Application, Installation, & Service Manual

WD-Series

Wall Mounted Domestic Hot Water Water-Source Heat Pump

R134a 60Hz

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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 electrical shock.**

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

WARNING: **Refrigeration 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 the system 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 equipment.**

Model Nomenclature

WD—16—H—B—1S—CD—xx

Series:
WD = water to domestic hot water

Nominal Size:
16 = 016 compressor
(equivalent to 3000W water heater)

Functions:
H = Heating

Refrigerant:
B = R134a

Voltage Code:
1 = 208/230-1-60

Revision:
01, 02 etc.

DHW Condenser:
D = double wall

Outdoor/Source Coil:
C = Copper coaxial
Z = CuNi coaxial

Compressor:
L = single stage rotary

APPLICATION TABLE

MODEL	FUNCTION	REFRIGERANT	VOLTAGE	COMPRESSOR	OUTDOOR COIL	DHW CONDENSER	REVISIONS			
WD-16	H	B	1	L	C Z	D	03			

This manual applies only to the models and revisions listed in this table.

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

go to TABLE OF CONTENTS

Table of Contents

Tables & Documents 3

WD-Series System Description 4
General Overview 4
Heat Source: Water Well (Open Loop) 4
Heat Source: Hydronic Buffer Tank 4
Heat Source: Closed Ground Loop 4

Installation Basics 5
Sample Bill of Materials 5
Unpacking the Unit 5
Unit Placement 5

Wiring 6
Heat Pump Power Supply Connections 6
Tank Power Supply Connections 6
Tank / A-231 Control Connections 6
DHW Circulator Wiring 6
Ground Loop Circulator Wiring 6
Water Valve Wiring 6
Control Transformer 6
DHW Aquastat 7
Optional Ground Loop Aquastat 7
002341CDG - WD-Series Wiring Connections 8
002342CDG - Ground Loop Lockout Aquastat Connection 9

Piping 10
Domestic Hot Water Piping 10
Outdoor Piping - Open Loop 10
002339PDG - Piping Connections (Open Loop Source) 11
Outdoor Piping - Ground Loop 12
002340PDG - Piping Connections (Ground Loop Source) 13

Startup Procedure 14
Pre-start Inspection 14
Unit Startup 14
Startup Record 15

Routine Maintenance 16
Heat Exchanger Flushing Procedures 16

Troubleshooting Guide 17

Repair Procedures 22
Pumpdown Procedure 22
General Repair Procedure 22
Vacuuming & Charging Procedure 22
Compressor Replacement Procedure 23

Model Specific Information 24
Shipping Information 24
Refrigerant Charge 24
DHW Loop Flow Rate 24
Outdoor Loop Flow Rate 24
Operating Temperature Limits 24
Electrical Specifications 24
Outdoor Loop Pressure Drops 24
Performance Tables 25
Wiring Diagram (208/230-1-60) 26
Wiring Diagram - Contactor Kits 27
WD-Series Refrigeration Circuit 28
Dimensions 29

Warranty 30

Tables & Documents

Tables

Table 1 - Power Supply Connections 6
Table 2 - Tank / A-231 Control Connections 6
Table 3 - DHW Aquastat Settings 7
Table 4 - DHW Aquastat Setpoints 7
Table 5 - Optional Ground Loop Aquastat Connections 7
Table 6 - Optional Ground Loop Aquastat Setpoints 7
Table 7 - Shipping Information 24
Table 8 - Refrigerant Charge 24
Table 9 - DHW Loop Flow Rate 24
Table 10 - Outdoor Loop Flow Rate 24
Table 11 - Operating Temperature Limits 24
Table 12 - Electrical Specifications 24
Table 13 - Outdoor Loop Pressure Drops 24

Documents

002341CDG - WD-Series Wiring Connections 8
002342CDG - WD-Series Ground Loop Low Temperature Lockout Aquastat Connection 9
002339PDG - WD-Series Piping Connections (Open Loop / Well Water Source) 11
002340PDG - WD-Series Piping Connections (Ground Loop Source) 13
002256SCH-04 - WD-Series Schematic Diagram 208/230-1-60, Rotary Compressor 26
002265SCH - A-Series Transformer/Contactor Kit Schematic Diagram 27
002258RCD - WD-Series Refrigeration Circuit 28

go to TABLE OF CONTENTS

WD-Series System Description

General Overview

The WD-16 heat pump is a water-source heat pump that can fully take over residential domestic hot water (DHW) heating from an electric or gas-fired water heating device. It is a variation on the geothermal space heating Nordic W and WH-series, which have long histories of reliable operation.

Being a water source heat pump that uses higher-temperature R134a refrigerant, it does require a source fluid that is at least 45°F (7°C) year-round. This can be:

- Open loop: water from a water well capable of at least 4 gpm sustained flow, with verified water temperature of 45°F (7°C)
- The hydronic buffer tank of a lower temperature space heating (e.g. in-floor heating) heat pump
- A wastewater stream, e.g. the cooling loop from industrial equipment
- A ground loop, perhaps shared with a larger space heating/cooling geothermal heat pump (see cautions below)

The heat pump will provide all of the heating capacity of a 3000W electric water heating tank. An electric or gas water tank will still be used, to store water heated by the heat pump and provide backup water heating. A typical installation will have the heat pump controlling the power supply to the tank through an accessory transformer/contactor box, so that tank power will be enabled if the heat pump locks out on a safety control or is turned off via its ON/OFF switch. When heat pump is active, tank elements and electronics will be disabled; when tank is enabled because the heat pump is disabled, the tank will operate under its own controls, just as it normally would.

Heating is done with a double-wall brazed plate condenser, which satisfies all plumbing codes for domestic water. With its R134a refrigerant, the heat pump is easily able to heat DHW to its final temperature of 140°F (60°C). The outdoor (source) coaxial heat exchanger is copper / steel with optional CuNi inner tube available.

A bronze head DHW circulator is built in, and will provide adequate flow rate if the heat pump is located within 20 ft (6 m) of the tank. Water temperature sampling is provided by a duty cycle timer, meaning that no external temperature probe is required. The heat pump has built a built in digital aquastat, to turn the heat pump on when input water temperature falls below an adjustable temperature of 120°F (49°C) at the *bottom* of the tank and off when it reaches an adjustable temperature of 140°F (60°C). The aquastat's current water temperature is displayed through a window in the front of the unit. (To adjust aquastat's water temperature settings, cover must be removed.)

The heat pump has a shallow form factor, so that it may be wall mounted to save mechanical room floor space.

Heat Source: Water Well (Open Loop)

Well water can be conveniently used as a medium for the heat pump to extract its heat from, if the well water temperature is above **45°F (7°C).** The groundwater temperature should be verified as the first step in a proposed open loop installation.

Also, the well needs to be able to supply 4 gpm on a continuous basis (3 gpm if water temperature is 54°F / 12°C or greater). This flow capability must be verified by a well test. Well water quality should also be verified. Water can be discharged into a 2nd well, surface runoff, or a body of water.

See **Piping** section for more details.

Heat Source: Hydronic Buffer Tank

Hydronic space heating heat pumps, either air source (ATW-series) or geothermal (W-series), have a buffer tank that is heated to a moderate temperature in heating season and cooled in the summer for air conditioning. This tank can be used as a source for the WD unit.

In the summer, this has the advantage of the combined system heating domestic water using heat removed from the house, thereby greatly increasing the overall efficiency. Cooling load on the main heat pump will be also reduced, which may allow smaller main heat pump sizing in hot climates.

Heat Source: Closed Ground Loop

A closed ground loop is an excellent heat source for the heat pump in warmer climates, where the loop temperature is above **45°F (7°C)** year-round. The WD-16 may be piggybacked onto an existing larger spacing heating ground loop, provided it has spare capacity according to its historical temperature data.

Note that geothermal ground loops in Canada and the northern USA are normally designed to reach minimum temperatures of around freezing (**32°F / 0 °C**) at the end of the heating season. In suitably equipped systems, most or all of the DHW load is satisfied by the desuperheater of the main space heating heat pump when the heat pump has long run times during heating season. In these systems, a WD-series heat pump can still be a good addition, as long as it is locked out using an aquastat when the loop is too cold, and there is some run data indicating the loop warms to **45°F (7°C)** in a timely manner after the end of heating season, either due to cooling mode operation or heat transfer through the ground. In this way, dedicated DHW heating can be added for the shoulder and summer seasons, and domestic hot water can be heated very efficiently year-round.

See **Piping** section for more details.

go to TABLE OF CONTENTS

Installation Basics

Sample Bill of Materials

Although not exhaustive, following is a list of materials needed for a typical installation:

FROM MARITIME GEOTHERMAL
- WD-SERIES HEAT PUMP
- A-231 TRANSFORMER/CONTACTOR KIT
- P/T PORTS

OPTIONAL FROM MARITIME GEOTHERMAL
- COMPRESSOR SOUND JACKET
- COMPRESSOR SECURE START
- GROUND LOOP LOW TEMP. LOCKOUT AQUASTAT
- WATER VALVE (OPEN LOOP ONLY) - RAINBIRD SOLENOID OR HAILIN MOTORIZED

DHW
- ELECTRIC/GAS TANK, 40/60 GAL (IF NOT PRESENT)
- ¾" COPPER OR OTHER HIGH-TEMPERATURE PIPE
- ¾" FITTINGS, BALL VALVES, BOILER DRAINS, CV

SOURCE: OPEN LOOP
- 3/4" BLACK PLASTIC WATER PIPE
- 3/4" BARBED FITTINGS & HOSE CLAMPS
- 3/4" - 1" TEE TO WATER SYSTEM
- DOLE OR HAYS FLOW RESTRICTOR: 3 OR 4 GPM
- WATER SOLENOID VALVE (IF NOT FROM MGL)
- THERMOSTAT WIRE 18-2/18-3 FOR WATER VALVE

OR

SOURCE: CLOSED LOOP
- CIRC PUMP DELIVERING 4 GPM OR GREATER
- ¾" PE PIPE
- PIPE FITTINGS INCL. TEE TO MAIN GROUND LOOP
- ¾" CLEAR HOSE (HEAT PUMP TO CIRC PUMP)
- HOSE CLAMPS
- LOCKOUT AQUASTAT IF GROUND LOOP EXPECTED TO DROP BELOW THE 45°F MIN ELT

ELECTRICAL
- HEAT PUMP SERVICE WIRE: 12-2/12-3
- WATER TANK SERVICE WIRE
- HEAT PUMP BREAKER: 20A
- WATER TANK BREAKER
- THERMOSTAT WIRE 18-2 FOR HEAT PUMP TO A-231
- THERMOSTAT WIRE 18-2 FOR WATER VALVE
- THERMOSTAT WIRE 18-4 (IF AQUASTAT USED)

Unpacking the Unit

When the heat pump and A-231 kit reach their destination, they 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.

Unit Placement

The heat pump must be placed within 20 ft (6 m) of the domestic hot water tank. This, along with the requirement for 3/4" piping, ensure the built-in DHW circulation pump can deliver the flow rate required for efficient operation.

IMPORTANT NOTE: Longer than a 20 ft run to water tank or the use of smaller than nominal 3/4" piping will lead to lower efficiency and/or nuisance high pressure control trips.

The piping between the heat pump and tank must be well insulated to avoid excessive heat loss when sampling is active.

The heat pump is designed to be wall-mounted. See the **Dimensions** section toward the end of this document for mounting bolt pattern on wall. Four 5/16" lag bolts into solid wood or equivalent must be used to carry the significant weight of the heat pump and water in heat exchangers.

CAUTION: Failure to mount the heat pump securely can result in serious injury or flooding hazard.

The heat pump cover should remain unobstructed for a distance of **two feet** to facilitate servicing and general maintenance.

If floor mounted, provision should be made to eliminate tipping hazard. Raising the indoor unit off the floor a few inches is generally a good practice since this will prevent rusting of the bottom panel of the unit and deaden vibrations. A piece of 2" Styrofoam can be placed under the unit.

go to TABLE OF CONTENTS

Wiring

Heat Pump Power Supply Connections

The unit has a 7/8" knockout for main power supply connection to the electrical box. There are also a 7/8" knockout and a 1/2" opening with plastic grommet (grommet hole is 3/8") for control and ground loop circulator connections.

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

IMPORTANT NOTE: A properly qualified electrician should be retained for all connections to the heat pump and associated controls. The connections to the unit MUST CONFORM TO LOCAL CODES.

TABLE 1 - Power Supply Connections		
Line	**Description**	**Comments**
L1	**Line 1**	
L2	**Line 2**	
N**	**Neutral**	** Only required if connecting a 115VAC ground loop circulator
GND	**Ground**	Connect to ground lug

Tank Power Supply Connections

The domestic water tank, whether electric or gas with electronic ignition, will be wired so that its electrical power (and thus its ability to heat domestic water) can be turned on and off by the heat pump. In this way, it can take over water heating duties if the heat pump experiences a safety control trip, or when heat pump is turned off via its ON/OFF switch or breaker. However, it will not be able to come on while the heat pump is active, avoiding the operating cost of unintentional operation.

The tank will have its own breaker and power supply wire, separate from the heat pump. Many 3000W electric water heating tanks require a 20A breaker with #12 wire, but this should be verified based on tank model by an electrician. Gas tanks may have a different breaker and wire size for the electronic ignition.

Tank power will be connected from the supply breaker to the A-231 Accessory Contactor Box available from Maritime Geothermal Ltd., and from there to the tank. If electrical supply to the tank is other than 208/230-1-60, other accessory contactor box numbers are available (listed on the A-Series Schematic Diagram toward the end of this manual). See wiring diagram on following page.

Tank / A-231 Control Connections

The heat pump will control the tank (through the A-231 accessory box) using dry contacts. Use an 18-2 thermostat wire to connect terminals D1 and D2 in the heat pump electrical box with the matching terminals in the A-231 contactor box. See wiring diagram on following page.

TABLE 2 - Tank / A-231 Control Connections	
Signal	**Description**
D1	**Dry contact to control tank power**
D2	**Dry contact to control tank power**
Use a 2-conductor 18ga cable.	

DHW Circulator Wiring

The DHW circulator pump is built in to the heat pump, so no field wiring is required.

Ground Loop Circulator Wiring

A ground loop circulator is only required when the heat source is a ***closed ground loop***. Power is supplied from the terminal strip in the heat pump's electrical box, so that the circulator is powered with the compressor.

Wire the pump to the appropriate 115V or 230V terminals using 14-2 BX cable, as shown in the wiring diagram on following page. Connect ground wire to ground lug.

Water Valve Wiring

A water valve is only required when the heat source is an ***open loop (water well)***. For both of the following types of valves, the wires may be run out the wiring knockout on **right hand** side of the cabinet, so that it comes out near the OUTDOOR OUT connection where the water valve is located.

a) Solenoid (Rainbird) Valve

A fast acting solenoid valve can be used, due to the low potential for water hammer at the low flow rate of the WD-16 heat pump.

Connect the solenoid valve to the C and V terminals in the heat pump electrical box using 18-2 thermostat wire, as shown in the wiring diagram on following page.

a) Motorized (Hailin) Valve

An economical motorized ball valve is available as an accessory from Maritime Geothermal Ltd.. This is a bit slower closing than a solenoid valve to avoid any water hammer, but does require a dedicated 2VAC power wire (R).

Connect the valve to the C, Rv, and V terminals in the heat pump electrical box using 18-3 thermostat wire, as shown in the wiring diagram on following page.

Control Transformer

The low voltage controls are powered by a 40VA class II transformer in the heat pump's electrical box. The same type of transformer is used to power the tank contactor in the A-231. Transformers are impedance protected, so must be replaced if accidentally shorted out.

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

go to TABLE OF CONTENTS

DHW Aquastat

Since this aquastat is built in, no field wired aquastat or temperature probe is required.

In normal working mode, the aquastat displays the current water IN temperature, and this display is visible from outside the unit with cover on. The value will vary slightly, and will most accurately reflect the water temperature at the bottom of the tank at the end of the sampling ON cycle.

To make adjustments, remove the cover of the unit.

- Press the **UP** arrow to check the water setpoint temperature.
- Press the **DOWN** arrow to check the temperature differential. (The heat pump will come on when the water temperature falls below the setpoint by the differential, and will heat the tank back up to the setpoint.)
- To change settings, press and hold the **S** button for 3 seconds. Use the arrow keys to select setting F1-F6 (see below table). Press **S** to display current value. To change that value, press and hold **S** while simultaneously pressing an arrow key. Press ⏻ to save the setting and return to normal display.

Note that when the ON/OFF switch is in the OFF position, the aquastat display will turn off. Settings will be retained.

TABLE 3 - DHW Aquastat Settings	
F1	Setpoint temperature (degrees)
F2	Temperature differential (degrees)
F3	Compressor delay time (minutes)
F4	Temperature calibration value (degrees)
F5	°F / °C
F6	High temperature alarm ON/OFF (not used)

TABLE 4 - DHW Aquastat Setpoints		
	°F	**°C**
Setpoint (F1)	**120 - 140**	**49 - 60**
Differential (F2)	**10**	**5**
Activation*	**110 - 130**	**43 - 54**
* Activation is determined by the Setpoint & Differential values		

Optional Ground Loop Aquastat

If using the WD-series heat pump where the source (ground loop) temperature might seasonally fall below the minimum of ~45°F, an additional aquastat may be used to deactivate the heat pump to avoid nuisance low pressure safety control trips, and also activate the tank elements or burner to provide DHW heating while the heat pump is disabled.

A single stage aquastat may be used. If a 2-stage aquastat is used, wire and use only stage 1.

To add this low temperature protection, remove the jumper between **Rv** and **R** at the heat pump terminal strip. Connect the aquastat using 18-3 thermostat wire as shown in the table and on the diagram on following page.

Tightly strap the aquastat probe to the ***main ground loop pipe coming in from the ground loop***. If ground loop is shared, it should be a common pipe that experiences flow if either heat pump is operating . Completely insulate that section of pipe with probe. The best results will be obtained if probe is strapped to a metal fitting, or better, inserted into a dry well in the pipe. Poor contact with the ground loop fluid or poor insulation will result in excessive cycling (turning on and off) of the heat pump.

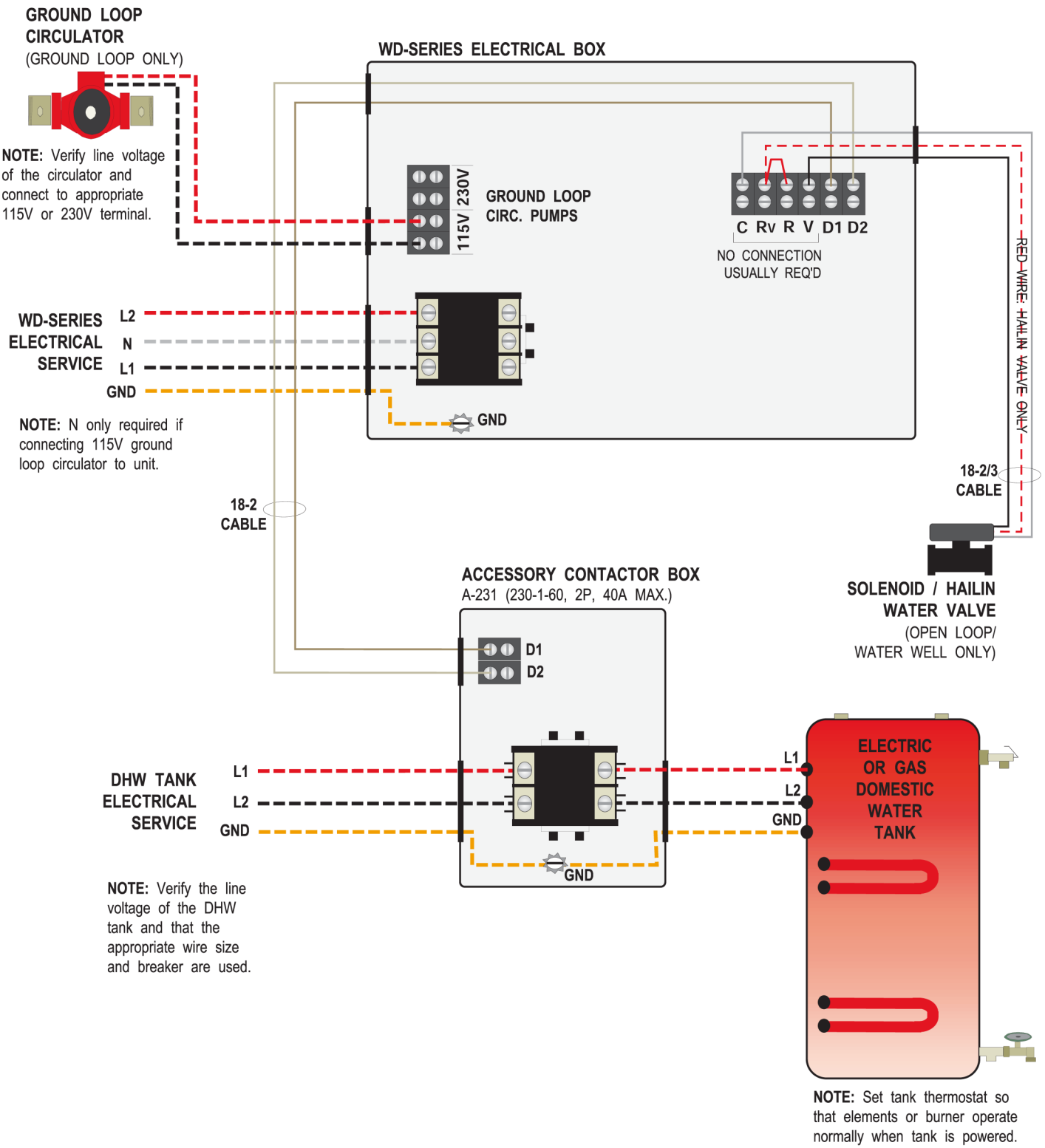
Put the aquastat in **cooling** mode, and set as per following table.

TABLE 5 - Opt. Ground Loop Aquastat Connections		
Heat Pump	**Aquastat**	**Description**
C	**COM**	**24VAC common (ground)**
*** R_V**	**24V, STAGE 1 C**	**24VAC from transformer**
*** R**	**STAGE 1 NO**	**24VAC to heat pump**
Use a 3-conductor 18ga cable. *** Remove wire jumper between R_T and R at heat pump.**		

TABLE 6 - Opt. Ground Loop Aquastat Setpoints				
	Stage 1		**Stage 2 (not used)**	
	°F	**°C**	**°F**	**°C**
MODE	**COOLING**		**-**	**-**
Setpoint	**45**	**7**	**-**	**-**
Delta	**5**	**3**	**-**	**-**
Activation*	**50**	**10**	**-**	**-**
* Activation is determined by the Setpoint and Delta values				

go to TABLE OF CONTENTS

WD-Series Wiring Connections



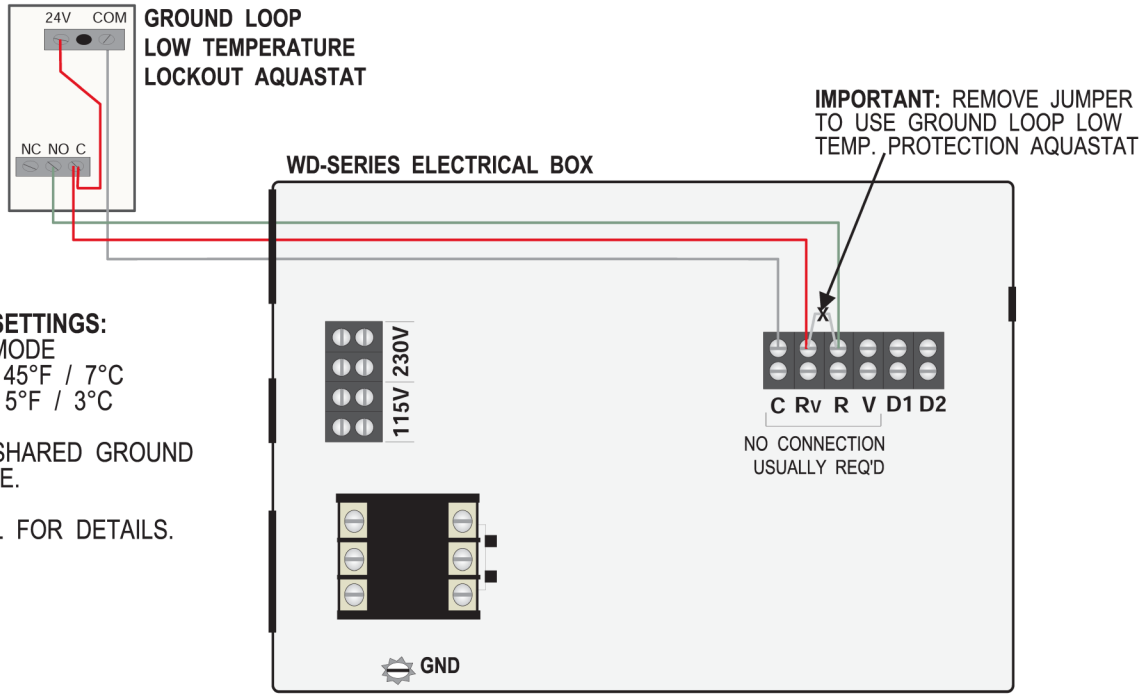
REV	ECO #	IMPL BY	APVD BY	DATE
02	Prod. Release	Dan Rheault	Dan Rheault	26-Jun-2020
01	Initial Release	Dan Rheault	Dan Rheault	30-Aug-2018

Drawn By: Dan Rheault	Date: 30-Aug-2018	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 30-Aug-2018	Drawing Name: WD-Series Wiring Connections
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	

Size	Drawing Number	Drawing Rev	Sheet
A	002341CDG	02	1 of 1

go to TABLE OF CONTENTS

WD-Series Ground Loop
Low Temperature Lockout Aquastat Connection



AQUASTAT SETTINGS:
- COOLING MODE
- SETPOINT: 45°F / 7°C
- DELTA: 5°F / 3°C

PROBE ON SHARED GROUND LOOP IN PIPE.

SEE MANUAL FOR DETAILS.

REV	ECO #	IMPL BY	APVD BY	DATE
02	Prod. Release	Dan Rheault	Dan Rheault	26-Jun-2020
01	Initial Release	Dan Rheault	Dan Rheault	31-Aug-2018

Drawn By Dan Rheault	Date 31-Aug-2018	
Checked By Dan Rheault	Date 31-Aug-2018	
Approved By (ENG)	Date	
Approved By (MFG)	Date	
Approved By	Date	

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

Drawing Name: WD-Series Ground Loop Aquastat Connection

Size	Drawing Number	Drawing Rev	Sheet
A	002342CDG	02	1 of 1

go to TABLE OF CONTENTS

Piping

Domestic Hot Water Piping

The connections for the DHW Loop circuit are 3/4" brass FNPT. They are labelled as DHW IN and DHW OUT.

The heat pump works by pumping water from the bottom of the tank, and heating it using the double wall brazed plate condenser. The built in bronze head circulation pump then returns the heated water to the bottom of the tank. In the tank, the hottest water will naturally migrate to the top of the tank, from where it will be supplied to the house.

Since the water in the bottom of the tank could be as cold as the cold water supply, it cannot be assured that water returned from the heat pump will be heated to its final temperature. For this reason, the water must be returned to the bottom of the tank, not the top (unlike in a hydronic space heating buffer tank). Returning water to the top of the tank will result in unpleasant variations in the hot water temperature supplied to the house.

The piping between the heat pump and tank needs to be high-temperature nominal 3/4" or larger piping, with a run in each direction of less than 20 ft (6 m). If this is not observed, the built-in circulator will not be able to supply the 4 gpm flow rate necessary for efficient and trouble-free operation.

The piping between the heat pump and tank must be well insulated to avoid excessive heat loss when sampling is active.

WARNING: FOR DHW LOOP, USE ONLY COPPER OR OTHER PIPING WITH 200°F RATING, SUITABLE FOR POTABLE WATER. MELTING & RUPTURING OF UNSUITABLE PLASTIC PIPING WILL LEAD TO FLOODING.

IMPORTANT NOTE: Longer than a 20 ft run to water tank or the use of smaller than nominal 3/4" piping will lead to lower efficiency and/or nuisance high pressure control trips.

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.

In the following diagrams, note that there is no shutoff ball valve in the DHW OUT pipe. Effective shutoff may still be achieved by closing the cold water supply to the tank.

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

Outdoor Piping - Open Loop

Well water can be conveniently used as a medium for the heat pump to extract its heat from, if the well water temperature is above **45°F (7°C).** Groundwater temperatures across the Canadian prairie provinces and Northern Ontario may be too cold, although in any area local exceptions will exist. The groundwater temperature should be verified as the first step in a proposed open loop installation.

The well needs to be able to supply 4 gpm for the heat pump source and 3 gpm for household usage (total 7 gpm) on a continuous basis. Source flow can be reduced by 1 gpm if the water temperature is 54°F (12°C) or greater, for a total of 6 gpm. This flow capability must be verified by flowing the well for as long as possible (e.g. 12 hours) at the flow rate required, and measuring the pumping fluid level to ensure it is still well above the submersible pump intake.

Well water quality should also be verified. First, **solids or TDS should be less than 1 ppm (1 mg/L)** if a return well is used. To avoid scale formation on the inside of the heat pump's outdoor loop coil, **total hardness should be less than 350 ppm / 350 mg/L**. In practice, scaling is very rarely a problem in the outdoor loop because scale does not generally form at low well water temperatures; however, this is more likely to be a problem for the DHW loop exchanger with its higher temperatures. Should scale form, heat pump performance will gradually deteriorate, and will require periodic flushing with a calcium/lime removing solution (see Routine Maintenance section). Finally, corrosive (salty) water can cause failure of heat exchangers, leading to loss of refrigerant and water entering the refrigeration circuit, which ruins the heat pump. **If chlorides exceed 20 ppm (20 mg/L), or significant Ammonia (>0.5 ppm) or H_2S (>0.2 ppm) is present, the use of a DHW heat pump should be reconsidered.**

The water discharged on the outdoor loop is clean; the heat pump has no effect other than reducing the temperature of the water. It can be discharged into a 2nd well, surface runoff (drain, ditch, leaching field), or a lake or stream. It should not be returned to the source well, since this will eventually cool the water so much that the heat pump will shut off on its low pressure safety control. **ENSURE SELECTED METHOD CONFORMS TO LOCAL REGULATIONS.**

Water flow through the heat pump is turned on and off by a water valve, which is controlled by a 24VAC signal from the heat pump (see previous chapter). It should be installed on the **OUT** pipe of the heat pump, so that the heat exchanger remains full of water at all times. Both a fast-acting 'Rainbird' solenoid valve or slower Hailin motorized ball valve are available as accessories and are recommended for this application.

A flow restricting ('Dole') valve is required downstream of the water valve. This is a passive (non-electrical) device which automatically varies the size of its rubber orifice in order to restrict flow to its stamped gpm value, regardless of water pressure. This is important in order to conserve water and provide backpressure to the water system, which could otherwise be too low for the comfort of people taking showers or otherwise using the domestic water system. Use a 4 gpm Dole valve, or 3 gpm if well water temperature is 54°F (12°C) or greater.

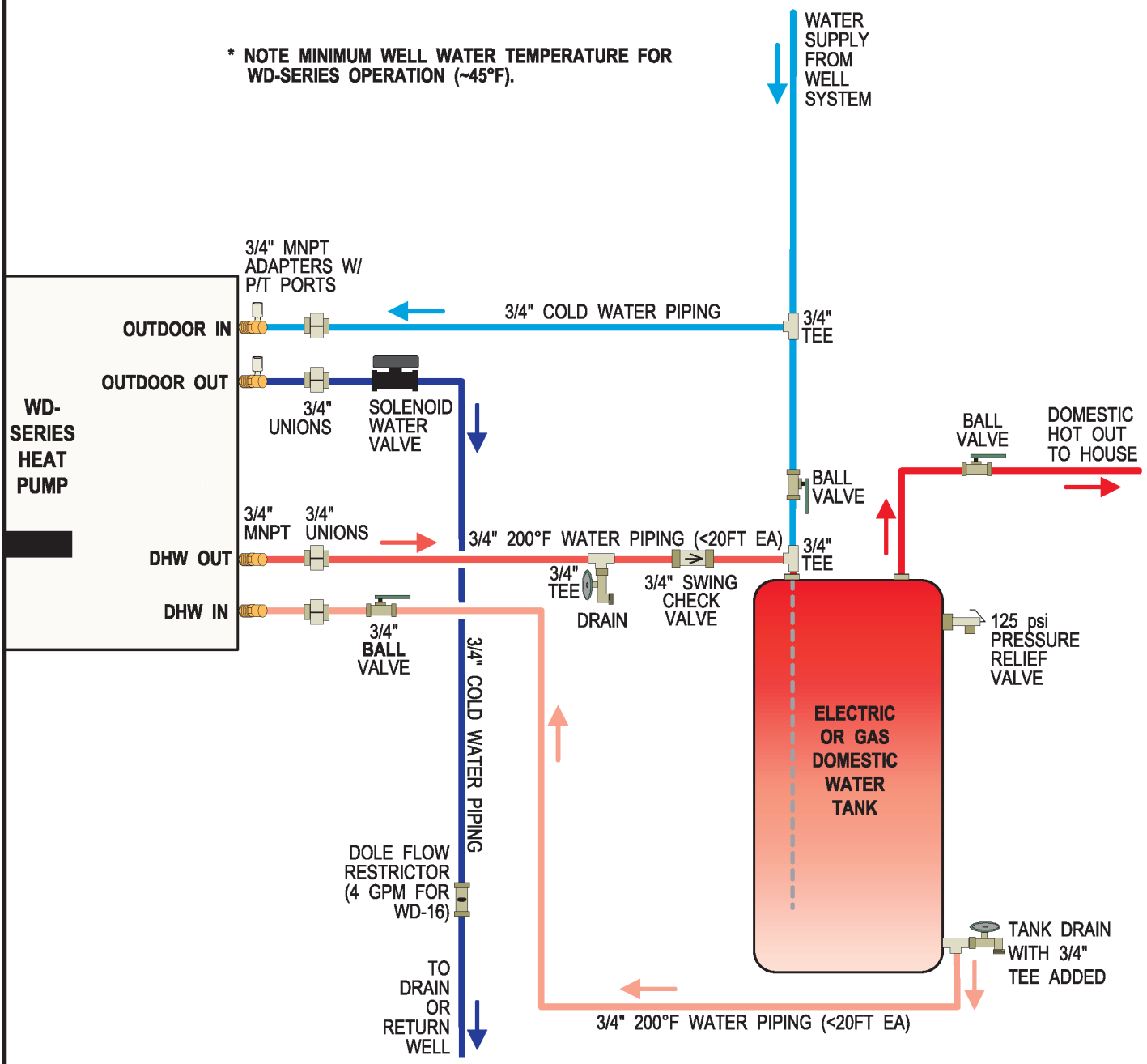
The use of a variable speed submersible pump is recommended, which varies its speed to maintain a constant water system pressure. A traditional fixed speed submersible pump (or jet pump, if it can supply the flow required) can be used, but since it will almost certainly be oversized, it will cycle on and off continuously, which may shorten its service life. This problem can be mitigated somewhat by installing the largest air bladder tank available, or installing a mechanical 'cycle stop' valve upstream of the air bladder / pressure tank which varies its orifice to put backpressure on the pump during periods of low flow in order to keep it from cycling off.

The connections for the Outdoor Loop circuit are 3/4" brass FNPT. They are labelled as OUTDOOR IN and OUTDOOR OUT. P/T ports should be installed at the heat pump's outdoor loop ports, so that temperature and pressure drop can be easily measured.

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

go to TABLE OF CONTENTS

WD-Series Piping Connections
(Open Loop / Well Water Source)



REV	ECO #	IMPL BY	APVD BY	DATE
02	000313	D. RHEAULT	D. RHEAULT	1-Jul-2023
01	ISSUE 02	D. RHEAULT	D. RHEAULT	14-Apr-2022
01	Initial Release	D. RHEAULT	D. RHEAULT	29-Aug-2018

Drawn By: Dan Rheault	Date: 29-Aug-2018	
Checked By: Dan Rheault	Date: 29-Aug-2018	
Approved By (ENG): Dan Rheault	Date: 29-Aug-2018	
Approved By (MFG):	Date:	
Approved By:	Date:	

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

Drawing Name: WD-Series Piping Connections (Open Loop)

Size	Drawing Number	REV	SHEET
A	002339PDG	02	1 of 1

go to TABLE OF CONTENTS

Outdoor Piping - Ground Loop

A closed ground loop is an excellent heat source for the heat pump in warmer climates, where the loop temperature is above **45°F (7°C)** year-round. The WD-16 may be piggybacked onto an existing larger spacing heating ground loop, provided it has spare capacity according to its historical temperature data.

Note that geothermal ground loops in Canada and the northern USA are normally designed to reach minimum temperatures of around freezing (**32°F / 0 °C**) at the end of the heating season. In suitably equipped systems, most or all of the DHW load is satisfied by the desuperheater of the main space heating heat pump when the heat pump has long run times during heating season. In these systems, a WD-series heat pump can still be a good addition, as long as it is locked out using an aquastat when the ground loop is too cold, and there is some run data indicating the loop warms to **45°F (7°C)** in a timely manner after the end of heating season, either due to cooling mode operation or heat transfer through the ground. In this way, dedicated DHW heating can be added for the shoulder and summer seasons, and domestic hot water can be heated very efficiently year-round.

This document will provide notes on piggybacking onto an existing larger ground loop. For full details on ground loops, refer to the residential W-series or R-series manuals available at **www.nordicghp.com**.

The WD-series heat pump should be connected to the existing ground loop in parallel with the main space heating heat pump. Each heat pump should have its own circulation pump or pump pack. The WD-16 can use a modestly sized circulator due to its lower required flow rate.

There must be a check valve added to each heat pump's circuit, as shown in the diagrams, to ensure that when only one heat pump's circulator is operating, flow does not go back through the other heat pump instead of through the ground loop.

Antifreeze is not required for the WD-16, because of its higher minimum operating temperature. However, there will be antifreeze in the ground loop if the main heat pump requires it. See installation manual for that unit.

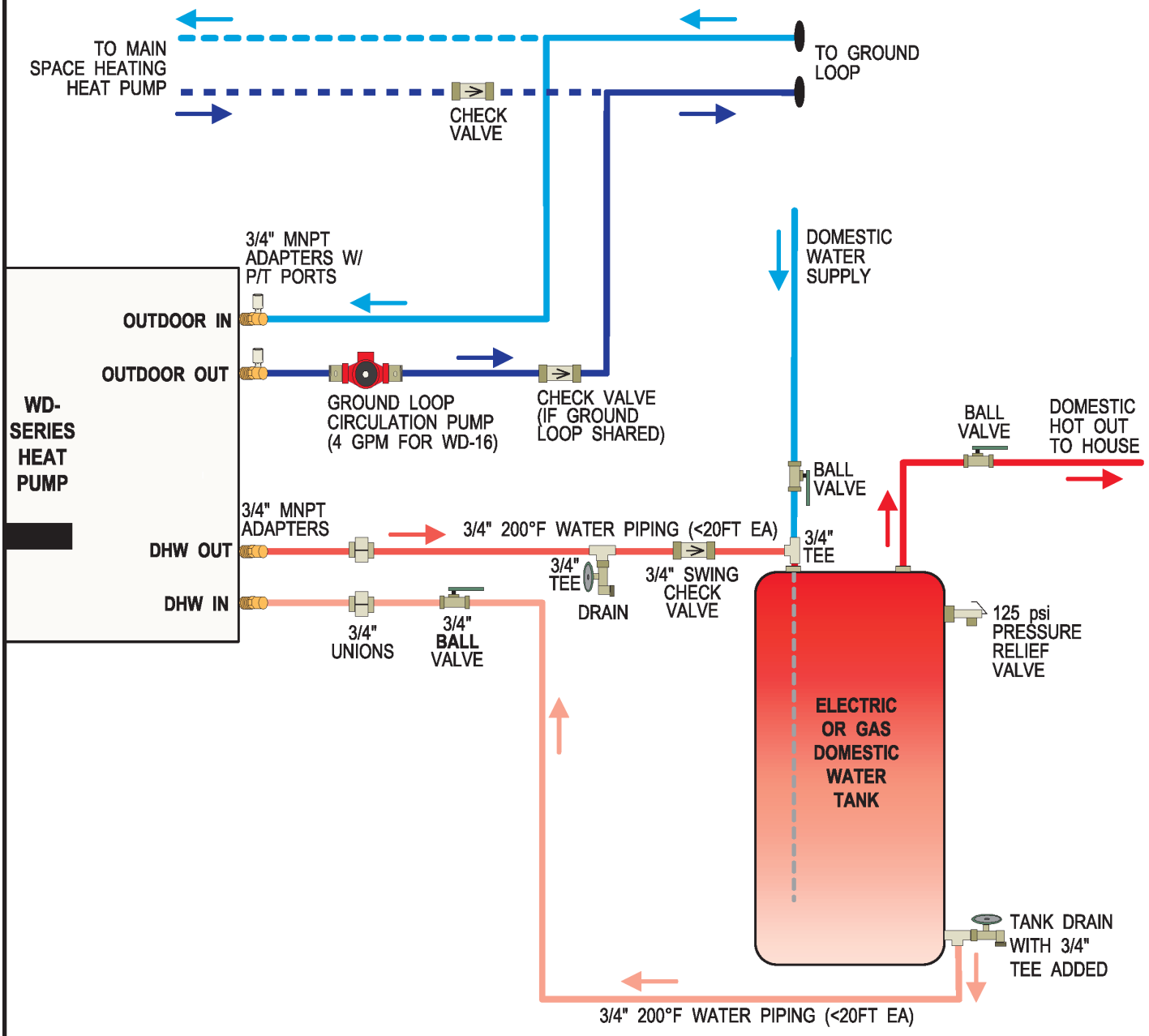
The installation of P/T plugs/ports (pressure / temperature, pronounced "*Pete's plugs"*) is recommended on both the entering and leaving lines at the heat pump. This will allow the installer or homeowner to check water flow through the loop by measuring the pressure difference through the heat exchanger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

After WD connection, the loop must be re-purged of air using the standard procedures.

go to TABLE OF CONTENTS

WD-Series Piping Connections (Ground Loop Source)

*** NOTE MINIMUM OUTDOOR LOOP TEMPERATURE FOR WD-SERIES OPERATION.**
IF GROUND LOOP IS DESIGNED TO APPROACH MINIMUM TEMPERATURE OF ~45°F, USE AQUASTAT TO LOCK OUT WD UNIT AT LOW LOOP TEMPERATURES TO AVOID NUISANCE SAFETY CONTROL TRIPS.



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Drawn By: Dan Rheault	Date: 29-Aug-2018	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 29-Aug-2018	Drawing Name: WD-Series Piping Connections (Ground Loop)
Approved By (ENG): Dan Rheault	Date: 29-Aug-2018	
Approved By (MFG):	Date:	
Approved By:	Date:	

Size	Drawing Number	REV	SHEET
A	002340PDG	02	1 of 1

go to TABLE OF CONTENTS

Startup Procedure

The startup record 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..

Pre-Start Inspection

DHW Loop:

1. Verify that the heat pump is located within 20 ft (6 m) of the water tank, and that 3/4" or larger piping has been used for the connection from the heat pump to tank.
2. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the DHW tank.
3. 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.

Outdoor Loop (Ground Loop):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the ground loop, and that full flow is available to the heat pump.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Antifreeze is not required for the WD-series, but may be present in the ground loop. Note that the WD-series requires a 45°F (7°C) minimum entering liquid temperature on the source (ground loop) side.
4. Record the static loop pressure on the startup sheet.

Outdoor Loop (Open Loop):

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

Electrical:

1. **Ensure the power to the unit is off.**
2. Verify all high voltage connections. Ensure that there are no stray wire strands, all connections are tight and the ground wire is connected tightly to the ground connector.
3. Record the fuse / circuit breaker size and wire gauge for the heat pump.
4. Verify that the control connections (if used) are properly connected and all control signals are off.
5. Verify that the circulator pumps are connected to the proper voltage terminals in the heat pump. Record the voltages of the circulator pumps.

Unit Startup

It is recommended that safety glasses be worn during the following procedures.

Preparation:

1. Remove the caps from the service ports and connect a refrigeration manifold set to the unit.

Operation:

1. Turn the power on to the heat pump. Note that the unit may start up automatically within 6 minutes, if using the built-in temperature switch for control.
2. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.
3. If using an external aquastat for control, set the heating aquastat setpoints to activate Y; otherwise, unit will start if tank temperature is below 120°F. The water valve will open, and compressor and outdoor circulator will start.
4. Check the refrigeration gauges. The suction and discharge pressures will depend on the loop temperatures, but they should be about **35-70 psi** and **150-250 psi** respectively for a typical start-up.
5. Verify the DHW IN and DHW OUT temperatures 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.
6. Monitor the refrigeration gauges while the unit runs. Record the requested data on the startup sheet after 10 minutes of runtime.

Final Inspection:

1. Turn the power off to the unit and remove all test equipment.
2. Install the electrical box cover and the heat pump cover. Install the service port caps securely to prevent refrigerant loss.
3. Do a final check for leaks in the ground water / ground loop system and ensure the area is clean.
4. Turn the power on to the unit. Set the aquastat to its final setting (if used) and record the values.

Startup Record:

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

go to TABLE OF CONTENTS

Startup Record Sheet - WD Series

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 #**			

PRE-START INSPECTION

DHW System	All shut-off valve are open (full flow available)					
	Heat pump and piping are full and purged of air					
	Water system static pressure		psi	kPa		
Ground Loop System	All shut-off valve are open (full flow available)					
	Loop is full and purged of air					
	Loop static pressure		PSI	kPa		
Ground Water System	Water Valve installed in OUT line					
	Flow control installed in OUT line					
Electrical	High voltage connections are correct and securely fastened					
	Circuit breaker (or fuse) size and wire gauge for Heat Pump		A		Ga.	
	Outdoor circulator pump voltage		V			
	Low voltage connections are correct and securely fastened					

STARTUP DATA

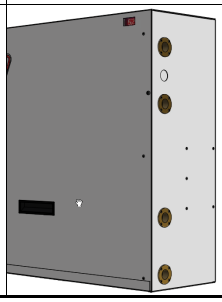
Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3							VAC
Operation (10 minutes)	Suction Pressure / Discharge Pressure					psig	kPa	
	DHW In, DHW Out, Delta T		In		Out		°F	°C
	Outdoor In (Supply In), Outdoor Out (Supply Out), Delta T		In		Out		°F	°C
	Outdoor Flow		Igpm	USgpm		L/s		
	Compressor L1 (black wire) current		A					
	Heating aquastat setpoint and discharge pressure at cycle end		°F	°C		psig	kPa	
Final Aquastat Settings (if used)	Heating S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C	
	Cooling S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta					°F	°C	

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

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

go to TABLE OF CONTENTS

Routine Maintenance

MAINTENANCE SCHEDULE			
Item		**Interval**	**Procedure**
Compressor Contactor		1 year	Inspect for pitted or burned points. Replace if necessary.
Heat Exchangers (DHW Brazed Plate *or* Outdoor Loop Coaxial Coil)		When experiencing performance degradation that is not explained by a refrigeration circuit problem or low loop flow rate	Disconnect the loop and flush heat exchanger with a calcium removing solution. Generally not required for outdoor closed loops or cold water outdoor open loop systems; whenever system performance is reduced for DHW loop or warm water outdoor open loop systems. See instructions below.

Heat Exchanger Flushing Procedure - DHW Loop or Outdoor Open Loop

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

Heat Exchanger Flushing Procedure - Outdoor Closed Ground Loop

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

go to TABLE OF CONTENTS

Troubleshooting Guide

Repair procedures and reference refrigeration circuit diagrams can be found at the end of the troubleshooting guide.

STEP 1: Remove the cover and verify that there is power to the heat pump, referring to POWER SUPPLY TROUBLESHOOTING below. If ok, proceed to STEP 2.

STEP 2: Check to see if there is a fault code on the control board. If there is, record the fault code. Turn the power off, wait 10 seconds and turn the power back on.

STEP 3: If the tank temperature is below 120F or below the aquastat setting (if used), and a 24VAC signal does not appear across Y and C of the terminal strip within 1 minute, proceed to the THERMOSTAT TROUBLESHOOTING section, otherwise proceed to STEP 4.

STEP 4: If a fault code appears once a signal is present at Y and the compressor does not attempt to start, proceed to the FAULT CODE TROUBLESHOOTING section, otherwise proceed to STEP 5.

STEP 5: If no fault codes appear 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.

NOTE: To speed up the troubleshooting process, the TEST jumper on the safety board can be placed to the YES position to change the anti-short cycle timer to 5 seconds. **Be sure to set it back to NO when servicing is complete**. Be aware that if left in the TEST position, functionality may automatically revert back to standard operation after a short period of time; remove jumper, install in standard position, run unit, and replace jumper in TEST position to re-activate.

POWER SUPPLY TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No 230VAC power at compressor contactor	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 24VAC between R and C on terminal strip	Faulty transformer or transformer impedance protection tripped.	230VAC is present across L1 and L2/L3 of the compressor contactor but 24VAC is not present across Rv and C on the terminal strip.	Replace transformer.

go to TABLE OF CONTENTS

BUILT-IN AQUASTAT TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
No display on aquastat (if used)	No power to heat pump.	230VAC is not present across L1 and L2/L3 of the compressor contactor.	Check breaker, wiring, and disconnect switch.
	Faulty aquastat.	230VAC is present across L1 and L2/L3 of the compressor contactor but there is no display on aquastat	Replace aquastat.
No Y signal to heat pump control board	Incorrect aquastat setup.	Water temperature is cold, aquastat display is on but does not indicate red dot beside HEAT on the display.	Correct the setup (see **Wiring** chapter).
	ON/OFF switch on heat pump is turned off.	Inspect switch, located on heat pump cabinet.	Turn switch on.
	Faulty aquastat.	24VAC on pin 5 of aquastat, red dot is displayed beside HEAT, but no 24VAC output on pin 6.	Replace aquastat.

FAULT CODE TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
Fault Code 1 (High Pressure Control)	**High operating refrigerant pressure**	Using a refrigeration gauge set, verify that high pressure approaches or exceeds 375 psi with compressor on.	See “High Discharge Pressure” in Operation Troubleshooting section.
	Faulty High Pressure Control (open). * For this test there must be a signal present on Y, but compressor should not be running (disconnect compressor power plug).	Verify that there is 24VAC across HPS (right terminal) on the control board and C of the terminal strip, as well as HPS (left terminal) and C.	Replace high pressure control if voltage is present on one terminal but not the other.
	Faulty control board.	24VAC is present across HPS (right terminal) and C of the terminal strip, as well as HPS (left terminal) and C, but is not present across V and C on terminal strip after 10 minutes.	Replace control board.
Fault Code 2 (Low Pressure Control)	Little or no refrigerant in unit.	With compressor off, use a refrigeration gauge set to check refrigeration pressure of the unit for a very low value (less than 50 psi).	Locate the leak and repair it. Spray 9, a sniffer, and dye are common methods of locating a leak.
	Faulty Low pressure control (open). * For this test there must be a signal present on Y, but compressor should not be running (disconnect compressor power plug).	Verify if there is 24VAC across LPS on the control board and C of the terminal strip, as well as HPS (left terminal) and C.	Replace high pressure control if voltage is present on one terminal but not the other.
	Faulty control board.	24VAC is present across LPS and C of the terminal strip, as well as HPS (left terminal) and C, but is not present across V and C on terminal strip after 10 minutes.	Replace control board.
Fault Code 5 (Brownout)	Low voltage from the electrical grid.	Verify that the electrical supply has dropped below ~165VAC, causing transformer voltage to drop below 18VAC.	Contact electrical utility or wait for regular service to be restored.
Fault Code 6 (Low flash line temperature)	Low operating suction temperature.	Using a thermometer, verify that TXV flash line temperature is close to or below freezing.	See “Low suction temperature” in Operation Troubleshooting section.

go to TABLE OF CONTENTS

COMPRESSOR TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
Compressor will not start	Faulty control board.	Measuring from C on the terminal strip, verify there is voltage at Y, HP1, HP2, LP1, LP2, and both flow pins but no voltage present at CC.	Replace control board.
	Faulty run capacitor. (Single phase only)	Check value with capacitance meter. Should match label on capacitor. Compressor will hum while trying to start and then trip its overload.	Replace if faulty.
	Loose or faulty wiring.	Check all compressor wiring, including inside compressor electrical box.	Fix any loose connections. Replace any damaged wires.
	Faulty compressor contactor.	Voltage on line side with contactor held closed, but no voltage on one or both terminals on the load side. Points pitted or burned. Or, 24VAC across coil but contactor will not engage.	Replace contactor.
	Thermal overload on compressor tripped.	Ohmmeter shows reading when placed across R and S terminals and infinity between C & R or C & S. A valid resistance reading is present again after the compressor has cooled down.	Proceed to Operation Troubleshooting to determine the cause of the thermal overload trip.
	Burned out motor (open winding)	Remove wires from compressor. Ohmmeter shows infinite resistance between any two terminals. Note: Be sure compressor overload has had a chance to reset. If compressor is hot, this may take several hours.	Replace the compressor.
	Burned out motor (shorted windings)	Remove wires from compressor. Resistance between any two terminals is below the specified value.	Replace the compressor.
	Motor shorted to ground.	Remove wires from compressor. Check for infinite resistance between each terminal and ground.	If any terminal to ground is not infinite replace the compressor.
	Seized compressor due to locked or damaged mechanism.	Compressor attempts to start but trips its internal overload after a few seconds. (Run capacitor already verified)	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.
Compressor starts hard	Start capacitor faulty. (Single phase only)	Check with capacitance meter. Check for black residue around blowout hole on top of capacitor.	Replace if faulty. Remove black residue in electrical box if any.
	Potential Relay faulty. (Single phase only)	Replace with new one and verify compressor starts properly.	Replace if faulty.
	Compressor is “tight” due to damaged mechanism	Compressor attempts to start but trips its internal overload after a few seconds. Run capacitor has been verified already.	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.

go to TABLE OF CONTENTS

OPERATION TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
High Discharge Pressure	Aquastat setpoint too high.	Verify aquastat setting.	Lower aquastat setpoint to recommended value of **140°F (60°C).**
	Low or no indoor loop flow.	Delta T across the Indoor Loop ports should be 4-12°F (2-6°C), or compare pressure drop to the tables for the unit.	Verify built-in circ. pump is working. Check that 3/4" pipe is used to tank, and distance to tank is < 20ft. Check for restrictions in the circuit, e.g. valve partially closed.
	Double wall condenser plugged by calcium scale.	High pressure drop across DHW ports on heat pump, scale visible on inside of DHW ports when pipes disconnected.	Flush DHW heat exchanger as described in the **General Maintenance** section.
	TXV adjusted too far closed.	Verify superheat. It should be between 8-12°F (3-6°C). Superheat will be high if TXV is closed too far.	Adjust TXV to obtain 8-12°F (3-6°C) superheat.
	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Filter-dryer plugged.	Feel each end of the filter-dryer: it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Unit is overcharged. (Only possible if unit has been serviced in the field and incorrectly charged.)	High sub-cooling, low delta T across air coil.	Remove 1/4 lb of refrigerant at a time and verify that the discharge pressure reduces.
Low Suction Temperature	Low or no outdoor liquid flow	Delta T across the Outdoor Loop ports should be 3-9°F (2-5°C), or compare pressure drop to the tables for the unit.	Determine the cause of the flow restriction and correct it. Verify outdoor loop pump is working for ground loop systems. Verify well pump and water valve are working for ground water systems, and that flow restrictors (e.g. Dole valves) are not plugged or undersized.
	Loop entering liquid temperature too cold.	Measure the entering liquid temperature. Should be 45°F (7°C) or greater.	Use a different source fluid loop, or install a low temperature lockout aquastat.
	Dirty or fouled coaxial heat exchanger (more likely for open loop, unlikely for ground loop)	High pressure drop across outdoor loop ports on heat pump, scale visible on inside of outdoor loop ports when pipes disconnected.	Flush outdoor heat exchanger as described in the **General Maintenance** section.
	Indoor loop entering liquid temperature too cold	Measure temperature. Should be above 45°F (7°C).	Restrict indoor liquid flow temporarily until DHW tank comes up to temperature, or use electric elements to bring tank to above minimum temperature.
	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.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
Low Suction Pressure (Loss of Charge)	Low refrigerant charge.	Entering liquid temperature and flow on both loops are good but suction pressure is low. 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.

go to TABLE OF CONTENTS

OPERATION TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High Suction Pressure (may appear to not be pumping)	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.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Compressor frosting up	See Low Suction Temperature 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.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
Random high pressure trip (does not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it shouldn't, tripping the high pressure control.	Replace contactor.
	Intermittent Indoor circulator.	Verify wiring is good.	Correct the wiring or replace the circulator.
Domestic hot water is too hot	Faulty built-in aquastat - failed closed.	Check contact operation. Should open and close according to its F1 and F2 settings.	Replace aquastat if faulty.

go to TABLE OF CONTENTS

Repair Procedures

Pumpdown Procedure

1. Connect the refrigerant recovery unit to the heat pump's internal service ports via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. Plan to dispose of refrigerant if there was a compressor burnout.
2. All refrigerant to water heat exchangers (brazed plates) **must either have full flow or be completely drained** of fluid before recovery begins. Failure to do so can freeze and rupture the heat exchanger, voiding its warranty.
3. Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual.
4. 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.
5. Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive gauge pressure of 5-10 psig is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected.

The heat pump is now ready for repairs.

General Repair Procedure

1. Perform repairs to system.
   - Always ensure nitrogen is flowing through the system at the lowest flow rate that can be felt at the discharge during any brazing procedures to prevent soot buildup inside the pipes.
   - It is recommended to replace the liquid line filter-dryer any time the refrigeration system has been exposed to the atmosphere.
   - Place a wet rag around any valves being installed, as almost all valve types have non-metallic seats or seals that will be damaged by excessive heat, and aim the torch flame away from the valve body. Solder only one joint at a time and cool joints down in between.
2. Pressure test the system with nitrogen. It is recommended to check for leaks using leak detection spray, Spray Nine, or soapy water. Check at 10, 25, 50 and 100 psig. Allow the system to sit at 100 psig for at least an hour, then re-check.

Vacuuming & Charging Procedure

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

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

go to TABLE OF CONTENTS

Compressor Replacement Procedure

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

go to TABLE OF CONTENTS

Model Specific Information

Table 7 - Shipping Information				
MODEL	WEIGHT lb. (kg)	DIMENSIONS in (cm)		
		L	W	H
WD-16	160 (73)	38 (97)	16 (41)	33 (84)

Table 8 - Refrigerant Charge				
MODEL	lb	kg	Refrigerant	Oil Type
WD-16	1.5	0.7	R134a	POE

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

Table 9 - DHW Loop Flow Rate		
MODEL	gpm	L/s
WD-16	4	0.25

This flow rate will be achieved using built-in circ. pump using nom. 3/4" piping to DHW tank, with heat pump within 20 ft (6 m) of tank.

Table 10 - Outdoor Loop Flow Rate		
MODEL	gpm	L/s
WD-16	4 *	0.25 *

* This flow rate can be reduced to **3 gpm** if entering water temperature is 54°F (12°C) or higher.

Table 11 - Operating Temperature Limits					
Loop	Mode	Parameter	(°F)	(°C)	Note
INDOOR	DHW Heating	Minimum EWT	**70-110**	**21-43**	Use formula **(Outdoor ELT + 20°F)** or **(Outdoor ELT + 11°C)**.
	DHW Heating	Maximum LWT	**160**	**71**	**140°F (60°C)** if using built-in temperature switch.
OUTDOOR	DHW Heating	Minimum ELT	**45**	**7**	
	DHW Heating	Maximum ELT	**90**	**32**	

Table 12 - Electrical Specifications												
	Code	Power Supply			Compressor		Outdoor Circulator	Indoor Circulator	FLA	MCA	Max. Breaker	Min. Wire
		V-ø-Hz	MIN	MAX	RLA	LRA	Max A	Max A	Amps	Amps	Amps	ga
WD-16	1	208/230-1-60	187	253	**4.3**	**20**	1.0	2.0	**7.5**	**8.6**	**15**	**#14-2***

* additional conductor required (#14-3) if connecting 115v outdoor circulator to heat pump.

Table 13: Outdoor Loop Pressure Drop			OUTDOOR (water 50°F)	
	gpm	L/s	psi	kPa
WD-16	2	0.13	0.8	5.5
	3	0.19	1.5	10
	4	**0.25**	**2.4**	**17**
	5	0.32	3.5	24
	6	0.38	4.7	32
	7	0.44	6.2	43
	8	0.50	7.8	54

go to TABLE OF CONTENTS

Performance Tables

WD-16-H-B-1S *R134a, 60 Hz, QXEM-B18A130*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
HEATING	**50**	40	4	47	-3.1	6,200	3.2	789	**116**	128	4		4.4	**8,700**	**3.23**
	60	48	4	56	-3.8	7,600	3.5	854	**115**	128	4		5.2	**10,400**	**3.57**
	70	57	4	65	-5.0	10,000	3.8	901	**114**	128	4	**120**	6.5	**12,900**	**4.20**
	80	66	4	74	-6.4	12,700	3.9	937	**112**	129	4		7.9	**15,700**	**4.91**
	90	75	4	82	-7.6	15,200	4.1	965	**111**	129	4		9.2	**18,300**	**5.56**
	50	41	4	48	-2.4	4,700	3.8	917	**136**	147	4		3.9	**7,700**	**2.46**
	60	49	4	57	-3.0	6,000	4.1	973	**135**	148	4		4.6	**9,200**	**2.77**
	70	58	4	66	-4.1	8,100	4.3	1,015	**134**	148	4	**140**	5.7	**11,400**	**3.29**
	80	67	4	75	-5.2	10,300	4.4	1,050	**133**	149	4		6.9	**13,700**	**3.82**
	90	76	4	84	-6.2	12,400	4.6	1,081	**132**	149	4		8.0	**15,900**	**4.31**

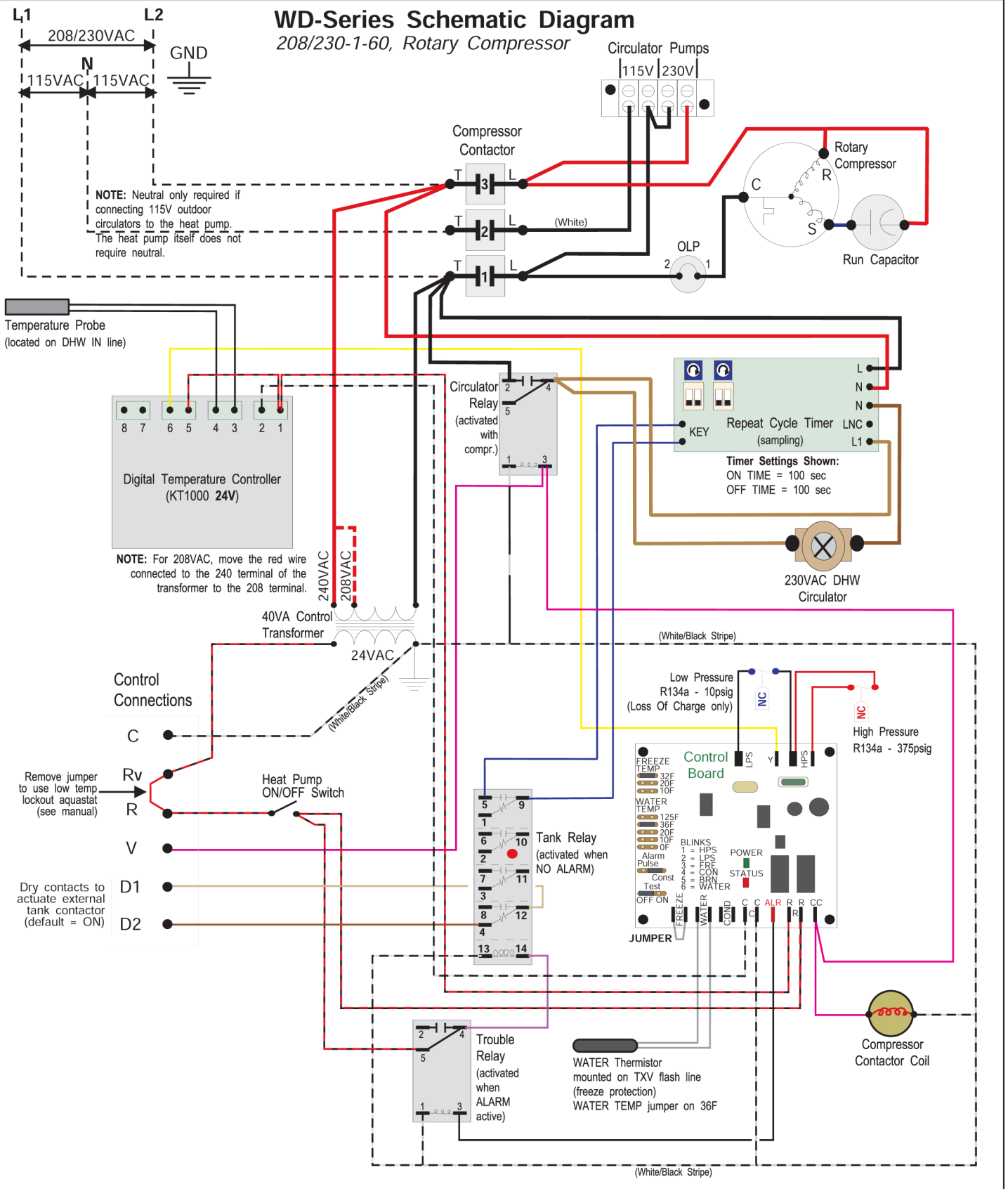
METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (W)	Compressor Current (A)	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (W)	**COP_H**
HEATING (METRIC)	10.0	4.2	0.25	8.3	-1.7	1,820	3.2	789	46.4	53.1	0.25		2.4	**2,550**	**3.23**
	15.6	9.1	0.25	13.5	-2.1	2,230	3.5	854	46.0	53.3	0.25		2.9	**3,050**	**3.57**
	21.1	13.9	0.25	18.3	-2.8	2,930	3.8	901	45.3	53.6	0.25	**49**	3.6	**3,780**	**4.20**
	26.7	18.8	0.25	23.1	-3.6	3,720	3.9	937	44.5	53.8	0.25		4.4	**4,600**	**4.91**
	32.2	23.7	0.25	28.0	-4.2	4,450	4.1	965	43.8	54.1	0.25		5.1	**5,360**	**5.56**
	10.0	4.8	0.25	8.7	-1.3	1,380	3.8	917	57.8	64.0	0.25		2.2	**2,260**	**2.46**
	15.6	9.7	0.25	13.9	-1.7	1,760	4.1	973	57.4	64.3	0.25		2.6	**2,700**	**2.77**
	21.1	14.6	0.25	18.8	-2.3	2,370	4.3	1,015	56.8	64.5	0.25	**60**	3.2	**3,340**	**3.29**
	26.7	19.4	0.25	23.8	-2.9	3,020	4.4	1,050	56.2	64.8	0.25		3.8	**4,020**	**3.82**
	32.2	24.3	0.25	28.8	-3.4	3,630	4.6	1,081	55.6	65.0	0.25		4.4	**4,660**	**4.31**

go to TABLE OF CONTENTS

WD-Series Schematic Diagram

208/230-1-60, Rotary Compressor



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03	Prod. Release	D. RHEAULT	D. RHEAULT	19-Aug-2020
02	Initial Release	D. RHEAULT	D. RHEAULT	1-Jun-2019
01	Prelim. Rel.	D. RHEAULT	D. RHEAULT	1-Dec-2017

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

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

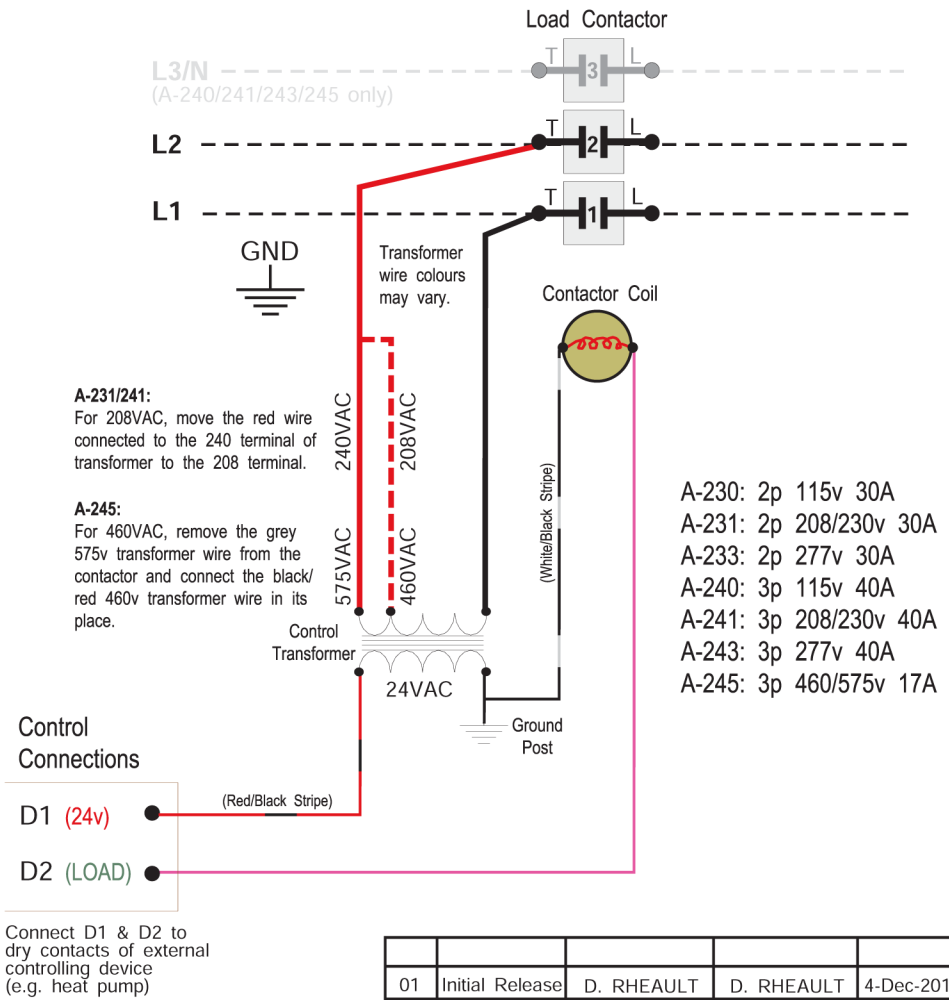
Drawing Name: WD-**-H-B-1L-CD Schematic Diagram

Size	Drawing Number	REV	SHEET
A	002256SCH	04	1 of 1

go to TABLE OF CONTENTS

A-Series Transformer/Contactor Kit Schematic Diagram

A-230/231/233/240/241/243/245



REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	4-Dec-2017

Drawn By: Dan Rheault	Date: 4-Dec-2017	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By: Dan Rheault	Date: 4-Dec-2017	
Approved By (ENG): Dan Rheault	Date: 4-Dec-2017	Drawing Name: A-230/231/233/240/241/243/245 Schematic Diagram
Approved By (MFG):	Date:	
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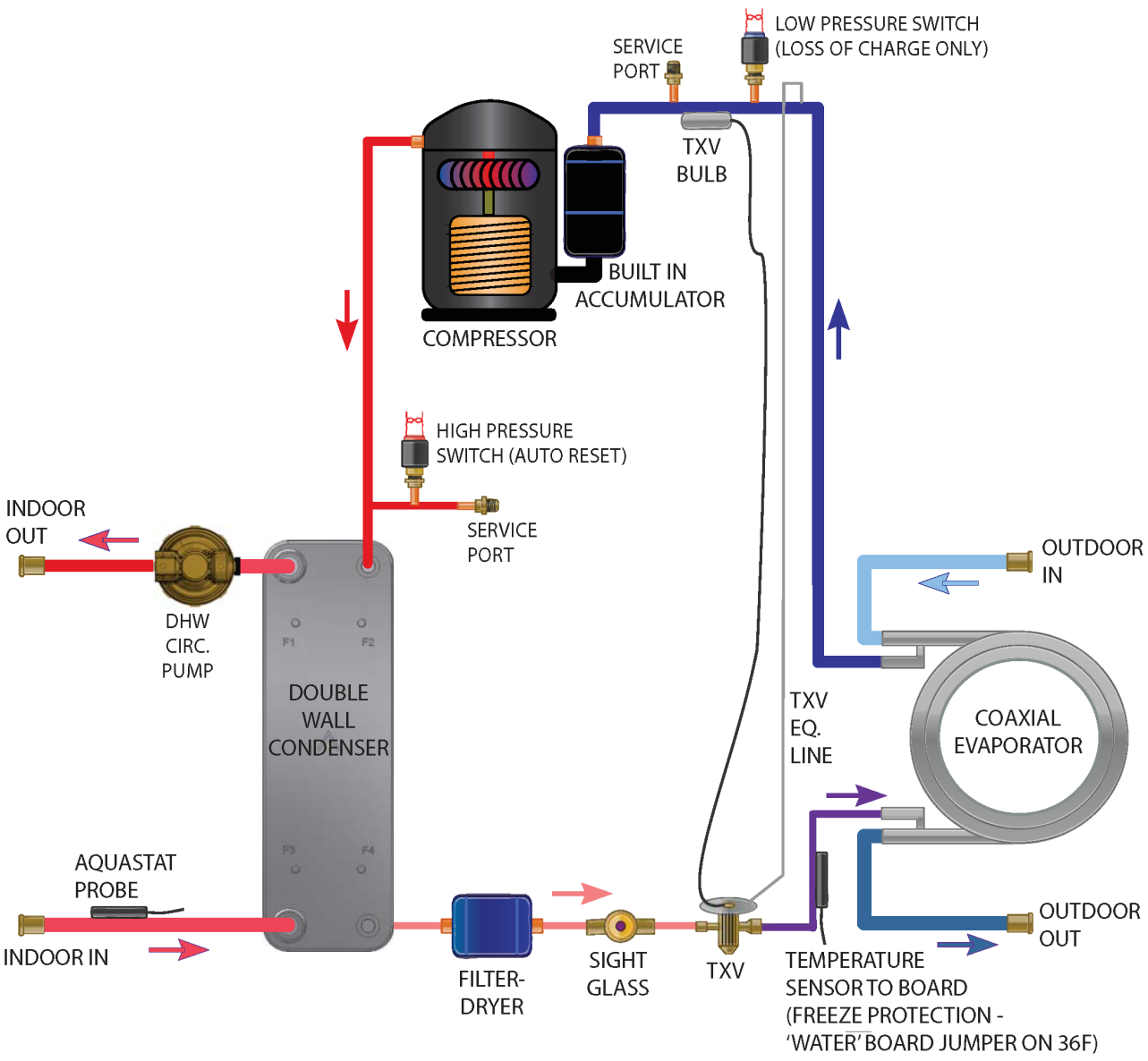
go to TABLE OF CONTENTS

WD-Series Refrigeration Circuit



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03	000313	D. RHEAULT	D. RHEAULT	1-Jul-2023
02	Initial Release	D. RHEAULT	D. RHEAULT	26-Jun-2020
01	Prelim. Rel.	D. RHEAULT	D. RHEAULT	15-Nov-2017

Drawn By: DAN RHEAULT	Date: 15-Nov-2017	
Checked By: DAN RHEAULT	Date: 15-Nov-2017	
Eng. Approved By	Date	
Mfg. Approved By	Date	
Approved By	Date	

MARITIME GEOTHERMAL LTD.
P.O. Box 2555
170 Plantation Rd.
Petitcodiac, NB CANADA E4Z 6H4

Drawing Name: WD-Series Refrigeration Circuit

Size	Drawing Number	Drawing Revision	Sheet
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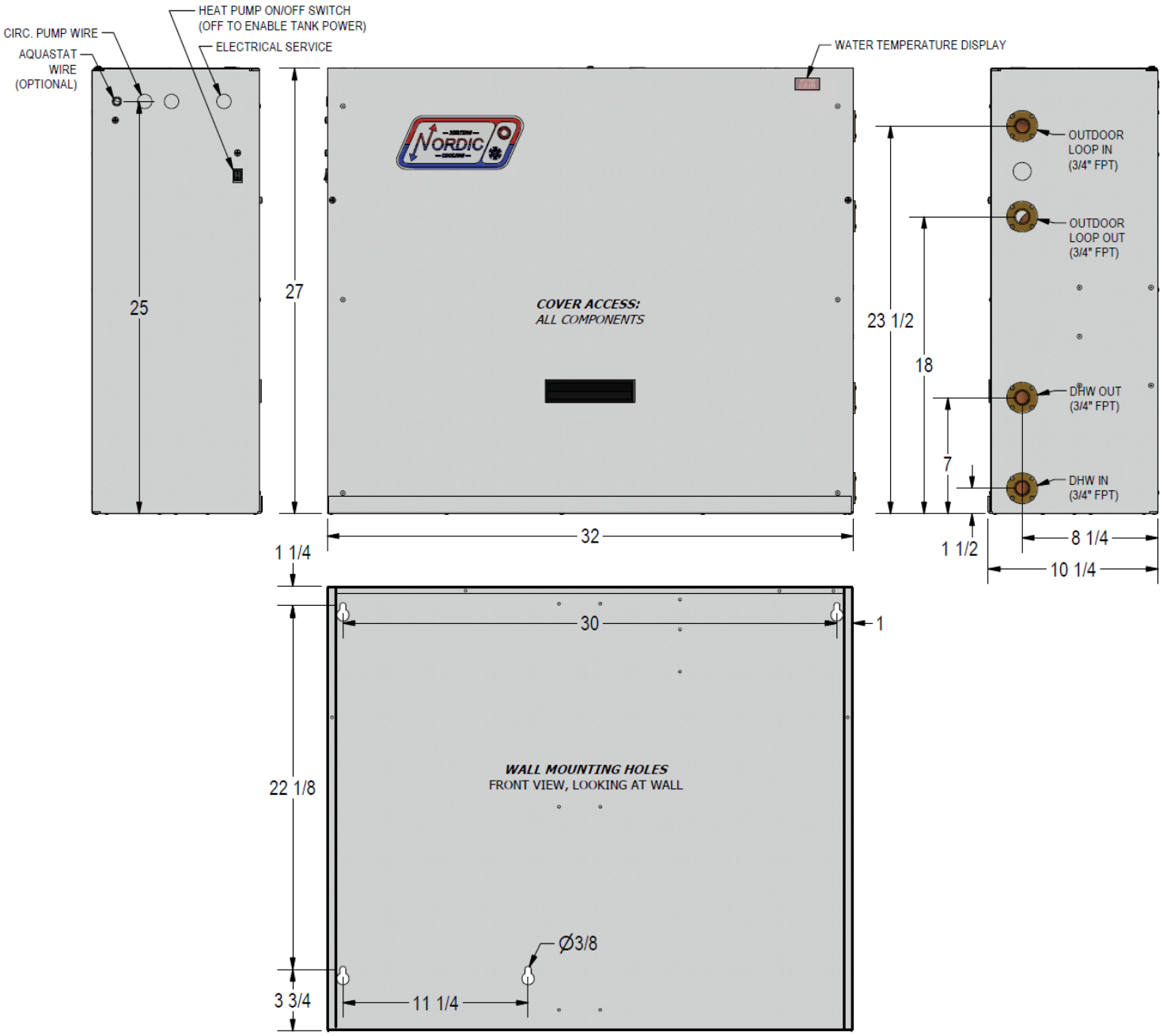
go to TABLE OF CONTENTS

Dimensions



go to TABLE OF CONTENTS

LIMITED RESIDENTIAL WARRANTY

MARITIME GEOTHERMAL LTD. warrants that the heat pumps manufactured by it shall be free from defects in materials and workmanship for a period of (5) FIVE YEARS after the date of installation or for a period of (5) FIVE YEARS AND (60) SIXTY DAYS after the date of shipment, whichever occurs first. In addition MARITIME GEOTHERMAL LTD. warrants that the compressor shall be free of defects in materials and workmanship for an additional period of (2) TWO YEARS from said date.

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

This warranty is subject to the following conditions:

1. The NORDIC® heat pump must be properly installed and maintained in accordance with MARITIME GEOTHERMAL LTD.'s installation and maintenance instructions.
2. The installer must complete the "**Installation Data Sheet**", have it endorsed by the owner and return it to Maritime Geothermal Ltd. within 21 days of installation of the unit.
3. It is the responsibility of the building or general contractor to supply temporary heat to the structure prior to occupancy. These heat pumps are designed to provide heat only to the completely finished and insulated structure. Start-up of the unit shall not be scheduled prior to completion of construction and final duct installation for validation of this warranty.
4. It is the customer's responsibility to supply the proper quantity and quality of water.

If the heat pump, manufactured by MARITIME GEOTHERMAL LTD., fails to conform to this warranty, MARITIME GEOTHERMAL LTD.'s sole and exclusive liability shall be, at its option, to repair or replace any part or component which is returned by the customer during the applicable warranty period set forth above, provided that (1) MARITIME GEOTHERMAL LTD. is promptly notified in writing upon discovery by the customer that such part or component fails to conform to this warranty. (2) The customer returns such part or component to MARITIME GEOTHERMAL LTD., transportation charges prepaid, within (30) thirty days of failure, and (3) MARITIME GEOTHERMAL LTD.'s examination of such component shall disclose to its satisfaction that such part or component fails to meet this warranty and the alleged defects were not caused by accident, misuse, neglect, alteration, improper installation, repair or improper testing.

go to TABLE OF CONTENTS