



Two-Stage Split Geothermal Heat Pump Installation & Operating Instructions Model: (RT-SE*)

Application

- Retrofit existing forced air installations
- Dual Heat – combine this geothermal unit and A-coil with stand-by gas or oil furnace
- LMC (Load management control) ready
- Tested to UL Standards 1995

Information

The air coil furnished with this product has been tested and certified with this unit. To maintain the specification performance and product certification, the air coil shipped with this unit **must be** used.

This unit is NOT tax credit eligible when a coil other than the furnished coil is used.

For proper performance, the CFM airflow required in the specification table must be provided by the installed furnace blower/air handler.

Since this product requires line sets and air coil installation, an experienced and licensed refrigeration technician is required.



ART-268-00 1.0

Domestic Water Heater, Desuperheater

Energy Star promotes the desuperheater and it is standard with this series. 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 17.

Note

The EZGEO control board has a configuration mode dial switch. This must be correctly set during installation, see EZGEO Controller (HC112) and Field Setup sections.

Drawings: **EC001, HC112, NH501, NR501, UAW502, UAW508, XX029**

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



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Introduction

When used and controlled properly, geothermal heat pumps can save hundreds of dollars in heating and cooling costs per year. Northern Heat Pump *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.

This is a pre-wired package for converting a new or existing oil or gas furnace into a dual heat system. This is a complete package for both heating and air conditioning, utility load control, and compatible with DC drive variable speed furnaces. There are **no** additional relays or option hardware needed for the outlined application.

The utility load control receiver properly switches the heating mode **and** properly controls the air conditioning mode during summer load interrupt. The blower circuit and control is also designed for heating interrupt (blower handled by gas furnace only) **and** continuous operating blower during cooling peak load interrupt. Typically these controls and design features are only found in this product.

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 for ease of servicing; front (2), right and left bottom. 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 page 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:

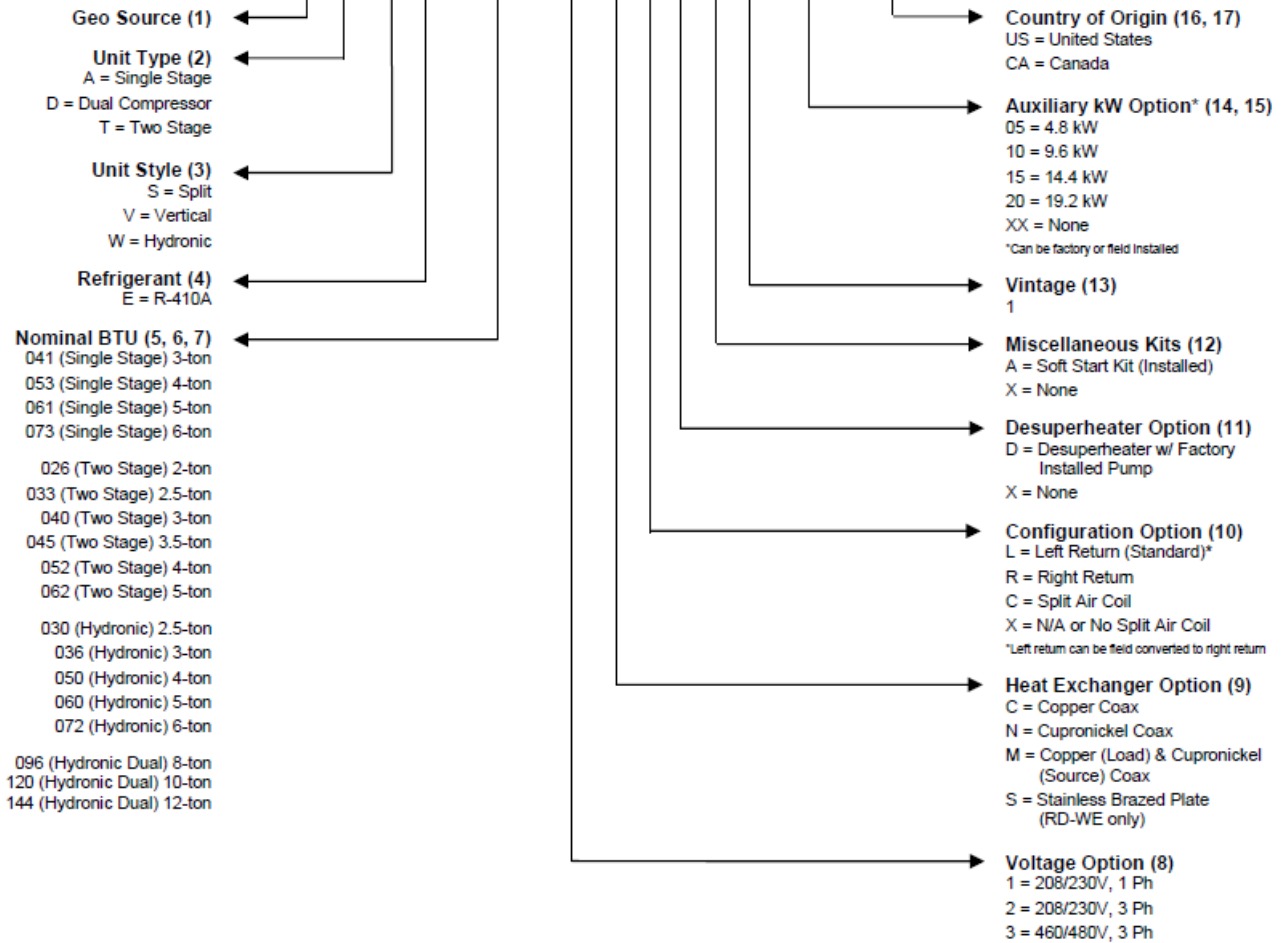
- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use a quenching cloth for brazing operations.
- Have a fire extinguisher available for all brazing operations.

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



Mechanical Specifications – R410A Two-Stage Compressor

MODEL	RT-SE-040 (3 ton)	RT-SE-052 (4 ton)	RT-SE-062 (5 ton)
Coax & Piping Water Volume – gal	.65	1.1	1.1
Source Temperature °F (min/max)	20°/120°	20°/120°	20°/120°
Nominal source differential* °F (H/C)	9/11°	6/11°	6/10°
Factory Charge R410A	6 lbs. 1 oz.	7 lbs. 2 oz.	7 lbs. 2 oz.
Static Pressure – Nominal	0.3	0.3	0.3
Static Pressure – Design	0.5	0.5	0.5
Air Filter	7/8 X 28 7/8 X 27 1/2	7/8 X 27 1/2 X 37 7/8	7/8 X 27 1/2 X 37 7/8
Weight– Base Unit Only (lbs)	275	320	320

HEAT EXCHANGER PRESSURE DROP TABLE

Water-to-Air (Source Side, Pure Water @ 68° F)								
Model	GPM	PSID	Model	GPM	PSID	Model	GPM	PSID
3-ton	6	1.8 (ref)	4-ton	8	1.3	5-ton	10	1.9
	9	2.4 (ref)		12	2.5		15	3.6
	12	4.3 (ref)		16	4.0		20	5.8
	15	6.7 (ref)		20	5.8		25	8.5

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

HEATING – ISO 13256-1 SPECIFICATION – ENERGY STAR

Model	Stage	Source GPM	GWHP – Ground Water				GLHP – Ground Loop			
			50° F		68° F		32° F/41° F		68° F	
			Capacity Btu/h	Blower CFM	Temp Rise	COP	Capacity Btu/h	Blower CFM	Temp Rise	COP
RT-SE-040	FL	10	41800	1200	32	4.05	32800	1200	27	3.70
RT-SE-040	PL	10	29600	1000	28	4.19	27000	1000	26	3.85
RT-SE-052	FL	12	55700	1500	34	4.06	44400	1500	29	3.55
RT-SE-052	PL	12	37300	1200	29	4.20	33400	1200	27	3.67
RT-SE-062	FL	15	66800	1875	33	4.02	54500	1875	28	3.55
RT-SE-062	PL	15	49100	1480	31	4.20	44500	1480	29	3.66

1. Capacities are based on temperatures shown in heading, source is left group return air is right group.
2. Stated Btu/h is the ISO 13256-1 formula adjusted, actual HP supply energy delivered is 2% greater.
3. Temp rise is based on sensible only.
4. All ratings based upon operation at lower voltage or dual voltage rated models.
5. Ground Loop Heat Pump ratings based on 15% antifreeze solution.

COOLING – ISO 13256-1 SPECIFICATION – ENERGY STAR

Model	Stage	Source GPM	GWHP – Ground Water				GLHP – Ground Loop			
			59° F		80.6° F		77° F/68° F		80.6° F	
			Capacity Btu/h	Blower CFM	Temp Drop	EER	Capacity Btu/h	Blower CFM	Temp Drop	EER
RT-SE-040	FL	10	47000	1250	23	20.1	43200	1250	22	15.9
RT-SE-040	PL	10	35100	1050	22	23.4	30700	1050	21	19.3
RT-SE-052	FL	12	64200	1600	23	19.1	58300	1600	22	15.0
RT-SE-052	PL	12	47700	1275	22	23.7	46100	1275	22	19.2
RT-SE-062	FL	15	71500	2000	23	18.9	66100	2000	23	14.7
RT-SE-062	PL	15	55500	1650	21	23.3	50100	1650	22	19.6

Electrical Data – Single Phase

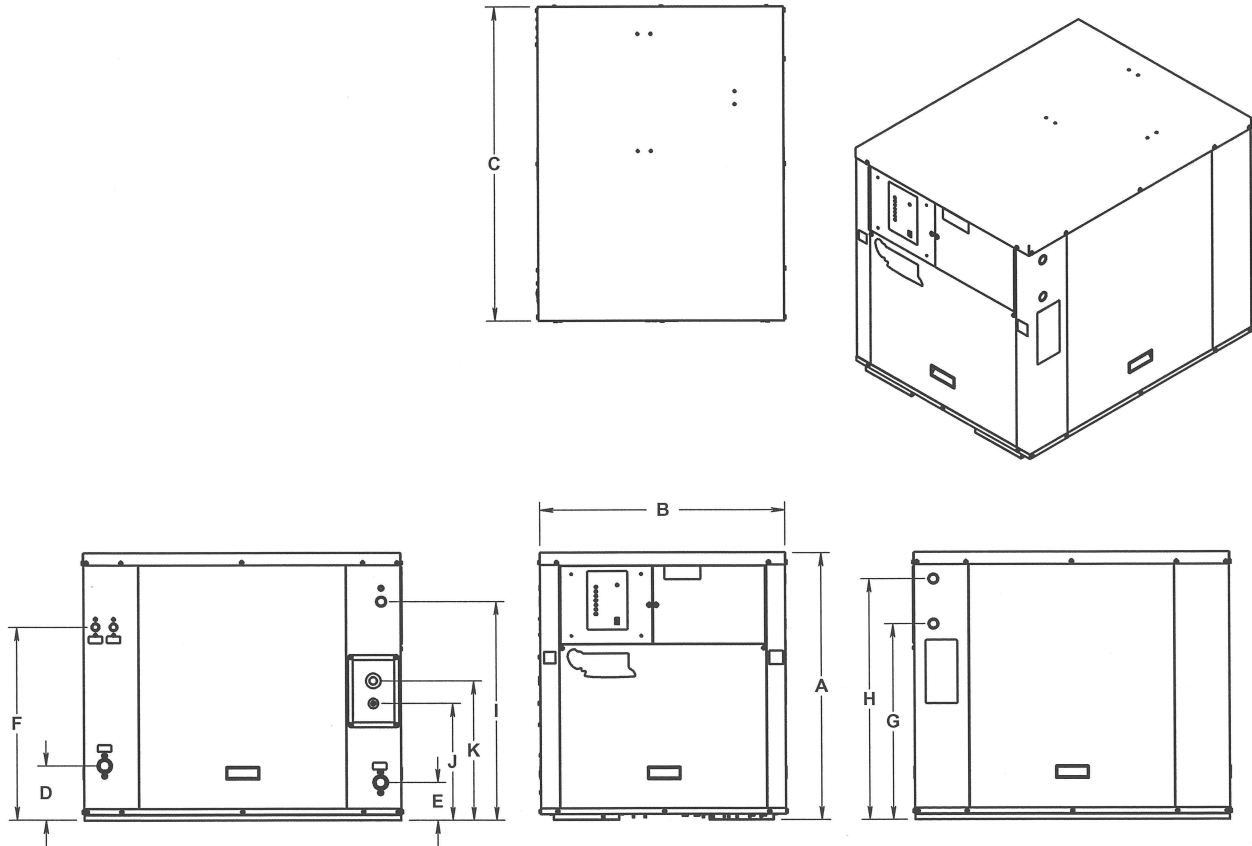
Model	Voltage	Compressor		Desup. Pump	Loop Pump (Ext)	Total	Min.	Max. Fuse/ HACR
	(60 Hz)	RLA	LRA	FLA	FLA	FLA	Ampac.	
040	208/230-1	17.9	96	.15	4.4	22.5	26.9	40
052	208/230-1	27.1	152.9	.15	4.4	31.5	38.2	60
062	208/230-1	29.7	179.2	.15	4.4	34.3	41.7	70

Electrical Data – Three-Phase

Model	Voltage	Compressor		Desup. Pump	Loop Pump (Ext)	Total	Min.	Max. Fuse/ HACR
	(60 Hz)	RLA	LRA	FLA	FLA	FLA	Ampac.	
040	200/230-3	14.2	88	.15	4.4	18.6	22.1	30
052	200/230-3	16.5	110.0	.15	4.4	20.9	25.0	40

Product Dimensions

		SPLIT UNITS					
		RT-SE-062	RT-SE-052	RT-SE-045	RT-SE-040	RT-SE-033	RT-SE-026
Overall Cabinet	A (Height)	29 5/8" [75.3cm]					
	B (Width)	27" [68.5cm]					
	C (Depth)	34 7/8" [88.5cm]					
Water Connections	D (Source Out)	6 1/8" [15.4cm]					
	E (Source In)	4 1/4" [10.6cm]					
	F (Desuperheater In/Out)	21 7/16" [54.5cm]					
	Source In/Out	1" NPT					
	Desuperheater In/Out	1/2" NPT					
Electrical Connections	G	21 11/16" [55.1cm]					
		Ø1.125 X Ø.875 Double Knockout					
	H	26 11/16" [67.8cm]					
		Ø1.125 X Ø.875 Double Knockout					
Line Set Connections	I	24 1/4" [61.6cm]					
		Ø1.125 X Ø.875 Double Knockout					
	J (Liquid)	12 15/16" [32.9cm]					
		Ø.875 Hole					
	K (Suction)	15 7/16" [39.2cm]					
		Ø1.375 Hole					



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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.

2. If this is a Dual Heat system, this product relates only to the addition to the furnace ducting system external to the gas or oil force air furnace. The owner/ installer assumes all responsibility and/or liability associated with any needed installation of the gas/oil furnace, fuel system, flue, chimney, etc. Any instructions or comments made within this manual (or factory phone assistance) relating to the gas/oil furnace are provided as comments of assistance and “helps” only.

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.

3. 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.
4. 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 NHP Series unit cannot produce airflow and cannot correct airflow problems inherent within the existing furnace system. The following items should be carefully considered and properly followed for all installations:

Examination of the existing forced air furnace – Prior to starting this installation or furnace modification, examine the total furnace system and make necessary comments or recommendations to the homeowner. Remember, if a marginal condition exists within the existing forced air system, the installation of a geothermal heat pump will not cure PRE-EXISTING conditions. Consider such items as proper fossil fuel ignition, is the furnace cycling on hi-limit, filter, adequate cold air return, adequate supply duct and room register (1 register per 100 CFM) etc.

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.

Supply plenum – Carefully examine all sides of the plenum. The coil must be installed on the supply side of the fossil fuel furnace. Verify all transitions have angles less than 30°, the coil is centered within the plenum, and there are no odd shaped angles or odd shaped transitions within the plenum.

Other plenum equipment – Auxiliary equipment such as humidifiers, zone plenum dampers, etc., located within the plenum which may cause a non-uniform airflow issues may have to be removed if they cause to great reduction to system airflow. Zone dampers within the trunk line at least 12" (30cm) from the coil typically are no problem. When horizontal zone dampers are involved, perform all check-out functions with smallest zone open first.

Comment – zone dampers cause back pressure on the blower and overall reduced airflow. Reduced airflow can cause the geothermal unit to perform poorly or in some cases cause icing or freeze ups in the geo loop or air coil.

Insufficient cold air return capacity – Installation experience indicates this is a major concern. In fact, it could represent a problem in as many as 60% of the installations, especially if there is a requirement to increase airflow with the existing blower and the existing cold air return capacity is already undersized or restricted. Check the static pressure within the return cabinet or the suction at the filter cabinet door. Do not assume because there is a register on the wall, the hole behind the register or the passageways are equal to this register. Sharp offsets and transitions in the cold air return system often cause severe restrictions. Expect to add additional registers or a relief register in the main cold air return duct.

Blower CFM capacity – The furnace forced air system must have an airflow capacity larger than the minimum requirement on the NHP Series specification sheet (see **unit nameplate and/or Mechanical Specifications on page 3**). It is near impossible to correctly measure CFM airflow in an existing residential installation. Experience and rule of thumb indicators will have to be followed to determine the existing furnace CFM capacity. The following may be helpful:

- a. Existing furnace nameplate - Typically represents a high or optimistic rating and is a function of the systems static pressure. What changes have been made to the heating system since installation?
- b. Blower motor size - Used only as a minimal guide.
 - 2 ton unit - 1/3 HP or larger
 - 3 ton unit - 1/2 HP or larger
 - 4 ton unit - 3/4 HP or larger
 - 5 ton unit - 1 HP or larger
- c. Observe/examine airflow ducting system and design - Use duct sizing table (EC001), or industry equivalent duct capacity airflow charts and determine if the system is capable of

delivering the CFM required on the nameplate. Especially check the number of registers and the number of “6 inch rounds”. The same would apply to cold air return duct capacity.

- d. Calculated CFM - By measuring the temperature rise across the existing furnace, the CFM can be approximated. The accuracy of this formula will depend upon the estimated or determined Btu output (actual heat energy across the furnace, not nameplate input).

$$\text{CFM} = \frac{\text{Btuh (output)}}{\text{Temperature Rise} \times 1.08}$$

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



The NHP 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 (61 meters) 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.

Figure 1

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 ethanol should be considered should damage ever occur to the loop. 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 IGSHA 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.

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.

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. (Figure 3) 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

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.

Pressurized Loops do not require an air separator. They require purge and fill ports between the loop manifold valves and the insulated pump pack. 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 3. Geo heat pump Btu/h capacity and efficiency are directly related to the GPM flow through the unit.

Vibration pad – 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 hardness < 100 PPM
- Iron fouling < 0.2 PPM (Ferrous)
- < 0.5 PPM of oxygen
- Hydrogen sulfide (H₂S) < 0.5 PPM
- Chloride levels < 20 PPM
- Erosion/clogging < 10 PPM, particles
- Filter, if required < 800 micron size

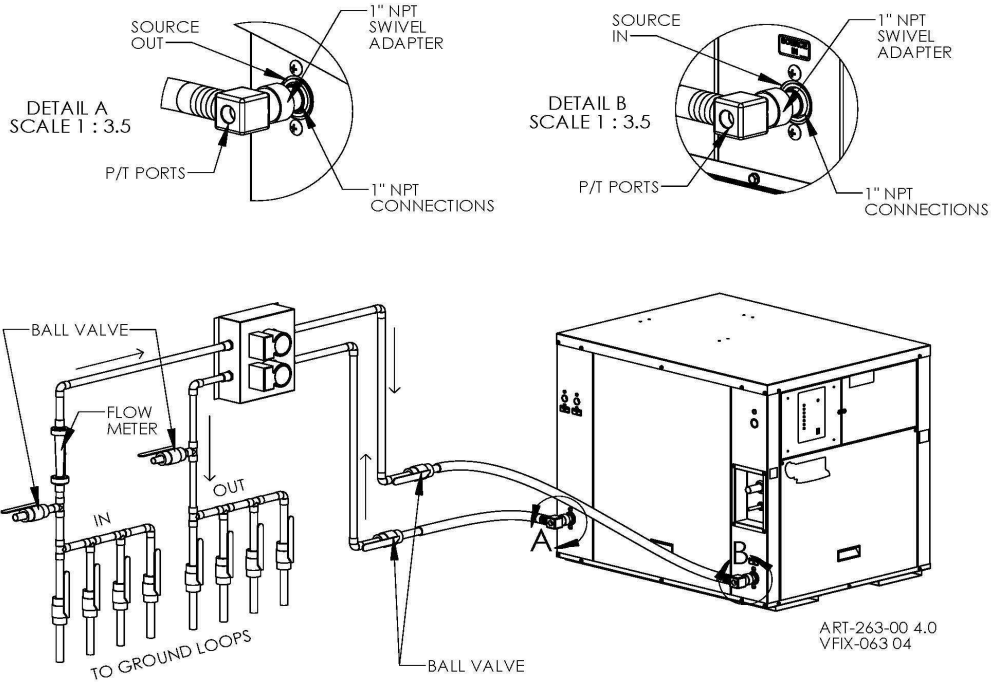


Figure 4 – Pressurized Closed Loop with Flow Center – Typical piping arrangement.

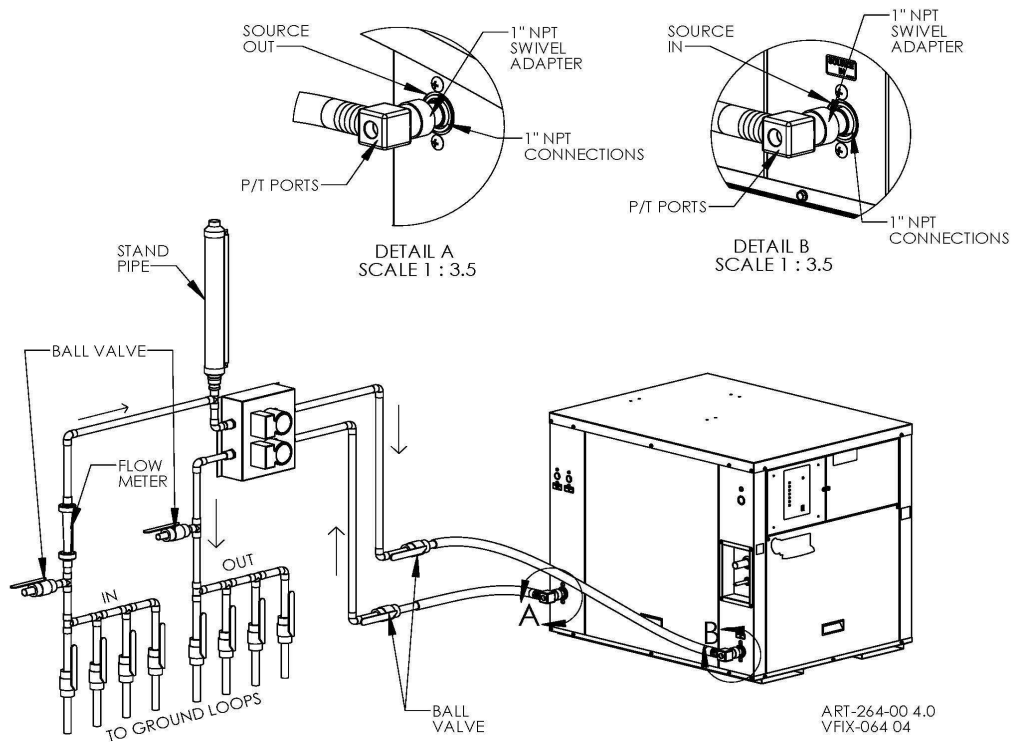


Figure 5 – Non-Pressurized Closed Loop with Flow Center – Typical piping diagram.

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

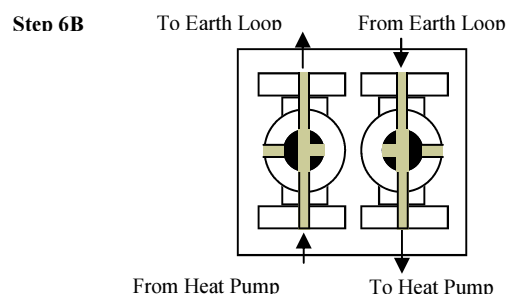
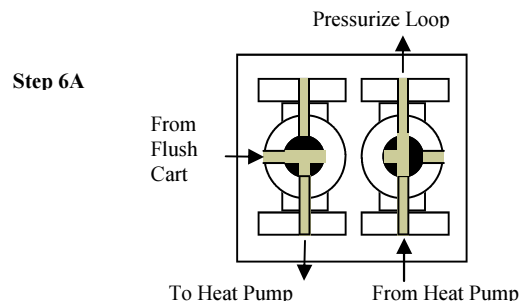
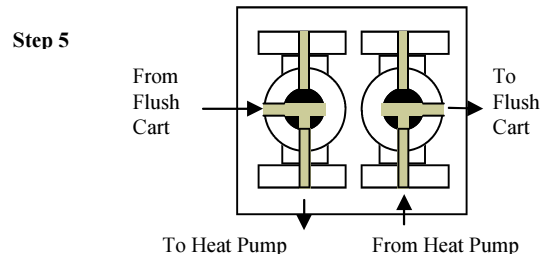
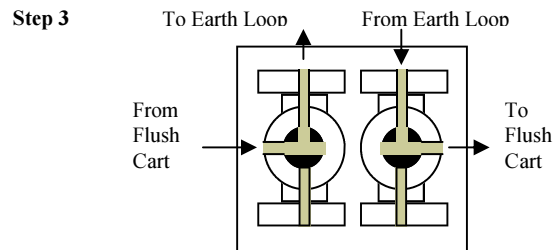
Turn off the flush cart pump. The system should remain pressurized. Release excess pressure by rotating either module valve to allow a small amount of water to pass through and out of the system and into the container. Some initial loss of pressure can be expected and is due to the expansion of the earth 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 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 to 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.

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. 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. Pressure temperature (P/T) plugs are placed in the supply and discharge lines 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 control/shut off valve must be mounted to regulate the maximum water flow through the unit. Remove handle to prevent accidental change of flow.

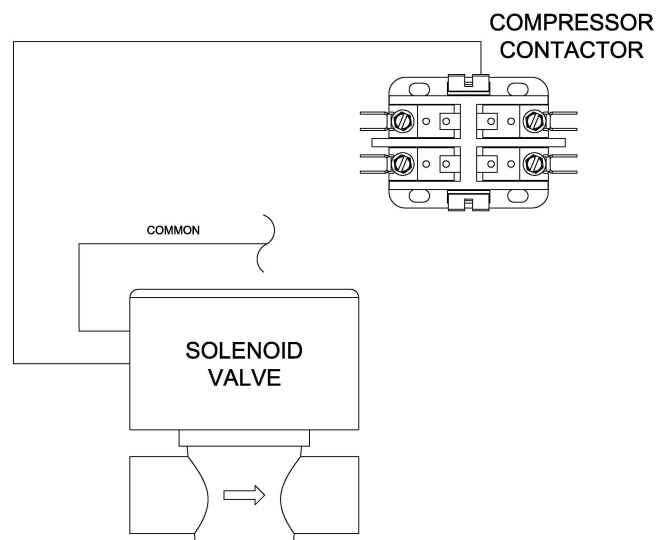
A solenoid valve is then installed and wired to TB C & Y terminal on the heat pump. (Refer to NS501) This valve will open when the unit is running and close when the unit stops. A visual flow meter is then installed to allow visual inspection of the flow requirements. The flow meter can also be useful 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 10 ft. (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.

⚠ 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 of the unit 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).

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.



NOTES:
1. FACTORY WIRING HAS BEEN OMITTED FROM THIS DRAWING. ART-323-00 2.0

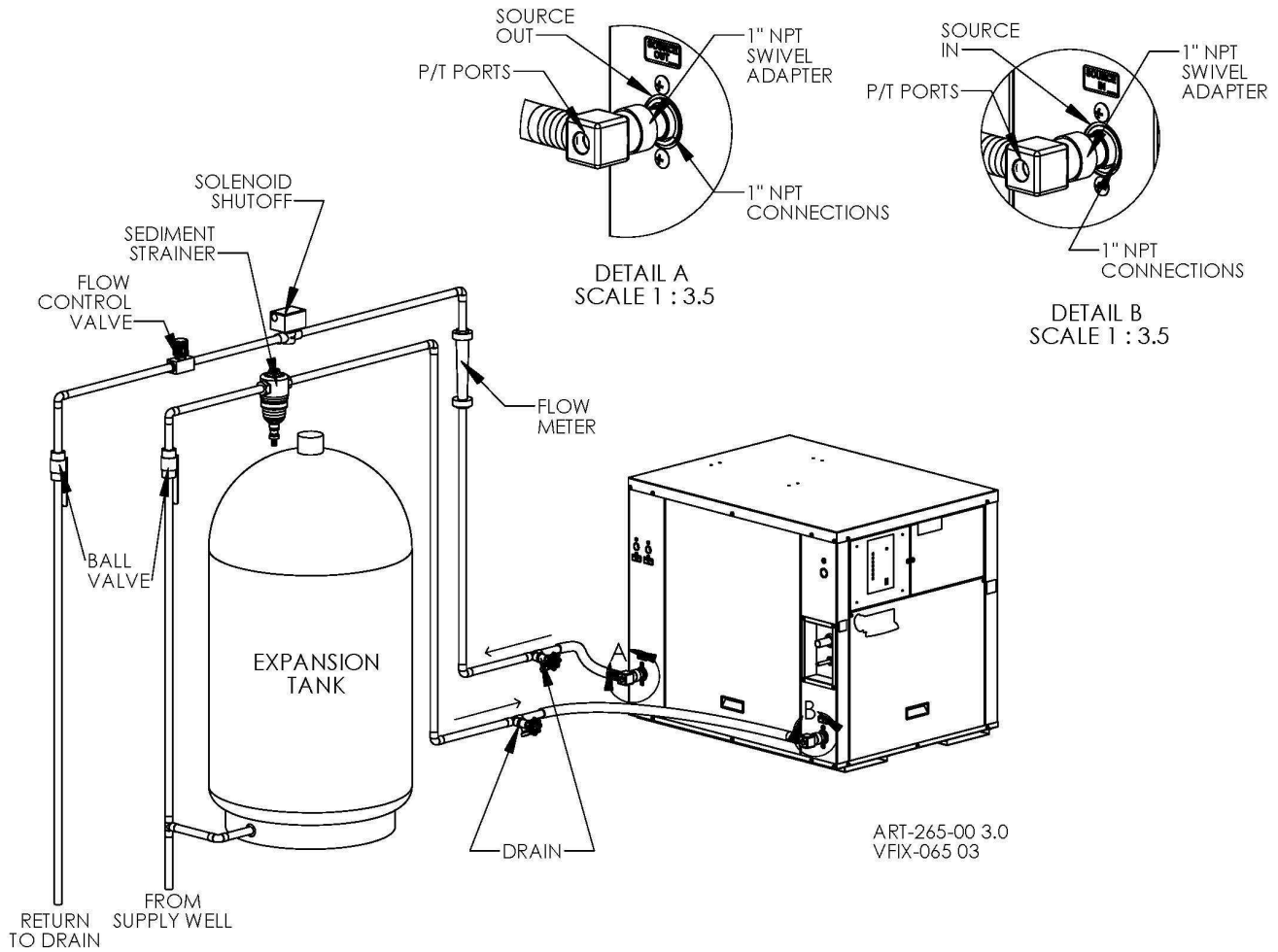


Figure 6: Open Loop Well to Well – Typical piping diagram.

Open Loop Freeze Protection Switch – Heat pump installations on open loop systems, using a non-antifreeze protected water source during the heating mode require the use of a water coil freeze protection switch. If the water supply to the heat pump is interrupted for any reason, continued operation of the compressor will cause the water remaining in the water-to-refrigerant heat exchanger to freeze and rupture. The freeze protection switch will shut the unit down before freezing can occur and protect the heat pump against flow loss and damage.

Option – 39° F (4° C) pipe clamp-on, part number 6047. Connect in series with low limit.

Water Coil Maintenance – 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 are equipped with a desuperheater and an integrated circulating pump (can be a price deduct) 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.

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.

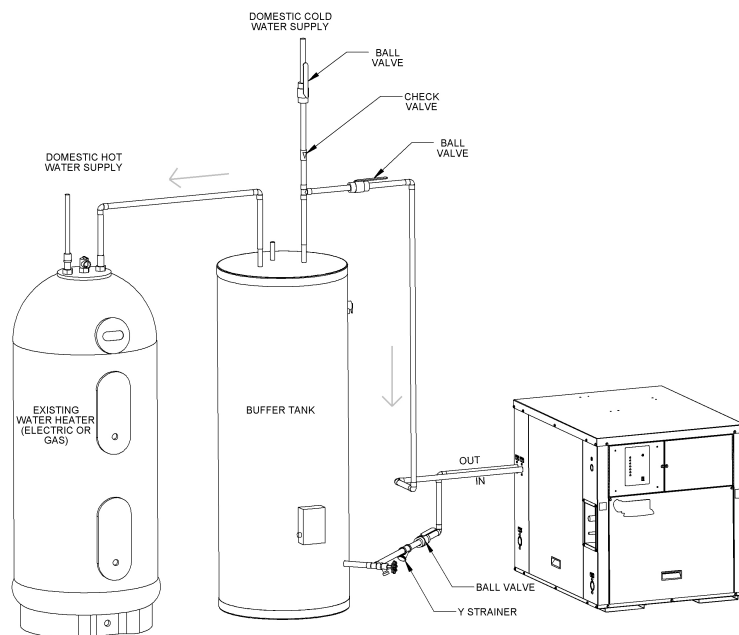
2. Shut off valves should also be used to service the desuperheater pump without draining the entire hot water tank. Note: Always be sure these valves are open when pump is running.
3. Pump problems develop by running the pump dry or with air in the system. All air must be purged from the desuperheater 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 (46° C) to 130° F (54° C).

- 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 a negative effect of energy efficiency.

Figure 7 – Desuperheater Piping, Buffer Tank

This is the most effective and efficient arrangement 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.



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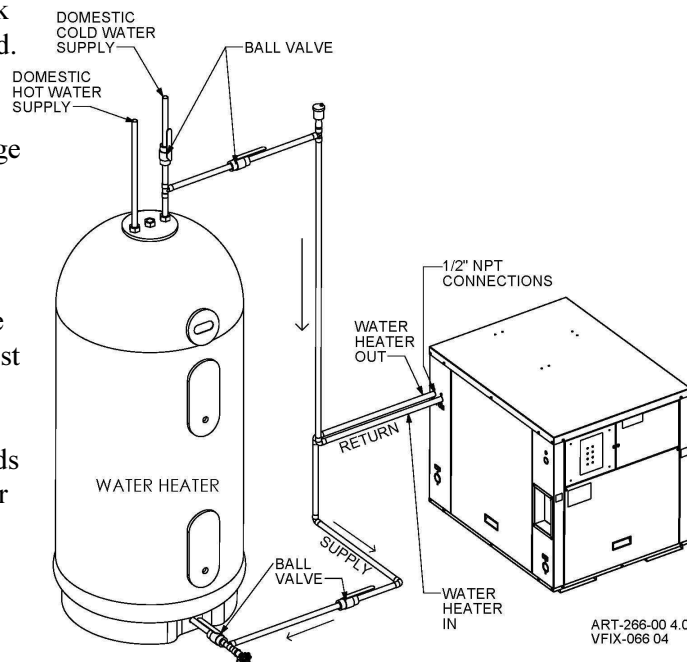
Figure 7A – Desuperheater, Single Tank Concept

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).



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CAUTION

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

Duct System

An air filter must always be installed upstream of the air coil on the return air side of the air handler or furnace. If there is limited access to the filter rack for normal maintenance, it is suggested that a return air filter grill be installed. Be sure that the return duct is properly installed and free of leaks to prevent dirt and debris from bypassing the filter and plugging the air coil.

In applications using galvanized metal ductwork, a flexible duct connector is recommended on both the supply and return air plenums to minimize vibration from the blower. To maximize sound attenuation of the unit blower, the supply and return plenums should include an internal duct liner of 1-inch thick glass fiber or be constructed of UL listed ductboard. Insulation is usually not installed in the supply branch ducts. Ducts in unconditioned areas should be wrapped with a minimum of 1-inch (25mm) duct insulation. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended as the unit's performance will be adversely affected. If the air handler is connected to existing ductwork, a previous check should have been made to assure that the duct system has the capacity to handle the air required for the unit application. If the existing duct system is not designed to handle the increased air flow, larger ductwork should be installed. All ductwork should be checked for leaks and repairs made accordingly. The duct system and diffusers should be sized to handle the design airflow quietly. If air noise or excessive airflow is a problem, the blower speed can be changed to a lower speed to reduce airflow. This will reduce the performance of the unit slightly in heating; however, it will increase the temperature rise across the air coil. **Airflow must still meet minimum requirements.**

Air Coil Installation

Northern Heat Pump Split models can be purchased either without an air coil or with a factory matched air coil. If your heat pump was purchased with a matched air coil, you can be assured your heat pump will perform as designed, meeting or exceeding Energy Star requirements. As air coils can dramatically alter system performance, no performance guarantees can be made if an air coil other than the coil we furnish is used.

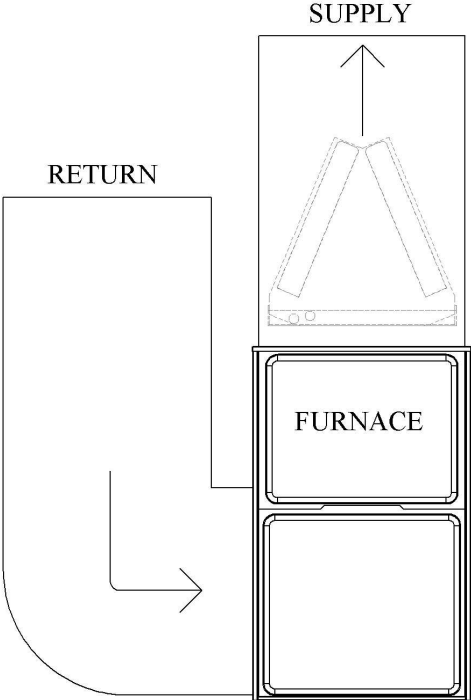
Gas, Oil, or Electric Furnace – The heat pump refrigerant air coil may be installed in one of two different configurations. How you choose to install the air coil is dependent on your structure's size and space requirements, personal preferences, and the furnace manufacturer's recommendations. **Refer to your furnace owner's manual and installation manual or consult with the furnace manufacturer to make certain the installation conforms to their requirements.**

The air coil provided by Northern Heat Pump is relatively large. Although the large physical size of the coil may present some installation challenges, the size is necessary to achieve optimum system performance.

The air coil may be placed in either the return side or the supply side of the heating system. The following page illustrates two of the mounting methods which may be used.

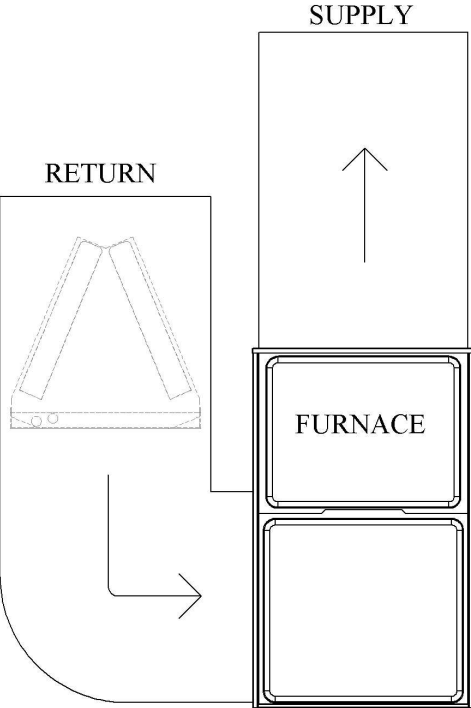
Auxiliary Electric Resistance Strip Heating – If auxiliary electric heat is to be used in this system, an Electro Industries WarmFlo Select plenum heater (SL1) is compatible with your heat pump's EZGEO controls, and is the recommended auxiliary electric heat solution. Interfacing this plenum heater to your NHP split unit heat pump is relatively simple, and will be discussed later in this manual (see **Field Setup Overview**).

Coil in Supply Plenum Method



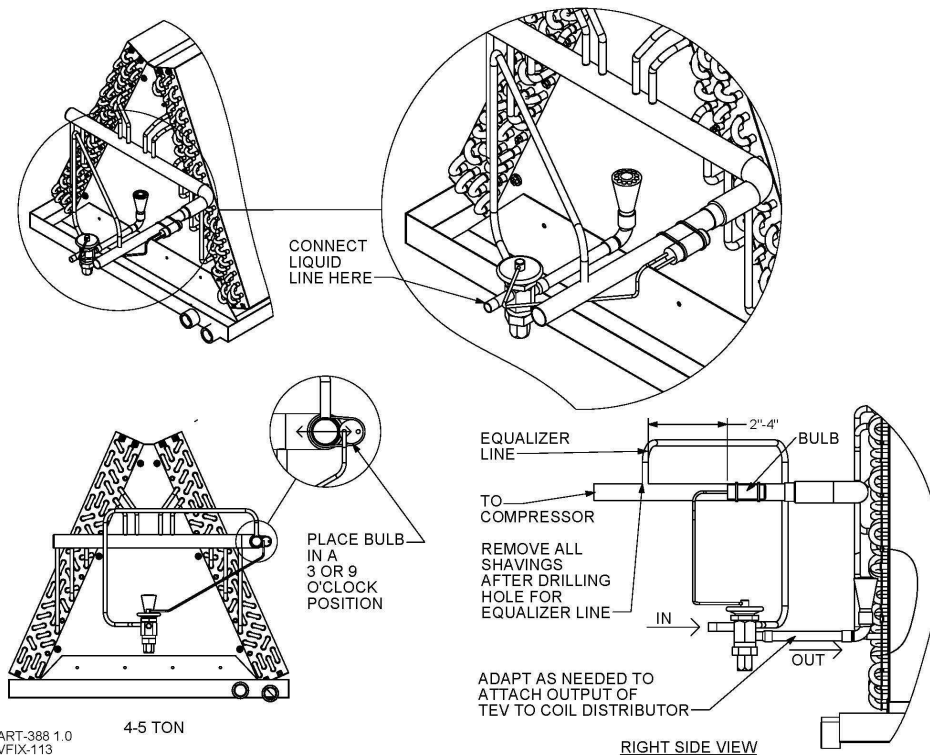
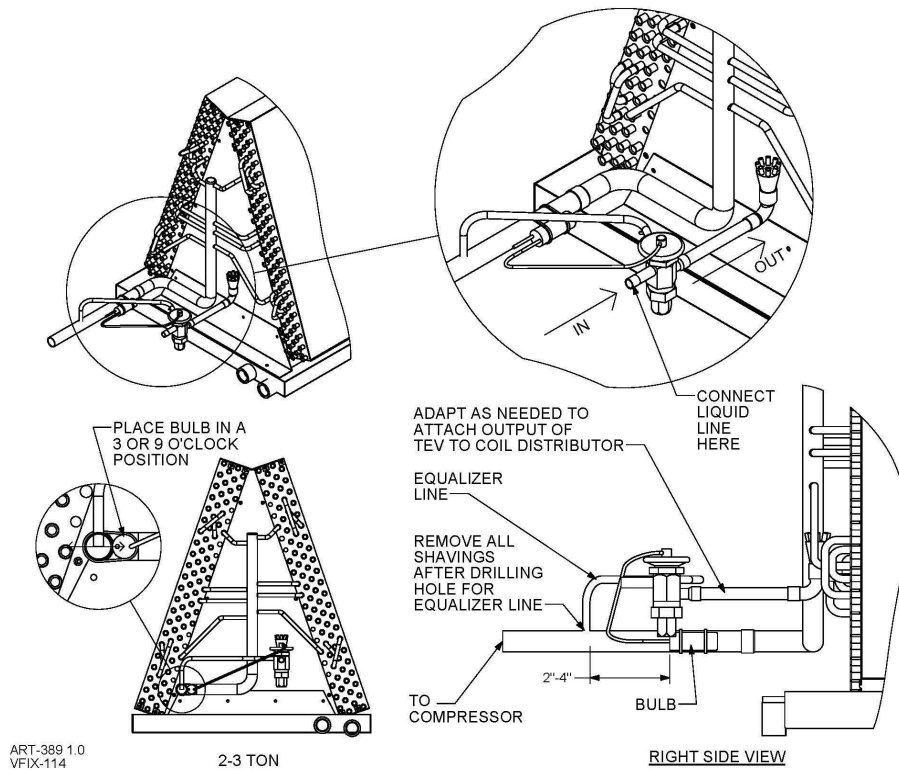
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Coil in Return Ductwork Method



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Field Installed Thermal Expansion Valve (TEV) – Factory matched air coils are provided with a field installed TEV. Care must be taken when making the brazed connection at the distributor. Too much heat could cause the factory distributor brazing to soften, potentially causing pinhole leaks. Please refer to the diagrams below for installation details.



ST Duct Sensor – See page 31 for details relating to installing ST sensor above coil.

Airflow (CFM) – As listed on the unit nameplate and the page 3 specification table the minimum CFM must flow through this coil. It is the installer's responsibility to inspect, analyze, and, if necessary, revise the overall ducting system sizing/quality, the furnace blower size/motor, furnace restrictions, return air restrictions, air filter, etc. This involves more than looking at the furnace nameplate. **Proper CFM must be assured and guaranteed by the installer.**

As the plenum is fabricated or rebuilt, all transitions must have angles of less than 30°, the coil must be centered within the plenum, and there should not be any odd shaped angles or odd shaped transitions within the plenum.

Mechanical Installation Refrigeration

Overview

The NHP Series split unit includes pre-charged R-410A, with the filter drier factory installed in the unit. **The charge may need to be fine tuned** based upon line set length and system performance. Line set lengths of over 25ft (7.6 meters) are not recommended due to performance loss and potential oil return issues.

Forced Air Coil – The refrigerant coil supplied with this product model number must be used for this installation. The nameplate and specification table ratings only apply when using the furnished air coil.

- **Do not** use existing or older A-coils because they probably are not designed for R-410A, may be contaminated from other refrigerants, may not be large enough, and may not have the correct TXV metering valve.
- Realizing the furnished coil is large, provisions and plenum arrangements must be made to accommodate this coil. This is necessary again for proper Geo HP performance and meeting specification requirements, Energy Star, ARI, etc.
- Airflow (minimum CFM) is also a key requirement for proper performance and rating, see previous section.

Line Set Information – Factory charge is set to include enough refrigerant for 10ft (3 meters) of line set and the forced air coil provided. If a line set of more than 10ft is used, additional R-410A refrigerant is required to be added to the system. Added amount of refrigerant needed is based upon 0.5oz per ft for 3/8" and 1.0oz per ft for 1/2" liquid lines.

Tube diameters and lengths for the line set are determined using the table on the following page. The suction lines must be insulated. When handling the line set, ensure that no kinks occur when bending the tubes into position. If one of the tubes happens to kink and it cannot be fully removed. The tube must be replaced; a kink in a tube will adversely affect system performance.

When installing the line set, it is imperative that the lines do not come in direct contact with any other surfaces. Adhering to this practice will further reduce any changes of compressor vibration transmitting into other areas of the building. When hangers are necessary; use hangers that incorporate isolation sleeves. Depending upon the length of tubing used, it is possible

Refrigerant Installation Practices – The line sets, recharging, and charge verification must be done by a professional/licensed refrigeration technician. Industry standard and proper cleaning, nitrogen flow, brazing techniques, and leak verification must be followed with this installation. Brazed connections points on both the compressor side and air coil side of the line set are required. During the brazing process, it is critical that 2-3 psi of nitrogen be circulated through the system in order to prevent internal oxidation. Low silver phos-copper braze alloy shall also be used on all brazed connection points.

Before brazing, wrap the service valves with a heat sink to prevent damage caused by excessive heat. **This unit is shipped with a factory charge, DO NOT open the service valves until the line set has been leak tested, purged, and evacuated.** Depending upon the length of the line set, copper adapters may be needed to accommodate larger diameter tubing.

Proper evacuation (500 microns) must take place prior to opening the main unit ball valves.

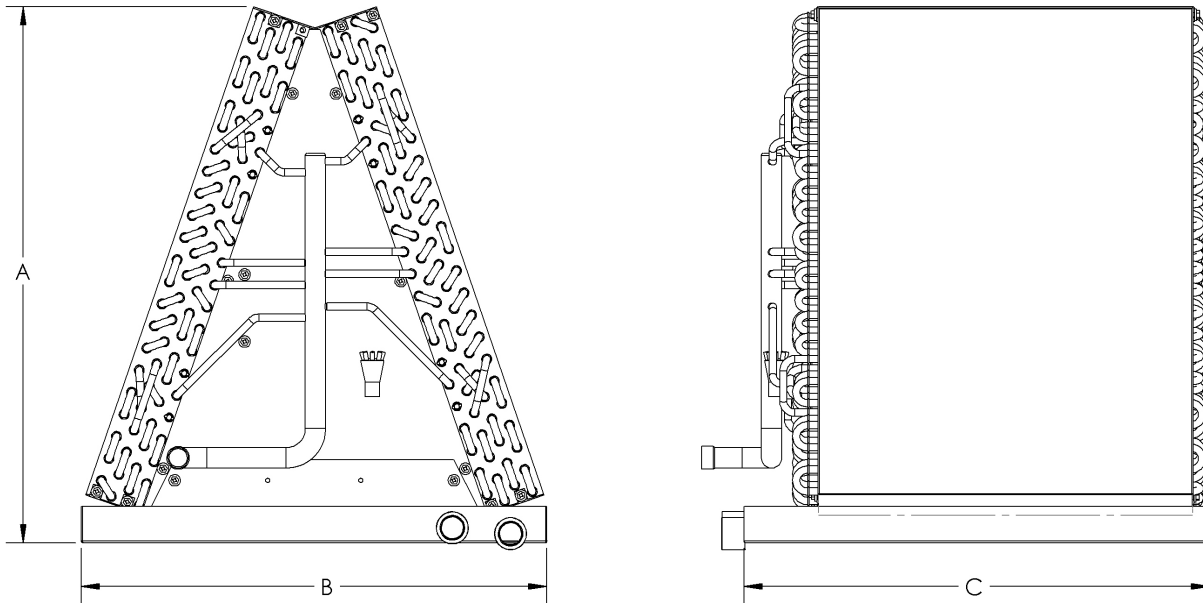
Once the service valves have been opened, the **final charge** may need to be fine tuned based upon the subcooling and superheat chart.

Line Set Size Information

Model	10 Feet		20 Feet		30 Feet	
	Suction	Liquid	Suction	Liquid	Suction	Liquid
040	7/8"	3/8"	7/8"	3/8"	7/8"	3/8"
052	7/8"	3/8"	7/8"	3/8"	7/8"	3/8"
062	7/8"	3/8"	7/8"	3/8"	7/8"	3/8"

See specification chart, page 3, or unit nameplate for factory charge. As stated earlier, this represents the furnished air coil and 10-foot (3 meter) line set. For additional line set length and charge “tweaking” field add as required, see Line Set Information earlier in this section.

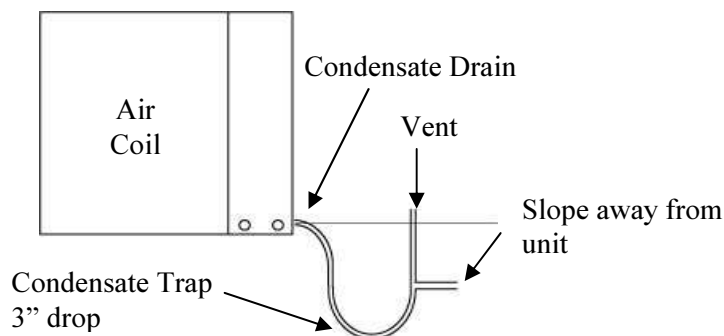
Forced Air Coil – Reference Information



MODEL	A (IN.)	B (IN.)	C (IN.)
RT-SE-026	16 - 1/4	20	20
RT-SE-033	16 - 1/4	20	20
RT-SE-040	23	20	20
RT-SE-052	22-1/4	23 - 1/2	23 - 3/4
RT-SE-062	22-1/4	23 - 1/2	23 - 3/4

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Condensate Drain – Typical condensate drain installation, shown below. If there is no nearby floor drain, a condensate drain pump must be used.



Charging Procedure

Leak Testing – The line set must be pressurized and checked for leaks before evacuating and charging the unit. To pressure the line set, attach refrigerant gauges to the service ports and add nitrogen until the pressure reaches 60-90 psig. Never use oxygen or acetylene to pressure test. Use a halogen leak tester or a good quality bubble solution to detect leaks on all connections made in the field. Check the service valve ports and stem for leaks. If a leak is found, repair it and repeat the above steps. For safety reasons do not pressurize system above 150 psig. The system is now ready for evacuation and charging.

System Evacuation – Ensure that the line set and air coil are evacuated before opening service valves to the split unit. The line set must be evacuated to at least 500 microns to remove the moisture and air that may still be in the line set and coil. Evacuate the system through both service ports to prevent false readings on the gauge because of pressure drop through service ports.

Charging the System – After purging and evacuating the line set, fully open the service valves counterclockwise. Add the previously calculated R-410A (liquid) into the liquid line service port. Never add liquid refrigerant into the suction side of a compressor. Start the unit and measure superheat and subcooling. Keep adding refrigerant until the unit meets the superheat and subcooling values on Unit Operating Conditions chart.

Superheat and Subcooling

Comments

1. This is a two TXV system – heating, internal to the main cabinet at the water coil refrigerant entrance and cooling, within the plenum air coil at the air coil liquid entrance.
2. First begin in heating and check superheat associated with the TXV at the water coil (evaporator) as follows.
3. Depending upon findings and requirement for adjustment, next check subcool and superheat in cooling.

Determining Superheat

1. Measure the temperature of the suction line at the point where the expansion valve bulb is clamped.
2. Determine the suction pressure in the suction line by attaching refrigeration gauges to the schrader connection on the suction side of the compressor.
3. Convert the pressure obtained in Step 2 to the saturation temperature by using the R-410A Pressure/Temperature Conversion Chart on page 26.
4. Subtract the temperature obtained in Step 3 from Step 1. The difference is the amount of superheat for the unit. Refer to Unit Operating Conditions for superheat ranges at specific entering water conditions.

Superheat Adjustment

1. Remove the seal cap from the bottom of the TXV valve.
2. Turn the adjustment screw clockwise to increase superheat and counterclockwise to decrease superheat. One complete 360° turn changes the superheat approximately 3-4° F. regardless of refrigerant type. You may need to allow as much as 30 minutes after the adjustment is made for the system to stabilize.
3. Once the proper superheat setting has been achieved, replace and tighten the seal cap. **Warning:** There are 8 total (360°) turns on the superheat adjustment stem from wide open to fully closed. When adjusting the superheat stem clockwise (superheat increase) and the stop is reached, any further clockwise turning adjustment will damage the valve.

Determining Subcooling

1. Measure the temperature of the liquid line on the small refrigerant line (liquid line) feeding the air coil cabinet.
2. Measure the liquid line pressure by attaching refrigerant gauges to the schrader connection on the liquid line service valve.
3. Convert the pressure obtained in Step 2 to the saturation temperature by using the R-410A Pressure/Temperature Conversion Chart.
4. Subtract the temperature in Step 1 from the temperature in Step 3. The difference will be the subcooling value for that unit. Refer to Unit Operating Conditions chart for subcooling ranges at specific enter water conditions.

Unit Operating Conditions – Heat

Model	Stage	Source Temp	Source temp Δ	GPM	Air temp Δ	Amps 240	Blower AMPS	CFM	Discharge pressure at 68 deg A-RT	Discharge temp	Sub cool at TXV	Suction pressure at bulb	Suction temp at bulb	Super- heat at bulb
RT-SE-026	2	32	3.3-5.3	6	26-32	8.6-9.6	1.5	840-880	317-337	161-167	16.3-20.3	80-88	30-36	10.1-14.1
	2	50	4.8-6.8	6	34-39	9.7-10.7	1.5	850-890	365-385	161-167	16.4-20.4	115-123	44-50	8.0-12.0
	2	68	7.2-9.2	6	41-46	11.0-12.0	1.4	840-880	411-431	167-173	16.4-20.4	146-154	61-67	9.3-13.1
	1	41	2.7-4.7	6	22-27	5.8-6.8	1.0	690-730	298-318	148-154	10.8-14.8	100-108	40-46	7.6-11.6
	1	50	3.0-5.0	6	27-32	6.1-7.1	1.0	690-730	322-342	148-154	11.8-15.8	119-127	48-54	7.7-11.7
	1	68	5.1-7.1	6	33-38	6.4-7.4	1.0	690-730	358-378	150-156	12.1-16.1	151-159	63-69	8.4-12.4
RT-SE-040	2	32	4.0-6.0	9	24-29	11.4-12.4	2.4	1190-1230	305-325	133-139	15.4-19.4	79-88	31-37	10.9-14.9
	2	50	5.4-7.4	9	31-36	12.9-13.9	2.3	1200-1240	345-365	136-142	17.7-21.7	19-117	46-50	9.6-13.6
	2	68	8.0-10.0	9	41-46	14.4-15.4	2.2	1190-1230	404-424	143-149	15.5-19.5	148-156	62-69	9.7-13.7
	1	41	3.3-5.3	9	24-29	8.1-9.1	1.6	980-1020	298-318	131-137	13.5-17.5	98-106	40-46	8.7-12.7
	1	50	3.7-5.7	9	27-32	8.4-9.4	1.6	990-1030	315-335	128-134	13.0-17.0	114-122	45-51	6.9-10.9
	1	68	5.6-7.6	9	33-38	9.0-10.0	1.6	970-1010	354-374	133-139	15.1-19.1	150-158	61-68	8.1-12.1
RT-SE-052	2	32	3.4-7.4	12	26-34	17.0-23.0	3.0	1487-1567	313-353	165-175	14-22	71-91	28-34	7.4-15.4
	2	50	5.6-9.6	12	35-43	19.5-25.5	3.0	1485-1565	360-400	167-176	17.8-25.8	106-126	43-49	4.5-12.5
	1	41	3.0-7.0	12	26-34	11.4-17.4	2.1	1177-1257	304-344	153-163	8.4-16.4	92-112	39-45	6.1-14.1
	1	50	3.4-7.4	12	30-38	11.9-17.9	2.1	1188-1268	325-365	153-163	10.6-18.6	109-129	46-52	5.7-13.7
RT-SE-062	2	32	3.9-5.9	15	26-31	20.4-21.4	4.7	1850-1890	317-337	161-167	15.3-19.3	73-82	30-36	12.9-16.9
	2	50	6.0-8.0	15	34-41	23.0-24.0	4.7	1850-1890	363-383	160-166	17.3-21.3	103-111	43-50	10.3-14.3
	2	68	8.0-10.0	15	40-45	25.2-26.2	4.7	1860-1900	408-428	165-171	18.2-22.2	132-140	56-62	10.7-14.7
	1	41	4.2-6.2	15	25-30	15.9-16.9	3.6	1590-1630	310-330	153-159	11.8-15.8	95-103	38-45	9.0-13.0
	1	50	4.3-6.3	15	28-33	16.3-17.3	3.6	1600-1640	325-345	152-158	12.5-16.5	110-118	45-52	9.1-13.1
	1	68	6.4-8.4	15	35-40	17.5-18.5	3.6	1620-1660	367-387	151-157	12.5-16.5	146-154	60-66	7.9-11.9

NOTE: These are nominal expected conditions, will vary from model to model. Refrigeration technician must use his own experience and judgment to verify proper charge and proper setting of TXV. However, TXV for Geo systems must be set for a balance between heating and cooling.

Unit Operating Conditions – Cool

Model	Stage	Source Temp	Source temp Δ	GPM	Air temp Δ Dry bulb	Amps 240	Blower AMPS	CFM	Discharge pressure at 80 deg A-RT	Discharge temp	Sub-cool at TXV	Suction pressure at bulb	Suction temp at bulb	Super-heat at bulb
RT-SE-026	2	59	9.4-11.4	6	20.5-25.5	6.4-8.5	1.9	921-961	219-239	121-127	8.1-12.1	129-136	58-64	14.2-18.2
	2	77	9.0-11.0	6	20.1-25.1	7.7-9.7	1.8	917-947	281-301	138-144	8.2-12.2	132-142	60-66	13.8-17.8
	2	86	8.5-10.5	6	19.2-24.2	8.6-10.6	1.8	928-968	324-344	147-153	8.5-12.5	136-146	60-66	12.4-16.4
	1	59	6.7-8.7	6	18.9-23.9	3.7-5.6	1.4	782-822	205-225	106-112	3.5-7.5	138-148	61-67	12.2-16.2
	1	68	6.4-8.4	6	17.7-22.7	4.1-6.1	1.6	797-837	236-256	115-121	3.6-7.6	141-151	62-67	11.8-15.8
	1	86	6.1-8.1	6	17.4-22.4	5.2-7.2	1.5	808-848	302-322	136-142	4.5-8.5	145-155	63-69	11.0-15.0
RT-SE-040	2	59	11.2-13.2	9	22.5-27.5	10.1-12.1	2.5	1234-1274	252-272	122-128	18.1-22.1	134-144	62-68	14.6-18.6
	2	77	10.5-12.5	9	21.8-26.8	12.2-14.2	2.5	1220-1260	321-341	132-138	17.2-21.2	139-149	61-67	11.2-15.2
	2	86	9.6-11.6	9	21.1-26.1	13.2-15.2	2.6	1229-1269	363-383	142-148	18.8-22.8	137-147	59-65	10.8-14.8
	1	59	7.8-9.8	9	21.1-26.1	5.8-7.8	2.1	1021-1061	233-253	108-114	14.7-18.7	143-153	63-69	12.2-16.2
	1	68	7.6-9.6	9	19.2-24.2	6.6-8.6	2.2	1052-1092	267-287	115-121	13.7-17.7	145-155	61-67	9.6-13.6
	1	86	6.7-8.7	9	18.6-23.6	8.4-10.4	2.1	1063-1103	334-354	131-137	14.6-20.6	147-157	62-68	9.2-13.2
RT-SE-052	2	59	11.9-15.9	12	21.2-29.2	13.9-19.9	3.8	1562-1642	244-284	125-135	18.1-26.1	124-144	57-63	10.5-18.5
	2	77	11.3-15.3	12	19.4-27.4	16.7-22.7	3.7	1580-1660	308-348	142-152	17.3-25.3	128-148	58-64	9.6-17.6
	1	59	8.2-12.2	12	20.7-28.7	6.7-12.7	2.0	1181-1241	219-259	111-121	12.9-20.9	131-151	60-66	9.7-17.7
	1	68	41133.0	12	19.9-27.9	7.8-13.8	2.0	1164-1244	249-289	123-133	12.9-20.9	132-152	60-66	8.8-16.8
RT-SE-062	2	59	11.7-13.7	15	22.6-27.6	17.5-19.5	5.2	1814-1854	257-277	124-130	19.8-23.8	120-130	53-59	11.9-15.9
	2	77	10.7-12.7	15	21.3-26.3	20.3-22.3	5.2	1823-1863	321-341	140-146	18.1-22.1	122-132	53-59	11.4-15.4
	2	86	9.9-11.9	15	21.2-26.2	22.1-24.1	5.1	1812-1852	358-378	151-157	18.4-22.4	122-132	53-59	12.5-16.5
	1	59	7.3-9.3	15	21.2-26.2	9.8-11.8	2.8	1373-1413	218-238	116-120	14.0-18.0	136-146	57-63	9.5-13.5
	1	68	8.2-10.2	15	21.9-26.9	11.9-13.9	3.0	1398-1438	261-261	123-129	13.7-17.7	130-140	55-61	9.4-13.4
	1	86	7.5-9.5	15	20.6-25.6	14.7-16.7	2.9	1387-1437	327-347	143-149	13.6-17.6	136-146	57-63	9.3-13.3

NOTE: These are nominal expected conditions, will vary from model to model. Refrigeration technician must use his own experience and judgment to verify proper charge and proper setting of TXV. However, TXV for Geo systems must be set for a balance between heating and cooling.

Pressure/Temperature Conversion Chart for R-410A

PRESSURE (PSIG)	TEMP °F	PRESSURE (PSIG)	TEMP °F	PRESSURE (PSIG)	TEMP °F	PRESSURE (PSIG)	TEMP °F	PRESSURE (PSIG)	TEMP °F
60	8.5	180	63.5	300	96.3	420	120.6	540	140.0
62	9.9	182	64.2	302	96.8	422	120.9	542	140.3
64	11.2	184	64.8	304	97.2	424	121.3	544	140.6
66	12.5	186	65.5	306	97.7	426	121.6	546	140.9
68	13.8	188	66.1	308	98.1	428	122.0	548	141.2
70	15.1	190	66.8	310	98.6	430	122.3	550	141.4
72	16.3	192	67.4	312	99.0	432	122.7	552	141.7
74	17.5	194	68.0	314	99.5	434	123.0	554	142.0
76	18.7	196	68.7	316	99.9	436	123.4	556	142.3
78	19.8	198	69.3	318	100.4	438	123.7	558	142.6
80	21.0	200	69.9	320	100.8	440	124.1	560	142.9
82	22.1	202	70.5	322	101.2	442	124.4	562	143.2
84	23.2	204	71.1	324	101.7	444	124.8	564	143.5
86	24.3	206	71.7	326	102.1	446	125.1	566	143.7
88	25.4	208	72.3	328	102.5	448	125.4	568	144.0
90	26.5	210	72.9	330	103.0	450	125.8	570	144.3
92	27.5	212	73.5	332	103.4	452	126.1	572	144.6
94	28.6	214	74.1	334	103.8	454	126.5	574	144.9
96	29.6	216	74.7	336	104.2	456	126.8	576	145.1
98	30.6	218	75.3	338	104.7	458	127.1	578	145.4
100	31.6	220	75.8	340	105.1	460	127.5	580	145.7
102	32.6	222	76.4	342	105.5	462	127.8	582	146.0
104	33.5	224	77.0	344	105.9	464	128.1	584	146.2
106	34.5	226	77.5	346	106.3	466	128.5	586	146.5
108	35.4	228	78.1	348	106.7	468	128.8	588	146.8
110	36.4	230	78.7	350	107.2	470	129.1	590	147.1
112	37.3	232	79.2	352	107.6	472	129.4	592	147.3
114	38.2	234	79.8	354	108.0	474	129.8	594	147.6
116	39.1	236	80.3	356	108.4	476	130.1	596	147.9
118	40.0	238	80.9	358	108.8	478	130.4	598	148.2
120	40.9	240	81.4	360	109.2	480	130.7	600	148.4
122	41.7	242	81.9	362	109.6	482	131.1	602	148.7
124	42.6	244	82.5	364	110.0	484	131.4	604	149.0
126	43.4	246	83.0	366	110.4	486	131.7	606	149.2
128	44.3	248	83.5	368	110.8	488	132.0	608	149.5
130	45.1	250	84.1	370	111.2	490	132.3		
132	45.9	252	84.6	372	111.6	492	132.7		
134	46.7	254	85.1	374	112.0	494	133.0		
136	47.5	256	85.6	376	112.3	496	133.3		
138	48.3	258	86.1	378	112.7	498	133.6		
140	49.1	260	86.6	380	113.1	500	133.9		
142	49.9	262	87.1	382	113.5	502	134.2		
144	50.7	264	87.7	384	113.9	504	134.5		
146	51.5	266	88.2	386	114.3	506	134.9		
148	52.2	268	88.7	388	114.7	508	135.2		
150	53.0	270	89.2	390	115.0	510	135.5		
152	53.7	272	89.6	392	115.4	512	135.8		
154	54.5	274	90.1	394	115.8	514	136.1		
156	55.2	276	90.6	396	116.2	516	136.4		
158	55.9	278	91.1	398	116.5	518	136.7		
160	56.6	280	91.6	400	116.9	520	137.0		
162	57.4	282	92.1	402	117.3	522	137.3		
164	58.1	284	92.6	404	117.6	524	137.6		
166	58.8	286	93.0	406	118.0	526	137.9		
168	59.5	288	93.5	408	118.4	528	138.2		
170	60.2	290	94.0	410	118.7	530	138.5		
172	60.8	292	94.5	412	119.1	532	138.8		
174	61.5	294	94.9	414	119.5	534	139.1		
176	62.2	296	95.4	416	119.8	536	139.4		
178	62.9	298	95.8	418	120.2	538	139.7		

Electrical Hookup

⚠ 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.

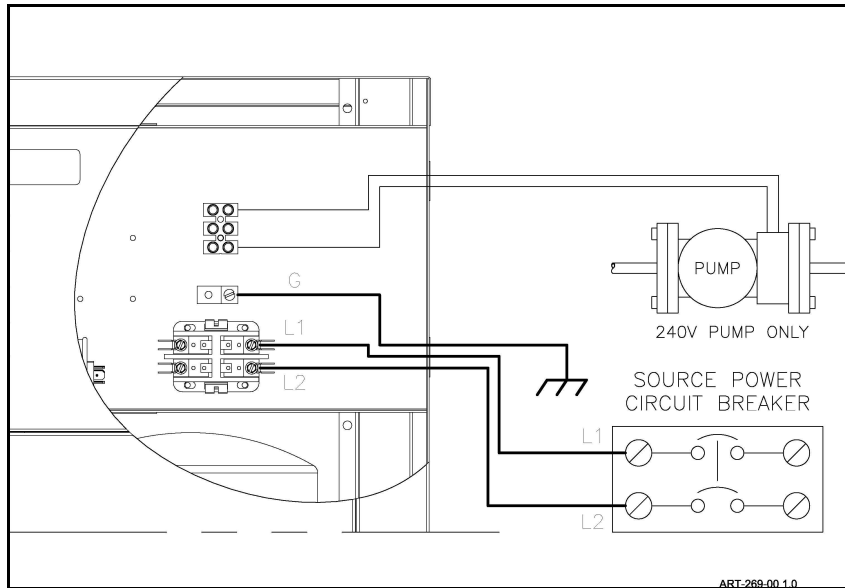
Line Voltage

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.

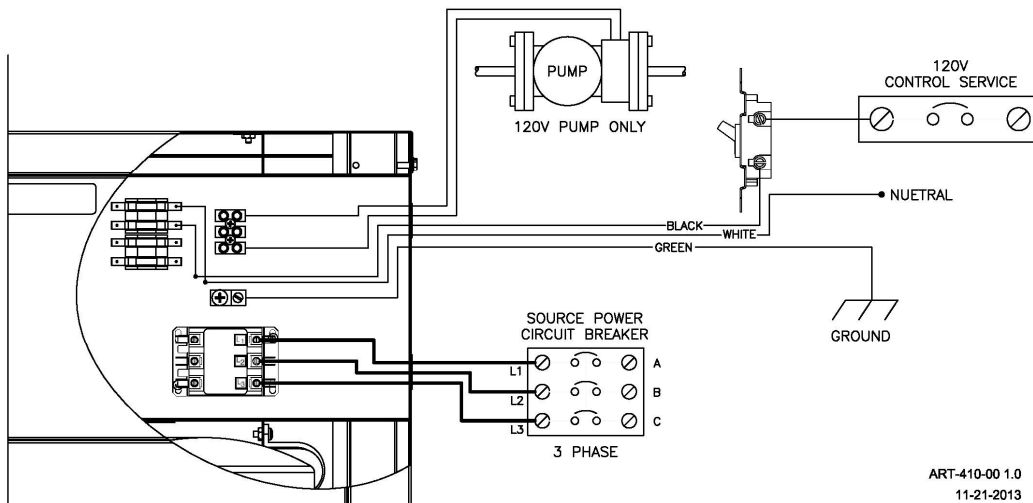
- If this unit includes AUX EL module, its own nameplate provides kW and current/voltage requirement.

The field power supply connection is at the compressor contactor, at the end of the line voltage control box.

Single Phase



Three Phase



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

Loop pumps – the loop pump station can be powered at the TB above the contactor. 5-amp fusing is included, left of terminal block.

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.

EZGEO Controller

EZGEO Features

Review attached HC112 HELPS document which lists the various characteristics and capability of this controller product.

Application

The EZGEO controller is standard on all Northern Heat Pump models.

Even more specific, this model factory default is mode D and SW OVER = position 1 (-15° OT).

WARNING

IF THERE IS NO AUTOMATIC STANDBY (GAS) OPERATING FROM THE EZGEO FURNACE TB-W, THE SW OVER DIAL SWITCH MUST BE SET TO Ø POSITION. THIS STATEMENT RELATES TO MODES B, C, AND D. ONCE THERE IS A LOGIC TRANSFER TO SB, THE FURNACE MUST FINISH OUT ROOMSTAT-W. THUS THERE IS NO FURNACE OR NO HEAT THE SYSTEM WILL BASICALLY BE LOCKED UP WAITING FOR HEAT ENERGY TO SATISFY THE THERMOSTAT.

Room Thermostat

This is general hookup information, before proceeding review previous section – EZGEO Controller – and determine operating **mode** for this particular application.

Use **conventional** (not heat pump with O and compressor Y) heat/cool. This controller is designed to operate from a basic 1H/1C thermostat. 2H/2C can also be used. See next section for comments relating to W2 and Y2 from the roomstat.

The thermostat can be mechanical, digital, power robbing, battery operated, setback, etc. If required, set heat anticipator to 0.2. If electronic/digital stat, setup may ask for “cycles per hour”. As with most heat pump products, the efficiency of your Northern Heat Pump relates directly to long run times. We recommend a small number of cycles (2 cycles per hour).

Note 1: Do not (even with heat pump) use a heat pump thermostat.

Note 2: If programmable roomstat has external sensors, make sure setup is for display monitor only and any programming for these sensors that has to do with interrupting any output functions, ODT, auxiliary, setback, etc. are **not active** or program **disabled**.

Note 3: A high quality digital thermostat (part number 5021) is available from Northern Heat Pump which has been pre-programmed to match the requirements of this unit. See the Accessories list later in this manual.

Connect the standard R, W, G, and Y (and W2 and Y2 in the case of 2H/2C) stat terminals to the EZGEO board upper left terminal block. If the specific roomstat requires common or C, this can be picked up from a tab on the board bottom right.

NOTE

The installer must be familiar with the manufacturer’s low voltage wiring terminology, screw terminal terminology/colors, etc. This manufacturer’s terminology must be related to Northern Heat Pump’s screw terminal identification within this controller. The intent of this instruction manual is **not** to train each installer on the terminology related to the specific product you are installing.

Utility Load Control

Bottom 2-screw terminal block marked blue and blu/wht. Remove the jumper and extend the two wires to the utility furnished control device. For electric energy operation (off-peak) the two blue wires represent contact closure as shipped. **Do not apply external voltage or external power to the blue wires**, they are simply looking for a closed contact during off-peak.

- The maximum “AC noise” on the blue wire is 5 volts, peak to peak. The blue/white TB is actually common and if grounding is proper as suggested in the next paragraph, this should dampen any effect. But it is always good practice to run these wires separate from any current carrying line voltage Romex or other conductors.
- One load control wire pair handles both **winter** and **summer** interrupt.
- If load control reverse logic is required, a “closed to interrupt contact” can be connected to SB SW to COM. Another way to resolve this issue is through the use of an interposing relay. Consult factory if an interposing relay is required.
- If load management interrupt does not apply, simply leave the blue wires jumpered.

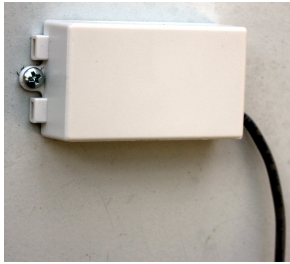
Grounding

Caution – 24 volts common grounding – the installer must determine whether the furnace fan center COM screw terminal has a good ground bond (not simply furnace skin). If the fan center COM is not adequately grounded, use a green wire from the EZGEO lower right C tab to a ground bond.

EZGEO Control Dials

The EZGEO control board contains 4 on-board dials which control how the system operates. The usage of these control dials is explained later in this manual.

Temperature Sensors



Outdoor Sensor (OT) – extend sensor to an outdoor location properly sampling the outdoor temperature. Select a location away from direct sunlight and where the sensor will not pick up false temperature from the heat pump outdoor unit, refrigerant line sets, dryer vent, reflection off of steel siding, etc. Do not install the sensor in any type of enclosure, as this will falsely trap and pick up radiant sun temperature. Mount the sensor horizontally on the structure using the screws provided.

Duct Sensor (ST) – install in the warm air plenum at least 12” (31 cm) above heat pump A-coil. Locate to one side so the air coming through the A-coil passes over the sensor tip. The ST sensor does not have an end cap; the small black electronic part just within the tube end is the actual sensor. The only purpose of the metal tube is the protection of the sensor. Best results are obtained by positioning the sensor so the black tip is directly in the air leaving the A-coil. This air is most often towards the edges of the plenum.

Other Sensor Related Comments - If additional cable length is required, you must use the following rules for extending the cable.

- Use unshielded (low capacitance, preferred twisted) 3 or 4-wire low voltage cable.
- 50 feet (15 meters) is maximum (total).
- Do not, under any circumstances, use leftover wires within the normal thermostat cable.
- Route the sensor cable making sure you do not crimp, cut, staple, or damage the cable in any way.
- Keep sensor cables at least 12” (31cm) away from any line voltage wiring, romex, etc.

For easy sensor cable disconnect and reconnect, the WarmFlo board has a plug-in 4-place terminal block. Before disconnecting, you will notice two red wires are under the red screw and two white wires is under the COM screw. The black wire represents the data information from each sensor and must be connected to the appropriate OT or ST screw.

The sensor is polarity specific and is sensitive to incorrect voltage. It must be protected from static voltage, etc. Do not cross connect or inadvertently short out sensor wires with power on. Permanent destruct damage may result.

Gas Furnace Hookup – Mode D

See hookup drawing NH501, the gas furnace wiring is at the EZGEO board bottom left terminal block.

Gas Furnace (or Oil with Fan Center Terminal Wiring Strip)

The control board lower left 6 terminal screw points are used for the furnace interface. However, all 6 are not necessarily used, based on type of furnace, blower, burner, etc.

24-volt power – for the Split unit (mode D) the power for the EZGEO Controller comes from the gas furnace transformer.

Basic furnace, PSC blower motor – in addition to R and C above, add W and G.

Variable speed blower, ECM motor, single Y – in addition to the above add Y to Y.

Variable speed blower, ECM motor, available Y1 and Y2 speeds – in addition to the above, the control board Y goes to furnace Y1 and control board Y2 goes to furnace Y2.

2-stage or variable stage burner – if mode B, C, D and 2-stage furnace burner, program the gas furnace for high burner internal control (next section also has other options for stat W2).

ECM blower motor speed/setup – the gas furnace blower is setup identical to an air conditioning/gas furnace arrangement. See model number specification page and determine Y1 and Y2 CFM requirements for this Geo HP unit. Relate this directly to an air conditioner CFM requirement or CFM per ton. Set the gas furnace bit switches (or setup technique) for the ECM blower speed/CFM to deliver the proper airflow when the Geo HP Y1 or Y2 stages are active. These are the direct hardware connections at the furnace terminal block – Y1 and Y2.

ST Sensor – Installed in the supply air duct, see page 31.

Additional Hookup or Special System Equipment Concerns

Additional Room Thermostat Connection Points

On the EZGEO board, upper left, are three optional control tabs – W2, E-GAS, and Y2. These can be used for troubleshooting or emergency full output energy or with a conventional 2H/2C room thermostat. If the geo system has been sized to meet 100% of the heating load, it may be desirable to control the strip heat (if equipped) at the thermostat. Configuring the thermostat to 2H/2C or 2H/1C and setting the AUX EL dial to “Disable” allows the EZGEO control to function in this manner.

W2 – mode B, this conditions AUX EL all stages on, with compressor in Y2.

- E-GAS – this conditions the system to standby or transfers the room thermostat W to gas furnace. This is active for all modes, it should never be used for mode A when there’s no gas furnace connected.
- Y2 – in cooling, this forces compressor to full capacity. It can be an override to the cooling sequence condition shown in Figures 1, 2, 3, 4.

Special Oil Furnace Comment

This controller is designed to interface directly with a furnace fan center containing 24-volt transformer (40VA or larger), blower relay, and a “W” function to operate the furnace. If this installation is for an **oil furnace** with only oil control “T and T” terminals, a special fan center will need to be added with an isolation relay at the “W” terminal so only isolated contacts are connected to the oil burner master control “T and T”. Another choice is to order EE-5053 relay with accompanying HD001 instruction sheet.

Remotely Located Standby Override Switch

On the bottom of the board is an “SB SW” tab. Using an external switch between this “SB SW” tab and a common tab provides the same function as the two-position system selector switch on the front of your EZGEO control panel. In this configuration, either of these switches allows the homeowner to manually force the HVAC system to utilize a fossil fuel system. A closure of the external switch is the equivalent to the system selector switch being in the “up” or “standby” position.

Important note on cooling mode: To operate in cooling mode, neither of the switches can be in the override position. Thus, the selector switch on your EZGEO control panel **MUST** be in the “down” position **AND** the external switch must be in “heat pump” or “normal” position in order for the heat pump to operate in cooling mode. If one or both of these switches are not the proper positions, cooling will not occur.

Load Control, Other Products or Hardware

If there is a need to “pass on” the utility load control receiver function to other heating equipment, radiant floor boiler, peak interrupter, etc; there is an isolated contact on this control board. Locate tabs COM/EL/SB. In the electric mode there is an isolated contact between COM and EL. This contact is for low voltage only, 1-amp maximum.

Note: There may be a 1 or 2 minute delay between this relay contact action and the actual load control receiver. This delay coincides with various blower purge functions.

Note: This contact **also** follows front panel standby switch and all other standby functions such as SOT-S, etc.

Optional – NHP Geo Alarm

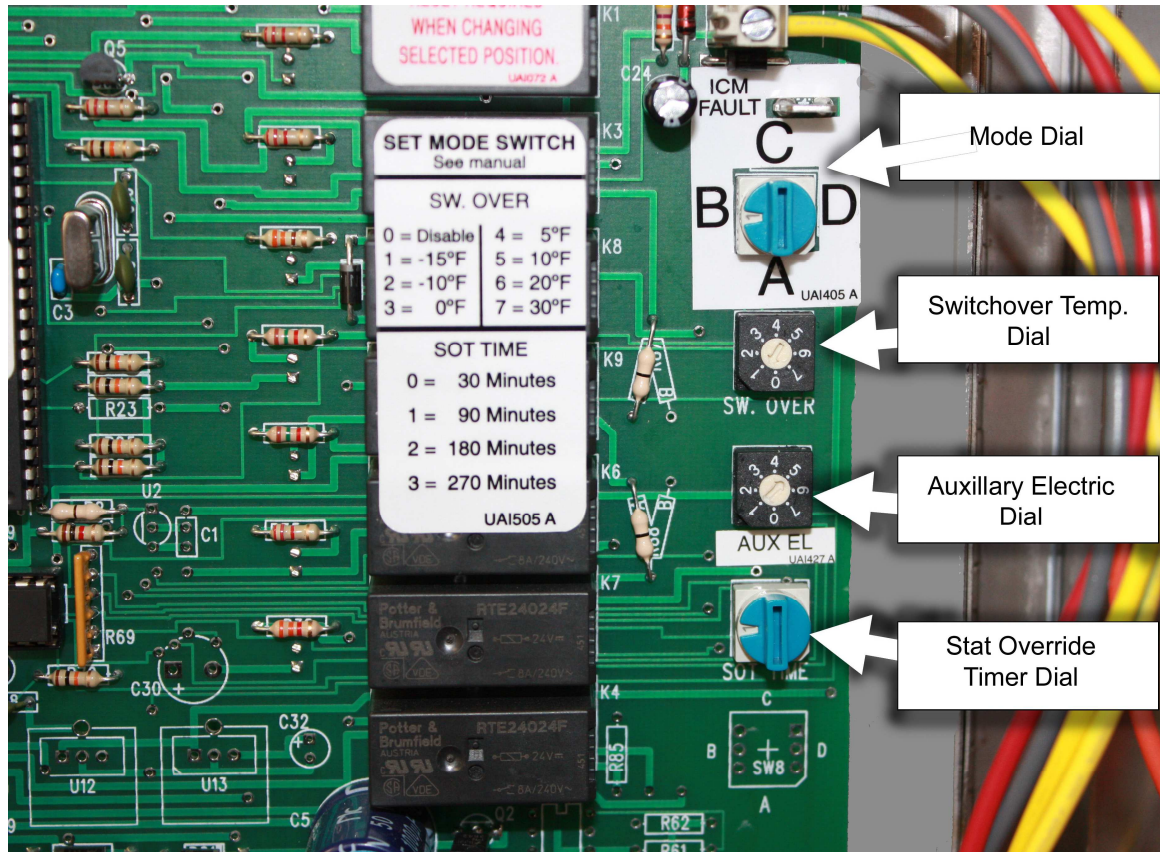
As shown on hookup drawing NH501, there are provisions for an external buzzer and LED device. When the Geo HP declares a fault or dead compressor alarm, this device will sound an audible and turn on the LED light.

- The 2-wire hookup can be extended as much as 100 feet (30 meters), use 18 or 20 gauge wire.
- The audible can be turned off with the pushbutton. But if the system is not repaired within 4 hours the audible will again sound.
- The LED light will continue until the system is repaired and power off reset.
- The system may recover on its own, but the LED will continue indicating there “was” a fault situation. This LED is only turned off by a power off reset at the disconnect.
- Order R-AL-FD-1

Field Setup Overview

Your EZGEO-equipped Northern Heat Pump can be set up at your location to fit most any requirements and conditions. This is accomplished with the use of the various dials and switches located on the EZGEO board. It is extremely important the installer properly goes through this section and sets up the various switches to match the installation requirements. Again, refer to HC112 Helps – EZGEO Controller section for further details on these setups. The diagram below shows the dial locations on the EZGEO board.

Warning: Power-down reset required whenever changing any of the switch positions on the back side of the board.



Mode Dial

Mode Switch	Mode	SW OVER	Configuration
A	Geo only	N/A	NOT APPLICABLE FOR THIS MODEL
B	Geo/AUX EL	0	NOT APPLICABLE FOR THIS MODEL
	Geo/AUX EL/gas	Value	NOT APPLICABLE FOR THIS MODEL
C	Geo/gas	Value	NOT APPLICABLE FOR THIS MODEL
D	Split/gas	Value	No AUX EL, gas furnace, auto SB, utility load control

*Mode B also requires the proper setting and interpretation of SW OVER dial switch. As shown in the mode selection table, if the configuration is AUX electric only, SW OVER switch must be in position 0. If it is both AUX EL and gas, the SW OVER switch must be in a temperature value position.

Switchover Temperature (SW OVER)

This switch is shipped from the factory with a square “GAS” label. This label should be removed ONLY if a secondary furnace is present and active in the system. The installer should remove the label and adjust this switch only after reading this manual and understanding the operation of the switch. Select the OT temperature

to interrupt the compressor and transfer to the sequence shown on applicable mode Figures 2, 3, 4. This only applies when a gas furnace is connected. For all non-SB configurations must be set to 0 position (disable).

- 0 = Disable 4 = 5° F
- 1 = -15° F 5 = 10° F
- 2 = -10° F 6 = 20° F
- 3 = 0° F 7 = 30° F

Using Electric Strip Heat for Supplemental or Emergency Backup Purposes

The EZGEO control board has the ability to interface with an Electro Industries WarmFlo Select Plenum Heater (SL1). The SL1 plenum heater is sold separately and must be inserted into the plenum above the system A-Coil. A special cable (available from Electro Industries) is required to connect the EZGEO controller to the internal power supply board included within the WarmFlo Select Plenum heater. Once this connection is made, the EZGEO will assume full control of the electric elements and correctly operate them per the AUX EL setup parameters as laid out by the installing contractor (or NHP guidelines) In this situation, it should be noted that since the EZGEO controller is “taking over” the operation of the WarmFlo plenum heater, the plenum heater indicator lights and switches will become inoperable.

The addition of this type of auxiliary heat will require careful analysis and setup by the installing contractor. – See “EZGEO Board Dial Configurations” for suggested setup).

Strip Heat Enable/ Disable(AUX EL)

When equipped with an auxiliary strip heater, the AUX EL dial allows the EZGEO control to be configured to enable the strip heat based upon the outdoor temperature (OT). Setting the dial to 0 = Disable, the strip heat will not turn on unless W2 is energized. When W2 is energized, all strip heat stages are activated. Setting the dial to 7 = Enable, will activate all stages of the strip heat at the beginning of a heat call. Please note, the Enable dial setting is typically only used during initial startup inspection, troubleshooting, or in special cases when strip heat is needed to operate all the time. If AUX EL dial is set to enable during a heat call, all strip heat stages will remain active until the end of the heat call regardless of where AUX EL dial is set back to.

Warning: Leaving the AUX EL dial set to the Enable position will lead to reduced system efficiency and higher operating costs.

0 = Disable	4 = 0° F (default)
1 = -30° F	5 = 5° F
2 = -20° F	6 = 10° F
3 = -10° F	7 = Enable

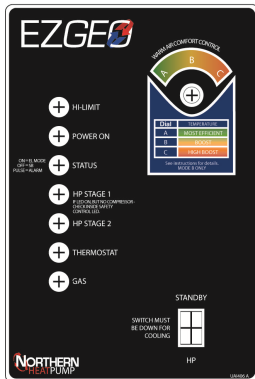
Stat Override Timer (SOT)

Again, see the appropriate mode Figures 1, 2, 3, 4 for the sequence action after the SOT timeout (end). The intent of the SOT is to take care of very unusual heat/cool conditions or building matching situations, the general sequence relating to OT temperature should take care of proper thermostat cycling without ever reaching SOT timeout (end). Thus, it is recommended the SOT be a high number.

- 0 = 30 minutes 2 = 180 minutes
- 1 = 90 minutes 3 = 270 minutes

Information

Front panel decal showing efficiency dial and LED’s.



Efficiency Setting (Front Panel)

This applies to **AUX EL module** or supplementary heating only, mode **B**. By adjusting this dial switch the homeowner can boost the ST target temp.

- A = ST target temperature
- B = +5° F
- C = +10° F

Gas Furnace CFM

See previous page on gas furnace hookup for proper programming of ECM motor for the required CFM output.

Outdoor Temp (OT) Factory Default Settings

	Default
ST target temp	90° F (32° C)
Dead compressor ST	70° F (21° C)
OT temp, heating – HI >	20° F (-7° C)
OT temp, cooling – HI >	80° F (27° C)

EZGEO Board Dial Configurations

Below is a list of different configurations the EZGEO system can be adapted to and the matching appropriate EZGEO board settings. Note that for split geo units, the Mode Dial must be set to “D”.

Undersized heat pump with fossil fuel furnace (Split)

- Mode Dial: D
- SW Over: 1=-15° 2=-10°F 3=0°F 4=5°F 5=10°F 6=20°F 7=30°F
- AUX EL: 0
- Front Dial: 0
- SOT Dial: 0=30min 1=90min 2=180min 3=270min
- Thermostat type: Conventional 1H/2C

Geothermal heat pump with fossil fuel furnace (Spilt).

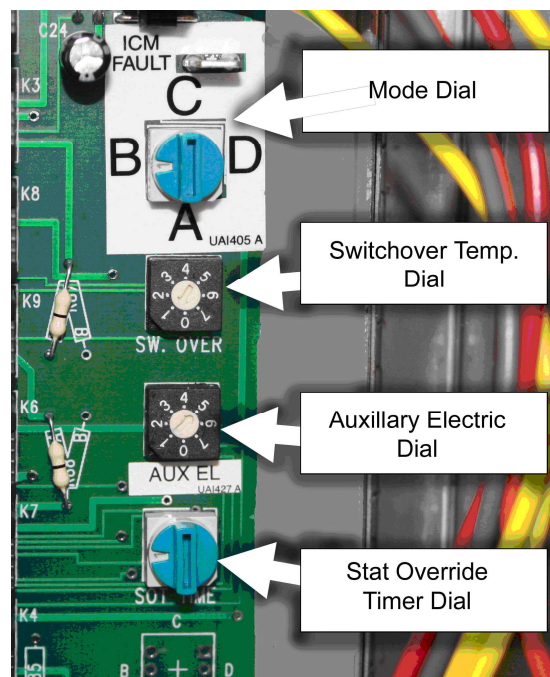
- Mode Dial: D
- SW Over Dial: 0
- AUX EL: 0
- Front Dial: 0
- SOT Dial: 0=30min 1=90min 2=180min 3=270min
- Thermostat type: Conventional 1H/2C

Undersized heat pump with electric heat package

- Mode Dial: B
- SW Over Dial: 0
- AUX EL: 1=(-30°F) 2=(-20°F) 3=(-10°F) 4=0°F 5=5°F 6=10°F
- SOT Dial 0=30min 1=90min 2=180min 3=270min
- Thermostat type: Conventional 1H/2C/E

Heat pump with emergency electric heat package

- Mode Dial: B
- SW Over Dial: 0
- AUX EL: 0
- SOT Dial: 0=30min/ 1=90min/ 2=180min/ 3=270min
- Thermostat type: Conventional 2H/2C



Operation Indicators

Front Panel LED's

- **Hi-limit** – when the AUX EL hi-limit probe (automatic reset or manual reset) opens this top red LED is on. The electric elements will be interrupted via a safety relay circuit whenever this HL LED is illuminated (mode B only).
- **PWR ON** – indicates good fuse and 24-volt power source from the furnace terminal block.
- See below for bad sensor indication.
- **Status mode** – in some ways this can be a utility load control indicator, but there are additional programmable functions which cause this unit to go to standby (see HC112 EZGEO section and sequence charts).
- In addition this LED provides monitor for the two alarm conditions.
 - Dead compressor – fast pulsing, 1/10 second
 - ICM fault – slow pulsing, 1 second
- **HP-Y1** – the output “Y” screw terminal is active at 24 volts high. This provides the “Y” input to the ICM compressor monitor board. Compressor will react as a function of this ICM safety board.
- **HP-Y2** – the output “Y2” screw terminal is active at 24 volts high.
- **T-stat call** – the room thermostat W or Y is active or 24 volts high.
- **Gas call** – the furnace “W” or terminal block feeding furnace W, 24 volts high.

Override Switch – the front panel slide switch is a direct hardware disabling of the HP-Y1 and electric elements functions. The room thermostat heat call wire or function is directly controlling the fossil fuel or gas furnace. This function can also be on a remote switch, see previous statement for “SBSW” tab.

WARNING

THIS FRONT PANEL MANUAL OVERRIDE SWITCH IS A HARDWARE DIRECT TO GAS FURNACE FUNCTION. THUS THERE ARE NO BLOWER PURGE CYCLES. IF THE ELECTRIC ELEMENTS ARE ON AND HOT WHEN SWITCHING TO OVERRIDE AND IMMEDIATELY ALLOWING THE GAS FURNACE, OVERHEAT ON THE ELECTRIC ELEMENTS AND POTENTIAL ELECTRO-MATE MANUAL RESET IS POSSIBLE. THIS FRONT PANEL OVERRIDE SWITCH SHOULD ONLY BE ACTIVATED WHEN THERE IS NOT A ROOMSTAT HEAT CALL.

Note: This switch must be in the “normal” position during **cooling**.

ICM board (inside) – fault LED pulses with last open limit condition, see next page.

Sensor Monitor Indicators – in addition to using PC software to readout the temperature sensors, there is a built-in go/no-go type monitor visible on the green PWR ON second from the top LED.

- If there is detection of miswired or totally inoperative sensor, this LED has a blinking or pulse mode. By checking the pulsing pattern, the appropriate sensor can be identified.
- ST sensor - two, 100 ms blinks every second
- OT sensor - 100 ms blink every second
- Both bad - ½ second on, ½ second off, alternating.

Power On, Startup

Before applying power to the heat pump, check the following items:

1. Water supply plumbing to the heat pump is complete and operational.
2. Low voltage wiring of the thermostat and any additional control wiring is complete.
3. Set thermostat to the **OFF** position.
4. All high voltage wiring is correct including fuses, breakers, and wire sizes.
5. The heat pump is located in a warm area above 50°F [10°C]. Starting the system with low ambient temperature conditions is more difficult.
6. Manually open water valve on well system to check flow. Never operate the system without adequate source water ground loop or open loop supply.
7. You may now apply power to the unit. A 1 to 5 minute delay on power up is programmed into the heat pump before the compressor will operate. This delay prevents short cycling of the unit.
 - During this time the blower may be active.
 - Verify water flow rate and temperature of the source side flow to be at recommended levels.
8. The source side water flow rate is at the required level, see specification page. Low water temperature starting may require flow reduction until the system is up to operating temperature.

The following steps will assure that your system is heating and cooling properly. After the initial time-out period is completed the heat pump is now ready for operation. Note: EZGEO, HC112, sequence charts (mode A, B, C, D) determine compressor staging.

1. Place the thermostat to the “HEAT” position. Turn the thermostat up to activate a call for heat. The compressor should start.
2. After the unit has run for about 3 minutes, check the source side supply and return water temperature. A water temperature **decrease** is normal in the heating mode, but the specific operating water temperature can effect the water flow rate (GPM) stated in the specification table.
3. Verify warm air temperature rise and loop source water decrease are approximately as stated in the specification table, page 3.
4. Turn the thermostat to the off position. The compressor will shut down in a few seconds.
5. Place the thermostat in the “COOL” position. Next turn thermostat down to active a call for cooling. The compressor will start after a 5 minute anti-short cycle period from its last shutdown.
6. After the unit has run about 3 minutes, check the source side supply and return water temperatures. A water temperature **rise** is normal in the cooling mode.
7. Verify cool air temperature drop and loop source water increase are approximately as stated in the specification table, page 3.
8. Instruct the owner on correct operation of the thermostat and heat pump system.

Operational Tips

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. Air flow problems
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 (550 PSI)
2 blink = low pressure cutout (40 PSI)
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.

 CAUTION

The front panel override switch **should not** be changed during a heat call. There are no purge cycles when manually changing the override switch with an active heat call and could cause an undesired overheat situation

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. The freeze protection switch (on open loop systems) will also activate the lockout at 40 PSI in the heating mode to protect the water coil against freeze rupture. Do not reset a well water system in the heating mode without first verifying water flow.

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.**

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

Preventative Maintenance

Water 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.

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 flexible “P-trap” 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.

Air Coil – In order to keep your Northern Heat pump 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.

Troubleshooting – EZGEO Control

Comment – Split, mode D, does not require ST sensor. Certain items below only relate to modes B and C.

Sensor Temperature Calibration – both remote sensors are digital electronic and factory calibrated. Normally these do not require field calibration or verification. However, if sensor temperature error is determined, use special PC software disc and PC serial port cable. The PC screen has direct readout of both temperatures, allows a visual determination of WarmFlo internal temperature settings, and can be used to offset either temperature sensor for troubleshooting and demonstration purposes. This is especially valuable during summer installation.

Override, “E” Tab Input – during a normal roomstat heat call and W2 is jumpered to W, it brings on all four stages and essentially bypasses any temperature sensing or stage modulation functions. In other words, with an W2 input (still need the normal W stat input) this is simply a turn-on/turn-off device.

During a normal roomstat heat call and E-GAS is jumpered to W, it forces a standby (SB) action.

During a normal roomstat cool call and Y2 is jumpered to Y, it forces a compressor to full capacity.

SOT bypass – Adding a jumper wire between J6 and Common will shorten the SOT time down to 1/30th of the SOT set point. For example, if SOT dial is set to position 0 (30 minutes), the EZGEO control will switch to full output in one minute with the test wire in place.

Bad sensor, safety – if the internal logic detects open sensor wire, incorrectly wired sensor, or some bad sensor transmitted value conditions; the green LED reverts to a pulsing mode. Basically the appropriate sensor is set internally to a 0° value and the WarmFlo main board only allows stage 1 and stage 2 on.

- OT sensor – approximately 1/10 second blip every ½ second
- ST sensor – two, 1/10 second blips every ½ second
- Both bad – ½ second on and ½ second off, alternating

Bad sensor, operating default condition – the detection of bad sensor forces the controller to a fixed stage operation.

- ST sensor
 - Stages 1 and 2 on, stages 3 and 4 off (5 kW maximum)
 - The PC screen reads “254” or “BAD”
- OT sensor
 - Set to a default of 2° F (-17° C), see Figures 1, 2, 3, 4
 - The PC screen reads “254” or “BAD”

Internal fuses – the internal desuperheater pump and the source loop pump station terminal block have internal fuses. These are located above the compressor contactor.

- The external decal provides the fuse size and details.

Troubleshooting/Repair Helps

1. This EZGEO controller contains several interference suppression components, but as an electronic logic product, unpredictable and unusual transients or interferences may sometimes cause strange results. If the EZGEO controller is “acting strange”, one immediate step would be power down reset. Simply turn off the 24-volt source power (probably furnace or air handler circuit breaker), when the green LED goes out, count to 10, and re-energize power supply.
2. The terminal blocks for control wire hook-up are designed for a wire insertion and screw clamp down. If there is no wire connected and the screw is loose, the screw may not necessarily make a good electrical contact to the inside components. Example – if you are jumpering the thermostat terminals without thermostat wire connection or if you are attempting to measure voltage on the screw head, you may get erroneous or unpredictable results if the screw is not tightened down.
3. Use general heating system logic information and basic understanding of the terminal block wiring functions when measuring voltage to determine proper operation of this module.
4. The outdoor sensor must be located outdoors for this controller to correctly operate. Do not leave the outdoor sensor “hanging in conditioned space” and attempt to run this system. Note: OT sensor tip must be up.

Alarm/Fault Active

The status LED and alarm output continue until power-off reset. The EZGEO system will attempt to maintain room temperature or prevent freeze-up.

- Mode A – by definition, no backup, at each roomstat W cycle, compressor will retry.
- Modes B, C, D – with gas furnace standby roomstat W is transferred to gas furnace operation.
- Mode B, SW OVER = 0 – AUX EL will be active and do the heating.
- Cooling – same as mode A, each thermostat cycle will attempt a compressor.

Note: Do not repeatedly cycle the compressor and cause consecutive faults. This will result in **permanent** compressor damage and perhaps void warranty. If the Geo system goes into a fault mode, it has already made three attempts to clear the limit condition, repeated cycling of the roomstat will not do any good, it will simply cause damage. Call for service.

Backup/freeze-up – the intent of modes B, C, D with either AUX EL or gas furnace is to prevent freeze-up. If this Geo system is installed without backup (mode A) there is no secondary means of creating heat.

Correct use of mode selection – by definition modes B, C, D installation **include** gas furnace and/or AUX EL module. If the system is setup in either B, C, or D and there is no gas furnace and/or AUX EL freeze-up may still occur because the roomstat is assuming a heat source which will bring up the temperature to satisfy the roomstat.

WARNING

WHEN CONFIGURED WITH A GAS FURNACE AND/OR AUX EL (MODES B, C, D) IT IS THE USER'S RESPONSIBILITY TO HAVE CIRCUIT BREAKERS TURNED ON, GAS IN THE TANK, GAS VALVES OPEN, AN OPERATIONAL GAS FURNACE, ETC. THE EZGEO CONTROLLER CANNOT DETECT "NO GAS IN THE TANK".

Overheat Plenum, Control Override

When AUX EL stages are not active, the ST sensor also controls compressor functions. This also prevents compressor and gas furnace on at the same time (mode D/refrigerant coil in plenum).

- ST > 105° F (40° C) – compressor Y2 turned off
- ST > 112° F (44.5° C) – compressor off

Operation continues to the end of heat call cycle or if ST < 100° F (38° C) compressor Y2 will re-energize.

EZGEO Bypass

Behind the front panel hinged door the various wires from the EZGEO board terminate on a Geo standard terminology terminal block. If necessary to prevent building freeze-up, etc. the wires from the EZGEO board can be disconnected from this terminal block and the room thermostat (or another heat pump type roomstat) can be transferred to this terminal block to run the compressor/heat pump in an emergency mode.

- R to Y1 and Y2 – compressor high capacity and blower at full airflow.
- RV – can be left unterminated for heating (NHP concept design is reversing valve high during cooling)
- G – not needed.
- Fault – monitored output only, not needed.

Gas furnace only option, operating mode B, C, D – with EZGEO board disconnected, roomstat can go directly to gas furnace W and appropriate blower terminals. This is assuming gas furnace has its own blower.

Front panel override switch – if mode is B, C, or D and gas furnace is active via EZGEO board with a potential compressor problem (probably fault LED on) the front panel switch in the up position will transfer the roomstat to the gas furnace. Depending upon the blower configuration, it should follow with the functioning gas furnace, but local HVAC contractor needs to verify.

Troubleshooting – General

Troubleshooting Guide for Water-to-Air Geo “Heating”

	Head pressure	Subcool	Suction pressure	Superheat	Compressor Amp Draw	Air temp differential	Source temp differential
Undercharged system	Low	Low	Low	High	Low	Low	Low
Overcharged system	High	High	High	Low	High	High	High
Low air flow	High	Low	High	High	High	High	Low
High air 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 air temperature	Low	High	Low	Low	Low	High	High
High return air temperature	High	Low	High	High	High	Low	Low
Scaled source coil	Low	High	Low	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

Troubleshooting Guide for Water-to-Air Geo “cooling”

	Head pressure	Subcool	Suction pressure	Superheat	Compressor Amp Draw	Air temp differential	Source temp differential
Undercharged system	Low	Low	Low	High	Low	Low	Low
Overcharged system	High	High	High	Low	High	Low	Low
Low air flow	Low	High	Low	Low	Low	High	Low
High air 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 air temperature	Low	High	Low	Low	Low	Low	Low
High return air temperature/Humidity	High	Low	High	High	High	Low	High
Scaled source 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

Accessories/Options

	Part Number
NHP GEO Alarm	R-AL-FD-1
Fuse – source loop pump, 10A	UFUSE1799
Fuse – desuperheater pump, 3A	UFUSE1796
Soft Start Kit	R-SS-1
NHP Digital 4-Wire Thermostat (Pre-programmed)	5021
Open loop, freeze limit, 39° F (4° C), pipe mounted	6047
Warmflo Select SL1 Plenum Heater	EM-W*
Sound vibration pad	R-PAD-2735-1

*10, 15, 20, and 25 kW upflow and downflow models available.

Electro-HELPS XIII

DUCT SIZING TABLE

DUCT CAP. CFM	DUCT DIAM IN.	Equivalent Friction Rectangular Ducts (In.)										
		1	2	3	4	5	6	7	8	9	10	11
80	5.3	5x5	6x4	9x3								
100	5.8	6x5	7x4	10x3								
125	6.3	6x6	7x5	9x4	12x3							
150	6.8	7x6	8x5	10x4	15x3							
175	7.2	7x6	9x5	11x4	17x3							
200	7.5	7x7	8x6	10x5	13x4	19x3						
225	7.9	8x7	9x6	11x5	14x4	21x3						
250	8.2	8x7	10x6	12x5	16x4	23x3						
275	8.5	8x8	9x7	10x6	13x6	17x4	25x3					
300	8.8	8x8	9x7	11x6	14x5	18x4	27x3					
350	9.3	9x8	11x7	13x6	16x5	21x4	32x3					
400	9.8	9x9	10x8	12x7	14x6	18x5	24x4	36x3				
450	10.2	10x9	11x8	13x7	15x6	19x5	26x4	40x3				
500	10.7	10x10	11x9	12x8	14x7	17x6	21x5	28x4	44x3			
550	11.0	10x10	11x9	13x8	15x7	18x6	23x5	32x4	48x3			
600	11.4	11x10	12x9	14x8	16x7	20x6	25x5	35x4	52x3			
650	11.8	11x11	12x10	13x9	15x8	17x7	21x6	27x5	37x4			
700	12.1	11x11	12x10	14x9	16x8	18x7	22x6	29x5	40x4			
750	12.3	12x11	13x10	15x9	17x8	20x7	24x6	30x5	42x4			
800	12.7	12x11	14x10	15x9	18x8	21x7	25x6	32x5	45x4			
850	13.0	12x12	13x11	14x10	16x9	18x8	21x7	26x6	35x5			
900	13.2	12x12	14x11	15x10	17x9	19x8	23x7	28x6	36x5			
950	13.6	13x12	14x11	16x10	18x9	20x8	24x7	30x6	38x5			
1000	13.9	13x12	15x11	16x10	18x9	21x8	25x7	31x6	40x5			
1100	14.3	13x13	14x12	16x11	18x10	20x9	23x8	27x7	33x6	43x5		
1200	14.8	14x13	15x12	17x11	19x10	21x9	25x8	29x7	36x6	47x5		
1300	15.2	14x14	15x13	16x12	18x11	20x10	23x9	26x8	31x7	39x6		
1400	15.7	15x14	16x13	17x12	19x11	21x10	24x9	28x8	34x7	41x6		

NOTE:

If sizing is in question, always go to the larger duct for CFM in question.

Grilles and registers shall be sized according to manufacturers performance data capable of handling the CFM of the duct at a throw based on room dimensions. Return air registers should be selected to provide for 450 FPM face velocity.

The above capacities assume individual duct static pressures of less than about 0.1. If the static pressure is higher, assume considerably reduced CFM.

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EVALUATING AND SIZING DUCT WORK SYSTEMS

Quickie Method

- The trunkline duct work off of the plenum should have 70 square inches per ton for the supply side
- The return air plenum should have 80 square inches per ton

Standards Used

- Heat pumps require 400 CFM to 450 CFM per ton to operate
- Use a friction per 100 ft. of duct of .08 when sizing or evaluating supply duct work
- Use a friction per 100 ft. of duct of .06 when sizing or evaluating return air duct work
- Duct work is manufactured in 8 ft. lengths
- Rectangular duct work is normally 8 inches tall
- Return air grills are normally 8 inches high and the width of one or two joist spaces
- 7 inch round pipe will handle approximately 150 CFM
- 6 inch round pipe will handle approximately 100 CFM

Tips

- Never go larger than a 3 to 1 ratio on rectangular duct work width to height when figuring a duct work system
- Common branch duct round pipe is either 6 inch or 7 inch
- Never use branch duct piping smaller than 6 inch round pipe when using a heat pump system
- Normal practice when sizing new duct work is to use a friction per 100 ft. of duct of .08 for the supply line duct work and .06 for the return line duct work
- When doing a retrofit job you will more likely have problems with the distribution of air to the rooms than the size of the duct work

Evaluating Existing Duct Work

1. Perform a heat loss/gain calculation on the structure and obtain the size system needed and the CFM needed per room.
2. Figure the total CFM needed for the system room by room or: 400 CFM minimum to 450 CFM maximum x heat pump system tonnage.
3. Figure the CFM that can be supplied with each trunkline leaving the plenum using the duct calculator with a friction per 100 ft. of duct of .08.
4. The total CFM that the trunkline(s) can handle must equal or exceed the CFM required by the heat pump system. If it is not, the duct work will have to be replaced or changed.
5. If the trunkline is large enough, subtract the heat loss/gain CFM (whichever is larger) needed per room, fed by the first section of trunkline from the total provided. Then figure the size of the next piece of trunkline for the remaining CFM.
6. The return air duct work must handle the CFM put out by the supply side of the system. Using the duct calculator, figure the amount of air that can be handled by the existing system. Use a friction per 100 ft. of duct of .06. Figure the trunklines first, then branch ducts.

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HELPS – EZGEO Controller

All functions and definitions will apply to all NHP models, see appropriate model or type. Use Installation Manual to determine which part of this Helps document applies.

This exclusive controller provides installer and user-friendly functions for Geo heat pump applications. It will be helpful to grasp the EZGEO concept prior to studying the mode configuration charts and sequence of events.

First, this is a list of features/functions which are an integral part of this EZGEO system.

- Geo source, **forced air** – EZGEO is standard.
- Geo source, **split** – EZGEO is standard.
- Room thermostat – conventional 4-wire or 6-wire stat required.
- Application **mode** selection – 4-position dial switch allows installer to select the mode that fits the hardware/usage configuration.
- Outdoor temperature sensing (**OT**) – determines compressor staging, auxiliary electric (when applicable) and/or switchover to gas.
- **Two-stage** compressor – sequenced by outdoor temperature (OT) and SOT timeout, see function charts – Figures 1, 2, 3, 4.
- Forced air supply temperature sensing (**ST**) – used for the “dead compressor” alarm and controls compressors if ST is too high – zone dampers, accidental gas furnace, full load to high, etc. – where AUX electric is installed (mode B only) this regulates AUX EL module based upon heating needs and comfort.
- Alarms or fault notification – front panel yellow **EL LED pulses** at two different rates.
 - After compressor control board (ICM) has sequenced through three retries.
 - Dead compressor, plenum temperature is less than set point (factory default 85° F).
- Interface and control associated with utility control receivers (**LMC or blues**).
- **Standby (SB)** – forced function by LMC, front panel switch, optional remote switch, E-GAS, alarm, or stat override timer (SOT). Also, for modes B, C, D when OT is below **SW OVER** set point.
- Dual fuel – **gas furnace with split models** (RT-SE Series), mode D.
 - This is also possible with other Geo units (two blower) but special consideration needs to be addressed for ducting, airflow arrangements, both blowers, etc. (modes B and C).

Mode dial switch – installer must determine application/configuration and set up as required.

Mode Switch	Mode	SW OVER	Configuration
A	Geo only	N/A	No AUX EL, no gas, no auto SB, but load control can interrupt compressor for cooling (not heating)
B	Geo/AUX EL	0	AUX EL (with compressor supplement or emergency), utility load control, etc.
	Geo/AUX EL/gas	Value	AUX EL, gas, auto SB, utility load control, etc. AUX EL is compressor supplement above SW OVER value, below SW OVER point gas has priority.
C	Geo/gas	Value	No AUX EL, gas furnace, auto SB, utility load control
D	Split/gas	Value	No AUX EL, gas furnace, auto SB, utility load control

SW OVER dial switch – if the OT sensor temperature is below this set point (at R to W start) the action shown on the appropriate Figures 2, 3, 4 mode sequence chart takes place. Remains to end of stat cycle. Notice – mode B has two conditions, correct position of SW OVER is very important.

- If configured with AUX EL only (no gas), must set to 0 position.
- If no gas is connected or operational and SW OVER is set in a non-0 position, cold air only could result because the stat W cannot be satisfied without a heating source.

Heat/cool sequence – reference the Figures 1, 2, 3, 4 function sequence charts. These are selected or used based upon the application or setup mode (mode dial switch, back of EZGEO board, see above). Added information for the column headings:

- **Stats** – represents the 4-wire stat W (heat) or Y (cool) call, or 6-wire W, W2 (heat) or Y1, Y2 (cool).
- **OT** – the range or outside temperature window for the various staging functions. This is checked at W heat call and a second time at 10 minutes.
- **SOT** – the stat override timer, represents the run time following the stat call. Timing begins at W or Y high and at the timing end a specific action results.
- **SB** – standby, interrupts all electric source or energy heating (compressor and AUX EL), converts or transfers the stat W function to gas/oil as shown on the sequence charts. The return action from the listed initiating standby functions is different.
 - SOT, SW OVER, OT chart line – continue to the end of stat W heat call
 - Alarm – continues until power off reset
 - LMC, SW OVER, E-gas (heating) – when function ends, clears SB, back to appropriate sequence chart line (as if there is a new W call), SOT is reset
 - LMC, override switch (cooling) – clears with end of function, SOT is not reset, blower = G
- **Heat pump three staging functions:**
 - Off – compressor not running
 - Y1 – compressor contactor for run and low capacity
 - Y2 – compressor solenoid for high capacity
- **Blower, ECM type** – the nominal speed or CFM related to each specific model/size is programmed into the ECM motor. These nominal CFM's are triggered or controlled by three functions.
 - G – continuous air
 - Y1 – relates to compressor part capacity
 - Y2 – relates to compressor full capacity
- **AUX EL** – when auxiliary is installed (ordered separately) and the provided cable (standard WF control/interface) is plugged into EZGEO board J1 (with a mode B only) these stages become active. The ST temperature relating to the ST-target factory default plus the front panel efficiency dial is the final determination on which stages are actually heating. When the outdoor temperature, as measured by the OT sensor, drops below the AUX EL dial setting, the auxiliary electric feature is enabled.
 - STG 1 – first 5 kW
 - STG 2-4 – the remaining connected or installed stages
- **Gas W** – the mode B, C, or D functions when the gas furnace should be running. There is an attempted safety ST < 100° F sensing point and logic which initiates EZGEO reset after 30-minute gas W.
- **SW OVER** – the OT sensor is reporting a temperature value less than the SW OVER dial switch setting, switch to standby (SB) or gas.
- **Alarm** – shows the two alarm conditions and the action based upon the appropriate mode settings.
- **Status front panel yellow EL LED** – The alarm condition can be reset or cleared but the LED continues to pulse until there's actual power off and power cycled back on.
- **LMC** – load management control or utility load control function, blue wires.

Variables/factory defaults – can be changed with PC software, listed are the factory default values.

	Default
ST-target temp	90°
Dead compressor ST	70°
OT temp, heating (part load) – OT >	20°
OT temp, cooling (full load) – OT >	80°

Efficiency dial, front panel – this is a “boost” temperature function to the setup ST-target temp.

- 0 = normal = download value
- 1 = A = download value + 5
- 2 = B = download value + 10
- 3 through 7 are programmed the same as normal

Overheat plenum, control override – when AUX EL stages are not active, the ST sensor also controls compressor functions. This also prevents compressor and gas furnace on at the same time (mode D/refrigerant coil in plenum).

- ST > 105° F (40° C) – compressor Y2 turned off
- ST > 112° F (42° C) – compressor off

Operation continues to the end of heat call cycle or if ST < 100° F compressor Y2 will re-energize.

Front panel LED – see installation manual Observation Indicators section for detail.

SOT time dial switch – this is a 4-position rotary switch which begins counting time with each stat W (heat) or each stat Y (cool) input. Depending upon the dial switch setting (chart in installation manual, Field Setup section) action results after the selected minutes have elapsed. Figures 1, 2, 3, 4 charts provide this sequencing information.

- Heating – at the end of LMC or SB, the SOT start time is reset to 0.
- Cooling – at the end of LMC, the SOT start time is not reset, as the SOT times out the system will go to compressor full capacity.

ECM blower motor – this controller provides three outputs which coincide with G and heat pump stage Y1 and Y2. Whenever the AUX EL (mode B) is activated the blower is Y2 speed. However, the furnace TB outputs only apply to mode D (split) because the blower is external. For the configurations where the blower is within the Geo cabinet, the blower speeds are directly tied (hardware) to compressor Y1 and Y2.

- The actual blower size, programming, and CFM output relate to the specific Geo HP model.

AUX EL (KN-) electric heat module** – can only apply to mode B (concerning mode D, there is consideration for electric furnace, Electro-Mate with gas furnace, etc. but this is not documented). Also must be strip heat module or WarmFlo compatible with this EZGEO J1 cable.

1. Applies to mode B only.
2. Setup determines an “ST-target temp” which is similar to DT related with EZ-Mate or EB-A type temperature set point. The operating set point is ST-target plus front dial boost selection.
3. This ST-target temp can be increased with the front dial boost setting, see page 1.
4. When the attached mode B sequence chart has checkmarks in STG1, stage 1 only is active and operates at ST-target temp and boost.
5. When the mode B sequence chart has checkmarks in STG2-4, all stages operate at ST-target temp and boost.

Note: This supplement electric module can only operate with the heat pump/compressor Y1 or Y2 functions. Because the blower is hardware connected to the HP-Y1 and HP-Y2 terminal block, the compressor must be active. If there is a hardware configuration arrangement where heating is needed below compressor plus AUX EL, that configuration must include a gas (or fossil fuel) furnace which is activated by SW OVER. However, under special short term installation conditions, if there is a desire to run AUX only (without compressor) the yellow wire at the ICM board Y tab can be disconnected.

Special LMC comment – with mode B and hardware configuration of all three heat sources, LMC causes auto SB/gas and gas continues to the end of SB. SB can happen in addition to LMC (see page 1 center). However, SB to gas has priority over Geo/AUX EL. W2 activates full AUX EL.

Alarms – EZGEO board has two functions, the Figures 1, 2, 3, 4 sequence charts provide the action when either of these alarms is active.

- **Fault** is the output of the Geo unit internal ICM board indicating there has been three consecutive limit or flow switch failures. The ICM board holds off the compressor until there is a power off reset. Where standby gas or AUX EL exist (B, C, D) heating will continue with the roomstat W.
- **ST < 70° F** is a setup value referred to as dead compressor ST. 10 minutes after each new roomstat W ST is monitored. If ST ever falls below the setup value a 30-minute timer is started (because there may also be an ICM board fault coincident with this). At the end of the 30 minutes if ST is still less than the setup value the unit switches to standby. The system remains in standby to the completion of stat W.
Note: This only applies when there is no AUX EL active.

Mode A – NHP Geo, Function Sequence, Figure 1

STAT	OT	SOT		SB	Heat Pump			Blower			AUX EL		Gas W	SW OVER	Alarm	EL LED
		Start	End		Off	Y1	Y2	G	Y1	Y2	STG1	STG2-4				
1	W	> 20	✓			✓		✓	+					N/A		✓
2	W		✓			✓		✓	+							✓
3	W	< 20	✓			✓		✓	+							✓
4	W		✓			✓		✓	+							✓
5																
6	W					Fault	✓		+	T					Fault	P
7	W					✓				T					ST <	P
8																
9																
10																
11																
12																
13	Y	< 90	✓				✓		+	✓						✓
14	Y		✓				✓		+	✓						✓
15	Y	> 90	✓				✓		+	✓						✓
16	Y		✓				✓		+	✓						✓
17	Y					LMC	✓			T						OFF
18	Y						Fault	✓		✓					Fault	P
19	Y2						✓		+	✓						✓

✓ = EZGEO internal action or on
 + = Hardware within Geo unit (BL Y1 and Y2, not G)
 T = T-stat can do "FAN ON" G
 LMC = Utility receiver, on-peak

Mode B – NHP Geo, Function Sequence, Figure 2

STAT	OT	SOT		SB	Heat Pump			Blower			AUX EL	Gas W	SW OVER	Alarm	EL LED
		Start	End		OFF	Y1	Y2	G	Y1	Y2					
1	W	> 20	✓			✓		✓	+						✓
2	W		✓			✓		✓	+						✓
3	W	< 20	✓			✓		✓	+						✓
4	W	< AUX EL	✓			✓		✓	+		✓		Ø		✓
5	W		✓			✓		✓	+		✓		Ø		✓
6	W		✓	✓				T				✓	✓		Off
7															
8	W			LMC				T				✓			Off
9	W					✓		✓	+		✓		Ø	Fault	P
10				✓		✓		✓	+			✓	✓	Fault	P
11	W					✓		✓	✓		✓			< 70	P
12	W2					✓		✓	+		✓				✓
13															
14	Y	< 90	✓			✓		✓	+						✓
15	Y		✓			✓		✓	+						✓
16	Y	> 90	✓			✓		✓	+						✓
17	Y		✓			✓		✓	+						✓
18	Y			LMC		✓		T							Off
19	Y					✓		✓	+					Fault	P
20	Y2					✓		✓	+						✓

✓ = EZGEO internal action or on
 + = Hardware within Geo unit (BL Y1 and Y2, not G)
 T = T-stat can do "FAN ON" G
 X = Not used, ST has AUX EL temp.
 LMC = Utility receiver, on-peak
 Line 6/7 and 10/11 are OR, depending upon SW OVER setting
 SW OVER ✓ means non-Ø setting, OT > setting no action, OT < setting the action shown in the appropriate line
 AUX EL = Standby Heat (onboard dial selection - 0 = disable, 1 = -30° F, 2 = -20° F, 3 = -10° F, 4 = 0° F, 5 = 5° F, 6 = 10° F, 7 = Always enable)

Mode C – NHP Geo, Function Sequence, Figure 3

STAT	OT	SOT		SB	Heat Pump			Blower			AUX EL			Gas W	SW OVER	Alarm	EL LED
		Start	End		OFF	Y1	Y2	G	Y1	Y2	STG1	STG2-4					
1	W	> 20	✓				✓	+	✓								✓
2	W		✓				✓	+	✓	+							✓
3	W	< 20	✓				✓	+	✓	+							✓
4	W	<AUX EL	✓				✓	+	✓	+							✓
5	W		✓	✓			✓		T				✓			OFF	
6																	
7	W			✓			✓		T				✓	✓		OFF	
8	W			LMC			✓		T				✓			OFF	
9	W			✓			Fault	✓	+				✓		Fault	P	
10	W			✓			✓						✓		< 70	P	
11																	
12																	
13																	
14	Y	< 90	✓				✓	+	✓								✓
15	Y		✓				✓	+	✓	+							✓
16	Y	> 90	✓				✓	+	✓	+							✓
17	Y		✓				✓	+	✓	+							✓
18	Y			LMC			✓		T							OFF	
19	Y						Fault	✓	✓	+					Fault	P	
20	Y2						✓	✓	✓	+							✓

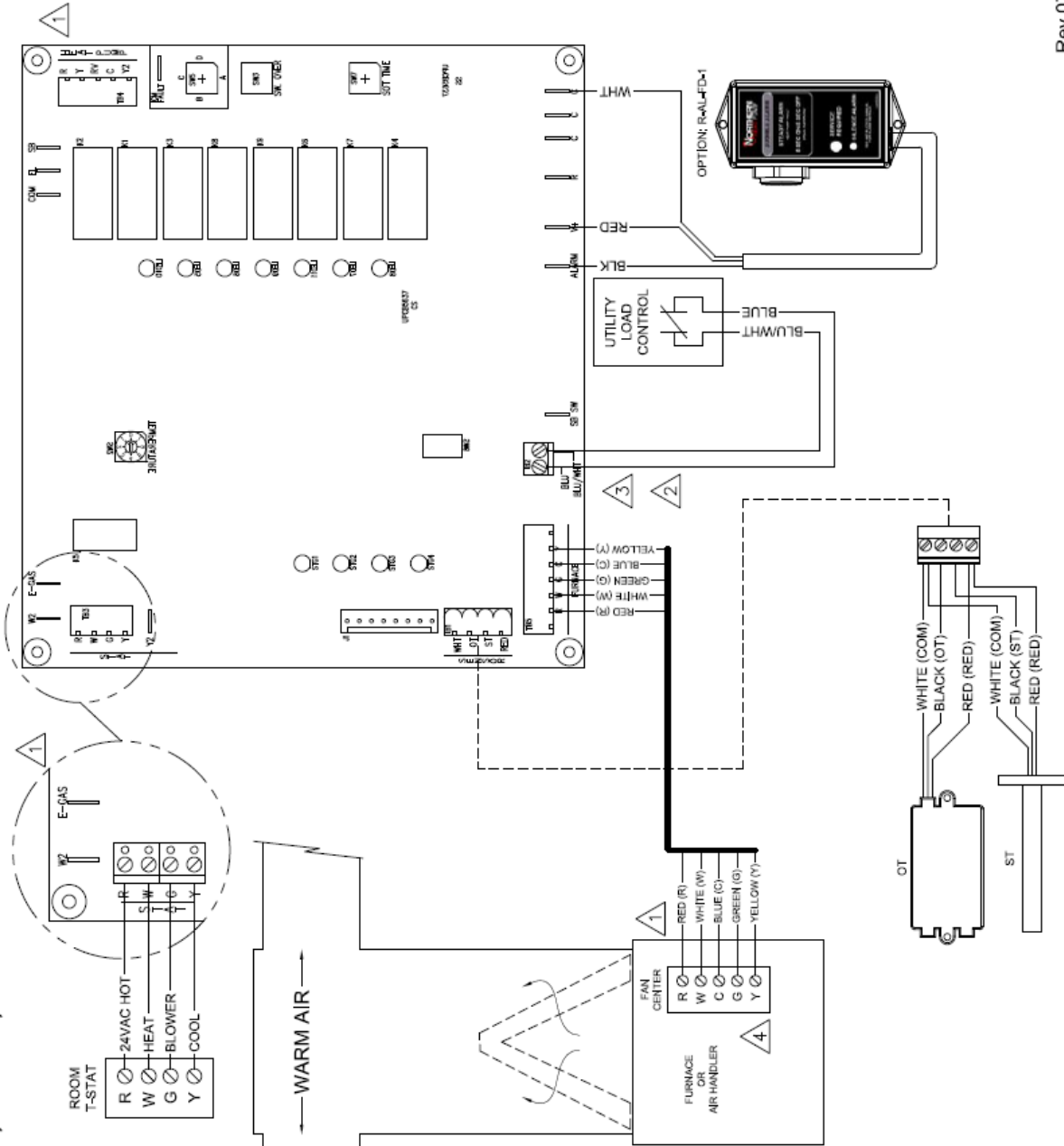
✓ = EZGEO internal action or on
 + = Hardware within Geo unit (BL Y1 and Y2, not G)
 T = T-stat can do "FAN ON" G
 LMC = Utility receiver, on-peak
 AUX EL = Standby Heat (onboard dial selection - 0 = disable, 1 = -30° F, 2 = -20° F, 3 = -10° F, 4 = 0° F, 5 = 5° F, 6 = 10° F, 7 = Always enable)

Mode D – NHP Geo, Function Sequence, Figure 4

STAT	OT	SOT		Heat Pumps	Blower	AUX FI.	Gas	SW	FI
		Start	03/14/2011						
1	W	> 20	✓		✓				✓
2	W		✓	✓	✓				✓
3	W	< 20	✓	✓	✓				✓
4	W	< AUX EL	✓	✓	✓				✓
5	W		✓	✓	T		✓		OFF
6									
7	W		✓	✓	T		✓	✓	OFF
8	W		LMC	✓	T		✓		OFF
9	W		✓	Fault	T		✓	Fault	P
10									
11									
12									
13									
14	Y	< 90	✓	✓	✓				✓
15	Y		✓	✓	✓				✓
16	Y	> 90	✓	✓	✓				✓
17	Y		✓	✓	✓				✓
18	Y		LMC	✓	✓				OFF
19	Y			Fault	✓			Fault	P
20	Y2			✓	✓				✓

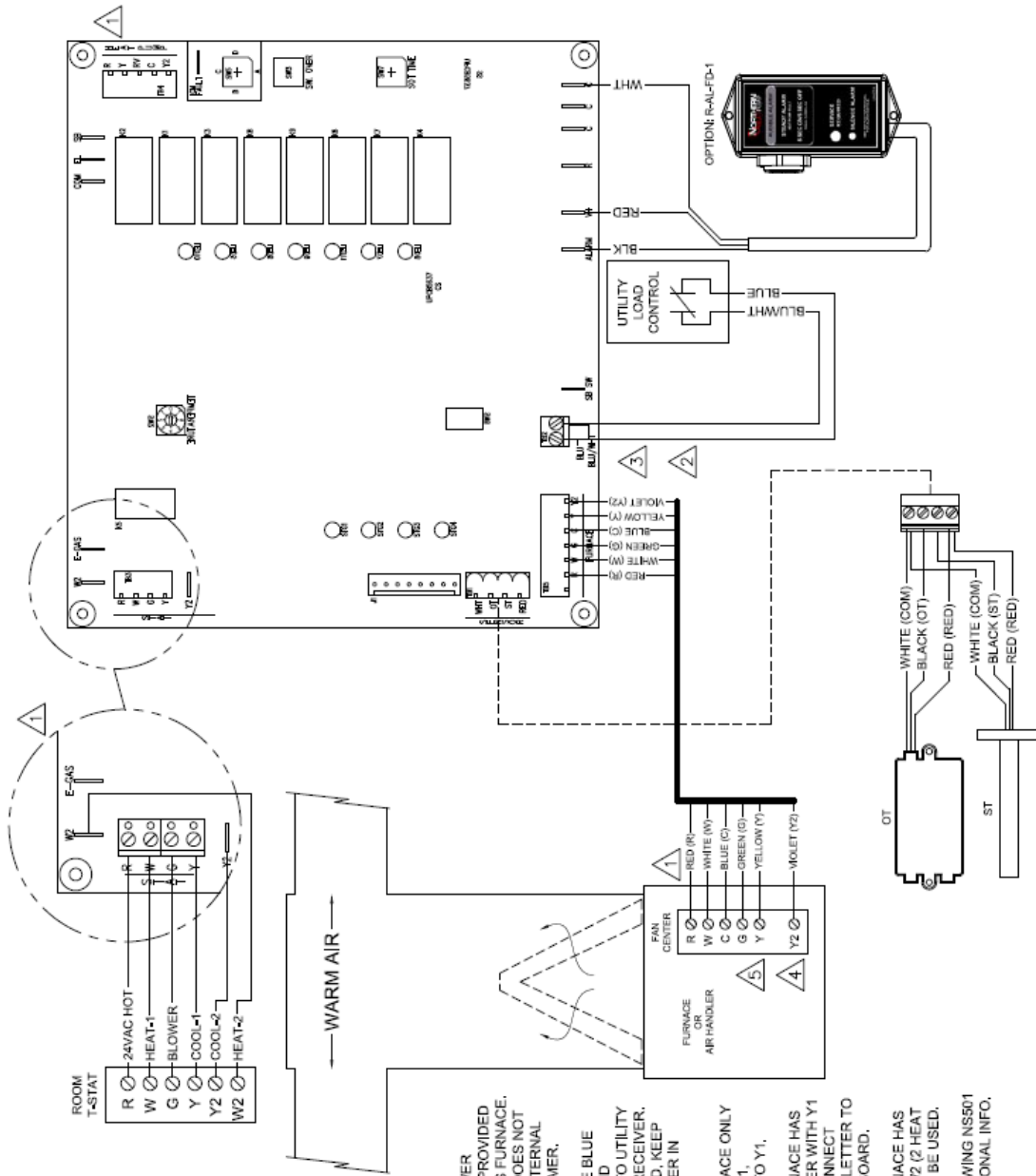
✓ = EZGEO internal action or on
 + = Hardware within Geo unit (BL Y1 and Y2, not G)
 T = T-stat can do "FAN ON"
 LMC = Utility receiver, on-peak
 AUX EL = Standby Heat (onboard dial selection – 0 = disable, 1 = -30° F, 2 = -20° F, 3 = -10° F, 4 = 0° F, 5 = 5° F, 6 = 10° F, 7 = Always enable)

SPLIT UNIT RT-SE SERIES HOOKUP CONVENTIONAL, 1H/1C, FOUR WIRE



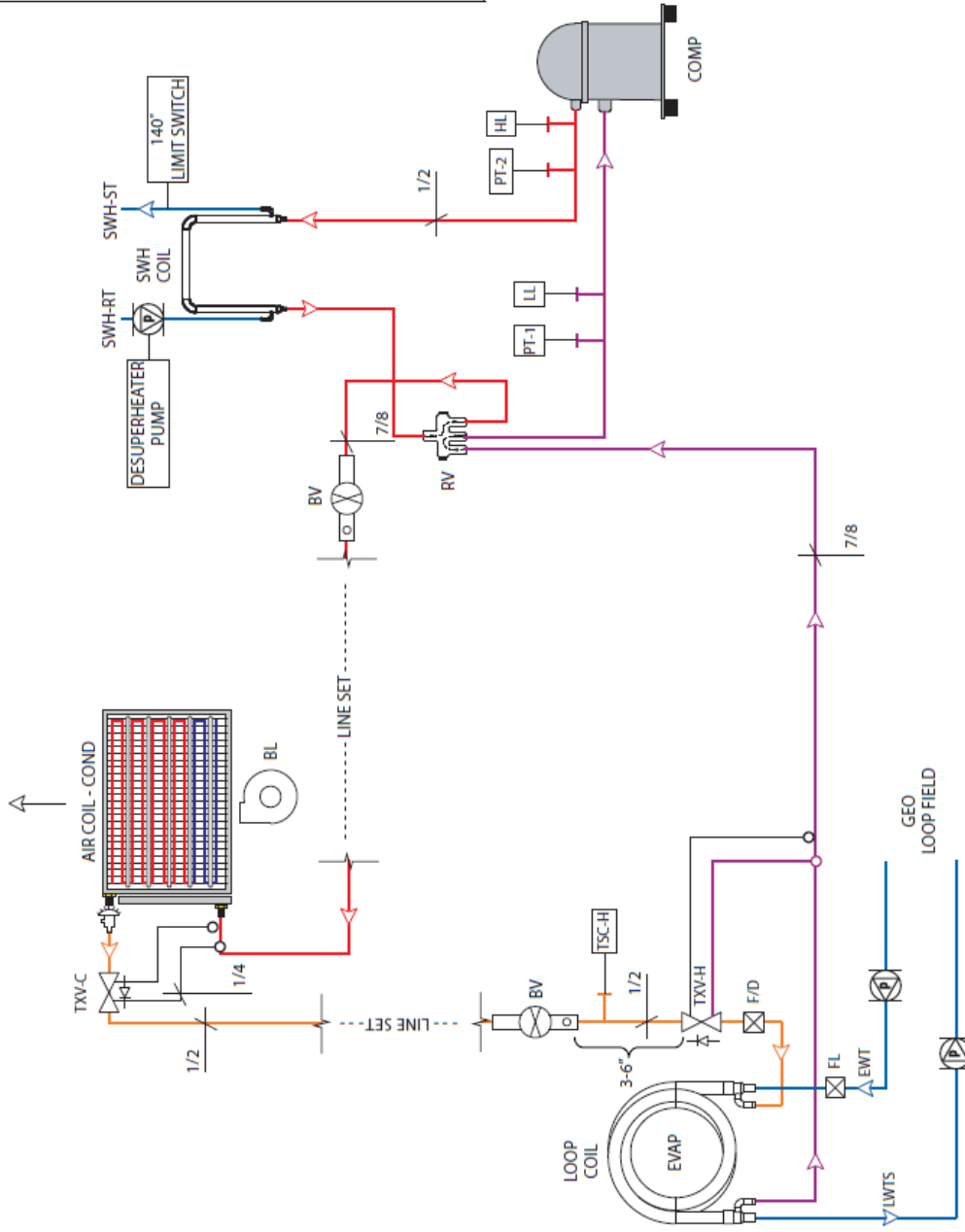
- NOTES:
1. 24V POWER SUPPLY IS PROVIDED BY THE GAS FURNACE. GEO UNIT DOES NOT HAVE AN INTERNAL TRANSFORMER.
 2. REMOVE BLUE JUMPER AND CONNECT TO UTILITY CONTROL RECEIVER. IF NOT USED, KEEP BLUE JUMPER IN PLACE.
 3. IF FURNACE HAS W2, W2 MUST BE TAKEN CARE OF AT GAS FURNACE.
 4. IF FURNACE HAS ECM BLOWER WITH Y1 AND Y2, CONNECT LETTER BY LETTER TO CONTROL BOARD.
 5. SEE DRAWING NS501 FOR ADDITIONAL INFO.

SPLIT UNIT RT-SE SERIES HOOKUP CONVENTIONAL, 2H/2C, SIX WIRE



- NOTES:
- 1 24V POWER SUPPLY IS PROVIDED BY THE GAS FURNACE. GEO UNIT DOES NOT HAVE AN INTERNAL TRANSFORMER.
 - 2 REMOVE BLUE JUMPER AND CONNECT TO UTILITY CONTROL RECEIVER. IF NOT USED, KEEP BLUE JUMPER IN PLACE.
 - 3 IF FURNACE ONLY HAS Y OR Y1, CONNECT TO Y1.
 - 4 IF FURNACE HAS ECM BLOWER WITH Y1 AND Y2, CONNECT LETTER BY LETTER TO CONTROL BOARD.
 - 5 IF FURNACE HAS W2, STAT W2 (HEAT MODE) CAN BE USED.
 6. SEE DRAWING NS801 FOR ADDITIONAL INFO.

**NORTHERN HEAT PUMP
SPLIT SYSTEM
- HEAT MODE**

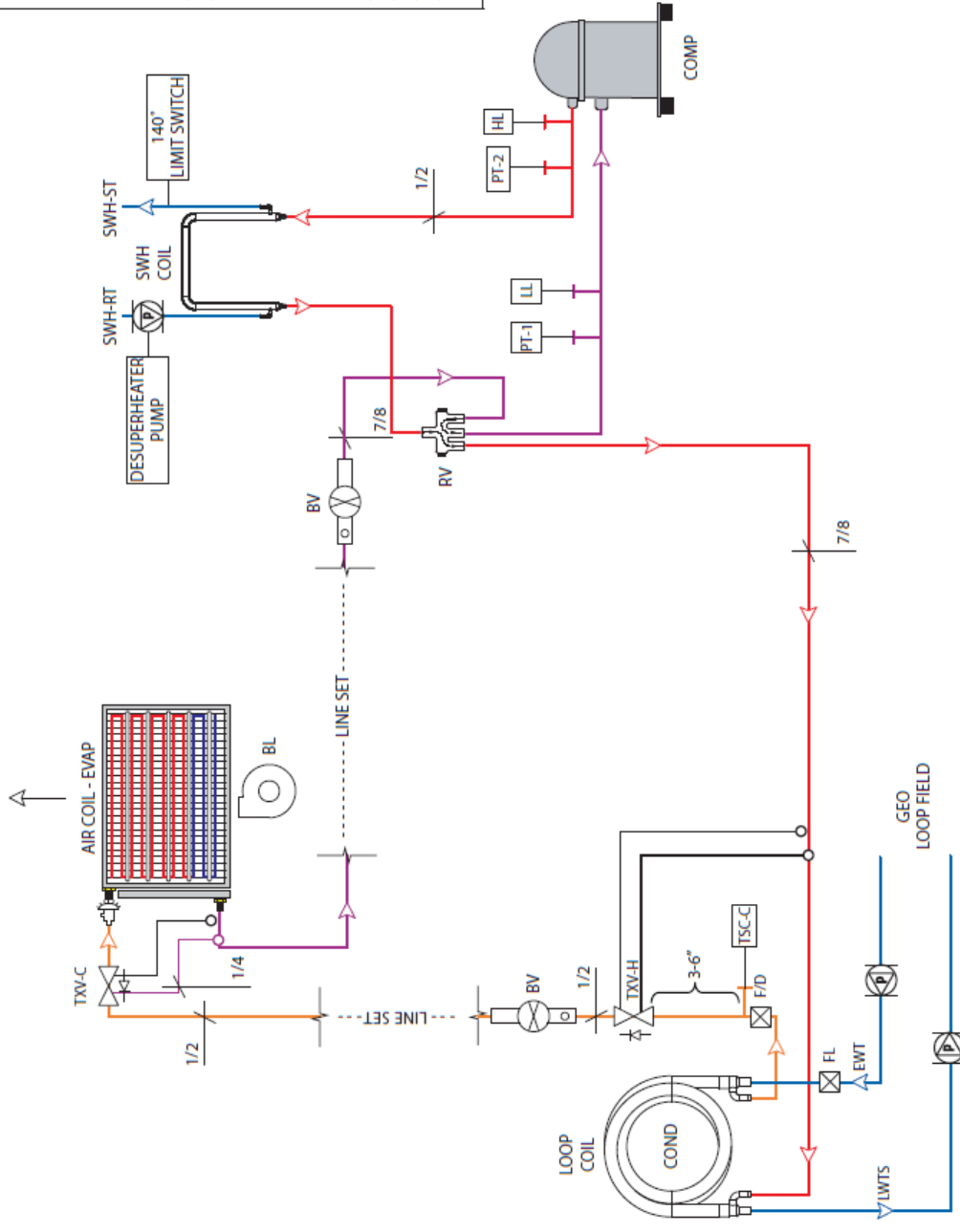


COMP	Name
COMP	Compressor
HL	Pressure high limit
LL	Pressure low limit
PT	Pressure test port
SDW-COIL	Supplementary heat exchanger
DW-ST	Ref. DW supply
DW-RT	Ref. DW return
RV	Reversing valve
BV	Ball valve
AIR COIL	Air heat exchanger
BL	Ref. Blower
TXV-C	Expansion valve - cool
TXV-H	Expansion valve - heat
F/D	Filter/dryer
LOOP COIL	Source heat exchanger
P	Ref. Pump
FL	Flow switch
EWT	Ref. Loop entering
LWTs	Source leaving water temperature sensor
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
REC	Receiver



NR501 P1
Rev. E 04-26-2013

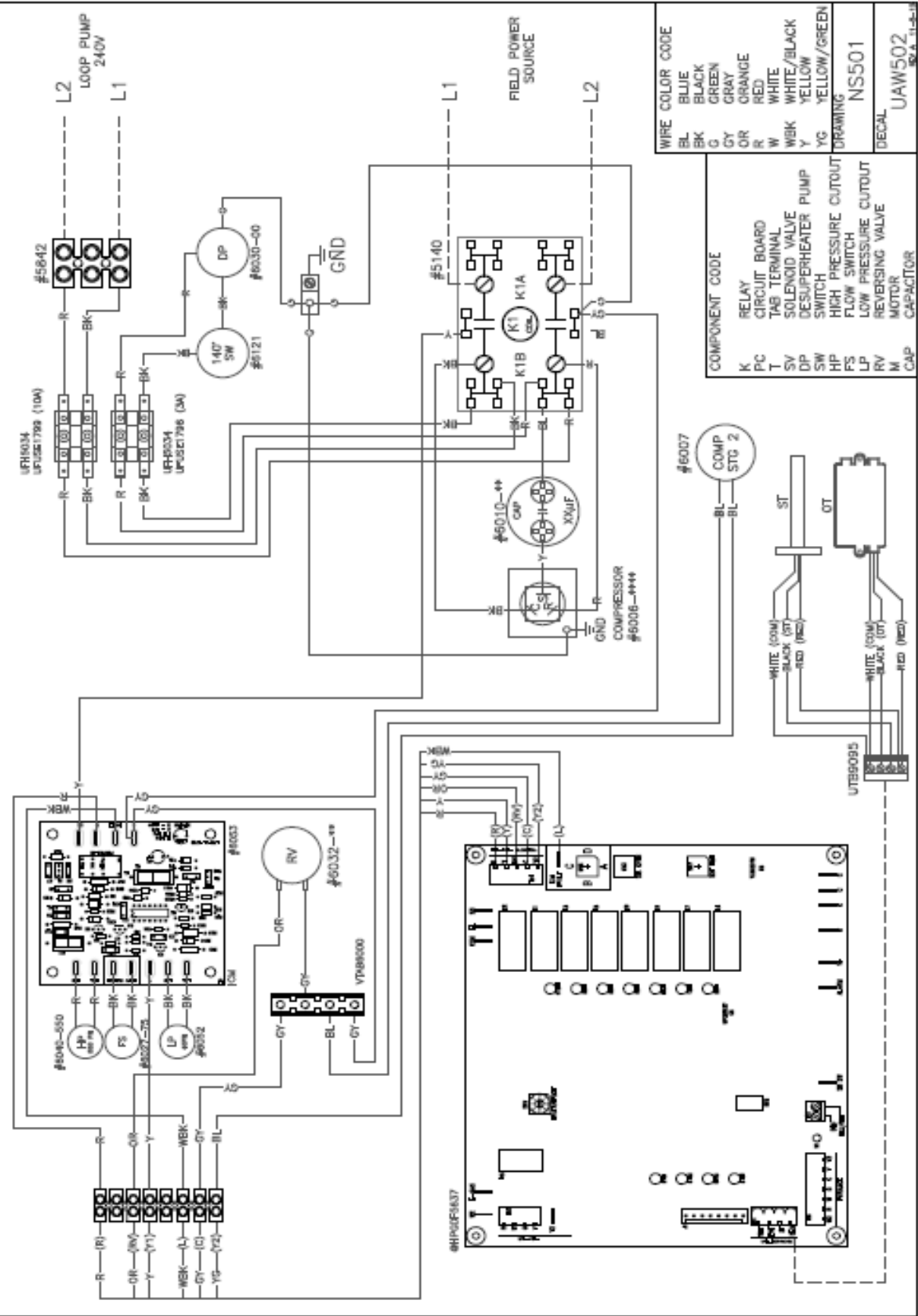
**NORTHERN HEAT PUMP
SPLIT SYSTEM
- COOLING MODE**



	Name
COMP	Compressor
HL	Pressure high limit
LL	Pressure low limit
PT	Pressure test port
SDW-COIL	Supplementary heat exchanger
DW-ST	Ref: DW supply
DW-RT	Ref: DW return
BV	Reversing valve
BV	Ball valve
AIR COIL	Air heat exchanger
BL	Ref: Blower
TXV-C	Expansion valve - cool
TXV-H	Expansion valve - heat
F/D	Filter/dryer
LOOP COIL	Source heat exchanger
P	Ref: Pump
FL	Flow switch
EWT	Ref: Loop entering
LWTs	Source leaving water temperature sensor
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
REC	Receiver



HEAT PUMP SPLIT RT-SE



WIRE COLOR CODE	
BL	BLUE
BK	BLACK
G	GREEN
GY	GRAY
OR	ORANGE
R	RED
W	WHITE
WBK	WHITE/BLACK
Y	YELLOW
YG	YELLOW/GREEN

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

NS501
 UAW502
REV. 11-8-11

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.