Water to Water Geothermal Heat Pump

Installation & Operating Instructions

Model: RA-WE* (Single Compressor)
RD-WE* (Dual Compressor)

Application

- Geo source loop or ground water fluid
- Load water heat/cool output
- Low temperature, radiant floor heating
- Air handler larger water coil, heat/cool
- Tested to UL Standards 1995 and CSA Standards C22.2

3-Phase Models

Also see and use NI704

Domestic Water Heater, Desuperheater

Energy Star promotes the desuperheater; however, it only efficiently produces hot water if the tank temperature is less than 115° F (46° C). A hot water buffer tank is suggested for proper and efficient application, see page 19.

Drawings: **NR701, NR705, NR706, UAW701, UAW705, XX029**

DO NOT DESTROY THIS MANUAL. PLEASE READ CAREFULLY AND KEEP IN A SAFE PLACE FOR FUTURE REFERENCE BY A SERVICE TECHNICIAN.

ENERGY STAR

Intertek

AHRI CERTIFIED
www.ahridirectory.org
Water Source HP
ANSI/AHRI/ASHRAE/ISO13256-1

www.northernheatpump.com

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Introduction

When used and controlled properly, geothermal heat pumps can save hundreds of dollars per year. ***NorthStar Series*** geothermal heat pumps are designed to provide maximum efficiency, comfort, and reliability. Solid and simple electric controls allow for low maintenance and built in safety protection.

Compressor safety and limit shutdown is included with the standard ICM control board. However, operational control is considerably simpler and limited to an aquastat type contact closure wired between terminal block R and HW screws. Cooling is activated with a contact closure between R and O.

The RD-WE Series is commonly referred to as "Dual Compressor". This is more than two compressors; it is two complete refrigerant loop systems, feeding through a single but isolated two section heat exchanger. This provides increased efficiency plus each operates independently and can serve as a failure backup.

Pump (loop and hydronic) connections are provided, with inline fuses.

Moving and Storage
Units should be stored in original packaging in a clean dry area. Store and move units in normal upright position. Do not stack units.

Initial Inspection
Be certain to inspect all cartons and crates as units are received before signing the freight bill. Verify that all items received have no physical damage. Report any damages or shortages on the freight bill. The purchaser is responsible for filing the necessary claims with the carrier. Concealed or hidden damages not discovered until removing packaging must be reported to the carrier within 15 days of receipt.

Unit Location and Mounting
Locate the unit in an indoor area where the ambient temperature will remain above 45°F [8°C]. Northern Heat Pump provides 4 removable panels (all 4 sides) for servicing ease. This unit is zero clearance rated; however, allow enough room to remove panels for service and maintenance. Suggest setting unit on a sound vibration pad, see accessories price sheet, R-PAD-2735-1-**. Water supply should **not** be hard plumbed directly with copper pipe as this could transfer any vibration to living space.

Please read and understand conditions associated with proper installation, unauthorized changes, and POWER ON procedures.

Warranty Statement
See the last pages of this manual for detailed limited warranty coverage explanation.

Safety Considerations

⚠ WARNING

BEFORE PERFORMING SERVICE OR MAINTENANCE OPERATIONS ON A SYSTEM, TURN OFF MAIN POWER SWITCHES TO THE INDOOR UNIT. IF APPLICABLE, TURN OFF THE ACCESSORY HEATER POWER SWITCH. ELECTRICAL SHOCK COULD CAUSE PERSONAL INJURY.

Installing and servicing heating and air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair or service heating and air conditioning equipment. Untrained personnel can perform the basic maintenance functions of cleaning coils and cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply, such as the following safety measures:

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use a quenching cloth for brazing operations.
- Have a fire extinguisher available for all brazing operations.

Northern Heat Pump Configurator

R	A	-	V	E	-	0	2	8	-	1	-	C	L	D	X	1	-	X	X	-	U	S
1	2		3	4		5	6	7		8		9	10	11	12	13		14	15		16	17

Model Number Digits

RA-VE-028-1-CLDX1-XX-US

Geo Source (1)

Unit Type (2)
A = Single Stage
D = Dual Compressor
T = Two Stage

Unit Style (3)
S = Split
V = Vertical
W = Hydronic

Refrigerant (4)
E = R-410A

Nominal BTU (5, 6, 7)
041 (Single Stage) 3-ton
053 (Single Stage) 4-ton
061 (Single Stage) 5-ton
073 (Single Stage) 6-ton

026 (Two Stage) 2-ton
033 (Two Stage) 2.5-ton
040 (Two Stage) 3-ton
045 (Two Stage) 3.5-ton
052 (Two Stage) 4-ton
062 (Two Stage) 5-ton

030 (Hydronic) 2.5-ton
036 (Hydronic) 3-ton
050 (Hydronic) 4-ton
060 (Hydronic) 5-ton
072 (Hydronic) 6-ton

096 (Hydronic Dual) 8-ton
120 (Hydronic Dual) 10-ton
144 (Hydronic Dual) 12-ton

Country of Origin (16, 17)
US = United States
CA = Canada

Auxiliary kW Option* (14, 15)
05 = 4.8 kW
10 = 9.6 kW
15 = 14.4 kW
20 = 19.2 kW
XX = None
*Can be factory or field installed

Vintage (13)
1

Miscellaneous Kits (12)
A = Soft Start Kit (Installed)
X = None

Desuperheater Option (11)
D = Desuperheater w/ Factory Installed Pump
X = None

Configuration Option (10)
L = Left Return (Standard)*
R = Right Return
C = Split Air Coil
X = N/A or No Split Air Coil
*Left return can be field converted to right return

Heat Exchanger Option (9)
C = Copper Coax
N = Cupronickel Coax
M = Copper (Load) & Cupronickel (Source) Coax
S = Stainless Brazed Plate (RD-WE only)

Voltage Option (8)
1 = 208/230V, 1 Ph
2 = 208/230V, 3 Ph
3 = 460/480V, 3 Ph

RA-WE – Mechanical Specifications – R410A Single Stage Compressor

MODEL	RA-WE-036 (3 ton)	RA-WE-050 (4 ton)	RA-WE-060 (5 ton)	RA-WE-072 (6 ton)
Source & Load GPM – Heating	12	16	15	18
Source & Load GPM – Cooling	12	16	15	20
Factory Charge R410A	3 lbs. 14 oz.	4 lbs. 8 oz.	6 lbs. 6 oz.	7 lbs. 8 oz.
Source Temperature °F (min/max)	20°/120°	20°/120°	20°/120°	20°/120°
Water Connection (NPT – female)	1"	1"	1-¼"	1-¼"
Heat Exchanger Type	Coax	Coax	Coax	Coax
Loop Coil & Piping Water Volume (gal)	.77	1.1	1.38	2.3
Load Coil Water Volume (gal)	.98	.98	1.38	2.3
Desuperheater Connection (NPT – female)	½"	½"	½"	½"
Weight– Packaged (lbs)	340	345	525	575
Width of Cabinet (inches)	27	27	25	25
Height (Inches)	29	29	49	49
Depth (Inches)	35	35	32	32

HEAT EXCHANGER PRESSURE DROP TABLE

Water-to-Water (Source Side and Load Side, Pure Water @ 68° F											
Model	GPM	PSID	Model	GPM	PSID	Model	GPM	PSID	Model	GPM	PSID
3-ton	6	2.0	4-ton	8	1.3	5-ton	12	1.84	6-ton	16	1.80
	9	3.6		12	2.5		14	2.24		18	2.34
	12	5.5		16	4.0		15	2.44		20	2.86
	15	7.8		20	5.8		17	3.03		23	3.80

PRESSURE DROP MULTIPLIERS

	Freeze Point (° F)	20° F	25° F	30° F	35° F	40° F
Pure Water Multiplier	32.0	1.00	1.00	1.00	1.00	1.00
Methanol 12.5%* Multiplier	16.2	–	1.25	1.21	1.18	1.15
Propylene Glycol 20%* Multiplier	18.4	1.39	1.35	1.31	1.28	1.24
Ethanol 20%* Multiplier	18.1	1.56	1.47	1.42	1.36	1.31

*By volume Feet of Head = PSI x 2.31

ISO 13256-2 Performance – Energy Star

Model	Source / Load GPM	Ground Water Heat Pump				Ground Loop Heat Pump			
		Cooling 59°F		Heating 50°F		Cooling Full Load 77°F		Heating Full Load 32°F	
		Capacity Btu/h	EER Btu/h/W	Capacity Btu/h	COP	Capacity Btu/h	EER Btu/h/W	Capacity Btu/h	COP
RA-WE-036	12 / 12	40100	20.7	43900	3.7	36600	16.1	32300	3.1
RA-WE-050	16 / 16	55100	20.1	60100	3.6	54200	16.1	45200	3.1
RA-WE-060	15 / 15	65000	20.4	68000	3.7	58200	16.1	52000	3.1
RA-WE-072	18 / 18	75000	20.1	80500	3.7	71900	16.1	62900	3.1

Heating capacities based upon 104°F hydronic return water.
Cooling capacities based upon 53.6 F hydronic return water.
Ground Loop Heat Pump ratings based on 15% antifreeze solution.
All ratings based upon operation at lower voltage of dual voltage rated models.

RD-WE – Mechanical Specifications – R410A Dual Compressor

MODEL	RD-WE-096 (8 ton)	RD-WE-120 (10 ton)	RD-WE-144 (12 ton)
Source & Load GPM – Heating	16	20	24
Source & Load GPM – Cooling	16	20	24
Factory Charge R410A*	4 lbs. 2 oz. x (2*)	4 lbs. 2 oz. x (2*)	4 lbs. 2 oz. x (2*)
Source Temperature °F (min/max)	20°/120°	20°/120°	20°/120°
Water Connection (NPT – male)	1-½"	1-½"	1-½"
Heat Exchanger Type	Brazed plate	Brazed plate	Brazed plate
Loop Coil & Piping Water Volume (gal)	1.62	1.62	1.62
Load Coil Water Volume (gal)	1.62	1.62	1.62
Weight– Packaged (lbs)	510	525	535

*Dual compressor models contain dual refrigeration circuits, amount shown is for each circuit.

HEAT EXCHANGER PRESSURE DROP TABLE

Water-to-Water (Source Side and Load Side, Pure Water @ 68° F								
Model	**GPM**	**PSID**	**Model**	**GPM**	**PSID**	**Model**	**GPM**	**PSID**
8-ton	12	0.79	10-ton	15	1.10	12-ton	16	1.21
	14	0.99		16	1.21		17	1.33
	15	1.10		17	1.33		18	1.45
	16	1.21		18	1.45		20	1.71
	17	1.33		20	1.71		22	2.00
	18	1.45		22	2.00		23	2.14
	20	1.71		23	2.14		24	2.30
	22	2.00		24	2.30		25	2.46
	23	2.14		25	2.46		26	2.62
	24	2.30		26	2.62		27	2.79
	25	2.46		27	2.79		28	2.96
	26	2.62		28	2.96		30	3.32
	27	2.79		30	3.32		32	3.98
	28	2.96		32	3.98		34	4.02
	30	3.32		34	4.02		36	4.53

PRESSURE DROP MULTIPLIERS

	Freeze Point (° F)	**20° F**	**25° F**	**30° F**	**35° F**	**40° F**
Pure Water Multiplier	32.0	1.00	1.00	1.00	1.00	1.00
Methanol 12.5%* Multiplier	16.2	–	1.25	1.21	1.18	1.15
Propylene Glycol 20%* Multiplier	18.4	1.39	1.35	1.31	1.28	1.24
Ethanol 20%* Multiplier	18.1	1.56	1.47	1.42	1.36	1.31

*By volume Feet of Head = PSI x 2.31

ISO 13256-2 Performance – Energy Star

Model	Source / Load GPM	Stage	Ground Water Heat Pump				Ground Loop Heat Pump			
			Cooling 59°F		Heating 50°F		Cooling Full Load 77°F/68°F		Heating Full Load 32°F/41°F	
			BTUh	EER	BTUh	COP	BTUh	EER	BTUh	COP
RD-WE-096	16 / 16	FL	103000	19.7	110200	3.5	95700	15.7	86900	2.9
		PL	55100	21.5	58200	3.8	53100	18.3	52200	3.5
RD-WE-120	20 / 20	FL	120000	19.5	128000	3.5	103200	15.6	99900	2.8
		PL	64000	21.0	71500	3.8	57000	18.1	55500	3.5
RD-WE-144*	24 / 24	FL	137500	19.0	147600	3.4	126000	14.4	121000	2.7
		PL	73500	20.2	78500	3.7	70000	18.0	68500	3.3

Heating capacities based upon 104°F hydronic return water.
Cooling capacities based upon 53.6°F hydronic return water.
Ground Loop Heat Pump ratings based on 15% antifreeze solution.
All ratings based upon operation at lower voltage of dual voltage rated models.
*RD-WE-144 is outside the scope of AHRI and Energy Star.

RA-WE – Electrical Data – Single Phase

Model	Voltage	Compressor		Load Pump	Desup. Pump	Source Pump	Total	Min.	Max. Fuse/ HACR
	(60 Hz)	RLA	LRA	FLA	FLA	FLA	FLA	Ampac.	
RA-WE-036	208/230-1	17.9	112	1.8	.15	4.4	24.3	28.7	40
RA-WE-050	208/230-1	26.4	134	1.8	.15	4.4	33.3	39.2	60
RA-WE-060	208/230-1	28.3	178	1.8	.15	4.4	34.7	41.7	60
RA-WE-072	208/230-1	36.9	185	1.8	.15	4.4	43.3	52.5	80

RD-WE – Electrical Data – Single Phase

Model	Voltage	Compressor		Load Pump	Desup. Pump	Source Pump	Total	Min.	Max. Fuse/ HACR
	(60 Hz)	RLA	LRA	FLA	FLA	FLA	FLA	Ampac.	
RD-WE-096	208/230-1	26.4 x 2	134 x 2	1.8	.15	4.4	33.3 x 2	39.2 x 2	60 x 2
RD-WE-120	208/230-1	28.3 x 2	178 x 2	1.8	.15	4.4	34.7 x 2	41.7 x 2	60 x 2
RD-WE-144	208/230-1	36.9 x 2	185 x 2	1.8	.15	4.4	43.3 x 2	52.5 x 2	80 x 2

Note: Dual compressor models contain dual power circuits for the compressors, amperages shown are for each circuit. Please refer to NI704 for 3-phase models.

Product Dimensions – RA-WE-036 & RA-WE-050

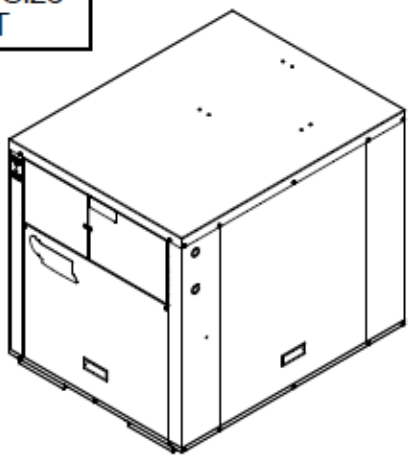
	Cabinet Dimensions		
	A (Height)	B (Width)	C (Depth)
RA-WE-036	29 5/8"	26 15/16"	34 13/16"
RA-WE-050			

Water Connections

Source		Hydronic		Desuperheater	
In	Out	In	Out	In	Out
D	E	F	G	H	
4 3/16"	6 1/16"	8 11/16"	10 9/16"	21 7/16"	
Connection Size 1" FPT				Connection Size 1/2" FPT	

Electrical Connections

I	J	K
21 11/16"	26 11/16"	24 1/4"
∅1.125 X ∅.875 Double Knockout		



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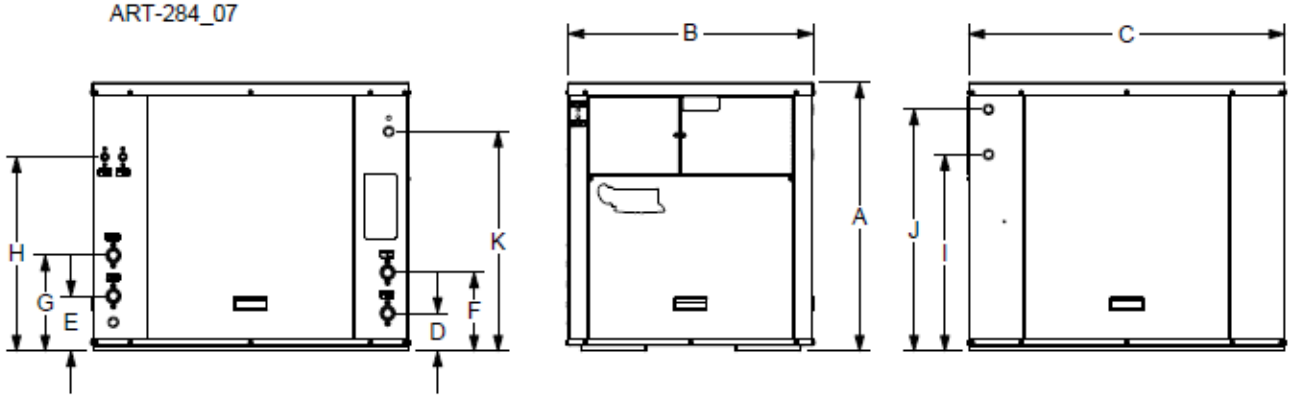


Product Dimensions – RA-WE-060 & RA-WE-072

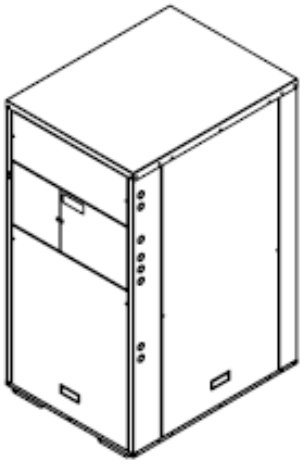
	Cabinet Dimensions		
	A (Height)	B (Width)	C (Depth)
RA-WE-060	48 11/16"	24 7/8"	32 1/16"
RA-WE-072			

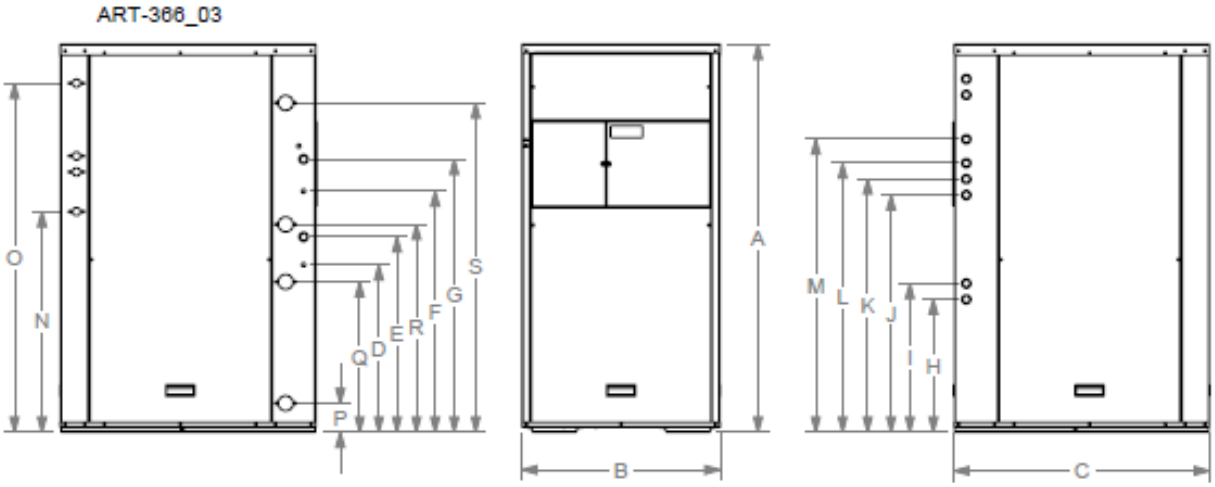
Electrical Connections

D	E	F	G	H	I	J	K	L	M
21"	24 1/2"	30 1/4"	34 1/4"	16 11/16"	18 11/16"	29 3/4"	31 3/4"	33 3/4"	36 3/4"
Ø.500 Hole		Ø1.125 X Ø.875 Double Knockout							

Water Connections

	Desuperheater		Source		Load	
	In	Out	In	Out	In	Out
	N	O	P	Q	R	S
RA-WE-060	27 11/16"	43 13/16"	3 5/8"	18 7/8"	26 1/16"	41 5/16"
RA-WE-072	27 11/16"	43 13/16"	3 5/8"	22 7/8"	26 1/16"	45 5/16"
	Connection Size 1/2" FPT		Connection Size 1 1/4" FPT			





Product Dimensions – RD-WE

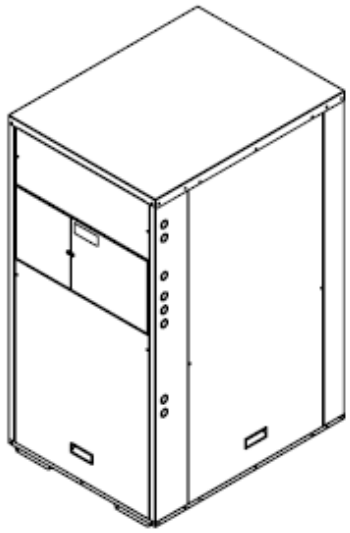
	Cabinet Dimensions		
	A (Height)	B (Width)	C (Depth)
RD-WE-096	48 11/16"	24 7/8"	32 1/16"
RD-WE-120			
RD-WE-144			

Electrical Connections

D	E	F	G	H	I	J	K	L	M
21"	24 1/2"	30 1/4"	34 1/4"	16 11/16"	18 11/16"	29 3/4"	31 3/4"	33 3/4"	36 3/4"
∅.500 Hole	∅1.125 X ∅.875 Double Knockout								

Water Connections

Desuperheater		Source		Load	
In	Out	In	Out	In	Out
N	O	P	Q	R	S
32 11/16"	34 11/16"	7 11/16"	24 11/16"	10 11/16"	27 11/16"
Connection Size 1/2" FPT		Connection Size 1 1/2" MPT			



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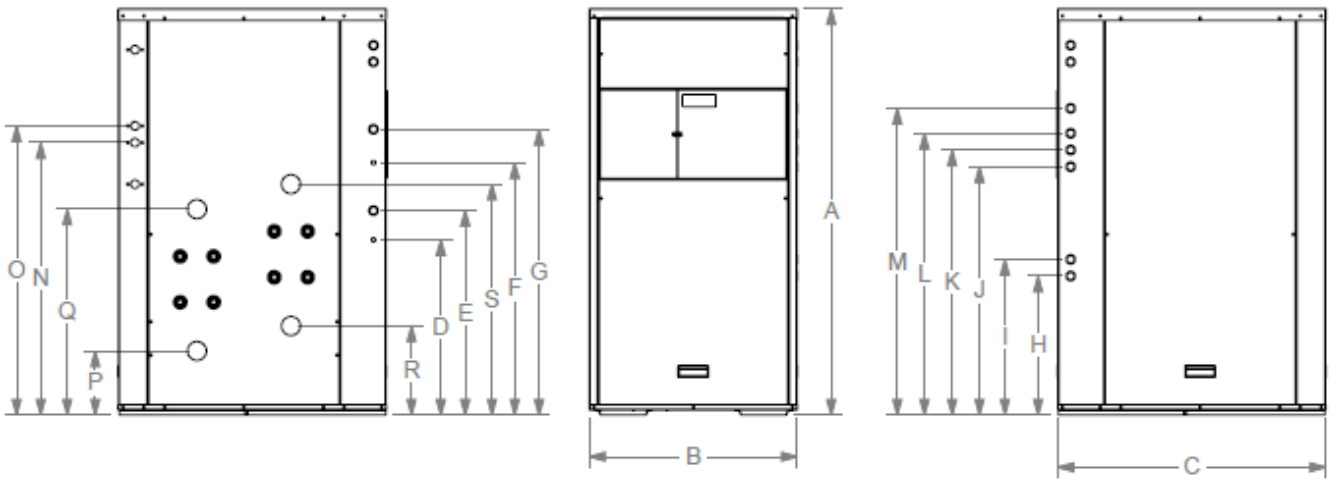


Installation Requirements

1. All installation work must be performed by trained, qualified contractors or technicians. Northern Heat Pump, sponsors installation and service schools to assist the installer. **Visit our Website at www.northernheatpump.com for upcoming service schools.**

⚠ WARNING

ALL ELECTRICAL WIRING MUST BE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE AND LOCAL ELECTRIC CODES, ORDINANCES, AND REGULATIONS.

⚠ WARNING

OBSERVE ELECTRIC POLARITY AND WIRING COLORS. FAILURE TO OBSERVE COULD CAUSE ELECTRIC SHOCK AND/OR DAMAGE TO THE EQUIPMENT.

⚠ CAUTION

This unit can only be used for its intended design as described in this manual. Any internal wiring changes, modifications to the circuit board, modifications or bypass of any controls, or installation practices not according to the details of this manual will void the product warranty, the safety certification label, and manufacturer product liability. Northern Heat Pump, cannot be held responsible for field modifications, incorrect installations, and conditions which may bypass or compromise the built-in safety features and controls.

⚠ CAUTION

This unit shall not be operated (either heating section or blower) until the interior of the structure is completed and cleaned. This also means all duct work must be complete with filter, etc. Manufacturer's warranty is void if this unit is operated during structure construction.

⚠ CAUTION

Hazards or unsafe practices could result in property damage, product damage, severe personal injury and/or death.

2. All removed or discharged refrigerant must be recovered. Local and federal statutes are to be observed. Should a compressor need replacing, the compressor oil is to remain with the compressor. Refrigerant lines on the compressor must be sealed.

3. Remember, safety is the installer's responsibility and the installer must know this product well enough to instruct the end user on its safe use.

At Northern Heat Pump, the safety of the installer and the end user is of highest priority. Remember, safety is the installer's responsibility and the installer must know this product well enough to instruct the end user on its safe use. Professional installers should be trained and experienced in the areas of handling electrical components, sheet metal products, and material handling processes.

Mechanical Installation Overview

This ***NorthStar Series*** unit cannot heat or cool energy by itself. Heat pumps use the fluid in the source loop as the energy source. Thus the design and installation of the source fluid system may be the most important part of this heat pump system. The following items should be carefully considered and properly followed for all installations:

Heating capacity – Size the geothermal heat pump according to the normal heating requirements as the building exists today. Do not necessarily match to the existing furnace nameplate because it may be oversized. Do not oversize the geothermal heat pump.

Closed Loop Applications – Closed loop system re-circulates the same water/antifreeze solution through a closed system of underground high-density polyethylene pipe. As the solution passes through the pipe it collects heat (in the heating mode) that is being transferred from the relatively warm surrounding soil through the pipe and into the relatively cold solution. The solution is circulated back to the heat pump that extracts its heat and then returns to the ground to absorb more heat from the earth. Earth loops must be sized properly for each particular geographic area and individual capacity requirements.

Horizontal Closed Loop

Figure 1

The ***NorthStar Series*** heat pumps are designed to operate on either **vertical or horizontal closed loop applications.** (Figures 1 & 2) Vertical loops are typically installed with a well drilling rig up to 200 feet (60 m) deep or more. Horizontal systems are typically installed with excavating or trenching equipment approximately six to eight feet deep, depending on geographic location and length of pipe used.

Vertical Closed Loop

Figure 2

Lake or Pond Loops – Closed loop systems may also be used in lakes or rivers to supply a heat source to the heat pump. Typically a loop consisting of geothermal pipe can be designed and placed in an area not much deeper than 15ft (4.5 meters) with some water currents present. In any lake or pond, municipal and area codes must be observed in regards to a lake or pond loop. The use of an environmentally friendly loop fluid like food grade propylene glycol should be considered if the loop was ever damaged. Consult an IGSHPA or CGC certified installer for proper lake or pond loop design.

Mechanical Installation Source Water

⚠ WARNING

LOOP DESIGN IS EXTREMELY IMPORTANT FOR PROPER HEAT PUMP OPERATION. INCORRECT LOOP DESIGN WILL REDUCE HEAT PUMP EFFICIENCY, CAUSE POOR PERFORMANCE OR MAY RENDER THE SYSTEM UNUSABLE. CONTACT AN IGSHPA OR CGC CERTIFIED GEOTHERMAL LOOP CONTRACTOR FOR PROPER INSTALLATIONS.

Water Connections General

The following pages outline typical piping arrangements for the most common source water connection options, as well as flushing and filling procedures and antifreeze requirements for closed loop systems. Do **not** connect copper piping directly to the source water connection points on this unit. A section of flexible piping is recommended to reduce and isolate vibrations transmitting from the compressor into other parts of the system.

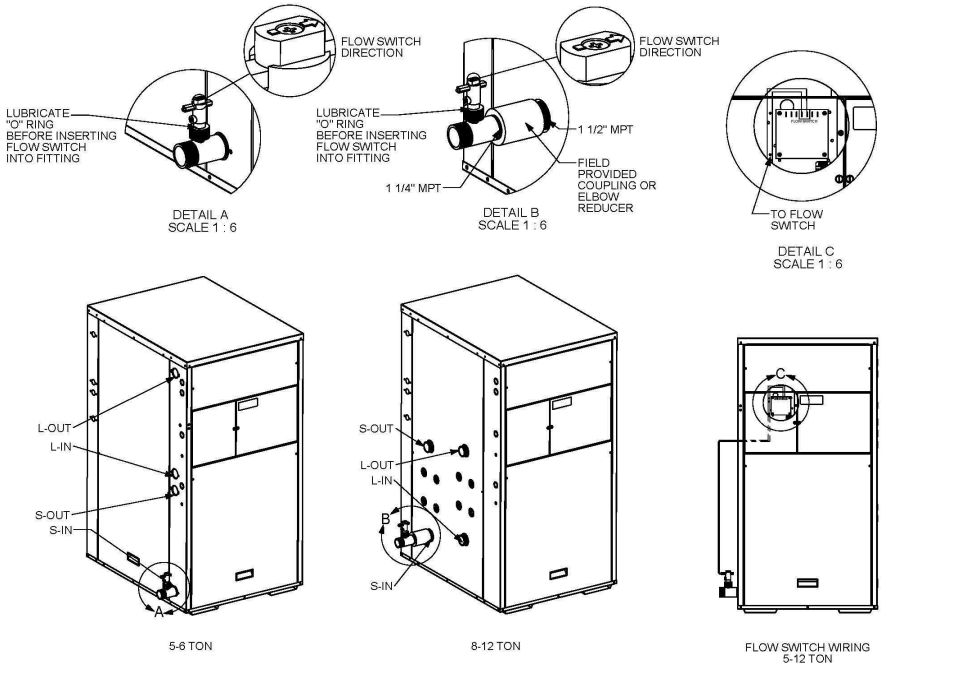
This manual covers wide range of heat pump capacities. As a result water connections show one representative cabinet size. Exact water connection locations and size vary based upon these ranges, (2-1/2 ton – 4-ton), (5 – 6 ton), and (8 – 12 ton). See product dimension pages at the beginning of the manual for exact location and pipe size.

Once closed loops are completed, they must be pressure tested to at least 60 PSI to insure integrity. Once pressure is tested, loop must be purged of all foreign debris and filled with fluid. All air must be removed at this time by flushing the system. (Table 2) shows approximate fluid volumes.

Flow Switch – depending upon the model series and size the mounting and field installation requirement differs.

- RA-WE-030, 036, 050 – factory mounted internal and provided complete
- RA-WE-060, 072 – loose kit, field installed external, wired to ICM board (see diagram below)
- RD-WE Series – loose kit, field installed external, wired to ICM board (see diagram below). Also, an adapter is required for 8-12 ton models. 8-12 ton models have 1-1/2" MPT ports, therefore a field provided coupling is required to attach the 1-1/4" flow nipple to 8-12 ton models. The flow switch itself is directional and must be installed facing the correct direction.

Note: The directional arrow is located at the top of the switch and must be pointing toward the heat pump. Product warranty is void if this flow switch is not installed.



Pressure/Temperature (P/T) plugs – Should be installed in the adaptor elbow on the entering and leaving water line of the heat pump on a closed system. (Figures 3 and 4) A thermometer can be inserted into the P/T ports to check entering and leaving water temperatures. A pressure gauge can also be inserted into these P/T ports to determine the pressure differential between the entering and leaving water. This pressure differential can then be compared to the engineering specifications data to determine the flow rate of the system.

P/T Adapter

Figure 3

Flow Center – if selecting non-pressure closed loop design (Figure 5), a flow center is required. Flow center is the key to installation ease and long-term reliability.

A **Flow Meter** is an important part of the system. It provides a visual indicator of loop flow in GPM. A flow meter can be installed on either side of the pump pack, but must be installed per manufacturer recommendations so it reads accurately.

Non-Pressurized Loops require an air separator/stand pipe to eliminate air and to hold enough fluid to compensate for the expansion and contraction of the loop pipe and fluid. Purge and fill valves should be placed between the loop manifold valves and the insulated pump pack. See figure 4.

Pressurized Loops do not require an air separator. They require purge and fill ports between the loop manifold valves and the insulated pump pack. See figure 5. After purging a pressurized loop, it should maintain 45 to 60 psi static pressure. The geothermal loop pipe stretches under pressure so may need to be pressurized above the desired pressure several times to achieve the recommended static pressure. Pressurized loops must maintain enough static pressure to compensate for the expansion and contraction of the loop pipe and fluid.

Loop Pump Selection – select a loop circulation pump based upon the GPM required and total system pressure drop. See specification, page 5. Geo heat pump Btu/h capacity and efficiency are directly related to the GPM flow through the unit.

Vibration pad – We suggest setting the unit on a sound vibration pad, available from most distributors or accessories price sheet – R-PAD-2735-1-**.

Water quality – models with standard copper heat exchanger coils require the installer to evaluate water quality and meet minimum water properties.

- pH/calcium hardness — pH < 7.5 and Ca harness < 100 PPM
- Iron fouling — < 0.2 PPM (Ferrous)
  < 0.5 PPM of oxygen
- Hydrogen sulfide (H_2S) — < 0.5 PPM
- Chloride levels — < 20 PPM
- Erosion/clogging — < 10 PPM, particles
- Filter, if required — < 800 micron size

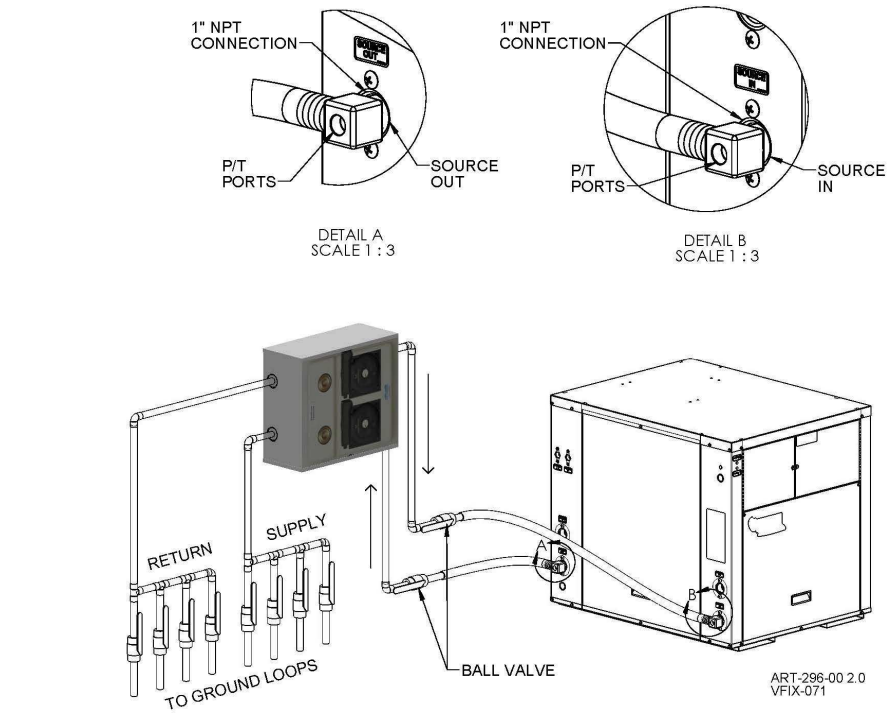


Figure 4 – Pressurized Closed Loop with Flow Center – Typical piping arrangement.*

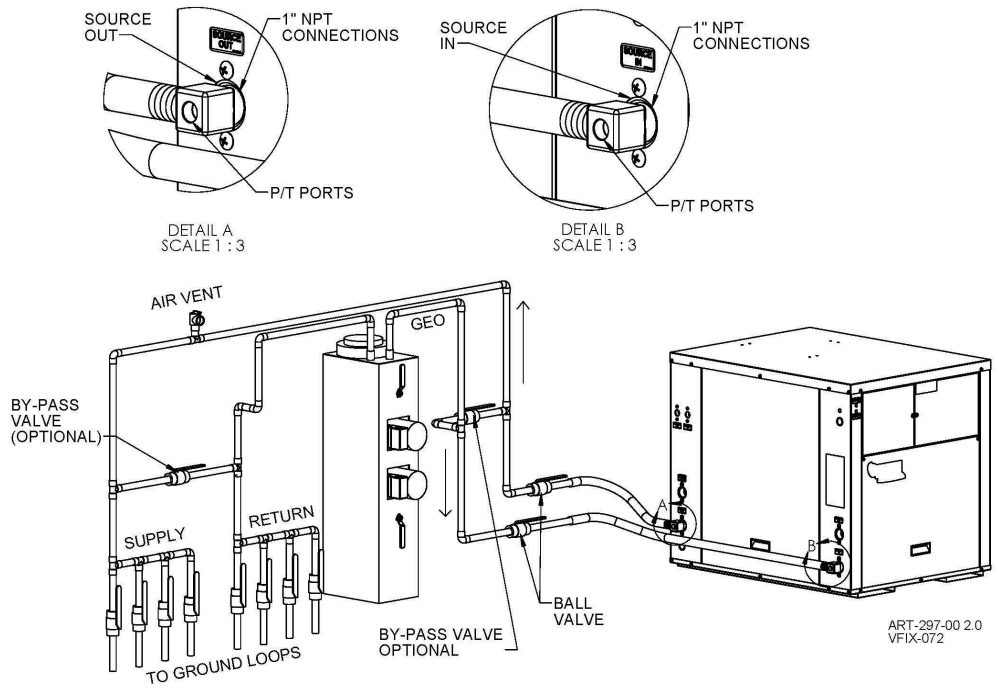


Figure 5 – Non-Pressurized Closed Loop with Flow Center – Typical piping diagram.*

*4-ton model shown, for water connection locations on other models reference product dimension pages.

Flushing and Filling the System Using 3-Way Valves

Step 1
Use water and a high volume head circulator pump to flush air and debris and to fill the loop system.

- Refer to recommendations provided by IGSHPA or CGC when choosing a pump for the flushing process.
- It is recommended that pump suction be from the bottom of a large volume container. Use a suction line strainer to prevent debris discharged into the container from being recycled to the system.

Step 2
Pump water into the system by connecting the pump discharge hose to one (not both) of the 1.00" NPT water connections located on the sides of the module.
Connect a return hose to the opposite side of the module to discharge debris and air as water is added to the loop.

Step 3
Rotate the module valves as shown in step 3 diagram:

Step 4
Start the pump. Add anti-freeze and water to the container as needed so that no air enters the system. This will push any air out of the loop. If flushing assembly is equipped with valves to reverse flow direction, do so occasionally to help remove trapped air. When bubbles cease in the return hose container, the earth loop has been completely flushed.

Step 5
Flush the heat pump. To do so, simply rotate the valves as shown in step 5 diagram while the pump is running. Flush the heat pump using the same procedure as used to flush the earth loop.

Pressurizing the System (does not apply to Figure 5)

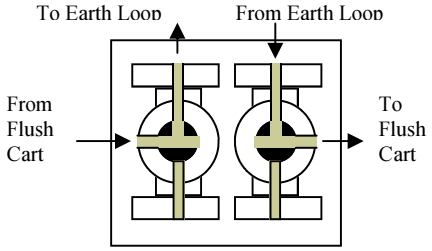
Step 6
After flushing and filling the system, rotate the module valve discharging into the flush container as shown in step 6A diagram to pressurize the loop. Then turn the valves as in step 6B.

Step 7
Turn off the flush cart pump. The system should remain pressurized. Release excess pressure by rotating either module valve to allow a small amount of water to pass through and out of the system and into the container. Some initial loss of pressure can be expected and is due to the expansion of the earth loop pipe under pressure. The pressure will stabilize if the system has no leaks.

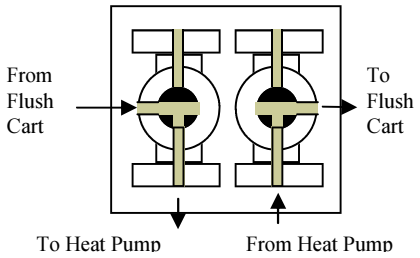
Step 8
Flushing, filling and pressurization should be complete. Start the loop pump module circulators.

Step 9
Troubleshoot. If for some reason the circulators are not operating, power off and diagnose the problem.

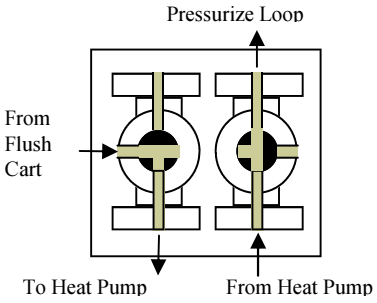
Step 3



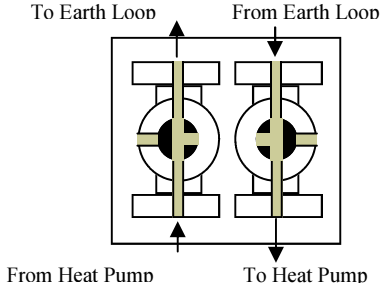
Step 5



Step 6A



Step 6B



Step 10
Using a single water pressure gauge, measure the pressure drop at the pressure/temperature plugs across the heat pump heat exchanger. Compare the measurement with the flow versus the pressure drop table (Table#3) and determine the actual flow rate. If the flow rate is low, recheck the selection of the loop pump module model for sufficient capacity. If the model is correct, there is likely trapped air or a restriction in the flow circuit. System pressure should increase rapidly as the flush pump works to force more water into the system. Additional flushing of the loop is needed if the water level in the loop falls. This shows that there is air in the system. System operating pressures should be between 10 to 40 PSI.

Antifreeze

DO NOT mix more than 25% propylene glycol with water to achieve a lower than 15°F [-9°C] freeze protection. (See Table 3) A more concentrated mixture cannot be pumped through the earth loop at low temperatures. Lack of antifreeze will cause unit shutdown problems during cold weather operation (longest unit run time) when the loop temperatures fall below the freeze protection of the antifreeze. Flow rate requirements for closed loop solutions are higher than open loop systems because water temperatures supplied to the heat pump are generally lower. **Typically** 2.0 to 3.0 gallons per minute (GPM) per ton are required for proper operation of the heat pump and the earth coupled heat exchanger.

Table 2 – Approximate Fluid Volume (gal) per 100ft

Pipe	Size	Volume
Polyethylene	¾" IPS SDR 11	2.8
	1" IPS SDR 11	4.5
	1-1/4" IPS SDR 11	8.0
	1-1/2" IPS SDR 11	10.9
	2" IPS SDR 11	18.0
Rubber Hose	1"	3.9
Copper	1"	4.1
	1.25"	6.4
	1.5"	9.2

Table 3 – Antifreeze Percentages by Volume*

Minimum Temperature for Freeze Protection					
	10°F	16°F	17°F	21°F	25°F
Type	-12°C	-9°C	-8°C	-6°C	-4°C
Methanol	25%	21%	18%	16%	10%
Propylene Glycol	38%	30%	25%	22%	15%
Ethanol	22%	20%	18%	14%	10%

*Reference information only, see product manufacturer specification for percentage.

⚠ WARNING

DO NOT USE CALCIUM AS ANTI-FREEZE. FOLLOW CGC/IGSHPA RECOMMENDATIONS FOR THE APPROPRIATE TYPE AND AMOUNT OF ANTI-FREEZE.

⚠ WARNING

PREVENTING FREEZE-UP IS INSTALLER/USER RESPONSIBILITY. LEAKING HEAT EXCHANGER OR PIPING (EXTERNAL OR INTERNAL WITHIN THE REFRIGERANT/ COMPRESSOR) ARE NOT COVERED BY WARRANTY.

Open Loop/Well – An open system gets its name from the open discharge of water after it has been used by the heat pump. A well must be available that can supply all of the water requirements of the heat pump along with any other water requirements drawing off that same well. The well must be capable of supplying the heat pumps required flow rated for up to 24 hours per day for the coldest winter day.

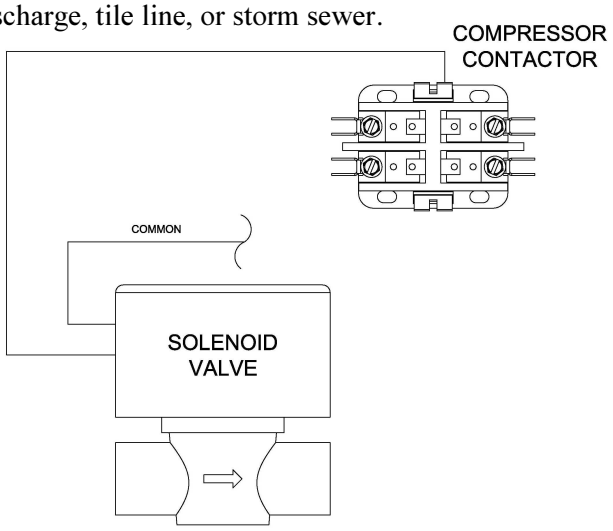
The discharge water is typically returned to the earth via a properly designed drain field or in a lake.

Figure 6 shows the necessary components for water piping of an open system. First a bladder type pressure tank with a "draw down" of at least 1-1/2 to 2 times the well pump capacity must be installed on the supply side of the heat pump to prevent short cycling the well pump. Constant pressure well pumps need to deliver the GPM flow rate of the NHP unit and other possible consecutive demands. Shut off valves and boiler drains on the entering and leaving water lines are necessary for future maintenance. A screen strainer is placed on the supply line with a mesh size of 40 to 60 and enough surface area to allow for particle buildup between cleanings. Hose kits are installed between the heat pump and ridged plumbing to reduce vibration transfer. Hose kits have pressure temperature (P/T) plugs placed in the supply and discharge hydrant elbows so that thermometers or pressure gauges can be inserted into the water stream. On the well water discharge side of the heat pump a flow meter is installed to provide a visual indicator of open loop flow in GPM. The water solenoid valve must be installed to control water flow through the unit. After the water solenoid a flow control valve is installed to limit maximum flow through the heat pump. The ball valve installed in the leaving water line can be used to create a small amount of back pressure to quiet the flow control valve if needed. Discharge water temperature should not drop below 38° at any time during the units operation. Remove handle on the entering and leaving water ball valves to prevent accidental change of flow.

A solenoid valve is then installed and wired to compressor contactor. This valve will open when the unit is running and close when the unit stops. A visual flow meter is then installed to allow visual inspection of the flow requirements. The flow meter can also be useful in determining when maintenance is required. Schedule 40 PVC piping, copper tubing, polyethylene or rubber hose can be used for supply and discharge water lines. Limit rubber hose to 10ft. (3 meters) to prevent excessive pressure drop. Make sure line sizes are large enough to supply the required flow with a reasonable pressure drop (generally 1.00" diameter). Water discharge is generally made to a drain field, stream, pond, surface discharge, tile line, or storm sewer.

Solenoid Valve Wiring (for Open Loop Systems)

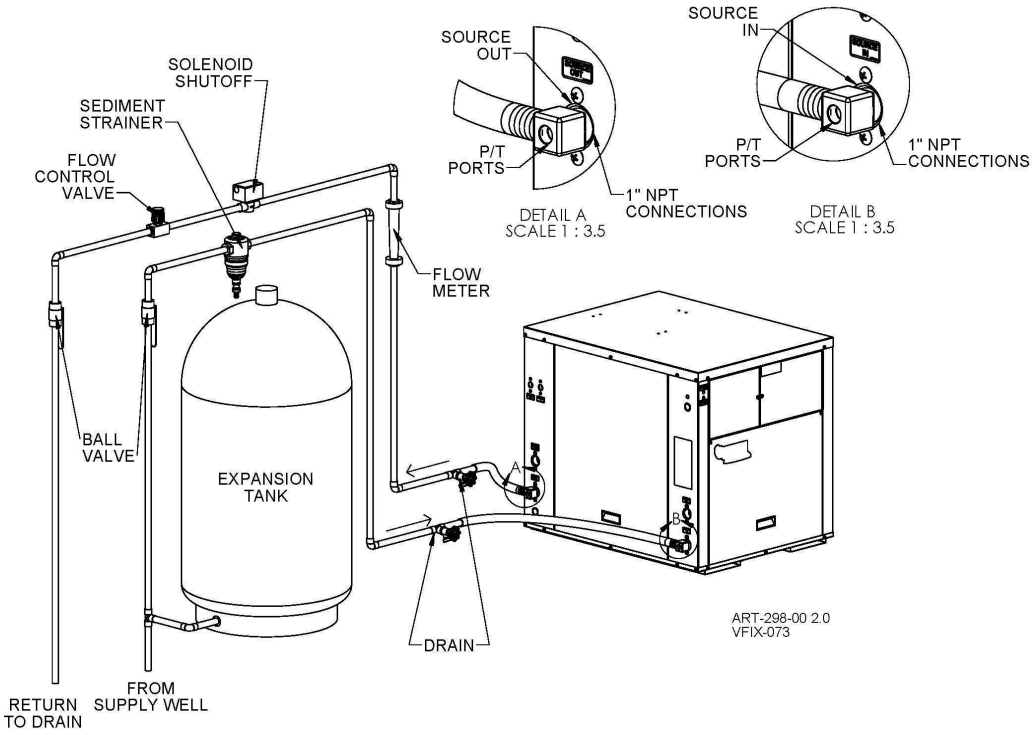
Locate the compressor contactor in the right-hand high-voltage side of the control panel. Wire the solenoid valve as shown in this diagram.



⚠ CAUTION

Using a drain field requires soil conditions and adequate sizing to assure rapid percolation or the required flow rates will not be achieved. Consult local codes and ordinances to assure compliance. Do not discharge water to a septic system. The heat pump should never be operated with flow rates (GPM) less than specified. Operation with less than required flow rate or no flow may result in freezing water in the water to refrigerant heat exchanger. This will cause the unit to shut down on low-pressure lockout. If the unit locks out, verify that the unit has the required flow and reset the unit by shutting off power to the unit for one minute. Do not continually reset the unit; if the unit locks out more than once call your service professional. Continued reset of the unit can freeze water inside the water coil to the point of rupturing the water coil (no warranty for frozen coils).

Figure 6: **Open Loop Well** – Typical piping diagram.



RD-WE Series, Freeze Protection – this heat pump is equipped with freeze protection temperature sensors used to monitor source side entering water temperature and load side leaving water temperature. The sensors are connected to a circuit board located in the control box and is wired in-series with the low pressure cutout switch. If one of these sensors drops below the set point, the low pressure circuit is opened on the ICM control causing it to lockout the compressor(s). If the ICM board shows a low pressure fault code and the low pressure switch is closed. Check the two LEDS on the freeze protection board.

Setup – this control contains a jumper peg that configures the sensors to operate either at open loop temperatures or closed loop temperatures. (J5-1 jumpered to J5-2 = closed loop). (J5-3 jumpered to J5-2 = open loop).

Red LED	Green LED	Function
Off	On	Normal
Off	1 blink every 2 seconds	Bad source entering water sensor
Off	2 blinks every 2 seconds	Bad load leaving water sensor
1 blink every 2 seconds	On	Source entering water freeze detection
2 blinks every 2 seconds	On	Load leaving water freeze detection
On	On	Both sensors freeze detection

Source Side Temperature Settings	Load Side Temperature Settings
Closed loop ≤ 15F = open	≤ 37F = open
Closed loop > 18F = closed	> 40F = closed
Open loop ≤ 37F = open	
Open loop > 40F = closed	

Source Coil for Open Systems - Water quality is a major concern for open systems. Problems can occur from scaling, particle buildup, suspended solids, corrosion, pH levels outside the 7-9 ranges, or biological growth. If poor water quality is known to exist in your area, a **cupronickel** water coil may be required when ordering the system, or installing a closed loop system may be the best alternative. Water coil cleaning on an open loop system may be necessary on a regular basis.

Desuperheater, Domestic Hot Water

General
All NHP Series units can be equipped with a desuperheater and an integrated circulating pump that can provide Supplemental Domestic hot Water (SDW). This is done by stripping heat from the superheated gas leaving the compressor.

Fuses – 3-amp fuses are installed in series with the desuperheater pump. The fuses are located in the line voltage control box, upper right. Remove the fuses (turn 230 power source off) to disable the pump whenever the system is not in operation.

Dual Compressor Models – contain two desuperheater heat exchangers, one for each refrigeration circuit. The water side of these exchangers is piped in series. These models still utilize one circulating pump.

General Plumbing and Installation Suggestions
1. Insulated ½" copper piping should be used from the hot water tank to the desuperheater connections on the left side of the unit. The copper tubing should be straight to maintain good water velocity and prevent pockets from forming at the pump inlet.

⚠ CAUTION

Due to high water temperatures generated by the desuperheater, PEX or poly pipe may rupture if coupled directly to heat pump outlet.

2. Shut off valves should also be used to service the desuperheater pump without draining the entire hot water tank. Note: Always be sure these valves are open when pump is running.
3. Pump problems develop by running the pump dry or with air in the system. All air must be purged from the desuperheater plumbing before the pump is engaged.
4. To purge air from the lines, loosen the desuperheater pump from its housing by turning the brass collar. Let water drip out of the housing until flow is established and re-tighten the brass collar.
5. Never operate the system without the high temperature switch (normally factory installed) otherwise tank temperatures could become dangerously high.
6. Poor water quality may restrict the effectiveness of using the desuperheater pump and will not allow the pump to circulate.
7. Desuperheater maintenance includes periodically opening the drain on the hot water tank to remove any deposits. Hard water may cause scale buildup in the desuperheater coil reducing its effectiveness.
8. The temperature difference between the water entering and leaving the desuperheater should be 5°F to 15°F. The water flow should be approximately 0.4 GPM per ton of nominal cooling.
9. Northern Heat Pump strongly suggests a water heater buffer tank, Figure 7, for the maximum efficiency from the provided desuperheater module. The Figure 7A single tank plumbing and application is shown for information only.

There are a number of ways the desuperheater/pump can be plumbed with and into the building/household water heater tank. **However**, many common methods used **are not** very effective because they simply circulate already heated water from the water heater tank through the desuperheater. The heat pump desuperheater cannot effectively produce hot water energy if the temperature of the water entering the desuperheater is close to or beyond the compressor gas capability to transfer energy into this circulated water – typically 110° F (43° C) to 130° F (54° C). Note: Health code requires 130° F (54° C) minimum.

- Example – if the water heater electric element thermostat is set at 140° F (60° C), it will maintain the tank at 140° F (60° C). There is no point in circulating 140° F (60° C) water through the desuperheater because it is picking up very little or no energy from the compressor hot gas.
- In fact, the energy flow may even be negative if the Geo HP loop temperature is too low, it is possible for a **single tank** hot water heater to actually flow energy into the Geo HP system with very bad system efficiency.

Figure 7 – Desuperheater Piping, Buffer Tank*
This arrangement is the most effective and efficient and the recommended installation. The buffer tank need not be as big as the standard water heater; 40-gallon size can be very effective. With this two tank system the desuperheater will always act as a city/well water **pre-heater** and the standard water heater (electric elements or gas) only requires tempering energy which is a very small percentage of domestic water heater energy required.

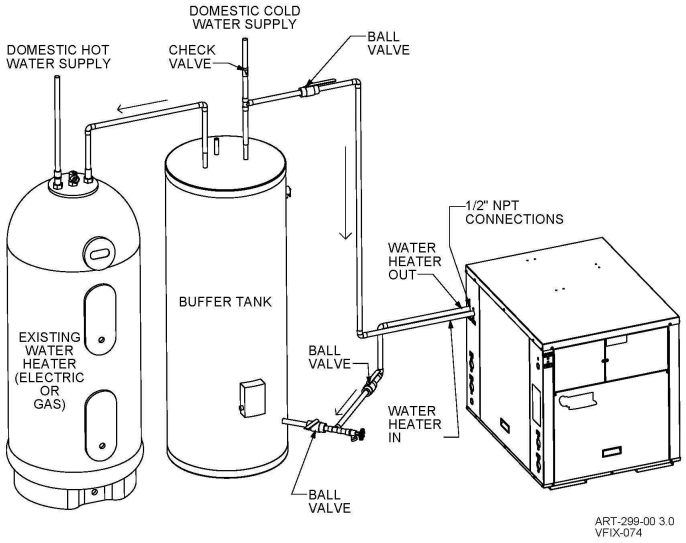
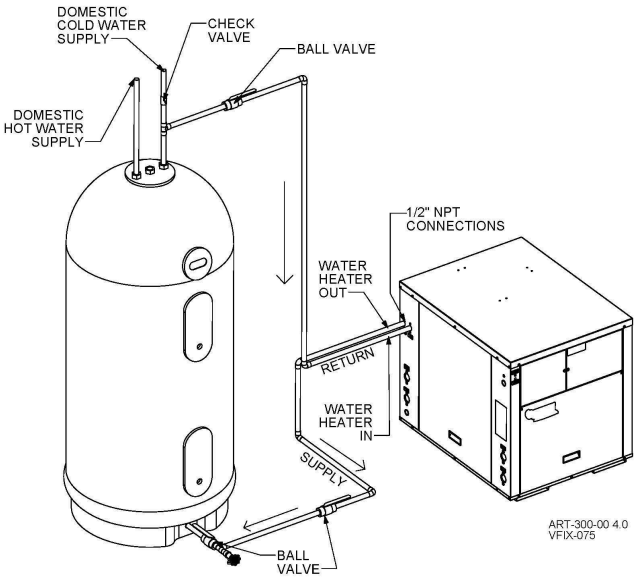


Figure 7A – Desuperheater, Single Tank Concept*
Draw water from the bottom drain and returning it to the cold water supply line. This method requires a check valve in the cold water supply to prevent water from flowing into the building or household cold water supply. A spring-type check valve with a pressure rating of 1/2 PSI or less is recommended.

Inspect the dip tube in the water heater cold inlet for a check valve. If a check valve is present it must be removed or damage to the desuperheater circulator will occur.

Before restoring electrical supply to the water heater, adjust the temperature setting on the tank.

- On tanks with both upper and lower elements, the lower element should be turned down to the lowest setting, approximately 100° F (38° C). The upper element should be adjusted to 120° F (49° C) to 130° F (54° C). Depending upon the specific needs of the customer, you may want to adjust the upper element differently.
- On tanks with a single element, lower the thermostat setting to 120° F (49° C).



⚠ CAUTION

Do not run desuperheater pump without supply from water heater. This will damage the pump.

*4-ton model shown, for water connection locations on other models reference product dimension pages.

Hydronic (Load), Space Water Heating, Installation

Plumbing
The Geo unit load circuit is basically a heat exchanger with piping ports for out and in flow. There are no pumps within the unit. Use standard water heating loop parts/components and piping/plumbing best practices as if this Geo unit is a "boiler". The minimum GPM flow requirement and pressure drop within the Geo unit heat exchanger is shown on the page 3 specification chart, for the appropriate model size. The internal feet of head resistance or pumping requirement is at the nominal GPM shown.

Depending upon the installation/heating zone concept, plumbing will depend upon decision for closed loop pressure or non-pressure system. If the vertical lift is less than approximately 15 feet (4.5 meters), a buffer tank with non-pressure concept is recommended.

Load Distribution/Zones Pumping, Pressurized
If the design involves a pressure system, expansion tank is required with an external safety valve ASME stamp and rated for 30 psi maximum. The necessary air relief and air separation components are strongly recommended for long-term continuous operations.

Call for aquastat heating (HW terminal) assumes the minimum, continuous, flow through the Geo unit heat exchanger is always greater than the minimum GPM shown on the mechanical specification chart, for the appropriate model. This Geo unit **does not** include a flow switch for the load circuit, if the flow is less than the specified minimum GPM or if there is no flow due to air locks, pump failure or load water circuit issues, the compressor will immediately lock out with high pressure. After the second reset compressor cycle, the compressor will be on permanent lockout with no further action until service or troubleshooting takes place.

- If an external flow switch is added, wire it in series with the internal loop flow switch.

Load Heating Zones
If there are small zones or zones which cannot handle the Btu/h capacity of the appropriate installed model (specification chart Btu/h) or if these zones reduce the GPM water flow, there must be external controls or a buffer tank within the system to make sure the compressor does not short cycle or the system does not overheat. For a Geo water to water unit the most effective and easiest method of handling multiple zones is with a buffer tank system.

⚠ WARNING

THE SYSTEM MUST BE DESIGNED FOR A MINIMUM 10 TO 15 MINUTE COMPRESSOR RUN TIME ON EACH AQUASTAT CALL. IF, DURING THE LIFE OF THE WARRANTY, THERE ARE COMPRESSOR FAILURE ISSUES AND AN EVALUATION OF THE INSTALLATION DETERMINES THERE WAS NO PROVISION FOR TAKING CARE OF COMPRESSOR SHORT CYCLING OR COMPRESSOR HIGH DISCHARGE PRESSURE REPEATED OPERATION, WARRANTY MAY BE REJECTED.

Hydronic Buffer Tank Consideration
Inclusion of a buffer tank is ideal for non-pressure concept and is the simplest pumping/plumbing approach. The number and size of heating zones has no immediate consideration, the Geo unit has its own external main pump which simply "pumps into" a buffer tank circulating loop. If all pumps are installed below the lower half of the buffer tank, a non-pressure tank is the ideal solution. No purging or air lock issue will develop in this situation.

Each heating zone pump has its own thermostat control device which simply causes its pump to pull energy from the buffer tank as required. An aquastat type device on the buffer tank controls or determines the Geo unit HW call.

Buffer tank sizing is typically 6 to 10 gallons per ton. If it is a heating only installation, a larger buffer tank is suggested and should be considered.

Buffer Tank Controller – HP-BTC or HP-BTC-24
This add-on optional Electro Industries controller is suggested to improve and easily take care of the buffer tank, up to 6 zone pumps/valves, 4-wire stat for cooling, cooling fan coil pump, etc. In addition, a major feature of this controller is the ability to operate the buffer tank temperature with outdoor reset concept. In its pricing category, it is consider the most complete buffer tank controller available. The application drawings (HX101) have nine suggested piping or usage configurations.

Forced Air Fan Coil
The water coil can be one zone from a buffer tank. When the zone controller is used, this is typically the priority zone and with priority on the other hydronic zones are held off. The water coil should operate from the tank's highest temperature.

- If cooling is desired or planned for the forced air water coil, the forced air room thermostat (1H/1C) will control the Geo unit reversing valve as well as the call for heat/cool controls the air handler blower. The buffer tank aquastat will need to function as a heat/cool device to activate the Geo unit.

Load Loop Temperature Operating Point Consideration
The efficiency of this water to water Geo unit directly relates to the load aquastat set point or operating water temperature. Even though this unit is specified or rated at 110° (43° C) outlet temperature, the efficiency COP can change as much as 0.8 or 1.0 from 110° F (43° C) to 90° F (32° C) (COP 2.4 versus COP 3.2). The higher the load return water temperature, the higher the compressor discharge pressure and the higher compressor motor current draw or watts.

Water Quality
It is very important to fill the hydronic system with good quality water to prevent bacteria or algae growth in the antifreeze solution. This growth can cause a buildup on the heat exchanger surfaces, reducing efficiency, capacity and cause lockouts. The water used to fill the system should have 100-PPM grains hardness or less. There are different qualities of water, which are acceptable for use in these systems. Starting with the lowest to the highest, softened water, bottled water, reverse osmosis (RO) water, and distilled water. **NOTE:** When using reverse osmosis (RO) or distilled water you **MUST** use a glycol such as **EnviroGard Ultra HD** that contains additional inhibitors for glycol concentrations below 35%. Using good quality water and adding 2 ounces of household chlorine bleach for each 10 gallons of fluid, or boiler system conditioner can reduce the possibility of a problem.

Electrical Hookup

3-phase models (both 208 and 480) – also see and use NI704.

⚠ WARNING

DISCONNECT ALL ELECTRICAL POWER BEFORE ELECTRICALLY CONNECTING OR SERVICING THE UNIT. FAILURE TO DISCONNECT THE ELECTRICAL POWER BEFORE WORKING ON THIS PRODUCT CAN CREATE A HAZARD LEADING TO PERSONAL INJURY OR DEATH.

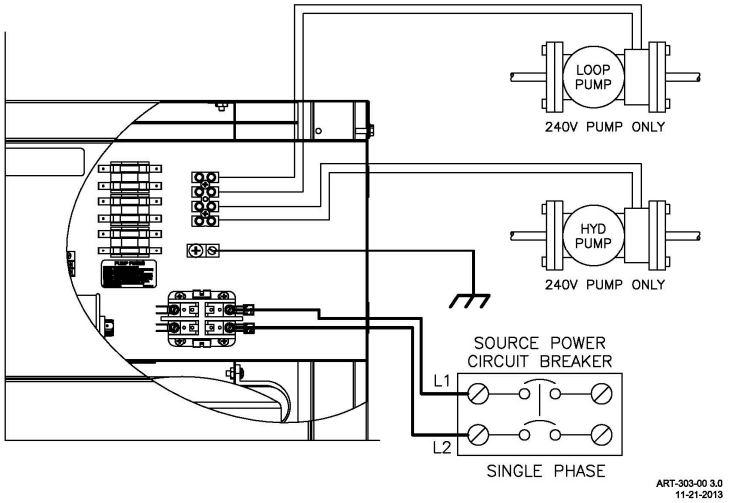
Line Voltage

The nameplate and/or Installation and Operating Manual specification page provides RLA, LRA, and total amps requirement. Select the proper wire size to comply with your type of wire routing and NEC field wiring requirements.

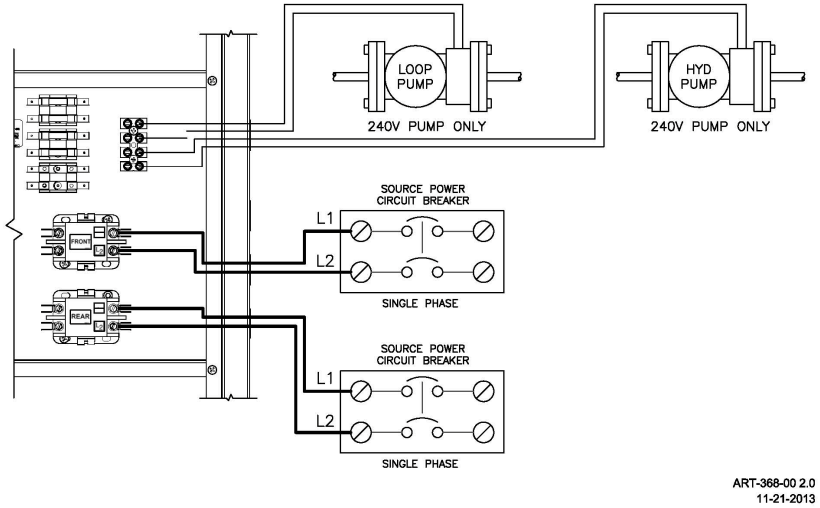
The field power supply connection is located at the compressor contactor in the lower right hand corner of the control box. Dual compressor models have separate contactors that feed each compressor individually. A dedicated circuit must be fed to each contactor, see electrical data chart for circuit breaker requirements.

The control transformer, desuperheater pump, and loop and load pumps are powered off of the first or "front" contactor. If the heat pump needs only to be run in part load, the circuit feeding the rear compressor can be simply shut off without affecting the operation of system.

Single Compressor Models – 2.5 through 6-ton



Dual Compressor Models – 8 through 12-ton



Disconnect – field provided external safety disconnect is required, see nameplate max amps.

Grounding – route and install the proper size ground conductor between the ground lug above the compressor contactor and the building service entrance panel ground bus. This must be a conductor wire size according to NEC code for the total amp rating of the installed model. The conduit is not sufficient ground conductor.

⚠ WARNING

USE ONLY COPPER WIRE FOR CONNECTION TO THE CIRCUIT BREAKER TERMINALS AND INSIDE THIS PRODUCT'S CABINET.

⚠ WARNING

TO AVOID THE RISK OF ELECTRIC SHOCK OR DEATH, WIRING TO THE UNIT MUST BE PROPERLY GROUNDED. FAILURE TO PROPERLY GROUND THE UNIT CAN RESULT IN A HAZARD LEADING TO PERSONAL INJURY OR DEATH.

Control Wiring

Operating Aquastat (or Buffer Tank Controller, HP-BTC)
The closed-for-heat contact is simply wired to terminal block R and HW. For set point and differential, see previous section on operating temperature consideration and compressor short cycling.

Loop Pump
The internal terminal provides 240 (L1 and L2) 10A fused output for the loop pump or flow center.

Hydronic Main Pump
The external circulating pump for the buffer tank or large single zone system can be operated from the internal "HYD PUMP" terminal block. Note this is a 10A fused 240V output that operates coincident with the HW input. If the hydronic loop pump is 120V, you must use an isolation relay from this internal terminal block connection.

Forced-Air Air Handler/Water Coil
The room thermostat for the forced air coil and its appropriate control mechanism must operate the air handler and the pump for the water coil. Also, if it is to be used for cooling, the thermostat must provide the O terminal reversing valve O function to this Geo unit and appropriately control the compressor HW terminal.

Buffer Tank Controller, Optional
This controller can be considered a central wiring point for all zone thermostats, zone pumps, forced air thermostat, forced air water coil pump, forced air blower (gas furnace blower), etc. The HP-BTC installation manual provides complete details and drawings for all external hookup devices including the connection between HP-BTC and this NHP geo unit.

Note:
Once the roomstat is set for COOL it must remain in COOL for the summer season. If it is turned off or switched back and forth, the buffer tank could actually heat up in summer.

Operation Indicators

External Monitor Lights
The two monitor lights indicate control power and/or fault indicator.

ICM Board – The ICM board performs the functions controlling the compressor operation: system lockout, compressor anti-short cycle, and a five minute delay after power is applied.

The control will begin the 5-minute time delay upon a Y call from the thermostat. After the time delay expires, the compressor contactor will be energized as long as the high and low pressure switches are closed. If either switch is open after the delay expires, the compressor will not energize. If either switch opens while the compressor is energized, it will de-energize immediately and begin the anti-short cycle delay. The compressor will not be allowed to turn on again until the anti-short cycle delay expires and both pressure switches are closed. The flow switch will have a 30-second bypass timer in which the control will ignore an open flow switch for the first 30 seconds. If the flow switch remains open after the 30-second bypass timer expires, the unit will de-energize the compressor and begin the anti-short cycle delay. If the control experiences three high pressure, low pressure, or flow switch faults in a 60-minute period, it will lock out the compressor and energize the fault output. A manual reset of power will be required to reset the lockout condition.

Problems that could cause a lockout situation include:

1. Water flow problems
2. Freeze sensor (RD-WE series)
3. Internal heat pump operation problems
4. Cold ambient air temperature conditions

The control has a status LED to indicate which type of fault or lockout has occurred. If a high pressure fault or lockout occurs, the status LED will blink once. If a low pressure fault or lockout occurs, the status LED will blink twice. If a flow switch fault occurs, the status LED will blink three times.

ICM Fault Code LED

1 blink = high pressure cutout
2 blink = low pressure cutout
3 blink = Flow switch open

The anti-short cycle function puts a time-out period of **5 fixed ±20%** minutes on the compressor before re-starting. This function protects the compressor from repeated on/off operation in the event of a loose wire or faulty controller.

DO NOT reset the system more than once.
Repeated resetting of the lockout can cause serious damage. **If same lockout occurs contact your service dealer immediately.**

High and Low Pressure Switches – The heat pump is equipped with both high and low pressure switches that shut the unit off if the refrigerant pressure exceeds 550 PSI or goes below 40 PSI. Do not reset a well water system in the heating mode without first verifying water flow.

Pressure Switch Settings

	Low Pressure Switch	High Pressure Switch	Fault Code LED
Cut-out pressure	40 PSI	550 PSI	1 blink = high pressure cutout
Cut-in pressure	65 PSI	420 PSI	2 blink = low pressure cutout

RD-WE Series, Freeze Protection – this heat pump is equipped with freeze protection temperature sensors used to monitor source side entering water temperature and load side leaving water temperature. The sensors are connected to a circuit board located in the control box and is **wired in series with the low pressure cutout switch**. If one of these sensors drops below the set point, the low pressure circuit is opened on the ICM control

causing it to lockout the compressor(s). If the ICM board shows a low pressure fault code and the low pressure switch is closed. Check the two LEDS on the freeze protection board.

Setup – this control contains a jumper peg that configures the sensors to operate either at open loop temperatures or closed loop temperatures. (J3-1 jumpered to J3-2 = closed loop). (J3-3 jumpered to J3-2 = open loop).

Red LED	Green LED	Function
Off	On	Normal
Off	1 blink every 2 seconds	Bad source entering water sensor
Off	2 blinks every 2 seconds	Bad load leaving water sensor
1 blink every 2 seconds	On	Source entering water freeze detection
2 blinks every 2 seconds	On	Load leaving water freeze detection
On	On	Both sensors freeze detection

Source Side Temperature Settings	Load Side Temperature Settings
Closed loop ≤ 15F = open	≤ 37F = open
Closed loop > 18F = closed	> 40F = closed
Open loop ≤ 37F = open	
Open loop > 40F = closed	

Troubleshooting Guide for Water to Water Geo “Heating”

	Head pressure	Subcool	Suction pressure	Superheat	Compressor Amp Draw	Load temp differential	Source temp differential
Undercharged system	Low	Low	Low	High	Low	Low	Low
Overcharged system	High	High	High	Low	High	High	High
Low Load flow	High	Low	High	High	High	High	Low
High Load flow	Low	Low	High	High	High	Low	High
Low source flow	Low	High	Low	Low	Low	Low	High
High source flow	High	Low	High	High	High	High	Low
Low return Load temperature	Low	High	Low	Low	Low	High	High
High return Load temperature	High	Low	High	High	High	Low	Low
Scaled source coil	Low	High	Low	Low	Low	Low	Low
Scaled Load coil	High	Low	High	High	High	Low	Low
Restricted filter/drier	Low	High	Low	High	Low	Low	Low
Bad TXV / No Bulb charge	Low	High	Low	High	Low	Low	Low

Troubleshooting Guide for Water to Water Geo “Chiller”

	Head pressure	Subcool	Suction pressure	Superheat	Compressor Amp Draw	Load temp differential	Source temp differential
Undercharged system	Low	Low	Low	High	Low	Low	Low
Overcharged system	High	High	High	Low	High	Low	Low
Low Load flow	Low	High	Low	Low	Low	High	Low
High Load flow	Low	Low	High	High	High	Low	High
Low source flow	High	Low	High	High	High	Low	High
High source flow	Low	High	Low	Low	Low	High	Low
Low return Load temperature	Low	High	Low	Low	Low	Low	Low
High return Load temperature	High	Low	High	High	High	Low	High
Scaled source coil	High	Low	High	High	High	Low	Low
Scaled load coil	Low	High	High	Low	Low	Low	Low
Restricted filter/drier	Low	High	Low	High	Low	Low	Low
Bad TXV / No Bulb charge	Low	High	Low	High	Low	Low	Low

Unit Operating Conditions – Heat

Model	Stage	Source Temp	Source temp Δ	Source GPM	Load Temp Δ	Load GPM	Total Amps 240	Discharge Pressure	Discharge temp	Sub cool at TXV	Suction pressure at bulb	Suction temp at bulb	Super-heat at bulb
RA-WE-030	N/A	32	2.3-4.3	8	4.4-6.4	8.0	10.4-11.4	397-417	185-191	20.6-24-6	83-9.3	36-42	12.6-16.6
	N/A	50	4.2-6.2	8	5.9-7.9	8.0	10.5-11.5	409-429	168-174	20.8-24.8	114-124	49-55	10.3-14.3
	N/A	68	6.7-8.7	8	7.4-9.4	8.0	10.4-11.4	418-438	158-164	21.1-24.1	149-159	62-68	8.8-12.8
RA-WE-036	N/A	32	2.5-4.5	9	4.9-6.9	9.0	14.1-15.1	416-436	198-204	15.9-19.9	83-93	33-39	10.5-14.5
	N/A	50	3.2-5.2	9	6.3-8.3	9.0	14.0-15.0	422-442	168-174	12.7-16.7	113-123	47-53	9.0-13.0
	N/A	68	6.7-7.7	9	8.3-10.3	9.0	14.2-15.2	431-451	170-176	12.3-16.3	145-155	61-67	9.1-13.1
RA-WE-050	N/A	32	2.8-4.8	12	5.5-7.5	12	19.5-20.5	415-435	196-202	14.8-18.8	80-90	34-40	12.8-16.8
	N/A	50	4.6-6.6	12	7.1-9.1	12	19.9-20.9	427-447	178-184	15.3-19.3	111-121	47-53	10.1-14.1
	N/A	68	7.1-9.1	12	9.3-11.3	12	19.7-20.7	436-456	169-175	14.7-18.7	145-155	61-67	9.4-13.4
RA-WE-060	N/A	32	2.4-6.4	15	5.6-9.6	15	19.9-25.9	382-422	175-185	16.1-24.1	72-92	31-37	9.6-17.6
	N/A	50	3.3-7.3	15	6.1-10.1	15	19.9-25.9	391-431	157-167	15.1-23.1	105-125	46-52	7.3-15.3
RA-WE-072	N/A	32	2.5-6.5	18	5.9-9.9	18	24.1-30.1	376-416	172-182	9.8-17.8	70-90	32-38	11.5-19.5
	N/A	50	4.4-8.4	18	8.0-12.0	18	25.2-31.5	390-430	159-169	9.3-17.3	101-121	46-52	9.0-17.0
RA-WE-096	2	32	4.7-8.7	16	10.0-14.0	16	18.1-24.1	309-439	191-201	17.7-25.7	66-86	24-30	6.3-14.3
	2	50	8.2-12.2	16	13.3-17.3	16	19.3-25.3	423-463	172-182	21.0-29.0	94-114	38-44	4.4-12.4
	1	41	2.6-6.6	16	5.1-9.1	16	17.4-23.4	394-434	169-179	15.9-23.9	87-107	34-40	4.1-12.1
	1	50	3.4-7.4	16	6.3-10.3	16	17.7-23.7	404-444	1632-172	17.8-25.8	104-124	44-50	6.0-14.0
RA-WE-120	2	32	4.3-8.3	20	8.9-12.9	20	21.2-27.2	402-442	197-207	16.4-24.4	69-89	28-34	8.8-16.8
	2	50	7.4-11.4	20	12.3-16.3	20	22.0-28.0	422-462	181-191	18.8-26.8	96-116	41-47	6.6-14.6
	1	41	2.4-6.4	20	4.3-8.3	20	20.5-26.5	393-433	181-191	15.2-23.2	85-105	37-43	7.7-15.7
	1	50	2.7-6.7	20	5.4-9.4	20	20.0-26.0	399-439	171-181	15.4-23.4	103-123	44-50	6.6-14.6
RA-WE-144	2	32	3.9-7.9	24	8.5-12.5	24	27.1-33.1	394-434	158-168	13.5-21.5	73-93	25-31	3.0-11.0
	2	50	7.3-11.3	24	12.1-16.1	24	29.9-35.9	430-470	174-184	21.8-29.8	97-117	39-45	3.5-11.5
	1	41	2.5-6.5	24	4.5-8.5	24	27.3-33.3	403-443	176-186	18.5-26.5	88-108	33-39	2.1-10.1
	1	50	2.9-6.9	24	5.5-9.5	24	26.6-32.6	404-444	166-176	18.5-26.5	105-125	44-50	4.9-12.9

Unit Operating Conditions – Cool

Model	Stage	Source Temp	Source temp Δ	Source GPM	Load Temp Δ	Load GPM	Total Amps (240)	Discharge Pressure	Discharge temp	Sub cool at TXV	Suction pressure at bulb	Suction temp at bulb	Super-heat at bulb
RA-WE-030	N/A	50	7.1-9.1	8	6.1-8.1	8	4.0-5.0	183-203	97-103	5.1-9.1	115-125	48-54	9.4-13.4
	N/A	59	6.8-8.8	8	5.7-7.7	8	4.6-5.6	213-233	106-112	5.2-9.2	117-127	49-55	9.2-13.2
	N/A	77	6.2-8.2	8	5.1-7.1	8	5.8-6.8	275-295	127-133	5.3-9.3	119-129	50-56	9.2-13.2
	N/A	86	5.6-7.6	8	4.8-6.8	8	6.6-7.6	313-333	138-144	5.5-9.5	120-130	51-57	9.5-13.5
RA-WE-036	N/A	50	6.7-8.7	9	5.9-7.9	9	6.7-7.7	195-215	109-115	6.0-10.0	107-117	48-54	12.7-16.7
	N/A	59	6.6-8.6	9	5.7-7.7	9	7.5-8.5	222-242	116-122	10.6-14.6	109-119	49-55	12.3-16.3
	N/A	77	6.0-8.0	9	5.0-7.0	9	9.4-10.4	286-306	136-142	12.8-16.8	112-122	50-56	12.4-16.4
	N/A	86	5.6-7.6	9	4.8-6.8	9	10.3-11.3	320-340	147-153	14.9-20.9	114-124	50-56	12.2-16.2
RA-WE-050	N/A	50	6.7-8.7	12	5.9-7.9	12	6.7-7.7	195-215	108-114	6.0-10.0	107-117	48-54	12.7-16.7
	N/A	59	6.6-8.6	12	5.7-7.7	12	7.5-8.5	222-242	116-122	10.6-14.6	109-119	49-55	12.3-16.3
	N/A	77	6.0-8.0	12	5.0-7.0	12	9.4-10.4	286-306	136-142	12.8-16.8	112-122	50-56	12.4-16.4
	N/A	86	5.6-7.6	12	4.8-6.8	12	10.3-11.3	320-340	147-153	14.9-18.9	114-124	50-56	12.2-16.2
RA-WE-060	N/A	59	8.8-12.8	15	7.3-11.3	15	10.0-16.0	204-244	103-113	4.3-12.3	106-126	46-52	6.8-14.8
	N/A	77	8.1-12.1	15	6.2-10.2	15	13.1-19.1	267-307	121-131	6.7-14.7	107-127	47-53	7.0-15.0
RA-WE-072	N/A	50	7.7-11.7	18	7.3-11.3	18	13.4-19.4	174-214	103-113	8.1-16.1	94-114	42-48	8.5-16.5
	N/A	59	7.7-11.7	18	5.9-9.9	18	15.1-21.1	204-244	111-121	6.7-14.7	101-121	45-51	8.7-16.7
	N/A	77	7.7-11.7	18	5.6-9.6	18	18.7-24.7	267-307	124-134	7.7-15.7	107-127	47-53	7.1-15.1
RD-WE-096	2	50	13.7-17.7	16	12.0-16.0	16	7.6-13.6	182-222	100-110	10.7-18.7	87-107	36-42	5.4-13.4
	2	59	13.9-17.9	16	12.3-16.3	16	8.8-14.8	214-254	112-122	13.0-21.0	89-109	38-44	6.3-14.3
	2	77	11.0-15.0	16	11.1-15.1	16	11.8-17.8	279-319	133-143	13.4-21.4	92-112	40-46	7.5-15.5
	1	50	6.3-10.3	16	5.1-9.1	16	7.2-13.2	172-212	99-109	7.2-15.2	96-116	43-49	8.2-16.2
	1	59	6.5-10.5	16	5.6-9.6	16	8.4-14.4	203-243	105-115	8.1-16.1	102-122	45-51	7.6-15.6
	1	68	6.6-10.6	16	5.3-9.3	16	9.6-15.6	233-273	115-125	8.5-16.5	104-124	46-52	7.7-15.7
RD-WE-120	2	59	12.2-16.2	20	10.1-14.1	20	10.6-16.6	217-257	116-126	10.7-18.7	90-110	41-47	8.7-16.7
	2	77	10.5-14.5	20	9.4-13.4	20	14.0-20.0	282-322	138-148	10.9-18.9	93-113	43-49	9.9-17.9
	1	59	5.4-9.4	20	3.8-7.8	20	9.7-15.7	202-242	112-122	6.8-14.8	99-119	47-53	10.7-18.7
	1	68	5.6-9.6	20	4.3-8.3	20	11.5-17.5	237-277	121-131	6.5-14.5	103-113	47-53	9.6-17.6
RD-WE-144	2	50	12.5-16.5	24	11.0-15.0	24	12.8-18.8	193-233	108-114	5.8-13.8	91-111	39-45	6.1-14.1
	2	59	13.3-17.3	24	10.1-14.1	24	14.5-20.5	221-261	111-121	5.8-13.8	99-119	43-49	7.2-15.2
	2	77	10.7-14.7	24	10.0-14.0	24	18.7-24.7	287-327	130-140	8.9-16.9	99-119	43-49	6.7-14.7
	1	50	5.4-9.4	24	4.8-8.8	24	11.6-17.6	171-211	98-108	3.1-11.1	95-115	43-49	9.1-17.1
	1	59	6.0-10.0	24	3.8-7.8	24	13.5-19.5	205-245	108-118	3.7-11.7	105-125	48-54	9.5-17.5

Preventive Maintenance

Source Coil Maintenance –In closed loop systems, water coil maintenance is generally not needed. However, if a dirty installation or deterioration of the piping has caused debris to accumulate in the system, the water coil should be cleaned using standard cleaning procedures. For open loop systems installed in areas with a high mineral content, it is best to schedule regular periodic maintenance to inspect and clean the coil if necessary. Should cleaning become necessary, do so using the following standard cleaning procedure:

- Chlorine Cleaning (Bacterial Growth)

1. Turn thermostat to "Off" position.
2. Connect a circulating pump to hose bibs on entering water and leaving waterside of heat exchanger.
3. Using a five-gallon pail of water add chlorine bleach mixture. The chlorine should be strong enough to kill the bacteria. Suggested initial mixture is 1 part chlorine bleach to 4 parts water.
4. Close shut off valves upstream and downstream of heat exchanger.
5. Open hose bibs to allow circulation of bleach solution.
6. Start pump and circulate solution through heat exchanger for 15 minutes to one hour. Solution should change color to indicate the chlorine is killing the bacteria and removing it from the heat exchanger.
7. Flush used solution down the drain by adding fresh water supply. Flush until leaving water is clear.
8. Repeat procedure until solution runs clear through the chlorine circulation process.
9. Flush entire heat pump system with water. This procedure can be repeated annually, semiannually, or as often as it takes to keep bacteria out of the heat exchanger, or when bacteria appears in a visual flow meter to the point the flow cannot be read.

- Muriatic Acid Cleaning (Difficult Scaling and Particle Buildup Problems)

Consult installer due to dangerous nature of acids.
Iron out solutions and de-scaling products are also useful

Fan Coil Air Filter Maintenance – A dirty fan coil air filter will result in lower efficiency and performance. Under normal operating conditions, a monthly cleaning or replacement should be satisfactory.

Heat Pump Water Coil Maintenance – (source or loop) In closed loop systems, water coil maintenance is generally not needed. However, if a dirty installation or deterioration of the piping has caused debris to accumulate in the system, the water coil should be cleaned using standard cleaning procedures. For open loop systems installed in areas with a high mineral content, it is best to schedule regular periodic maintenance to inspect and clean the coil if necessary. A dirty or fouled heat exchanger can cause the units to trip either low or high pressure. Should cleaning become necessary, do so using the following standard cleaning procedure: see water coil preventive maintenance.

Fan Coil Condensate Drip Pan and Drain – Inspection and cleaning of the condensate drain system during the cooling season will help prevent the system from plugging up, potentially causing water damage to your structure and floor coverings. Inspect the condensate drain line to make certain it remains clear of obstructions. In some areas, airborne bacteria can cause algae to grow in the drip pan. In these areas, it may be necessary to treat the drain pan with an algae inhibiting chemical, as this algae together with lint and dust could plug the drain piping. Fan coils with the water coil in a negative pressure chamber will need a trap that is vented after the trap for the condensate to drain properly.

Water/Air Coil – In order to keep your fan coil operation at peak efficiency, the air coil should be inspected and cleaned when necessary. If the coil is excessively dirty, the coil can be cleaned with a household vacuum cleaner and a soft brush. The aluminum fins are fragile and bend easily, so take great care not to damage the fins, and remember these fins are sharp, so take the needed safety precautions.

Accessories/Options

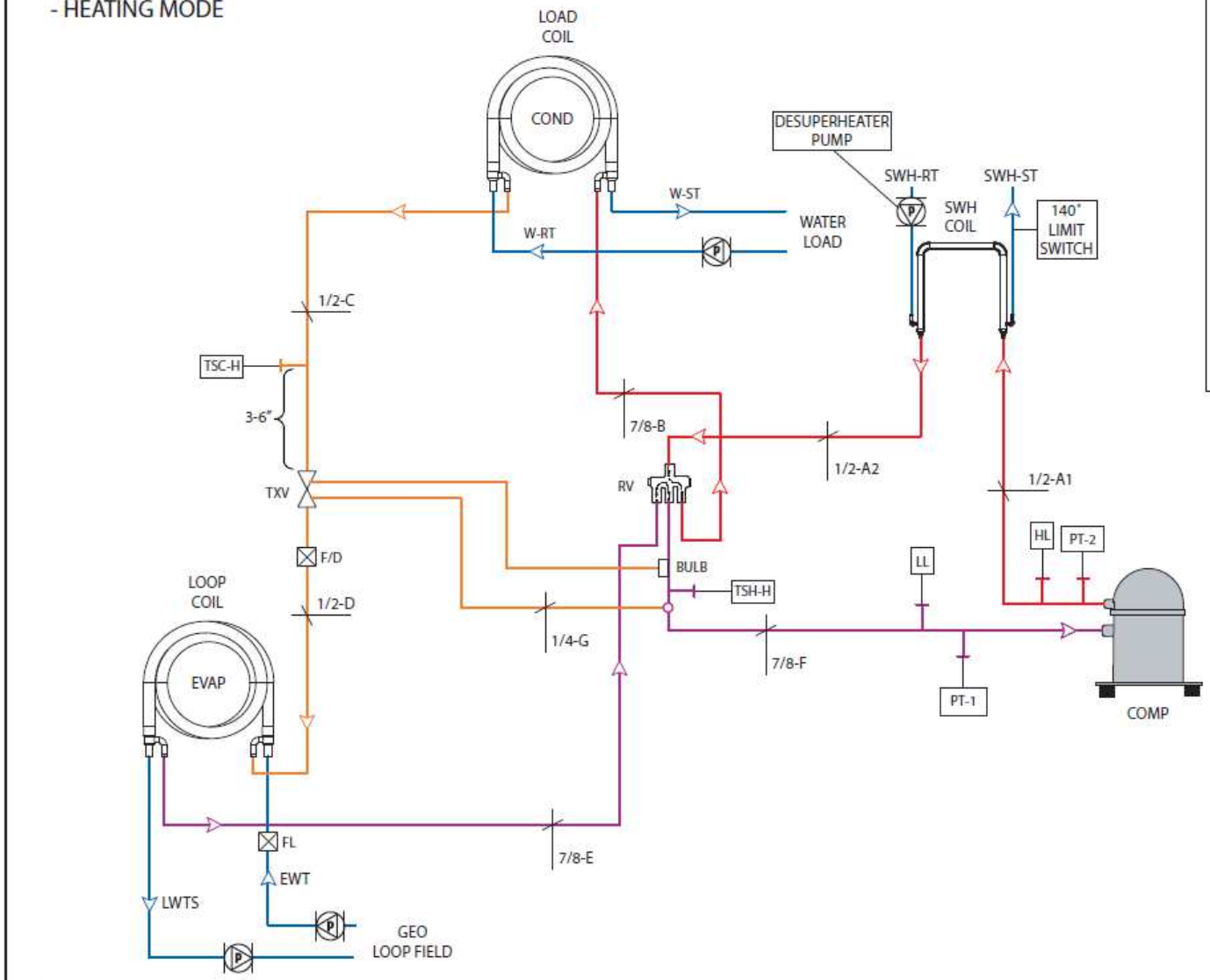
	Part Number
Fault/alarm external annunciator	R-AL-FD-1
Fuse – source loop pump, 10A	UFUSE1799
Fuse – desuperheater pump, 3A	UFUSE1796
NHP Digital 4-Wire Thermostat (pre-programmed)	5021
Open loop, freeze limit, 39° F (4° C), pipe mounted	6047
Sound vibration pad	R-PAD-2735-1
Buffer Tank Controller, 120V Zone Pumps	HP-BTC
Buffer Tank Controller, 24V Zone Valves	HP-BTC-24
Switching Relay, Single Pump Control for HP-BTC-24 above	EE-5051
Zone interface controller, 1 to 4 zones (within BTC)	EB-ZXA-1
Zone interface controller, additional 4 zones (within BTC)	EB-ZEA-2

Loop Flow Center
Contact your distributor for non-pressure recommendation.

Hydronics Buffer Tank
Contact your distributor for your zone, sizing, hydronic system diagram for recommended buffer tank system.

Buffer Tank Controller
Suggest Electro Industries matched controller, see part numbers above.

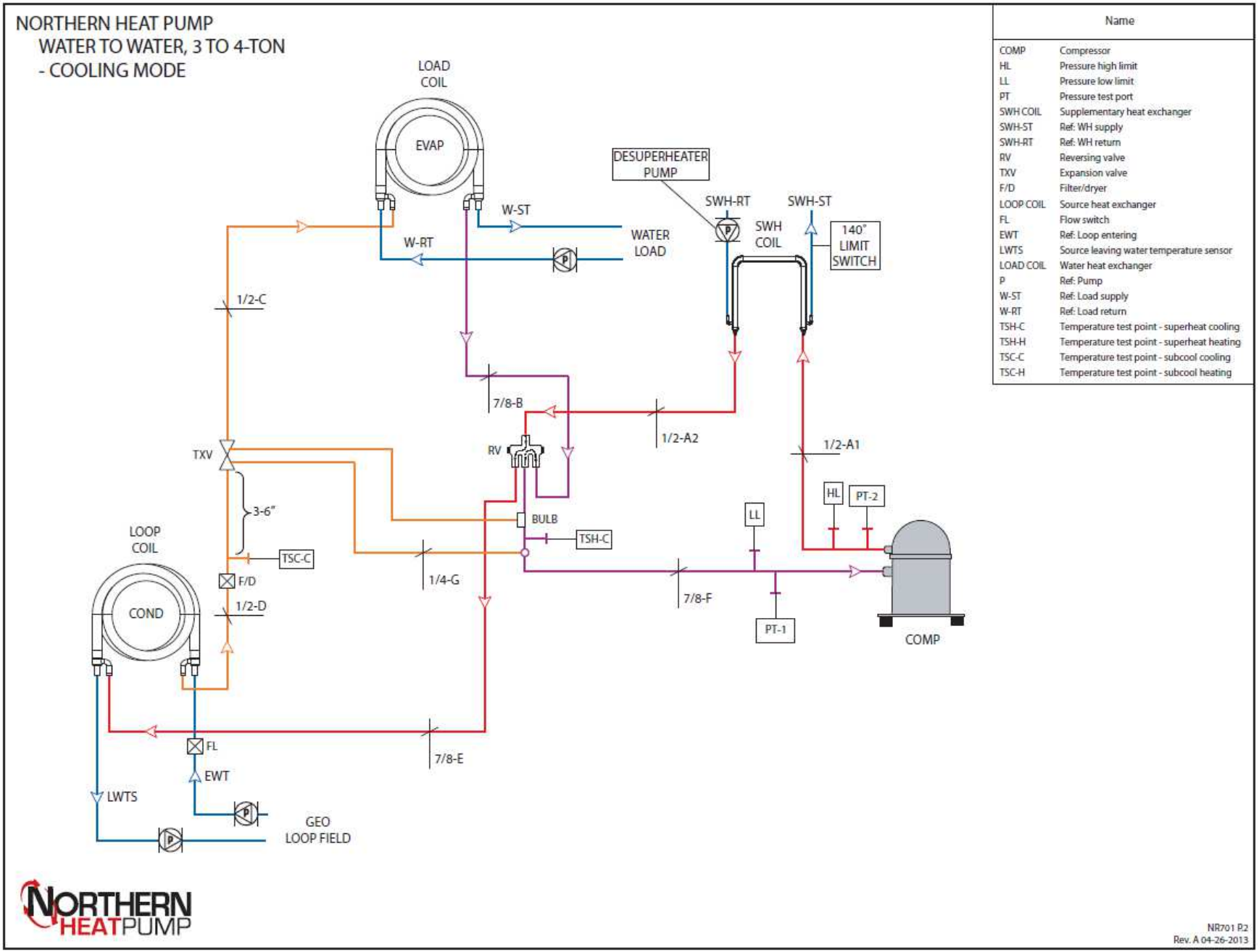
NORTHERN HEAT PUMP
WATER TO WATER, 3 TO 4-TON
- HEATING MODE

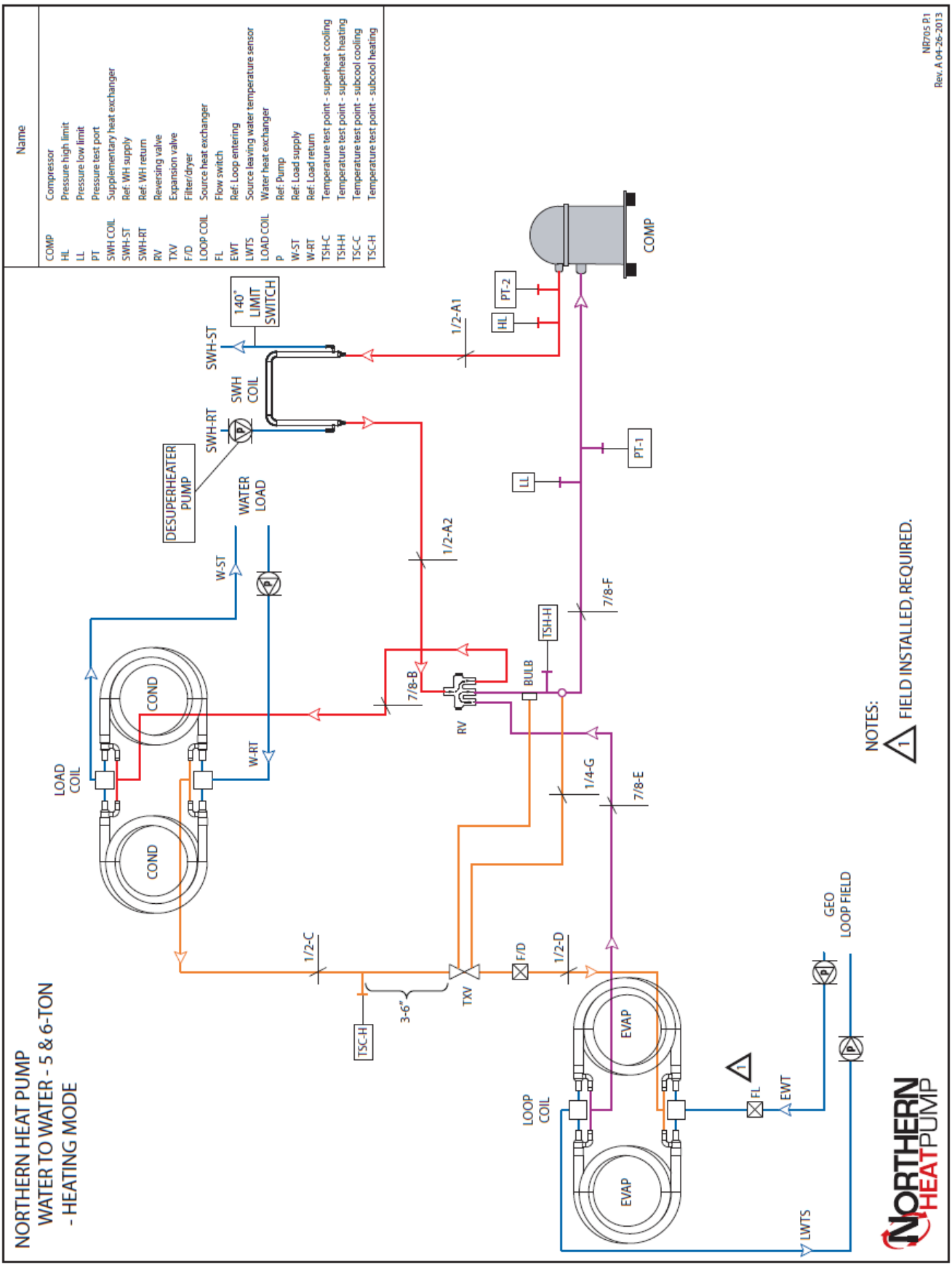


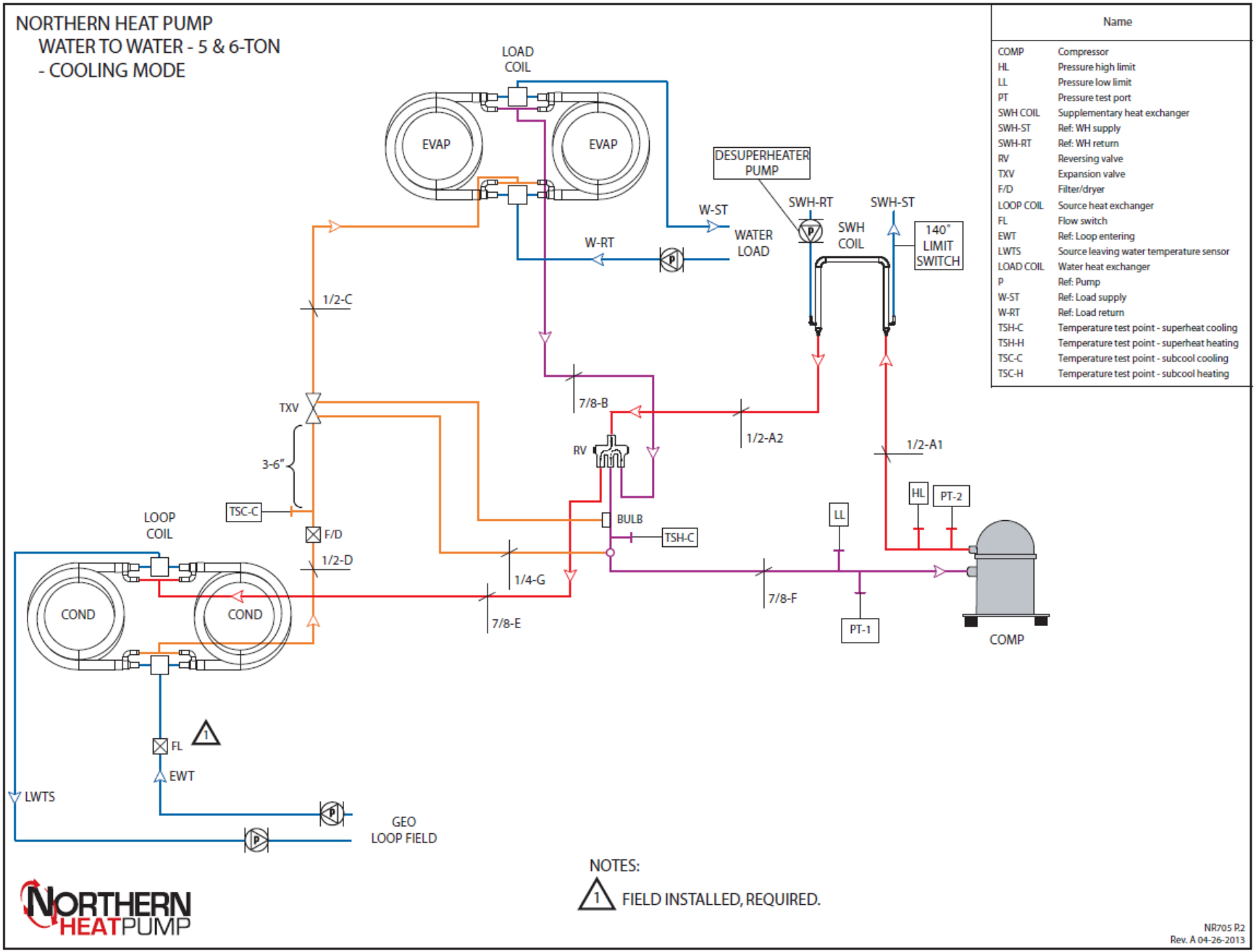
Name	
COMP	Compressor
HL	Pressure high limit
LL	Pressure low limit
PT	Pressure test port
SWH COIL	Supplementary heat exchanger
SWH-ST	Ref: WH supply
SWH-RT	Ref: WH return
RV	Reversing valve
TXV	Expansion valve
F/D	Filter/dryer
LOOP COIL	Source heat exchanger
FL	Flow switch
EWT	Ref: Loop entering
LWTS	Source leaving water temperature sensor
LOAD COIL	Water heat exchanger
P	Ref: Pump
W-ST	Ref: Load supply
W-RT	Ref: Load return
TSH-C	Temperature test point - superheat cooling
TSH-H	Temperature test point - superheat heating
TSC-C	Temperature test point - subcool cooling
TSC-H	Temperature test point - subcool heating

NORTHERN HEATPUMP

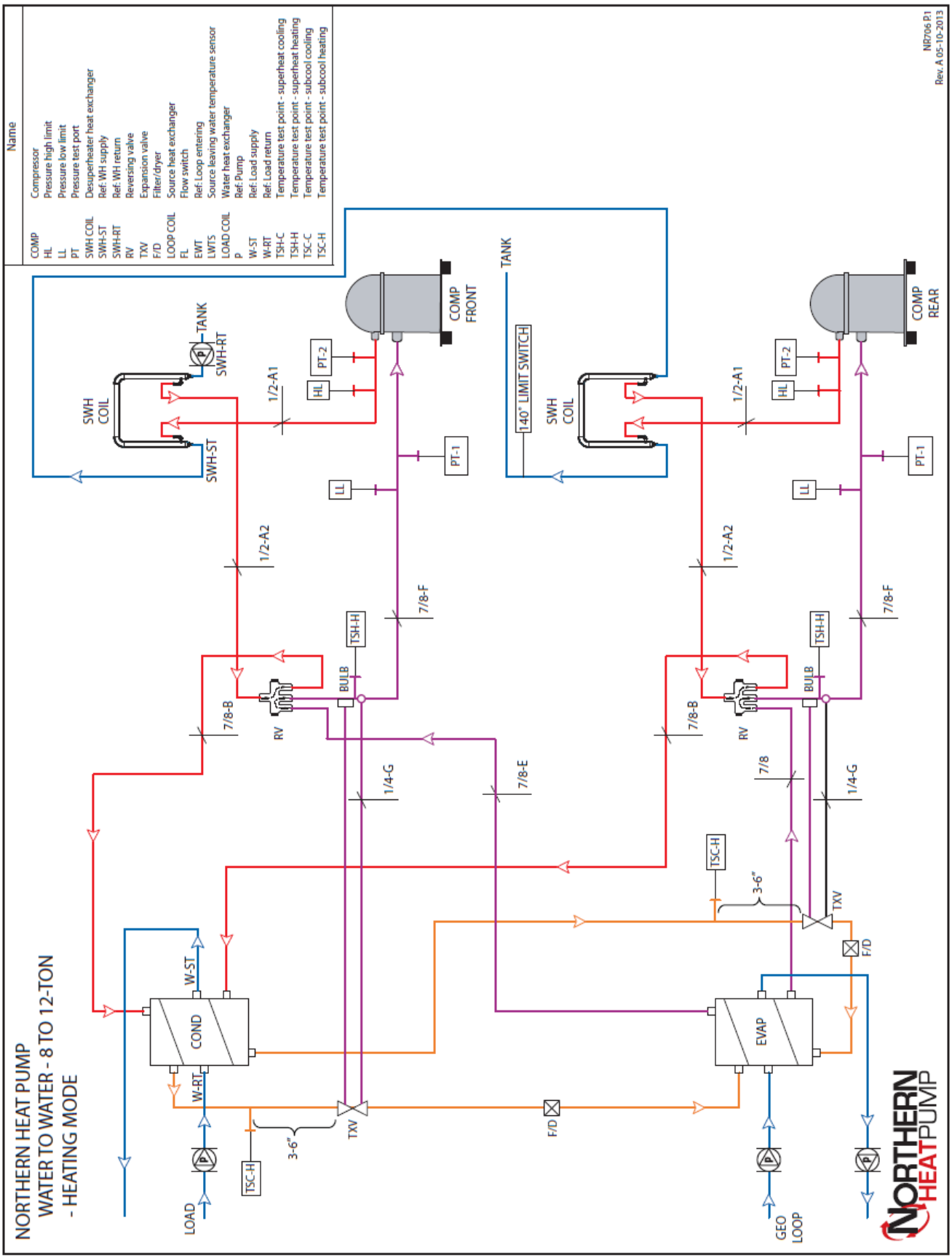
NR701 P.1
Rev. A 04-26-2013

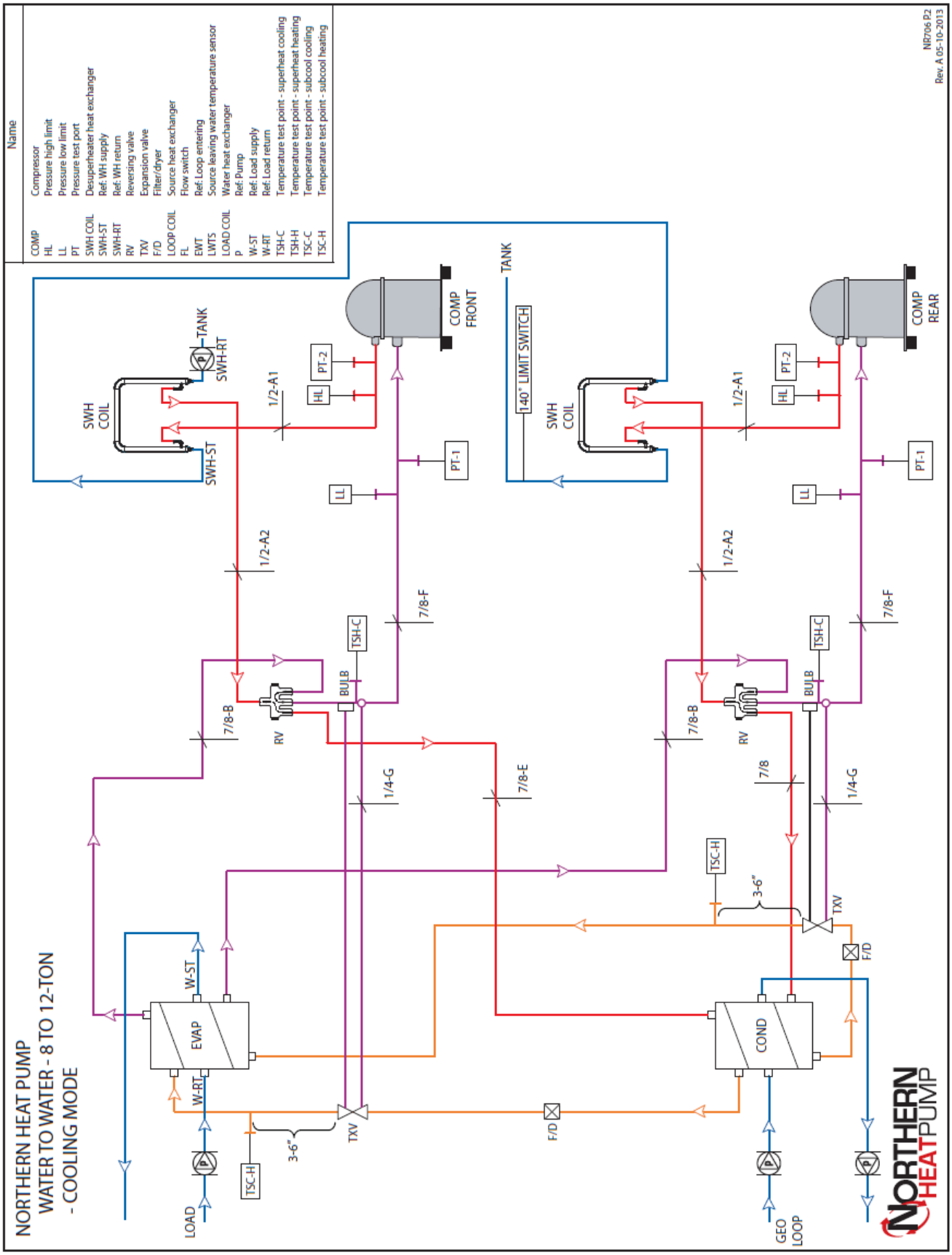

NORTHERN HEAT PUMP
WATER TO WATER, 3 TO 4-TON
- COOLING MODE
LOAD COIL
EVAP
DESUPERHEATER PUMP
SWH-RT
SWH-ST
SWH COIL
140° LIMIT SWITCH
W-ST
W-RT
WATER LOAD
1/2-C
7/8-B
1/2-A2
1/2-A1
RV
TXV
3-6"
BULB
TSH-C
HL
PT-2
LL
LOOP COIL
TSC-C
F/D
1/4-G
7/8-F
COND
1/2-D
PT-1
COMP
FL
7/8-E
EWT
LWTS
GEO LOOP FIELD
Name
COMP Compressor
HL Pressure high limit
LL Pressure low limit
PT Pressure test port
SWH COIL Supplementary heat exchanger
SWH-ST Ref: WH supply
SWH-RT Ref: WH return
RV Reversing valve
TXV Expansion valve
F/D Filter/dryer
LOOP COIL Source heat exchanger
FL Flow switch
EWT Ref: Loop entering
LWTS Source leaving water temperature sensor
LOAD COIL Water heat exchanger
P Ref: Pump
W-ST Ref: Load supply
W-RT Ref: Load return
TSH-C Temperature test point - superheat cooling
TSH-H Temperature test point - superheat heating
TSC-C Temperature test point - subcool cooling
TSC-H Temperature test point - subcool heating
NORTHERN HEATPUMP
NR701 P2
Rev. A 04-26-2013

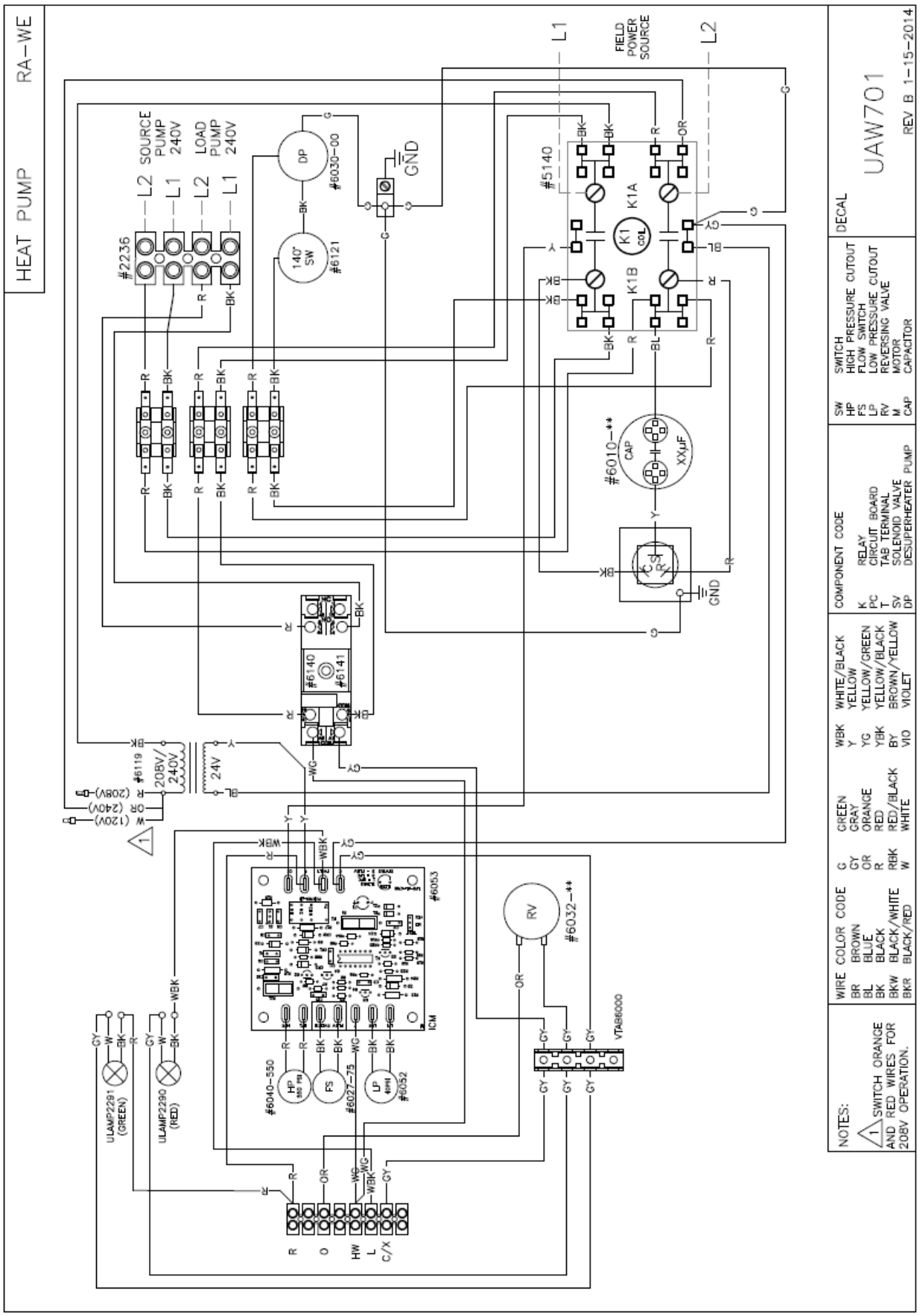

NORTHERN HEAT PUMP
WATER TO WATER - 5 & 6-TON
- HEATING MODE
Name
COMP Compressor
HL Pressure high limit
LL Pressure low limit
PT Pressure test port
SWH COIL Supplementary heat exchanger
SWH-ST Ref: WH supply
SWH-RT Ref: WH return
RV Reversing valve
TXV Expansion valve
F/D Filter/dryer
LOOP COIL Source heat exchanger
FL Flow switch
EWT Ref: Loop entering
LWTS Source leaving water temperature sensor
LOAD COIL Water heat exchanger
P Ref: Pump
W-ST Ref: Load supply
W-RT Ref: Load return
TSH-C Temperature test point - superheat cooling
TSH-H Temperature test point - superheat heating
TSC-C Temperature test point - subcool cooling
TSC-H Temperature test point - subcool heating
NI705 P1
Rev. A 04-26-2013
COMP
PT-2
HL
140° LIMIT SWITCH
SWH-ST
SWH COIL
SWH-RT
DESUPERHEATER PUMP
WATER LOAD
W-ST
W-RT
LOAD COIL
COND
COND
1/2-A1
1/2-A2
PT-1
LL
TSH-H
BULB
RV
7/8-B
7/8-F
1/4-G
7/8-E
1/2-C
3-6"
TSC-H
TXV
F/D
1/2-D
LOOP COIL
EVAP
EVAP
FL
EWT
LWTS
GEO LOOP FIELD
NOTES:
1 FIELD INSTALLED, REQUIRED.
NORTHERN HEATPUMP

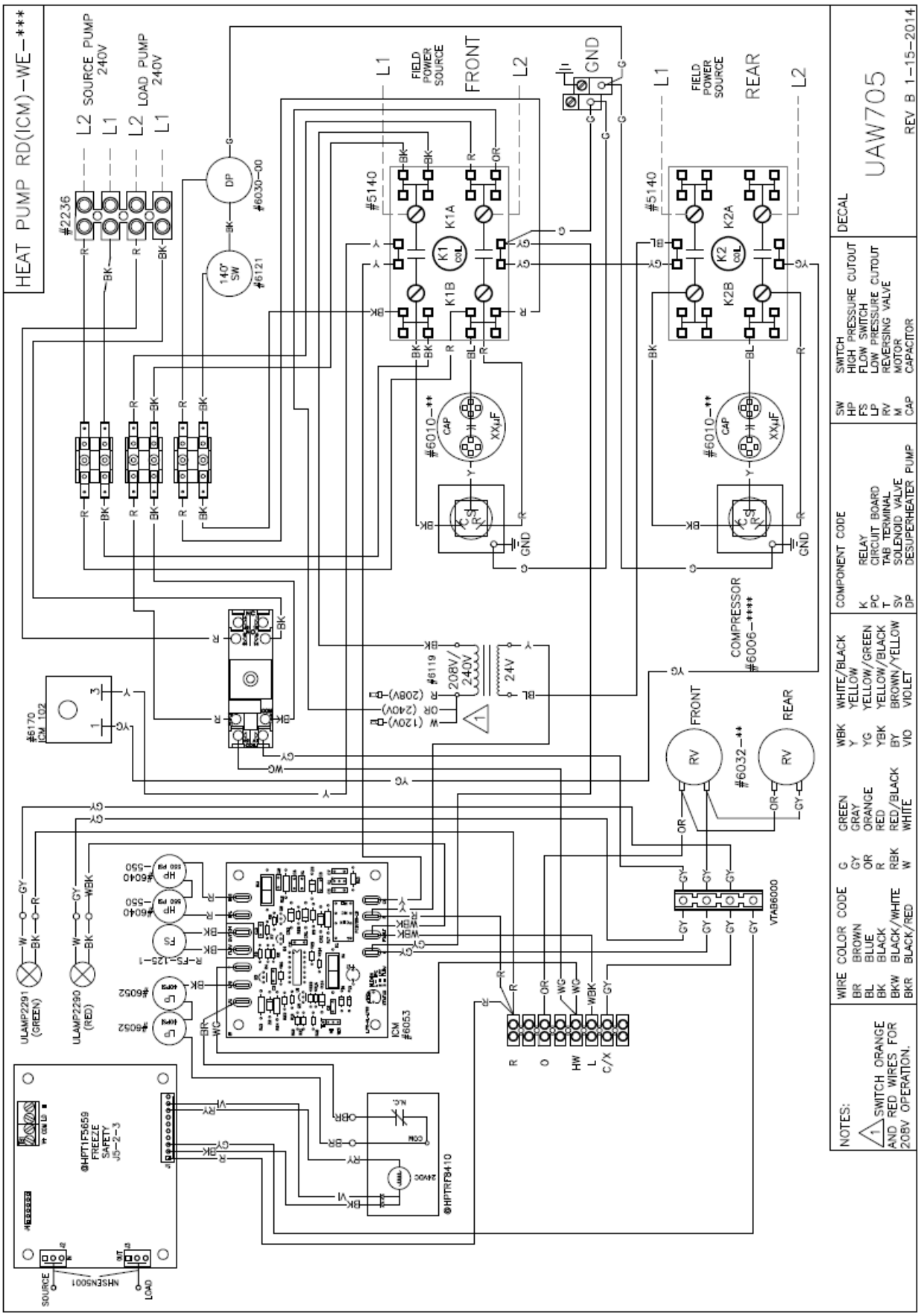


Name	
COMP	Compressor
HL	Pressure high limit
LL	Pressure low limit
PT	Pressure test port
SWH COIL	Supplementary heat exchanger
SWH-ST	Ref: WH supply
SWH-RT	Ref: WH return
RV	Reversing valve
TXV	Expansion valve
F/D	Filter/dryer
LOOP COIL	Source heat exchanger
FL	Flow switch
EWT	Ref: Loop entering
LWTS	Source leaving water temperature sensor
LOAD COIL	Water heat exchanger
P	Ref: Pump
W-ST	Ref: Load supply
W-RT	Ref: Load return
TSH-C	Temperature test point - superheat cooling
TSH-H	Temperature test point - superheat heating
TSC-C	Temperature test point - subcool cooling
TSC-H	Temperature test point - subcool heating


NORTHERN HEAT PUMP
WATER TO WATER - 8 TO 12-TON
- HEATING MODE
Name
COMP Compressor
HL Pressure high limit
LL Pressure low limit
PT Pressure test port
SWH COIL Desuperheater heat exchanger
SWH-ST Ref: WH supply
SWH-RT Ref: WH return
RV Reversing valve
TXV Expansion valve
F/D Filter/dryer
LOOP COIL Source heat exchanger
FL Flow switch
EWT Ref: Loop entering
LWTS Source leaving water temperature sensor
LOAD COIL Water heat exchanger
P Ref: Pump
W-ST Ref: Load supply
W-RT Ref: Load return
TSH-C Temperature test point - superheat cooling
TSH-H Temperature test point - superheat heating
TSC-C Temperature test point - subcool cooling
TSC-H Temperature test point - subcool heating
NR706 P1
Rev. A 05-10-2013
COMP FRONT
COMP REAR
TANK
SWH-RT
SWH-ST
SWH COIL
140° LIMIT SWITCH
1/2-A1
1/2-A2
7/8-B
7/8-E
7/8-F
7/8
1/4-G
3-6"
PT-1
PT-2
HL
LL
TSH-H
TSC-H
BULB
RV
TXV
F/D
W-ST
W-RT
COND
EVAP
LOAD
GEO LOOP
NORTHERN HEATPUMP


NORTHERN HEAT PUMP
WATER TO WATER - 8 TO 12-TON
- COOLING MODE
Name
COMP Compressor
HL Pressure high limit
LL Pressure low limit
PT Pressure test port
SWH COIL Desuperheater heat exchanger
SWH-ST Ref: WH supply
SWH-RT Ref: WH return
RV Reversing valve
TXV Expansion valve
F/D Filter/dryer
LOOP COIL Source heat exchanger
FL Flow switch
EWT Ref: Loop entering
LWTS Source leaving water temperature sensor
LOAD COIL Water heat exchanger
P Ref: Pump
W-ST Ref: Load supply
W-RT Ref: Load return
TSH-C Temperature test point - superheat cooling
TSH-H Temperature test point - superheat heating
TSC-C Temperature test point - subcool cooling
TSC-H Temperature test point - subcool heating
NR706 P2
Rev. A 05-10-2013
TANK
SWH-RT
SWH-ST
SWH COIL
COMP FRONT
COMP REAR
140° LIMIT SWITCH
PT-2
HL
PT-1
LL
1/2-A1
1/2-A2
7/8-F
7/8-B
7/8-E
7/8
1/4-G
RV
BULB
TSH-C
TSC-H
3-6"
TXV
F/D
EVAP
COND
W-ST
W-RT
LOAD
GEO LOOP
NORTHERN HEATPUMP


HEAT PUMP
RA-WE
L1
L2
FIELD POWER SOURCE
SOURCE PUMP 240V
LOAD PUMP 240V
#2236
#5140
K1A
K1B
K1 COIL
#6030-00
DP
140' SW
#6121
GND
#6010-**
CAP
XXµF
#6119
208V/240V
24V
#6140
#6141
#6053
ICM
#6040-550
HP
#6027-75
FS
LP
#6052
RV
#6032-**
VTA86000
ULAMP2291 (GREEN)
ULAMP2290 (RED)
R
O
HW
L
C/X
W (120V)
OR (240V)
R (208V)
1
NOTES:
1 SWITCH ORANGE AND RED WIRES FOR 208V OPERATION.
WIRE COLOR CODE
BR BROWN
BL BLUE
BK BLACK
BKW BLACK/WHITE
BKR BLACK/RED
G GREEN
GY GRAY
OR ORANGE
R RED
RBK RED/BLACK
W WHITE
WBK WHITE/BLACK
Y YELLOW
YG YELLOW/GREEN
YBK YELLOW/BLACK
BY BROWN/YELLOW
VIO VIOLET
COMPONENT CODE
K RELAY
PC CIRCUIT BOARD
T TAB TERMINAL
SV SOLENOID VALVE
DP DESUPERHEATER PUMP
SW SWITCH
HP HIGH PRESSURE CUTOUT
FS FLOW SWITCH
LP LOW PRESSURE CUTOUT
RV REVERSING VALVE
M MOTOR
CAP CAPACITOR
DECAL
UAW701
REV B 1-15-2014


HEAT PUMP RD(ICM)-WE-***
UAW705
REV B 1-15-2014
SOURCE PUMP 240V
LOAD PUMP 240V
FIELD POWER SOURCE
FRONT
REAR
GND
L1
L2
#2236
#6030-00
#6121
#5140
K1A
K1B
K2A
K2B
K1
K2
#6010-**
CAP
XXµF
#6170
ICM 102
#6119
208V/240V
24V
COMPRESSOR
#6006-****
#6032-**
RV
VTAB6000
ULAMP2291 (GREEN)
ULAMP2290 (RED)
#6040 -550
#6052
R-FS-125-1
ICM #6053
#HPTR78410
#HPT1F5659 FREEZE SAFETY J5-2-3
NHSENS001
SOURCE
LOAD
DECAL
COMPONENT CODE
K RELAY
PC CIRCUIT BOARD
T TAB TERMINAL
SV SOLENOID VALVE
DP DESUPERHEATER PUMP
SW SWITCH
HP HIGH PRESSURE CUTOUT
FS FLOW SWITCH
LP LOW PRESSURE CUTOUT
RV REVERSING VALVE
M MOTOR
CAP CAPACITOR
WIRE COLOR CODE
BR BROWN
BL BLUE
BK BLACK
BKW BLACK/WHITE
BKR BLACK/RED
G GREEN
GY GRAY
OR ORANGE
R RED
RBK RED/BLACK
W WHITE
WBK WHITE/BLACK
Y YELLOW
YG YELLOW/GREEN
YBK YELLOW/BLACK
BY BROWN/YELLOW
VIO VIOLET
NOTES:
1 SWITCH ORANGE AND RED WIRES FOR 208V OPERATION.

Northern Heat Pump™ Residential Limited Product Warranty

Effective March 2014

NORTHERN GEO warrants to the owner, at the original installation site, for a period of three (3) years from date of original purchase, that the product and product parts manufactured by NORTHERN GEO are free from manufacturing defects in materials and workmanship, when used under normal conditions and when such product has not been modified or changed in any manner after leaving the manufacturing plant. If any product or product parts manufactured by NORTHERN GEO are found to have manufacturing defects in materials or workmanship, such will be repaired or replaced by NORTHERN GEO. NORTHERN GEO shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. NORTHERN GEO may request that the materials be returned to NORTHERN GEO at owner's expense for factory inspection. The determination as to whether product or product parts shall be repaired, or in the alternative, replaced, shall be made by NORTHERN GEO or its authorized representative.

TEN YEAR (10) LIMITED WARRANTY ON REFRIGERATION COMPONENTS

NORTHERN GEO warrants that the compressor, reversing valve, expansion valve and heat exchanger(s) of its products are free from defects in materials and workmanship through the tenth year following date of original purchase. If any compressor, reversing valve, expansion valve or heat exchanger(s) are found to have a manufacturing defect in materials or workmanship, NORTHERN GEO will repair or replace them at their discretion.

LIFETIME LIMITED WARRANTY ON UNIT CABINET

NORTHERN GEO warrants that the cabinet to be free from defects in materials and workmanship for the life of the unit. If any panel fails NORTHERN GEO will repair or replace them at their discretion.

NORTHERN GEO shall cover labor costs according to the Repair / Replacement Labor Allowance Schedule for a period of three (3) years from the date of original purchase, at the original installation site on all parts excluding the compressor, reversing valve, expansion valve, and heat exchanger(s). NORTHERN GEO shall cover labor costs according to the Repair / Replacement Labor Allowance Schedule for a period of ten (10) years from the date of original purchase, at the original installation site, on parts including the compressor, reversing valve, expansion valve, and heat exchanger(s). The Repair / Replacement Labor Allowance is designed to reduce the cost of repairs. This Repair / Replacement Labor Allowance may not cover the entire labor fee charged by your dealer / contractor.

Northern Geo
Manufacturer of Geothermal Heat Pumps for the North

75 WEST VEUM

APPLETON, MN. 56208

320-297-9100

CONDITIONS AND LIMITATIONS:

1. This warranty is limited to residential, single family dwelling installations only. Any commercial or multi-unit dwelling installations fall under the NORTHERN GEO Commercial Limited Product Warranty.
2. NORTHERN GEO shall not be liable for performance related issues resulting from improper installation, improper sizing, improper duct or distribution system, or any other installation deficiencies.
3. If at the time of a request for service the owner cannot provide an original sales receipt or a warranty card registration then the warranty period for the product will have deemed to begin the date the product is shipped from the factory and **NOT** the date of original purchase.
4. The product must have been sold and installed by a licensed electrician, plumbing, or heating contractor.
5. The application and installation of the product must be in compliance with NORTHERN GEO specifications, as stated in the installation and instruction manual, and all state, provincial and federal codes and statutes. If not, the warranty will be null and void.
6. The purchaser shall have maintained the product in accordance with the manual that accompanies the unit. Annually, a qualified and licensed contractor must inspect the product to assure it is in proper working condition.
7. All related heating components must be maintained in good operating condition.
8. All lines must be checked to confirm that all condensation drains properly from the unit.
9. Replacement of a product or product part under this limited warranty does not extend the warranty term or period.
10. Replacement product parts are warranted to be free from defects in material and workmanship for ninety (90) days from the date of installation. All exclusions, conditions, and limitations expressed in this warranty apply.
11. Before warranty claims will be honored, NORTHERN GEO shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. Remedies under this warranty are limited to repairing or replacing alleged defective product or product parts. The decision whether to repair or, in the alternative, replace products or product parts shall be made by NORTHERN GEO or its authorized representative.

THIS WARRANTY DOES NOT COVER:

1. Costs for labor for diagnosis, removal or reinstallation of an alleged defective product or product part, transportation to NORTHERN GEO or its designated location, and any other materials necessary to perform the exchange, except as stated in this warranty. Replacement material will be invoiced to the distributor in the usual manner and will be subject to adjustment upon verification of defect.
2. Any product or product part that has been damaged as a result of being improperly serviced or operated, including, but not limited to, the following: operated during construction phase, with insufficient water or air flow; allowed to freeze; subjected to flood conditions; subjected to improper voltages or power supplies; operated with air flow or water conditions and/or fuels or additives which cause unusual deposits or corrosion in or on the product; chemical or galvanic erosion; improper maintenance or subject to any other abuse or negligence.
3. Any product or product part that has been damaged as a result of natural disasters, including, but not limited to, lightning, fire, earthquake, hurricanes, tornadoes or floods.
4. Any product or product part that has been damaged as a result of shipment or handling by the freight carrier. It is the receiver's responsibility to claim and process freight damage with the carrier.
5. Any product or product part that has been defaced, abused or suffered unusual wear and tear as determined by NORTHERN GEO or its authorized representative.
6. Workmanship of any installer of the product or product part. This warranty does not assume any liability of any nature for unsatisfactory performance caused by improper installation.
7. Transportation charges for any replacement product, product part or component, service calls, normal maintenance; replacement of fuses, filters, refrigerant, etc.

THESE WARRANTIES DO NOT EXTEND TO ANYONE EXCEPT THE OWNER AND ONLY WHEN THE PRODUCT IS IN THE ORIGINAL INSTALLATION SITE. THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.

ALL IMPLIED WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED WITH RESPECT TO ALL PURCHASERS OR OWNERS. NORTHERN GEO IS NOT BOUND BY PROMISES MADE BY OTHERS BEYOND THE TERMS OF THESE WARRANTIES. FAILURE TO RETURN THE WARRANTY CARD SHALL HAVE NO EFFECT ON THE DISCLAIMER OF THESE IMPLIED WARRANTIES.

ALL EXPRESS WARRANTIES SHALL BE LIMITED TO THE DURATION OF THIS EXPRESS LIMITED WARRANTIES SET FORTH HEREIN AND EXCLUDE ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM THE BREACH THEREOF. SOME STATES OR PROVINCES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY. PRODUCTS OR PARTS OF OTHER MANUFACTURERS ATTACHED ARE SPECIFICALLY EXCLUDED FROM THE WARRANTY.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY HAVE OTHER RIGHTS WHICH VARY UNDER THE LAWS OF EACH STATE. IF ANY PROVISION OF THIS WARRANTY IS PROHIBITED OR INVALID UNDER APPLICABLE STATE OR PROVINCIAL LAW, THAT PROVISION SHALL BE INEFFECTIVE TO THE EXTENT OF THE PROHIBITION OR INVALIDITY WITHOUT INVALIDATING THE REMAINDER OF THE AFFECTED PROVISION OR THE OTHER PROVISIONS OF THIS WARRANTY.