OUT=counter-clockwise)**

The heating TXV's are set to four turns in from all the way out at the factory. This should be sufficient for most installations, however it is sometimes necessary to make adjustments if the ground conditions vary or if the loop lengths vary. The procedure below explains how to properly adjust the TXV's so that the task can be completed in the minimum amount of time.

- The goal is to obtain a superheat value **of 8-14°F (4-8°C)** on each evaporator loop. It is good practice to average out the last few readings as the TXV's tend to cycle, causing the superheat to vary.
- Adjusting a TXV **in** (clockwise) increases the superheat of its evaporator loop. Adjusting a TXV **out** (counter-clockwise) decreases the superheat of its evaporator loop.
- Adjusting one TXV affects the remaining evaporator loops, adjustments must be small and done to only one TXV at a time.
- Adjustments are done every other time interval (ie every 10 minutes). The next two intervals should be averaged together for the next adjustment.
- Always adjust the TXV that is the furthest out.

ADJUSTMENT PROCEDURE

1. Fill in the information section at the top of the adjustment record sheet. Circle °F or °C at the top right.
2. Record all data for the initial readings (elapsed time 0). Adjust the TXV for the loop that is the furthest out. Record the number of the TXV, how much it was adjusted in turns (ie 1/4, 1/2, 1), and in which direction it was adjusted. Record the new position of the adjusted TXV in the appropriate P column of the next row. Record the remaining TXV positions in their individual P columns in the next row.
3. At the next time interval, record the data in the current row. Verify that the superheat of the adjusted TXV has changed in the desired direction. Do not adjust the TXV. Mark —- in the TXV #, Turns, and In/Out columns.
4. At the next time interval, record all data. Adjust the TXV that is the furthest out. Record the TXV #, Turns and In/Out values. Record the new position of the adjusted TXV in the appropriate P column of the next row. Record the remaining TXV positions in their individual P columns in the next row.
5. Repeat Steps 2 and 3 until all superheat values are within **8-14°F (4-8°C)**.

Heating TXV Adjustment Record - DXS-Series Size 25-65 Two-Stage R410a

Installation Site		City		Province		Country		Serial #	
Installer		Company		Date		Model		°F °C	

TIME		COMMON			LOOP 1			LOOP 2			LOOP 3			LOOP 4			LOOP 5			LOOP 6			ADJUSTMENT		
Actual	EL	S	ET	D	P1	V1	S1	P2	V2	S2	P3	V3	S3	P4	V4	S4	P5	V5	S5	P6	V6	S6	TXV #	Turns	In/Out
	0																								
	5																								
	10																								
	15																								
	20																								
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GENERAL MAINTENANCE SCHEDULE		
Item	**Interval**	**Procedure**
Air Filter (In Air Handler)	6 months or as recommended in air handler manual	Inspect for dirt. Replace if necessary.
Contactor	1 year	Inspect for pitted or burned points. Replace if necessary.
Condensate Drain (In Air Handler)	1 year or as recommended in air handler manual	Inspect for clogs. Remove and clean if necessary.

Troubleshooting Guide

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

STEP 1: Verify that the display is present on the thermostat. If it is not, proceed to POWER SUPPLY TROUBLE SHOOTING, otherwise proceed to STEP 2.

STEP 2: Remove the door and electrical box cover and check to see if the HI or LOW LED's are flashing or on. Record The results . Turn the power off, wait 10 seconds and turn the power back on.

STEP 3: Set the thermostat to call for heating or cooling depending on the season, If a 24VAC signal does not appear across Y1 and C of the terminal strip within 6 minutes, proceed to the THERMOSTAT TROUBLESHOOTING section, otherwise proceed to STEP 4.

STEP 4: If the HI or LOW LEDs flash and the compressor does not attempt to start, proceed to the SAFETY CONTROL TROUBLESHOOTING section, otherwise proceed to STEP 5.

STEP 5: If HI or LOW pressure LED's are not flashing and the compressor 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, otherwise proceed to STEP 6.

STEP 6: If the compressor starts and sounds normal, this means the compressor is OK and the problem lies elsewhere. Proceed to the OPERATION TROUBLESHOOTING section.

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 display on thermostat	Blown Primary or Secondary fuse on transformer.	Visually inspect. Remove fuse and check for continuity if in doubt.	Replace fuse.
	Blown fuse on control board.	Visually inspect. Remove fuse and check for continuity if in doubt.	Replace fuse.
	Faulty transformer.	230VAC is present across H1 and H4 of the transformer but 24VAC is not present across X1 and X4 of the transformer.	Replace transformer.
	Faulty wiring between heat pump and thermostat.	24VAC is not present across C and $R(R_H)$ of the thermostat.	Correct the wiring.
	Faulty Thermostat.	24VAC is present across C and R (R_H) of the thermostat but thermostat has no display.	Replace thermostat.

THERMOSTAT TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No Y1 signal to heat pump (after 6 minutes)	Incorrect thermostat set-up.	Thermostat does not indicate a call for heat. No 24VAC signal present across C and Stage 1 of the thermo-stat.	Correct the setup.
	Faulty thermostat to heat pump wiring.	24VAC signal present across Stage 1 and C of the thermostat but not present across Y1 and C of the ter-minal strip.	Correct or replace wiring.
	Faulty thermostat.	No 24VAC between Stage 1 and C of the thermostat when a call is indi-cated on the thermostat.	Replace thermostat.

SAFETY CONTROLS TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High Pressure Control	Faulty High Pressure Con-trol (open). *HP pressures must be at static levels.	Hi LED is flashing. Short H to H on the connector at the left of the con-trol board and verify whether the LED stops flashing or remains flash-ing.	Replace high pressure control if LED stops flashing, replace con-trol board if it does not.
Low Pressure Control	Faulty Low pressure con-trol (open). * Must be a signal present on Y1 for this test. *HP pressures must be at static levels.	Lo LED is flashing. Short L to L on the connector at the left of the con-trol board and verify whether the LED stops flashing or remains flash-ing.	Replace low pressure control if LED stops flashing, replace con-trol board if it does not.
	Unit out of refrigerant.	Check static refrigeration pressure of the unit for a very low value.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.

COMPRESSOR TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Compressor will not start	Manual High pressure control tripped.	Press the button on the control, it will click when pressed.	Proceed to Operation Trouble-shooting.
	Faulty control board.	Hi and Low LED's off, HB is flashing but Y LED is not on, or no 24VAC across Y and C of bottom right con-nector.	Replace control board.
	Faulty run capacitor. (Single phase only)	Check value with capacitance me-ter. Should match label on capaci-tor. Compressor will hum while try-ing to start and then trip its overload.	Replace if faulty.
	Loose or faulty wiring.	Check all compressor wiring, includ-ing inside compressor electrical box.	Fix any loose connections. Re-place 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 Trouble-shooting 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 termi-nals is below the specified value.	Replace the compressor.
	Motor shorted to ground.	Remove wires from compressor. Check for infinite resistance be-tween 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 electri-cal 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 compres-sor.

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High Discharge Pressure	Air Flow.	See Fan Troubleshooting section.	Correct the problem.
	Heating TXV's adjusted too far closed.	Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be high if TXV's are closed too far.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
	One or more heating TXV's stuck (too far closed).	Adjusting the TXV does not affect the superheat or the suction pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	Faulty Normally Open solenoid valve (stuck closed).	A click can be heard when the coil is energized but the valve is cold instead of warm.	Replace NO valve.
	Faulty cooling TXV bypass check valve. (blocked)	Temperature drop can be felt across the cooling TXV. Unit operates properly in cooling mode.	Try switching modes a few times. Replace check valve if problem continues.
	Filter-drier plugged.	Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-drier.
	Undersized Air Handler air coil.	High sub-cooling, low delta T across air coil.	Verify size of air coil. Attempt to reduce charge and verify in both modes. Replace with proper size air handler
	Unit is overcharged.	High sub-cooling, low delta T across air coil.	Remove 1/2lb of refrigerant at a time and verify that the discharge pressure reduces.
Surging Discharge Pressure	Heating TXV's adjusted too far closed.	Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be high if TXV is closed too far.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
Low Suction Pressure	Heating TXV's adjusted too far closed.	Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	One or more heating TXV's stuck (too far closed).	Adjusting the TXV does not affect the superheat or the suction pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	Faulty Normally Open solenoid valve (stuck closed). ** May actually draw a vacuum.**	A click can be heard when the coil is energized but the valve is cold instead of warm.	Replace NO valve.
	Filter-drier plugged.	Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-drier.
	Low refrigerant charge.	Check static refrigeration pressure of the unit for a very low value. Low discharge pressure when running.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.

OPERATION TROUBLESHOOTING - HEATING MODE

Fault	Possible Cause	Verification	Recommended Action
Low Suction Pressure (continued)	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.
	Loop piping interchanged (ie Loop 1 connected between Vapour 1 and Liquid 2)	Affected TXV's do not seem to operate properly. Switch to cooling mode and verify all liquid line temperatures for each individual loop switch. The liquid line for the loop in use should be warmer than the others, If loops are interchanged, the wrong liquid line will be warmer.	Pump the unit down and swap the interchanged lines.
	Loop field too small	Charge is good, superheats are good, vapor line temperatures are low.	Increase loop size.
High Suction Pressure (may appear to not be pumping)	Leaking reversing valve.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Heating TXV's adjusted too far open.	Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be low if TXV's are open too far.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
	One or more heating TXV's stuck (too far open).	Adjusting the TXV does not affect the superheat of the loop or the suction pressure. Low super heat, low discharge pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	Faulty cooling check valve (leaking)	Also low discharge pressure. Switch to cooling mode. Unit operates correctly when loop is in use. Loop lines get cold when loop not in use instead of warming to ambient, compressor frosts up.	Identify the check valve. Try switching modes a few times. Replace if problem continues.
	Faulty heating TXV bypass check valve. (Leaking)	Low superheat and discharge pressure. Switch to cooling mode. Unit operates properly on all loops.	Try switching modes a few times. Replace check valve if problem continues.
Compressor frosting up	See Low Suction Pressure in this section.		
Heating TXV frosting up heavily	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
Random high pressure trip (does not occur while on site)	Intermittent fan.	See Fan Troubleshooting section.	Correct the problem.
Random manual high pressure trip (does not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run without the fan, tripping the high pressure control.	Replace contactor.

OPERATION TROUBLESHOOTING - COOLING MODE

Fault	Possible Cause	Verification	Recommended Action
Heating instead of cooling	Thermostat not set up properly.	Verify that there is 24VAC across O/B/W1 and C of the terminal strip when calling for cooling.	Correct thermostat setup. Change to a different thermostat.
	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. Discharge pressure will continue to rise even if there is a loop switch.	Replace solenoid if faulty.
	Faulty reversing valve.	A click can be heard when the coil is energized but hot gas is still directed to the air coil. Discharge pressure will continue to rise even if there is a loop switch.	Replace reversing valve.
High Discharge Pressure	Faulty heating TXV bypass check valve. (blocked)	Temperature drop can be felt across the cooling TXV. Unit operates properly in cooling mode.	Try switching modes a few times. Replace check valve if problem continues.
High Pressure control trips	Faulty Loop Pressure switch	Loop LED does not come on around **480PSIG**. Shorting S and S causes the LED to come on.	Replace loop pressure switch.
	Faulty Loop Pressure switch Input	Shorting S and S does not cause the Loop Switch LED to come on, or does not cause a loop change.	Replace the control board.
High Pressure control and manual high pressure control trips (very fast)	Faulty reclaim valve solenoid.	Verify solenoid by removing it from the shaft while energized. If there is no click the solenoid is bad	Replace reclaim solenoid coil.
	Faulty reclaim valve.	A click can be heard when the valve is selected but the unit still trips out.	Replace the reclaim valve
	Faulty control board output. (L1 to L5).	Loop LED does not come on or there is no 24VAC across the loop output and C of the control board when the loop is selected.	Replace the control board.
Loop changes occur too frequently	Unit overcharged.	Head pressure quickly rises and loop switch value is reached very quickly.	Remove refrigerant 1/2 pound at a time until loop switching returns to normal.
	Loop field saturated	Head pressure rises quickly in two loop mode.	Install soaker hose.
	Loop field too small	Head pressure rises quickly in two loop mode.	Increase loop size.

OPERATION TROUBLESHOOTING - COOLING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High Suction Pressure (may appear to not be pumping)	Cooling TXV adjusted too far open.	Verify superheat. It should be between 8-12°F (3-6°C). Superheat will be low if TXV is open too far.	Adjust TXV to obtain 8-12°F (3-6°C) superheat.
	TXV stuck open.	Adjusting the TXV does not affect the superheat or the suction pressure. Low super heat and discharge pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	Leaking reversing valve.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Leaking reclaim valve.	Scavenger line remains hot where it enters the common suction line.	Replace reclaim valve.
Low Suction Pressure	Air Flow	See Fan Troubleshooting section. **Note:** low airflow will cause the air coil to ice up once the suction drops below **90PSIG**.	Correct the problem.
	Cooling TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	Low or no refrigerant charge.	Entering air temperature and airflow are good but suction is low. Check static refrigeration pressure of unit for very low value.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.
	Leaking cooling check valve	Unit operates correctly when loop is in use. Loop lines get cold when loop not in use instead of warming to ambient, compressor frosts up.	Identify the check valve. Try switching modes a few times. Replace if problem continues.
	Faulty NO solenoid valve coil.	Verify solenoid by removing it from the shaft while the unit is running. There should be an audible click sound if the solenoid is working.	Replace solenoid if faulty.
	Faulty NO solenoid valve.	A click can be heard when the coil is energized. Unused loops stay cold instead of gradually warming to ambient. Compressor frosts up.	Replace NO valve.
	Faulty cooling TXV bypass check valve (leaking)	Also low discharge pressure. Switch to cooling mode. Unit operates correctly.	Identify the check valve. Try switching modes a few times. Replace if problem continues.
	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Compressor frosting up	See Low Suction Pressure in this section.		
TXV frosting up	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.

OPERATION TROUBLESHOOTING - COOLING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Random Low Pressure trip (does not occur while there)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run without the fan, tripping the low pressure control.	Replace contactor.
	Intermittent fan.	See Fan Troubleshooting section.	Correct the problem.

FAN TROUBLESHOOTING (AIR HANDLER)			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Low Airflow	Dirty air filter	Inspect.	Replace.
	Dirty air coil.	Inspect.	Clean.
	Poor Ductwork	Measure delta T between supply and return ducts at the unit, it in heating mode, it should not be above 30°F(17°C).	The ECM fan will provide proper airflow up to 0.5 inH2o for 1/2HP motors and 0.7 inH2o for 1HP motors. The ductwork is poorly designed or greatly undersized if the fan motor cannot provide the required airflow.
	Air flow selected on air handler is too low.	Check selection on air handler	Select a higher setting.
Fan operating on wrong Stage speed	Incorrect connections to air handler.	Refer to air handler instruction manual for proper connections.	Correct the connections.
Fan not operating or operating intermittently	Faulty air handler wiring.	Verify the wiring using the air handler instruction manual.	Repair any loose connections.
	Faulty fan motor.	Inspect as per air handler instruction manual.	Replace motor if faulty.

PLENUM HEATER TROUBLE SHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No 230VAC across plenum heater L1 and L2	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 plenum heater disconnect box (if installed), voltmeter shows voltage on the line side but not on the load side. Check if breaker is tripped.	Reset breaker or replace fuse at plenum heater disconnect box. Replace fuse with proper size and type. (Time-delay type "D")
	Same "Line" to L1 and L2	Measuring L1 to ground and L2 to ground both yield 115VAC, but L1 to L2 yields 0VAC.	Correct wiring.
No W2 signal at Heat pump terminal strip	No call for auxiliary or emergency heat from thermostat.	Verify that the thermostat is indicating that auxiliary or emergency heat should be on.	Set thermostat to engage auxiliary or emergency heat (note some thermostats require a jumper between auxiliary and emergency. Check the thermostat manual).
	Faulty thermostat.	Thermostat doesn't indicate a call for auxiliary or emergency when it should.	Replace thermostat.
	Faulty thermostat.	Thermostat indicates auxiliary or emergency but no 24VAC signal present across C and the auxiliary and/or emergency pin at the thermostat.	Replace thermostat.
	Faulty thermostat wiring.	24VAC signal is present across C and the auxiliary and/or emergency pin at the thermostat but no 24VAC signal is present across W2 and C at the heat pump terminal strip.	Correct wiring.
No 24VAC signal from C to ground at the plenum heater control connector	Plenum Heater transformer is burned out.	Voltmeter does not show 24VAC across transformer secondary winding.	Replace transformer.
	Plenum heater control board is faulty.	Transformer tested OK in previous step.	Replace control board.
No 24VAC signal from 1 to ground at the plenum heater control connector	Faulty wiring.	24VAC present across C and ground at the plenum heater, but not across ground of the plenum heater and I of the heat pump terminal strip	Correct wiring.
	Faulty wiring.	If previous step tested OK, 24VAC is present across ground of the plenum heart and 1 of the heat pump terminal strip, but not across ground of the plenum heater and 1 of the plenum heater.	Correct wiring.

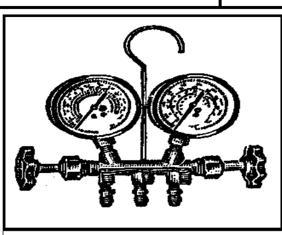
PLENUM HEATER TROUBLE SHOOTING

Fault	Possible Cause	Verification	Recommended Action
No 24VAC signal from 1 to ground at the plenum heater control connector	Faulty Plenum Heater Relay in heat pump	24VAC is present across pin 1 and pin 3 of the relay, 24VAC is present from heat pump terminal strip I to plenum heater ground, but not from heat pump terminal strip 1 to plenum heater ground.	Replace relay.
Thermal overload is tripped.	Fan not operating	See Fan Not Operating section	Correct problem. Reset thermal overload.
	Faulty overload	Reset thermal overload	Replace if faulty.

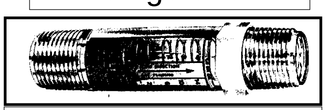
DOMESTIC HOT WATER (DHW) TROUBLE SHOOTING

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. (140°F if required by local code)	Visually inspect the setting.	Readjust the setting to 120°F. (140°F if required by local code)
	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.	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)	Circulator pump not operating.	Visually inspect the pump to see if shaft is turning. 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 obstruction	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. (140°F if required by local code)	Visually inspect the setting.	Readjust the setting to 120°F. (140°F if required by local code)

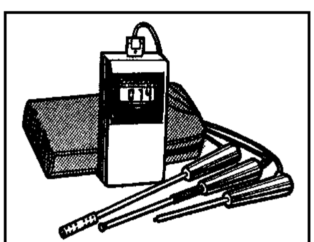
Trouble Shooting Tools



Refrigeration



In-line Flowmeter



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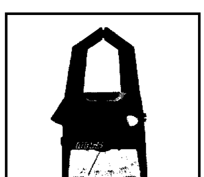
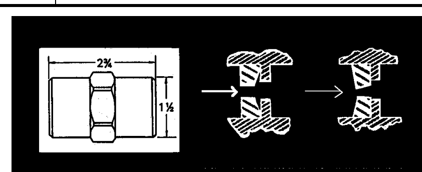


Multimeter - Voltmeter /



Dole flow control Valve

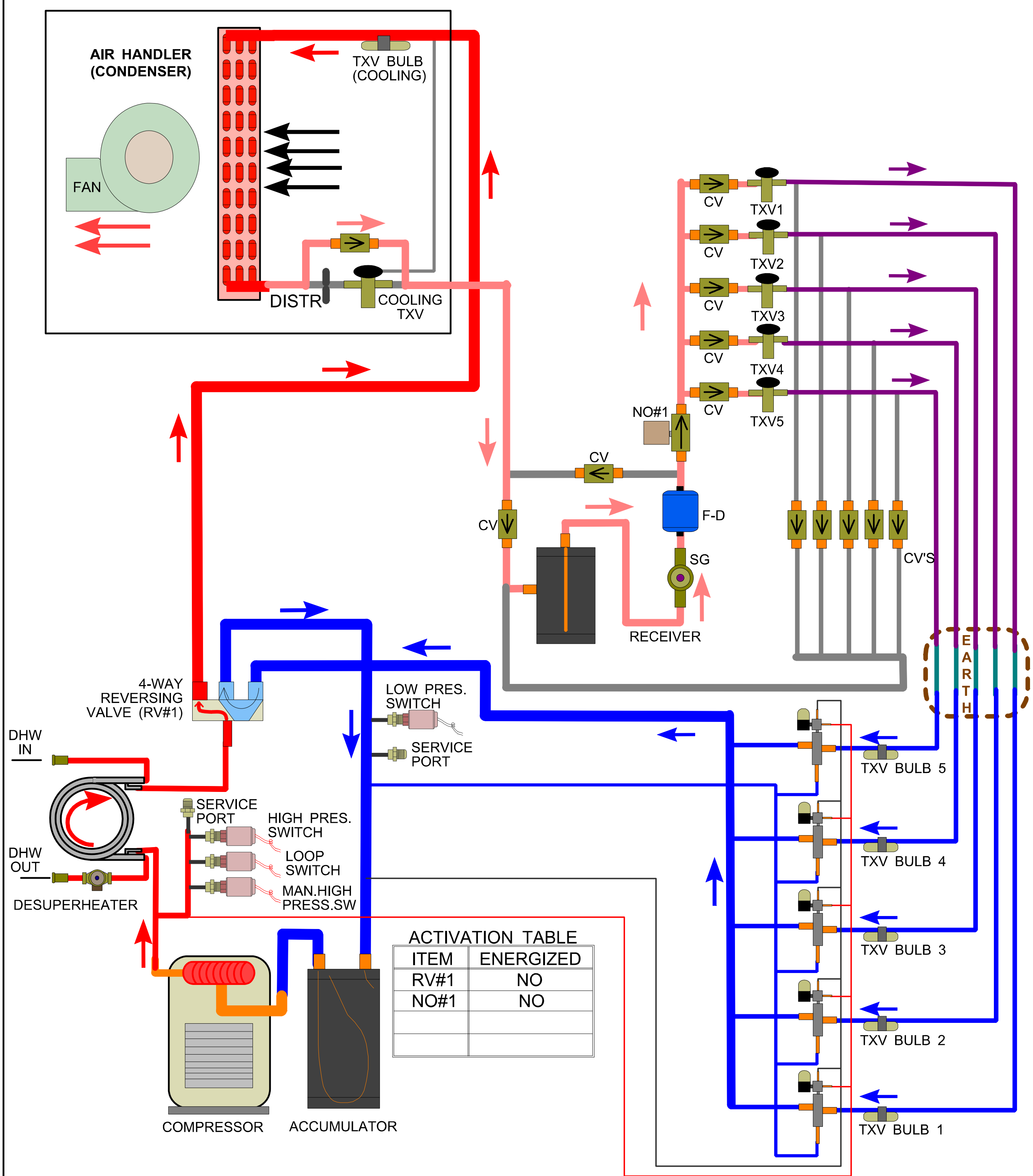
The Dole® flow control is a simple, self-cleaning device designed to deliver a constant volume of water from any outlet whether the pressure is 15 psig or as high as 125 psi. The controlling mechanism consists of a flexible orifice that varies its area inversely with pressure so that a constant flow is maintained.

PUMP DOWN PROCEDURE	
STEP 1	Connect the refrigerant recovery unit to the heat pump service ports via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. **If there was a compressor burn out, the refrigerant cannot be reused and must be disposed of according to local codes.**
STEP 2	Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual.
STEP 3	Allow the recovery unit suction pressure to reach a vacuum. Once achieved, close the charging manifold valves. Shut down, purge and disconnect the recovery unit as per the instructions in its manual. Ensure the recovery tank valve is closed before disconnecting the hose to it.
STEP 4	Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive pressure of 5-10PSIG is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected.
STEP 5	The heat pump is now ready for repairs. Always ensure nitrogen is flowing through the system during any soldering procedures to prevent soot buildup inside the pipes. Maritime Geothermal Ltd. recommends replacing the liquid line filter-drier anytime the refrigeration system has been exposed to the atmosphere.

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

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

DXS (Modular-TXV) REFRIGERATION CIRCUIT - HEATING MODE



ACTIVATION TABLE

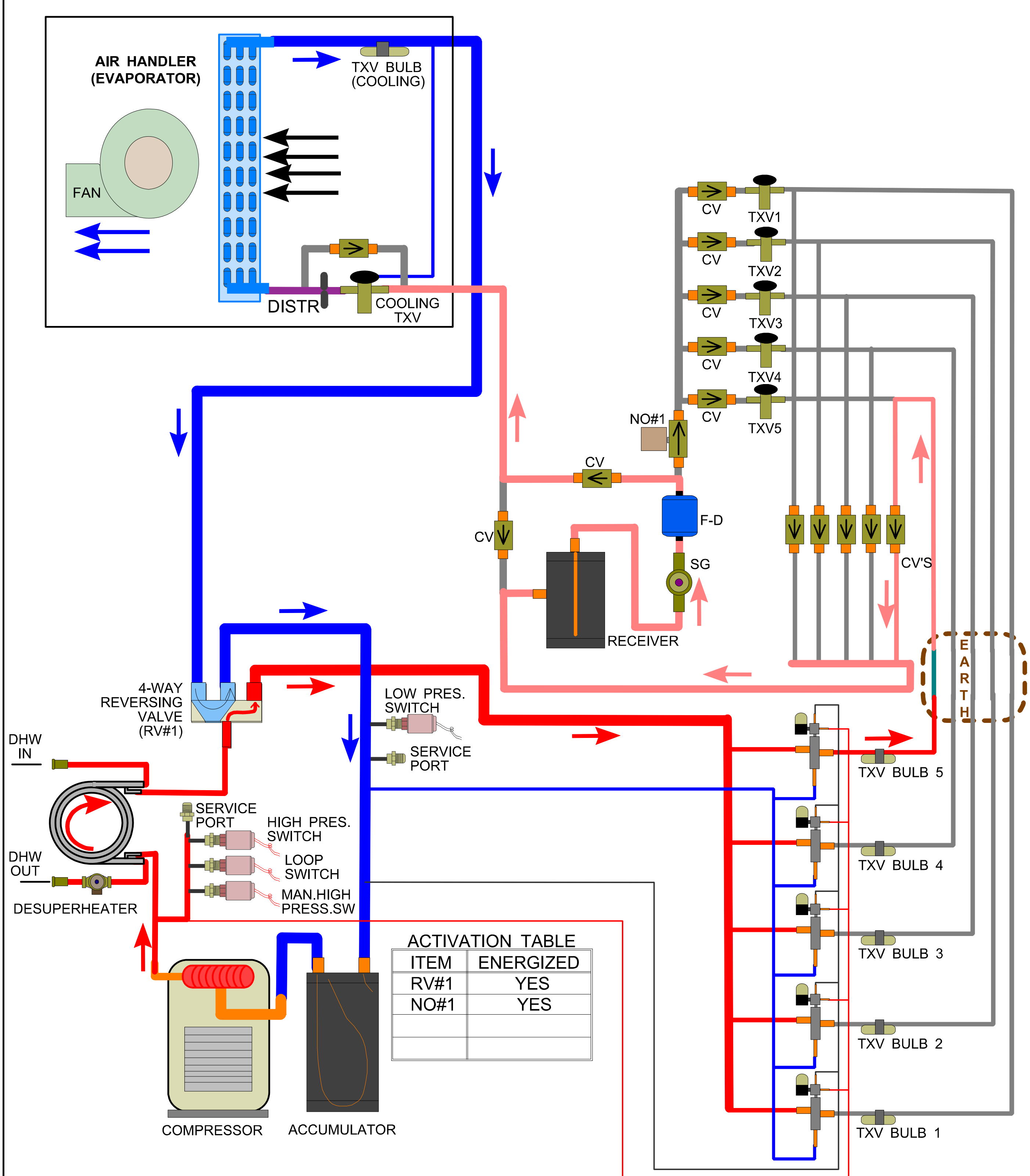
ITEM	ENERGIZED
RV#1	NO
NO#1	NO

					Drawn By D. RHEAULT	Date 12-Nov-2012
					Checked By D. RHEAULT	Date 12-Nov-2012
					Approved By (ENG) D. RHEAULT	Date 12-Nov-2012
01	000205	D. RHEAULT	D. RHEAULT	12-Nov-2012	Approved By (MFG)	Date
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date

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

Drawing Name	DXS (Modular - TXV) Refrigeration Circuit - Heating Mode		
Size: A	Drawing Number: 001734RCD	REV: 01	SHEET: 1 of 1

DXS (Modular-TXV) REFRIGERATION CIRCUIT - COOLING MODE



ACTIVATION TABLE

ITEM	ENERGIZED
RV#1	YES
NO#1	YES

REV	ECO #	IMPL BY	APVD BY	DATE
01	000205	D. RHEAULT	D. RHEAULT	12-Nov-2012

Drawn By: D. RHEAULT	Date: 12-Nov-2012	
Checked By: D. RHEAULT	Date: 12-Nov-2012	
Approved By (ENG): D. RHEAULT	Date: 12-Nov-2012	
Approved By (MFG)	Date	
Approved By	Date	

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

Drawing Name: DXS (Modular - TXV) Refrigeration Circuit - Cooling Mode

Size	Drawing Number	REV	SHEET
A	001735RCD	01	1 of 1

Model Specific Information

This section provides general information particular to each model. For complete specifications please see the specifications document for the desired model

REFRIGERANT CHARGE CHART

Table 18 - Refrigerant - R410a		
SIZE	Lbs.	kg
25	8.0	3.6
45	12.0	7.3
55	16.0	9.1
65	20.0	9.1
System contains POE oil.		

SHIPPING INFORMATION

Table 19 - Shipping Information				
MODEL	WEIGHT	DIMENSIONS in (cm)		
SIZE	Lbs. (kg)	L	W	H
45	TBD	40 (102)	36 (91)	60 (152)
45	TBD	40 (102)	36 (91)	60 (152)
55	TBD	40 (102)	36 (91)	60 (152)
65	TBD	40 (102)	36 (91)	60 (152)

STADARD CAPACITY RATINGS

The tables below depict the results of standard capacity rating tests according to ARI 870-2005.

Table 16 - Standard Capacity Ratings - Heating 60Hz								
EAT 70°F (21.1°C)					VAPOUR LINE 32°F (0°C)			
Model	Size	Mode	Airflow		Input Energy	Capacity		COP_H
	Tons		CFM	L/s	Watts	BTU/Hr	kW	W/W
25	2	Stage 1	800	378	1,435	17,700	5.2	3.60
45	3	Stage 1	1200	566	2,285	31,100	9.1	3.99
55	4	Stage 1	1500	708	3,375	43,500	12.7	3.78
65	5	Stage 1	1900	897	4,180	53,300	15.6	3.74

Table 17 - Standard Capacity Ratings - Cooling 60Hz								
EAT 80°F (26.7°C)					LIQUID LINE 77°F (25°C)			
Model	Size	Mode	Airflow		Input Energy	Capacity		EER
	Tons		CFM	L/s	Watts	BTU/Hr	kW	BTU/W-Hr
25	2	Stage 1	800	378	1,295	24,900	7.3	19.3
45	3	Stage 1	1200	566	2,240	43,200	12.6	19.3
55	4	Stage 1	1500	708	2,900	51,500	15.1	17.8
65	5	Stage 1	1900	897	3,620	63,900	18.7	17.6

CAPACITY RATINGS

DXS-25-HACW-P-1S — **Heating Mode (Nominal 2 ton)** — **R410a 60 Hz**

Source Data (Outdoor Loop)			Power Consumption					Sink Data (Indoor Loop)						
Suction Pressure	Evap. Temp	HAB	Compressor		Fan*	Total Electrical	**COPh**	Discharge Pressure	Cond. Temp.	EAT	Air Flow	LAT	Delta T	**Net Output**
PSIG	°F	BTU/Hr	Watts	Amps	Watts	Watts	**W/W**	PSIG	°F	°F	CFM	°F	°F	**BTU/Hr**
kPa	°C	Watts						kPa	°C	°C	L/sec	°C	°C	**Watts**
62	10	8,983	1,184	5.3	105	1,289	**3.04**	280	91	70.0	1,000	83.6	13.6	**13,383**
430	-12.2	2,632						1927	32.8	21.1	472	28.7	7.5	**3,921**
70	15	9,885	1,222	5.5	105	1,327	**3.18**	288	93	70.0	1,000	84.6	14.6	**14,413**
484	-9.4	2,896						1985	33.9	21.1	472	29.2	8.1	**4,223**
79	20	10,856	1,259	5.7	105	1,364	**3.33**	296	95	70.0	1,000	85.7	15.7	**15,511**
543	-6.7	3,181						2044	35.0	21.1	472	29.9	8.7	**4,545**
88	25	11,899	1,296	5.9	105	1,401	**3.49**	305	97	70.0	1,000	86.9	16.9	**16,681**
605	-3.9	3,486						2104	36.1	21.1	472	30.5	9.4	**4,888**
97	30	13,015	1,334	6.0	105	1,439	**3.65**	314	99	70.0	1,000	88.2	18.2	**17,927**
672	-1.1	3,813						2165	37.2	21.1	472	31.2	10.1	**5,252**
108	35	14,207	1,372	6.2	105	1,477	**3.82**	323	101	70.0	1,000	89.5	19.5	**19,249**
743	1.7	4,163						2228	38.3	21.1	472	32.0	10.9	**5,640**
119	40	15,476	1,412	6.4	105	1,517	**3.99**	332	103	70.0	1,000	91.0	21.0	**20,652**
819	4.4	4,535						2292	39.4	21.1	472	32.8	11.6	**6,051**
131	45	16,825	1,452	6.6	105	1,557	**4.17**	342	105	70.0	1,000	92.5	22.5	**22,139**
900	7.2	4,930						2357	40.6	21.1	472	33.6	12.5	**6,487**

Compressor: ZPS20K4E-PFV — * @ 37.3Pa (0.15inH2o) Ext. Static

DXS-25-HACW-P-1S — **Cooling Mode** — **R410a 60 Hz**

Source Data (Indoor Loop)									Power Consumption					Sink Data (Outdoor Loop)		
Suct. Pres.	Evap. Temp	EAT	Air Flow	LAT	Delta T	Latent	Sensible	**HAB**	Compressor		Fan*	Total Electrical	**Efficiency**	Disch. Pres.	Cond. Temp.	Net Output
PSIG	°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	**BTU/Hr**	Watts	Amps	Watts	Watts	**EER**	PSIG	°F	BTU/Hr
kPa	°C	°C	L/sec	°C	°C	Watts	Watts	**Watts**					**COPc**	kPa	°C	Watts
143	50	80.0	1,000	62.8	17.2	7,352	18,221	**25,574**	1,099	4.7	110	1,209	**21.1**	237	80	29,701
987	10.0	26.7	472	17.1	9.5	2,154	5,339	**7,493**					**6.20**	1,631	26.7	8,702
143	50	80.0	1,000	63.3	16.7	7,164	17,753	**24,917**	1,185	5.1	110	1,295	**19.2**	255	85	29,338
987	10.0	26.7	472	17.4	9.3	2,099	5,202	**7,300**					**5.64**	1,761	29.4	8,596
143	50	80.0	1,000	63.7	16.3	6,971	17,277	**24,249**	1,274	5.4	110	1,384	**17.5**	275	90	28,973
987	10.0	26.7	472	17.6	9.0	2,043	5,062	**7,105**					**5.13**	1,899	32.2	8,489
143	50	80.0	1,000	64.2	15.8	6,776	16,793	**23,569**	1,367	5.8	110	1,477	**16.0**	296	95	28,609
987	10.0	26.7	472	17.9	8.8	1,985	4,920	**6,906**					**4.68**	2,044	35.0	8,382
143	51	80.0	1,000	64.5	15.5	6,639	16,453	**23,092**	1,463	6.2	110	1,573	**14.7**	319	100	28,462
987	10.3	26.7	472	18.1	8.6	1,945	4,821	**6,766**					**4.30**	2,196	37.8	8,339
143	51	80.0	1,000	65.0	15.0	6,435	15,948	**22,383**	1,565	6.6	110	1,675	**13.4**	342	105	28,100
987	10.3	26.7	472	18.3	8.3	1,885	4,673	**6,558**					**3.91**	2,357	40.6	8,233
143	51	80.0	1,000	65.5	14.5	6,227	15,433	**21,661**	1,673	7.1	110	1,783	**12.2**	366	110	27,745
987	10.3	26.7	472	18.6	8.1	1,825	4,522	**6,347**					**3.56**	2,526	43.3	8,129
143	51	80.0	1,000	66.0	14.0	6,016	14,909	**20,925**	1,787	7.6	110	1,897	**11.0**	392	115	27,400
987	10.3	26.7	472	18.9	7.8	1,763	4,368	**6,131**					**3.23**	2,705	46.1	8,028

Compressor: ZPS20K4E-PFV — * @ 37.3Pa (0.15inH2o) Ext. Static

CAPACITY RATINGS (continued)

DXS-45-HACW-P-1S — **Heating Mode (Nominal 3 ton)** — R410a 60 Hz

Source Data (Outdoor Loop)			Power Consumption					Sink Data (Indoor Loop)						
Suction Pressure	Evap. Temp	HAB	Compressor		Fan*	Total Electrical	**COPh**	Discharge Pressure	Cond. Temp.	EAT	Air Flow	LAT	Delta T	**Net Output**
PSIG	°F	BTU/Hr	Watts	Amps	Watts	Watts	**W/W**	PSIG	°F	°F	CFM	°F	°F	**BTU/Hr**
kPa	°C	Watts						kPa	°C	°C	L/sec	°C	°C	**Watts**
62	10	17,610	1,939	8.5	180	2,119	**3.44**	305	97	70.0	1,400	86.7	16.7	**24,840**
430	-12.2	5,160						2104	36.1	21.1	661	30.4	9.3	**7,278**
70	15	19,204	1,996	8.7	180	2,176	**3.59**	314	99	70.0	1,400	87.9	17.9	**26,630**
484	-9.4	5,627						2165	37.2	21.1	661	31.1	10.0	**7,803**
79	20	20,790	2,080	9.1	180	2,260	**3.70**	328	102	70.0	1,400	89.2	19.2	**28,502**
543	-6.7	6,092						2259	38.9	21.1	661	31.8	10.7	**8,351**
88	25	22,475	2,165	9.5	180	2,345	**3.81**	342	105	70.0	1,400	90.5	20.5	**30,479**
605	-3.9	6,585						2357	40.6	21.1	661	32.5	11.4	**8,930**
97	30	25,716	2,220	9.8	180	2,400	**4.14**	352	107	70.0	1,400	92.8	22.8	**33,907**
672	-1.1	7,535						2424	41.7	21.1	661	33.8	12.7	**9,935**
108	35	27,900	2,280	10.0	180	2,460	**4.32**	361	109	70.0	1,400	94.4	24.4	**36,297**
743	1.7	8,175						2492	42.8	21.1	661	34.7	13.6	**10,635**
119	40	30,025	2,372	10.5	180	2,552	**4.45**	377	112	70.0	1,400	96.1	26.1	**38,733**
819	4.4	8,797						2597	44.4	21.1	661	35.6	14.5	**11,349**
131	45	32,256	2,467	10.9	180	2,647	**4.57**	392	115	70.0	1,400	97.8	27.8	**41,289**
900	7.2	9,451						2705	46.1	21.1	661	36.5	15.4	**12,098**

Compressor: ZPS30K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

DXS-45-HACW-P-1S — **Cooling Mode** — R410a 60 Hz

Source Data (Indoor Loop)									Power Consumption					Sink Data (Outdoor Loop)		
Suct. Pres.	Evap. Temp	EAT	Air Flow	LAT	Delta T	Latent	Sensible	**HAB**	Compressor		Fan*	Total Electrical	**Efficiency**	Disch. Pres.	Cond. Temp.	Net Output
PSIG	°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	**BTU/Hr**	Watts	Amps	Watts	Watts	**EER**	PSIG	°F	BTU/Hr
kPa	°C	°C	L/sec	°C	°C	Watts	Watts	**Watts**					**COPc**	kPa	°C	Watts
141	49.5	80.0	1,400	61.7	18.3	15,075	31,525	**46,600**	1,650	7.0	190	1,840	**25.3**	237	80	52,879
969	9.7	26.7	661	16.5	10.2	4,417	9,237	**13,654**					**7.42**	1,631	26.7	15,493
141	49.5	80.0	1,400	62.2	17.8	14,703	30,748	**45,451**	1,771	7.4	190	1,961	**23.2**	255	85	52,143
969	9.7	26.7	661	16.8	9.9	4,308	9,009	**13,317**					**6.79**	1,761	29.4	15,278
141	49.5	80.0	1,400	62.6	17.4	14,326	29,958	**44,284**	1,895	7.9	190	2,085	**21.2**	275	90	51,401
969	9.7	26.7	661	17.0	9.7	4,197	8,778	**12,975**					**6.22**	1,899	32.2	15,060
143	50	80.0	1,400	62.9	17.1	14,066	29,414	**43,480**	2,026	8.5	190	2,216	**19.6**	296	95	51,042
987	10.0	26.7	661	17.2	9.5	4,121	8,618	**12,739**					**5.75**	2,044	35.0	14,955
143	50	80.0	1,400	62.4	17.6	12,580	29,006	**41,586**	2,118	9.0	190	2,308	**18.0**	319	100	49,465
987	10.0	26.7	661	16.9	9.8	3,686	8,499	**12,185**					**5.28**	2,196	37.8	14,493
143	50	80.0	1,400	62.9	17.1	12,211	28,155	**40,366**	2,259	9.6	190	2,449	**16.5**	342	105	48,723
987	10.0	26.7	661	17.2	9.5	3,578	8,249	**11,827**					**4.83**	2,357	40.6	14,276
143	51	80.0	1,400	63.5	16.5	11,787	27,179	**38,966**	2,469	10.5	190	2,659	**14.7**	377	112	48,042
987	10.3	26.7	661	17.5	9.2	3,454	7,963	**11,417**					**4.29**	2,597	44.4	14,076
143	51	80.0	1,400	63.8	16.2	11,555	26,643	**38,198**	2,565	10.9	190	2,755	**13.9**	392	115	47,599
987	10.3	26.7	661	17.7	9.0	3,386	7,806	**11,192**					**4.06**	2,705	46.1	13,947

Compressor: ZPS30K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

DXS-55-HACW-P-1S — Heating Mode (Nominal 4 ton) — R410a 60 Hz

Source Data (Outdoor Loop)			Power Consumption					Sink Data (Indoor Loop)						
Suction Pressure	Evap. Temp	HAB	Compressor		Fan*	Total Electrical	**COPh**	Discharge Pressure	Cond. Temp.	EAT	Air Flow	LAT	Delta T	**Net Output**
PSIG	°F	BTU/Hr	Watts	Amps	Watts	Watts	**W/W**	PSIG	°F	°F	CFM	°F	°F	**BTU/Hr**
kPa	°C	Watts						kPa	°C	°C	L/sec	°C	°C	**Watts**
62	10	19,476	2,740	12.0	335	3,075	**2.86**	319	100	70.0	1,700	88.1	18.1	**29,971**
430	-12.2	5,707						2196	37.8	21.1	802	31.2	10.0	**8,781**
70	15	21,698	2,813	12.4	335	3,148	**3.02**	328	102	70.0	1,700	89.6	19.6	**32,441**
484	-9.4	6,357						2259	38.9	21.1	802	32.0	10.9	**9,505**
79	20	24,093	2,885	12.7	335	3,220	**3.19**	337	104	70.0	1,700	91.2	21.2	**35,083**
543	-6.7	7,059						2324	40.0	21.1	802	32.9	11.8	**10,279**
88	25	26,667	2,957	13.0	335	3,292	**3.37**	347	106	70.0	1,700	92.9	22.9	**37,904**
605	-3.9	7,813						2390	41.1	21.1	802	33.8	12.7	**11,106**
97	30	30,965	3,072	13.4	335	3,407	**3.66**	357	108	70.0	1,700	95.7	25.7	**42,594**
672	-1.1	9,073						2458	42.2	21.1	802	35.4	14.3	**12,480**
108	35	34,068	3,147	13.7	335	3,482	**3.87**	366	110	70.0	1,700	97.7	27.7	**45,951**
743	1.7	9,982						2526	43.3	21.1	802	36.5	15.4	**13,464**
119	40	37,377	3,223	14.1	335	3,558	**4.08**	377	112	70.0	1,700	99.9	29.9	**49,519**
819	4.4	10,951						2597	44.4	21.1	802	37.7	16.6	**14,509**
131	45	40,897	3,300	14.4	335	3,635	**4.30**	387	114	70.0	1,700	102.2	32.2	**53,304**
900	7.2	11,983						2668	45.6	21.1	802	39.0	17.9	**15,618**

Compressor: ZPS40K4E-PFV — * @ 37.3Pa (0.15inH2o) Ext. Static

DXS-55-HACW-P-1S — Cooling Mode — R410a 60 Hz

Source Data (Indoor Loop)									Power Consumption					Sink Data (Outdoor Loop)		
Suct. Pres.	Evap. Temp	EAT	Air Flow	LAT	Delta T	Latent	Sensible	**HAB**	Compressor		Fan*	Total Electrical	**Efficiency**	Disch. Pres.	Cond. Temp.	Net Output
PSIG	°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	**BTU/Hr**	Watts	Amps	Watts	Watts	**EER**	PSIG	°F	BTU/Hr
kPa	°C	°C	L/sec	°C	°C	Watts	Watts	**Watts**					**COPc**	kPa	°C	Watts
136	47	80.0	1,700	61.2	18.8	16,828	36,807	**53,635**	2,297	9.8	365	2,662	**20.1**	237	80	62,721
934	8.3	26.7	802	16.2	10.4	4,931	10,784	**15,715**					**5.90**	1,631	26.7	18,377
136	47	80.0	1,700	61.7	18.3	16,422	35,919	**52,340**	2,447	10.4	365	2,812	**18.6**	255	85	61,937
934	8.3	26.7	802	16.5	10.2	4,812	10,524	**15,336**					**5.45**	1,761	29.4	18,147
136	47.5	80.0	1,700	62.0	18.0	16,163	35,353	**51,516**	2,601	11.0	365	2,966	**17.4**	275	90	61,638
934	8.6	26.7	802	16.6	10.0	4,736	10,358	**15,094**					**5.09**	1,899	32.2	18,060
138	48	80.0	1,700	62.3	17.7	15,887	34,749	**50,636**	2,760	11.7	365	3,125	**16.2**	296	95	61,302
951	8.9	26.7	802	16.8	9.9	4,655	10,181	**14,836**					**4.75**	2,044	35.0	17,961
138	48	80.0	1,700	62.6	17.4	13,966	33,377	**47,343**	2,889	12.3	365	3,254	**14.6**	319	100	58,448
951	8.9	26.7	802	17.0	9.7	4,092	9,779	**13,871**					**4.26**	2,196	37.8	17,125
138	49	80.0	1,700	62.9	17.1	13,686	32,707	**46,393**	3,059	13.1	365	3,424	**13.5**	342	105	58,080
951	9.2	26.7	802	17.2	9.5	4,010	9,583	**13,593**					**3.97**	2,357	40.6	17,017
141	49	80.0	1,700	63.3	16.7	13,389	31,996	**45,385**	3,238	13.8	365	3,603	**12.6**	366	110	57,684
969	9.4	26.7	802	17.4	9.3	3,923	9,375	**13,298**					**3.69**	2,526	43.3	16,901
141	49	80.0	1,700	63.9	16.1	12,943	30,931	**43,874**	3,427	14.6	365	3,792	**11.6**	392	115	56,816
969	9.4	26.7	802	17.7	9.0	3,792	9,063	**12,855**					**3.39**	2,705	46.1	16,647

Compressor: ZPS40K4E-PFV — * @ 37.3Pa (0.15inH2o) Ext. Static

DXS-65-HACW-P-1S — Heating Mode (Nominal 5 ton) — R410a 60 Hz

Source Data (Outdoor Loop)			Power Consumption					Sink Data (Indoor Loop)						
Suction Pressure	Evap. Temp	HAB	Compressor		Fan*	Total Electrical	**COPh**	Discharge Pressure	Cond. Temp.	EAT	Air Flow	LAT	Delta T	**Net Output**
PSIG	°F	BTU/Hr	Watts	Amps	Watts	Watts	**W/W**	PSIG	°F	°F	CFM	°F	°F	**BTU/Hr**
kPa	°C	Watts						kPa	°C	°C	L/sec	°C	°C	**Watts**
62	10	27,054	3,384	14.7	455	3,839	**3.06**	301	96	70.0	2,100	88.0	18.0	**40,155**
430	-12.2	7,927						2073	35.6	21.1	991	31.1	10.0	**11,765**
70	15	29,807	3,484	15.1	455	3,939	**3.22**	310	98	70.0	2,100	89.4	19.4	**43,251**
484	-9.4	8,733						2134	36.7	21.1	991	31.9	10.8	**12,672**
79	20	32,777	3,584	15.5	455	4,039	**3.38**	319	100	70.0	2,100	90.9	20.9	**46,560**
543	-6.7	9,603						2196	37.8	21.1	991	32.7	11.6	**13,642**
88	25	35,969	3,683	15.9	455	4,138	**3.55**	328	102	70.0	2,100	92.5	22.5	**50,092**
605	-3.9	10,539						2259	38.9	21.1	991	33.6	12.5	**14,677**
97	30	39,930	3,712	16.3	455	4,167	**3.81**	337	104	70.0	2,100	95.3	25.3	**54,151**
672	-1.1	11,699						2324	40.0	21.1	991	35.2	14.1	**15,866**
108	35	43,638	3,811	16.7	455	4,266	**4.00**	347	106	70.0	2,100	97.2	27.2	**58,198**
743	1.7	12,786						2390	41.1	21.1	991	36.2	15.1	**17,052**
119	40	47,592	3,912	17.2	455	4,367	**4.19**	357	108	70.0	2,100	99.2	29.2	**62,498**
819	4.4	13,944						2458	42.2	21.1	991	37.4	16.2	**18,312**
131	45	51,799	4,016	17.6	455	4,471	**4.39**	366	110	70.0	2,100	101.4	31.4	**67,060**
900	7.2	15,177						2526	43.3	21.1	991	38.5	17.4	**19,649**

Compressor: ZPS51K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

DXS-65-HACW-P-1S — Cooling Mode — R410a 60 Hz

Source Data (Indoor Loop)									Power Consumption					Sink Data (Outdoor Loop)		
Suct. Pres.	Evap. Temp	EAT	Air Flow	LAT	Delta T	Latent	Sensible	**HAB**	Compressor		Fan*	Total Electrical	**Efficiency**	Disch. Pres.	Cond. Temp.	Net Output
PSIG	°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	**BTU/Hr**	Watts	Amps	Watts	Watts	**EER**	PSIG	°F	BTU/Hr
kPa	°C	°C	L/sec	°C	°C	Watts	Watts	**Watts**					**COPc**	kPa	°C	Watts
131	45.5	80.0	2,100	63.0	17.0	21,714	43,372	**65,086**	2,843	12.4	515	3,358	**19.4**	237	80	76,548
900	7.5	26.7	991	17.2	9.4	6,362	12,708	**19,070**					**5.68**	1,631	26.7	22,428
133	46	80.0	2,100	63.3	16.7	21,412	42,767	**64,179**	3,055	13.2	515	3,570	**18.0**	255	85	76,364
917	7.8	26.7	991	17.4	9.3	6,274	12,531	**18,804**					**5.27**	1,761	29.4	22,375
133	46.5	80.0	2,100	63.5	16.5	21,088	42,121	**63,208**	3,273	14.0	515	3,788	**16.7**	275	90	76,137
917	8.1	26.7	991	17.5	9.2	6,179	12,341	**18,520**					**4.89**	1,899	32.2	22,308
136	47	80.0	2,100	63.8	16.2	20,743	41,431	**62,174**	3,498	14.8	515	4,013	**15.5**	296	95	75,869
934	8.3	26.7	991	17.7	9.0	6,078	12,139	**18,217**					**4.54**	2,044	35.0	22,229
136	48	80.0	2,100	62.7	17.3	18,024	42,307	**60,331**	3,663	15.7	515	4,178	**14.4**	319	100	74,592
934	8.6	26.7	991	17.1	9.6	5,281	12,396	**17,677**					**4.23**	2,196	37.8	21,855
138	48	80.0	2,100	63.0	17.0	17,678	41,496	**59,174**	3,903	16.7	515	4,418	**13.4**	342	105	74,254
951	8.9	26.7	991	17.2	9.4	5,180	12,158	**17,338**					**3.92**	2,357	40.6	21,756
138	49	80.0	2,100	63.4	16.6	17,312	40,635	**57,947**	4,155	17.6	515	4,670	**12.4**	366	110	73,886
951	9.2	26.7	991	17.4	9.2	5,072	11,906	**16,978**					**3.64**	2,526	43.3	21,648
141	49	80.0	2,100	63.8	16.2	16,923	39,724	**56,647**	4,421	18.7	515	4,936	**11.5**	392	115	73,493
969	9.4	26.7	991	17.6	9.0	4,958	11,639	**16,597**					**3.36**	2,705	46.1	21,533

Compressor: ZPS51K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

ELECTRICAL TABLES

Table 18 - Heat Pump Electrical Information (230-1-60)

Model	Compressor		FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	Amps	Amps	Amps	ga
25	15.0	58	16.0	19.8	30	#10-3
45	18.6	79	19.6	24.3	40	#8-3
55	24.3	117	25.3	31.4	50	#6-3
65	29.3	134	30.3	37.6	60	#6-3

Table 19- Heat Pump Electrical Information (208-3-60)

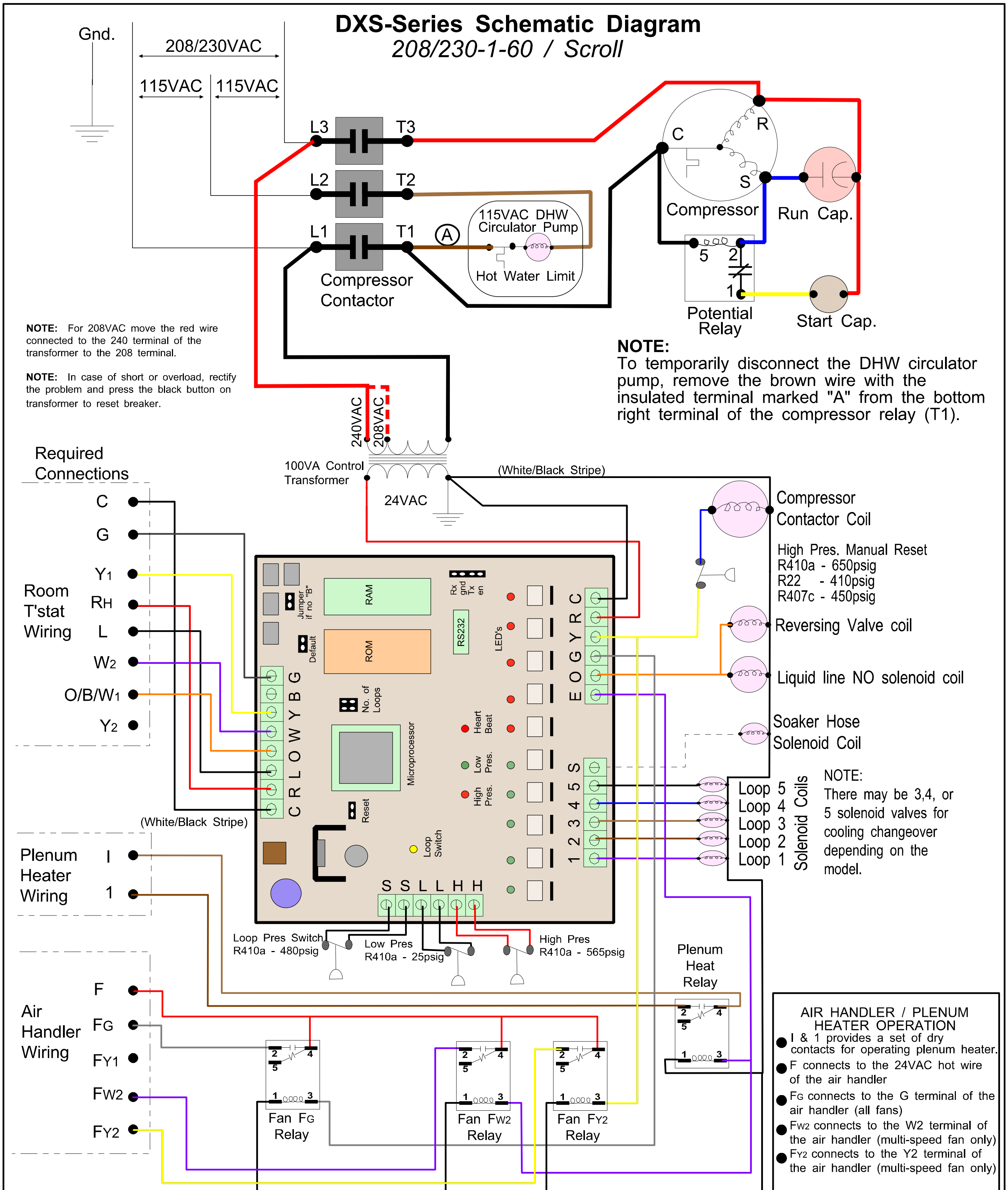
Model	Compressor		FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	Amps	Amps	Amps	ga
25	7.9	55	8.7	10.7	15	#14-3
45	11.6	73	12.4	15.3	20	#10-3
55	15.3	83	16.1	19.9	30	#8-3
65	17.4	110	18.2	22.6	40	#8-3

Table 20 - Heat Pump Electrical Information (220-1-50)

Model	Compressor		FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	Amps	Amps	Amps	ga
25	10.0	52	11.0	13.5	20	#12-2
45	15.0	67	16.0	19.8	30	#10-2
55	17.7	98	18.7	23.1	30	#10-2
65	22.5	153	23.5	29.1	40	#8-2

Table 21 - Heat Pump Electrical Information (380-3-50)

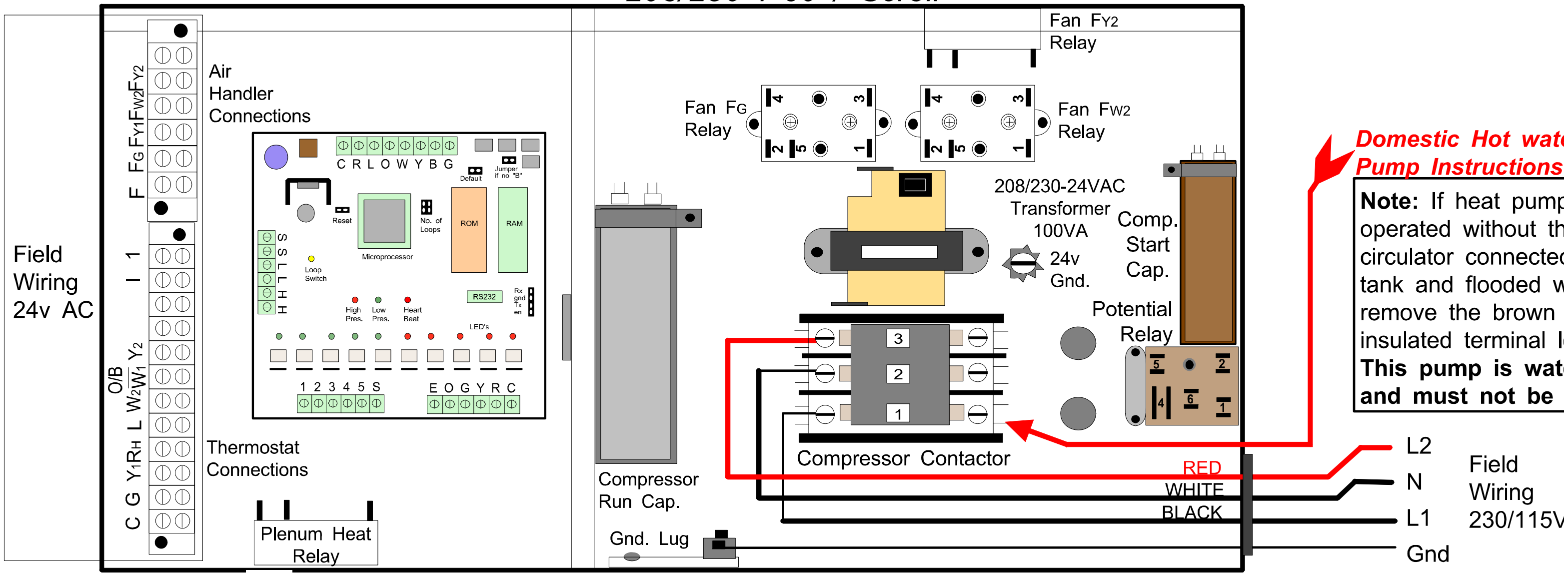
Model	Compressor		FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	Amps	Amps	Amps	ga
25	3.9	27	4.7	5.7	15	#14-4
45	6.1	38	6.9	8.4	15	#14-4
55	6.8	43	7.6	9.3	15	#14-4
65	8.6	52	9.4	11.6	20	#12-4



					Drawn By: Chris Geddes	Date: 04 SEP 11	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4			
					Checked By: Chris Geddes	Date: 04 SEP 11				
					Approved By (ENG): Chris Geddes	Date: 04 SEP 11	Drawing Name: DXS-**-HAC*-P*-1S Schematic Diagram			
					Approved By (MFG)	Date				
01	Initial Release	C. GEDDES	C. GEDDES	04 SEP 11	Approved By	Date	Size: A	Drawing Number: 001568SCH	REV: 01	SHEET: 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE						

DXS-Series Electrical Box Diagram

208/230-1-60 / Scroll



Domestic Hot water Circulator Pump Instructions (HW & HACW):

Note: If heat pump is to be operated without the hot water circulator connected to the water tank and flooded with water, remove the brown wire with the insulated terminal located here. **This pump is water lubricated and must not be run dry.**

IMPORTANT NOTE FOR 208-1-60 POWER

Ensure red wire is connected to the 208 terminal on the transformer instead of the 230V terminal.

Heat Pump Electrical Service Requirements

208/230VAC Single Phase 60Hz (208/230-1-60)

Model Size	Min. Circuit Ampacity	Min. Wire Gauge	TD Fuse or Breaker
25	20	10-3	30
45	24	8-3	40
55	31	6-3	50
65	38	6-3	60
80	46	6-3	60

208/230/115VAC CONNECTIONS

Wire	Colour	Contactor
L2	Red	L3
N	White	L2
L1	Black	L1
Connect "Gnd" to Gnd. Lug		

Low Voltage Wiring (24VAC)

Thermostat Wiring

Use an 18-7 conductor cable to connect this unit to the thermostat.

C - 24VAC Common
G - Fan
Y1 - Stage 1 Heat/Cool (Compressor)
RH - 24VAC Hot
L - Trouble (if available on thermostat)
W2 - Stage 3 Heat (Plenum Heater)
O/B/W1 - Reversing Valve (Active in Cooling)
Y2 - Not Applicable

Air Handler Wiring

Use an 18-4 conductor cable to connect this unit to the Air Handler:

F - Air Handler R (24VAC hot wire)
FG - Air Handler G (Circulation Fan Speed)
FY1 - Not Applicable
FW2 - Air Handler W2 (Backup Heat Fan Speed)
FY2 - Air Handler Y2 (Stage 2 Fan Speed)
NOTE: Use only F and FG for air handlers with single speed fan motors.

Plenum Heat Wiring

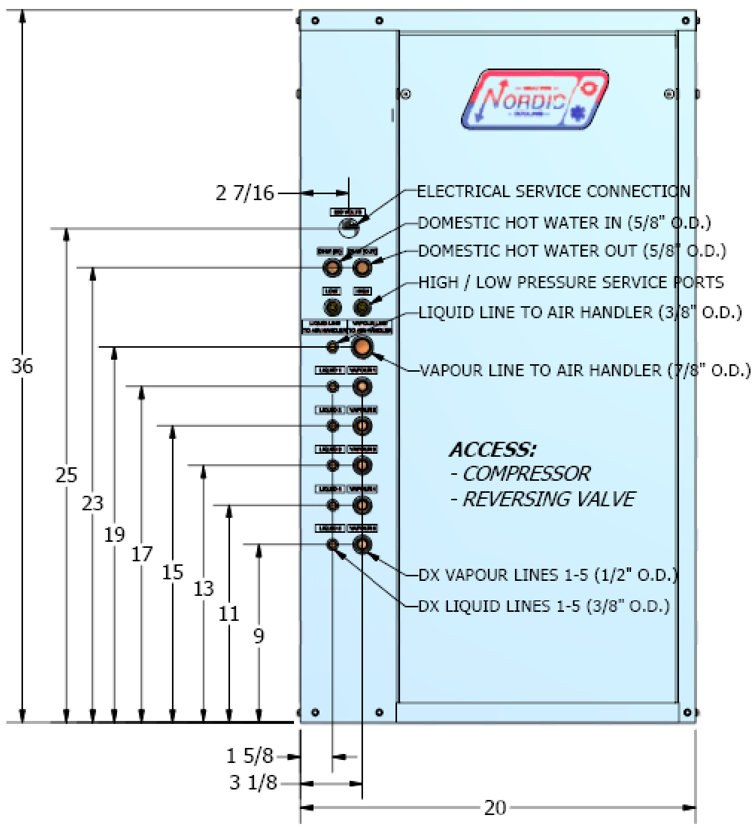
Use an 18-2 conductor cable to connect this unit to the Plenum Heater:

I-1 - SPST Dry Contacts to operate the Plenum Heater

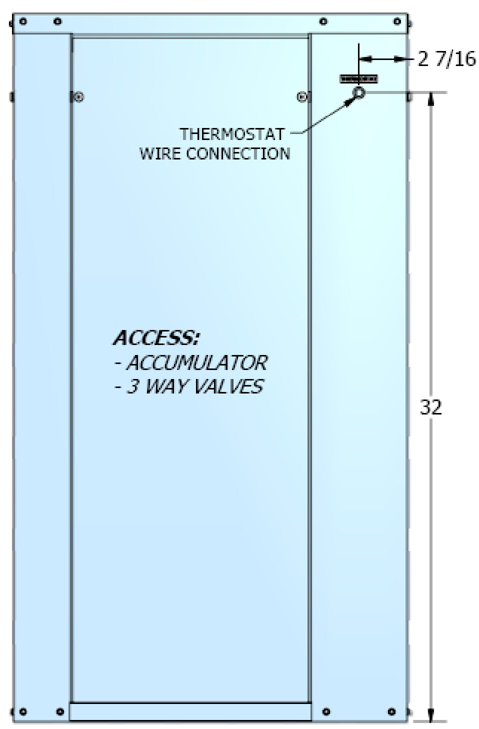
					Drawn By Chris Geddes	Date 04 OCT 11
					Checked By Chris Geddes	Date 04 OCT 11
					Approved By (ENG) Chris Geddes	Date 04 OCT 11
01	Initial Release	C. GEDDES	C. GEDDES	04 OCT 11	Approved By (MFG)	Date
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date

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

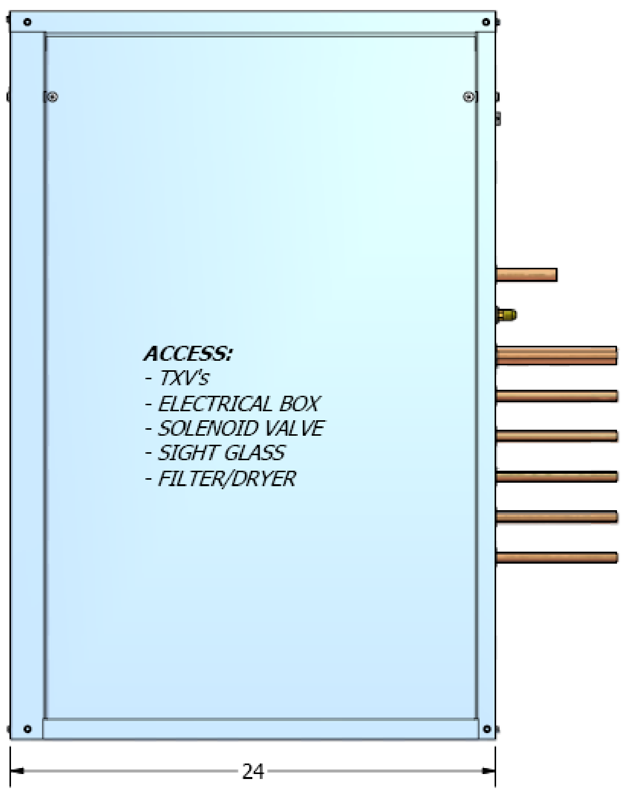
Drawing Name			
DXS-**-HAC*-P*-1S Electrical Box Diagram			
Size	Drawing Number	REV	SHEET
A	001569ELB	01	1 of 1



Front View



Back View



Left Side View

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LIMITED EXPRESS WARRANTY

It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd., a corporation registered in New Brunswick, Canada, ("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.
EXCEPT AS SPECIFICALLY SET FORTH HEREIN, THERE IS NO EXPRESS WARRANTY AS TO ANY OF 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 BEARS 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, not withstanding 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 • Customer Service • PO Box 2555 • Petitcodiac, New Brunswick E4Z 6H4 • (506) 756-8135 • or e-mail to info@nordicghp.com 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. Please refer to the MG Installation, Installation and Service Manual for operating and maintenance instructions.

An extended warranty option is also available. Please contact Maritime Geothermal Ltd. via the contact information in the previous paragraph for more information.