NORTHERN HEAT PUMP

INSTALLATION

And Maintenance Manual

XTERRA SERIES
Horizontal and Vertical,
Single and Dual Stage Geothermal Heat Pumps:
FORCAIR
AQUA2
SOURC3

TABLE OF CONTENTS

RESIDENTIAL MODEL # DESCRIPTION

RA VE 502 - C 1 3 1

UNIT DESIGNATION
R=*RESIDENTIAL*

UNIT TYPE
A=*STANDARD*
M=*MULTI*
D=*DUAL COMPRESSOR*
S=*SPECIAL*
W=*HEAT ONLY*
T=*TWO SPEED*
P=MINI

UNIT STYLE
W=*HYDRONIC*
V=*VERTICAL*
D=*DOWNFLOW*
H=*HORIZONTAL*
S=SPLIT

REFRIGERANT TYPE
E=R410A REFRIGERANT
F=R22 REFRIGERANT

NORMAL SIZE
X 1000 BTU/H

DESUPERHEATER OPTION
1=*NONE*
2=*PARTIAL DESUPERHEATER*
3=*FULL TIME*

HEAT EXCHANGER
C=*COPPER*
F=*S.S. FLATPLATE*
H=*CUPRO HYDRONIC LOOP*
N=*CUPRO NICKEL*

CONFIGURATION
1=*LEFT SIDE RETURN (STD)*
2=*RIGHT SIDE RETURN*
3=NONE

BLOWER TYPE
1=None
2=*Standard PSC 3 Speed Blower*
3=*ECM Blower*

POWER SUPPLY
1=*208/230V 1Ph*
2=*208/230V 3Ph*
3=*575V 3Ph*
4=460/480V 3PH
5=220/240V 1PH 50HZ
6=380V 3PH 50HZ

SERIAL # DESCRIPTION

XL 08 01 A 1000 A

BILL OF MFG

YEAR OF MFG

MONTH OF MFG

FUTURE USE
A=*LINE NUMBER*

SEQUENTIAL NUMBER

MFG LOCATION
A=*SOUTH RAILWAY PLANT*

X TERRA SERIES
ENERGY EXTRACTION SYSTEM

COMMERCIAL MODEL # DESCRIPTION

CD WE 114 2 - C 1 1

UNIT DESIGNATION
C=*COMMERCIAL*

UNIT TYPE
A=*STANDARD*
M=*MULTI*
D=*DUAL COMPRESSOR*
S=*SPECIAL*
W=*HEAT ONLY*
T=*TWO SPEED*
P=MINI

UNIT STYLE
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3=*ECM Blower*

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C=*COPPER*
F=*S.S. FLATPLATE*
H=*CUPRO HYDRONIC LOOP*
N=*CUPRO NICKEL*

DESUPERHEATER OPTION
1=*NONE*
2=*PARTIAL DESUPERHEATER*
3=*FULL TIME*

SERIAL # DESCRIPTION

XL 08 01 A 1000 A

BILL OF MFG

YEAR OF MFG

MONTH OF MFG

MFG LOCATION
A=*SOUTH RAILWAY PLANT*

SEQUENTIAL NUMBER

FUTURE USE
A=*LINE NUMBER*

XTerra Physical Data - R22

MODEL	RA*F36	RA*F48	RA*F61	RA*F68
Compressor -1 Each	SCROLL			
Factory Charge R22 -(oz)	72	80	88	96
PSC Fan Motor & Blower				
Fan Motor Type/Speeds	PSC/3	PSC/3	PSC/3	PSC/3
Fan Motor HP	0.5	0.5	0.75	0.75
Blower Wheel Size Dia. x W	9x9	9x9	10x10	10x10
ECM Fan Motor & Blower –OPTIONAL				
Fan Motor Type	ECM	ECM	ECM	ECM
Fan Motor HP	0.5	0.5	0.75	1.0
Water Connection Size				
Residential Class	3/4”	3/4”	3/4”	3/4
HWG Water Connection Size				
Residential Class	3/4”	3/4”	3/4”	3/4”
***FORCAIR/SOURC3* Vertical (Upflow and Downflow)**				
Air Coil Dimensions H x W	20x20	20x20	20x28	20x28
Air Coil Total Face Area ft^2	2.7	2.7	3.8	3.8
Air Coil Tube Size (in)	3/8	3/8	3/8	3/8
Air Coil Fin Spacing (fpi)	12	12	12	12
Air Coil Number of Rows	5	5	5	5
Filter Standard 1” Disposable	20x24	20x24	22x30	22x30
Filter Optional Electrostatic 1”	20x24	20x24	22x30	22x30
Weight– Packaged (lbs)	280	330	375	395
Width of Cabinet	28”	28”	28”	28”
Height	53”	53”	53”	53”
Depth	27”	27”	27”	27”
Horizontal				
Air Coil Dimensions HxW	20x20	20x20	20 x 28	20 x 28
Air Coil Total Face Area ft^2	2.7	2.7	3.8	3.8
Air Coil Tube Size (in)	3/8	3/8	3/8	3/8
Air Coil Fin Spacing (fpi)	12	12	12	12
Air Coil Number of Rows	5	5	5	5
Filter Standard 1” Disposable	20x24	20x24	22x30	22x30
Filter Optional Electrostatic 1”	20x24	20x24	22x30	22x30
Weight– Packaged (lbs)	290	340	380	400
Width of Cabinet	26”	26”	26”	26”
Height	25”	25”	25”	25”
Depth	58”	58”	58”	58”
***AQUA2* Hydronic**				
Weight– Packaged (lbs)	200	220	235	255
Width of Cabinet	27”	27”	27”	27”
Height	25.5”	25.5”	25.5”	25.5”
Depth	28”	28”	28”	28”

All units have rubber compressor mountings and thermostatic expansion valves.

Data Subject To Change Without Notice.

XTerra Physical Data - R410A SINGLE STAGE COMPRESSOR

MODEL	RA*E36	RA*E50	RA*E57	RA*E70
Compressor -1 Each	SCROLL			
Factory Charge R22 -(oz)	72	80	88	96
PSC Fan Motor & Blower				
Fan Motor Type/Speeds	PSC/3	PSC/3	PSC/3	PSC/3
Fan Motor HP	0.5	0.5	0.75	0.75
Blower Wheel Size Dia. x W	9x9	9x9	9x9	10x10
ECM Fan Motor & Blower –OPTIONAL				
Fan Motor Type	ECM	ECM	ECM	ECM
Fan Motor HP	0.5	0.5	0.75	1.0
Water Connection Size				
Residential Class	3/4”	3/4”	3/4”	3/4
HWG Water Connection Size				
Residential Class	3/4”	3/4”	3/4”	3/4”
***FORCAIR* Vertical (Upflow and Downflow)**				
Air Coil Dimensions H x W	20x20	20x20	20x28	20x28
Air Coil Total Face Area ft^2	2.7	2.7	3.8	3.8
Air Coil Tube Size (in)	3/8	3/8	3/8	3/8
Air Coil Fin Spacing (fpi)	12	12	12	12
Air Coil Number of Rows	5	5	5	5
Filter Standard 1” Disposable	20x24	20x24	22x30	22x30
Filter Optional Electrostatic 1”	20x24	20x24	22x30	22x30
Weight– Packaged (lbs)	280	330	375	395
Width of Cabinet	28”	28”	28”	28”
Height	53”	53”	53”	53”
Depth	27”	27”	27”	27”
Horizontal				
Air Coil Dimensions HxW	20x20	20x20	20 x 28	20 x 28
Air Coil Total Face Area ft^2	2.7	2.7	3.8	3.8
Air Coil Tube Size (in)	3/8	3/8	3/8	3/8
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Air Coil Number of Rows	5	5	5	5
Filter Standard 1” Disposable	20x24	20x24	22x30	22x30
Filter Optional Electrostatic 1”	20x24	20x24	22x30	22x30
Weight– Packaged (lbs)	290	340	380	400
Width of Cabinet	26”	26”	26”	26”
Height	25”	25”	25”	25”
Depth	58”	58”	58”	58”
***AQUA2* Hydronic**				
Weight– Packaged (lbs)	200	220	235	255
Width of Cabinet	27”	27”	27”	27”
Height	25.5”	25.5”	25.5”	25.5”
Depth	28”	28”	28”	28”

All units have rubber compressor mountings and thermostatic expansion valves.

Data Subject To Change Without Notice.

XTerra Physical Data - R410A DUAL STAGE COMPRESSOR

MODEL	**RT*E30**	**RT*E40**	**RT*E51**	**RT*E60**
Compressor -1 Each	SCROLL			
Factory Charge R22 -(oz)	72	80	96	96
PSC Fan Motor & Blower				
Fan Motor Type/Speeds	PSC/3	PSC/3	PSC/3	PSC/3
Fan Motor HP	0.5	0.5	0.5	0.75
Blower Wheel Size Dia. x W	9x9	9x9	9x9	10x10
ECM Fan Motor & Blower—OPTIONAL				
Fan Motor Type	ECM	ECM	ECM	ECM
Fan Motor HP	0.5	0.5	0.5	0.75
Water Connection Size				
Residential Class	3/4”	3/4”	3/4”	3/4
HWG Water Connection Size				
Residential Class	3/4”	3/4”	3/4”	3/4”
***FORCAIR/SOURC3* Vertical (Upflow and Downflow)**				
Air Coil Dimensions H x W	20x20	20x20	20x28	20x28
Air Coil Total Face Area ft^2	2.7	2.7	3.8	3.8
Air Coil Tube Size (in)	3/8	3/8	3/8	3/8
Air Coil Fin Spacing (fpi)	12	12	12	12
Air Coil Number of Rows	5	5	5	5
Filter Standard 1” Disposable	20x24	20x24	22x30	22x30
Filter Optional Electrostatic 1”	20x24	20x24	22x30	22x30
Weight– Packaged (lbs)	280	330	375	395
Width of Cabinet	28”	28”	28”	28”
Height	53”	53”	53”	53”
Depth	27”	27”	27”	27”
Horizontal				
Air Coil Dimensions HxW	20x20	20x20	20 x 28	20 x 28
Air Coil Total Face Area ft^2	2.7	2.7	3.8	3.8
Air Coil Tube Size (in)	3/8	3/8	3/8	3/8
Air Coil Fin Spacing (fpi)	12	12	12	12
Air Coil Number of Rows	5	5	5	5
Filter Standard 1” Disposable	20x24	20x24	22x30	22x30
Filter Optional Electrostatic 1”	20x24	20x24	22x30	22x30
Weight– Packaged (lbs)	290	340	380	400
Width of Cabinet	26”	26”	26”	26”
Height	25”	25”	25”	25”
Depth	58”	58”	58”	58”
***AQUA2* Hydronic**				
Weight– Packaged (lbs)	200	220	235	255
Width of Cabinet	27”	27”	27”	27”
Height	25.5”	25.5”	25.5”	25.5”
Depth	28”	28”	28”	28”

All units have rubber compressor mountings and thermostatic expansion valves.

Data Subject To Change Without Notice.

GENERAL INFORMATION

XTERRA Series Geothermal heat pumps are designed to provide maximum efficiency and reliability. Solid and simple electric controls allow for low maintenance and built in safety protection. When properly installed and maintained you can trust Northern Heat Pump.

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.

SAFETY

Service of refrigerant based equipment can be hazardous due to system pressure and high voltage electrical energy. Only trained and qualified service personnel can install, repair or service refrigerant equipment. The installation must meet all local electric, plumbing, heating and air conditioning codes.

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.

WARNING:

Turn off the main switches before performing service or maintenance to this unit. Electric shock can cause personal injury.

VERTICAL UNIT LOCATION AND MOUNTING

Locate the unit in an indoor area where the ambient temperature will remain above 7°C. NHP provides 3 removable panels for ease of servicing; front, right and rear side. Allow enough room to remove panels and for filter maintenance. Units should be mounted on a vibration absorbing pad (rubber or extruded polystyrene) slightly larger than the base to provide isolation between the floor and the unit. (figure # 1) Water supply should **not** be hard plumbed directly with copper pipe as this could transfer any vibration to living space.

VERTICAL CONDENSATE DRAIN

Vertical *FORCAIR* and *SOURC3* units must have a condensate drain installed to remove moisture from the evaporating pan when air conditioning. **Vertical forced air models have an internal trap built into the unit.** The connection must satisfy local plumbing codes. To ensure free condensate flow the drain line must slope away from the unit.
Install the condensate drain line into an open drain. (Figure # 1)

HORIZONTAL MOUNTING

Horizontal units may be mounted on any surface that can support their weight. Typically they are suspended by threaded rods attached to the unit by using corner hanging brackets (See Figure # 2).
If the unit is set on an attic floor or similar situation, an anti-vibration pad similar to the vertical units should be used to help isolate any noise. All installations should conform to local codes. Allow enough space to access electrical panels, compressor compartment and filter rack.

Figure # 1

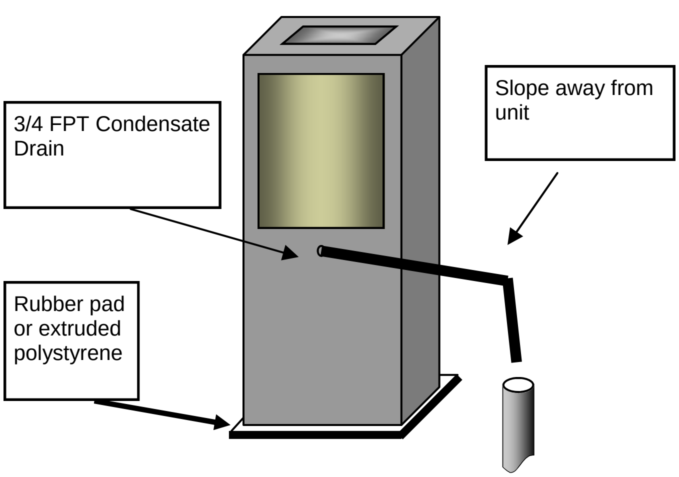
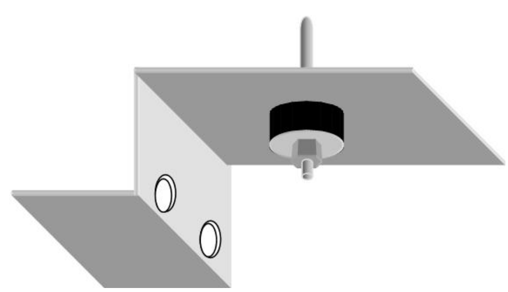


Figure # 2

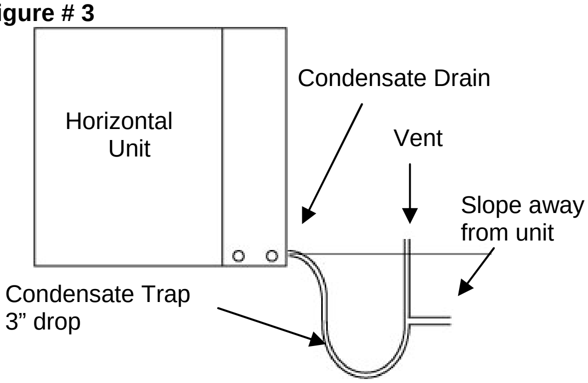


HORIZONTAL CONDENSATE DRAIN

Horizontal units are not internally trapped: An external trap is required. Two drain connections are located at the radiator end of the cabinet. Use either connection and plug the remaining connection. Each unit must also include its own vent for condensate. (Figure # 3)

The condensate drain incorporates a 3/4" FPT port. A drain line attached to this port must slope away from unit and must be properly vented.
Horizontal units should be pitched slightly towards the drain end by minimum 1/4" to help condensate drain.

Figure # 3



DUCTING SYSTEM

All *XTERRA* Series models include a return duct air flange and filter rack. Both return and supply ducts should be isolated with a flexible connection to minimize vibration transfer to the ducting.
To further reduce noise, both return and supply duct can be internally insulated the first few feet with duct board.
Note: Undersized ducting on new or retrofitted systems can not only increase air noise, it can affect heat transfer to the building and unit performance. **Size duct to appropriate blower outputs and building needs.**

> ***WARNING:***
> *Before driving screws into the cabinet check on the inside of the unit to make sure the screws will not hit any electrical or refrigeration lines.*

ELECTRICAL

All electrical and wiring must comply with local code. Power supplied to the unit must be within the operating range on the unit's description and rating plate.

CLOSED LOOP APPLICATIONS

A 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.

The *XTERRA* Series heat pumps are designed to operate on either **vertical or horizontal closed loop applications.** (Figures 4 & 5) Vertical loops are typically installed with a well drilling rig up to 200 feet 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. Earth loops must be sized properly for each particular geographic area and individual capacity requirements. Contact your local installer for loop sizing requirements in your area.

Figure #4

Horizontal Loop

Figure #5

Vertical Loop

Once closed loops are completed, they must be pressure tested to ensure 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 # 1 shows approximate fluid volumes:

DO NOT Mix more than 25% propylene glycol with water to achieve a lower than –9°C freeze protection. (See Table #2) 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 #1

Approximate Fluid Volume (gal) per 100" of pipe

Pipe	Size	Volume
Polyethylene	3/4" 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

WARNING:

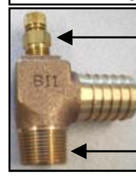
Do NOT use calcium as anti-freeze. Follow IGSHPA recommendations for the appropriate type and amount of anti-freeze.

Table #2 **Antifreeze Percentages by Volume**

Type	Minimum Temp. for Freeze Protection -12°C (10°F)	-9°C (16°F)	-8°C (17°F)	-6°C (21°F)	-4°C (25°F)
Methanol	**25%**	**21%**	**18%**	**16%**	**10%**
100% USP Food Grade Propylene Glycol	**38%**	**30%**	**25%**	**22%**	**15%**
Ethanol	**22%**	**20%**	**18%**	**14%**	**10%**

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# 6) 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.

Figure # 6 **Heat Pump Adaptor Elbow**



LOOP PUMP SELECTION

Select a loop circulation pump based upon the gpm required and total system pressure drop.
Refer to Table # 3.

Table # 3 **Heat Exchanger Pressure Drop**

Unit Size	LOOP GPM	PD (FT)	PD (PSI)
3 Ton	4.0	2.7	1.2
	8.0	11.3	4.9
4 Ton	6.0	6.2	2.7
	11.0	24.2	10.5
5 Ton	8.0	11.5	5.0
	13.0	34.6	15.0
6 Ton	10.0	19.6	8.5
	14.0	45.7	19.8

Data and specifications may change without notice

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 with some water currents present. In any lake or pond, municipal and area by-laws must be observed in regards to a lake or pond loop. The use of an environmentally friendly loop fluid like ethanol should be considered if the loop was ever damaged. Consult a IGSHPA certified installer for proper lake or pond loop design.

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 loop unusable. Contact a IGSHPA certified geothermal loop contractor for proper installations.

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 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" 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.

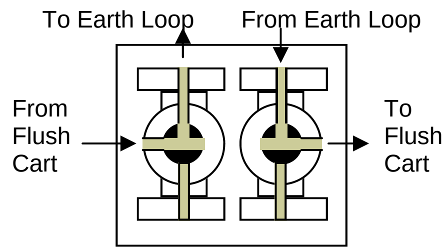
Pressurizing The System

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.

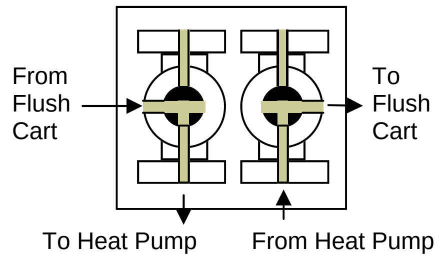
Step 7
Turn off the flush cart pump. The system should remain pressurized. Release excess pressure by rotating either module valve to allow a small amount of water to pass through and out of the system and into the container. Some initial loss of pressure can be expected and is due to the expansion of 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.

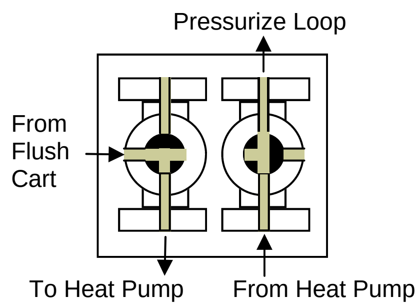
Step 3



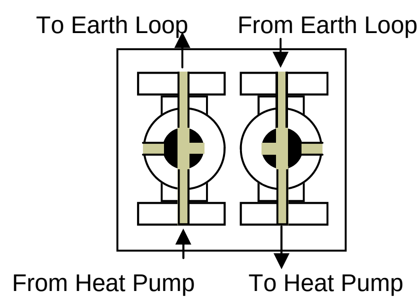
Step 5



Step 6A



Step 6B



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.

OPEN SYSTEM APPLICATIONS

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 # 7 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 X & Y terminal on the heat pump. (See page 15 in Electrical Section) This valve will open when the unit is running and close when the unit stops.

A visual flow meter is then installed to allow visual inspection of the flow requirements. The flow meter can also be useful in determining when maintenance is required. Schedule 40 PVC piping, copper tubing, polyethylene or rubber hose can be used for supply and discharge water lines. Limit rubber hose to 10ft. to prevent excessive pressure drop. Make sure line sizes are large enough to supply the required flow with a reasonable pressure drop (generally 1" 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 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.

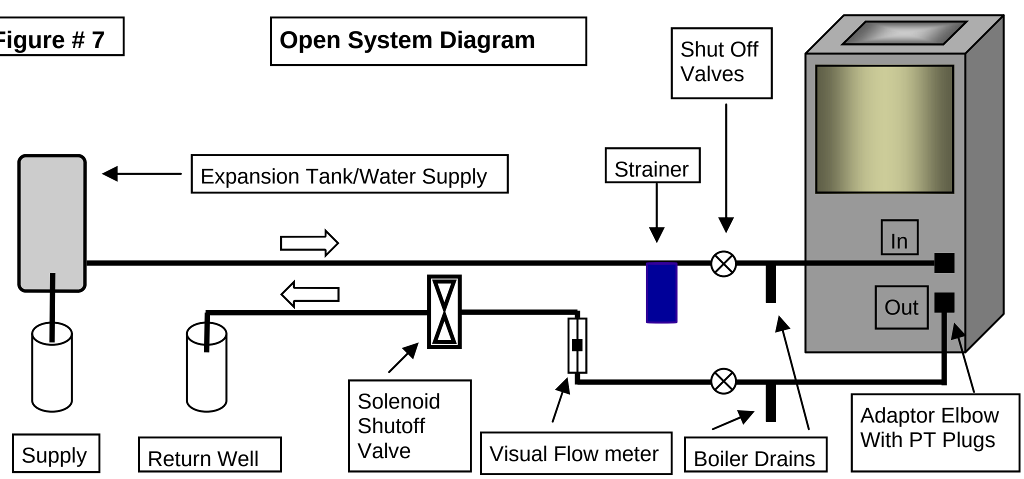
Open Loop Freeze Protection Switch

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 (low pressure switch) will shut the unit down before freezing can occur and protect the heat pump against flow loss and damage.

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 **cupro-nickel** 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.

Figure # 7 **Open System Diagram**



Depending on the specific water quality issue, the water coil can be cleaned by the following methods:

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.

Miradic 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.

HYDRONIC HEAT EXCHANGE

Radiant Floor Heating

Hydronic side heat exchangers can be a variety of different types. Probably the most popular form of hydronic heat exchanger is radiant floor heat tubing. Radiant floor heating gives excellent comfort and very high efficiencies by supplying low temperature water to the floor slab and keeping the heat concentrated evenly near the floor. Radiant floor heating systems heat the occupants and surfaces directly with radiant energy not by heating air that transfers the heat to the occupants.

Radiant floor heating usually consists of tubing laid in the slab. The amount and spacing of the tubing is calculated to meet the capacity of the space being heated. To optimize the efficiency, the fluid temperature inside the tubing should be maintained as low as possible. The type of floor covering and the spacing of the pipe in the floor have the greatest effect on operating fluid temperature.

NHP designs its hydronic heat pump line using a 46°C (115°F) leaving water design point. This leaving water temperature is the ideal maximum fluid temperature for radiant floor systems. Operating temperatures higher than this would result in less efficient operation and possibly an uncomfortable condition.

Fan Coils

Fan coils can be used with NHP hydronic AQUA2 heat pumps in the heating and cooling mode. In many cases radiant floor heating and fan coil cooling are used together. Fan coils also provide dehumidification. Dehumidification rates can be adjusted by varying the fan coil operating temperature and air flow.

Fan coils are available in many different sizes and configurations making them very flexible to your particular application. **Note:** When selecting fan coil units for cooling use, make sure they include condensate drain pans.

Fan coils are sized for capacity at specific water temperature and flow rate combinations. Their sizing is also based on air temperatures, airflow rates (which remain constant based on fan speed selection and static pressure differential), and humidity conditions. The fan coils are then matched to the heat pump at a common system flow rate and operating temperature to provide the overall system capacity to a space load.

High static pressure fan coils work well with hydronic heat pumps. These systems, produced by Unico System, Space Pak and others, provide heating and cooling for houses without ductwork. They use a high static pressure blower to supply air through small diameter chase ways to the living space. The blower passes through a water-to-air coil which is coupled to a water-to-water heat pump to provide heating and cooling. These systems work nicely on retrofit applications where ductwork isn't available or wanted. When sizing the fan coil, keep in mind maximum recommended water temp. LWT 46°C (115°F) . However, running the heat pump continuously will result in very high operating pressure and may shorten the life of the unit.

Base Board Heating

Cast iron radiators have been used successfully. If these radiators are rated for an output of 70 Btuh/square inch at 130°F the system should still operate at the standard 115°F HYD LWT of the water-to-water heat pump. Some installations may require additional use of an air handler or more aggressive finned tube to provide enough heat during the colder weather.

Other Applications

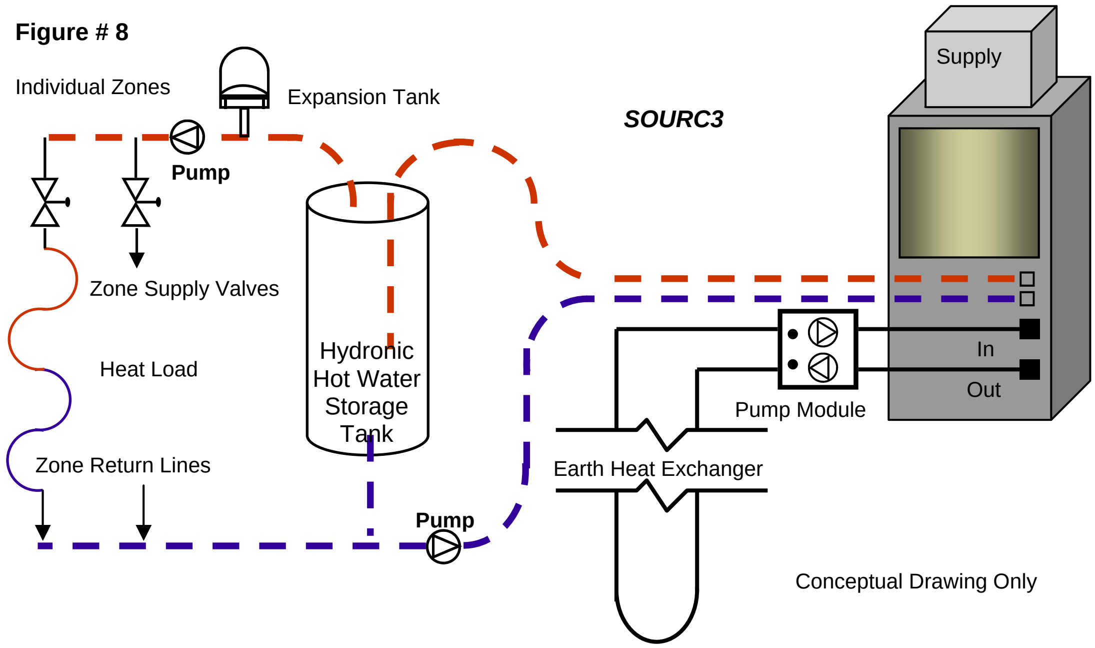
Open loop hydronic applications (Figure # 8)such as outdoor swimming pools, hot tubs, whirlpools, tank heating, etc. are easily sized and based on heat exchanger operating temperature and flow. Often sizing a heat pump to these applications comes down to recovery time; the larger the heat pump (within reason to avoid short cycling), the faster the system recovery time. Note: Installing a plate heat exchanger between the heat pump and an open system is required when corrosive fluid is used in the open loop, especially on swimming pools where pH imbalance can damage the heat pump.

Other forms of closed loop systems such as indoor swimming pools, pretreated fresh air systems, snow melt, and valance heating/cooling systems are also very common with water-to-water heat pumps. The sizing of the heat pump to these systems is more precise and information from the system manufacture is required. Note: Expect the maximum operating temperature of an indirect coupled application to be approximately 12°C below the maximum operating temperature of the heat pump.

Systems must be constructed to all appropriate codes and according to accepted plumbing practices.

Should NHP heat pumps be installed in an industrial application in Europe, the unit will be "fitted with means for disconnection from the supply mains having a contact separation in all poles that provide full disconnection under overvoltage category III, the instructions state that means for disconnection must be incorporated in the fixed wiring in accordance with the wiring rules" in Europe.

Figure # 8



STORAGE TANKS

Coupling the heat pump to the space conditioning heat exchanger through a water storage tank is recommended (Figure # 9). In fact, the only instance where these storage tanks are not recommended, is when the heat pump is coupled to a large heat exchanger capable of absorbing the entire heating or cooling capacity of the heat pump requiring high discharge water temperatures. Insulated hot water heaters are commonly used for storage tanks.

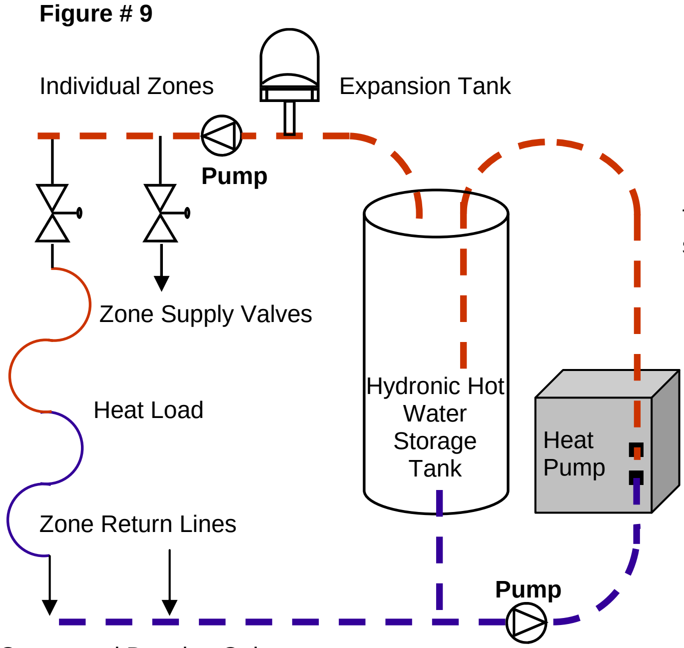
In applications that use multiple smaller zones, storage tanks absorb the relatively large amount of energy supplied by the compressor to provide longer run times and less compressor cycling for the heat pump. Storage tanks also serve to dispense energy in small amounts so that the conditioned zones have time to absorb heat without short cycling.
When properly sized, a storage tank eliminates many problems with multiple zone hydronic systems. These problems include;

1) Excessive leaving water temperature if a single zone cannot dissipate heat quickly enough.
2) Flow reduction through the heat pump when only one zone is calling which can occur because the pump is normally sized to provide the heat pumps required flow with all zones calling. When sizing storage tanks to the heat pump, a **good rule of thumb is 10 gallons of storage tank per ton of hydronic capacity.**

The tank temperature can be controlled with a simple Aqua stat or a set point controller.

CAUTION
For proper operation adequate water flow must be achieved through heat pump heat exchangers.

Figure # 9



Conceptual Drawing Only

CIRCULATION FLUID

The fluid circulating through the hydronic side of the geothermal heat pump system is the transfer medium for the heating and cooling being supplied to the conditioned space. Selection of this fluid is very important. Water is the most readily available fluid but has the draw back of expansion during freezing which can damage the system.

Antifreeze must be used wherever the possibility of freezing exists from the environment or from use of the unit in the cooling mode. A propylene glycol based antifreeze and water solution is recommended. Freeze protection for the hydronic side fluid down to –7 degrees Celsius (20% propylene glycol) by volume in water is recommended for most indoor applications.
(Table # 4) Using over 40% solution in hydronic side applications can cause pumping problems due to high viscosity.

The water being added to the system should have 100 PPM grains hardness or less. If poor water conditions exist on the site, softened water is recommended, or acceptable water should be brought in. Bacteria or algae's growth in the water is a possibility, especially bacteria or algae that thrive at the particular temperatures produced in the heating system. This growth can cause buildup on hydronic side heat exchanger surfaces reducing the efficiency of the system or causing the heat pump to run at higher head pressures and cut out.

HYDRONIC SIDE CIRCULATORS

Hydronic circulator pumps transfer the energy supplied by water-to-water heat pumps to the space conditioning exchanger. (Figure # 11) When selecting a circulator be sure to select a pump with the ability to supply the required flow rate at the system pressure drop. The circulator supplying the heat pump should be placed in the water supply line entering the unit to provide the best pump performance. Individual zone pumps should also be installed in the supply line to the heated zones.

Small circulator pumps can be used. If these pumps are impedance protected they do not require additional fusing if powered directly from the heat pump. If impedance protected pumps are not used, inline fuses should be supplied according to code.

A common problem with circulator pumps is trapped air in the system. This air accumulates in the suction port of the circulator pump causing cavitations in the pump that leads noisy operation and premature pump failure. Air can be eliminated by completely purging the system or by placing an air separator in the plumbing lines.

The entire system must be purged of air during initial **installation** and pressurized to a 20 to 30 psi static pressure to avoid air entering the system. This initial static pressure may fluctuate when going from the heating to cooling modes but should always remain above zero. If a leak in the system allows the static pressure to drop, the leak must be repaired to assure proper system operation. If air continually enters the loop; corrosion, bacteria, or pump cavitations may occur.

The hydronic side circulator supplying the heat pump should be controlled to run only when the heat pump is also running.

EXPANSION TANKS

Expansion tanks must be used in the hydronic side of the water-to-water system to absorb the change in pressure of the closed system due to the change in temperature when heat is supplied to the system. Diaphragm-type expansion tanks should be used. The diaphragm in these tanks is filled with pressurized air which expands or contracts to maintain constant overall system pressure as the fluid in the system expands with increasing temperature. Use diaphragm tanks that are compatible with glycol-based antifreeze fluids (butyl rubber diaphragms will slowly dissolve with glycol-based antifreezes). Expansion tanks should be installed in the system near the suction of the circulator whenever possible. This maintains positive pressure at the circulator and reduces the highest working pressure of the system.

Table # 4

Type	Minimum Temp. for Freeze Protection -12°C (10°F)	-9°C (16°F)	-8°C (17°F)	-6°C (21°F)	-4°C (25°F)
Methanol	**25%**	**21%**	**18%**	**16%**	**10%**
100% USP Food Grade Propylene Glycol	**38%**	**30%**	**25%**	**22%**	**15%**
Ethanol	**22%**	**20%**	**18%**	**14%**	**10%**

ELECTRICAL

ELECTRICAL SERVICE

The main electrical service should be fusible and capable of providing the amperes required by the unit at nameplate voltage. All wiring shall comply with the national electrical code and/or any local codes that may apply. Access to the line voltage contactor is gained through the electrical knockouts provided on either sides of the heat pump next to the front corner.

WARNING: The unit must be properly grounded!

WIRING HYDRONIC PUMPS

When supplying water pumps off the system power supply, use impendence protected motors. The module can be wired directly to the contactor and grounded in the grounding lug. A relay (RP) and terminal block (BP) are supplied in the electrical box for the hydronic side pumps. The relay will start the pump with a call from the aqua stat on *SOURC3* units. The pump relay is activated by power to G on the terminal strip (BT) of hydronic units (wire G to X). The use of impedance-protected pumps eliminates the need for additional fusing. Do not connect more than a 1/3-horse power pump to the internal pump relay.
If larger pumps are required or impedance protected pumps are not used, a separate power supply is required. To start this pump use a 24-volt relay controlled from the Y and X terminals.

24-VOLT CONTROL CIRCUIT

Transformer
An electrical diagram is provided to operate all control features of the heat pump. The transformer can be quickly overloaded when using it for additional control equipment like zone valves or fan coil relays.
On more complicated control systems transformer capacity is used up quickly.
If the systems external controls require more than 40 VA of power from the transformer an external transformer must be used. The heat pump's transformer can generally power simpler control systems consisting of a few relays or zone valves (depending of course on the VA draw of the components).
The *SOURC3* heat pump requires at least two temperature controls. The first is a forced air heat pump thermostat connected directly to the terminal strip. This thermostat controls forced air heating and cooling as any thermostat would. The second control is a aqua stat, which is powered from R on the terminal strip, through the aqua stat, and back to H on the low voltage thermostat block in the heat pump.
The aqua stat tells the heat pump when hydronic side water heating is required and when the hydronic side is satisfied. **The *SOURC3* combination heat pump can only run one mode at a time** (one thermostat must have priority over the other). Any number or types of thermostats, aqua stats, or switches can be used with an independent power supply (typically a 24 volt transformer) to activate specific zone controls. These zone controls are normally either a zone pump or zone valves. End switches on the zone valves can be used to pass a signal to a pump relay when the zone valve is open. The pump relay then activates a common pump, which supplies any number of zones.

NOTE: A common maximum aqua stat set point is 46°C (115°F). The tank will then shut down when it reaches 46°C however the leaving water temperature from the heat pump is actually higher (near the maximum operating temperature). The Aqua stat maximum set point should limit the head pressure of the heat pump to 325 psi.

If the thermostat is equipped with an anticipator it should be set to its lowest setting to avoid interfering with heat pump operation.

Digital Timer
The timer performs the following functions which control the compressor operation: system lockout, compressor anti-short cycle, and a five minute delay after power is applied.

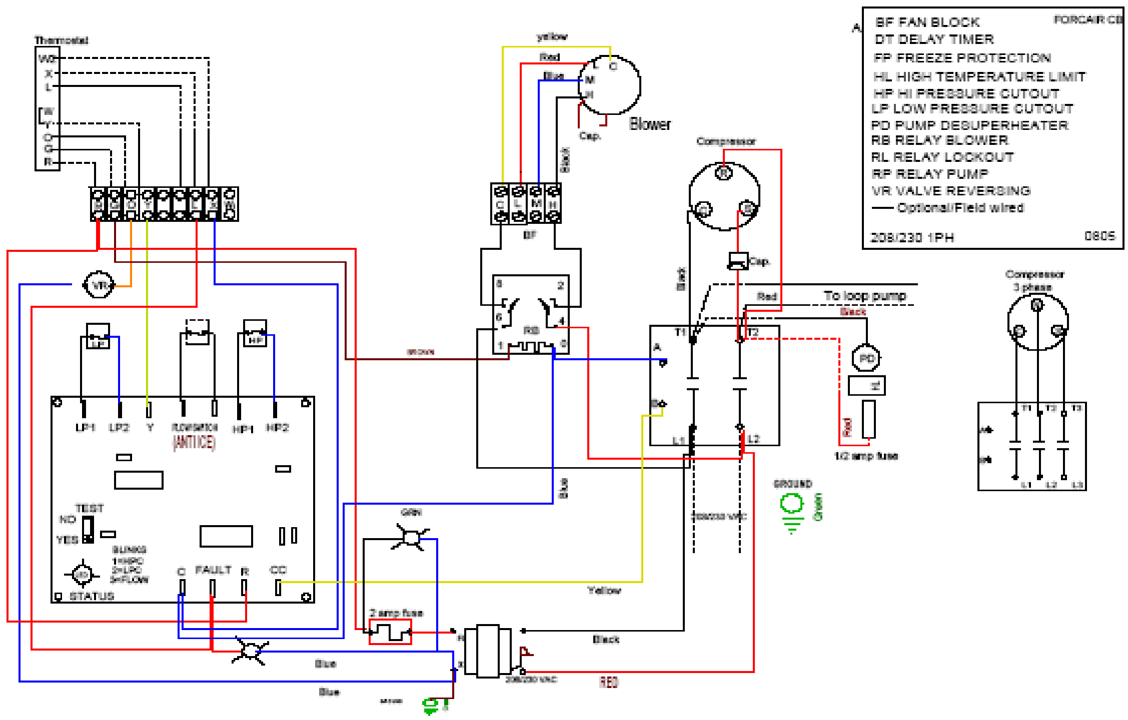
System lockout occurs if the high pressure and low pressure switches open. The timer blocks the signal from the thermostat to the contactor to energize the compressor. This lockout condition means that the unit has shut itself down to protect itself, and will not come back on until power has been disconnected (circuit breaker) to the heat pump.
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

If a lockout condition exists, the heat pump should not be reset more than once and a service technician should be called immediately. The cause of the lockout must be determined or repeated reset damage may occur to the system.

The anti-short cycle function puts a time-out period of ***ten*** 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.

FORCAIR Wiring Diagram Figure #11



SOURC3 Wiring Diagram Figure #12

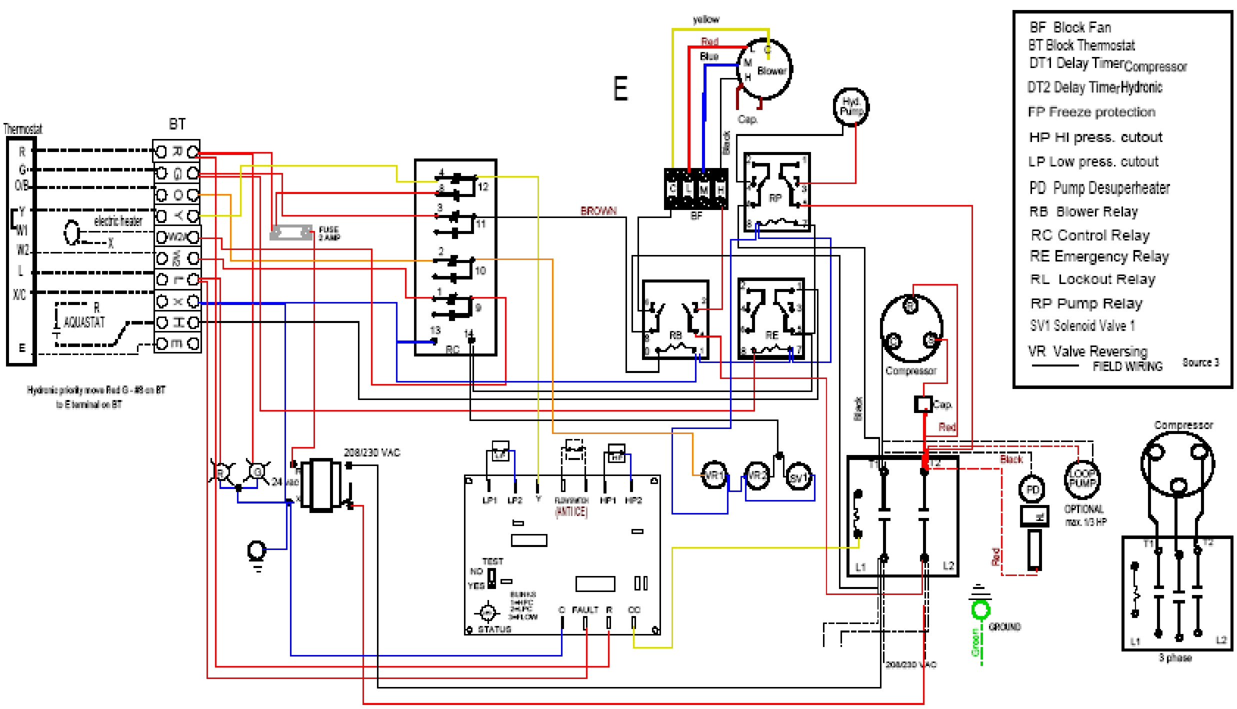
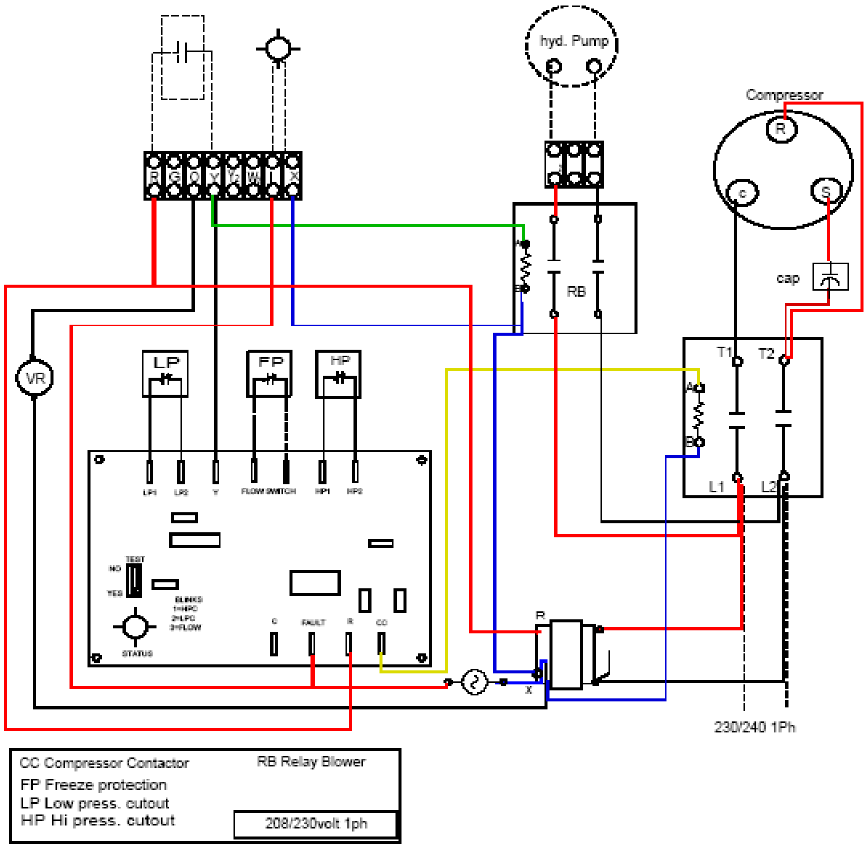


Figure #13 ***AQUA2*** **Wiring Diagram**



Block Terminal – Thermostat

Block terminals have the following input functions:

R	24 Volt Power
G	Fan
O	Reversing Valve
Y	Compressor
W2A	Second Stage Auxiliary
W2	Second Stage Electric
L	Lockout Indicator
X	Common
H	Hydronic (Sourc3)
E	Emergency Relay

Thermostat/Aqua stat

Consult the instructions in the thermostat box for proper mounting and thermostat operation.

CAUTION:

Improper wiring of controls may result in transformer burnout.

Power is supplied to the thermostat by connecting the R and X terminals to the heat pump terminal strip. The Y terminal energizes the compressor. The unit is put into the cooling mode when the thermostat energizes the O terminal which operates the reversing valve. A compressor lockout is indicated by the L terminal, which is used to power the lockout LED on a thermostat or an external 24-volt lockout light.

On hydronic *AQUA2* and *SOURC3* units the pump relay (RP) is connected to the circulation pump high voltage connection block (BP). The hydronic side circulation pump receives power from BP, which is energized by RP. Running a jumper wire from Y to G on the terminal strip (BP) of a hydronic unit will bring the circulation pump on seconds before the compressor to prove water flow. The hydronic pump relay (RP) on a *SOURC3* unit energizes automatically when the system runs in the hydronic mode.

A simple, single stage heating aqua stat on a storage tank or wall mounted thermostat may be all that is required for simple heat only systems. This thermostat closes and passes power to the Y terminal (H terminal for *SOURC3* units), energizing the compressor and circulation pumps in the heating mode. When mounting aqua stats inside storage tanks. Always use submergible or submersible type aqua stats.

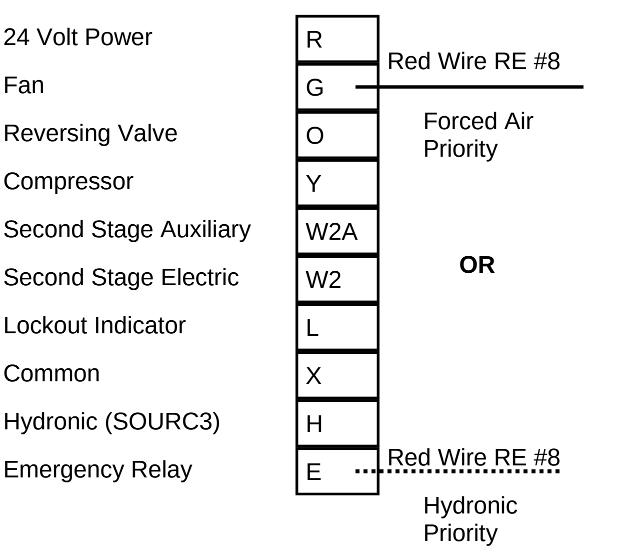
A cooling aqua stat can be mounted on the water supply line. This aqua stat acts as a low limit switch, which shuts the heat pump down when the cooling water reaches a set minimum temperature (e.g. 2°C).

Changeover from heating to cooling can be achieved in two ways:

1) With a manual toggle switch to select the control aqua stat (heating or cooling)
2) A cooling thermostat which powers the coil of a single pole/double throw relay which selects the heating aqua stat (normally closed contacts) or cooling aqua stat (normally open contacts). NOTE: Always wire the system to shut down (anti-short cycle) between a heating and cooling changeover mode. Nuisance trip-outs may occur from changing modes on the “fly”.

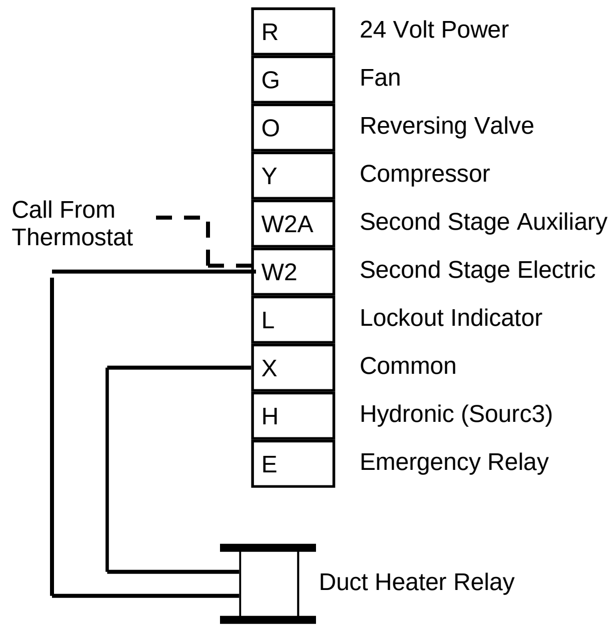
Forced Air or Hydronic Priority SOURC3 Model

The *XTERRA Series SOURC3* heat pump is capable of either priority forced air or hydronic water heating. The unit is set to priority forced air at the factory. To set the unit to priority hydronic water heating: Move the Red wire (G— #8 RE) from the “G” terminal to terminal “E” as shown below:



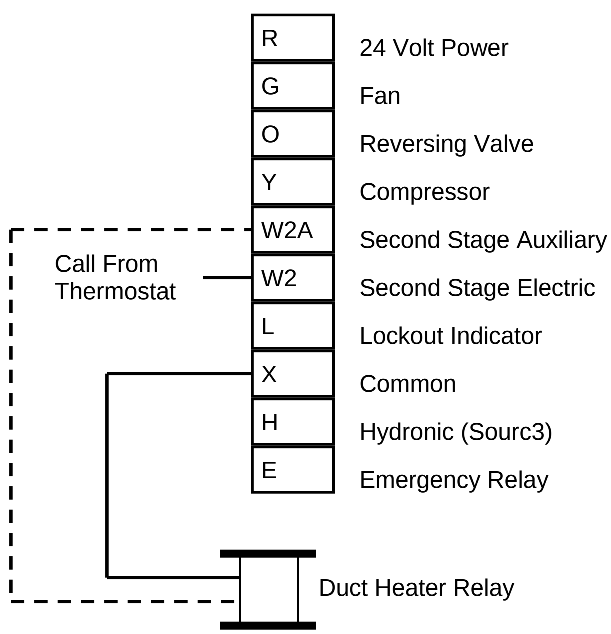
Second Stage Duct Heater - *FORCAIR* Model

A second stage electric duct heater can be added in conjunction with a *XTERRA* Series heat pump to help supplement heat if required. This duct heater can also act as an emergency backup if the heat pump should fault for any reason.
A two stage thermostat is required to activate the second stage. On a *FORCAIR* model heat pump, wire the second stage as shown below:



Second Stage Duct Heater - SOURC3 Model

Since the *SOURC3* model can run in either forced air mode or hydronic mode, second stage must be wired through W2 and W2A as shown below:



Electrical Data R22

Xterra Series *FORCAIR (V,H)*

Model	Voltage (60 Hz)	Compressor RLA	Compressor LRA	Fan FLA	Without Pumps Total FLA	Without Pumps Min. Ampac.	Without Pumps Max. Fuse Ckt Bkr.
16	208/230-1	10	41.0	2	12.0	14.5	20
18	208/230-1	10.7	45.0	2	12.7	15.4	20
22	208/230-1	12.1	54.0	2	14.1	17.1	30
24	208/230-1	13.6	63.0	2	15.6	19.0	30
36	208/230-1	17.9	100.0	4.3	22.2	26.7	40
	208-3	11.4	77.0	4.3	15.7	18.6	30
48	208/230-1	24.4	150.0	4.3	28.7	34.8	50
	208-3	16.4	91.0	4.3	20.7	24.8	40
	575-3	6.4	37.0	4.3	10.7	12.3	15
61	208/230-1	32.1	148.0	5.0	37.1	45.1	70
	208-3	19.3	137.0	5.0	24.3	29.1	40
	575-3	7.9	50.0	5.0	12.9	14.8	20
68	208/230-1	32.1	176.0	5.0	37.1	45.1	70
	208-3	20.7	156.0	5.0	25.7	30.9	50
	575-3	8.2	54.0	5.0	13.2	15.3	20

Xterra Series *AQUA2*

Model	Voltage (60 Hz)	Compressor RLA	Compressor LRA	Pump/s FLA	Without Pumps Total FLA	Without Pumps Min. Ampac.	Without Pumps Max. Fuse Ckt Bkr.
36	208/230-1	17.9	100.0	2.2	20.1	24.6	40
	208-3	11.4	77.0	2.2	13.6	16.5	30
48	208/230-1	24.4	150.0	2.2	26.6	32.7	50
	208-3	16.4	91.0	2.2	18.6	22.7	40
	575-3	6.4	37.0	2.2	8.6	10.2	15
61	208/230-1	32.1	148.0	4.4	36.5	44.5	70
	208-3	19.3	137.0	4.4	23.7	28.5	40
	575-3	7.9	50.0	4.4	12.3	14.2	20
68	208/230-1	32.1	176.0	4.4	36.5	44.5	70
	208-3	20.7	156.0	4.4	25.1	30.3	50
	575-3	8.2	54.0	4.4	12.6	14.7	20
Special	208-3	18.9	146.0	11.4	30.3	35.0	40
	575-3	6.7	60.0	2.2	8.9	10.6	15
	400-3	9.5	73.0	2.2	11.7	14.1	20

Xterra Series *SOURC3*

Model	Voltage (60 Hz)	Compressor RLA	Compressor LRA	1/3 HP Pump FLA	Fan FLA	Without Pumps Total FLA	Without Pumps Min. Ampac.	Without Pumps Max. Fuse Ckt Bkr.
36	208/230-1	17.9	100.0	2.2	4.3	22.2	26.7	40
	208-3	11.4	77.0	2.2	4.3	15.7	18.6	30
48	208/230-1	24.4	150.0	2.2	4.3	28.7	34.8	50
	208-3	16.4	91.0	2.2	4.3	20.7	24.8	40
	575-3	6.4	37.0	2.2	4.3	10.7	12.3	15
61	208/230-1	32.1	148.0	2.2	5.0	37.1	45.1	70
	208-3	19.3	137.0	2.2	5.0	24.3	29.1	40
	575-3	7.9	50.0	2.2	5.0	12.85	14.8	20
68	208/230-1	32.1	176.0	5.0	37.1	69.2	77.2	70
	208-3	20.7	156.0	2.2	5.0	25.7	30.9	50
	575-3	8.2	54.0	2.2	5.0	13.2	15.3	20

*575vac units require dual voltage (208/230 voltage for pumps and blower).

Due to continuing product improvements data may change without notice.

Electrical Data R410A

Xterra Series *FORCAIR (V,H)*

Model	Voltage (60 Hz)	Compressor		Fan	Without Pumps		
		RLA	LRA	FLA	Total FLA	Min. Ampac.	Max. Fuse Ckt Bkr.
16	208/230-1	10.0	48.0	2.0	12.0	14.5	20
22	208/230-1	15.0	61.0	2.0	17.0	20.8	30
24	208/230-1	14.3	64.0	2.0	16.3	19.9	30
30(2 stage)	208/230-1	19.0	82.0	4.3	23.3	28.1	40
36	208/230-1	20.0	112.0	4.3	24.3	29.3	50
	575-3	5.7	34.1	4.3	10.0	11.4	15
40(2 stage)	208/230-1	24.0	96.0	4.3	28.3	34.3	50
50	208/230-1	30.0	145.0	4.3	34.3	41.8	60
	575-3	6.8	40.0	4.3	10.1	12.8	15
51(2 stage)	208/230-1	26.0	118.0	4.3	30.3	36.8	60
57	208/230-1	33.6	172.0	5.0	38.6	47.0	80
	575-3	8.6	54.0	5.0	13.6	15.8	20
60(2 stage)	208/230-1	32.1	148.0	5.0	37.1	45.1	70
70	208/230-1	35.7	148.0	5.0	40.7	49.6	80

Xterra Series *AQUA2*

Model	Voltage (60 Hz)	Compressor		Pump/s	Without Pumps		
		RLA	LRA	FLA	Total FLA	Min. Ampac.	Max. Fuse Ckt Bkr.
16	208/230-1	10.0	48.0	2.2	12.2	14.7	20
22	208/230-1	15.0	61.0	2.2	17.2	21.0	30
24	208/230-1	14.3	64.0	2.2	16.5	20.1	30
30(2 stage)	208/230-1	19.0	82.0	2.2	21.2	26.0	40
36	208/230-1	20.0	112.0	2.2	22.2	27.2	50
	575-3	5.7	34.1	2.2	7.9	9.3	15
40(2 stage)	208/230-1	24.0	96.0	2.2	26.2	32.2	50
50	208/230-1	30.0	145.0	2.2	32.2	39.7	70
	575-3	6.8	40.0	2.2	10.1	10.7	15
51(2 stage)	208/230-1	26.0	118.0	2.2	28.2	34.7	60
57	208/230-1	33.6	158.0	4.4	38.0	46.4	80
	575-3	8.6	54.0	4.4	13.0	15.2	20
60(2 stage)	208/230-1	32.1	148.0	4.4	36.5	44.5	70
70	208/230-1	35.7	148.0	4.4	40.1	49.0	80

Xterra Series *SOURC3*

Model	Voltage (60 Hz)	Compressor		1/3 HP Pump	Fan	Without Pumps		
		RLA	LRA	FLA	FLA	Total FLA	Min. Ampac.	Max. Fuse Ckt Bkr.
36	208/230-1	20.0	112.0	2.2	4.3	24.3	29.3	50
	575-3	5.7	34.1	2.2	4.3	38.4	46.9	15
50	208/230-1	30.0	145.0	2.2	4.3	34.3	41.8	70
	575-3	6.8	40.0	2.2	4.3	10.1	10.7	15
57	208/230-1	33.6	158.0	2.2	5.0	38.6	47.0	80
	575-3	8.6	54.0	4.4	5.0	59.0	72.5	20
70	208/230-1	35.7	148.0	2.2	5.0	40.7	49.6	80

Due to continuing product improvements data may change without notice.

DESUPERHEATER HOT WATER GENERATOR OPTION

An NHP *Xterra* unit equipped with an optional desuperheater can provide supplemental heating of 60 to 70% of a home's domestic hot water demand. This is done by stripping heat from the superheated gas leaving the compressor. A desuperheater pump, internally mounted in the unit, circulates water from the domestic hot water tank, heats it using a double walled water-to-refrigerant heat exchanger and returns it to the tank.

Insulated copper tubing should be used to run from the hot water tank to the desuperheater connections on the left side of the unit. This tubing can be connected to the hot water tank three ways as shown in Figures # 14 & 15.

CAUTION:
Due to high water temperatures generated by the desuperheater, PEX or poly pipe may rupture if coupled directly to heat pump outlet. Therefore use a minimum of 4 feet of copper pipe from the heat pump desuperheater.

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. 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.

The use ½ inch copper tubing from the tank to the desuperheater inlet is recommended to maintain good water velocities so air pockets cannot form at the pump inlet. An air vent in the inlet line can also help systems where air is a problem. Shut off valves should also be used to service the desuperheater pump without draining the entire hot water tank. Always be sure these valves are open when pump is running. ***CAUTION:*** *Do Not run Desuperheater pump without supply from water heater. This will damage the pump.*

Poor water quality may restrict the effectiveness of using the desuperheater pump and does not allow the pump to circulate the leaving water temperature above 60°C. Never operate the system without the high temperature switch otherwise tank temperatures could become dangerously high.

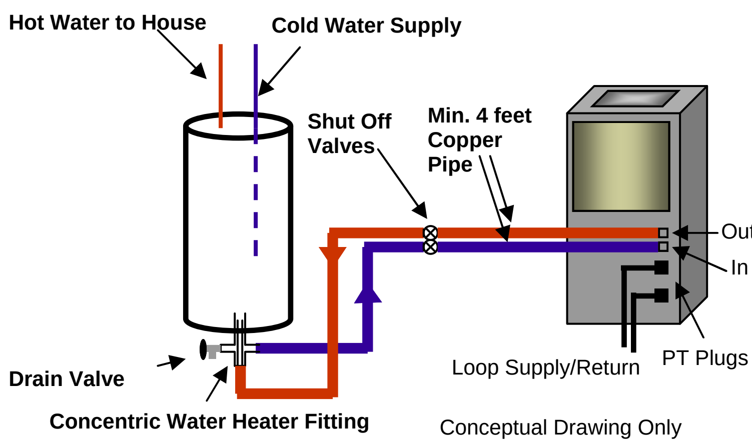
INLINE FUSE

An inline fuse is in series with the desuperheater pump. The fuse is attached to desuperheater pump wiring harnesses beneath the electrical panel. Remove the fuse to disable the pump whenever the system is not in operation. 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.

CAUTION: *Disconnect power before servicing.*

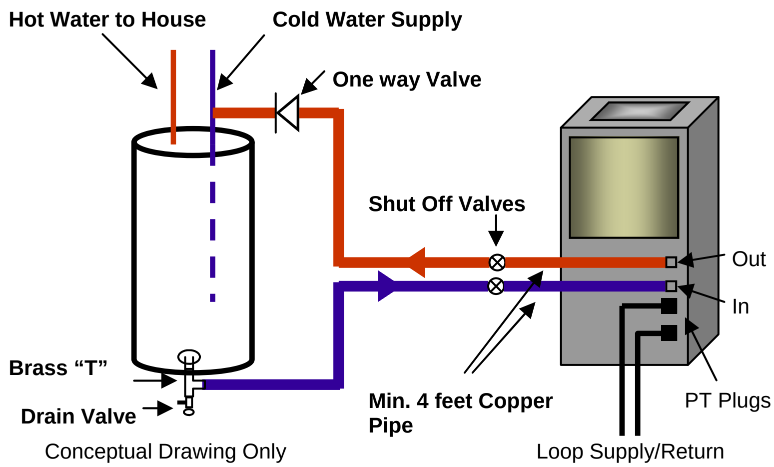
METHOD 1 **Figure #14**

Using a desuperheater tee (concentric water heater fitting) installed in the drain at the bottom of the water heater. Choose this method for ease of installation and efficiency. The tee eliminates the need to tap into the domestic hot water lines and eliminates possible household water supply temperature variations that could occur from connecting to the cold/ hot water lines.



METHOD #2 **Figure #15**

Drawing water from the bottom drain and returning it to the cold water supply line. This method may require a check valve in the return line to the cold water supply to prevent water from flowing backwards through the desuperheater. Flowing water through the pump backwards could possibly damage the rotor bearing, which reduces pump life and causes noise problems in the pump. A spring-type check valve with a pressure rating of ½ psi or less is recommended.



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. Manually open water valve on well system to check flow. Make sure all valves are open and air has been purged from the loop system. Never operate the system without adequate ground loop or open loop water supply.
3. Low voltage wiring of the thermostat and any additional control wiring is complete.
4. Set thermostat to the **OFF** position.
5. All high voltage wiring is correct including fuses, breakers, and wire sizes.
6. The heat pump is located in a warm area (above 8° C). Starting the system with low ambient temperature conditions is more difficult. Ensure space temperatures are warm enough (10°C or above) to start in the heating mode.
7. The hydronic side water flow rate is at the required level. Low water temperature starting may require flow reduction until the system is up to operating temperature.-HYDRONIC UNIT
8. You may now apply power to the unit. A 2 to 4 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 pump relay will energize the hydronic side-circulating pump.
   -Verify flow rate and temperature of the hydronic side flow to be at recommended levels.

   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.

Turn the thermostat up to its highest temperature setting. Place the thermostat to the "HEAT" position. The compressor should start If an electronic thermostat is used it may cause its own compressor delay at this time but the compressor will come on after the time-out period.

After the unit has run for five minutes, check the hydronic side return and supply water temperature. A water temperature rise of 8 to 10°C is normal in the heating mode, but variations in water temperature and water flow rate can cause variations outside the normal range, check capacity tables for temperature rise at your particular conditions.

Turn the thermostat to the off position. The compressor will shut down in one to two seconds.

Next turn thermostat to its lowest setting. Place the thermostat in the "COOL" position. The compressor will start after an anti-short cycle period for three to four minutes from its last shutdown.

After the unit has run for five minutes, check the hydronic side return and supply water temperatures. A water temperature drop of 8 to 10°C is normal in the cooling mode, but factors mentioned in the heating section can affect temperature drop also.

Instruct the owner on correct operation of the thermostat and heat pump system. The unit is now operational.

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 375 psi or goes below 25 psi. The freeze protection switch (on open loop systems) will also activate the lockout at 35 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 one or two times.

Repeated resetting of the lockout can cause serious damage. I**f lockout occurs more than twice contact your service dealer immediately.**

TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
Unit does not run	Tripped Breaker/Blown Fuse	Reset circuit or replace fuse. Always check and use correct size
	Blown controller fuse	Replace controller fuse. Replace with correct fuse.
	Low Voltage Supply	Contact local power company if voltage is below that specified for your unit
	Low voltage in circuit	Check the 24 volt transformer for voltage less than 18 volts or possible burnout.
	Thermostat	Set thermostat on "Cool" and lowest temperature setting and unit should run. Set thermostat on "Heat" and highest setting and unit should run. If in both cases the unit fails to run, thermostat could be wired incorrect or thermostat is faulty. To prove, disconnect thermostat wires on the unit and jumper between "Red", "Yellow" and "Green" terminals and unit should run.
	Interruptible Power	Check incoming supply voltage

Hydronic pump runs but compressor does not or compressor short cycles	Thermostat	Check settings, calibration and wiring and if thermostat has an anticipator set at 1.0 or 1.2
	Wiring	Check for loose or broken wires at compressor, capacitor or contactor
	Blow Fuse	Replace controller fuse. Replace with correct fuse.
	High or Low Pressure Controls	Unit could be off on the high or low pressure cutout control. Check water GPM, ambient temperature and loss of refrigerant. If still failing to run, check for faulty pressure controls. Replace if needed.
	Defective Capacitor	Check. If defective, remove and replace. Wire correctly.
	Voltage supply low	If voltage is below minimum required, call local power company. Check compressor voltage for possible open terminal.
	Low Voltage Circuit	Check 24 volt transformer for voltage under 18 volts or burnout.
	Compressor Overload Open	An internal compressor overload is used in all cases. If compressor is too hot, the compressor will not reset until cooled off. It may be defective or an open overload. Replace compressor.
	Compressor Motor Grounded	Internal winding grounded to case. Replace the compressor. If burnt out, replace the liquid line filter drier also.
	Compressor Windings Open	Check continuity of the windings with an ohm-meter. If windings are open, replace compressor and liquid line drier.

Unit Short Cycles	Thermostat	Improper thermostat location (e.g. near kitchen). Anticipator should be 1.0 or 1.2
	Compressor Overload	Defective compressor overload, check and replace if necessary. If the compressor is running hot, it may be due to insufficient refrigerant charge.
	Blow Fuse	Replace controller fuse. Replace with correct fuse.
	Aqua stat	The differential is set too close. Increase differential setting.
	Wiring and Controls	Loose connection or control contactor defective.

Insufficient cooling or heating	Loop fluid	Lack of pressure, temperature and/or quantity of water.
	Loss of Conditioned Air	Check ductwork design or introduction of ambient air through windows and doors.
	Thermostat	Improper thermostat location (e.g. near kitchen). Anticipator should be 1.0 or 1.2
	Airflow Across Fan Coil	Lack of airflow or improper distribution of air. Check motor speed and duct size. Also check filter for reduced air flow.
	Refrigerant Charge	Low refrigerant charge causes inefficient operation. Adjust only after checking CFM and GPM
	Compressor	If discharge pressure is low and suction pressure too high, compressor is not pumping properly. Compressor needs to be replaced.
	Reversing Valve	Defective valve creating bypass of refrigerant from discharge to suction side of compressor. When replacing reversing valve, direct heat away from valve and protect by wrapping in wet cloth.
	Desuperheater	Circuit (in-line fuse) should be disconnected in winter to allow full heat load to house.
No Response in Heating Mode	Thermostat Setting	Check setting. Is it below room temperature?
	Defective Thermostat	Check operations of thermostat. Replace if defective.
	Wired Incorrectly	Check for loose, broken or incorrect wiring.
	High Aqua stat Setting	Heat pump is trying to heat water that is too hot. Reduce the setting on the aqua stat.
Does Not Cool (only heats)	Reversing Valve Does Not Shift	Defective solenoid valve not energizing. Replace coil on valve.
	Reversing Valve Does Not Shift, Valve is Stuck	The solenoid valve is de-energized due to incorrect wiring at the unit or thermostat. Replace if valve is tight or frozen and will not move. Switch to cooling from heating a few times to help loosen valve.
	Aqua stat Is Set Too Low	Heat pump is trying to cool water too low. Increase setting on aqua stat.
	Insufficient Antifreeze	Water is freezing in hydronic coil. Check antifreeze level and add if necessary to maintain proper freeze protection.

Noisy Operation	Compressor	Make sure compressor is not in direct contact with cabinet. Cold surroundings can cause liquid slugging. Increase ambient temperature.
	Contactor	The "clattering" and "humming" noise in the contactor could be due to control voltage less than 18 volts. Check for low supply voltage, low transformer output or extra long runs of thermostat wires. If the contactor contacts are pitted, or corroded, or coil is defective, repair or replace.
	Rattles and Vibrations	Check for loose screws, panels or internal components. Tighten and secure. Copper piping could be hitting the metal surfaces, isolate if necessary.
	Water and Airborne Noises	Undersized ductwork will cause high airflow velocities and noisy operation. Excessive water through the water cooled heat exchanger will cause a squealing sound. Check for correct water flow for good operation and to eliminate noise.
	Cavitating Pumps	Purge air from closed loop system.

XTerra Series Heat Pumps
Residential and Commercial Warranty Schedule

Residential Applications Only:

All Parts-2 Years

Years 1 and 2, Northern Heat Pump Inc. (NHP) will replace defective parts, F.O.B Winkler, MB, prepaid freight only. Defective parts include only parts that fail due to defective material or workmanship and not improper installation.

All Parts-1 Year and Labour

On Year 1, NHP will replace defective parts, F.O.B Winkler MB, prepaid freight only. Defective parts include only parts that fail due to defective material or workmanship and not improper installation. NHP will cover the cost of the labour to replace the defective part according to, and not exceeding, NHP Labour Allowance Schedule (see Warranty Schedule in dealer catalogue)

Refrigeration Components-5 Years

On years 3 through 5, NHP will replace defective refrigerant components including compressor, expansion valve, evaporator, condenser and reversing valve F.O.B Winkler, MB, prepaid freight only, that fail due to defective material or workmanship and not from improper servicing or neglect.

Stainless Steel Cabinet-Lifetime

NHP will warranty all stainless steel cabinet panels, due to defective material, for the lifetime of the unit.

Commercial Applications Only:

All Parts-1 Year and Labour

On Year 1, Northern Heat Pump will replace defective parts, F.O.B Winkler MB, prepaid freight only. Defective parts include only parts that fail due to defective material or workmanship and not improper installation. NHP will cover the cost of the labour to replace the defective part according to, and not exceeding, NHP Labour Allowance Schedule (see Warranty Schedule in dealer catalogue)

Refrigeration Components-3 Years

On years 2 through 3, NHP will replace defective refrigerant components including compressor, expansion valve, evaporator, condenser and reversing valve, F.O.B Winkler, MB, prepaid freight only, that fail due to defective material or workmanship and not from improper servicing or neglect.

Exceptions To Warranty

This Warranty does not apply to:

1. Any portion of the system not supplied by Northern Heat Pump.
2. Scratches, dents or discoloration, on or in surfaces of products or units.
3. Air filters, fuses, refrigerant and oil.
4. Products or components that have had I.D. nametags or faceplates altered, removed or defaced.
5. Products that have defects or are damaged due to a harsh environment, including corrosive liquid or air supply or operation at abnormal temperatures.
6. Products or units damaged during shipment.
7. Products or units damaged from: improper service, installation, wiring, electrical, inadequate air flows, fire, floods, misapplication, modification, acts of God, rupture or breakage of the water condenser coil or tubing if subject to freezing applications without proper protection.
8. Products or components that are field altered from original factory design.
9. Products that are disconnected or moved from original installation.
10. Any products that have not been paid for, in full, to the authorized NHP dealer or contractor.

How To obtain Warranty

If you have a problem with your unit or system or if you may have a warranty issue, please promptly notify your dealer within thirty (30) days of the issue. If it is determined that the Northern Heat Pump unit or component is the result of the problem, defective parts should be returned to the Northern Heat Pump factory, prepaid at your expense. All warranty claims and questions are to be directed to: Northern Heat Pump Warranty, Unit 3-201 South Railway Ave., Winkler, MB, Canada, R6W 1J9. Northern Heat Pump is not responsible for any delay in shipment of components and will make every effort to process claims as quickly as possible.

Limitations to Warranty

Warranty begins on the date of shipment of unit or return of product warranty registration card to Northern Heat Pump. All service must be performed by an authorized Northern Heat Pump service person. Northern Heat Pump will not be liable for consequential or incidental expenses, damages or losses with regards to any product or service. This warranty is given is lieu of all other express warranties, whether written or oral and do not extend beyond the warranty duration set forth above.

Notes:

3 - 201 South Railway Ave., Winkler, Manitoba, CANADA, R6W 1J9

Phone: 1-204-325-9772 Fax: 1-204-325-4954

email: info@northernheatpump.com

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